Money Left on the Kitchen Table:
Exploring sluggish mortgage refinancing using administrative data, surveys, and field experiments[*]

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Abstract

Refinancing a mortgage is an important but complicated decision. Failing to do so optimally can cost borrowers thousands of dollars. This paper investigates a setting where the decision is easier because borrowers receive a pre-approved offer with no upfront monetary costs that offers a significant reduction in monthly payments ($204 on average). Based on administrative data from about 800,000 offers sent to borrowers, we show that more than 50% do not refinance. In doing so, they leave thousands of dollars on the table. A large-scale survey matched to the administrative data, links this failure to suspicion about the motives of financial institutions. The deals of the bank seem to be too good to be true. In addition, we find that time preferences are somewhat related to failures to refinance. Evidence from three field experiments with about 100,000 borrowers each show that it is very difficult to increase applications rate in such an environment. Financial incentives, i.e. gift cards, to apply can even backfire - consistent with the interpretation that monetary incentives can increase suspicion even further.

Keywords: refinancing, household finance, suspicion, present bias
JEL: G02, G21, C93

1 Introduction

Refinancing is one of the most important financial decisions of households. Getting this decision wrong can be very costly for homeowners. Previous research does suggest that borrowers do not optimally refinance (see, e.g., Stanton, 1995; Campbell, 2006; Agarwal et al., 2012). The many borrowers who do not refinance when they should or do so sluggishly (referred in industry circles as "woodheads") potentially leave a lot of money on the table. Keys et al. (2014) estimate based on loan-level data that the median present-discounted cost of failing to refinance is about $11,500.

However, showing that households make *mistakes* and why they make them is challenging. In general, refinancing is a complicated optimization problem. First, borrowers usually have to invest effort searching for, and obtaining, refinancing offers. If they are rationally inattentive (e.g. Sims, 2003; Reis, 2006), it might appear that they refinance sluggishly. Some borrowers may not qualify for a refinancing offer and a potential lower market interest rate is irrelevant for them.[1] Additionally, most refinance offers require upfront monetary costs such as closing costs and appraisal fees. Those costs need to be compensated by discounted savings and the forgone option value of refinancing (i.e. borrowers also need to consider expectations of future interest rates) (e.g., see, Agarwal et al., 2013b). Empirically, it is therefore often not easy to quantify how much money (if any) borrowers leave on the table by not refinancing because we do not observe the offers that the borrowers received (if any) nor the monetary costs of refinancing.

In this paper, we take advantage of the Home Affordable Refinance Program (HARP)[2], a setting that has multiple features that allow us to address these issues. First, we have detailed information about the offers that were sent to about 800,000 borrow-

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[1] Andersen et al. (2014a) look at Danish data to get around this problem as in Denmark everybody has the option to refinance.

[2] For details about the HARP program, see www.harp.gov.

ers and then observe whether the borrower refinanced through this program, and if not, whether they paid off the loan later. Second, all those offers have no upfront costs – all prepayment penalties and appraisal costs are waived and provide substantial savings, suggesting that refinancing should be frequent. This allows us to ask 1) how much money do borrowers leave on the table by not accepting the refinance offers, 2) whether heterogeneity in borrower's preferences, attitudes, and/or financial sophistication can explain part of the refinance patterns. Finally, HARP refinancing is very lucrative for same-servicer refinancing as these loans are sold at a premium (see, p. 35 in Fuster et al., 2013). Additionally, it turns out that lenders exploit barriers to competition induced by the program, and do not reduce the mortgage rates as much as they could (Agarwal et al., 2015). This low interest rate pass-through creates considerable profits for the banking sector. It also creates incentives to our FI to conduct several different (behaviorally informed) interventions to attempt to increase refinancing rates. Thus HARP provides us with a relatively unique setting in which many empirical problems are minimized.

The results show that only 16.23 % of the borrowers applied to the first refinance offer sent by the financial institution (FI). While we observe refinance offers from our FI, we do not have information about other offers from competitors. However, we do know whether borrowers paid off their mortgage – which can be either through another refinance offer from our FI, by refinancing with a competitor or paying off the loan in full. Eventually, an additional 23.61% paid off their loan by May 2013 (which was on average 290 days after receiving the first offer from the FI). That means that 60.16% did not refinance. This is stunningly high given the fact that there are no monetary costs and that the pre-approved offers are attractive: On average, the interest rate drops by 1.8 percentage points (median: 1.75). Such a rate decrease would lead to a monthly savings of $204 on average (median: $122). If non-applicants had picked up the offer from the FI, they would have saved several thousand dollars over the life time of the mortgage.

Our results show that many households leave substantial amounts of money on the table by not applying to the refinance offer. However, this does not mean that borrowers do not pay any attention to the offer because, on average, borrower react to the attractiveness of the offer in an expected way: The more attractive the offer (the greater decrease in interest rate) the more likely borrowers are to refinance. However, application rates increase only up to a certain point after which the application probability almost returns to the baseline level. Because borrowers react to the attractiveness of the offer, it appears that they at least looked at it.

We next investigated potential reasons for not refinancing by conducting a large-scale survey with a subset of borrowers. We match the answers to the survey to the administrative data. The responses suggest that part of the problem of sluggish refinancing is suspicion by borrowers of the motives of financial institutions. This may be thought of as changing the borrowers beliefs on the refinancing cost and increasing the expected value of this cost. Refinance offers under the HARP program seem too good to be true for many borrowers. Households expect there to be hidden fees and cumbersome processes that are not compensated by the attractiveness of the offer.[3] The evidence from the survey matched to the administrative data suggests that higher suspicion about the motives of financial institutions is robustly associated with lower application rates. This association is in line with evidence from a survey study done by FannieMae (FannieMae, 2013). The report shows that many non-applicants do not trust lenders or their communications. In addition, we find that typical time preference parameters such as present bias and discount rates are significantly related to the refinancing decision. Present bias and discount rates (following a $\beta - \delta$ model of Laibson (1997)) predict how sensitive borrowers

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[3]While there are no hidden costs involved, it turns out that lenders are indeed exploiting the program by not passing-though all the subsidies to consumers (Agarwal et al., 2015). The importance of intermediaries in program implementation, can also bee seen with the Home Affordable Modification Program (HAMP) (Agarwal et al., 2013a).

are to the attractiveness of the offer (i.e., the interest rate decrease). At the same time, other psychological factors, like numerical ability, conscientiousness, and others seem less important in determining refinance decisions.

Our resulting set of field experiments demonstrates that barriers to refinancing are extremely difficult to overcome. For example, the literature suggests that financial incentives may nudge present-biased individuals into applying (see, e.g. Charness and Gneezy, 2009; Gneezy et al., 2011). Based on this logic, in one field experiment the FI offered an immediate benefit, i.e. gift cards of up to \$100, for applying. In another field experiment, the FI relied on a third-party (in our case, Fannie Mae and Freddie Mac) to increase the credibility of the program. Finally, in a third field experiment the FI committed to paying \$500 to the borrower if the process took more than 30 days. However, when borrowers are suspicious, they are likely to discount such interventions. If anything, these interventions might backfire, and borrowers become even more suspicious. Evidence from three large-scale field experiments (with more than 100,000 borrowers per experiment) indicates that these interventions have no effect on application rates. Offering gift cards, for example, has – if anything – a slight negative effect on application rates. In other words, interventions that try to tackle psychological barriers like present-biased preferences may not be effective when customers are suspicious.

This paper makes contributions to several related literatures:

First, the paper documents that many borrowers are reluctant to refinance and leave substantial amounts of money on the table. There has been a substantial discussion whether individuals only make financial mistakes when the financial consequences are negligible (e.g. Agarwal et al., 2005).[4] Our paper contributes to this debate. On the one hand, we find that it is indeed true that when benefits increase, individuals are more likely

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[4]There is a larger debate about whether behavioral mistakes disappear when stakes are high enough (see literature in Pope and Schweitzer, 2011).

to refinance. On the other hand, still a large number of borrowers make mistakes that are substantial. Of course, the dollar amount that we can put on the mistake of the more than 50% that do not refinance is specific to our sample and the particular decision. However, the median foregone saving of the non-applicants in our sample is between \$19,000-26,000 (for discount rates varying between 10 and 4%) which is quite similar to the estimates by Keys et al. (2014). Mistakes in financial decisions appear to persist even when large sums are at stake. Those mistakes are not only costly for the household, but potentially for society at large as lower payments reduce defaults (see, e.g., Fuster and Willen, 2013), one of the rationales for the HARP program.

Second, the results in this paper can also contribute to the discussion of the benefit of loyalty and trust between consumers and firms. Past research showed that trust can affect participation in the stock market in general (e.g. Guiso et al., 2008, 2000). Our paper argues that a particular form of mistrust, i.e. suspicion in the motives of financial institutions, substantially affects the interaction between the FI and its borrowers, leaving both worth off. It suggests that once consumers are suspicious about the motives of a firm, it will be very difficult for firms to reestablish trust. This asymmetry between the difficulty of building up trust and the ease in destroying it is very similar to interpersonal relationships (see, e.g., Slovic, 1993). Our results also show that suspicion can be very targeted to a particular firm (i.e., the borrower's FI in this paper). This specific suspicion has different behavioral effects than trust in the banking system as a whole.

This result sheds light on the question of how sustainable it is to exploit consumers' decision-making biases. If the suspicion of our borrowers was really shaped by the past behavior of the financial industry, then the resulting loss of trust has delayed costs in that it restricts the FIs ability to sell its products. As such exploiting behavioral bias in the short-run, might then have long-term costs in terms of increased suspicion. Indeed, the importance of trust (and the lack thereof) in guiding customer behavior has been well

documented in marketing (Berry, 1996; Tax et al., 1998; Garbarino and Johnson, 1999; Sirdeshmukh et al., 2002; Harris and Goode, 2004), but trust and suspicious has received less attention in household finance.[5] Exceptions are the papers mentioned above on trust and stock market participation in general and a paper by Andersen et al. (2014b) that analyzes at the effect of exposure to defaulting banks during the financial crises on investment decisions. Moreover, suspicion can have an interesting effect on pricing decisions.[6] We argue in this paper that consumers are suspicious if firms offer them better deals. As a result, prices remain higher as consumers will not react positively to lower prices or better deals. This is related to the result in Bertrand et al. (2010) in which potential borrowers react negatively to giveaways by the lender. Overcoming such mistrust turns out to be very difficult - especially if attempts at persuading consumers involve additional monetary incentives like gift cards that might increase the suspicion even further.

Finally, we contribute to the discourse about what determines refinancing decisions. With the availability of loan-level data, researcher could investigate heterogeneity in re-financing (see, e.g., Archer et al., 1996; Peristiani et al., 1997; LaCour-Little, 1999; Deng et al., 2000). It turns out that borrower and mortgage characteristics are important de-terminants of refinancing. For example, differences in FICO scores matter – potentially because borrowers with low FICO scores were not able to refinance elsewhere. Ander-sen et al. (2014a) present convincing evidence from unique Danish data that show that socio-demographic variables are extremely important in explaining inertia and inatten-tion. Still a large unobserved borrower heterogeneity remains and Deng et al. (2000, : p. 277) summarizes "Either transaction costs vary a great deal across borrowers, or else some people are simply much worse at exercising options.' This research further increases

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[5]Trust has a longer tradition in other parts of economics, for example, in behavioral game theory (e.g., Camerer, 2003) or in the debate about credibility of monetary policy (e.g., Blinder, 2000).

[6]This point was shaped by a discussion with Botond Koszegi.

our understanding of borrower characteristics by examining borrower-level information about personality traits, skills, time and risk preferences and attitude variables. This is important as borrower characteristics previously used (like FICO or leverage) might also be proxies for personality traits, preferences or skills (e.g. Johnson et al., 2011; Meier and Sprenger, 2012, 2010; Gerardi et al., 2013). In our setup, we show that suspicion in the motives of financial institutions, as well as time and risk preferences explain part of the heterogeneity in refinancing. As such, our paper provides evidence about how borrower heterogeneity in refinancing is affected by psychological barriers.

The remainder of this paper is structured as follows: Section 2 highlights how mis-perception of the cost can affect the normative models of refinancing. Section 3 describes the data, the survey and the field experiments. Section 4 presents our results and section 5 concludes.

2 Extensions of Normative Models of Refinancing

Several normative models of refinancing have been proposed in the literature (e.g. Stanton, 1995; Bennett et al., 2000; Deng et al., 2000; Agarwal et al., 2013b). In the most simple version (see, e.g. Bennett et al., 2000), an option-pricing model predicts that a borrower refinances his or her mortgage if

$$P(T, t, r_0) - P(T, t, r_m) > TC$$

in which $P(T, t, r_0)$ is the value of a callable mortgage loan at period t with an interest rate r_0 and a maturity of T months. $P(T, t, r_m)$ is similar but with the lower current market rate of r_m. The left side of the equation is the intrinsic benefit of refinancing which is discounted by a discount factor of δ. This benefit has to be larger than TC which are the transaction costs. Importantly, TC can include multiple factors:

- The embedded option of refinancing later when the interest rate decreases even further. The option value and its evaluation by the borrower depends on the expected movement of the interest rate and the borrower's attitude towards uncertainty about the interest rate developments.

- Transaction costs include all the monetary costs involved with refinancing, like prepayment fees and all the legal costs involved.

- Transaction costs also include non-monetary costs of refinancing, including the time costs of shopping for and applying to an offer.

Agarwal et al. (2013b) were able to a derive closed-form expression for the minimum fall in interest rate that would justify refinancing. The formula for this threshold reflects several considerations, including the discount rate, expectations on exogenous mortgage repayment, the variance in mortgage rates, refinancing costs, unpaid principal balance, tax savings, and inflation. While the option model in its straightforward version does predict some of the dynamics in refinancing, it is not enough by itself (see, e.g., Deng et al., 2000). Stanton (1995) shows that mortgage holders behave "as though they face transaction costs that far exceed the explicit costs usually incurred on refinancing" (p. 677). According to his calculation the "non monetary prepayment costs amount to an average of 34 percent of the remaining principal balance" (p. 697). Based on behavioral research, we can think about extending the model in at least two dimensions that would affect the perceived cost of refinancing.

First, we may allow borrowers to be suspicious and not believe all the communications from the FI. Indeed, one critical assumption in traditional refinance models is that the refinancing costs are known to the borrower. This cost includes explicit (e.g., fees, insurance) and implicit (e.g., personal time) transaction costs. However, if borrowers are suspicious about the motives of financial institutions, they may not believe the costs

advertised by the financial institution. For example, if a borrower receives an offer that promises no monetary cost of refinancing, the borrower may still believe that there is a positive probability that the monetary cost will in fact be substantial. In such case, the expected monetary cost will be positive from the perspective of the borrower, making it less likely that they will accept the offer. Therefore, suspicious borrowers should be less likely to accept refinancing offers.

Second, another standard assumption in normative models is that it is not costly for consumers to evaluate alternatives presented to them. However, refinancing decisions tend to be complex, and borrowers may need to invest time and cognitive effort to carefully evaluate a refinancing offer. These costs may not be thought of as implicit refinancing costs, because they must be occurred even if the borrower concludes that the offer is not attractive enough. Moreover, these costs must be incurred upfront, before applying. If borrowers are present-biased (e.g. Laibson, 1997; Meier and Sprenger, 2010), such costs are likely to be over weighted compared to the long-term benefits of refinancing. Therefore, borrowers who are present biased may be less likely to accept refinancing offers.

Additionally, many other behavioral factors can affect refinancing decision, i.e. loss aversion (Tversky and Kahneman, 1992) can influence borrower's decision to give up an option now versus wait for a better or worse offer in the future (see Appendix D for a very simple model about the potential relationship between prospect theory and refinancing). Or borrowers might just not understand the financial implications of their choices (e.g. Lusardi and Mitchell, 2014).

3 Data and Design of Survey and Field Experiment

3.1 Administrative Data

Our data come from a large nation-wide financial institution (from now on called *FI*). The *FI* sent refinancing offers to selected, pre-approved borrowers between November 2011 and March 2013. Offer letters sent to borrowers with at least 10 years left on their mortgages contained two options, a *Maintain Offer* and an *Extend Offer*. Borrowers with fewer than 10 years left on their mortgages only received the *Extend Offer*. These offers were defined as follows:

1. *Maintain Offer:* This offer maintained all the mortgage terms (especially the amount of time remaining on the mortgage) but lowered the interest rate. Because the only difference between the current mortgate and the new one is the interest rate, this offer dominates the current mortgage in monetary terms. Therefore this offer provides us with a lower bound of the potential savings that the customer could earn by accepting the offer. As mentioned above, this offer was reserved for borrowers with at least 10 years remaining on their mortgages.

2. *Extend Offer:* This offer extended the term of the mortgage. If, for example, the current loan had a remaining term of 23 years, this offer (if accepted) extended the term to 30 years and adjusted the interest rate accordingly. The new interest rate was never higher than the current one, but it did not have to be lower necessarily. Even if the interest rate was the same as in the maintain offer, the monthly payment would be lower but the loan would be repaid over a longer time period. This trade-off makes the 'extend offer' more difficult to compare to the original loan.

Figure 1 provides an example of how these two offers were displayed. (*FI* changed the creatives slightly between mailings over time).

Figure 1: Offers Sent by *FI*

	Current Loan	Option 1: Maintain Term	Option 2: Extend Term
Product	‹XX-Year Fixed Loan›	‹XX-Year Fixed Loan›	‹XX-Year Fixed Loan›
Interest Rate/**APR**	‹X.XXX%›	‹X.XXX%/**X.XXX%**› **APR(e)**[5]	‹X.XXX%/**X.XXX%**› **APR(e)**[5]
Monthly Payment	‹$X,XXX›	‹$X,XXX›	‹$X,XXX›
		Payment Savings	**Payment Savings**
		‹$X,XXX›	‹$X,XXX›

We have extensive information on about 830,000 borrowers and their mortgages. Panel A in Table 1 shows summary statistics for both borrower and mortgage characteristics. Panel B shows details of the first offer that the borrowers received from the *FI*.

Panel B in the table shows that the Maintain offer reduces the mortgage interest rate by an average of 1.82 percentage points (median 1.75), translating to an average monthly saving of $ 204.25 (median $ 121.98). The Extend offers leads to a smaller reduction in the rate (average of 1.67 percentage points, median of 1.63), but leads to a higher average monthly saving of $ 268.51, since the mortgage payments are more spread out over time.

The *FI* set the new interest rate based on borrower and mortgage characteristics (e.g., original note rate, current FICO and mortgage size) as well as the market rate at the time the offer was sent out (the *FI* did not share their proprietary model determining the interest rate decrease with us). Therefore the decrease in interest rate may not be considered an exogenous variable. However, discussions with *FI* suggested that if we control for observable mortgage and borrower characteristics, the remaining variance in the attractiveness of the offer comes mainly from variations in the market rate at the time the offer was sent.

Table 1: Summary Statistics of Administrative Data

Variable	N	Mean	sd	Median
Panel A: Borrower and Mortgage Characteristics				
Term of Loan (in months)	832,412	301.9058	80.73663	360
Note Rate	832,412	5.770454	0.6853453	5.75
Original Loan Amount (in 1000$)	832,412	156.3001	80.91504	138
Original LTV	829,820	66.88159	16.77688	71.489
Current LTV	832,412	59.74856	31.08498	57.9935
Unpaid Principal Balance (in 1000$)	832,412	119.472	76.74343	99.9495
Income (in 1000$)	819,647	79.1019	33.94525	85
Original FICO (at loan origination)	680,175	730.2041	54.02852	740
Current FICO	826,395	739.7098	68.06811	760
Panel B: Offer Characteristics of 1st Offer				
Decrease in Interest Rate (Maintain)	766,696	1.820384	0.7587984	1.75
Monthly Savings (Maintain) (in $)	766,941	204.2475	215.2565	121.981
Decrease in Interest Rate (Extend)	832,411	1.663653	0.7196632	1.625
Monthly Savings (Extend) (in $)	832,411	364.4045	268.5113	287.542

Notes: Panel A shows characteristics of the borrower and the mortgage at the time of the first offer; Panel B shows characteristics of the 1st offer sent to borrowers.

Our analysis in the next section will focus on borrowers' response to the first offer they received from FI. We focus on the first offer because we do not have information on how the FI decided who received additional mailings.

Finally, we also have information about the status of all mortgages as of May 2013, that is, on average, 290 days (more than 9 months) after the first offer was mailed. In particular, we know whether the borrower paid off their mortgage with FI. For a borrower who did not respond to the first offer, paying off their loan can mean a number of things: a) the borrower applied to future offers, b) the borrower refinanced with FI outside of the HARP, c) the borrower refinanced with another provider, or d) the borrower paid off the loan (see, e.g. Archer et al., 1996; LaCour-Little, 1999, for a discussion of what could cause a loan to be paid off). We therefore need to be careful in interpreting "paid off" as

refinancing. However, we are certain that if the loan was not paid off, then the borrower did not refinance – even though they could have.

3.2   Survey Data

We were able to survey a subset of the borrowers in our administrative dataset and to match their survey responses to their administrative data. Around 170,000 borrowers who had an email address on file were invited to take our online survey. The survey was not conducted by the FI, but by Columbia University in July/September 2012. Appendix E shows the introductory email text. Our response rate was 2.3%, leading to 3,978 respondents. This is in the historical range of market research conducted by the FI, but lower than when using a pre-selected online panel. Of the individuals who responded to the survey, 1,900 completed the whole survey (48% completion rate).

Before we explain the questions in the survey, a natural question is to ask whether responders were substantially different than non-responders. While it is impossible to know selection effects on unobservable characteristics, we can use the administrative data to see whether responders differed from non-responders on observable borrower and mortgage characteristics. Table 2 shows a large set of summary statistics for non-responders (NR) and responders (R) to the survey as well as the results of t-tests comparing the differences. Given the large number of observations, many differences are statistically significant, so the question is more whether they are relevant in size. The differences in mortgage characteristics are rather small. For example, responders have about an 8 point higher FICO score. Given a standard deviation of 66, this seems rather low. However, one important difference is whether R and NR actually took up the refinance offer. About 16% of NR applied for a refinance offer, while 20% did among the R. Among the individuals that responded to the survey, those who completed the survey also differed from those who did

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not completed the survey (see Table A1 in the Appendix). Again the differences do not seem to be large in absolute terms, but we definitely have to keep the differences between completers and non-completers or non-responders in mind when trying to generalize from this self-selected sample.

Table 2: Selection into Survey?

Variable	Mean NR	Mean R	Mean NR-R	p-value two-tailed
Decrease in Interest Rate (Maintain)	1.56	1.58	-0.02	0.04
Term of Loan	311.05	302.99	8.05	0.00
Note Rate	5.70	5.67	0.03	0.01
Original Amount (in 1000$)	172.88	177.03	-4.15	0.00
Original LTV	68.62	66.81	1.82	0.00
Current LTV	66.56	61.92	4.64	0.00
Income (in 1000$)	82.44	84.26	-1.82	0.00
Original FICO	730.44	737.27	-6.84	0.00
Current FICO	740.13	747.83	-7.70	0.00
Applied to 1st offer (=1)	0.16	0.20	-0.04	0.00
Paid Off Later (=1)	0.30	0.34	-0.03	0.00
N	165,882	3978		

Notes: Observable characteristics of NR=Non-Responders and R=Responders and *p*-values from two-sided *t*-tests. The number of observations differs slightly between different variables. *N* in the table indicates the maximum number of observations.

The online survey took on average about 25 minutes to finish. It covered many constructs and was intended to investigate multiple possible psychological barriers to refinancing (see Appendix E for the full survey and Table 3 for summary statistics of the variables used in this paper). In the analysis below, we will focus mainly on two sets of constructs, related to our discussion in Section 2:

1. *Suspicion in motives of financial institutions.* We asked individuals how much they agreed or disagreed with four statements on a 5-point scale from 'strongly agree' to 'strongly disagree'.[7]

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[7]The question was introduced as follows "Below are four statements about the motives of financial institutions to offer refinance opportunities and the costs of refinancing. As a reference point, please think about the financial institution from which you have your mortgage."

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- "My financial institution will only offer me an option to refinance my mortgage if it is in my best interest to do so."
- "There has to be 'a catch' if my financial institution would offer me a lower interest rate."
- "Refinancing a mortgage (if the rate is lower than current interest rate) has hidden costs."
- "A significant amount of paperwork is involved in refinancing a mortgage with my financial institution."

We added up the answers to these four questions (taking into account the fact that the first item was reverse coded) in order to create a single item called "Suspicion in Motives of Banks" and reversed it, so that higher numbers mean more suspicion. As seen in Table 3, on average, borrowers tend to be more suspicion than not (average of 10 out of 16). However, the distribution is skewed, i.e., the median is 4.

2. *Time Preferences.* We measured individual time preferences using the "Dynamic Experiments for Estimating Preferences" (DEEP) methodology developed by Toubia et al. (2013). This method asks the respondent a series of binary choice questions, where each question has two alternatives: a sooner-smaller reward and a larger-later reward. The method is incentive-aligned, i.e., each choice has a positive probability of being realized. The set of questions is optimized on the fly for each respondent. Each question is designed to maximize the amount of information learned about the preferences of this particular respondent, based on his or her previous answers. Preferences are estimated based on a quasi-hyperbolic discounting model (Laibson, 1997; Strotz, 1956), using a hierarchical Bayes procedure that produces individual-level estimates shrunk towards a population mean. The utility derived from receiving \$$x$ in t days is modeled as: $U(x, t, \beta, \delta) = x\beta exp(-\delta t)$. Therefore, for each respondent to the survey time preferences are quantified with two parameters: β captures present bias ($\beta < 1$ corresponds to present bias, $\beta = 1$ corresponds to no present bias, $\beta > 1$ corresponds to future bias) and δ captures the daily discount

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rate. The average value for β and δ in our sample was 0.987 and 0.004, respectively. These values are in the range of measures from other papers, although they tend to reflect higher degrees of patience than was found in some other studies (see Toubia et al., 2013). This may be related to the characteristics of our survey responders, who were all home owners.

In addition to those constructs, the survey questions were designed to measure many aspects of individuals' financial decision-making (see Appendix E for the full list of the questions and their respective wordings). We will use the following in the analysis below:

- *Risk Preferences* were measured using the risk version of the DEEP methodology developed by Toubia et al. (2013). Like with time preferences, risk preferences were estimated at the individual level using adaptive questionnaires. The advantage of using an iterative procedure like DEEP is that it allows for the simultaneous estimation of loss aversion and distortion of probabilities as well as risk aversion (Holt and Laury, 2002; Tanaka et al., 2010). The underlying model is Cumulative Prospect Theory (Tversky and Kahneman, 1992), such that risk preferences are captured by three parameters: a probability weighing parameter α (smaller values mean more distortion of probabilities whereby low likelihood events are over weighted and high likelihood events under weighted, $\alpha = 1$ corresponds to no distortion), a risk aversion parameter σ (smaller values mean more risk aversion, $\sigma = 1$ implies risk neutrality), and a loss aversion parameter λ (higher values mean more loss aversion). The questionnaire consists of a series of binary choices between prospects, where each prospect is a gamble between two (positive or negative) outcomes.

- *Trust* levels were measured using a question on general trust from the World Value Survey (using a three-point scale). In addition, we ask about trust in bankers, banks, and large organizations (developed by Sapienza and Zingales (2012)). We combined the latter

three questions into a scale labeled "Trust in Financial Institutions".

- *Financial Literacy* was measured using questions standard in this literature (for a review, see Lusardi and Mitchell, 2014).

- *Numerical Ability* was measured using questions from Fernandes et al. (2014) and a version of the Cognitive Reflection Test (Frederick, 2005).

- *Conscientiousness* was measured using an 8-item instrument (Saucier, 1994).

- *Socio-Demographics*: We elicited a number of socio-demographic variables, e.g. education and ethnicity.

- *Moving Probability*: We elicited beliefs about expected probability of moving from 0 to 100%.

In the analysis presented in Section 4, we standardize all variables to have a mean of 0 and a standard deviation of 1.

3.3 Field Experiments

Partly based on the results from the survey study, we designed three field experiments with the FI. The experiments were conducted in the Spring of 2013. In each field experiment a new offer letter was created to address a specific barrier to refinancing, and tested with a control and a treatment group. The sample of the experiments consisted of borrowers who had not refinanced up to that point. As such, those might be particularly reluctant to refinance. The three experiments were as follows:

1. *Gift card* experiment. In this experiment around 103,000 borrowers were randomly assigned into four groups and received a new offer. Three treatment groups received $25, $50 or $100 immediately if they applied to the refinancing offer. A control

Table 3: Summary Statistics for Survey Completers

Variable	N	Mean	sd	Median	Min	Max
Suspicion in Motives of Banks	1729	10.405	2.942	4	0	16
Trust Others	1887	2.066	0.705	2	1	3
Trust Financial Institutions	1887	5.421	1.992	5	3	9
Present bias β	1865	0.987	0.144	1.010	0.060	1.346
Discount rate δ	1865	0.004	0.001	0.004	0.001	0.008
Probability weighing α	1846	0.607	0.157	0.593	0.160	0.928
Risk aversion σ	1846	0.482	0.077	0.484	0.296	0.691
Loss aversion λ	1846	1.300	0.427	1.345	0.210	2.134
Conscientiousness	1877	7.019	3.615	7	-23	28
Financial Literacy Scale	1878	6.256	1.057	6	0	8
Numeracy Scale	1877	5.136	1.935	5	0	8
Probability of Moving	1872	0.019	0.026	0.01	0	0.1
Age	1887	50.320	11.015	51	16	112
Female (=1)	1894	0.437	0.496	0	0	1
Ethnicity: White	1894	0.838	0.368	1	0	1
College	1894	0.364	0.481	0	0	1
Graduate Degree	1894	0.437	0.496	0	0	1
Democrat	1894	0.331	0.471	0	0	1
Republican	1894	0.258	0.438	0	0	1
Independent	1894	0.249	0.433	0	0	1

Notes: Summary statistics for the individuals who completed the survey.

group received the offer but no gift cards for applying. Table A4 in the Appendix shows that the randomization worked when comparing mortgage and borrower characteristics across conditions.

2. *Credibility* experiment. In this experiment, about 110,000 borrowers were randomly assigned to a control and a treatment group. The treatment group received the same offer letter as the control group but an extra flier was included, on which Fannie Mae and Freddie Mac informed the borrower about the HARP program and its benefits (see Figure A1 in Appendix for the text of the insert). Table A5 in the Appendix show that treatment and control group did not differ on any observable

characteristics – as expected due to the randomization.

3. *Express guarantee* experiment. In this experiment, around 80,000 borrowers received either a normal offer letter (control group) or an offer in which the FI promised to close in 30 days. If not, the borrower would receive $500. Table A6 in the Appendix shows that randomization worked, i.e. no differences in observable characteristics were found between the control and treatment groups.

4 Results

We will present the results in three steps. First, we analyze how much money borrowers could have saved if they were not sluggish in refinancing, using administrative data. We also study how they reacted to the attractiveness of the offer in terms of interest rate decrease. Second, focusing on the survey responses matched to the administrative data, we present results on whether and how psychological factors are associated with application rates. Third, we present results from the three large-scale field experiments.

4.1 Leaving Money on the Table? Application Rates and Potential Savings

This section investigates how borrowers reacted to the offer sent by FI. Table 4 shows how many borrowers applied to the first HARP offer they received and how many paid off the loan by May 2013 (which, on average, was 290 days after the borrower received their first offer). Paying off the loan can mean that a borrower either refinanced the loan later with FI or with another financial institution. It could, however, also indicate that the borrower just paid off the loan in full without refinancing. The table shows application and paid off rates. Panel A shows rates for all borrowers in our sample. In Panel B we

restrict the sample to borrowers who received the first offer at least 6 months before May 2013. This allowed the borrower to enough time to look for another offer beside the one by *FI*. For this subset, the first offer was received, on average, 333 days before May 2013.

Table 4 show that only about 16% applied to the first HARP offer they received from *FI*. An additional 24% paid off their loan later (by May 2013). This number increases to 27% for borrowers who received their first offer at least 6 months before the end of our time window. Therefore more than 55% did not refinance their loan – even though we know that they received at least one dominating, pre-approved offer from *FI*. That means, many borrowers do not refinance even if an attractive offer is presented to them, i.e., when there is no need for them to be aware that interest rates have changed or to search for a refinancing offer and when the offer has no associated monetary cost.

Table 4: Application & Refinance Rates

	Frequency	Percent	Cumulative
Panel A: All Borrowers			
Not Refinanced	500,776	60.16	60.16
Applied to 1st Offer	135,111	16.23	76.39
Paid Off Later	196,525	23.61	100.00
Panel B: 1st Offer > 180 Days Ago			
Not Refinanced	384,884	56.07	56.07
Applied to 1st Offer	115,783	16.87	72.93
Paid Off Later	185,819	27.07	100.00

Notes: Panel A shows application and refinance rates for all borrowers in our sample. Panel B shows application and refinance rates for borrowers who received their first offer more than 180 days before the latest information about refinance activities (May 2013).

In order to calculate how much money non-applicants leave on the table, we focus on the "maintain" offer – ensuring that we use only dominating offers, as everything except the interest rate is the same between the original mortgage and the offer foregone by

the borrower. Table 5 presents the offer details relative to the current mortgage for both applicants and non-applicants. "Applicants" are defined as borrowers who applied to their first offer, and "Non-applicants" are defined as borrowers who did not respond to the first offer *and* did not pay off their loan as of May 2013 (which was, on average, 290 days after receiving their first offer). Column (1) shows that non-applicants could have saved a lot of money by applying to the first offer. On average, their interest rate would have been almost 1.9 percentage points lower, resulting in an average monthly saving of $226. Those savings are extremely skewed, but even median savings would have been $133 per month. If we assume that the borrower would not pay off the mortgage earlier than the remaining term indicates, we can calculate the net present value (NPV) of the savings over the life of the mortgage. If future savings are discounted by 4% (10%) annually, on average, non-applicants could have saved $26,000 ($19,000). The mean savings represent about 30% of a households reported annual income.

Table 5: Savings of Applicants & Non-Applicants

	(1) Non-Applicants	(2) Applicants	(3) NA-A	(4) t-value
Interest Rate Decrease (Maintain)	1.893	1.853	0.040	16.335
	[1.75]	[1.75]		
Monthly savings (Maintain) (in $)	226.860	159.265	67.596	98.003
	[133.611]	[107.467]		
NPV of Savings (in 1000$) (r=0.04)	26.526	22.050	4.476	66.926
	[19.857]	[16.943]		
NPV of Savings (in 1000$) (r=0.1)	18.580	14.439	4.141	82.621
	[12.900]	[10.689]		
N	460,900	128,087		

Notes: Median values are in brackets. "Non-Applicants" are borrowers who neither applied to the offer sent by FI nor have repaid their loan by May 2013. Table shows savings benefits for 'Maintain' offers that strictly dominate the current mortgage.

Interestingly, Table 5 also shows that the savings foregone by non-applicants are actually larger than the savings realized by applicants. That is, non-applicants lost more

by not applying than applicants saved by applying. This is likely to be driven by systematic differences between applicants and non-applicants: if non-applicants have failed to refinance for a longer time, they should benefit more from refinancing today. However, this also raises the question of whether borrowers reacted to the attractiveness of the offer, i.e. whether the probability of applying increases with the size of the interest rate decrease. Figure 2 presents the distribution of interest rate decreases (left axis) and the corresponding application rates using a quadratic term (right axis).[8] The graph (which excludes the top 1% of the distribution for representation reasons) suggests that borrowers did react to the attractiveness of the interest rate decrease: the higher the decrease the higher the probability of applying. However, this is only true up to a certain point after which application rates go back to levels seen with lower interest rate decreases.

To investigate more rigorously the relationship between the attractiveness of the offer and the probability of applying, we perform a series of binomial and multinomial logistic regressions. Table 6 presents the outcome of a series of binomial logistic regressions that use as a dependent variable whether or not the borrower applied to their first HARP offer. Table 7 presents results from a series of multinominal logistic regressions where the dependent variable has three possible values: applying to the first offer, paying off the loan later, or not paying off the loan later (baseline). In each set of regressions we test three alternative model specifications. In the models in Column (1), the independent variables are the interest rate decrease and the interest rate decrease squared. In the models in Column (2) we check for the effect of borrower and mortgage characteristics in order to compare our results to previous papers on borrower characteristics. In Column (3) we include both sets of independent variables. However, we do not include controls for the date of the mailing in order to exploit the variance in interest rate decrease coming

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[8]A graph plotting the application rate for 100 interest rate decrease spline instead of the quadratic term looks very similar.

Figure 2: Distribution of Interest Rate Reduction & Application Rates
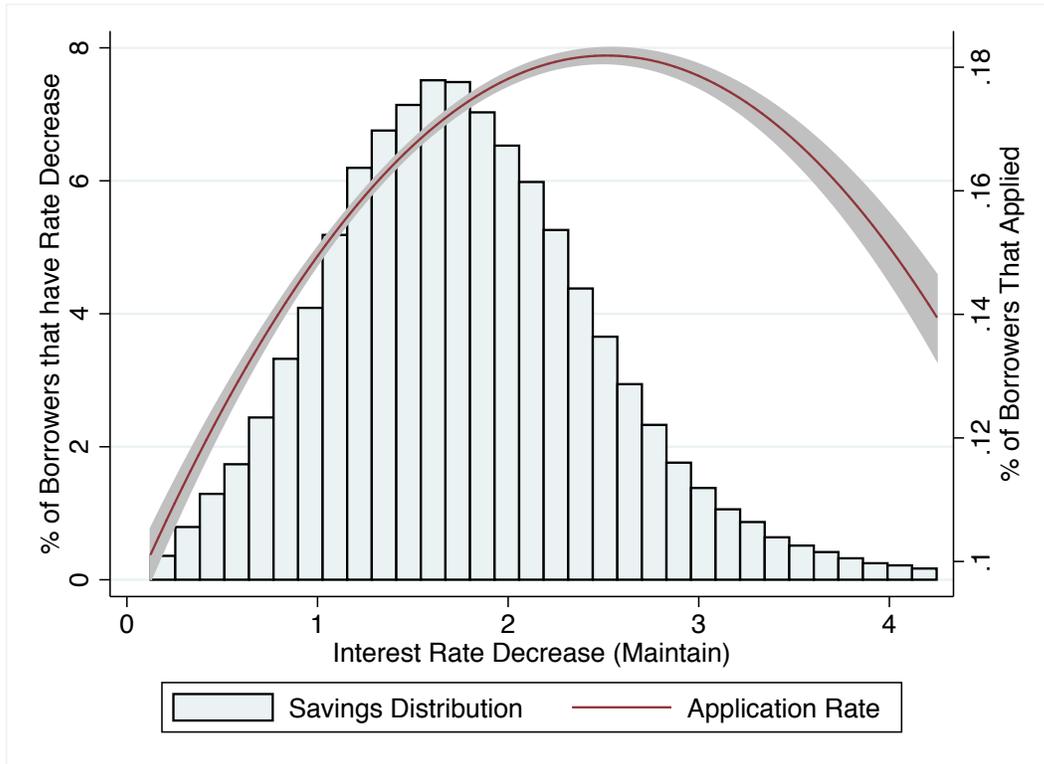
Notes: Distribution of interest rate decrease (on the left axis) and application rate (on the right axis). For the figure only, sample is restricted to offers with an interest rate decrease <4.249 (99% of all offers).

from the market rate at the time of the mailing. (We do control for the origination year of the loan, however).

The results show that borrowers react to the attractiveness of the offer: the higher the rate decrease the higher the probability that borrowers apply to the offer – even after controlling for many of the borrower and mortgage characteristics that partly determine the attractiveness of the offer (Column (3)). This is the case when the outside option is simply modeled as not responding to the first offer (Table 6) and when it is separated into paying off later or not (Table 7). It is reassuring that borrowers seem to react as expected to the characteristics of the offer, that is, they react to incentives. It also suggests that borrowers do take the time to open the offer letter and read the basic terms of the offer,

as they need to be aware of the terms of the offer in order to respond to them. However, even with more attractive offers the application rates do not climb over 20%. In fact, for very high interest rate increases, the application rate actually go back to lower levels of application rates.

4.2 Other Determinants of Refinancing

The borrower and mortgage characteristics show effects that are only partly in line with previous research on refinancing. Importantly, our approach is different from previous empirical papers as we know the exact offer and interest rate that the borrower received. In previous empirical studies, borrower characteristics serve as proxies for credit constraints, that is whether and to what conditions a borrower can refinance. As we control for the offered interest rate, borrower characteristics do not proxy for the attractiveness of the potential offer in our case. Borrower characteristics might then pick up omitted variables, like personality traits.

For example, when looking at the note rate, the results show that the higher the note rate the more borrowers are willing to apply to the offer (see Column (2) in Table 6 and Table 7). This is to be expected, since these borrowers are more likely to receive attractive refinancing offers (their starting point is worse). However, if we control for the attractiveness of the offer, the coefficient for note rate becomes negative in Table 6 and insignificant in 7. We see however that borrowers with a higher note rate are significantly more likely to pay off their mortgages later, after controlling for the characteristics of the first offer (see Column 3 in Table 7). These borrowers have more to benefit from refinancing, and therefore they are more motivated to seek multiple competitive refinancing offers (for the benefit of shopping around, see Woodward and Hall, 2012).

Original Amount is negatively correlated with application rates, which is contrary to

previous results (e.g., LaCour-Little, 1999). However, it is positively related to refinancing later. So, while the benefit of refinancing increases with mortgage size, borrowers with larger mortgages are not more likely to respond to a specific refinancing offer. They may, however, have an extra incentive to look for an even better option than the one received by FI.

Current LTV is positively correlated with application rates, indicating that borrowers with a higher LTV, who might potentially be somewhat constrained to refinance, are happier to apply to the pre-approved offer. While in general, research has shown that refinance rate decreases with LTV (e.g., Deng et al., 2000; Archer et al., 1996), our result show that when borrowers with high LTV receive a refinance offer, they are willing to refinance, potentially because they see this is a rare chance to do so. Finally, Unpaid Principal Balance, Income, and current FICO are all positively related to refinancing.

In sum, the results so far show that borrowers leave substantial amounts of money on the table by not applying to the offer sent by the FI. While borrower seem to react to the attractiveness of the offer in the expected direction, i.e., more attractive offers tend to increase the application probability, there are still about 50% of the borrowers who neither applied to the first offer they received nor paid off their loan (potentially by refinancing after receiving a later offer or through a competitor of FI).

Table 6: Effect of Rate Benefit on Application

	(1)	(2)	(3)
Interest Rate Decrease (Maintain)	0.459***		0.560***
	(0.020)		(0.022)
Interest Rate Decrease (Maintain)^2	-0.081***		-0.056***
	(0.005)		(0.005)
Original Term		0.000***	0.001***
		(0.000)	(0.000)
Original Note Rate		0.174***	-0.156***
		(0.009)	(0.013)
Original Amount (in 1000$)		-0.002***	-0.002***
		(0.000)	(0.000)
Original LTV		-0.000	-0.002***
		(0.000)	(0.000)
Current LTV		0.010***	0.012***
		(0.000)	(0.000)
Unpaid Principal Balance (in 1000$)		0.000	0.001***
		(0.000)	(0.000)
Blended Income at origination (in 1000$)		0.000*	0.000*
		(0.000)	(0.000)
Original FICO		-0.000	0.000
		(0.000)	(0.000)
Current FICO		0.001***	0.001***
		(0.000)	(0.000)
Constant	-2.097***	-4.279***	-3.495***
	(0.019)	(0.083)	(0.091)
Dummies for Loan Origination Period	No	Yes	Yes
Number of observations	608,301	608,301	608,301

Notes: Dependent variable: Borrower applied to first offer (=1) or not (=0). Logit Regressions. Standard errors in parenthesis. All independent variables are standardized to have a mean of 0 and a standard deviation of 1
Level of significance: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

Table 7: Effect of Rate Benefit on Application Multinomial Model

Base Outcome: Not Refinanced	(1)	(2)	(3)
Outcome 1: Applied to 1st Offer			
Interest Rate Decrease (Maintain)	0.195***		0.288***
	(0.020)		(0.023)
Interest Rate Decrease (Maintain)^2	-0.051***		-0.034***
	(0.005)		(0.005)
Original Term		0.001***	0.001***
		(0.000)	(0.000)
Original Note Rate		0.145***	0.002
		(0.009)	(0.014)
Original Amount (in 1000$)		-0.002***	-0.002***
		(0.000)	(0.000)
Original LTV		-0.002***	-0.002***
		(0.000)	(0.000)
Current LTV		0.012***	0.013***
		(0.000)	(0.000)
Unpaid Principal Balance (in 1000$)		0.002***	0.003***
		(0.000)	(0.000)
Blended Income at origination (in 1000$)		0.001***	0.001***
		(0.000)	(0.000)
Original FICO		0.000***	0.000***
		(0.000)	(0.000)
Current FICO		0.003***	0.003***
		(0.000)	(0.000)
Constant	-1.411***	-5.393***	-5.115***
	(0.020)	(0.087)	(0.096)
Outcome: Paid Off Later			
Interest Rate Decrease (Maintain)	-0.599***		-0.593***
	(0.019)		(0.022)
Interest Rate Decrease (Maintain)^2	0.006		-0.023***
	(0.005)		(0.006)
Original Term		0.003***	0.001***
		(0.000)	(0.000)
Original Note Rate		-0.111***	0.558***
		(0.008)	(0.012)
Original Amount (in 1000$)		0.001***	0.003***
		(0.000)	(0.000)
Original LTV		-0.004***	-0.001***
		(0.000)	(0.000)
Current LTV		0.006***	0.003***
		(0.000)	(0.000)
Unpaid Principal Balance (in 1000$)		0.003***	0.001***
		(0.000)	(0.000)
Blended Income at origination (in 1000$)		0.003***	0.003***
		(0.000)	(0.000)
Original FICO		0.001***	0.001***
		(0.000)	(0.000)
Current FICO		0.005***	0.005***
		(0.000)	(0.000)
Constant	0.031*	-6.614***	-8.791***
	(0.017)	(0.082)	(0.089)
Dummies for Origination Period	No	Yes	Yes
Number of observations	608,301	608,301	608,301

Notes: Mutlinominal logit regressions. Base outcome: Not Refinanced; Outcome 1: Applied to 1st Offer; Outcome 2: Paid Off Later. Standard errors in parenthesis. All independent variables are standardized to have a mean of 0 and a standard deviation of 1

Level of significance: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

4.3 Behavioral Barriers to Refinancing

The previous section suggested that around half of the borrowers in our sample leave money on the table by not refinancing their mortgages – even though we know that they received an offer to refinance that dominated their current mortgage. This section uses answers from our survey matched to administrative data to investigate potential explanations, i.e., barriers to refinancing. In presenting the results, we will mainly focus on two sets of variables discussed in Section 2: suspicion in the motives of banks and time preferences. Apart from these factors, this section also discusses a number of other potential barriers to refinance: personality traits (e.g., conscientiousness), cognitive skills (e.g., numerical ability), expectations about the future and risk preferences. Those factors can be thought of as influencing either the probability that the borrower forgets about the offer or looses it (conscientiousness), affecting how well the borrower understands the offer (financial literacy and numerical ability), or how the borrower thinks about future contingencies and their respective uncertainties. Importantly, the results cannot be interpreted as causal as both omitted variables and potential reverse causality cannot be ruled out. However, the evidence can nevertheless provide indicators about the potential importance of certain psychological barriers and be informative for interventions.

Figure 3 shows the cumulative distribution of our measure of borrower's suspicion in motives of banks for both applicants and non-applicants to the first offer. The figure shows that applicants are substantially less suspicious than non-applicants ($p < 0.001$ in a Kolmogorov-Smirnov test). When looking at raw differences between time preferences, there seem to be little differences in both βs (0.986 for applicants and 0.987 for non-applicants; $p = 0.87$ in t-test) or in δs (0.004 for applicants and 0.004 for non-applicants; $p = 0.94$ in t-test). None of the differences are statistically significant. The raw numbers therefore seem to suggest that suspicion in motives is substantially associated with

application probability while there is no main effect of time preferences.

As a next step, we test 1) whether those effects are robust to including control variables, 2) whether suspicion and time preferences interact with the attractiveness of the offer, and 3) whether the conclusions differ when non-applicants are further split between those who paid off their loan later vs. not.

Figure 3: Suspicion in Motives of Financial Institutions.
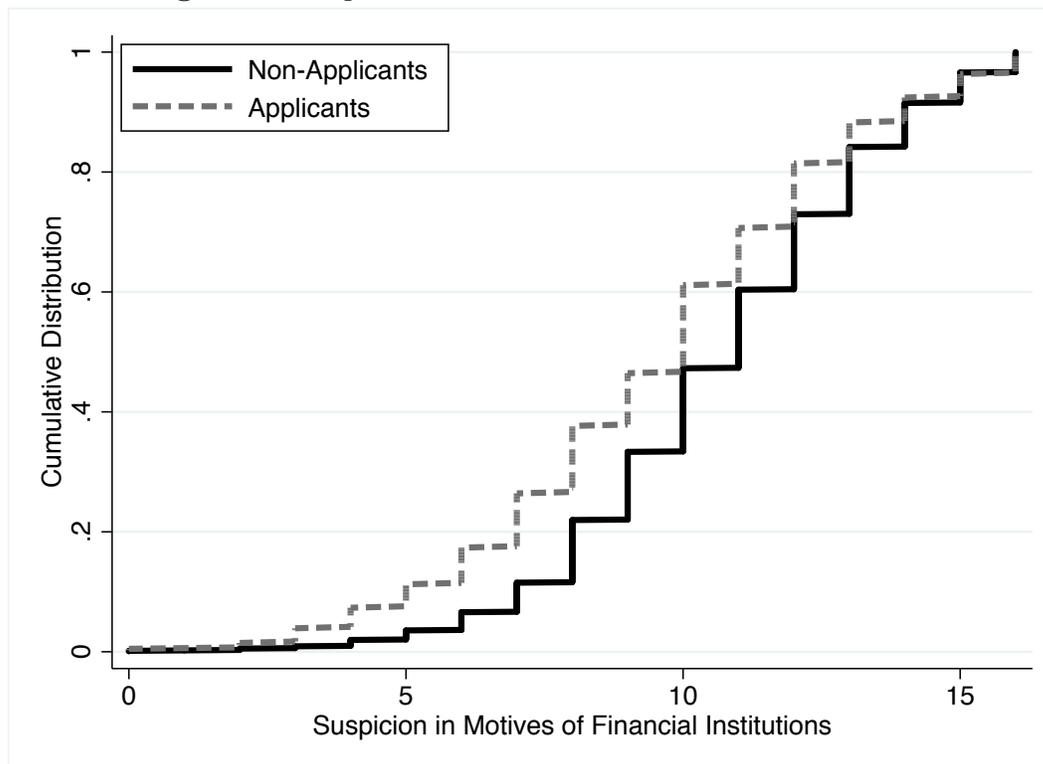
Notes: Higher measures mean more suspicion in motives. See Section 3.2 for details. The two distributions are statistically different in a Kolmogorov-Smirnov-test ($p < 0.001$)

Table 8 shows the results of a series of binomial logistic regressions in which the dependent variable is 1 if the borrower applied to the first offer and 0 otherwise. Table 9 uses a series of multinominal logistic models in which the baseline outcome is 'not paid off'. The other two outcomes are: 1) the borrower applied to the first offer he or she received and 2) the borrower did not apply to the first offer but paid off the loan later.

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In both tables, the different models add various control variables and test whether there are interaction effects between our two sets of variables of special interest, 'Suspicion in Motives of Banks' and time preferences (β, δ), and the attractiveness of the offer ("Interest Rate Decrease").[9] Column (1) and (2) focus on 'Suspicion in Motives of Banks', columns (3) and (4) focus on time and risk preferences and column (5) adds all the variables into one model.

Suspicion. The results in tables 8 and 9 show that suspicion in motives of bank is robustly associated with lower application rates, even after we control for socio-demographic and psychological factors, and mortgage characteristics in column (1). If we calculate the marginal effects in column (1), the results suggest that a 1 point increase in suspicion decreases the probability of refinancing by about 6 percentage points. This is consistent with our discussion in Section 2 and in line with survey evidence from a report by FannieMae (FannieMae, 2013). We can think of a suspicious borrower as one for whom the expected financial cost of refinancing is higher than the one advertised by the FI, making the borrower less likely to accept a refinancing offer. To counteract this effect, the FI would need to decrease the interest rate by about 2 percentage points. Suspicion also negatively affects whether borrowers refinance later ("paid off later") in Table 9. However, this latter effect is only statistically significant on the 10% level in the regression with all the control variables.

Interestingly enough, it seems that suspicion into the motives of banks is distinct from trust in general ("Trust in Others") or trust in financial institutions, bankers and large organizations ("Trust in Financial Institutions"). Including those trust measures does not affect the association between suspicion and applicant rate. Trust (either in others or financial institutions) does not positively affect application rates. If anything, trust in

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[9]In the sample of borrowers who selected into completing the survey, we do not find that the decrease in interest rate has a inverted u-shape relationship as in the full sample. We therefore report results with only a linear term for rate benefit.

financial institutions tend to reduce application rates ($p < 0.1$ in Table 8), although this effect is not robust (see Table 9). Answers to the 'trust' question seem to capture more than the expectation of being treated fairly. It might also indicate trust in the financial system leading to a more optimistic view that refinancing offers by competitors of FI might be available.

Time Preferences. Based on Section 2, we may expect present biased borrowers to be less likely to apply. However, the complete relationship between time preferences and refinancing is likely to be complex. Consider the effect of delta on refinancing in a threshold model, provided by Agarwal et al. (2013b). The benefit of reduced payments relative to the refinancing cost will be higher for low δ (i.e. more patient) customers. However, more patient borrowers may also be more willing to wait for a more attractive offer, which mitigates the former effect. Therefore the main effect of δ is unclear.

The results of the regressions confirm the raw data that there is no main effect of time preferences on application rates. Again, the null effect of the discount rate δ does not necessarily indicate a deviation from normative behavior as δ could have at least two, contradictory effects. On the one hand, more patient borrowers value the future savings more and therefore should be more likely to refinance. On the other hand, they may also be more likely to wait for a better offer to come (similar to the argument in DellaVigna and Paserman (2005) about job search). This is consistent directionally with the results in Table 9: low δ implies more likely to apply to 1st offer and more likely to pay off later.

Interestingly, we do find significant interactions between time preferences and the attractiveness of the offer. The interaction between β and the decrease in interest rate is negative, i.e., more present biased borrowers (smaller β) are more responsive to the attractiveness of the offer. The interaction between δ and the decrease in interest rate is negative, i.e., borrowers who do not discount the future as much (smaller δ) are more

responsive to the offer. We can only offer a speculative explanation for the interaction effect between the decrease in interest rate and β. Present biased borrowers should be more likely to overweigh the mental efforts required to consider the offer seriously, and may not consider the offer seriously unless it is very attractive. Therefore, larger long-term benefits (i.e., sharper decreases in interest rates) may be necessary to get the attention of present-biased borrowers and motivate them to invest the effort required to consider the offer seriously and assess its long-term benefits. This is consistent with the parameter β interacting negatively with the decrease in interest rate, i.e., borrowers who are more present biased (smaller β) are more responsive to the attractiveness of the offer. The interaction between the decrease in interest rate and δ might be explained as follows. Suppose a refinancing offer provides a monthly saving of S_m over T months, and suppose that δ_m is the borrowers monthly discount factor. Then the net present value of the savings for this borrower is: $\frac{1-exp(-\delta_m(T+1))}{1-exp(-\delta_m))} \times S_m$. Increasing the monthly saving by \$1 increases the net present value of the savings over the remaining life of the mortgage by: $\frac{1-exp(-\delta_m(T+1))}{1-exp(-\delta_m))}$. This expression is monotonically decreasing in δ_m. Therefore customers with higher values of δ_m should be less sensitive to changes in the attractiveness of the offer. This is consistent with the interaction between δ and the decrease in interest rate being negative.

The other (behavioral) control variables are also enlightening for understanding potential barriers to refinancing:

Risk preferences. Columns (4) to (6) in Table 8 show that when the outside option is defined as not responding to the first offer, risk preference parameters have little effect on the probability of applying to the first offer. In Table 9 which distinguishes between not paying off the loan at all and paying off the loan later but not through the first HARP offer, the effect of risk aversion is similar to the one in Table 8, with the coefficient associated with σ always negative but not always significantly so. In terms of probability weighing

and loss aversion, a different pattern of results emerges compared to the binomial model. The probability weighing parameter α has a significantly negative impact on applying to the first offer, and an even larger negative impact on paying off the loan later. Lower values of α implies stronger distortion of probabilities, such that events that are likely but not certain are discounted (i.e., the weight put on their probability when making decisions is less than the probability itself). This finding is consistent with the prediction from a simple model in Appendix D that borrowers who distort probabilities more heavily should be more likely to apply, as long as the probability of finding a better offer in the future is high enough. These borrowers under weigh the probability that they will have access to more attractive offers in the future (e.g., they under weigh the probability that such low interest rates will be available), and are therefore more likely to refinance their mortgage within our time window. Table 9 also shows that the loss aversion parameter λ has a significant positive impact on the probability of applying to the first offer, and an even larger positive impact on paying off the loan later. This is also consistent with our discussion in Appendix D. Borrowers who are more loss averse (higher values of λ) are more sensitive to potential regrets that would result from passing on an attractive opportunity to refinance, making them more likely to refinance, either with the first HARP offer they receive or with another offer within our time window. Interestingly, we see that the distortion of probabilities and loss aversion, which are typically considered drivers of irrational behavior, in this case make borrowers more likely to refinance. In other words, these psychological factors actually help borrowers make a decision that is optimal for them according to a normative model.

Conscientiousness. Our measure of conscientiousness is not associated with application rate on a conventional level of statistical significance. If conscientiousness captures the tendency to displace the offer or forget about it, then this result indicates that the application rates are not affected by individuals just displacing the offer.

Financial literacy and numerical ability. The results show that limited numerical ability or financial literacy is not responsible for low application rates. In fact, while numeracy has no significant association with application rates, individuals high on financial literacy are a little less likely to apply to the offer sent by FI. Table 9 reveals that this is partly due to the fact that they pay off later (similar to argued by Agarwal et al. (2012)). Financially savvy borrowers might therefore find other – presumably even more attractive – offers.

Probability of moving. The subjective assessment of the probability of moving in the next 12 months is negatively associated with application rates. As expected in a traditional refinance model (e.g., Agarwal et al., 2013b), borrowers who expect that they will move (and therefore very likely pay off the mortgage) are less likely to refinance as the benefit of refinancing gets much smaller than when they can profit from the decrease in interest rate for longer. Column (7) adds all the control variables together and confirms the results discussed above.

In conclusion, the results from the survey indicate that many potential hurdles, like numerical ability or conscientiousness, are less of a problem. One important factor elicited in our survey is suspicion. More suspicious borrowers may find the offer 'too good to be true' and expect hidden costs, resulting in a lower probability of applying.[10] We find only mixed evidence that time preferences predict the behavior of borrowers in our sample. We find no significant main effect of β and δ. We do find significant interaction terms, such that more attractive offers are required to motivate present biased borrowers to apply, and such that borrowers who are more patient in a traditional sense are more responsive to the

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[10]There are many conversations in online chat rooms about HARP offers that illustrate borrowers suspicion. For example on http://www.fatwallet.com/forums/finance/1165177/: Person 1: "Received a UPS letter package yesterday regarding refi'ing through Harp 2.0 with my current Citi mortgage. (...) The ad specifically states 'no cost to you', and the fine print doesn't hint at any other fees. So, my question is, what's the catch? (...)" Person 2: "There's no catch, why would you think there is?' (...)" Person 1: "My past dealings with the large banks have skewed me. But no doc stamps, title insurance, I just fail to see why they'd be so generous to the little guy. (...)"

attractiveness of the offer. Even though the extensive survey matched to administrative data allows controlling for a large number of variables, in the end, the results from this section cannot eliminate the problem that potentially omitted variables could generate the association between the variables. As such, the results from the survey can also not establish a causal relationship from suspicion to application rates. But the results suggest potential remedies for increasing refinancing. At the same time, once individuals are suspicious about banks' motives, it is expected to be very difficult to re-establish trust. The next section therefore analysis whether interventions from the bank can overcome psychological barriers to refinancing and increase application rates.

Table 8: Application vs. Suspicion, Time and Risk Preferences

	(1)	(2)	(3)	(4)	(5)
Suspicion in Motives of Banks (std.)	-0.389***	-0.389***			-0.400***
	(0.074)	(0.074)			(0.076)
Decrease in Interest Rate (Maintain) (std.)	-0.201	-0.193	-0.174	-0.179	-0.168
	(0.178)	(0.179)	(0.169)	(0.172)	(0.183)
Suspicion $\times$ Interest Rate Decrease		0.029			0.038
		(0.073)			(0.077)
Trust Others (std.)	0.032	0.034			0.052
	(0.075)	(0.075)			(0.077)
General Trust in Financial Institutions (std.)	-0.157*	-0.156*			-0.167**
	(0.081)	(0.081)			(0.082)
Present bias β (std.)			-0.065	-0.096	-0.106
			(0.139)	(0.144)	(0.151)
Discount rate δ (std.)			-0.024	-0.045	-0.042
			(0.139)	(0.143)	(0.151)
$\beta \times$ Interest Rate Decrease				-0.481***	-0.469***
				(0.152)	(0.159)
$\delta \times$ Interest Rate Decrease				-0.364**	-0.361**
				(0.149)	(0.155)
Prob. weighing α				-0.264	-0.210
				(0.505)	(0.537)
Risk aversion σ				-0.231*	-0.202
				(0.133)	(0.138)
Loss aversion λ				0.105	0.098
				(0.490)	(0.521)
Conscientiousness (std.)	0.066	0.069	0.046	0.042	0.050
	(0.074)	(0.075)	(0.071)	(0.072)	(0.075)
Fin. Literacy (std)	-0.178**	-0.179**	-0.161**	-0.142*	-0.143*
	(0.078)	(0.078)	(0.075)	(0.076)	(0.080)
Numeracy (std)	0.108	0.108	0.086	0.114	0.143
	(0.083)	(0.083)	(0.081)	(0.083)	(0.088)
Probability of Moving (next 12 months)	-7.397**	-7.365**	-7.676***	-7.441***	-6.735**
	(3.070)	(3.071)	(2.860)	(2.874)	(3.117)
Age	-0.003	-0.003	0.004	0.002	-0.004
	(0.008)	(0.008)	(0.007)	(0.007)	(0.008)
Female (=1)	-0.167	-0.169	-0.144	-0.139	-0.147
	(0.158)	(0.158)	(0.151)	(0.155)	(0.164)
Ethnicity: White (=1)	-0.131	-0.134	0.046	0.031	-0.141
	(0.205)	(0.205)	(0.195)	(0.198)	(0.211)
College degree (=1)	0.107	0.109	0.029	0.014	0.091
	(0.205)	(0.205)	(0.194)	(0.196)	(0.209)
Graduating degree (=1)	-0.130	-0.127	-0.200	-0.201	-0.144
	(0.210)	(0.211)	(0.200)	(0.202)	(0.215)
Democrat (=1)	0.269	0.264	0.265	0.238	0.266
	(0.237)	(0.237)	(0.225)	(0.227)	(0.240)
Republican (=1)	0.361	0.356	0.301	0.324	0.376
	(0.243)	(0.244)	(0.230)	(0.231)	(0.248)
Independent (=1)	0.434*	0.430*	0.392*	0.353	0.397
	(0.243)	(0.243)	(0.231)	(0.233)	(0.246)
Constant	-6.023***	-6.017***	-6.438***	-6.191***	-5.868***
	(2.193)	(2.192)	(2.100)	(2.142)	(2.270)
Mortgage Controls	YES	YES	YES	YES	YES
Origination Time Period Dummies	YES	YES	YES	YES	YES
N	1,181	1,181	1,263	1,244	1,150

Notes: Dependent variable: whether borrower applied to offer (=1), otherwise 0. Logit regression.
Standard errors in parentheses. All independent variables are standardized to have a mean of 0 and a standard deviation of 1. Mortgage control variables include: Term of offer, original term, original amount, original LTV, current LTV, Unpaid Principal Balance, original FICO, and current FICO.
For the full regression, see Table A2 in the Appendix.

Level of significance: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

Table 9: Application vs. Suspicion, Time and Risk Preferences Multinomial Model

Base Outcome: Not Paid Off	(1)	(2)	(3)	(4)	(5)
Outcome: Applied to 1st Offer					
Suspicion in Motives of Banks (std.)	-0.433***	-0.433***			-0.460***
	(0.083)	(0.083)			(0.086)
Interest Rate Decrease (Maintain) (std.)	-0.280	-0.272	-0.168	-0.196	-0.240
	(0.196)	(0.196)	(0.186)	(0.188)	(0.203)
Suspicion × Interest Rate Decrease		0.010			0.014
		(0.082)			(0.086)
Trust Others (std.)	0.059	0.060			0.089
	(0.083)	(0.083)			(0.085)
General Trust in Financial Institutions (std.)	-0.120	-0.119			-0.123
	(0.089)	(0.089)			(0.091)
Present bias β (std.)			-0.094	-0.091	-0.113
			(0.154)	(0.157)	(0.166)
Discount rate δ (std.)			-0.086	-0.085	-0.077
			(0.153)	(0.156)	(0.165)
$\beta\times$ Interest Rate Decrease				-0.573***	-0.571***
				(0.166)	(0.174)
$\delta\times$ Interest Rate Decrease				-0.453***	-0.455***
				(0.162)	(0.170)
Prob. weighing α			-1.256**	-1.393**	-1.447**
			(0.563)	(0.567)	(0.603)
Risk aversion σ			-0.263*	-0.305**	-0.250*
			(0.144)	(0.145)	(0.151)
Loss aversion λ			1.065**	1.172**	1.301**
			(0.543)	(0.546)	(0.583)
Conscientiousness (std.)	0.092	0.093	0.057	0.060	0.066
	(0.081)	(0.082)	(0.078)	(0.078)	(0.083)
Fin. Literacy (std)	-0.107	-0.107	-0.064	-0.049	-0.050
	(0.086)	(0.086)	(0.083)	(0.084)	(0.089)
Numeracy (std)	0.114	0.114	0.109	0.115	0.142
	(0.091)	(0.091)	(0.090)	(0.091)	(0.096)
Probability of Moving (next 12 months)	-7.896**	-7.870**	-8.275***	-8.314***	-7.642**
	(3.332)	(3.334)	(3.105)	(3.116)	(3.405)
Constant	-8.363***	-8.342***	-7.714***	-8.152***	-8.277***
	(2.425)	(2.424)	(2.334)	(2.359)	(2.521)
Outcome: Paid Off Later					
Suspicion in Motives of Banks (std.)	-0.097	-0.101			-0.142*
	(0.078)	(0.078)			(0.081)
Interest Rate Decreasee (Maintain) (std.)	-0.198	-0.200	-0.055	-0.060	-0.184
	(0.181)	(0.181)	(0.174)	(0.174)	(0.187)
Suspicion × Interest Rate Decrease		-0.053			-0.071
		(0.079)			(0.080)
Trust Others (std.)	0.062	0.060			0.079
	(0.076)	(0.076)			(0.078)
General Trust in Financial Institutions (std.)	0.084	0.083			0.091
	(0.080)	(0.080)			(0.083)
Present bias β (std.)			0.000	0.006	-0.017
			(0.145)	(0.146)	(0.155)
Discount rate δ (std.)			-0.108	-0.102	-0.084

	(1)	(2)	(3)	(4)	(5)
			(0.143)	(0.144)	(0.152)
$\beta \times$ Interest Rate Decrease				-0.193	-0.191
				(0.155)	(0.163)
$\delta \times$ Interest Rate Decrease				-0.204	-0.197
				(0.148)	(0.156)
Prob. weighing α			-2.455***	-2.506***	-2.690***
			(0.522)	(0.523)	(0.559)
Risk aversion σ			-0.147	-0.159	-0.088
			(0.135)	(0.136)	(0.144)
Loss aversion λ			2.344***	2.386***	2.642***
			(0.507)	(0.508)	(0.544)
Conscientiousness (std.)	0.059	0.056	0.049	0.050	0.038
	(0.072)	(0.072)	(0.071)	(0.071)	(0.074)
Fin. Literacy (std)	0.167**	0.168**	0.205**	0.212***	0.205**
	(0.083)	(0.083)	(0.081)	(0.081)	(0.086)
Numeracy (std)	0.008	0.009	-0.003	-0.000	-0.006
	(0.082)	(0.082)	(0.083)	(0.083)	(0.087)
Probability of Moving (next 12 months)	-0.783	-0.837	-1.413	-1.534	-1.583
	(2.816)	(2.819)	(2.639)	(2.646)	(2.909)
Constant	-7.907***	-7.903***	-6.814***	-6.992***	-7.944***
	(2.272)	(2.273)	(2.195)	(2.198)	(2.351)
Socio-Demographic Characteristics	YES	YES	YES	YES	YES
Mortgage Characteristics	YES	YES	YES	YES	YES
Origination Time Period Dummies	YES	YES	YES	YES	YES
Number of observations N	1,181	1,181	1,244	1,244	1,150

Notes: Table shows coefficients from a multinominal logit regression in which 'Did not pay off' is the base outcome. Standard errors are shown in parentheses. All independent variables are standardized to have a mean of 0 and a standard deviation of 1. Socio-Demographic Characteristics include age, gender, ethnicity, education, political orientation. Mortgage characteristics include original term, note rate, original amount, original and current LTV, unpaid principal balance, income, original and current FICO. For the full model, see Table A3 in the Appendix.

Level of significance: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$

4.4 Field Experiments

The FI implemented three field experiments in order to increase application rates. One, the gift card experiment, tried to address the problem of present-bias while the other two were attempts to overcome the problem of borrowers' suspicion in bank's motives.

Table 10 show the main effects of the experiment. For each of the three experiments, the table shows application rates for the control and the treatment group(s). Standard errors for the differences between treatment and control come from OLS regressions with treatment dummies.[11]

Results show that none of the interventions had a positive effect on application rates. Even more striking is the results that if anything, offering gift cards had a negative effect on application rates. Combining all the three gift cards conditions together (not shown in the table) suggests that the gift card intervention on average *decreased* the application rate by 0.4 percentage points ($p < 0.07$). Comparisons across the three different amounts seem to suggest that offering an intermediate amount has the most detrimental effect on application rates (however, the difference between the treatments is not statistically significant). The result indicates that small financial incentives can backfire in settings in which consumers are suspicious to begin with (related to the result on giveaways in Bertrand et al. (2010)).

The table also shows that third-party testimony (credibility experiment) and guarantees to be fast had positive effects on application rates. Those differences are, however, extremely small and far from statistically significant.[12]

In sum, the results from the three large-scale experiments indicate that it is extremely

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[11]Regressions including control variables yield very similar results.

[12]None of the treatments interacts in any significant way with suspicion or time preferences. However, the number of observations drop quite dramatically for this analysis as not as many survey responders where in the experimental sample.

difficult to increase application rates, i.e. to nudge borrowers into doing something that is in their best interest. The failure of the attempts by the FI to increase application rates have to be seen in light of the results from our survey that suspicion in the motives of financial institutions is high and strongly associated with application rates. In an environment in which trust is destroyed, it is very difficult to re-establish trust and to overcome suspicion. Such an asymmetry between the difficulty of building up trust and the ease with which it gets destroyed, has been documented also in interpersonal relationships (see, e.g., Slovic, 1993).

Table 10: Experimental Interventions

Treatments	N	Application Rates & Diff. to Control	s.e.	t-value
Gift Card Experiment				
0. Control Group	25,834	0.124		
1. Gift Card: $25	25,823	-.0031	.003	-1.12
2. Gift Card: $50	25,866	-.006	.003	-2.16
3. Gift Card: $100	25,836	-.003	.003	-1.16
Credibility Experiment				
0. Control Group	55,285	.159		
1. Agency Flier	55,267	.002	.002	0.96
Express Guarantee				
0. Control Group	39,504	.107		
1. Express Guarantee	39,501	.001	.002	0.29

Notes: Standard errors come from OLS regressions that regress treatment dummies on whether a household applied to the offer.

5 Conclusions

This paper investigates homeowners decisions to refinance their mortgage. We examine administrative data from a large US bank when a government program allowed the to send borrowers pre-approved refinance offers that had no monetary and no search costs involved and that always involved an often substantial decrease in payments. We see that at least 50% of borrowers are sluggish in refinancing and leave large amounts of money on the table. To better characterize the reasons for this, we conduct a large-scale survey and match the answers to the administrative data. Combining standard economic variables with measured perceptions allows us to identify important considerations in these decisions. It turns out that suspicion about the banks motives is strongly and robustly correlated with sluggish refinancing. Borrowers are expecting there "to be a catch" and that the offers will have hidden costs. In this environment where customers do not trust their financial provider, it appears very difficult to increase refinancing rates. Three large-scale field experiments show that efforts by the bank to increase application rates have no effect. If anything, providing extra incentives can backfire, reducing refinancing.

Our paper suggests future developments for descriptive refinancing models. For example, models such as Agarwal et al. (2012)'s may be extended to capture the effects we observe affecting refinancing including present bias, loss aversion, probability weighing, and perhaps even suspicion. Suspicion, which plays the largest role in explaining suspicious refinancing could be modeled by allowing borrowers to form probabilistic beliefs on the true refinancing cost. While these beliefs may assign positive probabilities to the refinancing cost advertised by the financial institution, they also could allow for the possibility that the actual cost will be higher.

Our research suggests that suspicion in banks motives decreases refinancing rates. Economists have long been concerned with credibility, particularly macroeconomics with

the credibility of central bankers (e.g. Blinder, 2000) and in game theory where credibility can play a central role in explaining behavior (e.g. Camerer, 2003). More recently, economists have been shown and importance of generalized trust financial institutions in explaining walking away from mortgages. Our work adds to this by demonstrating that suspicion of a particular bank's motives may reduce refinancing While we cannot establish a causal link, the association is robust and fairly strong To counteract a decrease of 1 point in the mean level of suspicion, a bank would need to reduce interest rates by 2 %. It is not so surprising that borrowers are suspicious in banks motives after the financial crises. Sapienza and Zingales (2012) and Guiso (2010) show that trust towards the financial sector dropped dramatically in 2008. But we also show that trust in the financial system in general and suspicion against a *particular* financial institution can have different effects. We believe that it is worth to further investigate the effect of suspicion on market transaction. One first step would be to compare countries that saw a dramatic drop in trust (e.g. the US) and countries that did not (e.g. Canada). Relatedly, it might be possible that consumers trust mutually owned financial institutions, like credit unions, more than investor-owned banks as our FI (as argued by Bubb and Kaufman (2013)).

The importance of suspicion is emphasized by the observation, consistent with psychological research, that once lost, trust is difficult to regain (Slovic, 1993) This asymmetry suggests that actions designed to increase trust, may have little or no effect. The evidence from the field experiments shows that it is extremely difficult to increase refinancing rates. While this is consistent with the idea that if borrowers are suspicious about banks motives it will be very difficult to change their behavior, our set-up did not allow to test this hypothesis directly.

In a next step it might be useful to conduct a randomized control trial and measure suspicion level and other behavioral constructs in a large enough sample to analyze heterogeneous treatment effects. And then it would be important to develop different

interventions that will 'nudge' borrowers into refinancing and unlocking savings for them as refinancing mistakes can cost households thousands of dollars.

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Appendix

A Additional Tables

Table A1: Selection into Completing the Survey?

Variable	Mean NC	Mean C	Mean NC-C	p-value two-tailed
Interest Rate Decrease (Maintain)	1.55	1.62	-0.07	0.00
Term of Loan	305.13	300.66	4.47	0.08
Note Rate	5.70	5.65	0.05	0.02
Original Amount (in 1000$)	182.77	170.75	12.02	0.00
Original LTV	66.41	67.25	-0.84	0.11
Current LTV	63.05	60.68	2.37	0.02
Income (in 1000$)	85.18	83.25	1.93	0.07
Original FICO	735.32	739.48	-4.15	0.02
Current FICO	743.86	752.17	-8.31	0.00
Applied (=1)	0.18	0.23	-0.04	0.00
Refinanced Later (=1)	0.34	0.33	0.01	0.40
N	2078	1900		

Notes: NC=Non-Completers; C=Completers. p-value of a two-sided t-test. The number of observations differ slightly between different variables. N in the table indicate the maximum number of observations.

Table A2: Application vs. Suspicion, Time and Risk Preferences (Full Binomial Model)

	(1)	(2)	(3)	(4)	(5)
Suspicion in Motives of Banks (std.)	-0.389***	-0.389***			-0.400***
	(0.074)	(0.074)			(0.076)
Interest Rate Decrease (Maintain) (std.)	-0.201	-0.193		-0.179	-0.168
	(0.178)	(0.179)		(0.172)	(0.183)
Suspicion × Interest Rate Decrease		0.029			0.038
		(0.073)			(0.077)
Trust Others (std.)	0.032	0.034			0.052
	(0.075)	(0.075)			(0.077)
General Trust in Financial Institutions (std.)	-0.157*	-0.156*			-0.167**
	(0.081)	(0.081)			(0.082)
Present bias β (std.)			-0.030	-0.096	-0.106
			(0.131)	(0.144)	(0.151)
Discount rate δ (std.)			-0.029	-0.045	-0.042
			(0.132)	(0.143)	(0.151)
$\beta\times$ Interest Rate Decrease				-0.481***	-0.469***
				(0.152)	(0.159)
$\delta\times$ Interest Rate Decrease				-0.364**	-0.361**
				(0.149)	(0.155)
Prob. weighing α				-0.264	-0.210
				(0.505)	(0.537)
Risk aversion σ				-0.231*	-0.202
				(0.133)	(0.138)
Loss aversion λ				0.105	0.098
				(0.490)	(0.521)
Conscientiousness (std.)	0.066	0.069	0.049	0.042	0.050
	(0.074)	(0.075)	(0.069)	(0.072)	(0.075)
Fin. Literacy (std)	-0.178**	-0.179**	-0.179**	-0.142*	-0.143*
	(0.078)	(0.078)	(0.071)	(0.076)	(0.080)
Numeracy (std)	0.108	0.108	0.103	0.114	0.143
	(0.083)	(0.083)	(0.077)	(0.083)	(0.088)
Probability of Moving (next 12 months)	-7.397**	-7.365**	-6.634**	-7.441***	-6.735**
	(3.070)	(3.071)	(2.713)	(2.874)	(3.117)
Age	-0.003	-0.003	0.008	0.002	-0.004
	(0.008)	(0.008)	(0.007)	(0.007)	(0.008)
Female (=1)	-0.167	-0.169	-0.088	-0.139	-0.147
	(0.158)	(0.158)	(0.142)	(0.155)	(0.164)
Ethnicity: White (=1)	-0.131	-0.134	0.060	0.031	-0.141
	(0.205)	(0.205)	(0.186)	(0.198)	(0.211)
College degree (=1)	0.107	0.109	-0.041	0.014	0.091
	(0.205)	(0.205)	(0.185)	(0.196)	(0.209)
Graduating degree (=1)	-0.130	-0.127	-0.202	-0.201	-0.144
	(0.210)	(0.211)	(0.189)	(0.202)	(0.215)
Democrat (=1)	0.269	0.264	0.213	0.238	0.266
	(0.237)	(0.237)	(0.210)	(0.227)	(0.240)
Republican (=1)	0.361	0.356	0.278	0.324	0.376
	(0.243)	(0.244)	(0.215)	(0.231)	(0.248)
Independent (=1)	0.434*	0.430*	0.332	0.353	0.397
	(0.243)	(0.243)	(0.216)	(0.233)	(0.246)
Original Term	-0.002	-0.002	-0.001	-0.002	-0.001
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Original Note Rate	0.739**	0.739**	0.336**	0.641**	0.705**
	(0.312)	(0.312)	(0.166)	(0.302)	(0.323)
Original Amount (in 1000$)	-0.002	-0.002	-0.005	-0.003	-0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Original LTV	-0.006	-0.006	-0.004	-0.005	-0.007
	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)
Current LTV	0.012***	0.012***	0.013***	0.014***	0.013***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Unpaid Principal Balance (in 1000$)	0.001	0.001	0.004	0.002	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Blended Income at origination (in 1000$)	0.001	0.001	0.001	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Original FICO	-0.001	-0.001	-0.001	-0.001	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Current FICO	0.002	0.002	0.003**	0.003**	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Constant	-6.023***	-6.017***	-5.094***	-6.191***	-5.868***
	(2.193)	(2.192)	(1.733)	(2.142)	(2.270)
Origination Time Period Dummies	YES	YES	YES	YES	YES
N	1,181	1,181	1,422	1,244	1,150

Notes: Dependent variable: whether borrower applied to offer (=1), otherwise 0. Logit regression. Standard errors in parentheses. All independent variables are standardized to have a mean of 0 and a standard deviation of 1.

Level of significance: *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Base Outcome: Not Refinanced	(1)	(2)	(3)	(4)	(5)
Outcome: Applied to 1st Offer					
Suspicion in Motives of Banks (std.)	-0.433***	-0.433***			-0.460***
	(0.083)	(0.083)			(0.086)
Interest Rate Decrease (Maintain) (std.)	-0.280	-0.272	-0.168	-0.196	-0.240
	(0.196)	(0.196)	(0.186)	(0.188)	(0.203)
Suspicion × Interest Rate Decrease		0.010			0.014
		(0.082)			(0.086)
Trust Others (std.)	0.059	0.060			0.089
	(0.083)	(0.083)			(0.085)
General Trust in Financial Institutions (std.)	-0.120	-0.119			-0.123
	(0.089)	(0.089)			(0.091)
Present bias β (std.)			-0.094	-0.091	-0.113
			(0.154)	(0.157)	(0.166)
Discount rate δ (std.)			-0.086	-0.085	-0.077
			(0.153)	(0.156)	(0.165)
$\beta \times$ Interest Rate Decrease				-0.573***	-0.571***
				(0.166)	(0.174)
$\delta \times$ Interest Rate Decrease				-0.453***	-0.455***
				(0.162)	(0.170)
Prob. weighing α			-1.256**	-1.393**	-1.447**
			(0.563)	(0.567)	(0.603)
Risk aversion σ			-0.263*	-0.305**	-0.250*
			(0.144)	(0.145)	(0.151)
Loss aversion λ			1.065**	1.172**	1.301**
			(0.543)	(0.546)	(0.583)
Conscientiousness (std.)	0.092	0.093	0.057	0.060	0.066
	(0.081)	(0.082)	(0.078)	(0.078)	(0.083)
Fin. Literacy (std)	-0.107	-0.107	-0.064	-0.049	-0.050
	(0.086)	(0.086)	(0.083)	(0.084)	(0.089)
Numeracy (std)	0.114	0.114	0.109	0.115	0.142
	(0.091)	(0.091)	(0.090)	(0.091)	(0.096)
Probability of Moving (next 12 months)	-7.896**	-7.870**	-8.275***	-8.314***	-7.642**
	(3.332)	(3.334)	(3.105)	(3.116)	(3.405)
Age	-0.005	-0.005	0.004	0.003	-0.005
	(0.009)	(0.009)	(0.008)	(0.008)	(0.009)
Female (=1)	0.010	0.008	0.050	0.072	0.049
	(0.175)	(0.175)	(0.170)	(0.171)	(0.182)
Ethnicity: White (=1)	-0.095	-0.097	0.123	0.099	-0.138
	(0.223)	(0.223)	(0.214)	(0.216)	(0.232)
College degree (=1)	0.128	0.130	-0.018	-0.017	0.099
	(0.226)	(0.226)	(0.216)	(0.217)	(0.233)
Graduating degree (=1)	-0.278	-0.276	-0.379*	-0.364	-0.315
	(0.231)	(0.231)	(0.220)	(0.222)	(0.237)
Democrat (=1)	0.204	0.201	0.240	0.215	0.241
	(0.258)	(0.258)	(0.246)	(0.248)	(0.264)
Republican (=1)	0.326	0.321	0.338	0.330	0.384
	(0.266)	(0.266)	(0.252)	(0.253)	(0.272)
Independent (=1)	0.454*	0.452*	0.428*	0.375	0.419
	(0.266)	(0.266)	(0.254)	(0.256)	(0.271)
Original Term	-0.003	-0.003	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Original Note Rate	0.932***	0.930***	0.658**	0.738**	0.909**
	(0.349)	(0.349)	(0.331)	(0.335)	(0.362)
Original Amount (in 1000$)	-0.002	-0.002	-0.003	-0.003	-0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Original LTV	-0.003	-0.003	-0.003	-0.003	-0.004
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Current LTV	0.009**	0.009**	0.012***	0.012***	0.011**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Unpaid Principal Balance (in 1000$)	0.005	0.005	0.006	0.005	0.003
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Blended Income at origination (in 1000$)	0.001	0.001	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Original FICO	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Current FICO	0.005***	0.005***	0.005***	0.006***	0.005***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	-8.363***	-8.342***	-7.714***	-8.152***	-8.277***
	(2.425)	(2.424)	(2.334)	(2.359)	(2.521)
Outcome: Paid Off Later					
Suspicion in Motives of Banks (std.)	-0.097	-0.101			-0.142*
	(0.078)	(0.078)			(0.081)
Interest Rate Decrease (Maintain) (std.)	-0.198	-0.200	-0.055	-0.060	-0.184
	(0.181)	(0.181)	(0.174)	(0.174)	(0.187)
Suspicion × Interest Rate Decrease		-0.053			-0.071
		(0.079)			(0.080)
Trust Others (std.)	0.062	0.060			0.079
	(0.076)	(0.076)			(0.078)
General Trust in Financial Institutions (std.)	0.084	0.083			0.091
	(0.080)	(0.080)			(0.083)
Present bias β (std.)			0.000	0.006	-0.017
			(0.145)	(0.146)	(0.155)
Discount rate δ (std.)			-0.108	-0.102	-0.084
			(0.143)	(0.144)	(0.152)

$\beta \times$ Interest Rate Decrease				-0.193	-0.191
				(0.155)	(0.163)
$\delta \times$ Interest Rate Decrease				-0.204	-0.197
				(0.148)	(0.156)
Prob. weighing α			-2.455***	-2.506***	-2.690***
			(0.522)	(0.523)	(0.559)
Risk aversion σ			-0.147	-0.159	-0.088
			(0.135)	(0.136)	(0.144)
Loss aversion λ			2.344***	2.386***	2.642***
			(0.507)	(0.508)	(0.544)
Conscientiousness (std.)	0.059	0.056	0.049	0.050	0.038
	(0.072)	(0.072)	(0.071)	(0.071)	(0.074)
Fin. Literacy (std)	0.167**	0.168**	0.205**	0.212***	0.205**
	(0.083)	(0.083)	(0.081)	(0.081)	(0.086)
Numeracy (std)	0.008	0.009	-0.003	-0.000	-0.006
	(0.082)	(0.082)	(0.083)	(0.083)	(0.087)
Probability of Moving (next 12 months)	-0.783	-0.837	-1.413	-1.534	-1.583
	(2.816)	(2.819)	(2.639)	(2.646)	(2.909)
Age	-0.003	-0.004	0.001	0.001	-0.002
	(0.008)	(0.008)	(0.007)	(0.007)	(0.008)
Female (=1)	0.380**	0.385**	0.447***	0.459***	0.422**
	(0.158)	(0.158)	(0.156)	(0.156)	(0.166)
Ethnicity: White (=1)	0.082	0.082	0.175	0.167	0.004
	(0.204)	(0.204)	(0.196)	(0.197)	(0.212)
College degree (=1)	0.067	0.067	-0.044	-0.048	0.050
	(0.213)	(0.213)	(0.206)	(0.206)	(0.221)
Graduating degree (=1)	-0.304	-0.305	-0.346*	-0.346*	-0.332
	(0.216)	(0.216)	(0.209)	(0.209)	(0.223)
Democrat (=1)	-0.149	-0.142	-0.042	-0.040	-0.049
	(0.225)	(0.225)	(0.216)	(0.217)	(0.232)
Republican (=1)	-0.076	-0.071	0.006	0.013	0.019
	(0.235)	(0.236)	(0.226)	(0.227)	(0.242)
Independent (=1)	0.045	0.050	0.053	0.041	0.042
	(0.236)	(0.237)	(0.228)	(0.229)	(0.243)
Original Term	-0.001	-0.001	-0.000	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Original Note Rate	0.480	0.479	0.210	0.244	0.478
	(0.325)	(0.325)	(0.312)	(0.312)	(0.337)
Original Amount (in 1000$)	0.001	0.001	0.001	0.001	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Original LTV	0.006	0.006	0.005	0.005	0.005
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Current LTV	-0.005	-0.005	-0.003	-0.003	-0.003
	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)
Unpaid Principal Balance (in 1000$)	0.006	0.006	0.006	0.006	0.005
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Blended Income at origination (in 1000$)	0.001	0.001	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Original FICO	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Current FICO	0.007***	0.007***	0.007***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	-7.907***	-7.903***	-6.814***	-6.992***	-7.944***
	(2.272)	(2.273)	(2.195)	(2.198)	(2.351)
Origination Time Period Dummies	YES	YES	YES	YES	YES
Number of observations	1,729	1,163	1,163	1,865	1,244
1,244	1,150				

Notes: Table shows coefficients from a multinominal logit regression in which 'Did not pay off' is the base outcome. Standard errors are shown in parentheses. All independent variables are standardized to have a mean of 0 and a standard deviation of 1.
Level of significance: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$

B Additional Figures

Figure A1: Agency flier experiment insert

Information from Fannie Mae and Freddie Mac about Expanded Opportunities to Refinance your Mortgage

You are receiving this notice because the mortgage on your home is owned either by Fannie Mae or Freddie Mac*, and, as a result, you may be eligible to refinance your mortgage under the Obama Administration's Home Affordable Refinance Program (commonly known as "HARP"). HARP was created in 2009 to help homeowners with little to no equity get a new, more affordable, more stable mortgage. Recently, HARP guidelines have been expanded to allow even more homeowners to qualify.

No doesn't always mean no! Even if you have no equity or you're underwater on your mortgage or you've been previously turned down for refinancing, you may still qualify for refinancing with HARP. Since 2009, **over 2.2 million homeowners have refinanced with HARP**, and many more still can benefit from HARP.

You May Qualify:	Your Benefits May Include:
• Regardless of your current income or credit score • Even if you owe more on your existing mortgage than your home's current value • Whether your home is your primary residence, second home, or investment property	• Lowering your monthly payment due to today's historically lower interest rates — homeowners are saving **over $250 per month** on average • Shortening your term to save money over the long term — **terms from 15 to 30 years** are available • Changing to a fixed-rate mortgage so your payments don't change • Rolling closing costs into your new loan • Avoiding spending money on a new appraisal • Reducing or not having to bring cash to closing

ACT NOW while mortgage rates are still low

Contact your mortgage company to see if you qualify for HARP.
For more information, visit:

- Fannie Mae's **KnowYourOptions.com** website
- Freddie Mac's website at **FreddieMac.com/avoidforeclosure/harp.html**
- U.S. Department of Treasury's **MakingHomeAffordable.gov** website

FannieMae.

John S. Forlines
Senior Vice President

Freddie Mac
We make home possible®

Tracy Mooney
Senior Vice President

* Fannie Mae and Freddie Mac are government-sponsored enterprises created by Congress to help provide mortgage funding to support homeownership in America.

NOTE: Be aware that the interest on any portion of your loan that is greater than the fair market value of your property is not tax deductible for federal income tax purposes. You should consult your tax advisor for more information.

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C Randomization Check Tables for Field Experiments

Table A4: Randomization Check - Gift Card

	Mean Control (C)	Mean Treatment (T)	Mean C-T	p-value two-tailed	t-value
Interest Rate Decrease (Maintain)	2.509	2.501	0.008	0.145	1.4567
Monthly Savings (Maintain)	292.143	290.113	2.030	0.304	1.028
Term of Loan	285.216	285.682	-0.465	0.454	-0.749
Note Rate	5.744	5.738	0.0062	0.258	1.131
Original Amount (in 1000$)	144.295	144.080	0.215	0.695	0.392
Original LTV	65.684	65.831	-0.146	0.235	-1.1867
Current LTV	47.742	47.685	0.057	0.774	0.2889
Unpaid Principal Balance (in 1000$)	98.714	98.847	-0.133	0.792	-0.264
Income (in 1000$)	79.109	79.010	0.099	0.687	0.404
Original FICO	729.298	729.558	-0.260	0.552	-0.595
Current FICO	738.514	738.361	0.153	0.759	0.307

Notes: Table test whether control and treatment groups differ in observable characteristics. Treatment group consists of any of the three gift card treatments groups (i.e. receiving 25$, 50$ or 100$) compared to the control group that didn't receive a gift card.

Table A5: Randomization Check - Agency Flier

	Mean Control (C)	Mean Treatment (T)	Mean C-T	p-value two-tailed	t-value
Interest Rate Decrease (Maintain)	2.484	2.489	-0.005	0.268	-1.108
Monthly Savings (Maintain)	267.099	267.771	-0.672	0.632	-0.478
Term of Loan?	307.364	307.436	-0.072	0.880	-0.151
Note Rate	5.817	5.822	-0.005	0.266	-1.111
Original Amount (in 1000$)	168.641	169.083	-0.442	0.400	-0.842
Original LTV?	68.328	68.302	0.026	0.797	0.257
Current LTV?	57.446	57.241	0.206	0.270	1.104
Unpaid Principal Balance (in 1000$)	127.867	128.153	-0.286	0.576	-0.560
Income (in 1000$)	80.215	80.127	0.088	0.669	0.428
Original FICO	724.406	724.572	-0.166	0.650	-0.454
Current FICO	730.157	730.368	-0.211	0.625	-0.489

Notes: Table test whether control and treatment groups differ in observable characteristics.

Table A6: Randomization Check - Express Guarantee

	Mean Control (C)	Mean Treatment (T)	Mean C-T	p-value two-tailed	t-value
Interest Rate Decrease (Maintain)	2.149	2.148	0.001	0.788	0.269
Monthly Savings (Maintain)	241.013	241.343	-0.330	0.861	-0.175
Term of Loan	295.010	295.860	-0.850	0.157	-1.414
Note Rate	5.788	5.791	-0.003	0.585	-0.546
Original Amount (in 1000$)	135.268	135.654	-0.386	0.406	-0.831
Original LTV	64.827	64.685	0.141	0.259	1.129
Current LTV	48.711	48.599	0.112	0.529	0.629
Unpaid Principal Balance (in 1000$)	93.599	93.901	-0.302	0.430	-0.789
Income (in 1000$)	75.812	75.753	0.059	0.812	0.238
Original FICO	730.968	730.365	0.603	0.178	1.348
Current FICO	740.834	740.381	0.453	0.363	0.910

Notes: Table test whether control and treatment groups differ in observable characteristics.

D Cumulative Prospect Theory and Refinancing

A critical assumption made in most normative models of refinancing is that borrowers are risk neutral (Agarwal et al. (2013b) acknowledge the limitations implied by this assumption). One may argue that the greatest uncertainty related to refinancing decisions relates to future interest rates, and in particular to what offers will be available in the future to a borrower who decides to forego a refinancing offer today. Therefore, risk averse borrowers should be more likely to accept a refinancing offer that is presented to them, rather than forego this offer and take the risk of not finding a similarly attractive or more attractive offer in the future. In addition to risk aversion, one may also allow borrowers to make decisions according to prospect theory (Tversky and Kahneman, 1992), rather than expected utility. Making predictions based on prospect theory requires assumptions on what the borrowers reference point is. One simple assumption is that the borrowers reference point is the current mortgage. In particular, one may argue that the monthly payments related to the current mortgage are not perceived as losses because they are expected (Novemsky and Kahneman, 2005), but rather that deviations from the regular payments may be perceived as gains or losses. We use a very simple and stylized model to illustrate the implications of this assumption.

For simplicity we consider a two-period model, in which refinancing may happen at $t = 1$ or $t = 2$. Suppose that at $t = 1$ the borrower receives a no-cost refinancing offer that would result in per-period savings of s_L over the periods $t = 1, 2$. Suppose that if the borrower rejects the offer, she will receive a more attractive offer in period $t = 2$ with probability p. The more attractive offer will result in per-period savings $s_H = \gamma s_L$ over period $t = 2$, with $\gamma > 1$. However, with probability $(1 - p)$ the borrower will not receive a refinancing offer in period $t = 2$ and therefore will not refinance. We assume a discount factor δ and a typical value function with curvature σ and probability weighing parameter α (Prelec, 1998). If the borrower accepts the refinancing offer, she will incur a gain of s_L over two periods, which will provide a total value of: $s_L^\sigma(1 + \delta)$. On the other hand, if the borrower does not accept the refinancing offer, she will incur a gain s_H in period $t = 2$ with probability p, and will remain with the status-quo with probability $1 - p$. This gives rise to a total value of: $exp[-(-lnp)^\alpha]s_H^\sigma(\delta)$.

Therefore, the borrower should accept the refinancing offer in period 1 if and only if:

$$(1 + \delta) > \gamma^\sigma exp[-(-lnp)^\alpha]\delta$$

This expression illustrates in a straightforward way the role of the risk aversion parameter σ and the probability weighing function parameter α. If the borrower is more risk averse (i.e., σ is smaller), the right-hand side is decreased (because $\gamma > 1$) and the borrower is more likely to refinance, all else equal. The role of the probability weighing parameter α depends on the sign of the derivate of $exp[-(-lnp)^\alpha]$ with respect to α. This derivative is positive if $p > \frac{1}{exp(1)}$ (which is close to 0.368) and negative otherwise.[13] Therefore as long as the probability that a better offer will be available in the future

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[13]The derivative is equal to $exp[-(-lnp)^\alpha](-lnp)^\alpha(-ln(-lnp))$. The first two terms are always positive.

is large enough, the right-hand side of the inequality is increasing in α. Under these conditions, as the borrower distorts probabilities more heavily (i.e, α is lower), the right-hand side is decreased, and the borrower is more likely to accept the offer at $t = 1$, all else equal. Therefore, as long as the probability of finding a better offer in the future is large enough, we should expect borrowers who discount probabilities more heavily to be more likely to accept refinancing offers. Intuitively, these borrowers underweigh the probability of receiving a more attractive offer in the future, making them behave as if this probability was lower than it actually is.

Interestingly, loss aversion does not appear in the above model. Indeed, if the reference point is the current mortgage, borrowers would only incur a loss if their mortgage payment increased. One way to allow loss aversion to enter the above model is to allow the borrower to have regrets. In particular, foregoing the current refinancing offer may imply losing the opportunity to save on monthly payments. To the extent that loss averse borrowers are more prone to regret, we should expect them to be more likely to refinance.

The last term is positive if $-lnp < 1$, i.e., $p > \frac{1}{exp(1)}$.

E   Survey Material

1. Introductory email message:

2. Survey questions

- Conscientiousness (9-scale Array from Extremely Inaccurate to Extremely Accurate)

- Organized
- Efficient
- Systematic
- Practical
- Disorganized
- Sloppy
- Inefficient
- Careless

- Financial literacy

  - 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."
  - Imagine that the interest rate on your saving account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy: 1 More than today with the money in this account, 2 Exactly the same as today with the money in this account, 3 Less than today with the money in this account, 4 Do not know
  - Normally, which asset described below displays the highest fluctuations over time? 1 Savings accounts, 2 Stocks, 3 Bonds, 4 Do not know
  - Do you think that the following statement is true or false? "If you were to invest $1,000 in a stock mutual fund, it would be possible to have less than $1,000 when you withdraw your money."
  - When an investor spreads his money among different assets, does the risk of losing a lot of money: 1 Increase, 2 Decrease, 3 Stay the same, 4 Do not know
  - Considering a long time period (for example 10 or 20 years), which asset described below normally gives the highest return? 1 Savings accounts, 2 Stocks, 3 Bonds, 4 Do not know
  - 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."
  - 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?

- Trust

  - Generally speaking, would you say that most people can be trusted or that you have to be very careful in dealing with people?
  - How much do you trust the followings? Other people
  - How much do you trust the followings? Bankers
  - How much do you trust the followings? Banks
  - How much do you trust the followings? Large corporations in general

- The following questions are about your relationship with your mortgage lender or your primary financial institution. Which of the following financial institutions is your mortgage lender (or your primary financial institution if you dont have a mortgage)?

  - How satisfied are you with your mortgage lender/primary financial institution on the following scale?
  - How fair do you think your mortgage payments are on the following scale?
  - When you took out your mortgage, how favorable to you were the terms offered by the lender?
  - How often did you feel that your financial institution (mortgage lender, if you have a mortgage) has offered you or tried to offer you terms or services that were unfavorable to you but favorable to them?
  - How likely is it that your mortgage lender will help you out if you are having difficulty making a mortgage payment?

- Are you a homeowner? (If no, the rest of the home value questions are not shown)

  - Currently, what is the market value of your house, i.e. what is your best estimation for how much you could sell your house now?

- How confident are you of your assessment on a 7-point scale?
- Over the next 12 months, how do you expect the value of your house to change?
- By what percent do you expect the value to go up?
- By what percent do you expect the value to go down?
- How confident are you of your predictions on a 7-point scale?
- Over the next 12 months, how do you expect the value of all houses in your zip-code to change on average?
- By what percent do you expect the value to go up?
- By what percent do you expect the value to go down?
- How confident are you of your predictions on a 7-point scale?

- Do you have a mortgage on your primary residence? (if no, the rest of the mortgage questions are not shown)

  - Currently, what is your monthly mortgage payment on your primary residence?
  - How confident are you of your assessment on a 7-point scale?
  - Currently, what is the current interest rate on your mortgage?
  - How confident are you of your assessment on a 7-point scale?
  - Over the next 6 months, how do you expect interest rates on mortgages to change?
  - By what percent do you expect the rate to go up?
  - By what percent do you expect the rate to go down?
  - How confident are you of your prediction on a 7-point scale?

- Motives of Financial Institutions (5-Scale Array). Below are four statements about the motives of financial institutions to offer refinance opportunities and the costs of refinancing. As a reference point, please think about the financial institution from which you have your mortgage. Please indicate whether you agree of disagree the following statements:

  - My financial institution will only offer me an option to refinance my mortgage if it is in my best interest to do so.whether you agree of disagree the following statements.¡/span¿¡/u¿
  - There has to be 'a catch' if my financial institution would offer me a lower interest rate.
  - Refinacing a mortgage (if the rate is lower than current interest rate) has hidden costs.
  - A significant amount of paperwork is involved in refinancing a mortgage with my financial institution.

- Refinancing

  - Would you refinance your mortgage if there were no closing costs, no appraisal necessary, and your monthly payment was reduced by $50?
  - Then, would you refinance your mortgage if there were no closing costs, no appraisal necessary, and your monthly payment was reduced by $100?
  - Then, would you refinance your mortgage if there were no closing costs, no appraisal necessary, and your monthly payment was reduced by $200?
  - Then, would you refinance your mortgage if there were no closing costs, no appraisal necessary, and your monthly payment was reduced by $500?
  - Have you gotten an offer to refinance your mortgage from your financial institution in the last 12 months?
  - Did you accept the offer?
  - Why not? Please explain.

- What is the probability that you will move in the next 12 months?

- Are you or your partner earning retirement, social security or annuity income?

- Do you have a mortgage on any property that is held in trust or that is a leasehold property or a co-op hotel, condotel, or manufactured home (mobile or modular)?

- Do you have a mortgage on any property for which there has been a change in title since it was purchased?

- Do you have a second mortgage on any of the properties that you own? This could be a Home Equity or Home Equity Line of Credit.

- If yes, who is the holder of this second lien?

- Which of the following financial institutions is your second mortgage lender?

- Which of the following financial institutions is your second mortgage lender? Other

- Have you heard of the Home Affordable Refinance Program (HARP)?

- The HARP program is a government sponsored program to reduce mortgage rates or payments for loans guaranteed or owned by Fannie Mae or Freddie Mac. This includes borrowers who own more on their mortgage than their homes are worth, but have consistently been paying their mortgage. The goal of the program is to lower monthly mortgage payments at no or limited cost to customers. Do you think you would be eligible for such program?

- Why not? Please explain.

- Numeracy:

  - 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?
  - 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?
  - If the chance of getting a disease is 20 out of 100, this would be the same as having a [blank]% chance of getting the disease.
  - 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?
  - If the chance of getting a disease is 10%, how many people would be expected to get the disease out of 1,000?
  - If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
  - A bat and ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?
  - 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?

- Socio-Demographics:

  - How many people, including yourself, primarily contribute to your household income?
  - What was your household income, before taxes, last year?
  - Is this income unusually high or low compared to what you would expect in a normal year, or is it normal?
  - How much has your family income been fluctuating over the years? Please select the answer below that best fits your situation.
  - What is your gender?
  - In what year were you born? (i.e. 1955)
  - What is your marital status?
  - What is the highest degree or level of school you have completed? If currently enrolled, mark the previous grade or highest degree received.
  - Is your partner currently employed?
  - In what industry are you currently employed? If not currently employed, mark the most recent industry in which you were employed.
  - How many children do you have?
  - Please specify your ethnicity. Asian, Black/African descent, Caucasian/White, East Indian, Latino/Hispanic, Middle Eastern, Native American, Pacific Islander, Other
  - What is your political affiliation?
  - Is English your first language?