The Mortgage Illusion*

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Abstract

We propose and test a new heuristic on the decision to buy or rent a house: the *mortgage illusion*, in which potential home buyers are influenced by the comparison between the monthly rental payment and the monthly mortgage installment, for fixed rate mortgages. We find experimental evidence that home buyers are more likely to buy when the monthly rental payment is higher than the monthly mortgage installment. Our experimental designs and results are robust to ownership bias and home buyers' budget constraints. Financial literacy and numeracy do not help to overcome the *mortgage illusion*.

JEL Codes: C91, D12, G02, G21

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1 Introduction

Buying a house is perhaps the most important financial decision that households face. For most American homeowners, housing 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 home buyers. It requires them to think about the terms of a mortgage, how much money they have to save for the down payment, the amount of tax shields the house purchase will create, among others. In addition, there are limited opportunities to learn from taking a mortgage. As a result, households 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 that people use are sometimes difficult to justify normatively. Previous research has shown that indeed housing decisions might be based in market inefficiencies (Brunnermeier and Julliard 2008; Simonsohn and Loewenstein 2006; Genesove and Mayer 2001; Case and Shiller 1988).

In this paper, we propose and run experiments that test a new heuristic used by households when deciding to buy or rent a house, the *mortgage illusion*. Households prone to it compare the monthly rental payment (R) and the monthly installment of a mortgage at a fixed rate (M) on two equivalent houses. More specifically, the *mortgage illusion* heuristic stipulates that one should buy the house only if the monthly mortgage installment is lower than the monthly rental payment and rent otherwise (buy if $M < R$; rent otherwise). We find that indeed the *mortgage illusion* heuristic influences the decision to buy a house. Potential home buyers are more likely to enter mortgage contracts when the monthly rental payment (R) they used to pay before buying is higher than the prospective monthly mortgage installment (M). Individuals use the rental payment (R) they pay as a reference point to the mortgage (M). As a result, they tend to prefer mortgages whose monthly mortgage installment (M) is around the monthly rental payment (R). In a nutshell, potential home buyers use the *mortgage illusion* in order to decide whether to buy or rent a house despite the fact that the monthly rental payment and the monthly mortgage installment are not directly comparable. For example, suppose an individual pays $1,000 each month for rent. She is then offered two equivalent 2% mortgages, both worth $250,000: (i) a 30-year mortgage whose monthly payment is $922; (ii) a 25-year mortgage whose monthly payment is $1,057. If she incurs the *mortgage illusion*, she would be more likely to buy in the former case and more likely to rent in the latter case.

In order to identify the causal effect of the *mortgage illusion* on the decision to buy or rent a house, we design experiments that aim to isolate the other factors that influence this decision. While most empirical behavioral finance papers make use of field data, it would be very hard to test the causal effect of the *mortgage illusion* on the field, as these experiments require many

identical houses available for renting and for selling at different prices at the same time.[1] Thus, we create scenarios in which we vary the difference between the mortgage monthly installment at a fixed rate and the monthly rental price, allowing that we compare in a controlled setting whether potential home buyers switch from buy to rent as we progress from the treated region $M < R$ to the controlled region $M > R$.

We find a causal effect of the *mortgage illusion* 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. In particular, we find that potential home buyers are more likely to buy if the mortgage monthly installment is lower than the monthly rental payment. Those results are robust to settings in which households' monthly budget constraints are not binding.

Initial evidence gathered from the Panel Study of Income Dynamics (PSID) hints at the *mortgage illusion* effect.[2] We extract individual yearly level data from PSID between 1993 and 2013 on the dollar amount panelists pay monthly for rent or for their mortgage. We identified 2,943 panelists that bought a house in the period of the panel (*i.e.*, between 1993 and 2013) and used to rent before the house purchase.[3] Figure 1 reports M-R, the difference between the first monthly mortgage installment and the last monthly rental payment. In figure 2, we control for potential income effects and report (M-R)/R. Panelists' M-R concentrates around zero, which is consistent with the *mortgage illusion* effect. These results suggest that panelists seem to use a threshold for the monthly mortgage installment that is around the monthly rental payment they used to pay. Of course, there are many confounding factors in the PSID analysis, which make it very hard, if not impossible to identify the *mortgage illusion* effect. One of the contributions of our paper is to identify it by running experiments in a controlled environment.

In our first main experiment, we aim to show that home buyers use the *mortgage illusion* heuristic even when they are also choosing whether to buy or rent a house based on a *discounted cash flow analysis*. Assume a set of mortgages with different maturities but worth the same. For instance, consider the previous example of two equivalent 2% mortgages both worth $250,000. The 25 and 30 years mortgage requests monthly payments of $1,057 and $922 respectively. Consider further the 2% perpetuity interest-only mortgage also worth $250,000. It requests perpetual monthly pay-

[1] Benjamin, Choi, and Fisher 2010, Biais, Hilton, Mazurier, and Pouget 2005, Camerer and Lovallo 1999, Cohn, Engelmann, Fehr, and Maréchal 2015 and Coffman 2014 are examples of studies in finance and economics that use controlled experimental settings.

[2] The PSID is the longest running household longitudinal survey worldwide. It is directed by the University of Michigan and began in 1968 with a US representative sample of 18,000 individuals.

[3] More specifically, selected panelists have the following characteristics: (i) those who provided for the first years only a monthly rental payment (R) and for the last years only a monthly mortgage installment (M) and (ii) those for which the first year in which the monthly mortgage installment shows up is one year after the last year the monthly rental payment shows up.

ments of $413. Define the monthly payment of the equivalent interest-only mortgage as Y. The *discounted cash flow analysis* rule is to buy if $Y < R$ (the monthly rental payment) and to rent if $Y > R$. Participants are asked whether they want to buy or rent a house in four different scenarios that form the four potential outcomes of two different effects: (i) the *mortgage illusion* effect, whose predictions might be to buy (if $M < R$) or rent (if $M > R$); (ii) the *discounted cash flow analysis* effect, whose predictions might be to buy (if $Y < R$) or rent (if $Y > R$). When the *discounted cash flow analysis* effect's prediction is renting, 48% of participants buy if the *mortgage illusion* effect predicts renting, and 71% of participants buy if the *mortgage illusion* effect predicts buying. Thus, out of the participants that rent in the scenario that both effects predict renting, 45% switch to buy as the *mortgage illusion* effect switches from rent to buy. In other words, when the *discounted cash flow analysis* effect's prediction is to rent, it has 45% less accuracy predicting participants' outcome if the *mortgage illusion* effect prediction is not coincident. 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 predicting participants' outcome if the *mortgage illusion* effect prediction does not coincide.

Our second main experiment is a non-parametric randomized control trial, in which the *mortgage illusion* effect is the treatment. Eight hundred forty-four participants take part in an online survey in which they should answer questions on whether they should buy or rent a house (as in experiment 1). In all questions, the monthly rental payment R and the *discounted cash flow analysis* effect's prediction are constant. We choose values that make the *discounted cash flow analysis* effect's prediction to be neutral between buying and renting. The only parameters that are not constant are the monthly mortgage installment M and the mortgage length term, which decreases with the monthly mortgage installment. Participants answer eight questions, 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. The order of the questions is randomly assigned. Results are consistent with the *mortgage illusion* effect and they cannot be explained by monthly budget constraints. More precisely, participants' answers cluster around three regions: (i) a low monthly mortgage installment region, for which the proportion of participants that buy is relatively high; (ii) an intermediate monthly mortgage installment region, in which mortgage values are around the monthly rental payment, for which the proportion of participants that buy is decreasing with the monthly mortgage installment; (iii) a high monthly mortgage installment region, for which the proportion of participants that buy is relatively low. Results can be seen in figure 4. Moreover, we compute the number of participants who switch from buying to renting as the monthly mortgage installment increases. We find that switchers concentrate in the regions in which the mortgage installment becomes higher than the monthly rental payment, as shown in figure 5. Results are consistent with participants using a monthly mortgage installment threshold that is around or

slightly higher than the monthly rental payment, which is the same pattern found in the PSID (see figures 1 and 2). Participants switch on average at 849 dollars, while the monthly rental price is 800 dollars. Our results are not driven by personal preferences. As can be seen in table 8, the results of OLS regressions are equivalent to those found in figure 4. In addition, results are robust to the inclusion of person fixed effects and cluster standard errors at the person level. These results indicate that our findings are not the result of effects that are constant across bins, such as ownership bias - the innate preference for buying or renting of each household - and different tax treatments for renting and buying.[4]

We run another four experiments that aim to check the robustness of our results. In experiment 3, the small differences experiment, we narrow the gap between the monthly rental payment and the monthly mortgage installment to 5 dollars and yet find that people are more likely to buy when the monthly mortgage installment is lower than the monthly rental payment, a result that is very unlikely to be explained by home buyers' monthly budget constraints. Experiment 4, the elevator study, adds a condition in which the monthly rental payment is the same as the monthly mortgage installment in order to elicit the baseline preference of participants. We observe that people are indeed more likely to switch from buying to renting around the threshold, when the monthly mortgage installment M is equal to the monthly rental payment R. Experiment 5, the correlates experiment, measures several potential individual biases that could be related to the mortgage illusion. Only the immediacy bias and the long-term discount factor significantly correlate with the mortgage illusion, *i.e.*, more impatient individuals are more likely to incur the mortgage illusion. We also observe that the mortgage illusion is lower among stock investors, full-time students, and married individuals. Experiment 6, the education study, shows that a financial education intervention is not effective at reducing the *mortgage illusion* effect.

Our paper contributes to the behavioral finance literature by proposing a new heuristic of personal biases in financial decision making. The *mortgage illusion* suggests that home buyers use the monthly rental payment as a reference point to the monthly mortgage installment. Therefore it fits with a broader class of behavioral anomalies related to reference-dependent preferences and the realization utility framework (Barberis and Xiong 2012 ; Ingersoll and Jin 2013). Individuals derive utility not only from consumption but also from realized gains. For instance, investors do not consider their full portfolio when evaluating their investing history. They instead focus on whether they gained or lost money on a particular investment (Barberis and Huang 2001). Similarly, Baker, Pan, and Wurgler 2012 show that managers use previous target peak stock prices as reference points for offer prices in merger and acquisitions. Loughran and Ritter 2002 and

[4]Even though the difference in tax shields created by the payment of mortgages is slightly different across bins, it is negligible if compared to the difference in tax shields between buying and renting.

Ljungqvist and Wilhelm 2005 discuss the use of reference points as an explanation for initial public offerings (IPOs) underpricing. Corporate managers engage in stock splits as investors prefer shares with lower prices (Baker, Greenwood, and Wurgler 2009). Baker and Xuan 2016 show that the price at which the chief executive officer (CEO) joined the company is a reference point for primary issuances. In addition, investors do not react the same way to negative and positive outcomes, as they become more pessimistic to the former than optimistic to the latter (Kuhnen 2015). And previous capital gains reduce investors sensitivity to risk, while previous losses, by making any new loss more painful, increase risk aversion (Barberis, Huang, Santos, et al. 2001). Along the same vein, the *mortgage illusion* suggests that home buyers use the monthly rental payment as a reference point to the monthly mortgage installment and derive utility from paying each month less for a mortgage than for rent. Home buyers may narrowly focus on monthly payments and be highly motivated to equalize their current rental payment with prospective mortgage installments. Another study that shows how narrow framing might influence households' portfolio decisions is Kumar and Lim 2008. The *mortgage illusion* is a heuristic that often leads investors to take decisions that are inconsistent with standard discounted cash flow valuations. It then relates to behavioral papers showing that investor sentiment or rules of thumb can affect financing decisions. Edmans, Garcia, and Norli 2007 show that investors overreact to sports event such as the World Cup. Graham and Harvey 2001 survey CFOs and find that they employ naive rules of thumb for capital budgeting decisions.

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 are constructed narrowly. In addition, investors 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 horses would really like to at least break even for a given day and end up making longer shots at the end of the day (McGlothlin 1956). Similarly, 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). Along the same vein, home buyers might focus on the monthly expenses of renting vs. buying - the *mortgage illusion* - and fail to consider that these expenses are part of a longer stream of payments.

The *mortgage illusion* is also consistent with 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. Movers arriving from a more expensive city end up renting pricier apartments than those arriving from cheaper cities (Simonsohn and Loewenstein 2006), which is consistent with anchoring to their original city's house prices.

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 (McGlothlin 1956; Kahneman and Lovallo 1993; Camerer, Babcock, Loewenstein, and Thaler 1997; Barberis and Huang 2001; Rabin and Thaler 2001). Kahneman and Frederick 2002 propose attribute substitution, when individuals struggle to find an answer to a decision problem and substitute the solution to a related simple problem. Rather than employing a *discounted cash flow analysis*, home buyers might be resorting to the simpler *mortgage illusion* when deciding whether to buy a house. Money illusion (Fisher 1928), when investors base their decision on nominal prices rather than real ones, is another manifestation of attribute substitution.

The recent housing crisis questioned 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 *mortgage illusion*. They directly compare the monthly rental payment and the monthly mortgage installment even though these two payments are not directly comparable. Those who incur the *mortgage illusion* are likely to enter 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 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.

Therefore, investigating the determinants of mortgage choice might shed some light on the subprime mortgage market in the US, one of the important drivers of the 2007-2009 Great Recession (Mayer, Pence, and Sherlund 2009, Gerardi, Goette, and Meier 2013, Brueckner, Calem, and Nakamura 2012). The *mortgage illusion* might have contributed to households picking mortgages that were not affordable in the long run which in turn might explain in part the rise in US mortgage delinquencies from 2007 to 2009, viewed by the literature as one of the culprits of the Great Recession. Behavioral biases can indeed lead to adverse macroeconomic shocks (Korniotis and Kumar 2011). If households were aware of the *mortgage illusion*, strategic default by investors that are in negative equity might have been prevented. Guiso, Sapienza, and Zingales 2013 show that home buyers strategically choose to default when the value of the house is lower than the value of the mortgage. Ghent and Kudlyak 2011 and Campbell and Cocco 2015 also study costly defaults

that might be caused by the *mortgage illusion*. If households follow the *mortgage illusion* they might end up defaulting on mortgages, worsening their balance sheets and their employment prospects. Mian and Sufi 2014 link the deterioration of household balance sheets to a drop in employment during the Great Recession.

The novel contribution of this paper is to document a new heuristic of home purchasing. Our findings indicate that potential home buyers use a simplistic rule that causes them to deviate from *discounted cash flow analysis*. In particular, our experiments suggest that around half of participants might turn away from the optimal discounted cash flow analysis decision when its prediction does not coincide with the *mortgage illusion* effect. The paper continues as follows. Section 2 presents how we collect the data for our experiments. Sections 3, 4 and 5 respectively explains the general design of our experiments, details our main experiments' procedures and findings and describes further experiments aimed to test the robustness of our results. Finally, section 6 concludes.

2 Data

Most of our experiments are run on Amazon Mechanical Turk (mTurk), an online double-blind platform. The experiments paid $0.50 for approximately a 10 minutes session. Workers are registered users from all over the world. For a description of typical mTurk workers, see Mason and Suri 2012. Previous research has shown that mTurk is a reliable source of data (Paolacci and Chandler 2014). The results of experiments conducted on mTurk replicate laboratory results (Berinsky, Huber, and Lenz 2012). Respondents on mTurk answer the questions in their environment allowing the execution of artefactual field experiments (Horton, Rand, and Zeckhauser 2011).

The data collection procedure was careful to ensure the quality of the data. First, only workers based in the United States were recruited to answer the study. Second, only workers with at least 95% positive rates on all the tasks accepted in the past were recruited. Third, workers were informed that payment would be contingent on answering all the survey. Fourth, in order to discourage workers to skip questions, a pop-up window appeared whenever a question was left blank. Fifth, we track the time respondents take to answer each question. Sixth, we use a within-subjects design alleviating concerns of heterogeneity of the sample. For similar cautionary steps, see Kuziemko, Norton, Saez, and Stantcheva 2015 and D'Acunto 2015. In addition to those steps, we included in the beginning of each study a method named "instruction manipulation check" developed by Oppenheimer, Meyvis, and Davidenko 2009 to select only the respondents that pay attention to the questions. In the instruction manipulation check, respondents are asked to give a specific response instead of answering the question. By employing this method, we select only workers who pay attention to the questions. The verbatim instruction manipulation check is

presented in the appendix section A.1.

3 Experimental Design

The objective of our experiments is to show that the *mortgage illusion* heuristic affects the decision to buy or rent a house. In other words, potential home-buyers are affected by the comparison between the monthly mortgage installment (M) and the monthly rental payment (R) when deciding to buy or rent a house. In particular, home-buyers are more inclined to buy a house if the monthly mortgage installment (M) is lower than the monthly rental payment (R).

A *discounted cash flow analysis* of the renting and buying alternatives would elicit the best financial housing decision. More precisely, consider a house selling at a price S dollars with the following mortgage conditions: down payment D in dollars, length term in years (T) and annual interest rate (i). If combined, those conditions are associated to a monthly mortgage installment M. Now suppose the same house is renting for a monthly rental payment (R). Consider further the monthly dollar amount yield (Y) off a savings deposit worth the house selling price S. We argue that the *discounted cash flow analysis* is to buy if $R > Y$ and to rent if $R < Y$. A quick intuitive explanation for this result is that the mortgage contract is nothing more than a loan from a bank that allows home-buyers to pay S dollars for the house seller. They could instead open a savings deposit yielding the same interest rate i as in the mortgage contract and collect Y dollars each month from it. If $Y > R$, she could rent the house and cash in Y - R each month. If instead $Y < R$, the *discounted cash flow analysis* would be to buy the house.

Our goal is to show that the beyond the basic *discounted cash flow analysis*, home-buyers follow the *mortgage illusion* heuristic when deciding whether they should buy or rent.

Hence, in our experiments, potential home-buyers will face a housing decision that is affected by at least these two factors: (i) the *mortgage illusion* heuristic, *i.e.*, whether R>M or R<M (we predict that they will prefer to buy if R>M and to rent if R<M) and (ii) *discounted cash flow analysis*, whether R>Y or R<Y (we predict that they will prefer to buy if R>Y and to rent if R<Y). By combining these two factors, home-buyers will answer whether to buy or rent a house in any of the four scenarios described in panel A of table 1, which also summarizes the main goal of each of the six experiments we implement in its panel B.

4 Main Experiments

4.1 Experiment 1: the *Mortgage Illusion or Discounted Cash Flow Study*

The objective of the first experiment is to study whether the *Mortgage illusion* heuristic matters, even in the presence of *discounted cash flow analysis* effects. Four hundred and eighty-three M-turk workers took part in the experiment (216 males, 267 females, mean age 36.3 years, 12.8 years standard deviation). We discard 37 answers, as they fail to answer a question in which we assess whether participants are paying attention or not. We have a final sample of 446 M-turk workers. Each participant should answer four questions. Each question represented one out of four scenarios and had as possible answers "buy" or "rent". The four scenarios were the combination of the two potential outcomes of the *Mortgage illusion* heuristic (Is M higher or lower than R?) and the *discounted cash flow analysis* (Is Y higher or lower than R?). They are described in panel A of table 2. In order to dissipate any potential effects of the order in which participants respond questions, we split them into four cohorts according to the Balanced Latin Square methodology, as can be seen in panel B of table 2. For instance, participants in cohort 1, first answer scenario A, then B, D and finally C, while those in cohort 3 follow the order C, D, B and A.[5]

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, assuming the participant owns D dollars in cash; 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(%). 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 illusion* heuristic and the *discounted cash flow analysis* effects. In scenario A, the *Mortgage illusion* heuristic influences home buyers to buy the house, as M=889 $<$ R=1150. The discounted cash flow analysis effect also influences home buyers to buy the house, as Y=883 $<$ R=1150. In the remaining three scenarios the *Mortgage illusion* heuristic and *discounted cash flow analysis* predictions are as follows: B, rent, buy; C, buy, rent; D, rent, rent. Panel A of table 2 describes all the parameters in each of the four different scenarios. Appendix A.2 shows the verbatim experiment scenarios read by participants.

[5]In the Balanced Latin Square methodology, each treatment condition appears only once in each position in the order sequence (controlling for order effects), and each treatment condition follows every other condition an equal number of times (controlling for carryover effects).

4.1.1 Experiment 1 Findings: the *Mortgage Illusion or Discounted Cash Flow Study*

We find that the *Mortgage illusion* heuristic positively 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. Home-buyers are also positively influenced by the *discounted cash flow analysis* effect: they become more likely to buy the house if the monthly yield Y off a savings account worth the house value is lower than the monthly rental payment R.

The two effects can be assessed in figure 3. The averages of home-buyers that answer "buy" in each of the four scenarios are plotted. The *Mortgage illusion* effect is consistent with the fact that (i) scenario D average is statistically lower than scenario C average, *i.e.*, home-buyers become more inclined to buy the house if M > R switches to M < R in a setting in which the discounted cash flow analysis effect influences home-buyers to rent the house; and that (ii) scenario B average is statistically lower than scenario A average, *i.e.*, home-buyers become more inclined to buy the house if M > R switches to M < R in a setting in which the *discounted cash flow analysis* effect influences home-buyers to buy the house. Likewise, the *discounted cash flow analysis* effect is also consistent with our results: (i) scenario D average is statistically lower than scenario B average, *i.e.*, home-buyers become more inclined to buy the house if Y > R switches to Y < R in a setting in which the *mortgage illusion* effect influences home-buyers to rent the house; and that (ii) scenario C average is statistically lower than scenario A average, *i.e.*, home-buyers become more inclined to buy the house if Y > R switches to Y < R in a setting in which the *mortgage illusion* effect influences home-buyers to buy the house.

The averages for the four different scenarios are shown in table 3. The unconditional average of buyers is 69% across the 1784 answers (4 answers by each of the 446 participants). The conditional average of buyers for the four scenarios are as follows: (A) Y > R, M > R: 85%; (B) Y < R, M > R: 72%; (C) Y > R, M < R: 71%; (D) Y > R, M > R: 48%. We can confirm that these differences in means are statistically significant in table 4, in which mean-comparison tests (t-tests) are performed.

Finally, we perform an OLS regression in which the outcome variable is the dummy that assumes value 1 if the respondent answers "buy" and 0 if she answers "rent"; and the regressors are (i) a *mortgage illusion* dummy (R-M) which assumes value 1 if M < R and 0 otherwise; (ii) a *discounted cash flow analysis* dummy (R-Y) which assumes value 1 if Y < R and 0 otherwise. We also include an interaction of the two dummies and a constant as follows:

$$P(Buy)_i = \alpha + \beta_1(R-M)_i + \beta_2(R-Y)_i + \beta_3(R-M)_i * (R-Y)_i + \epsilon_i$$

$$(R-M)_i = \begin{cases} 1 & \text{for} \quad M < R \\ 0 & \text{for} \quad M \geq R \end{cases}$$

$$(R-Y)_i = \begin{cases} 1 & \text{for} \quad Y < R \\ 0 & \text{for} \quad Y \geq R \end{cases}$$

It is worth noting that the two dummies assume value 1 when the underlying effects predict home-buyers to buy the house. A positive β_1 is consistent with a working *mortgage illusion* effect. A positive β_2 is consistent with a working *discounted cash flow analysis* effect. A positive interaction would mean that the *mortgage illusion* effect is stronger when the *discounted cash flow analysis* effect influences people to buy.

Results are shown in table 5. Standard errors are clustered at the person level. We find that both effects are positive and significant and that the interaction is negative and significant. More precisely the *mortgage illusion* effect increases the average of buyers by $\hat{\beta}_1 = 0.238$ (t-stat of 8.98) when the *discounted cash flow analysis* effect is to rent. If the *discounted cash flow analysis* effect is to buy, the *mortgage illusion* effect increases the average of buyers by $\hat{\beta}_1 - \hat{\beta}_3 = 0.12$ ($\hat{\beta}_3$'s t-stat of -3.78). The *discounted cash flow analysis* effect has a similar magnitude to the *mortgage illusion* effect. If the *mortgage illusion* effect is to rent, the *discounted cash flow analysis* effect increases the average of buyers by $\hat{\beta}_2 = 0.240$ (t-stat of 10.71). When the *mortgage illusion* effect is to buy, *discounted cash flow analysis* effect increases the average of buyers by $\hat{\beta}_2 - \hat{\beta}_3 = 0.122$. The average of buyers when both effects are to rent is estimated as $\hat{\alpha} = 0.475$ (t-stat of 20.06).

4.2 Experiment 2: the *Bin Study*

The objective of this experiment is to show that most home-buyers that base their decision on the *Mortgage Illusion* heuristic will switch from "buy" to "rent" or from "rent" to "buy" in a setting that the mortgage monthly installment M is around the monthly rental payment R. Eight hundred forty-four M-Turk workers took part in this experiment, out of which 74 were discarded as they failed a initial question that assessed whether they were paying attention or not. The final sample has 770 M-Turkers workers (444 males, 336 females, mean age 34.7 years, 10.8 years standard deviation).

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 R, 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 at the same annual interest rate of 3%. In all questions, if they decide to invest \$324,000 in the savings account, it will yield \$800 each month. Hence, the *discounted cash flow analysis* effect

prediction would be that home buyers would be neutral between "buy" or "rent" for all questions. The only 2 variables than 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). In order to dissipate any potential effect of the order in which participants answered questions, we split them into eight cohorts for which the order of questions were set according to the Balanced Latin Square Methodology. The details of the experiment can be found on table 6. Appendix A.3 shows the verbatim experiment scenarios read by participants.

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 the *Mortgage Illusion* heuristic does not affect the decision to buy or rent a house, we should find that on average the proportion of participants that choose to buy is not statistically different across the 8 different questions, which is equivalent to our first hypothesis:

> **Hypothesis 1: The *Mortgage Illusion* heuristic is used by home buyers if the proportion of buyers change with the mortgage monthly installment M**
>
> *In a randomized control trial in which the only source of variation is the mortgage monthly installment M, the* Mortgage Illusion *heuristic affects the decision to buy or rent a house if the average proportion of buyers is influenced by M*

The *Mortgage Illusion* heuristic might be a proxy for household financial constraints. Consider one home buyer that has a limited monthly budget B and does not feel comfortable to spend more than a fraction of her budget on the monthly mortgage installment M. Everything else constant, she will choose to rent a house if $M > B$ and if $R < B$. In contrast, it might be the case that she is still sensitive to the *Mortgage Illusion* heuristic even if her budget constraint is not biding, *i.e.*, if $M < B$ and if $R < B$:

> **Hypothesis 2: The *Mortgage Illusion* heuristic is used by home buyers whose household budget constraints are not binding.**
>
> *In a randomized control trial in which the only source of variation is the mortgage monthly installment M and that home buyers budget constraints are not binding, the* Mortgage Illusion *heuristic affects the decision to buy or rent a house if most of the change in the average*

proportion of buyers across bins is in bins for which the monthly mortgage installment M is around the monthly rental payment R.

Hypothesis 2 is consistent with a relatively high constant average proportion of buyers for bins in which $M < R$ and a relatively low constant average proportion of buyers for bins in which $M > R$. It is worth noting that there might be *transition bins* in which the average proportion of buyers decreases with M. More precisely, hypothesis 2 couldn't be rejected if our results have the following pattern: (i) for bins in which M is relatively lower than R, the average proportion of buyers is relatively high; (ii) for bins in which M is around R, the average proportion of buyers decreases with M; (iii) for bins in which M is relatively higher than R, the average proportion of buyers is relatively low.

4.2.1 Experiment 2 Findings: the *Bin Study*

Our findings support both hypotheses 1 and 2 and can be better seen in figure 4. Each of the participants answered all 8 questions and contributes with 8 observations, one for each bin. The average proportion of buyers is not constant across bins, corroborating hypothesis 1. And the pattern in how different the means are seems not to be driven by home buyers budget constraints, as proposed by hypothesis 2.

A quick inspection in figure 4 suggests hypothesis 1 is not rejected, which can be confirmed by taking a look at table 7. Mean-comparison tests (t-tests) are reported and we can conclude that means across bins are statistically different. For instance, the mean comparison between the bins 4 (M=775) and 5 (M=825) - respectively, just lower and just higher than the monthly rental payment R which is fixed at 800 dollars for all bins - yields a 8.1% statistically significant difference ($p < 0.01$).

Hypothesis 2 is also consistent with figure 4, in which we can see three regions: (i) a high-plateau region formed by bins 1 (M=625), 2 (M=675), 3 (M=725) and 4 (M=775); (ii) a decreasing transition region formed by bins 5 (M=825) and 6(M=875); (iii) a low-plateau region formed by bins 7 (M=925) and 8 (M=975). In conjunction with table 7, we can establish an objective criterium in order to form the regions: regions are well defined within frontiers and we can define that bin i and bin j are separated by a frontier if their means are statistically different. Either by taking a look at the 95% confidence intervals in figure 4 or which of the consecutive means are statistically different at the 1% significance level in table 7, this criterium defines that frontiers are two: the first one between bins 3 and 4 and the second one between bins 6 and 7. If home buyers were refraining from buying houses as a response to budge constraints, bins 7 and 8 should not form a low plateau region, but rather a continuation of the decreasing region formed by bins 4, 5 and 6.

Results might be influenced by the fact that each participant answers all 8 questions. In order to show that results are not driven by it, we implement two exercises that dissipate the multi-response effect. First, we include person fixed effects and cluster standard errors at the person level. Second, we run an exercise with a bootstrapping flavor, in which a person only answers one question.

Table 8 shows results for the fixed effects analysis. There are 3 specifications. The first column is the regression-equivalent to figure 4, with no fixed effects, and the first bin omitted. The estimated coefficients are exactly the averages found in figure 4 as there is no constant in the model. In contrast, the specification shown in column 2 includes a constant and measures the same effects as the ones in column 1, but in relative terms to the first bin, which is estimated in the constant coefficient. The specification with person fixed effects and standard errors clustered at the person level are shown in column 3. By comparing the estimated coefficients in columns 2 and 3, we can conclude that the person multi-response effect does not drive the *mortgage illusion* effect. Fixed effects include all the omitted variables that are constant for a person across bins. For instance, the buying preferences of home buyers should not affect the specification with person fixed effects as it is reasonable to assume that the innate willingness of the participant to buy a house does not change with the amount she has to pay each month for the mortgage. Other variables controlled for with the fixed effects are income, cognitive limitations and financial literacy. Moreover, this specification also allows for the standard errors for one person to be correlated across bins, as we use standard errors clustered at the person level. In other words, it is not a concern if a participant's second answer is influenced by her first answer.

It is also interesting to characterize the pattern of answers of participants. In particular if they follow a consistent pattern, which we split into three groups: (I) buyers, the ones that always answer "buy"; (II) renters, the ones that always answer "rent"; and (III) switchers, the ones that switch from "buy" to "rent" only once as the mortgage monthly installment M increases. All participants that do not fall into one of those three categories are defined as non-consistent participants. Table 9 shows how participants are split. Seventy-seven percent out of the 770 participants are consistent and those are sub-divided into 37.0% of buyers, 9.4% of renters and 31% of switchers.

Within the switchers it is interesting to note that 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. This can be confirmed by a quick comparison between figures 4 and 5. 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. This is consistent with our previous findings in the analysis of Panel Study of Income

Dynamics (PSID), in which mortgages monthly installments switches are in a region between the monthly rental payment R and R+100. We compute a final statistic that computes the average switch for consistent participants. More precisely, if a consistent participant switches from ”buy” to ”rent” in the region M in (i,j), we attribute it a switching value of (i+j)/2. For instance, if the switch occurs from M=775 to M=825, the switch value is 800. The average switching value for all switchers is M=849. This value falls in line with our two previous findings shown in figures 4 and 5. The average switch value is right in the middle of the region (R,R+100).

5 Robustness Experiments

5.1 Experiment 3: the *Small Differences Study*

It is worth investigating whether the *mortgage illusion* effect works in a very conservative setting. More precisely, in experiment 3, we present participants with scenarios in which they have a strong incentive to buy. That is, the outcome from the *discounted cash flow analysis* is to buy. The rent then decreases by very small amounts ($10). Our goal is to test whether such a small change in rental price would make participants switch to renting.

Five hundred eighty-five M-Turk workers take part in the experiment, but 48 are discarded as they fail to pass the attention filter. Five hundred thirty-seven participants remain (223 males, 314 females, mean age 37.1 years, 11.5 years standard deviation). The details of the experiment design can be seen in table 10. All parameters are constant, with the exception of the monthly rental payment R, which varies by 10 dollars amounts in the 4 different scenarios: 1035, 1045, 1055 and 1065 dollars. The house price, mortgage length contract, the annual interest rate are fixed at 270,000 dollars, 4% and 30 years respectively and they correspond to fixed mortgage monthly installment M and equivalent monthly yields Y (off a savings deposit worth the house value) of 1050 and 884 dollars. As Y=884 $<$ min{R} =1035, all scenarios correspond to a *discounted cash flow analysis* effect with a relatively strong incentive to buy. Participants are either in cohort A or cohort B and answer ”buy” or ”rent” for all four scenarios in the cohort. While cohort A presents scenarios in a ascending order of the monthly rental payment R, cohort B presents them in a descending order. Appendix A.4 shows the verbatim experiment scenarios read by participants.

5.1.1 Experiment 3 Findings: the *Small Differences Study*

Results are shown in table 11 and support the *mortgage illusion* effect. Panel A shows that participants have a strong incentive to buy, as 74% always answer buy. This is consistent with the fact

that the monthly rental payment R is at least 150 dollars higher than the monthly yields Y off a savings account worth the house value, which is the prediction of the *discounted cash flow analysis* effect. Another 13% of participants always answer rent, which adds up to 87% of our sample for which the *mortgage illusion* effect is not applicable - a setting in which the preference for buying or renting is so strong that participants always have the same answer.

It is interesting to study the remaining subsample which contains 13% of the sample and is made of switchers (9.5%), those that switch only once in the right direction (switch to rent as R decreases) and the inconsistent (3.4%), those that are not buyers, renters or switchers. Panel B shows the breakdown of switchers in three regions and gives evidence that most switch to rent at the M=1050 border, *i.e.*, from R=1055 to R=1045. More precisely, 47% switch at the border, 27% just before the border from 1065 to 1055 and 25% just after the border from 1045 to 1035.

This study confirms that even in a setting in which home buyers are strongly motivated to buy, around one-tenth of participants change their decision to "rent" under conditions that are very unlikely to be explained by effects other than the *mortgage illusion* effect. The very fine variations of the rental monthly payment R around the region in which it equals the monthly mortgage installment M discard the alternative explanation of home buyers budget constraints, as it is unlikely that 5 dollars increments would render the budget constraint binding. In addition, the decision to rent cannot be explained by the *discounted cash flow analysis* effect, as in this setting its prediction is to buy.

5.2 Experiment 4: the *Elevator Study*

One hundred twelve M-Turk workers take part in the experiment (34 males, 78 females, mean age 34.1 years, 10.8 years standard deviation). As in experiments 2 and 3, the objective of this experiment is to test whether switchers concentrate around the region where the monthly mortgage installment M is close to the monthly rental payment R. Relative to experiment 2, the new feature in this experiment is to test the robustness of results not only for different levels of M but also for different levels of R. Relative to experiment 3, the new feature in this experiment is to test the robustness of results for larger values of the difference between M and R. In this experiment, there are two cohorts, (A) for which the outcome of the *discounted cash flow analysis* is always to rent, and (B) for which the outcome of the *discounted cash flow analysis* is always to buy. (In experiment 2, the outcome of the *discounted cash flow analysis* is always neutral). Within each cohort, there are five scenarios. From scenario 1 to scenario 5, the monthly rental payment R is decreasing and the monthly mortgage installment M is increasing. In both cohorts, the monthly rental payment R and the monthly mortgage installment M are equal in scenario 3. The details of the experiment

design can be seen in table 12. If our predictions about the *mortgage illusion* effect are correct, we expect most participants to switch from buy to rent either from scenario 2 to scenario 3 or from scenario 3 to scenario 4 (in both cohorts) because the monthly mortgage installment M becomes equal or higher than the monthly rental payment R. Appendix A.5 shows the verbatim experiment scenarios read by participants.

5.2.1 Experiment 4 Findings: the *Elevator Study*

Results can be seen in table 13 and figure 6, which shows results at the person level. As expected, most consistent participants (switchers) switch to rent from scenarios 2 to 3 or from scenarios 3 to 4. Each participant is classified as either inconsistent or consistent based on the 5 answers given. An inconsistent participant is one that (i) switches from rent to buy as the mortgage monthly installment M increases; or (ii) switches more than once; A consistent participant can be of three types: (i) buyers, those that always buy; (ii) renters, those that always rent; or (iii) switchers, those that switch from buy to rent only once as the mortgage monthly installment M increases. Switchers can be classified in four regions, according to the scenarios between which they switch to rent. Overall, there are 13% of buyers, 12% of renters and 40% of switchers. Among the switchers, 6.3% switch from scenarios 1 to 2, 13% switch from scenarios 2 to 3, 15% switch from scenarios 3 to 4 and 6.3% switch from scenarios 4 to 5.

The findings in this experiment are consistent with a setting in which households are influenced by the *mortgage illusion* heuristic and not influenced by budget constraints. If they were influenced by the latter effect, there should be a higher number of switchers from scenarios 4 to 5, as this would be consistent with households switching to rent as they are not able to pay a relatively high monthly mortgage installment.

5.3 Experiment 5: the *Correlates Study*

The objective of this experiment is to test potential correlates of the mortgage illusion. Participants answered four scenarios that measured the extent to which they incurred the *mortgage illusion* or performed a *discounted cash flow analysis*.

Six hundred eighty mTurk workers take part in the experiment, but 84 are discarded as they fail to pass the attention filter. Five hundred ninety-six participants remain (219 males, 319 females, mean age 36.7 years, 12 years standard deviation). The details of the experiment design can be seen in table 14. Participants are asked to answer whether they would buy or rent a house depending on the terms of a mortgage contract and the monthly rental payment. We expose participants to 4 different scenarios. The house price, mortgage length contract, and the rent are fixed

at 300,000 dollars, 30 years and 1,100 dollars respectively. In the first two scenarios, the interest rate is 6% and in the last two they are 3%. We also use down payment as 46%, 29%, 24% and 0% from the first to the fourth scenarios respectively. Therefore, the outcomes from a *discounted cash flow analysis* (Y=1460 in the first two scenarios and 740 in the last two ones) predict renting in the first two scenarios and buying in the last two ones. This also corresponds to mortgage monthly installments M of 950 dollars in the first and the third scenarios and 1,250 in the second and fourth ones.

We first identify those participants that incur the *mortgage illusion* or performed a *discounted cash flow analysis*. DCF is a dummy that takes value 1 for participants that choose to rent in scenarios 1 and 2 and to buy in scenarios 3 and 4, and takes value 0 otherwise. Mortgage illusion is a dummy that takes value 1 if the participant chooses to buy in scenarios 1 and 3 and to rent in scenarios 2 and 4, and takes value 0 otherwise.

We then measure the following individual difference scales: attitude towards saving (6 items; α=.87; Yamauchi and Templer 1982), financial literacy (13 items; KR-20 α=.77; Fernandes, Lynch, and Netemeyer 2014), need-for-cognition (5 items; α=.88; Epstein, Pacini, Denes-Raj, and Heier 1996), numeracy (8 items; KR-20 α=.70; Soll, Keeney, and Larrick 2013), preference for numerical information (8 items; α=.89; Viswanathan 1993), propensity to plan for time in the short-run (6 items; α=.91; Lynch, Netemeyer, Spiller, and Zammit 2010) and propensity to plan for money in the long-run (6 items; α=.89; Lynch, Netemeyer, Spiller, and Zammit 2010), time discounting and immediacy bias Meier and Sprenger 2012), willingness to take financial risks (4 items; α=.78; Weber, Blais, and Betz 2002). The items of each individual difference scale can be found in the appendix section A.6.

Attitude towards saving measures the extent to which individuals keep track of their expenses and savings. Financial literacy, need-for-cognition, numeracy, and preference for numerical information measure individuals cognitive ability to deal with financial and/or numerical information. Propensity to plan for time and money measure the extent to which individuals plan their time schedule for the next 1-2 months and budget for the next 1-2 years. Time discounting measures the monthly discount factor by prompting individuals 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. And the 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, whether they are underwater in paying a mortgage, their net wealth, whether they have ever invested in stocks, the percentage of their investments in stocks, and their demographic characteristics (age, gender, number of children, annual income, occupation, marital status and education level). These

items can also be found in the appendix section A.6.

5.3.1 Experiment 5: Findings: the *Correlates Study*

We first test whether participants are influenced by the *mortgage illusion* and the *discounted cash flow analysis* effects. Results can be seen in table 15. We find that 5% of respondents make choices consistent with the *discounted cash flow analysis* (they rent in the first two scenarios and buy in the last two ones), whereas 24% of respondents make choices consistent with the *mortgage illusion* (they rent in the first and the third scenarios in which the rental payment is lower than the mortgage installment and buy in the second and the fourth scenarios in which the rental payment is higher than the mortgage installment). We also find that 23% of respondents always choose to buy while 14% always choose to rent in all scenarios, *i.e.*, no matter the conditions of the mortgage contract.

Next, we test how the individual difference and demographic scales correlate with the *mortgage illusion* and the *discounted cash flow analysis* effects.

The correlates between the individual difference scales and the *mortgage illusion* are shown in table 16. We find that individuals with a higher long-term time discount factor (who prefer larger payouts in 7 months rather than smaller payouts in 6 months) are less likely to incur the mortgage illusion (β=-.268; p=.054). We also find that people with a higher immediacy bias (who discount more immediate intervals) are more likely to incur the mortgage illusion (β=.251; p=.065). No other individual difference scale is significantly related to the *mortgage illusion*.

The correlates between the demographic scales and the *mortgage illusion* are shown in table 17. We find that individuals that have already invested in stocks are less likely to incur the mortgage illusion (β=-.073; p=.050). We also find that participants that are full-time students are less likely to incur the mortgage illusion (β=-.135; p=.021). Those that are married are also less likely to incur the mortgage illusion (β=-.073; p=.039). No other demographic scale is significantly associated to the *mortgage illusion*.

The correlates between the individual difference scales and the *discounted cash flow analysis* are shown in table 18. We only find a relatively weak significant positive relation for financial risk-taking (β=.004; p=.086). No other individual difference scale is significantly related to the *discounted cash flow analysis*.

The correlates between the demographic scales and the *discounted cash flow analysis* are shown in table 19. Individuals that are older are less likely to perform a DCF analysis (β=-0.001; p=.089). We also find that those that are married are more likely to perform a DCF analysis (β=.038; p=.046). No other demographic scale is significantly associated to the *discounted cash flow analysis*.

5.4 Experiment 6: the *Education Study*

The objective of this experiment is twofold. First, we would like to assess whether teaching participants that the monthly mortgage installment M might change without affecting the terms of debt of the mortgage contract affects or not how likely they are to consider the *mortgage illusion* effect when deciding to buy or rent a house. Second, we would like to implement a test in a university laboratory setting, which we did by inviting master students from the Catholic University of Portugal, a top institution in that country, to participate as subjects of our experiment.

Two hundred nineteen students take part in the experiment, out of which thirty-two are not considered as they fail to answer a question in which we assess whether they are paying attention or not. We are down to 187 students (88 males, 99 females, mean age 22.9 years, standard deviation age 1.47 years) that were split into two groups: (i) one in which they were treated with the following: they were asked to read a brochure that taught them basic valuation concepts of a mortgage contract, with 95 students; (ii) the other one in which they were not treated, with 92 students. Both groups answered the four scenarios, described in detail in table 20. As in previous experiments, the four scenarios represent the four possible outcomes of the *Mortgage illusion* and *discounted cash flow analysis* effects as each effect has the predictions buy and rent.

The difference between the treated group and the untreated one is that only the former read a brochure which instructs students on the valuation concepts of a mortgage contract. The brochure can be seen in the appendix subsection A.7.

5.4.1 Experiment 6: Findings: the *Education Study*

Our findings suggest that the treatment did not have any significant effect on the *Mortgage illusion* effect, which can be seen in column 7 of table 21, as the coefficient on the interaction of *Mortgage illusion* effect and the education dummy is not significant. If we compare columns 4 and 7, the only relevant difference is on the *discounted cash flow analysis*, which ceases to be significant in the more complete specification. It is interesting noting that the *Mortgage illusion* effect is still working in this experiment, but students that read the brochure were not influenced any differently than students that did not read the brochure. We can conclude that the education experiment is not effective in reducing the *Mortgage illusion* effect.

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 to use easy to implement rule-of-thumbs (Drexler, Fischer, and Schoar 2014) have been more effective at changing personal financial decision behaviors.

6 Conclusion

The decision to buy a house is a very important event for most households. 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 use 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 a rule of thumb that suggests taking the mortgage, that could increase the level of household leverage, which in turn could lead into personal bankruptcy in the medium term (Mian and Sufi 2011).

We propose a new heuristic along the features described above, the *mortgage illusion*. Home buyers in the PSID pay each month for their mortgage in the first year about the same as for their rent in the previous year before the house purchase. We then conduct a series of experiments that identify the *mortgage illusion* effect. We find that households are more likely to enter into mortgages if the monthly mortgage installment is lower than the monthly rental payment. In experiment 1, about half of participants reverse their decision from renting to buying due to the *mortgage illusion* when the *discounted cash flow analysis* is to rent. In experiment 2, we find that participants switch from buying to renting only for intermediate values of the monthly mortgage installment in a setting that the rent and the *discounted cash flow analysis* are constant. These results are robust to competing explanations, such as monthly liquidity constraints or ownership bias. They are also robust to person fixed effects suggesting that personal preferences cannot explain our findings. In experiment 3, we narrow the size of the difference between the monthly mortgage installment and the monthly rental payment to 5 dollars. We still find that participants switch around the threshold. This result is very hard to be explained by effects other than the *mortgage illusion*. In experiment 4, we add a baseline condition in which the monthly mortgage installment and the monthly rental payment. We replicate the *mortgage illusion* effect. In experiment 5, we measure stable individual differences such as personality traits and cognitive ability. We find that preferences for immediate rewards (immediacy bias) and impatience (reverse of long-term discount factor) positively correlate with the *mortgage illusion*. Married, full-time students and stock investors participants are less likely to incur the *mortgage illusion*. In experiment 6, a financial education intervention is not effective at reducing the *mortgage illusion* effect.

If the *mortgage illusion* was used by US households on the run-up for the housing bust around the 2007-2009 Great Recession, it might explain in part the rise in mortgage delinquencies (Adelino, Schoar, and Severino 2016) in that period, which some attribute as one of the main triggers of the financial crisis. Further research could study whether mortgage brokers explore the *mortgage illusion* to increase their profits while selling mortgages to households that are unaware that they are

purchasing a house that is a negative present value decision. It could be also interesting to investigate the cross-section and time series of households, in order to determine the characteristics of those more likely to follow the *mortgage illusion*.

Future research could also examine the psychological underpinnings of the *mortgage illusion*. Kahneman and Frederick 2002 argue that there are two systems of information processing. System 1 is posited to be evolutionary old and to process information in an intuitive manner, whereas System 2 is considered to have evolved more recently and to process information in a reflective manner. This dual process theory of thinking suggests that it is hard for people to avoid using System 1. 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 illusion* as they consider the monthly rental payment and the monthly mortgage installment at the same time. Experiment 5, the correlates study, indeed shows that financial literacy cannot explain the mortgage illusion.

The *mortgage illusion* is consistent with mental accounting. People might 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 rent or mortgage. The *mortgage illusion* is also consistent with anchoring. Home buyers, uncertain about how much they should each pay each month for their mortgage, end up anchoring on how much they pay for rent each month. A third possibility is that people are using the monthly rental payment as a reference point for the minimum amount they would like to pay for the mortgage each month, *i.e.*, they are targeting to pay for their mortgage each month at least the same they pay for rent before the home purchase. This entails that people are motivated to pay for mortgage the same as they pay for rent. Understanding the drivers of the *mortgage illusion* may shed light on its remedies. By knowing the situations in which the *mortgage illusion* is more likely to occur and/or the individuals that are more prone to it, future research can devise tools and explore mechanisms in order to prevent it.

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Figures and Tables

Figure 1: **The difference between mortgage and rent across home buyers**

The figure shows the number of home buyers as a function of M-R: the difference between current monthly mortgage installment (M) and previous year monthly rental payment (R). The panel data comes from the Panel of Study Income Dynamics Dataset and only panelists for which a non-missing mortgage and a missing rental in the current year and a missing mortgage and a non-missing rent are included in the analysis.

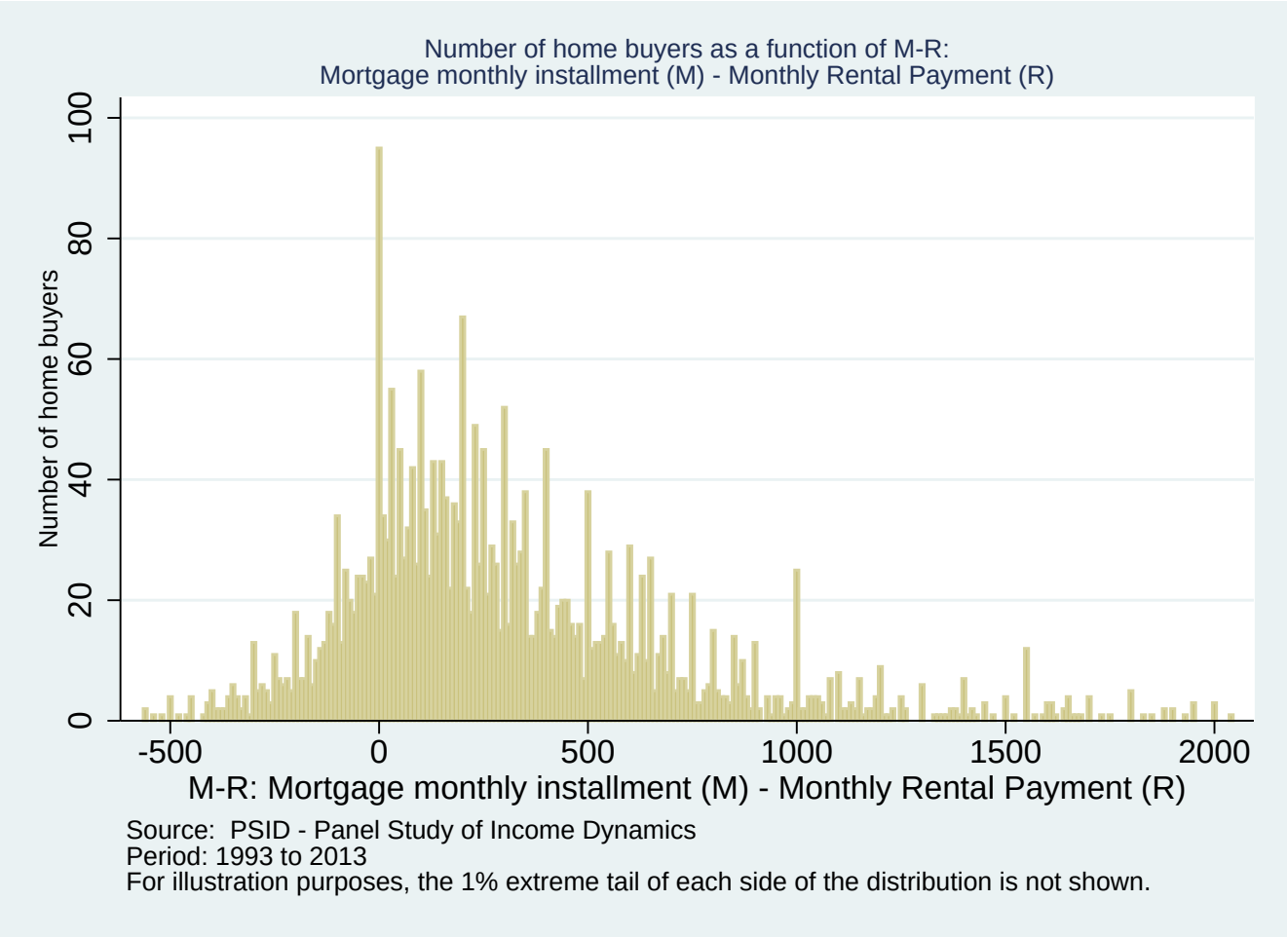

Figure 2: **The scaled difference between mortgage and rent across home buyers**

The figure shows the number of home buyers as a function of (M-R)/R : the difference between current monthly mortgage installment (M) and previous year monthly rental payment (R) scaled by R. The panel data comes from the Panel of Study Income Dynamics Dataset and only panelists for which a non-missing mortgage and a missing rental in the current year and a missing mortgage and a non-missing rent are included in the analysis.

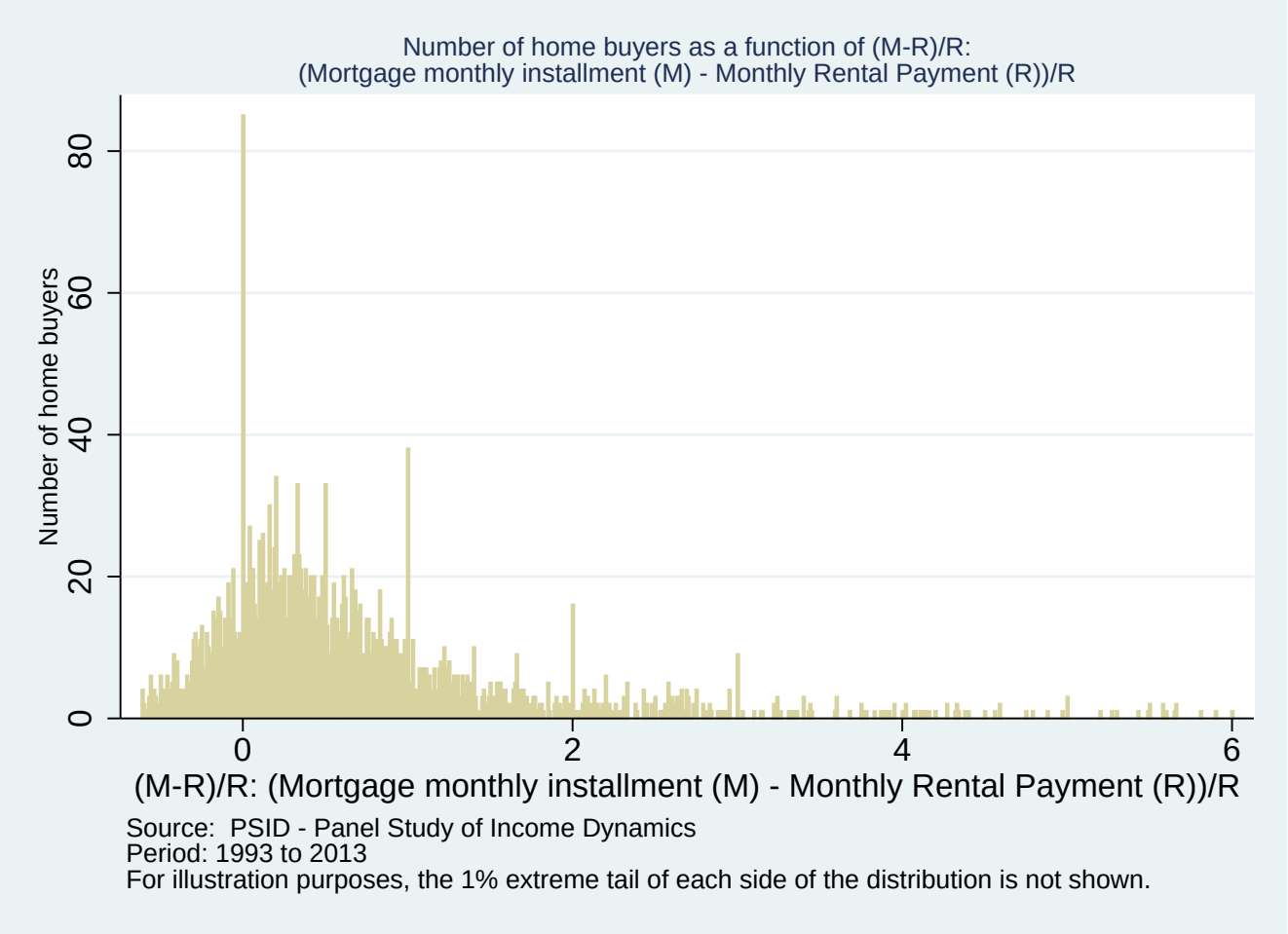

Table 1: Experiments - General Description

This table describes our experiments. Panel A shows the four scenarios considered in most experiments. The four scenarios are the 2x2 combination of the *mortgage illusion* effect and the *discounted cash flow analysis* effect. Both effects have as possible outcomes buy or rent. Y is the monthly mortgage installment of an interest-only perpetual mortgage worth the house price. M is the monthly mortgage installment in dollars. R is the monthly rental payment in dollars. Panel B summarizes all experiments run in this paper.

Panel A: Scenarios considered in experiments

Scenario	**Discounted Cash Flow Analysis**	**Mortgage Illusion**
A	Y <R (BUY)	M >R (RENT)
B	Y <R (BUY)	M <R (BUY)
C	Y >R (RENT)	M >R (RENT)
D	Y >R (RENT)	M <R (BUY)

Panel B: Description of the experiments

Exp	**Name**	**Description**	**Nbr part**	**Age Mean (SD)**	**% Fem**	**Result**
1 (Main)	Mort Illusion or DCF Study (MTurk)	Horse run between the *mortgage illusion* and *discounted cash flow* effects	446	36.3 (12.8)	55.3	Both work Mort ill stronger
2 (Main)	Bin Study (MTurk)	Random Control Treatment of the *mortgage illusion* effect	770	34.7 (10.8)	43.6	causal effect of Mort ill
3 (Rob)	Small Differences Study (MTurk)	Is the *mortgage illusion* effect relevant for small differences around the threshold?	537	37.1 (11.5)	58.5	Mort ill relevant even if financial constraint not binding
4 (Rob)	Elevator Study (MTurk)	*Mortgage illusion* effect when both R and M vary	112	34.1 (10.8)	69.6	Switchers concentrate around M=R
5 (Rob)	Correlates Study (MTurk)	Do other measures correlate with the *mortgage illusion* heuristic?	596	36.7 (12.0)	53.5	immediacy bias (+) and discount factor(-) correlates with mort. ill.
6 (Rob)	Education Study (Lab Study)	Is the *mortgage illusion* robust to an intervention?	187	22.9 (1.5)	52.9	mort. ill. survives intervention

Table 2: Experiment 1: Mortgage Illusion or Discounted Cash Flow Study - Description

This table describes experiment 1. Panel A details the scenarios under which participants should choose to buy or rent. DCF Decision is the outcome of the *discounted cash flow analysis* effect, which depends on R and Y. i is the annual interest rate charged on the mortgage. Y is the monthly mortgage installment of an interest-only perpetual mortgage worth the house price. M is the monthly mortgage installment in dollars. R is the monthly rental payment in dollars. 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. Panel B describes the Balanced Latin Square Cohorts of the experiment, implemented in order to dissipate the effect of the way questions are sorted.

Panel A: Scenarios

Scenario	**Mort Illusion Prediction**	**DCF Prediction**	**R**	**M**	**i (%)**	**Down payment(%)**	**Down payment**	**House Price**	**T**	**Y**
A	BUY	BUY	1150	889	4.0	20%	55,000	270,000	40	883
B	RENT	BUY	1150	1295	4.0	20%	55,000	270,000	20	883
C	BUY	RENT	1150	1089	5.5	20%	55,000	270,000	40	1207
D	RENT	RENT	1150	1462	5.5	20%	55,000	270,000	20	1207

Panel B: Balanced Latin Square Cohorts

COHORT	Q1	Q2	Q3	Q4
1	A	B	D	C
2	B	C	A	D
3	C	D	B	A
4	D	A	C	B

Figure 3: **Experiment 1: Probability of Buying as a Function of Mortgage Illusion and Discounted Cash Flow Analysis**

The figure shows the average number of participants that choose to buy per scenario, described in table 2. The predictions of the *mortgage illusion* and *DCF analysis* effects per scenario are respectively as follows: D: RENT, RENT; C: BUY, RENT; B: RENT, BUY; A: BUY, BUY. The vertical lines in each bar represent the 95% confidence interval for the distribution of probability of buying per scenario. The numerical equivalent of this figure can be seen in table 3.

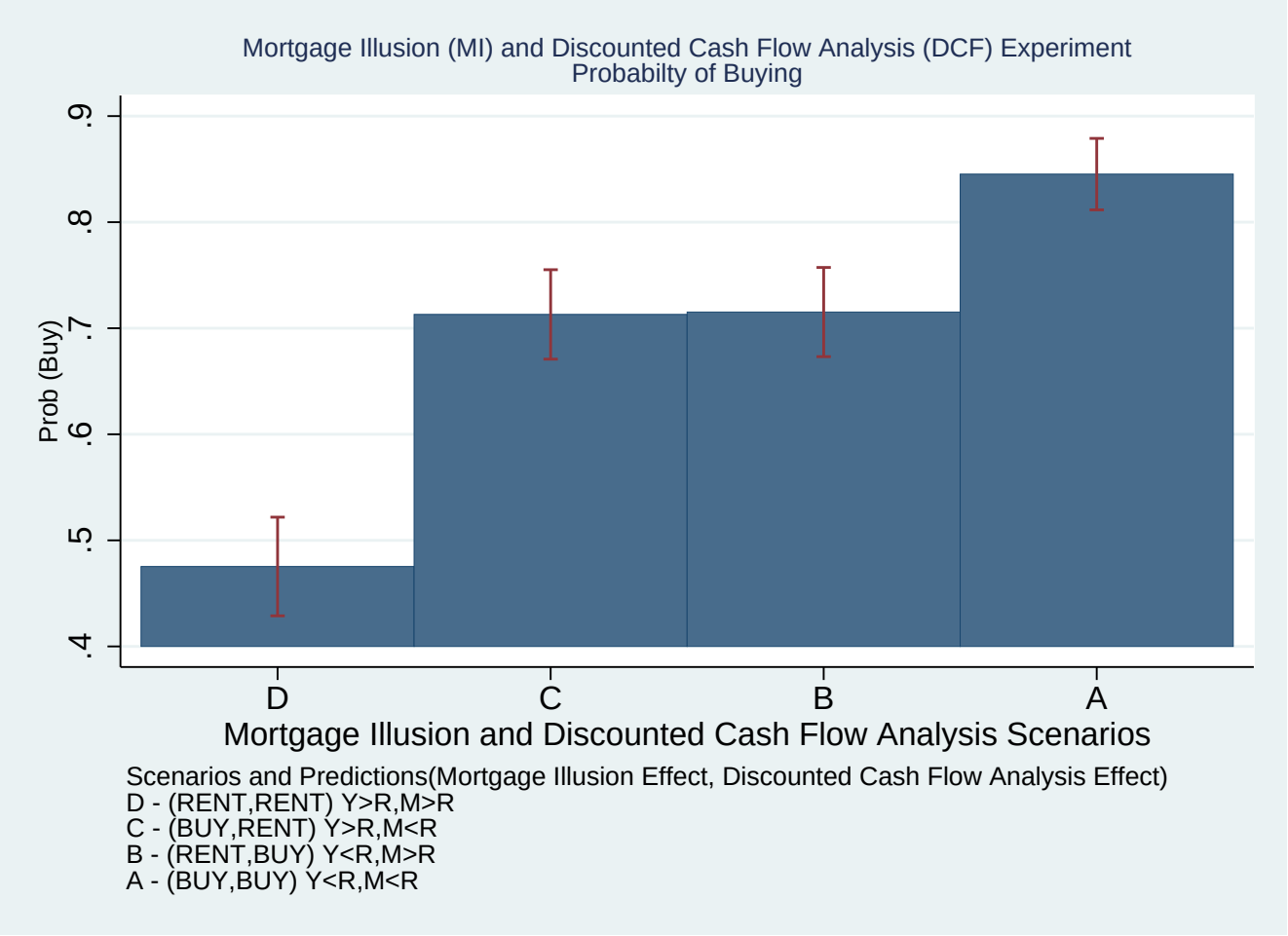

Table 3: Experiment 1: Probability of Buying as a Function of Mortgage Illusion and Discounted Cash Flow Analysis

This table shows the average number of participants that choose to buy per scenario, which are described in table 2. The averages in this table are the numerical representation of the outcomes in figure 3.

	N	Mean	Std
Buy (All obs)	1784	0.69	0.46
Buy Bin D (R<Y,R<M)	446	0.48	0.50
Buy Bin C (R<Y,R >M)	446	0.71	0.45
Buy Bin B (R >Y,R<M)	446	0.72	0.45
Buy Bin A (R >Y,R >M)	446	0.85	0.36

Table 4: Experiment 1: Probability of Buying as a Function of Mortgage Illusion and Discounted Cash Flow Analysis - Mean-comparison Tests

This table shows the results of mean-comparison tests between the probabilities of buying conditional on different scenarios, which are described in table 2 and whose outcomes are represented in figure 3. The mean-comparison tests are with paired observations. ***,**,* coefficient estimates are statistically distinct from 0 at the 1%, 5% and 10% levels, respectively.

	D	C	B	A
D	0			
C	-0.238***	0		
B	-0.240***	-0.002	0	
A	-0.370***	-0.132***	-0.130***	0

Table 5: Experiment 1: Probability of Buying as a Function of Mortgage Illusion and Discounted Cash Flow Analysis - OLS

This table shows the results of an ordinary least square regression of the probability of buying a house. The regressors are the *mortgage illusion* dummy, which is one for scenarios A and C (R >M, prediction to buy) and zero otherwise; the *discounted cash flow analysis* dummy, which is one for scenarios A and B (R >Y, prediction to buy) and zero otherwise; and an interaction of the two dummies. Standard errors are robust to heteroskedasticity and clustered at the person level. ***,**,* coefficient estimates are statistically distinct from 0 at the 1%, 5% and 10% levels, respectively.

	Mortgage Illusion and DCF Analysis Experiment - OLS			
	(1)	(2)	(3)	(4)
	Buy	Buy	Buy	Buy
Mortgage Illusion (R >M)	0.184***		0.184***	0.238***
	(8.91)		(8.91)	(8.98)
DCF (R >Y)		0.186***	0.186***	0.240***
		(12.08)	(12.08)	(10.71)
Interaction				-0.108***
				(-3.78)
Constant	0.595***	0.594***	0.502***	0.475***
	(30.37)	(32.44)	(22.27)	(20.06)
#Obs	1784	1784	1784	1784
R-squared	0.039	0.040	0.080	0.083

Table 6: Experiment 2: Bin Study - Description

This table describes experiment 2. Panel A details the scenarios under which participants should choose to buy or rent. DCF Decision is the outcome of the *discounted cash flow analysis* effect, which depends on R and Y. In this study, R=Y=800 for all scenarios and the DCF prediction is neutral between buying or renting. i is the annual interest rate charged on the mortgage. Y is the monthly mortgage installment of an interest-only perpetual mortgage worth the house price. M is the monthly mortgage installment in dollars. R is the monthly rental payment in dollars. 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. Panel B describes the Balanced Latin Square Cohorts of the experiment, implemented in order to dissipate the effect of the way questions are sorted.

Panel A: Scenarios

Bin	**DCF Decision**	**R**	**M**	**i (%)**	**Down Payment(%)**	**Down Payment**	**House Price**	**T (years)**	**T(months)**	**Y**
1	NEUTRAL	800	625	3.0%	46%	149,000	324,000	39	8	800
2	NEUTRAL	800	675	3.0%	46%	149,000	324,000	34	6	800
3	NEUTRAL	800	725	3.0%	46%	149,000	324,000	30	7	800
4	NEUTRAL	800	775	3.0%	46%	149,000	324,000	27	6	800
5	NEUTRAL	800	825	3.0%	46%	149,000	324,000	25	1	800
6	NEUTRAL	800	875	3.0%	46%	149,000	324,000	23	0	800
7	NEUTRAL	800	925	3.0%	46%	149,000	324,000	21	3	800
8	NEUTRAL	800	975	3.0%	46%	149,000	324,000	19	9	800

Panel B: Balanced Latin Square Cohorts

COHORT	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
A	1	2	8	3	7	4	6	5
B	2	3	1	4	8	5	7	6
C	3	4	2	5	1	6	8	7
D	4	5	3	6	2	7	1	8
E	5	6	4	7	3	8	2	1
F	6	7	5	8	4	1	3	2
G	7	8	6	1	5	2	4	3
H	8	1	7	2	6	3	5	4

Figure 4: **Experiment 2: Bin Study - Probability of Buying as a Function of the Mortgage Monthly Installment**

The figure shows the average number of participants that choose to buy per bin. The scenarios associated to each bin are described in table 6. 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 vertical lines in each bar represent the 95% confidence interval for the distribution of probability of buying per bin. The numerical equivalent of this figure can be seen in table 8.

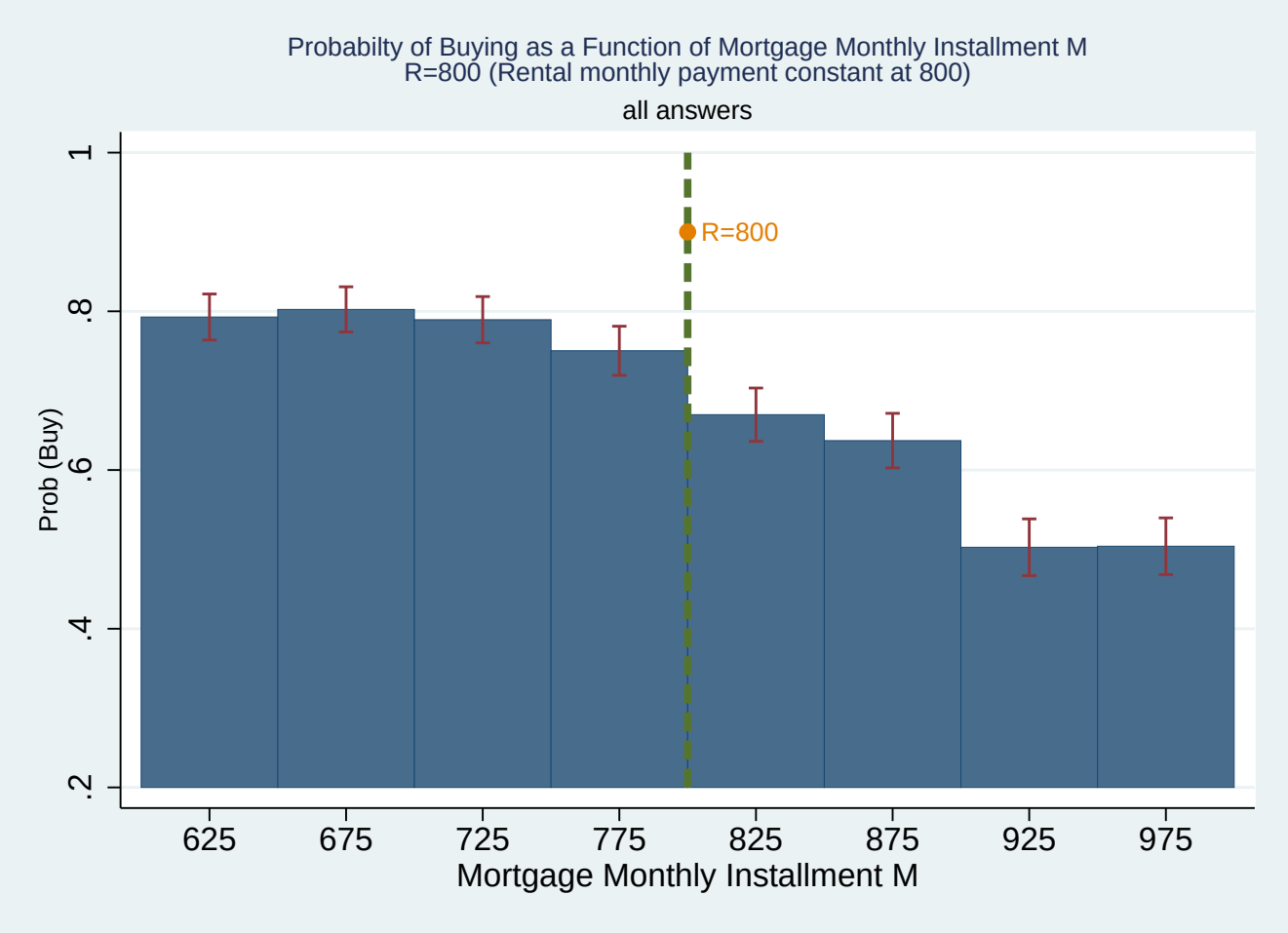

Table 7: Experiment 2: Bin Study - Mean-comparison Tests

This table shows the results of mean-comparison tests between the probabilities of buying conditional on different bins, which are described in table 6 and whose outcomes are represented in figure 4. The mean-comparison tests are with paired observations. ***,**,* coefficient estimates are statistically distinct from 0 at the 1%, 5% and 10% levels, respectively.

	1	2	3	4	5	6	7	8
1	0							
2	-0.010	0						
3	0.003	0.013	0					
4	0.042**	0.052**	0.039*	0				
5	0.123***	0.133***	0.120***	0.081***	0			
6	0.156***	0.165***	0.152***	0.113***	0.033	0		
7	0.290***	0.300***	0.287***	0.248***	0.167***	0.134***	0	
8	0.289***	0.298***	0.285***	0.246***	0.166***	0.133***	-0.001	0

Table 8: Experiment 2: Bin Study - Probability of Buying as a Function of the Mortgage Monthly Installment

This table shows the results of OLS regressions of the of the probability of buying a house. The regressors are the bins whose scenarios are described in table 6. The first column estimates represent the absolute proportion of buyers across bins . It is the numerical representation of figure 4. The second column adds a constant and its estimates represent the proportion of buyers across bins relative to the first bin, whose estimate is shown under "constant". The third column adds person fixed effects and its estimates represent the proportion of buyers across bins relative to the first bin, whose estimate is shown under "constant". Standard errors are robust to heteroskedasticity and clustered at the person level for third column. ***,**,* coefficient estimates are statistically distinct from 0 at the 1%, 5% and 10% levels, respectively.

	Bin Study - OLS		
	(1)	(2)	(3)
	OLS, no FE, no constant	OLS, no FE, constant	OLS, person FE, cluster person, constant
bin=2	0.802***	0.010	0.009
	(41.47)	(0.41)	(0.81)
bin=3	0.789***	-0.003	-0.003
	(40.82)	(-0.15)	(-0.22)
bin=4	0.750***	-0.042*	-0.043**
	(38.86)	(-1.83)	(-2.50)
bin=5	0.670***	-0.123***	-0.122***
	(34.68)	(-5.30)	(-6.29)
bin=6	0.637***	-0.156***	-0.156***
	(32.95)	(-6.70)	(-7.58)
bin=7	0.503***	-0.290***	-0.289***
	(25.98)	(-12.47)	(-13.09)
bin=8	0.504***	-0.289***	-0.288***
	(26.08)	(-12.43)	(-12.87)
Constant		0.793***	0.792***
		(48.18)	(61.80)
#Obs	6041	6041	6041
R-squared	0.586	0.063	0.579

Table 9: Experiment 2: Bin Study - Switchers - Summary Statistics

This table shows the summary statistics for the bin study at the person level, for participants that are considered consistent. Each participant is classified as either inconsistent or consistent based on the 8 answers given by each participant. An inconsistent participant is one that (i) switches from rent to buy as the mortgage monthly installment M increases; or (ii) switches more than once; A consistent participant can be of three types: (i) buyers, those that always buy; (ii) renters, those that always rent; or (iii) switchers, those that switch from buy to rent only once as the mortgage monthly installment M increases. Switchers can be classified in 7 regions, according to the scenarios between which they switch to rent.

	N	Mean	Std	CI Lower	CI Upper
consistent	770	0.77	0.015	0.74	0.80
buyer	770	0.37	0.017	0.34	0.41
renter	770	0.094	0.010	0.073	0.11
switcher	770	0.31	0.017	0.27	0.34
switch to rent at 625→675	770	0.013	0.0041	0.0050	0.021
switch to rent at 675→725	770	0.029	0.0060	0.017	0.040
switch to rent at 725→775	770	0.044	0.0074	0.030	0.059
switch to rent at 775→825	770	0.066	0.0090	0.049	0.084
switch to rent at 825→875	770	0.047	0.0076	0.032	0.062
switch to rent at 825→925	770	0.081	0.0098	0.061	0.100
switch to rent at 925→975	770	0.027	0.0059	0.016	0.039

Figure 5: **Experiment 2: Bin Study - Switchers**

The figure shows the number of switchers in the bin study per switching region. Switchers are participants that switch from buy to rent only once as the mortgage monthly installment M increases.

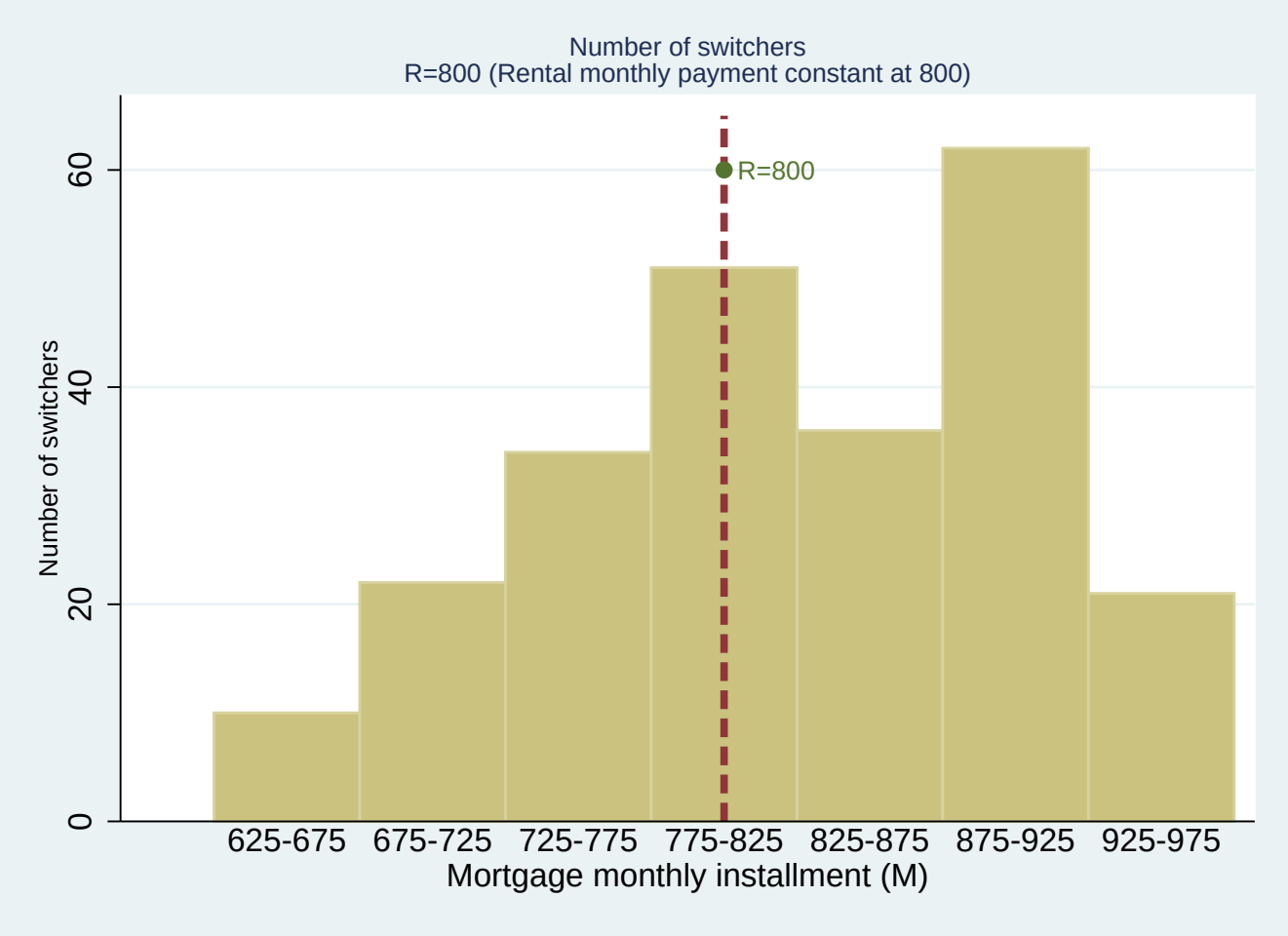

Table 10: Experiment 3: Small Differences Experiment - Description

This table describes experiment 3 and details the scenarios under which participants should choose to buy or rent. Each participant answers all the scenarios for either cohort A or cohort B. DCF Decision is the outcome of the *discounted cash flow analysis* effect, which depends on R and Y. i is the annual interest rate charged on the mortgage. Y is the monthly mortgage installment of an interest-only perpetual mortgage worth the house price. M is the monthly mortgage installment in dollars. R is the monthly rental payment in dollars. 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.

COHORT	SCENARIO	DCF DECISION	R	M	i (%)	Down payment	House Price	T	Y
A	1	BUY	1035	1050	4.0	19%	270,000	30	884
A	2	BUY	1045	1050	4.0	19%	270,000	30	884
A	3	BUY	1055	1050	4.0	19%	270,000	30	884
A	4	BUY	1065	1050	4.0	19%	270,000	30	884
B	4	BUY	1065	1050	4.0	19%	270,000	30	884
B	3	BUY	1055	1050	4.0	19%	270,000	30	884
B	2	BUY	1045	1050	4.0	19%	270,000	30	884
B	1	BUY	1035	1050	4.0	19%	270,000	30	884

Table 11: Experiment 3: Small Differences Experiment - Summary Statistics

This table shows the summary statistics for the small differences study at the person level. Each participant is classified as either inconsistent or consistent based on the 4 answers given by each participant. An inconsistent participant is one that (i) switches from buy to rent as the monthly rental payment R increases (cohort A) or switches from rent to buy as the monthly rental payment R decreases (cohort B); (ii) switches more than once. A consistent participant can be of three types: (i) buyers, those that always buy; (ii) renters, those that always rent; or (iii) switchers, those that switch from rent to buy only once as the monthly rental payment R increases (cohort A) or those that switch from buy to rent only once as the monthly rental payment R decreases (cohort B). Switchers can be classified in 3 regions, according to the monthly rental payments R between which they switch. Panel A shows summary statistics for all participants. Panel B shows summary statistics for the subsample of participants that are switchers or inconsistent. Panel C shows summary statistics for the subsample of participants that are switchers.

Panel A: All Participants

	N	Mean	Std	CI Lower	CI Upper
Buyers	537	0.74	0.019	0.70	0.78
Renters	537	0.13	0.015	0.10	0.16
Switchers	537	0.095	0.013	0.070	0.12
Inconsistent	537	0.034	0.0078	0.018	0.049

Panel B: Sub-sample for Switchers or Inconsistent

	N	Mean	Std	CI Lower	CI Upper
switch to rent at 1045↔1035	69	0.19	0.047	0.094	0.28
switch to rent at 1055↔1045	69	0.35	0.058	0.23	0.46
switch to rent at 1065↔1055	69	0.20	0.049	0.11	0.30
Inconsistent	69	0.26	0.053	0.15	0.37

Panel C: Sub-sample for Switchers

	N	Mean	Std	CI Lower	CI Upper
switch to rent at 1045↔1035	51	0.25	0.062	0.13	0.38
switch to rent at 1055↔1045	51	0.47	0.071	0.33	0.61
switch to rent at 1065↔1055	51	0.27	0.063	0.15	0.40

Table 12: Experiment 4: Elevator Experiment - Description

This table describes experiment 4 and details the scenarios under which participants should choose to buy or rent. Each participant answers all the scenarios for either cohort A or cohort B. DCF Decision is the outcome of the *discounted cash flow analysis* effect, which depends on R and Y. i is the annual interest rate charged on the mortgage. Y is the monthly mortgage installment of an interest-only perpetual mortgage worth the house price. M is the monthly mortgage installment in dollars. R is the monthly rental payment in dollars. 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.

COHORT	**SCENARIO**	**DCF Decision**	**R**	**M**	**i (%)**	**Down payment**	**Down payment(%)**	**House Price**	**T (years)**	**Y**
A	1	RENT	1250	750	5.5	150,000	50%	300,000	40	1341
A	2	RENT	1125	900	5.5	150,000	50%	300,000	25	1341
A	3	RENT	1000	1000	5.5	150,000	50%	300,000	20	1341
A	4	RENT	900	1125	5.5	150,000	50%	300,000	17	1341
A	5	RENT	750	1250	5.5	150,000	50%	300,000	15	1341
B	1	BUY	1250	500	2.0	90,000	35%	255,000	40	421
B	2	BUY	1000	750	2.0	90,000	35%	255,000	23	421
B	3	BUY	900	900	2.0	90,000	35%	255,000	18	421
B	4	BUY	750	1000	2.0	90,000	35%	255,000	16	421
B	5	BUY	500	1250	2.0	90,000	35%	255,000	12.5	421

Table 13: Experiment 4: Elevator Experiment - Summary Statistics

This table shows the summary statistics for the elevator study at the person level, for participants that are considered consistent. Each participant is classified as either inconsistent or consistent based on the 5 answers given by each participant. An inconsistent participant is one that (i) switches from rent to buy as the mortgage monthly installment M increases; or (ii) switches more than once; A consistent participant can be of three types: (i) buyers, those that always buy; (ii) renters, those that always rent; or (iii) switchers, those that switch from buy to rent only once as the mortgage monthly installment M increases. Switchers can be classified in four regions, according to the scenarios between which they switch to rent.

	N	Mean	Std	CI Lower	CI Upper
buyers	112	0.13	0.032	0.070	0.20
renters	112	0.12	0.030	0.056	0.18
switchers	112	0.40	0.047	0.31	0.49
switch to rent at 1$\mapsto$2	112	0.063	0.023	0.017	0.11
switch to rent at 2$\mapsto$3	112	0.13	0.031	0.063	0.19
switch to rent at 3$\mapsto$4	112	0.15	0.034	0.084	0.22
switch to rent at 4$\mapsto$5	112	0.063	0.023	0.017	0.11

Figure 6: **Experiment 4: Elevator Study - Switchers**

The figure shows the number of switchers in the bin study per switching region. Switchers are participants that switch from buy to rent only once. Scenarios are described in table 12.

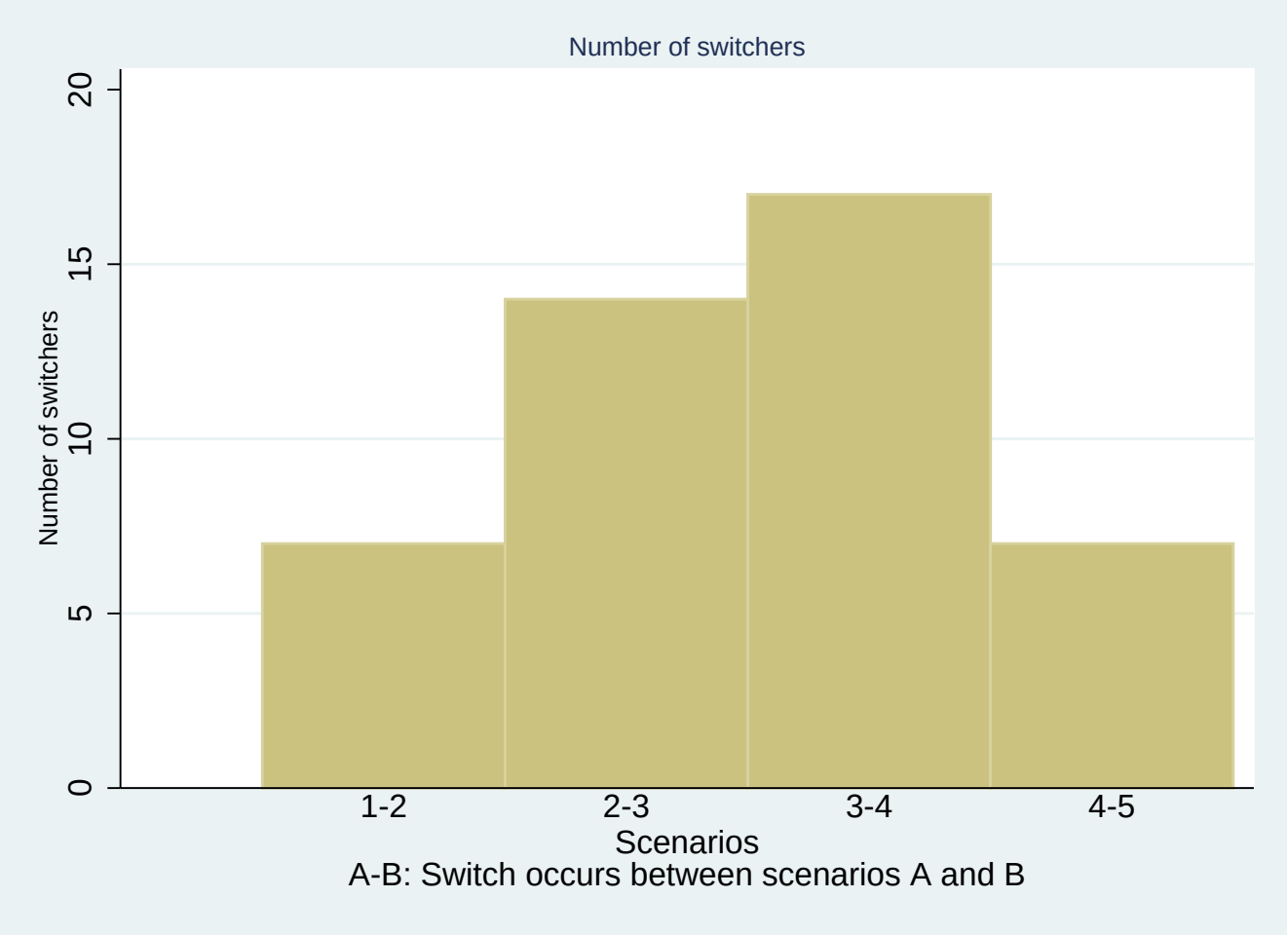

Table 14: Experiment 5: Correlates Experiment - Description

This table describes experiment 5 and details the scenarios under which participants should choose to buy or rent. Each participant answers all the scenarios. DCF Prediction is the outcome of the *discounted cash flow analysis* effect, which depends on R and Y. Mortgage Illusion Prediction is the outcome of the *mortgage illusion* effect, which depends on R and M. i is the annual interest rate charged on the mortgage. Y is the monthly mortgage installment of an interest-only perpetual mortgage worth the house price. M is the monthly mortgage installment in dollars. R is the monthly rental payment in dollars. 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.

SCENARIO	**DCF Prediction**	**Mortgage Illusion prediction**	**R**	**M**	**i (%)**	**Down payment**	**House Price**	**T**	**Y**
1	RENT	BUY	1100	950	6.0	46%	300,000	30	1460
2	RENT	RENT	1100	1250	6.0	29%	300,000	30	1460
3	BUY	BUY	1100	950	3.0	24%	300,000	30	740
4	BUY	RENT	1100	1250	3.0	0%	300,000	30	740

Table 15: Experiment 5: Correlates Experiment - Summary Statistics

This table shows the summary statistics for the correlates experiment at the person level. DCF is a dummy that takes value 1 for participants that choose to rent in scenarios 1 and 2 and to buy in scenarios 3 and 4, and takes value 0 otherwise. Mortgage illusion is a dummy that takes value 1 if the participant chooses to buy in scenarios 1 and 3 and to rent in scenarios 2 and 4, and takes value 0 otherwise. Buyer is a dummy that takes value 1 for participants that choose to buy in all four scenarios and takes value 0 otherwise. Renter is a dummy that takes value 1 for participants that choose to rent in all four scenarios and takes value 0 otherwise.

	N	Mean	Std	CI Lower	CI Upper
DCF: RENT, RENT, BUY, BUY	596	0.050	0.0090	0.033	0.068
Mortgage Illusion: BUY, RENT, BUY, RENT	596	0.24	0.018	0.21	0.28
Buyer: BUY, BUY, BUY, BUY	596	0.23	0.017	0.20	0.27
Renter: RENT, RENT, RENT, RENT	596	0.14	0.014	0.11	0.17

Table 16: Experiment 5: Correlates Experiment - Individual Difference Scales - Mortgage Illusion OLS

This table shows the correlation between the participant-level dummy Mortgage illusion and participant-level individual difference scales. Mortgage illusion is a dummy that takes value 1 if the participant chooses to buy in scenarios 1 and 3 and to rent in scenarios 2 and 4, and takes value 0 otherwise. The individual difference scales are defined in the appendix subsection A.6. Standard errors are robust to heteroskedasticity and clustered at the person level. ***,**,* coefficient estimates are statistically distinct from 0 at the 1%, 5% and 10% levels, respectively.

	Dep var: Mortgage Illusion: Buy, Rent, Buy, Rent												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Financial Literacy	-0.005												
	(-0.90)												
Numeracy		-0.003											
		(-0.40)											
Need for Cognition			-0.001										
			(-0.39)										
Time Discounting				-0.382									
				(-1.60)									
Immediacy Bias					0.251*								
					(1.85)								
Short-term Disc Factor (0-1)						-0.090							
						(-0.66)							
Medium-term Disc Factor (0-6)							-0.517						
							(-0.74)						
Long-term Disc Factor (6-7)								-0.268*					
								(-1.93)					
Propensity to Plan for Time									-0.001				
									(-0.08)				
Propensity to Plan for Money										0.002			
										(0.10)			
Preference for Numerical Information											-0.001		
											(-0.30)		
Money Attitude												0.001	
												(0.18)	
Financial Risk-taking													0.005
													(1.02)
Constant	0.287***	0.259***	0.267***	0.580***	0.004	0.325***	0.730	0.476***	0.246***	0.234***	0.249***	0.227***	0.187***
	(5.43)	(6.62)	(3.63)	(2.67)	(0.03)	(2.76)	(1.10)	(3.75)	(3.78)	(3.86)	(6.82)	(2.99)	(3.20)
#Obs	583	596	568	451	489	527	519	527	572	570	567	566	577
R-squared	0.001	0.000	0.000	0.006	0.007	0.001	0.001	0.007	0.000	0.000	0.000	0.000	0.002

Table 17: Experiment 5: Correlates Experiment - Demographics - Mortgage Illusion OLS

This table shows the correlation between the participant-level dummy Mortgage illusion and participant-level demographic scales. Mortgage illusion is a dummy that takes value 1 if the participant chooses to buy in scenarios 1 and 3 and to rent in scenarios 2 and 4, and takes value 0 otherwise. The individual demographic scales are defined in the appendix subsection A.6. Standard errors are robust to heteroskedasticity and clustered at the person level. ***,**,* coefficient estimates are statistically distinct from 0 at the 1%, 5% and 10% levels, respectively.

	Dep var: Mortgage Illusion: Buy, Rent, Buy, Rent													
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Homeowner	-0.046													
	(-1.25)													
Will to own home you live		-0.011												
		(-1.27)												
House debt			-0.013											
			(-0.48)											
Net Wealth				-0.000										
				(-0.73)										
Stock (ever invested)?					-0.073**									
					(-1.97)									
Equity (% Wealth Invested)						-0.001								
						(-1.61)								
Age							-0.002							
							(-1.57)							
Gender (Male=1)								0.013						
								(0.34)						
Children number									-0.015					
									(-1.06)					
Income Annual										0.004				
										(0.46)				
Full-time student											-0.135**			
											(-2.32)			
Unemployed												0.005		
												(0.07)		
Married													-0.073**	
													(-2.07)	
Education Level														0.014
														(0.70)
Constant	0.268***	0.321***	0.266***	0.254***	0.274***	0.244***	0.330***	0.238***	0.259***	0.228***	0.253***	0.245***	0.275***	0.194***
	(9.76)	(5.08)	(5.81)	(11.57)	(10.92)	(10.09)	(5.51)	(9.97)	(10.89)	(6.14)	(13.76)	(13.44)	(11.49)	(2.67)
#Obs	536	536	483	596	537	470	535	538	537	535	596	596	596	538
R-squared	0.003	0.003	0.000	0.001	0.007	0.005	0.004	0.000	0.002	0.000	0.005	0.000	0.007	0.001

Table 18: Experiment 5: Correlates Experiment - Individual Difference Scales - DCF OLS

This table shows the correlation between the participant-level dummy DCF and participant-level individual difference scales. DCF is a dummy that takes value 1 if the participant chooses to buy in scenarios 3 and 4 and to rent in scenarios 1 and 2, and takes value 0 otherwise. The individual difference scales are defined in the appendix subsection A.6. Standard errors are robust to heteroskedasticity and clustered at the person level. ***,**,* coefficient estimates are statistically distinct from 0 at the 1%, 5% and 10% levels, respectively.

	Dep var: DCF: Rent, Rent, Buy, Buy												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Financial Literacy	0.004												
	(1.22)												
Numeracy		0.004											
		(0.93)											
Need for Cognition			0.000										
			(0.13)										
Time Discounting				-0.132									
				(-1.12)									
Immediacy Bias					0.063								
					(0.87)								
Short-term Disc Factor (0-1)						-0.016							
						(-0.25)							
Medium-term Disc Factor (0-6)							-0.417						
							(-1.33)						
Long-term Disc Factor (6-7)								-0.066					
								(-0.92)					
Propensity to Plan for Time									0.004				
									(0.48)				
Propensity to Plan for Money										-0.000			
										(-0.01)			
Preference for Numerical Information											-0.000		
											(-0.05)		
Money Attitude												-0.001	
												(-0.84)	
Financial Risk-taking													0.004*
													(1.72)
Constant	0.018	0.033*	0.048	0.170	-0.012	0.063	0.446	0.112*	0.038	0.053*	0.052***	0.078**	0.004
	(0.65)	(1.74)	(1.30)	(1.57)	(-0.17)	(1.16)	(1.48)	(1.68)	(1.20)	(1.72)	(2.92)	(2.13)	(0.17)
#Obs	583	596	568	451	489	527	519	527	572	570	567	566	577
R-squared	0.003	0.002	0.000	0.003	0.002	0.000	0.003	0.002	0.000	0.000	0.000	0.001	0.004

Table 19: Experiment 5: Correlates Experiment - Demographics - DCF OLS

This table shows the correlation between the participant-level dummy DCF and participant-level demographic scales. DCF illusion is a dummy that takes value 1 if the participant chooses to buy in scenarios 3 and 4 and to rent in scenarios 1 and 2, and takes value 0 otherwise. The individual demographic scales are defined in the appendix subsection A.6. Standard errors are robust to heteroskedasticity and clustered at the person level. ***,**,* coefficient estimates are statistically distinct from 0 at the 1%, 5% and 10% levels, respectively.

	Dep var: DCF: Rent, Rent, Buy, Buy													
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Homeowner	0.020													
	(1.03)													
Will to own home you live		0.006												
		(1.63)												
House debt			-0.011											
			(-0.78)											
Net Wealth				-0.000										
				(-0.63)										
Stock (ever invested)?					0.028									
					(1.35)									
Equity (% Wealth Invested)						0.000								
						(0.75)								
Age							-0.001*							
							(-1.70)							
Gender (Male=1)								0.012						
								(0.62)						
Children number									-0.002					
									(-0.29)					
Income Annual										0.002				
										(0.33)				
Full-time student											0.009			
											(0.22)			
Unemployed												0.006		
												(0.14)		
Married													0.038**	
													(2.00)	
Education Level														0.010
														(0.96)
Constant	0.042***	0.016	0.072***	0.054***	0.041***	0.047***	0.089***	0.047***	0.054***	0.047**	0.050***	0.050***	0.034***	0.017
	(3.38)	(0.74)	(2.72)	(4.81)	(3.67)	(3.85)	(3.42)	(3.96)	(4.49)	(2.42)	(5.42)	(5.42)	(3.52)	(0.47)
#Obs	536	536	483	596	537	470	535	538	537	535	596	596	596	538
R-squared	0.002	0.003	0.001	0.001	0.004	0.001	0.003	0.001	0.000	0.000	0.000	0.000	0.008	0.002

Table 20: Experiment 6: Education Study Experiment- Description

This table describes experiment 6 and details the scenarios under which participants (university students) should choose to buy or rent. Each participant answers all the scenarios, but only half of the students read beforehand a brochure that teaches them how changing only mortgage length term and the monthly mortgage installment should not affect their decision to buy or rent a house. DCF Prediction is the outcome of the *discounted cash flow analysis* effect, which depends on R and Y. Mortgage Illusion Prediction is the outcome of the *mortgage illusion* effect, which depends on R and M. i is the annual interest rate charged on the mortgage. Y is the monthly mortgage installment of an interest-only perpetual mortgage worth the house price. M is the monthly mortgage installment in dollars. R is the monthly rental payment in dollars. 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.

Scenario	**Mortgage illusion prediction**	**DCF prediction**	**Y($)**	**R($)**	**M ($)**	**i(%)**	**Down Payment(%)**	**Down Payment**	**House Price($)**	**T(years)**
A	BUY	BUY	905	1250	1100	4.1	15%	40,000	270,000	30
B	RENT	BUY	905	1250	1400	4.1	15%	40,000	270,000	20
C	BUY	RENT	1315	1000	750	6.0	53%	143,000	270,000	30
D	RENT	RENT	1315	1000	1250	6.0	21%	58,000	270,000	30

Table 21: Experiment 6: Education Study Experiment - OLS

This table shows the results of an ordinary least square regression of the probability of buying a house. The regressors are the *mortgage illusion* dummy, which is one for scenarios A and C (R >M, prediction to buy) and zero otherwise; the *discounted cash flow analysis* dummy, which is one for scenarios A and B (R >Y, prediction to buy) and zero otherwise; an interaction of the two dummies; and education dummy, that takes value 1 for students that read beforehand a brochure that teaches them how changing only mortgage length term and the monthly mortgage installment should not affect their decision to buy or rent a house and takes value zero otherwise; and all the interactions of the education dummy with the previously described regressors. Standard errors are clustered at the person level.

	Dep Var: Buy=1 Rent=0						
	(1) Buy	(2) Buy	(3) Buy	(4) Buy	(5) Buy	(6) Buy	(7) Buy
Mortgage Illusion (R >M)	0.198***		0.198***	0.283***		0.187***	0.277***
	(6.86)		(6.86)	(7.22)		(4.80)	(5.06)
DCF (R >Y)		0.027	0.027	0.112***		-0.024	0.065
		(0.97)	(0.97)	(3.50)		(-0.61)	(1.35)
Mortgage Illusion * DCF				-0.171***			-0.179**
				(-3.47)			(-2.39)
Education dummy					0.101**	0.040	0.044
					(2.27)	(0.71)	(0.73)
Education * Mortgage Illusion						0.020	0.012
						(0.35)	(0.16)
Education * DCF						0.101*	0.093
						(1.84)	(1.45)
Education * Mortgage Illusion * DCF							0.016
							(0.16)
Constant	0.340***	0.425***	0.326***	0.283***	0.387***	0.306***	0.261***
	(12.68)	(16.50)	(11.42)	(9.34)	(12.39)	(7.44)	(5.93)
#Obs	1496	1496	1496	1496	1496	1496	1496
R-squared	0.040	0.001	0.040	0.048	0.010	0.053	0.061

***,**,* coefficient estimates are statistically distinct from 0 at the 1%, 5% and 10% levels, respectively; Standard errors clustered at the person level.

A Appendix

A.1 Verbatim Instruction Manipulation Check

Recent research on decision making shows that choices are affected by context. Differences in how people feel, their previous knowledge and experience, and their environment can affect choices. To help us understand how people make decisions, we are interested in information about you. Specifically, we are interested in whether you actually take the time to read the directions; if not, some results may not tell us very much about decision making in the real world. To show that you have read the instructions, please ignore the question below about how you are feeling and instead check only the none of the above option as your answer. Thank you very much.

Please check all words that describe how you are currently feeling: 1. Interested; 2. Distressed; 3. Excited; 4. Upset; 5. Strong; 6. Guilty; . . . ; 21. None of the above.

A.2 Experiment 1: *Mortgage illusion* or *Discounted Cash Flow* Study Verbatim Treatments

(Scenario A)

Imagine that you decided to move to a new home and that you found one that fits perfectly your housing needs. The price of the home is $270,000 and you already have a pre-approved mortgage. You can either rent the house for $1,150 a month or buy it under the following conditions. It is a 40-year fixed-rate mortgage with an interest rate of 4%. The required down-payment is $55,000. As a result, the mortgage monthly payment is $889. You have the down-payment money in your bank account. If you don't 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). Please indicate bellow whether you would buy or rent the house:

- Buy (pay $889 per month for mortgage)
- Rent (pay $1,150 per month for rent)

(Scenario B)

Now imagine that the mortgage is a 20-year fixed rate and the interest rate is 4%. As a result, the mortgage monthly payment is $1,295. All other conditions are the same. Please indicate bellow whether you would buy or rent the house:

- Buy (pay $1,295 per month for mortgage)
- Rent (pay $1,150 per month for rent)

(Scenario C)

Now imagine that the mortgage is a 20-year fixed rate and the interest rate is 5.5%. As a result, the mortgage monthly payment is $1,462. All other conditions are the same. Please indicate bellow whether you would buy or rent the house:

- Buy (pay $1,462 per month for mortgage)
- Rent (pay $1,150 per month for rent)

(Scenario D)

Now imagine that the mortgage is a 40-year fixed rate and the interest rate is 5.5%. As a result, the mortgage monthly payment is $1,089. All other conditions are the same. Please indicate bellow whether you would buy or rent the house:

- Buy (pay $1,089 per month for mortgage)
- Rent (pay $1,150 per month for rent)

A.3 Experiment 2: Bin Study Verbatim Treatments

(Scenario 1)

Imagine that you rent a home that fits your housing needs and that you are presented with the opportunity to purchase this home. The price of the home is $324,000 and you already have a pre-approved mortgage. It's a 39-year and 8 months fixed-rate mortgage (in total 476 months) with an annual interest rate of 3%. The required down payment is $149,000. As a result, the mortgage monthly payment is $625. You have the down payment money in your bank account. If you don't purchase your home, you can invest the down payment money in a savings account and you will earn 3% per year (the same as the mortgage interest rate). Considering that you pay $800 for rent each month, would you prefer to buy the home (and pay $625 per month for mortgage) or continue renting the home?

- Buy (pay $625 per month for mortgage)
- Rent (pay $800 per month for rent)

(Scenario 2)

Imagine that you rent a home that fits your housing needs and that you are presented with the opportunity to purchase this home. The price of the home is $324,000 and you already have a pre-approved mortgage. It's a 34-year and 6 months fixed-rate mortgage (in total 414 months) with an annual interest rate of 3%. The required down payment is $149,000. As a result, the mortgage monthly payment is $675. You have the down payment money in your bank account. If you don't purchase your home, you can invest the down payment money in a savings account and you will earn 3% per year (the same as the mortgage interest rate). Considering that you pay $800 for rent each month, would you prefer to buy the home (and pay $675 per month for mortgage) or continue renting the home?

- Buy (pay $675 per month for mortgage)
- Rent (pay $800 per month for rent)

(Scenario 3)

Imagine that you rent a home that fits your housing needs and that you are presented with the opportunity to purchase this home. The price of the home is $324,000 and you already have a pre-approved mortgage. It's a 30-year and 7 months fixed-rate mortgage (in total 367 months) with an annual interest rate of 3%. The required down payment is $149,000. As a result, the mortgage monthly payment is $725. You have the down payment money in your bank account. If you don't

purchase your home, you can invest the down payment money in a savings account and you will earn 3% per year (the same as the mortgage interest rate). Considering that you pay $800 for rent each month, would you prefer to buy the home (and pay $725 per month for mortgage) or continue renting the home?

- Buy (pay $725 per month for mortgage)
- Rent (pay $800 per month for rent)

(Scenario 4)

Imagine that you rent a home that fits your housing needs and that you are presented with the opportunity to purchase this home. The price of the home is $324,000 and you already have a pre-approved mortgage. It's a 27-year and 6 months fixed-rate mortgage (in total 330 months) with an annual interest rate of 3%. The required down payment is $149,000. As a result, the mortgage monthly payment is $775. You have the down payment money in your bank account. If you don't purchase your home, you can invest the down payment money in a savings account and you will earn 3% per year (the same as the mortgage interest rate). Considering that you pay $800 for rent each month, would you prefer to buy the home (and pay $775 per month for mortgage) or continue renting the home?

- Buy (pay $775 per month for mortgage)
- Rent (pay $800 per month for rent)

(Scenario 5)

Imagine that you rent a home that fits your housing needs and that you are presented with the opportunity to purchase this home. The price of the home is $324,000 and you already have a pre-approved mortgage. It's a 25-year and 1 month fixed-rate mortgage (in total 301 months) with an annual interest rate of 3%. The required down payment is $149,000. As a result, the mortgage monthly payment is $825. You have the down payment money in your bank account. If you don't purchase your home, you can invest the down payment money in a savings account and you will earn 3% per year (the same as the mortgage interest rate). Considering that you pay $800 for rent each month, would you prefer to buy the home (and pay $825 per month for mortgage) or continue renting the home?

- Buy (pay $825 per month for mortgage)
- Rent (pay $800 per month for rent)

(Scenario 6)

Imagine that you rent a home that fits your housing needs and that you are presented with the opportunity to purchase this home. The price of the home is $324,000 and you already have a pre-approved mortgage. It's a 23-year fixed-rate mortgage (in total 276 months) with an annual interest rate of 3%. The required down payment is $149,000. As a result, the mortgage monthly payment is $875. You have the down payment money in your bank account. If you don't purchase your home, you can invest the down payment money in a savings account and you will earn 3% per year (the same as the mortgage interest rate). Considering that you pay $800 for rent each month, would you prefer to buy the home (and pay $875 per month for mortgage) or continue renting the home?

- Buy (pay $875 per month for mortgage)
- Rent (pay $800 per month for rent)

(Scenario 7)

Imagine that you rent a home that fits your housing needs and that you are presented with the opportunity to purchase this home. The price of the home is $324,000 and you already have a pre-approved mortgage. It's a 21-year and 3 months fixed-rate mortgage (in total 255 months) with an annual interest rate of 3%. The required down payment is $149,000. As a result, the mortgage monthly payment is $925. You have the down payment money in your bank account. If you don't purchase your home, you can invest the down payment money in a savings account and you will earn 3% per year (the same as the mortgage interest rate). Considering that you pay $800 for rent each month, would you prefer to buy the home (and pay $925 per month for mortgage) or continue renting the home?

- Buy (pay $925 per month for mortgage)
- Rent (pay $800 per month for rent)

(Scenario 8)

Imagine that you rent a home that fits your housing needs and that you are presented with the opportunity to purchase this home. The price of the home is $324,000 and you already have a pre-approved mortgage. It's a 19-year and 9 months fixed-rate mortgage (in total 237 months) with an annual interest rate of 3%. The required down payment is $149,000. As a result, the mortgage monthly payment is $975. You have the down payment money in your bank account. If you don't purchase your home, you can invest the down payment money in a savings account and you will

earn 3% per year (the same as the mortgage interest rate). Considering that you pay $800 for rent each month, would you prefer to buy the home (and pay $975 per month for mortgage) or continue renting the home?

- Buy (pay $975 per month for mortgage)
- Rent (pay $800 per month for rent)

A.4 Experiment 3: Small Differences Study Verbatim Treatments

Note: For cohort A, questions were presented in the order shown below (Scenarios 1,2,3 and 4). For cohort B questions were presented in the opposite order (Scenarios 4,3,2 and 1).

Imagine that you rent a home that fits perfectly your housing needs and that you are presented with the opportunity to purchase this home. The price of the home is $270,000 and you already have a pre-approved mortgage. It's a 30-year fixed-rate mortgage with an interest rate of 4%. The required down-payment is $50,000. As a result, the mortgage monthly payment is $1050. You have the down-payment money in your bank account. If you don't 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). Now consider the following four scenarios in which the rent price you currently pay is different.

(Scenario 1)
Considering you pay $1035 for rent. Would you prefer to buy the home (and pay $1050 per month for mortgage) or continue renting the home?

- Buy (pay $1050 per month for mortgage)
- Rent (pay $1035 per month for rent)

(Scenario 2)
Considering you pay $1045 for rent. Would you prefer to buy the home (and pay $1050 per month for mortgage) or continue renting the home?

- Buy (pay $1050 per month for mortgage)
- Rent (pay $1045 per month for rent)

(Scenario 3)
Considering you pay $1055 for rent. Would you prefer to buy the home (and pay $1050 per month for mortgage) or continue renting the home?

- Buy (pay $1050 per month for mortgage)
- Rent (pay $1055 per month for rent)

(Scenario 4)

Considering you pay $1065 for rent. Would you prefer to buy the home (and pay $1050 per month for mortgage) or continue renting the home?

- Buy (pay $1050 per month for mortgage)
- Rent (pay $1065 per month for rent)

A.5 Experiment 4: Elevator Study Verbatim Treatments

(Cohort A)

In the next pages, we ask you to make a few financial decisions about whether buying or renting a house. You can use excel or the calculator if you want.

Choice Task: Scenario 1

Imagine you pay $1,250 for rent. You are considering the decision to buy the flat you live in (which is selling at $300,000) and you own $150,000 in cash. So you take a mortgage of $150,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $750 over 40 years, which corresponds to an annual interest rate of 5.5%. Would you buy the house? (Note: if you invest the $150,000 you own you will be paid interests at the same annual interest rate of 5.5%.)

- YES
- NO

Choice Task: Scenario 2

Now, imagine you pay $1,125 for rent. You are considering the decision to buy the flat you live in (which is selling at $300,000) and you own $150,000 in cash. So you take a mortgage of $150,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $900 over 25 years, which corresponds to an annual interest rate of 5.5%. Would you buy the house? (Note: if you invest the $150,000 you own you will be paid interests at the same annual interest rate of 5.5%.)

- YES
- NO

Choice Task: Scenario 3

Now, imagine you pay $1,000 for rent. You are considering the decision to buy the flat you live in (which is selling at $300,000) and you own $150,000 in cash. So you take a mortgage of $150,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $1000 over 20 years, which corresponds to an annual interest rate of 5.5 %. Would you buy the house? (Note: if you invest the $150,000 you own you will be paid interests at the same annual interest rate of 5.5%.)

- YES

- NO

Choice Task: Scenario 4

Now, imagine you pay $900 for rent. You are considering the decision to buy the flat you live in (which is selling at $300,000) and you own $150,000 in cash. So you take a mortgage of $150,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $1125 over 17 years, which corresponds to an annual interest rate of 5.5 %. Would you buy the house? (Note: if you invest the $150,000 you own you will be paid interests at the same annual interest rate of 5.5%.)

- YES
- NO

Choice Task: Scenario 5

Now, imagine you pay $750 for rent. You are considering the decision to buy the flat you live in (which is selling at $300,000) and you own $150,000 in cash. So you take a mortgage of $150,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $1250 over 15 years, which corresponds to an annual interest rate of 5.5 %. Would you buy the house? (Note: if you invest the $150,000 you own you will be paid interests at the same annual interest rate of 5.5%.)

- YES
- NO

(Cohort B)

In the next pages, we ask you to make a few financial decisions about whether buying or renting a house. You can use excel or the calculator if you want.

Choice Task: Scenario 1

Imagine you pay $1,250 for rent. You are considering the decision to buy the flat you live in (which is selling at $255,000) and you own $90,000 in cash. So you take a mortgage of $165,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $500 over 40 years, which corresponds to an annual interest rate of 2%. Would you buy the house? (Note: if you invest the $90,000 you own you will be paid interests at the same annual interest rate of 2%.)

- YES

- NO

Choice Task: Scenario 2

Now, imagine you pay $1000 for rent. You are considering the decision to buy the flat you live in (which is selling at $255,000) and you own $90,000 in cash. So you take a mortgage of $165,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $750 over 23 years, which corresponds to an annual interest rate of 2%. Would you buy the house? (Note: if you invest the $90,000 you own you will be paid interests at the same annual interest rate of 2%.)

- YES
- NO

Choice Task: Scenario 3

Now, imagine you pay $900 for rent. You are considering the decision to buy the flat you live in (which is selling at $255,000) and you own $90,000 in cash. So you take a mortgage of $165,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $900 over 18 years, which corresponds to an annual interest rate of 2%. Would you buy the house? (Note: if you invest the $90,000 you own you will be paid interests at the same annual interest rate of 2%.)

- YES
- NO

Choice Task: Scenario 4

Now, imagine you pay $750 for rent. You are considering the decision to buy the flat you live in (which is selling at $255,000) and you own $90,000 in cash. So you take a mortgage of $165,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $1000 over 16 years, which corresponds to an annual interest rate of 2%. Would you buy the house? (Note: if you invest the $90,000 you own you will be paid interests at the same annual interest rate of 2%.)

- YES
- NO

Choice Task: Scenario 5

Now, imagine you pay $500 for rent. You are considering the decision to buy the flat you live in (which is selling at $255,000) and you own $90,000 in cash. So you take a mortgage of $165,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $1250 over 12.5 years, which corresponds to an annual interest rate of 2%. Would you buy the house? (Note: if you invest the $90,000 you own you will be paid interests at the same annual interest rate of 2%.)

- YES
- NO

A.6 Experiment 5: Correlates Study

A.6.1 Verbatim Experimental Treatments

In the next pages, we ask you to make a few financial decisions about whether buying or renting a house. You can use excel or the calculator if you want. Choice Task: Scenario 1
Imagine you pay $1,100 for rent. You are considering the decision to buy the flat you live in (which is selling at $300,000) and you own $138,000 in cash. So you take a mortgage of $162,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of about $950 over 30 years, which corresponds to an annual interest rate of 6%. Would you buy the house? (Note: any investment you make you will be paid interests at the same annual interest rate of 6%.)

- YES
- NO

Choice Task: Scenario 2
Imagine you pay $1,100 for rent. You are considering the decision to buy the flat you live in (which is selling at $300,000) and you own $87,000 in cash. So you take a mortgage of $213,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of about $1250 over 30 years, which corresponds to an annual interest rate of 6%. Would you buy the house? (Note: any investment you make you will be paid interests at the same annual interest rate of 6%.)

- YES
- NO

Choice Task: Scenario 3
Imagine you pay $1,100 for rent. You are considering the decision to buy the flat you live in (which is selling at $300,000) and you own $72,000 in cash. So you take a mortgage of $228,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of about $950 over 30 years, which corresponds to an annual interest rate of 3%. Would you buy the house? (Note: any investment you make you will be paid interests at the same annual interest rate of 3%.)

- YES
- NO

Choice Task: Scenario 4
Imagine you pay $1,100 for rent. You are considering the decision to buy the flat you live in (which

is selling at $300,000). So you take a mortgage of $300,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of about $1250 over 30 years, which corresponds to an annual interest rate of 3%. Would you buy the house? (Note: any investment you make you will be paid interests at the same annual interest rate of 3%.)

- YES
- NO

A.6.2 Verbatim Measures

Attitude towards saving (coefficient alpha = .87)
For each question, the scale is from: 1 = strongly disagree to 6 = strongly agree.

1. I do financial planning for the future.
2. I put money aside on a regular basis for the future.
3. I save now to prepare for my old age.
4. I keep track of my money.
5. I follow a careful financial budget.
6. I am very prudent with money.

Propensity to plan for time in the short-run (coefficient alpha = .91)
For each question, the scale is from: 1 = strongly disagree to 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 in the long-run (coefficient alpha = .89)

For each question, the scale is from: 1 = strongly disagree to 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.

Financial Literacy Measure (KR-20 alpha = .77)

Note: *Correct answers for the questions below are displayed in italic.*

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 Bs 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

Need for Cognition (coefficient alpha = .88).

For each question, the scale is from: 1 = strongly disagree to 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 (KR-20 alpha = .70)

Note: *Correct answers for the questions below are displayed in italic.*

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.

Preference for Numerical Information (coefficient alpha = .89)

For each question, the scale is from: 1 = strongly disagree to 6 = strongly agree.

1. I enjoy work that requires the use of numbers.
2. I find it satisfying to solve day-to-day problems involving numbers.
3. Numerical information is very useful in everyday life.
4. I prefer not to pay attention to information involving numbers (reverse coded).
5. I don't like to think about issues involving numbers (reverse coded).
6. I like to make calculations using numerical information.
7. I don't find numerical information to be relevant for most situations (reverse coded).
8. I think it is important to learn and use numerical information to make well informed decisions.

Willingness to Take Investment Risk (coefficient alpha = .78)

For each question, the scale is from: 1=very unlikely to 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).

Time Discounting and Immediacy Bias

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)

A $75 guaranteed today

B $80 guaranteed in a month

Decision (2)

A $70 guaranteed today

B $80 guaranteed in a month

Decision (3)

A $65 guaranteed today

B $80 guaranteed in a month

Decision (4)

A $60 guaranteed today

B $80 guaranteed in a month

Decision (5)

A $50 guaranteed today

B $80 guaranteed in a month

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

Decision (6)

A $75 guaranteed today

B $80 guaranteed in 6 months

Decision (7)

A $70 guaranteed today

B $80 guaranteed in 6 months

Decision (8)

A $65 guaranteed today

B $80 guaranteed in 6 months

Decision (9)

A $60 guaranteed today

B $80 guaranteed in 6 months

Decision (10)

A $50 guaranteed today

B $80 guaranteed in 6 months

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

Decision (11)

A $75 guaranteed in 6 months

B $80 guaranteed in 7 months

Decision (12)

A $70 guaranteed in 6 months

B $80 guaranteed in 7 months

Decision (13)

A $65 guaranteed in 6 months

B $80 guaranteed in 7 months

Decision (14)

A $60 guaranteed in 6 months

B $80 guaranteed in 7 months

Decision (15)

A $50 guaranteed in 6 months

B $80 guaranteed in 7 months

Demographic measures

Note: The following questions intend to measure your household's level of material possessions and resources. Please read the questions carefully and provide your best estimate when you don't know the exact response.

Do you own the home where you now live?

- Yes (1)
- No (2)

How willing are you to own a home to live in?

- Not at all = 0 (1)
- 1 (2)
- 2 (3)
- 3 (4)
- 4 (5)
- 5 (6)
- 6 (7)
- Very much = 7 (8)

Is your home now worth more than you still owe on it, about what you still owe on it, or less than you still owe on it?

- My home is worth more than I still owe on it (1)
- My home is worth about what I still owe on it (2)
- My home is worth less than I still owe on it (3)

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 (1)
- No (2)

Please indicate below the percentage of your investments you allocate to fixed-income funds and to equity funds:
Fixed-income funds (1) Equity funds (2)

What is your age?

About how many years until you expect to retire?

- 5 or less (1)
- 6-10 (2)
- 11-15 (3)
- 16-20 (4)
- 20-30 (5)
- 31 or more (6)

What is your gender?

- Male (1)
- Female (2)

How many children do you have?

- None (1)
- 1 (2)
- 2 (3)
- 3 (4)
- 4 (5)
- 5 (6)

- 6 or more (7)

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 (1)
- Work full-time for an employer or the military (2)
- Work part-time for an employer or the military (3)
- Homemaker (4)
- Full-time student (5)
- Permanently sick, disabled, or unable to work (6)
- Unemployed or temporarily laid off (7)
- Retired (8)
- Prefer not to say (9)

What is your marital status?

- Single (1)
- Married (2)
- Divorced/Separated (3)
- Widowed (4)

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)

A.7 Experiment 6: Education Study

A.7.1 Verbatim Education Treatment

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 tented 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=$1635 <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.

A.7.2 Verbatim Experimental Treatments

In the next pages, we ask you to make a few financial decisions about whether buying or renting a house. You can use excel or the calculator in this computer if you want.

Choice Task: Scenario 1

Imagine you pay $1,250 for rent. You are considering the decision to buy the flat you live in (which is selling at $270,000) and you own $40,000 in cash. So you take a mortgage of $230,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $1,100 over 30 years, which corresponds to an annual interest rate of 4.1%. Would you buy the house? (Note: if you invest the $40,000 you own you will be paid interests at the same annual interest rate of 4.1%.)

- YES
- NO

Choice Task: Scenario 2

Now, imagine you pay $1,250 for rent. You are considering the decision to buy the flat you live in (which is selling at $270,000) and you own $40,000 in cash. So you take a mortgage of $230,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $1,400 over 20 years, which corresponds to an annual interest rate of 4.1%. Would you buy the house? (Note: if you invest the $40,000 you own you will be paid interests at the same annual interest rate of 4.1%.)

- YES
- NO

Choice Task: Scenario 3

Imagine you pay $1,000 for rent. You are considering the decision to buy the flat you live in (which is selling at $270,000) and you own $143,000 in cash. So you take a mortgage of $127,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $750 over 30 years, which corresponds to an annual interest rate of 6%. Would you buy the house? (Note: if you invest the $143,000 you own you will be paid interests at the same annual interest rate of 6%.)

- YES
- NO

Choice Task: Scenario 4

Imagine you pay $1,000 for rent. You are considering the decision to buy the flat you live in (which is selling at $270,000) and you own $58,000 in cash. So you take a mortgage of $212,000 from a bank. In order to pay back the bank, you will have to pay a monthly installment of $1,250 over 30

years, which corresponds to an annual interest rate of 6%. Would you buy the house? (Note: if you invest the $58,000 you own you will be paid interests at the same annual interest rate of 6%.)

- YES
- NO