

Effects of Post-Purchase Monitoring on Mortgage Delinquency and Financial-Well Being: Evidence from a Randomized Field Study

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Abstract

The purchase of a first home is not a one-time financial decision, but represents the starting point of a series of new decisions that require managing current consumption (e.g., mortgage payments, home improvements) while planning for unexpected expenses or shocks (e.g., home repairs, loss of income, increase in property taxes). Mistakes made are costly; missed mortgage payments can place the consumer at risk of mortgage default, with profound negative impacts for the consumer, the housing market and the economy at large. Through a randomized field experiment with 574 first time homebuyers, we test the impact of post purchase monitoring on mortgage delinquency. Prior to home purchase, all participants in our study complete an online module designed to aid in goal setting and implementation intentions. Those assigned to the treatment group who purchase a home (N=295) also receive offers for free ‘telephone financial coaching’ at quarterly intervals after purchase. We find that those offered financial coaching (intent to treat) exhibit significantly different financial outcomes, including lower rates of mortgage delinquency within the first year after home purchase. Effects are stronger for borrowers with lower credit scores (below 680). Estimates seem to hold up to a variety of identification tests. Coaching appears to serve as an external reminder or accountability mechanism. We extend this reasoning beyond savings to debt repayment. From a policy perspective, these results are promising in that relatively low-cost processes may increase adherence to timely mortgage payments, thereby reducing the probability of default and possible costs for taxpayers.¹

Keywords: Mortgage Foreclosure; RCT

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I. INTRODUCTION

The recent housing crisis calls into question the long-term sustainability of mortgages to lower income, highly leveraged borrowers. Mistakes made are costly; missed mortgage payments can place the homeowner at risk of mortgage default, with profound negative impacts for the consumer, the housing market and the economy at large. Regulatory changes, such as those included under the Dodd-Frank Wall Street Reform and Consumer Protection Act, seek to limit risky mortgage characteristics that have been associated with higher rates of default. However, there is concern that low and moderate income (LMI) households may be disproportionately disadvantaged by such policy changes Quercia et al. (2012). Identifying effective strategies to offset the higher default risk of mortgages to LMI homebuyers becomes a critical, yet challenging, objective.

Several factors increase the default risk of LMI borrowers. Lower incomes and greater financial instability may increase the impact of unexpected expenses (e.g. home repairs, increase in property taxes) or financial shocks (e.g. loss of income, medical problems). Lack of residual savings reduces the cushion available, while financial wealth accumulated through home equity is illiquid for several years after purchase due to high leverage at the time of closing. Further, establishing a habit of monthly mortgage payments may be difficult for first time homebuyers, many of whom may have limited experience with debt repayment, particularly for a transaction as large as a home purchase. New borrowers may fail to make timely mortgage payments because of common behavioral biases, including myopic decision frames, procrastination, and/or difficulties with self-regulation.

Despite the risk factors associated with LMI borrowers, certain affordable lending strategies have been associated with lower incidence of default Ding et al. (2011); Stegman et al. (2007). However, empirical studies to date fail to adequately deal with issues of selection bias due to lack of a valid control group. This limitation can be applied to financial counseling and education more broadly; most studies use non-random comparison groups with statistical tests to correct for potential bias Collins and ORourke (2010). It is expected that consumers who seek out homebuyer education and counseling may be more motivated than consumers not seeking services, and may be more future oriented Meier and Sprenger (2010, 2012). Even with statistical corrections for self-selection, it is difficult to determine the true impact of the interventions on mortgage outcomes. Further, identifying the precise

mechanism(s) responsible for reduced default risk is imperative to efficient replication. It is difficult to unpack the bundle of services provided with previous interventions and the relative impact of different components on mortgage outcomes. For example, programs may include pre-purchase education or counseling, mortgage payment or downpayment assistance subsidies, post-purchase support, and/or preventative servicing strategies Moulton (2012). Each of these treatments may also vary in scope and intensity, with some being very high touch and costly to provide.

This study reports on the results of a randomized field experiment of a post purchase monitoring intervention for LMI homebuyers. From June through December of 2011, 574 first time homebuyers purchasing homes through Ohio Housing Finance Agency's First Time Homebuyer Program were randomly assigned to treatment and control groups. Prior to home purchase, all participants completed an online module designed to aid in goal setting and implementation intentions. Those assigned to the treatment group who purchased a home during the study period (N=293) received offers for free 'telephone financial coaching' at quarterly intervals after purchase. The coaching interventions were designed to: (1) refine client-directed financial goals; (2) break down goals into actionable steps; and (3) monitor progress towards goals, with the coach serving as an external check on progress. Of the 293 assigned to the treatment group, 107 (37 percent) took up the offer. All treatment group participants continued to receive offers for coaching by phone, email and letter throughout the study period, potentially serving as an external reminder, regardless of take-up.

Participants assigned to the treatment group, regardless of take-up, exhibit significantly better financial outcomes, including lower rates of mortgage delinquency within the first 15-22 months after home purchase. This compliments previous research that finds that the act of surveying about certain financial behaviors may in fact increase the salience of the behavior and thus affect outcomes Stango and Zinman (2011); Zwane et al. (2011). Effects are stronger for borrowers with lower credit scores (below 680), who may have less established histories of timely debt repayment. Estimates seem to hold up to a variety of identification tests. Self-aware individuals (sophisticates) may demand more from external monitoring as they may have lower capacity for self-regulation Karlan et al. (2010).

The findings from this analysis build on a growing body of experimental studies evaluating the impact of targeted interventions on financial behaviors. With regard to savings, Duflo et al. 2003 find positive effects of simple incentives provided at the time of tax preparation. Similarly, Mills et al. 2008 find positive impact on savings and purchase behaviors for

participants enrolled in a matched savings individual development account (IDA) program. More directly related to debt repayment, Gartner and Todd (2005) reported on a randomized experiment providing on-line credit card education for delinquent borrowers; however, lack of take-up reduced the ability to detect measureable effects. Recent work by Collins 2012 evaluating mandatory financial education for subsidized housing residents finds evidence of an increase in self-reported financial behaviors, but not administrative indicators of savings or debt.

This analysis is based on a unique field study of a financial assessment and monitoring program designed for low and moderate income homebuyers purchasing homes through the Ohio Housing Finance Agency's First Time Homebuyer Program. This section describes the design of the monitoring program and the structure of the randomized experiment.

A. Design of Financial Assessment and Monitoring Program

The financial assessment and monitoring program evaluated in this study (named 'MyMoneyPath') was designed in conjunction with the Ohio Housing Finance Agency's (OHFA) First Time Homebuyer Program. Like most state Housing Finance Agencies (HFAs), Ohio's program provides reduced and at market interest rate mortgages to first time homebuyers with incomes below 115 percent of area median, subsidized in part through the sale of tax-exempt Mortgage Revenue Bonds (MRBs). On average, 100,000 LMI homebuyers purchase homes using state MRB programs every year, providing a potentially scalable opportunity for replicable interventions targeting this population Baumgartner and Pieters (2008); Collins and O'Rourke (2012); Baumeister et al. (2008). OHFA's program is one of the largest in the nation in terms of the number of homebuyers, funding mortgages for an average of 3,000 homebuyers per year over the last three years of State Housing Agencies (2011).

OHFA's program provides the ideal setting to isolate the effectiveness of targeted interventions. Because of the subsidized mortgage product, interest rates and loan terms are held constant across homebuyers at any given point in time. Further, while there are multiple lenders originating OHFA loans, all loans are sold to the same Master Servicer within 60 days of closing, holding constant variation in loan performance that may be due to more or less aggressive servicing. Importantly, as the owner of the mortgage, OHFA collects ongoing data on borrower loan performance, as well as credit histories that may be indicative of financial well-being. Finally, OHFA currently requires all homebuyers receiving downpayment assistance to complete its 'OHFA's Streamlined Homebuyer Education Program' prior to loan closing, allowing for easy

integration of the financial assessment and monitoring program developed for this study.

The MyMoneyPath program was designed as a low-touch, replicable, technology based intervention that would reduce mortgage delinquency through behaviorally targeted interventions. Specifically, the interventions consisted of three parts: (1) an online financial health assessment completed immediately prior to home closing; (2) an online financial planning module that allows participants to set self-identified financial goals and implementation intentions; and (3) telephone financial monitoring (coaching) offered at quarterly intervals for the first year after home purchase. While all study participants received the online financial health check-up, two-thirds of the participants were also assigned to receive the online financial planning module and telephone based monitoring after purchase. We focus primarily on the first year after home purchase, as borrowers often deplete savings in a build-up to home purchase and incur additional debt immediately after purchase.

The online financial health assessment collected self-report information from participants about their financial behaviors in five areas (budgeting, borrowing, savings, home and retirement), as well as basic demographic and socio-economic information. Questions targeted behaviors, such as having adequate emergency savings, managing personal debt, and investing in longer term financial goals, thought to be associated with the long term well-being of the new homeowner. After completion of the assessment, participants viewed a concise results sheet reporting the status of their financial health in each of the five areas, coded red if the area was in need of immediate attention, yellow if the area needed some attention, and green if the area was not in need of attention. The content of the financial health assessment and coding for the indicators was developed through interviews with industry experts in conjunction with the National Foundation for Credit Counseling (NFCC). Study participants received a \$25 gift card incentive at the completion of the online health assessment.

After completing the financial health assessment, those assigned to the treatment group were guided through an online, interactive financial planning module. For each of the five areas above, the online module guided participants through a review of their current health, allowed them to visualize how changes in certain financial variables (e.g., amount saved each month) would affect future time periods, and then were guided to identify specific goals and set implementation intentions for the next year. Several studies have shown that establishing specific implementation intentions can improve the likelihood of goal attainment, establishing links between specific situations and the desired behavioral responses Brandstatter et al. (2001);

Gollwitzer (1999, 1993); Gollwitzer and Brandstätter (1997).

Finally, participants assigned to the treatment group were provided with telephone financial monitoring (coaching), offered at quarterly intervals for the first year after home purchase. The coaching interventions were designed to: (1) refine client-directed financial goals; (2) break down goals into actionable steps; and (3) monitor progress towards goals, with the coach serving as an external check on progress. Previous research suggests that external monitoring can prove more effective than self-monitoring in terms of clients adherence to their goals Ariely and Wertenbroch (2002), as it increases the salience of accountability on four dimensions: expectation of being observed; identifiability; expectation that performance will be assessed, and expectation that one will have to give reasons for actions Lerner and Tetlock (1999). Further, external monitoring can lead to increased self-control, or the degree to which people can restrain impulses.

The application of external monitoring to financial behaviors is relatively new; however, preliminary evidence suggests that a model of external modeling, such as financial coaching, may lead to sustained behavioral change and thus goal-attainment Baumgartner and Pieters (2008); Collins and O'Rourke (2012); Baumeister et al. (2008). Coaching approaches illustrate how positive psychology is being applied to behavior such as financial decisions by increasing self-efficacy and self-control through accountability Baumeister (2002); Baumeister et al. (2008). In addition to monitoring, goal directed reminders have been associated with increased savings Karlan et al. (2010); Kast et al. (2012). Our study is the first known evaluation of monitoring applied to debt repayment, and specifically mortgage debt repayment.

B. Recruitment, Assignment, and Data Collection

Study enrollment occurred during the seven month period between June 1, and December 31, 2011. During the study period, all prospective homebuyers seeking mortgages through the Ohio Housing Finance Agency's homebuyer program completed the online assessment financial health assessment prior to home purchase. Upon completion of the assessment, prospective homebuyers were invited to participate in a study following an IRB approved protocol. Homebuyers who agreed to participate received a \$25 gift card via e-mail. Figure one provides a flow-diagram of the enrollment process. Of the 932 homebuyers completing the assessment, approximately two-thirds (574, or 62%) consented to participate in the study, about two-thirds of whom were randomly assigned to the treatment group. At the conclusion of the initial data collection period (June 30, 2012), 488 (85%) of the consenting

participants purchased a home, for whom 424 had complete credit-report and mortgage-origination data.² Of the 424 participating homebuyers, 295 had been randomly assigned to the treatment group and were offered telephone financial coaching at quarterly intervals after home purchase, commencing within two months of their purchase date and culminating in the anniversary month of their purchase. Of the 295 assigned to the treatment group, 107 (36%) took up at least one offer for financial coaching. An additional \$25 gift card was provided as an incentive for the first coaching session completed. All treatment group participants continued to receive offers for coaching by phone, email and letter throughout the study period, potentially serving as an external reminder, regardless of take-up.

II. DATA

A. Baseline Characteristics

The data for this study was collected from several different sources. Data on participant demographics and verified income was provided by the Ohio Housing Finance Agency at the time of home closing. Credit report data was provided by the Master Servicer for closed loans within 60-90 days of home closing, and one the one year anniversary of the initial credit report date, on or before March 15, 2013, whichever came first.³ Data on mortgage loan attributes and performance was provided at the time of closing and monthly thereafter by the Agency (through the Master Servicer). Finally, data on self-reported financial health was collected through the online financial health assessment completed prior to home closing, and on the one year anniversary of prior completion (on or before December 31, 2012). Participants were contacted by email and telephone to complete the one-year follow-up financial health assessment; of the 488 contacted, 225 completed the follow-up assessment, for a response rate of 46 percent. An incentive of a \$25 gift card was provided to all participants completing the follow-up assessment.

Table 1 presents summary statistics of baseline and follow-up characteristics for study borrowers, while Table 2 presents summary statistics for study borrowers with credit scores below 680 (n=272). Borrowers with credit scores below 680 are commonly considered subprime and may be more (or less) responsive to study

²Initial data at the time of purchase was not collected for 64 homebuyers at the time of purchase due to a glitch in OHFAs data collection procedures; while the 64 homebuyers completed the online assessment and were randomly assigned to the control or treatment group, they were not offered telephone financial coaching after purchase.

³The follow-up credit report data was collected 12 months after the initial credit report date for 96.5 percent of participants; however, because of constraints from the funder, data on the remaining 3.5 percent was collected 10 to 11 months after the initial report date, on March 15, 2013.

interventions than higher credit score borrowers. The average age of the primary borrower was 34 years, with a gross monthly household income of \$3,772, or about \$46,000 per year. About half (48%) of primary borrowers were female, with an average household size of 2.6. About one in five primary borrowers were either African-American or Hispanic, and about one in four had completed a college degree. From the credit report data, the average credit report score at the time of purchase was 668, with about 20% of borrowers ever late on any trade line in the past 24 months, and a non-housing debt to income ratio of about 15% (minimum monthly revolving and installment debt payments as a percent of monthly income, excluding the mortgage payment). From the self-reported data, the total amount of money in savings and checking accounts at the time of purchase is about \$3,000. Further, 8 percent of respondents reported that they would rather get \$40 now than \$60 in a month (a measure of future discounting).

Differences between treatment and control group borrowers at baseline are compared to test for the consistency of the random assignment. Overall, any differences in baseline characteristics are not significant, suggesting that the randomization process was effective.

B. Mortgage Default and Financial Health

The primary outcome of interest in this analysis is mortgage default. Here we define mortgage default to be equivalent to serious mortgage delinquency, given the short duration of time since purchase. Mortgage default is coded 1 if the borrower was ever 60 or more days late on their mortgage payment as of February 28, 2013, and 0 otherwise. It is important to note that as of February 28, 2013, the amount of time elapsed since closing was an average of 510 days, or 17 months. While the primary outcome of interest is mortgage default, a few other measures of financial health are explored. Measures such as reductions in revolving or installment debt balances, increases in savings, or automated (rather than manual) mortgage payments may help explain the mechanisms by which financial monitoring reduces default risk.

III. METHODS

Because of the randomized study design, comparisons of means between treatment and control group participants is the primary specification. However, additional covariates commonly associated with the outcomes (described above) are also included to ensure consistency in our results.

First, we employ the following equation to estimate average treatment effects for outcome Y for borrower, i :

$$Y_i = \alpha_0 + \beta_1 Treatment_i + \epsilon_i \quad (1)$$

where Y_i is alternately the borrower defaulting on the loan (missing 2 or more payments), credit score, installment debt levels, savings levels and use of automatic payments. Because the treatment was randomly assigned, β_1 provides a causal estimate of the effects of the program on client, i . ϵ_i is a HuberWhite corrected standard error to produce heteroscedasticity-consistent estimates.

A second equation includes a vector of controls in the off-chance that assignment was unbalanced based on observable characteristics of study participants (particularly since consent and attrition may not be random). This specification includes \mathbf{X}_i which includes credit score at loan application (the median score collected) which is presented by 5 categorical variables to deal with the non-linear form of credit score measures. The borrower's prior 24 months count of any delinquencies on any payments as measured in the credit report is also included, as is income (measured at loan application) debt-to-income ratio, reported savings and number of days since the borrower took out the mortgage. Other characteristics include gender, age, college education, minority race and household size. Also included is a measure of time preferences commonly used in surveys, which asks for a choice between \$40 today versus \$60 in a month. This reduced form model also produces average treatment effects conditional on measured characteristics:

$$Y_i = \alpha_0 + \beta_1 Treatment_i + \lambda \mathbf{X}_i + \epsilon_i \quad (2)$$

Dichotomous outcomes are estimated using a probit model with exponentiated coefficients. Continuous outcomes are estimated using an OLS model including a control for baseline levels, in effect providing an average change in the outcome associated with treatment assignment. Because we expect the effects of treatment to be stronger for lower-credit quality (greater default risk) we also restrict the sample to approximately 272 (out of 425 total) borrowers with credit scores below 680, a common cutoff for subprime credit quality.

Average treatment effects for all borrowers assigned to treatment, regardless of whether the study participant cooperated with the treatment, is useful as an estimate of overall effects for a pool of loans without the bias introduced from borrowers self-selecting into a program. This is also known as intent to treat (ITT). But since the program is not mandatory and some borrowers will not cooperate, the effect of treatment on the treated (TOT) may also be of interest. But because borrowers who cooperated may signal other characteristics correlated with outcomes, a simple indicator

for ‘participant’ would not provide unbiased estimates. Instead we use assignment to treatment (ITT) as a predictor for take-up of the treatment (TOT) using a two-stage least squares instrumental variable approach. All IV estimates use a limited information maximum likelihood (LIML) estimator, since this is generally more efficient and consistent than 2SLS for smaller sample sizes.

IV. RESULTS

Tables 1 and 2, as well as Figures 2-9 provide comparisons of means on the key outcomes of interest. For the total sample (Table 1), 10 percent of borrowers had experienced default, with slightly lower rates for treatment group participants (Figure 2). However, when the sample is limited to borrowers with credit scores below 680 (Table 2), the differences between treatment and control group participants are statistically significant, with 12.5 percent of treatment group participants experiencing mortgage default, compared with 23.6 percent of control group participants (Figure 3). These differences exist without accounting for the take-up of treatment; all participants assigned to treatment are included for comparison (intent to treat).

Aside from differences in mortgage default, other differences in financial health are explored. First, in terms of credit score changes, Figure 4 plots the distribution of credit scores by category (1= >620 ; 2=620-650; 3=650-680; 4=680-720; and 5= <720). While there appears to be an increase in borrowers with low credit scores (<620) on the follow-up credit-report, there do not appear to be systematic differences in credit scores for treatment and control group borrowers. Digging deeper into credit report data, borrowers assigned to the treatment group have slightly lower installment debt balances on their follow-up credit reports (Figure 5), and significantly lower revolving debt balances on their follow-up credit reports (\$4,239 compared with \$5,729). Further, the proportion of borrowers who have an increase in revolving debt of \$2,000 or more is significantly higher for treatment group participants (36% compared with 25%, Figure 6).

Indicators from the follow-up financial health assessment demonstrate that treatment group participants report significantly higher amounts in their checking and savings accounts; \$3,094 compared with \$2,182 for control group participants. A higher proportion also report that they are saving any money at the time of follow-up (Figure 8). It is important to note that the amount saved for control group participants is also substantially lower than the baseline amount reported of about \$3,000. This reduction in savings appears to have been buffered for treatment group participants. Finally, treatment group participants are significantly less likely to report making manual mortgage payments

on the follow-up assessment (Figure 7), suggesting that they may be utilizing automated payments as a mechanism to reduce their likelihood of mortgage delinquency.

Overall these comparisons show that treatment is associated with lower default, but primarily among low credit score borrowers. The mechanism that may have produced lowered default is the use of automatic payment of mortgage payments. Borrowers assigned to treatment also report saving more and appear to accumulate slightly less installment debt. There does not appear to be much effect on credit scores.

Table 3 begins the average treatment effect estimates for default, displaying exponentiated coefficients. Column 1 shows overall estimates of lower default among those borrowers assigned to treatment, although not at standard levels of significance. Restricting the sample to borrowers with credit scores under 680 in Column 2 produces larger estimates of the effect of treatment on default, and now at the 5% statistical significance level. Adding controls in Columns 3-4 provides consistent estimates.

Table 4 provides OLS estimates of changes in indicators of financial health from credit report data, including credit scores, installment debt, and revolving debt. While the comparison of means found significant differences for revolving debt balances, in the empirical specification, none are significant at standard levels. This may be due to the lumpy nature of account balances, particularly for revolving accounts. In Table 5, we provide probit results for a non-linear indicator of revolving (1) and installment (2) account balances that have increased by \$2,000 or more. Here, we see that treatment group borrowers are significantly less likely to have an increase in revolving debt of \$2,000 or more. There is no significant effect of the treatment on installment debt balances.

Finally, we explore some of the self-reported outcomes from the follow-up financial health assessment (Table 5, Columns 3, 4 and 5). Here, borrowers in the treatment group are significantly more likely to report saving money at follow-up, and are significantly less likely to report making manual mortgage payments (instead, enrolling in automated mortgage payments). Of note, there are no significant differences between treatment and control group participants on reported use of a household budget.

Table 6 estimates Treatment On Treated (TOT) for default using random assignment as an IV. Like in Table 3, effects are only significant for low credit score borrowers. Likewise for the estimates in Table 7. These results are re-assuring as robustness checks.

V. DISCUSSION & CONCLUSIONS

The results presented here provide promising evidence that simple interventions can have significant

impact on reducing the default risk of LMI borrowers. In particular, the offer of financial coaching (monitoring) after home purchase is associated with reduced mortgage default, particularly for borrowers with lower credit scores (below 680). This is salient given that these borrowers are most likely to be negatively impacted by tightened underwriting requirements and regulatory reforms post the housing crisis. To the extent that simple interventions, such as post-purchase monitoring, can be integrated into the mortgage structures for LMI households, default risk may be reduced to levels comparable to higher credit score borrowers.

We further explore changes in other financial outcomes within the first year of home purchase that may help explain the reduced default rates for those being monitored. We find some evidence that monitored borrowers have lower revolving debt, although this is lumpy; they are less likely to incur a significant amount (\$2,000 or more) of additional credit card debt within the first year after purchase. This is potentially important, as previous research suggests that credit card balances tend to increase within the first few years after home purchase. To the extent that monitoring might help mediate this increase, borrowers may be less constrained by non-mortgage debt.

Further, we find some evidence that borrowers receiving monitoring have higher savings amounts one year after purchase than control group borrowers. Overall, the amount of self-reported savings declines within the first year after purchase, in line with previous research. However, borrowers receiving monitoring are significantly likely to self-report saving money, and have higher savings balances (although this is not economically significant when controlling for savings amounts at baseline in the empirical specification). Contrary to the wisdom of financial planning, we do not find evidence that borrowers with monitoring are more likely to report using a budget. However, borrowers with monitoring are significantly more likely to automate their mortgage payments rather than pay manually, suggesting that monitoring may encourage borrowers to take advantage of programmed mechanisms to reduce default risk (like automated payments).

The positive effects of monitoring are found for the entire treatment group, not only those who took up the offer of financial coaching. This suggests one of two possible alternatives. First, simply being contacted with an offer of coaching may serve as a reminder or check on behavior that effectively reduces default risk. If it is simply the reminder, other mechanisms such as text messages or automated phone calls may also be effective at reducing default risk. However, if it is the sense of being monitored, contact from a real person may be necessary to affect behavior. Second, it could be that of those offered financial coaching, those with greater need self-sort into coaching. Thus, the average

treatment effect for all assigned to treatment improves by reducing the default of those at greatest risk. To the extent that self-sorting is effective, efficiency may be increased by offering services rather than requiring them for all participants.

It is important to caution that our sample is drawn from a select group of LMI homebuyers participating in a state HFA homeownership program. It is difficult to predict whether or not the results would hold up in a less structured program. Nonetheless, Ohio's program relies on private lenders to originate mortgages that are in line with conforming or FHA guidelines (all are guaranteed), services mortgages through a private lender, and funds mortgages through mortgage backed securities (MBS) in the secondary market. Thus, many of the characteristics of mainline originations are still in place, increasing the potential generalizability of the findings outside of the HFA context.

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VI. TABLES AND FIGURES

TABLE I: Summary- All

	(1)		
	Control mean/sd	Treatment mean/sd	Total mean/sd
Treatment	0 (0)	1 (0)	0.694 (0.461)
IV: TOT	0 (0)	0.359 (0.481)	0.249 (0.433)
CR lt 620	0.162 (0.369)	0.132 (0.339)	0.141 (0.349)
CR 620-650	0.215 (0.413)	0.275 (0.447)	0.256 (0.437)
CR 650-680	0.185 (0.389)	0.275 (0.447)	0.247 (0.432)
CR 680-720	0.223 (0.418)	0.159 (0.367)	0.179 (0.384)
Ever late any tradeline 24 mo	0.208 (0.407)	0.217 (0.413)	0.214 (0.411)
OHFA mntly inc at purchase (000)	38.56 (12.08)	37.32 (12.31)	37.70 (12.24)
DTI ratio non-housing debt at purchase	0.145 (0.142)	0.144 (0.245)	0.144 (0.219)
Female	0.446 (0.499)	0.471 (0.500)	0.464 (0.499)
Age	33.31 (10.64)	32.36 (9.898)	32.65 (10.13)
College	0.364 (0.483)	0.353 (0.479)	0.356 (0.479)
Minority	0.115 (0.321)	0.153 (0.360)	0.141 (0.349)
HH Size	2.419 (1.297)	2.431 (1.286)	2.427 (1.288)
Days since home purchase	506.7 (65.49)	515.4 (62.15)	512.8 (63.24)
Total savings	3010.2 (3297.5)	3239.1 (3340.0)	3169.5 (3324.9)
Wants 40 now (vs 60 in 1 month)	0.0620 (0.242)	0.0949 (0.294)	0.0849 (0.279)
Default	0.131 (0.338)	0.0949 (0.294)	0.106 (0.308)
Default, lt680	0.236 (0.428)	0.125 (0.332)	0.154 (0.362)
Credit post	646.9 (81.17)	644.1 (79.33)	645.0 (79.81)
Installment debt-post	30010.6 (30547.6)	28000.8 (26426.3)	28612.3 (27723.8)
Total Revolving Debt	5756 (5915.5)	4238.9 (4660.9)	4700.5 (5116.3)
Amt chk/sav	2182.1 (3250.1)	3094.2 (4949.2)	2810.5 (4502.6)
SR saving-post	0.536 (0.502)	0.708 (0.456)	0.655 (0.477)
Manual pay-post	0.870 (0.339)	0.721 (0.450)	0.767 (0.424)
Rev bal up 2k+	0.364 (0.483)	0.251 (0.434)	0.285 (0.452)
Observations	425		

Source: MMP Data

TABLE II: Summary - Low Credit score

	(1)		
	Control mean/sd	Treatment mean/sd	Total mean/sd
Treatment	0 (0)	1 (0)	0.735 (0.442)
IV: TOT	0 (0)	0.355 (0.480)	0.261 (0.440)
CR lt 620	0.292 (0.458)	0.195 (0.397)	0.221 (0.415)
CR 620-650	0.389 (0.491)	0.405 (0.492)	0.401 (0.491)
CR 650-680	0.319 (0.470)	0.400 (0.491)	0.379 (0.486)
CR 680-720	0 (0)	0 (0)	0 (0)
Ever late any tradeline 24 mo	0.333 (0.475)	0.290 (0.455)	0.301 (0.460)
OHFA mntly inc at purchase (000)	38.27 (12.58)	37.52 (12.52)	37.72 (12.51)
DTI ratio non-housing debt at purchase	0.133 (0.0858)	0.149 (0.289)	0.145 (0.252)
Female	0.500 (0.504)	0.470 (0.500)	0.478 (0.500)
Age	34.97 (10.41)	33.73 (10.34)	34.06 (10.35)
College	0.169 (0.377)	0.270 (0.445)	0.244 (0.430)
Minority	0.181 (0.387)	0.195 (0.397)	0.191 (0.394)
HH Size	2.746 (1.381)	2.605 (1.378)	2.642 (1.377)
Days since home purchase	500.9 (69.33)	513.9 (60.54)	510.4 (63.12)
Total savings	2579.7 (2632.1)	2822.3 (2840.4)	2758.7 (2784.6)
Wants 40 now (vs 60 in 1 month)	0.0563 (0.232)	0.0950 (0.294)	0.0849 (0.279)
Default	0.236 (0.428)	0.125 (0.332)	0.154 (0.362)
Default, lt680	0.236 (0.428)	0.125 (0.332)	0.154 (0.362)
Credit post	600.8 (72.54)	614.6 (69.52)	610.9 (70.47)
Installment debt-post	24908.5 (29328.9)	28149.8 (26759.7)	27291.8 (27445.3)
Total Revolving Debt	5836.5 (6704.4)	3843.7 (4180.7)	4371.2 (5038.5)
Amt chk/sav	1879.7 (4241.2)	2366.0 (3404.6)	2236.6 (3634.3)
SR saving-post	0.485 (0.508)	0.681 (0.469)	0.629 (0.485)
Manual pay-post	0.909 (0.292)	0.725 (0.449)	0.774 (0.420)
Rev bal up 2k+	0.306 (0.464)	0.220 (0.415)	0.243 (0.429)
Observations	272		

Source: MMP Data (FICO lt 680)

TABLE III: Effects of Treatment on Default Probit Intent to Treat (ITT) by Credit Score Level at Study Start

	(1) Default b/se	(2) Default, lt680 b/se	(3) Default b/se	(4) Default, lt680 b/se
Treatment	0.8284 (0.143)	0.6495** (0.129)	0.7655 (0.150)	0.6545** (0.138)
Controls	No	No	Yes	Yes
N	425	272	423	271
r2_p	0.004	0.020	0.191	0.117
chi2	1.196	4.721	1440.583	28.294
p	0.274	0.030	0.000	0.013

Exponentiated coefficients

Probit. Controls include baseline credit score, delinquent on trades, income, gender, debt to income, age, education, race, time in home, savings, time preferences.

* $p < .1$, ** $p < .05$, *** $p < .01$

TABLE IV: No Effects of Treatment on Credit Score and Installment Debt: OLS Intent to Treat (ITT)

	(1) Credit post b/se	(2) Ln Inst post b/se	(3) Ln Revlv post b/se	(4) Credit post b/se	(5) Ln Inst post b/se	(6) Ln Revlv post b/se
Treatment	4.9448 (6.002)	0.1831 (0.254)	-0.1844 (0.175)	10.2085 (8.900)	0.4015 (0.308)	-0.1104 (0.211)
N	424	424	424	274	274	274
r2	0.459	0.305	0.441	0.175	0.298	0.467
p	0.000	0.000	0.000	0.000	0.000	0.000

OLS.

* $p < .1$, ** $p < .05$, *** $p < .01$

TABLE V: Effects of Treatment on Self Reported Savings and Non-use of Automatic Payments Probit Intent to Treat (ITT)

	(1) Rev bal up 2k+ b/se	(2) Inst bal up 2k+ b/se	(3) SR saving-post b/se	(4) Manual pay-post b/se	(5) Use Budget b/se
Treatment	0.7226** (0.100)	1.0273 (0.137)	1.5778** (0.292)	0.5832** (0.128)	1.0684 (0.204)
N	424	424	223	223	225
r2_p	0.011	0.000	0.021	0.026	0.000
chi2	5.542	0.041	6.050	6.014	0.120
p	0.019	0.841	0.014	0.014	0.729

Exponentiated coefficients

* $p < .1$, ** $p < .05$, *** $p < .01$

TABLE VI: Treatment on Treated (TOT) Effects on Default using Assignment as Instrument (LIML IV Regression), by Starting Credit Score

	(1) Default b/se	(2) Default, lt680 b/se	(3) Default b/se	(4) Default, lt680 b/se
IV: TOT	-0.0998 (0.095)	-0.3130** (0.158)	-0.1600 (0.097)	-0.3037** (0.140)
Controls	No	No	Yes	Yes
Observations	425	272	423	271
F statistic for weak identification	164.7	109.3	140.5	39.18

LIML IV. Controls include baseline credit score, delinquent on trades, income, gender, debt to income, age, education, race, time in home, savings, time preferences.

* $p < .1$, ** $p < .05$, *** $p < .01$

TABLE VII: Treatment on Treated (TOT) Effects on Change in Credit Score and Installment Debt (log), Follow-up Self Reports of Saving and Manual Payments using Assignment as Instrument (LIML IV Regression)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Credit post b/se	Ln Inst post b/se	Ln Revlv post b/se	Rev bal up 2k+ b/se	Inst bal up 2k+ b/se	SR saving-post b/se	Manual pay-post b/se	Use Budget b/se
IV: TOT	13.6773 (16.596)	0.5103 (0.707)	-0.5232 (0.498)	-0.3159** (0.139)	0.0291 (0.144)	0.3476** (0.147)	-0.3015*** (0.114)	0.0461 (0.134)
Observations	424	424	424	424	424	223	223	225

LIML IV: Controls include baseline credit score, delinquent on trades, income, gender, debt to income, age, education, race, time in home, savings, time preferences.

* $p < .1$, ** $p < .05$, *** $p < .01$

Fig. 1: Study Design

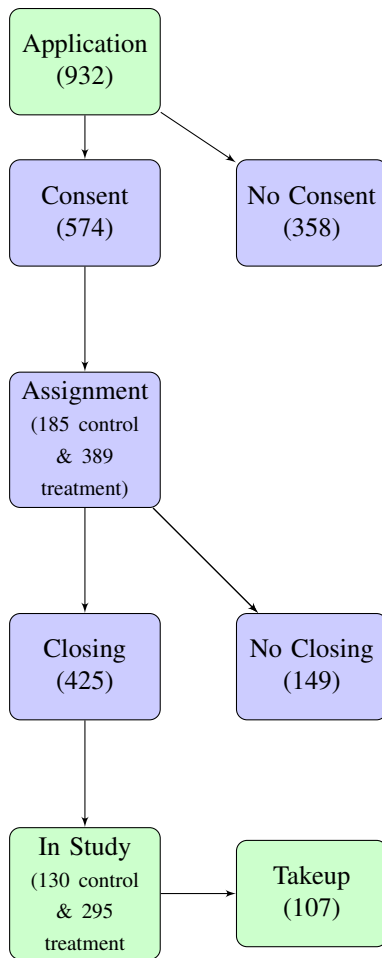


Fig. 2: Mean Default: Overall

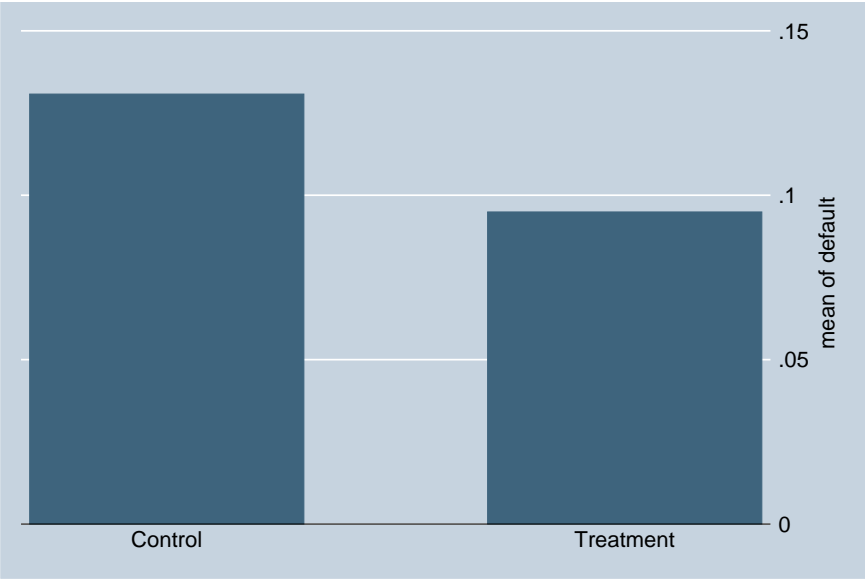


Fig. 3: Mean Default: Low Credit Score (lt 680) Only

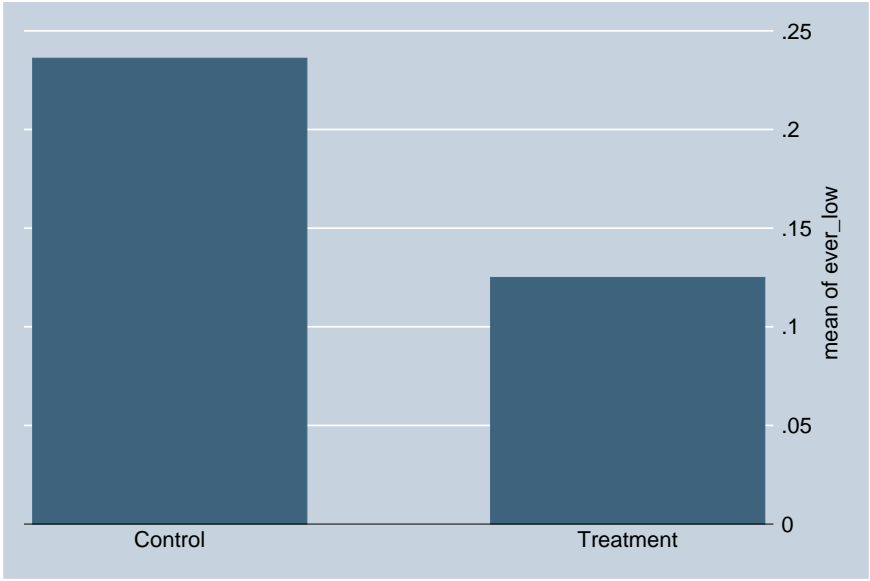


Fig. 4: Pre-Post Credit Score by Treatment

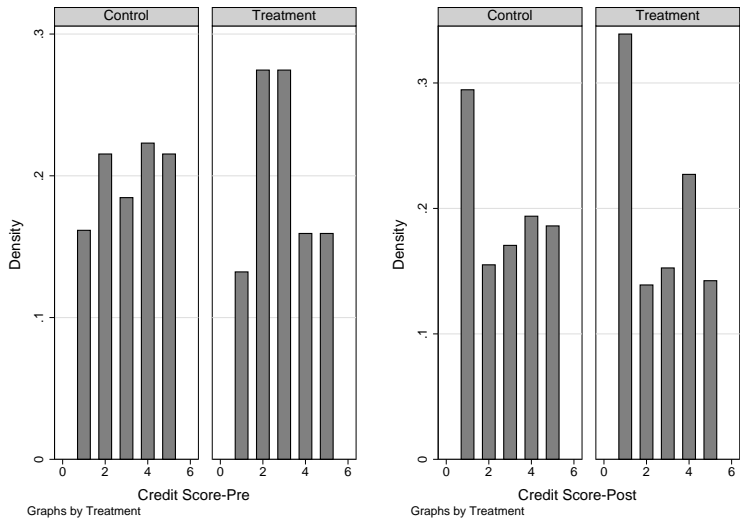


Fig. 5: Mean Total Installment Debt

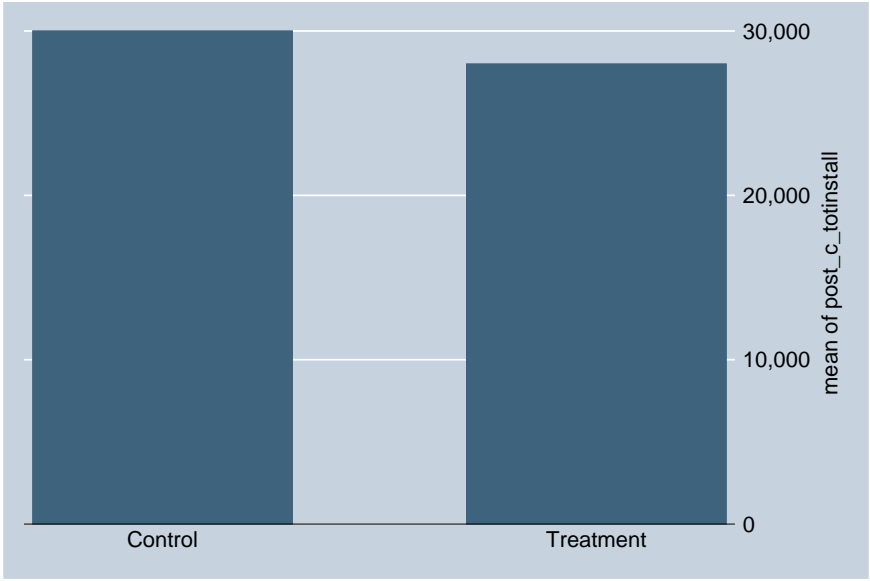


Fig. 6: Revolving Debt by Treatment

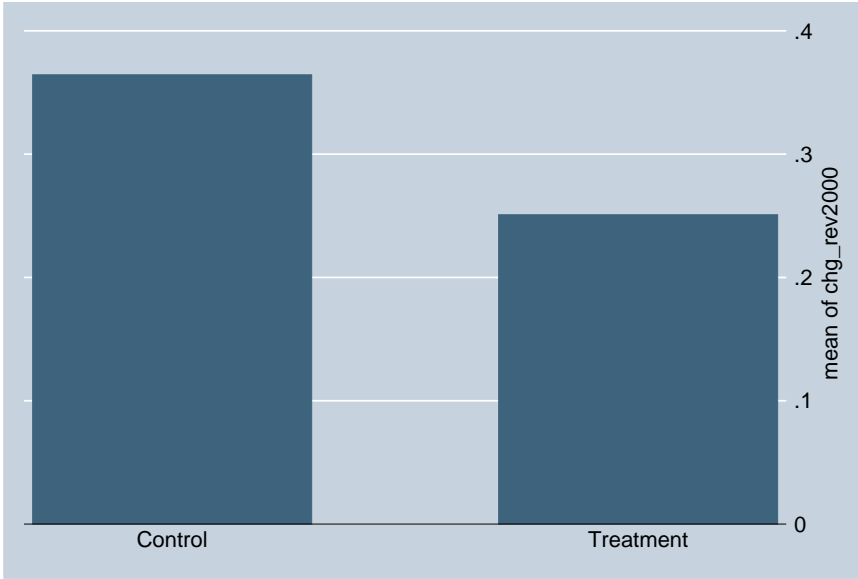


Fig. 7: Mean Self Reported Rate of 'Manual' Mortgage Payment (vs. auto pay)

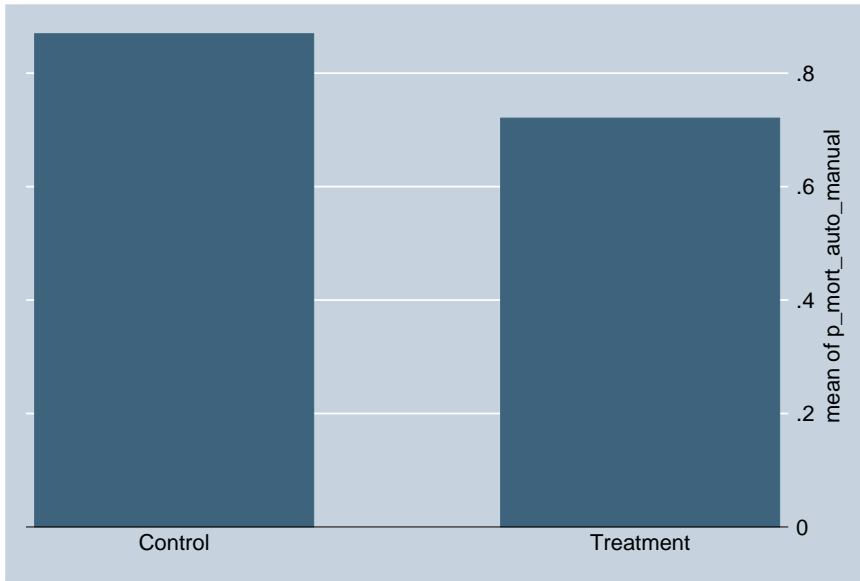


Fig. 8: Mean Self Report of 'Saving Money'

