

No Such Thing as a Free Option: Modification Offers and Borrower Mistakes*

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Abstract

I find that offers of debt forgiveness can financially hurt borrowers while benefiting the lender. In a field experiment, defaulted mortgage borrowers are randomly assigned offers to modify their mortgages in return for completing three payments and legal paperwork. Modification offers increase the fraction of borrowers making a payment over the next four months from 1% to 14%. However, 72% of responding borrowers ultimately fail to complete the terms of the modification and are worse off than had they not responded. On average, recipients of offers do not benefit financially, I hypothesize owing to a lack of financial sophistication.

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1 Introduction

At one point in the recent crisis, more than \$800 billion of mortgages were in default in the U.S. and over 5 million households faced foreclosure.¹ With backing by consumer advocates, investors, and academics, one policy proposal to help distressed borrowers was debt forgiveness, in which a lender reduces the principal balance owed on a delinquent mortgage.^{2,3} This was the focus of a 2012 national mortgage settlement over illegal foreclosure practices, requiring five banks to administer \$17 billion of debt-forgiving modifications.

But do mortgage modifications offering debt forgiveness always improve borrowers' expected financial outcomes? To test this, I conduct a randomized study in which borrowers can elect to start repayment and reduce the balance of a delinquent second mortgage. In a frictionless world with rational wealth-maximizers, borrowers must weakly benefit from such an offer. Whether borrowers optimally default on their debt; however, is an open question (Zinman, 2014). Offers of debt forgiveness may not be in borrower's best interests if they attract repayment on debts borrowers should not attempt to repay, for example owing to mistaken beliefs in legal punishments, reputational benefits, or their ability to maintain repayment.

I provide the first experimental analysis of mortgage modifications to estimate causal effects on household outcomes. I find that offering to reduce the amount a borrower is contractually obligated to pay can actually help a lender and financially hurt borrowers on average. It is not in the purely financial interests of many of the borrowers to respond to the offer. A large fraction of borrowers who accept the offer fail to meet its requirements

¹In this paper, default refers to falling 90 days or more behind in repayment. Foreclosure refers to the legal process of recovering collateral securing a loan.

²The first government program offering to modify loan terms, HAMP, focused on reducing monthly payments, extending loan maturities or lowering interest rates. HAMP experienced modification failure rates as high as 66% and, once modified, first year redefault rates of 60% (Schmeiser and Gross, 2014)

³Many of these calls were motivated by the theory that borrowers default when it is not in their financial interest to repay debts which sufficiently exceed the value of collateral (the option-based view, see (Kau and Keenan, 1995). For a sample of calls for principal-reduction, see (Braucher, 2010; Geanakoplos, 2010; Mian and Sufi, 2014; Shiller, 2009; Yoon, 2010)

and therefore fail to modify their loans, often due to a minor administrative friction of submitting paperwork correctly.

I randomly assign 1,673 delinquent second mortgage borrowers in the United States to one of two conditions. Borrowers randomly assigned to the treatment group are sent a letter containing an offer to reduce their mortgage's principal balance by 50%, reduce its interest rate by 2%, and reset its contractual status as a new, performing, loan. Borrowers in the control group do not receive an offer. The loan sample appears representative for examining the default behavior of a typical U.S. household, based on observables (details provided in Section 3).⁴ The modification offer does not affect the first mortgage, and this is important to evaluating the benefits a borrower should expect from repayment on this loan. Modification, for those who receive the offer, is contingent on making three reduced payments and completing one piece of legal paperwork.⁵

The study was implemented by a loan servicer to measure the efficacy of modification offers in improving borrower repayments. In the most straightforward analysis, I use purely experimental variation in the extension of these modification offers. A drawback of the experimental design is that the control group was limited to a size of 100 loans. In complementary analysis, I take advantage of a selection discontinuity to introduce additional loans to address the possibility of underpowered tests. These additional loans narrowly missed consideration for treatment owing to a difference in their length of delinquency.

Both sets of analysis agree: modification offers increase borrower repayment but do not visibly benefit borrower outcomes. In the short-run, 1% of the control group make a repayment in the four months following the offer, compared to 14% of the treatment group. Average repayments increase by \$1,198 over the next five years. In contrast to the observed increase in repayments, borrowers do not measurably avoid foreclosure, avoid bankruptcy,

⁴Conditional on a credit history, the median credit score in the U.S. is sub-prime (below 640, source: creditkarma.com, January 2015).

⁵A trial-period stipulating a small number of payments ("stip-to-mod") is an industry-standard approach of obtaining direct proof of borrower ability to repay. Three or more months of stipulated payments were also part of HAMP, during which time borrowers would also need to return paperwork, signed and notarized.

or improve their credit score.

Borrowers appear to hold mistaken beliefs in the ramifications to default. For most of these mortgages, given the lien position and the extent the loans are “underwater,” a financially sophisticated⁶ borrower should not respond to the modification offer if 1) the primary motivation is to keep her home, 2) to avoid being legally pursued on the debt, or 3) to directly benefit her credit score. And for those borrowers who do respond with repayment, approximately half fail to meet the requirements of the modification offer because of a minor administrative hurdle.

A sophisticated borrower should anticipate that there is no benefit from repayment to avoiding foreclosure when a lender’s secured claim has no collateral value backing it, as then there is no financial incentive to the lender to foreclose. This is the case for most second liens originated in the 2004-2007 period after a historic decline in house prices. Secondly, mortgages are de-facto non-recourse⁷ in the modern era of large, national, loan servicers (Bar-Gill, 2008; Geanakoplos, 2010). Lastly, a successful modification reports as a debt settlement to credit bureaus, negatively impacting credit score, and sporadic repayments on a defaulted loan have no effect. An additional legal consequence of repayment is that in the absence of payment, most treated borrowers would now be past the statute of limitations and thus effectively safe from foreclosure. Borrowers have reset the clock for future legal punishment by responding. I review the legal and credit benefits a financially sophisticated borrower should expect in Section 2. In the main results I demonstrate that the collateral values provide insufficient incentive for the level of observed repayments.

Borrowers are required to notarize and return a legal document while maintaining regular repayment in order to legally complete the modification. Most fail at this task. A majority of borrowers who meet the initial stipulated payment requirements continue to repay past the initial trial period, before eventually missing a timely payment and losing

⁶I use the term financial sophistication (Hastings et al., 2013) to refer to the ideal result of financial education: both knowledge and its proficient use under a rational model.

⁷Non-recourse refers to the absence of personal liability for a secured debt. This is (legally) the case for purchase loans in many states where a lender may pursue the collateral, but not the “note” or “deficiency.”

their eligibility to modify.

Both the lack of apparent benefits from the modification offer and the common failure at an administrative task raise the question of why borrowers accept such offers. One immediate source of borrower error is the high level of legal knowledge and financial reasoning required to assess the payoffs for default and repayment. In small illustrative surveys I conduct, a majority of mortgage borrowers do not distinguish relevant aspects of first versus second mortgages, nor do they apply backward-induction to appreciate the dependence of optimal foreclosure strategy on the market value of collateral. Respondents also overestimate the likelihood of recourse, and the benefits to occasional payment. That U.S. households may not, on average, be financially literate in survey responses is not new: [Lusardi and Tufano \(2009\)](#) find that only a third of their representative sample have a competent level of “debt literacy.” One contribution of this paper, then, is to present both survey and non-survey evidence on the heterogeneity amongst borrowers in the financial sophistication required to efficiently default on a debt.

Since the average borrower who responds to an offer is over-repaying under the standard model, I consider a number of different forms of mistaken beliefs and non-standard preferences to explain borrower behavior. In addition to a simple lack of financial sophistication, I consider overconfidence, time-inconsistency, and morality/self-image (stigma). Time-inconsistency and overconfidence can explain the nature of borrower failures, but do not explain apparently mis-appreciated payoffs; while morality can explain an apparent over-appreciation of the payoffs, but cannot explain non-monetary failures with a paperwork task. If borrowers were simply repaying because repaying is the morally right thing to do, they could also make partial payments at any time, which they do not. It seems reasonable that borrowers do not foresee the extent of their paperwork failures. This could be owing to a lack of sophistication in appreciating their future behavior or the task’s costs, or (its observational equivalent), overconfidence in their ability. I find that a lack of financial sophistication can contribute to an explanation of each finding of the experiment,

and my broad interpretation of the results is that financial management of distress is difficult. Many borrowers may follow a simple (and usually-useful) heuristic that “repayment of debt is the financially right thing to do.”

As well as contributing to the financial sophistication literature, this paper provides a new financial intermediation setting in which to apply insights from behavioral contract theory (Koszegi, 2013; Spinnewijn, 2014). Under non-common priors, a contract offer can attract agents whose subjective valuations of the contract are higher than its actuarially fair value, therefore lowering these agents’ wealth. In contrast, under a more classical framing of common priors and agents (borrowers) possessing private information (on their capacity to repay), Adelino et al. (2013) illustrate an under-provision of a new contract (debt-renegotiation) by the principal (lender). That the offers I study were extended on very delinquent, largely underwater, second liens is consistent with the prediction that the likelihood of debt-renegotiation varies by the likelihood of re-performance in the absence of modification. My results highlight, though, that it is lenders who may have the informational advantage in terms of distressed borrower’s ability to modify and the associated benefits. Similar to stylized facts that have inspired models challenging Rothschild-Stiglitz information asymmetries in other (insurance) markets, I find an absence of adverse selection. Under the parameters of this experiment, a lender increases their dollar recoveries by offering modifications.

This paper contributes to the household finance and mortgage literature with, to the best of my knowledge, the first randomized study of mortgage modifications, or of debt forgiveness in a developed country. Dobbie and Song (2015) review a modification program of unsecured credit-card debt. The program they review has a far greater number of participants but does not offer debt forgiveness. They find that (small) interest rate reductions cause small increases in borrower propensity to repay and avoid bankruptcy.

Previous mortgage studies, using observational datasets, find that borrowers sub-optimally exercise the other significant option imbedded in a mortgage contract, the right to prepay,

and that this sub-optimality covaries with borrower characteristics such as income and wealth (Agarwal et al., 2012; Amromin et al., 2011; Campbell, 2006; Campbell et al., 2011). I similarly observe that borrower mistakes in this experiment and inefficient defaults negatively correlate with proxies for borrower income (home value and interest rates at origination). That I find more financially sophisticated and higher income borrowers may “default better,” echoes previously documented relationships in studies of repayment behavior (Amromin et al., 2011; Jagtiani and Lang, 2010; Mayer et al., 2011). I contribute a novel methodology and level of detail of repayment failure data unavailable in existing datasets.

Naïve, cognitively limited households may not only over-borrow and prove more likely to miss payments in the first place, they might also mismanage their delinquency and over-repay compared to financial sophisticates. The results of this experiment sound a cautionary note to policy responses that rely on perfectly informed financial optimizers to deliver expected benefits.⁸

The rest of this paper proceeds as follows. Section 2 provides institutional background for the reader and addresses borrower understanding of the same details. Section 3 describes the experiment and dataset. Section 4 outlines the empirical analysis. Section 5 presents the main results. Section 6 discusses the potential channels and implications for policy, and Section 7 concludes.

2 Background: Loan Servicing and Default in the United States

A loan servicer is the licensed entity that collects repayments on behalf of the legal owner of a loan, such as a lender or a securitization trust. When a loan is performing as contractually agreed, the loan servicer processes payments. When a payment on a loan is missed,

⁸The offers in this experiment are similar to the majority of those implemented in the National Mortgage Settlement, presumably intended to be in consumers’ favour.

the servicer then typically begins attempts to contact the borrower to remind him to pay. If subsequent payments are missed and a borrower’s contractual delinquency increases, at 60 or 90 days of delinquency (varying by state), a servicer may issue a Notice Of Default and retain the option to pursue foreclosure of the collateral while ideally (from an investor or lender’s point of view) seeking to “cure” the default and move the loan out of its default status through a number of different, lower cost, methods. Common approaches to cure a default include encouraging repayment of late interest and fees; placing borrowers on temporary payment plans; modifying a loan; and collateral-focused, but non-foreclosure, activity such as arranging a “short-sale” or a deed-in-lieu of foreclosure.⁹ Outside of procedural debt collection activities, a servicer may infrequently and asynchronously initiate servicing campaigns to improve loan performance. It is in the context of a servicing campaign offering borrowers loan modifications that the treatments this paper studies are administered.

Ultimately, a secured lender can recover value from the collateral through foreclosure. A foreclosure sale recoups the collateral or the proceeds from the sale of the collateral to the lender. The equivalent remedy for an unsecured creditor is to pursue a borrower personally for a judgment to recover funds from income or other assets. Any of these legal actions involve costs and risks. A loan servicer has a limited amount of time to pursue actions owing to the statute of limitations (3-6 years typically, depending on state)—as a borrower can file an immediate motion for dismissal otherwise. In some states it is possible to pursue the collateral first, and then pursue a borrower for the deficiency, but as previous authors have observed, the lack of pursuit of these claims in the U.S. leaves mortgage debt, which is from a legal point of view recourse debt, de-facto non-recourse (Bar-Gill, 2008; Geanakoplos, 2010).

Second mortgages are a large, one trillion dollar, market (Lee et al., 2012) and have

⁹A short-sale is when the lender allows their collateral to be sold by the owner (the borrower) for less than the full amount of the debt, avoiding a foreclosure process. A deed-in-lieu is when a borrower conveys the deed (or ownership of the property) to the lender, essentially returning the property. For more detail on mortgage servicing see (Levitin and Twomey, 2010)

second liens on the collateral, subordinate to the (traditional) senior first lien mortgage. If a second lienholder pursues foreclosure when there is no residual value to their claim, they only incur additional losses. As a simple example, if it costs \$10 to foreclose; the first lien balance is \$100; the property value is commonly known to be \$80; and the second lien balance is \$30,¹⁰ the second lienholder realizes at best a net return of -\$10 if it initiates a foreclosure and \$0 if the senior lienholder forecloses. Foreclosing involves up-front legal costs, financing costs for purchase of the property at the foreclosure sale, and carrying costs of the property until resale.

From the borrower perspective, loan modifications do not provide a direct benefit to credit reputation via credit scores.¹¹ Credit scores in fact decline when a modification is reported as a debt settlement to the credit bureaus, and sporadic repayments on a defaulted loan, from a credit-monitoring point of view, do not change a loan's status.

2.1 Borrower Understanding of Loan Servicing

Typical mortgage borrowers—even those in default—might not understand important aspects of default. It might also be the case that borrowers do not act in a perfectly strategic fashion with respect to their objective lack of knowledge, which would, amongst other things, inhibit seeking advice. [Lusardi and Tufano \(2009\)](#), for example, find, that there is a systematic overconfidence in self-reports of “debt literacy.”

A financially sophisticated borrower in this experiment should not expect foreclosure from this lienholder. As the experiment occurs after a historic decline in house prices, net recoveries to the lender from foreclosure are estimated to be negative for most of the loans in this experiment. Consistent with the incentives to the second mortgage holder outlined above, foreclosures in the dataset over this time period are only initiated by the servicer of the first mortgage.

¹⁰This implies a loan-to-value (LTV) of 125% or combined-loan-to-value (CLTV) of 162.5%

¹¹Borrowers could become informed on this point if they perform an internet search for “modification credit score.” The top results from a popular internet search engine suggest there can be negative effects on credit score.

Borrowers might not understand the statute of limitations. By August 2015, an estimated 97% of treated borrowers would have been past the statute of limitations date an action against them personally (judgment) or the collateral (foreclosure) could not be immediately dismissed. Notice there is a slight distinction between requiring a motion for dismissal and not permitting the suit or foreclosure in the first place: this has been a legal grey-area for the collection of debt, as it requires a sophisticated consumer to understand this legal detail, and is an area of recent activity for the new Consumer Financial Protection Bureau.¹²

It does not appear as if respondents understand the difference between their first and second mortgages in small illustrative online surveys I conduct with U.S. mortgage borrowers (details in Appendix II), or that they understand the role a property's market value plays in foreclosure. Less than half of the respondents are correct with confidence about the seniority of their second lien mortgage compared to their first mortgage. This echoes findings that borrowers in adjustable mortgages under-appreciate the difference in adjustability between the mortgage they have and a traditional fixed rate mortgage (Bucks and Pence, 2008). In another survey I perform, less than 20% of respondents choose an answer that indicates the correct higher-order reasoning that a property's market value influences the likelihood of foreclosure by a second lienholder. On average, responses also imply that the ratio of debt to property value is not the most significant determinant in repayment decisions, that affordability is the most important determinant of repayment, and that benefits to credit scores from one-off payments are overestimated. These survey responses should be interpreted as merely suggestive of potential mechanisms driving borrower reactions to the offer, given the small sample size and differences between survey participants and experimental subjects, but they do illustrate borrowers overestimating the punishments associated with default and overestimating the benefits to repayment.

¹²<http://www.insidearm.com/daily/debt-collection-news/debt-collection/joint-cfpb-ftc-brief-collecting-on-time-barred-debt-can-violate-fdcpa/>
<http://www.consumerfinance.gov/newsroom/cfpb-report-finds-debt-collection-tops-older-consumer-complaints/>

3 Experiment Design

3.1 Treatment

In this experiment, treatment takes the form of a letter the servicer sends to borrowers containing a debt forgiveness offer. The text of the letter is provided in Appendix I. The letters are sent on December 22, 2010. A randomly selected control group of loans were held back from the servicing campaign and did not receive a letter. Owing to the size of the field experiment and the lack of advertising or nationwide coverage of the program, borrowers in the control arm are highly unlikely to have knowledge of the treatment being afforded the treatment group and vice versa.

The treatment offers borrowers a 50% reduction in the principal balance of the mortgage, a 2% reduction in interest rate, a standardized term of 30 years from the modification date, and a “fresh start” of contractually current loan status. This creates variation in the amount of reduction in monthly payment and the amount of reduction in borrower leverage (the ratio of mortgage debt to property value, the “combined-loan-to-value” or CLTV) because of different starting interest rates, loan maturities at the time of the modification offer, starting balances, and experienced house price paths. CLTV is, along with other ex-ante characteristics, likely to correlate with unobservables. For instance, it could correlate with borrower investment skill or risk tolerance. The modification offers would lead to a median estimated CLTV of 140% amongst all loans if they were modified, and a median CLTV of 119% amongst only those loans where borrowers attempt to modify. Most borrowers would not be in a positive equity position even after successfully completing a modification.

A simplified diagram of the modification process is provided in Figure 1. Interested borrowers are required to first register interest for the debt forgiveness program by telephone. Borrowers are then required to make three reduced monthly payments (January, February and March payments). The loan modification is legally complete only after a borrower signs

and notarizes a new promissory note affirming the new terms of repayment, and returns the paperwork to the appropriate address for processing.¹³ Paperwork for finalizing the modification is sent by the servicer after the payment criteria are met.¹⁴ While there is no specific campaign-related assistance, until the paperwork is complete, a borrower continues to be contacted as any other defaulted borrower, and, so long as they continue to make the new monthly payments they would typically be encouraged and reminded of the correct address to submit paperwork to etc.

‘Treatment’ in this experiment refers to a borrower’s randomization into a group being sent a letter containing an offer, not whether a borrower receives or reads an offer letter. Estimated effect sizes are therefore intent-to-treat if a borrower’s consideration of debt forgiveness is considered the treatment, as many borrowers will not open the letters in the time necessary (<1 month) to consider the offer. Recent average open rates in the US for direct marketing mail could be as high as 75% for land mail (an estimate from a marketing organization, hence this may be an upper bound on average open rates) and as low as 20.1% for e-mail.¹⁵ One might consider a letter from a creditor as more important than other direct mailings and hence more likely to be opened and read, but a delinquent borrower may exhibit an “ostrich effect”—the desire to avoid potentially negative news (Karlsson et al., 2009). Custers (2015) finds that more than 30% of delinquent borrowers in a UK sample admit to avoiding loan servicer contact as a method of coping with delinquent debt.

¹³The promissory note constitutes the formal legal promise to repay.

¹⁴These requirements are simple in contrast to the criteria and documentation needs faced by borrowers in qualifying for federal programs. As an example, one of the HAMP forms required can be found at http://www.makinghomeaffordable.gov/programs/lower-payments/Documents/RMA_english.03.30.2012_static.pdf

¹⁵The open rate for e-mails is measurable and verifiable to some extent.

Sources: <https://smallbusiness.yahoo.com/advisor/direct-mail-marketing-small-business-advice-152312052.html>, <http://www.marketingprofs.com/charts/2012/8560/email-open-and-click-rates-benchmarks-trends>.

3.2 Treatment randomization, dataset, and borrower characteristics

The experiment is implemented on a pool of 1,673 defaulted “closed-end” second lien mortgages,¹⁶ all of which have not received a payment in the preceding 10 months. Each loan shares the same legal ownership. In order to be included, the borrower’s mailing address has to match the property address,¹⁷ there has to be no record of recently returned mail, and the borrower has to have not already lost ownership of the property through foreclosure, or already be in bankruptcy.

I randomly assign treatment. Outside of the debt forgiveness offer, servicing of the loans does not differ across the two groups of loans. Because of previous experience with a similar campaign on another pools of loans, the servicer expected treatment to have a positive effect on re-performance, and therefore permitted only a 100 loan control group to be held back from treatment, leaving 1,573 loans for treatment.¹⁸

A key advantage of this setting is that the dataset provides a complete time series of loan-level borrower behavior with a randomized source of variation in modification offers. The dataset spans from the beginning of 2009 to 2014, two years prior and three years subsequent to the modification offer.¹⁹ I combine time series payment data with origination characteristics of the loans (such as interest rate and the state in which the property lies), along with credit, foreclosure, and bankruptcy indicators. Payment data is aggregated to the monthly level. This dataset lacks complete information on other household debts, income or wealth. Credit reports can partially compensate for this incomplete picture of borrower financial health. I supplement servicer-provided data with reports from a third party mortgage data provider (Core Logic) on the underlying first lien.

¹⁶Closed-end loans are non-revolving in nature like traditional first mortgages, in contrast to “Home Equity Lines of Credit” which borrowers could draw upon in a revolving fashion, similarly to a credit card.

¹⁷Addresses are checked/updated on at least an annual basis by the servicer, but ex-post it was discovered that servicing personnel performed this check by comparing zipcodes. As a result some of the borrowers might have been living at a different address in the same zipcode.

¹⁸With these sample sizes, at 0.8 power the design was estimated to detect differences of 5 percentage points in payment outcomes and approximately 10 percentage point differences in foreclosure or bankruptcy outcomes.

¹⁹[in March 2016 payment data was supplemented to five years]

Information on broader household financial outcomes such as foreclosure, bankruptcy, and credit score are also provided in the dataset. Whenever a lienholder initiates foreclosure, by law, other lienholders must be notified. As a result, this dataset includes information on any foreclosure activity on the property by a senior lienholder. Similarly, a servicer will receive notice of a borrower bankruptcy in order to implement a “stay” and stop attempts to contact a borrower. Credit (FICO) scores are updated in the ordinary course of business from any of the three main bureaus.

Table 1 presents summary statistics for the borrower pool and tests for balance between treatment and control groups across pre-treatment loan, property, and borrower attributes pre-treatment. There are no statistically significant differences in observables of either the second lien or the associated first lien, whose characteristics I receive from Core Logic reports, which gather information directly from property deeds where available.²⁰

The loan sample appears representative for the default behavior of typical U.S. households. Second mortgages such as these were used to finance the down payment in the purchase of a home, or used to extract cash out after a property appreciated in value.²¹ More than half of all privately securitized first mortgages from 2000-2007, and more than 70% of their defaults have second liens attached (Goodman et al., 2010). Sample averages are similar to subprime second lien origination population averages: an average origination CLTV of 97% and average balance of \$41,958 compares to overall 2000-2007 subprime averages of 100% and \$40,000. The underlying first liens are also similar to average 2000-2007 subprime first lien originations, with a sample average balance of \$189,361 and interest rate of 7.4% compared to population averages of approximately \$200,000 and 6.7%-7.7% Foote et al. (2009); Mayer et al. (2009). Table 2 shows that the loans are distributed across the U.S.

²⁰When data for first liens is available both from Core Logic and the servicing dataset, Core Logic values are used. In 13 cases both sources of data are missing for the first lien and I assume the first lien formed part of an 80/20 origination where the 2nd lien would provide 20% of the purchase price.

²¹Second liens during this period were often originated as the ‘20%’ in an 80/20 mortgage origination, where the 80 refers to the percentage of purchase price provided by the traditional first mortgage.

The primary driver of default in option-theoretic models is CLTV. I estimate CLTV by dividing the sum of the updated second lien and origination first lien balances by the most recent property value in the servicer-provided dataset, updated to the beginning of the experiment using changes in CoreLogic’s House Price Index (HPI) for the property’s zip code, county, or state, depending on availability of data. On the one hand, using original balances for the first liens will (somewhat) overestimate CLTV compared to the true CLTV a borrower faces, owing to a slow initial amortization of principal balance on the typical 30-year mortgage. This particular source of overestimation could be on the order of overstating a balance by 5% for the average loan in this dataset. On the other hand, any automated valuations used by the servicer,²² as well as the aggregate indices I use, do not incorporate the information that this particular borrower is in default. This will on average underestimate CLTV owing to the typically positive correlation between CLTV and default. Estimated CLTVs are very positively skewed (median 1.5, mean 2.0), as the denominator (property value) for lower-priced distressed “subprime” properties can quickly drop close to zero, especially when collateral values are updated based on expert appraisals and not a regionally aggregated same-sale index. To address this in the regression analysis, I also use dummy variables to non-parametrically control for CLTV.

At the bottom of Table 1 are summary statistics on variables describing aspects of borrower behavior in the two years prior to the experiment. I use these variables later to examine if historical borrower-servicer interactions are related to successful completion of a modification plan. The variables constructed are: 1) a binary indicator for whether the borrower previously verbally responded to servicer phone calls with promises of future payments; 2) a binary indicator for whether the borrower ever failed to keep a payment promise; 3) a binary indicator for whether a borrower made a payment in the 30 days following successful servicer-initiated contact; and 4) a binary indicator for whether the borrower ever scheduled a payment for some point in the future and when that date arrived,

²²Some of the values will be updates using Automated Valuation Models or “AVMs,” a remote valuation tool that does not involve a manual or in-person appraisal.

insufficient funds were available in the account, causing the borrower to be charged an “insufficient funds” fee.

4 Empirical Specification

The loan-specific outcomes I analyze are repayment responses and borrower-initiated telephone calls. I generate binary variables to indicate whether a borrower calls the servicer within four months of being sent a letter (a call being necessary to sign up for the program), whether a borrower makes a payment within four months of treatment, whether a modification is completed within a year of treatment, and whether a loan is contractually current 3 years later. “Contractually current” means a loan has been repaid as contractually agreed. I extend the period of observation for a completed modification to twelve months post-treatment for two reasons. While the terms of the debt forgiveness offer require three payments within three months, some borrowers do not stay on schedule, and servicing personnel appear to extend lenience on the timing of payments. It also takes time for borrowers to return a signed and notarized note to legally complete the modification and for the new balance to appear in the servicing dataset.

I use a linear probability model to test whether binary borrower outcomes, B_i , change as a result of sending a modification offer. This reverts to a simple regression model in the one case we are examining a continuous outcome variable of dollars repaid. We are interested in the estimate of β_1 in (1):

$$B_i = \alpha + \beta_1 * Offer_i + \varepsilon_i \tag{1}$$

In additional analysis, I add 497 “quasi-control” loans to the sample. These defaulted second liens narrowly miss inclusion in the experiment because they are less than 10 months delinquent at the beginning of the experiment. These loans satisfy all the other selection criteria of the experimental sample and are in default as they are more than 90 days

delinquent. I use the additional loans to reduce standard errors and improve the statistical precision of my estimates. In order to include these loans in the regression, I assume that the length of delinquency affects outcomes either linearly (equation (2)) or in accordance with a fourth order polynomial (equation (3)).

$$B_i = \alpha + \beta_2 * Offer_i + \delta * R_i + \gamma * X_i + \varepsilon_i \quad (2)$$

$$B_i = \alpha + \beta_3 * Offer_i + \delta_1 * R_i + \delta_2 * R_i^2 + \delta_3 * R_i^3 + \delta_4 * R_i^4 + \gamma * X_i + \varepsilon_i \quad (3)$$

Here, R_i is the running variable and equals months delinquent at the start of the experiment minus 10 in order to center the selection around 0. X represents a vector of loan characteristics to control for any observable differences in the additional loans. We are interested in β_2 and β_3 , the estimated effects of sending a modification offer.

I expect spatial correlation in outcomes owing to, amongst other things, the regional correlation in house price appreciation. I therefore cluster standard errors by the state the property lies in when estimating regressions (1), (2), (3). Results are similar when using Eicker-Huber-White standard errors.

In robustness checks specifically exploiting the discontinuity in treatment around 10 months, I use the robust local polynomial regression discontinuity design of (Calonico et al., 2014), with both linear and fourth-order polynomials, but a data-driven bandwidth for polynomial construction around the discontinuity (rather than global polynomial approximation).

5 Results

5.1 Do Modification Offers Affect Outcomes?

Modification offers increase debt-repayment. Figure 2 illustrates that both the share of borrowers who make any repayment and the average dollars repaid increase in the months following treatment. Table 3 formally tests for an immediate effect of offering modifications on phone calls and payments. Borrowers are required to call to register in the program before starting repayment. 21% of treated borrowers call the servicer at least once over the first four months, compared to 11% of borrowers in the control group. Treatment is associated with a 12 percentage point increase in the likelihood a borrower makes a repayment in the next four months: over 13% of treated borrowers make some payment in the first four months compared to 1% in the absence of treatment. All differences are statistically significant.

Table 4 introduces additional “quasi-control” accounts as described in Section 3, controlling for observable differences, and repeats the tests of Table 3. Point estimates do vary, and the level of statistical significance improves when examining one outcome (calls into the servicer) but standard errors increase in size examining the other outcome (any payment). Table 4 echoes the results of Table 3 when using additional accounts around the discontinuity in selection for treatment—an approach we will return to later when testing for benefits to broader household outcomes. In untabulated checks for robustness of the main result, estimated treatment effect sizes are similarly significant when using three or five month timeframes, and when using logit or probit specifications.

Table 5 presents results using longer-term re-performance outcomes as the dependent variable. As with the short-run results, I find positive and statistically significant average treatment effects on dollars collected and whether a loan is contractually current three years later. Five years later, the difference in contractual performance has receded to marginal statistical significance: 2.6% more treated borrowers are contractually performing, while

in dollar terms, the increase is clear: treatment increases average recoveries to the lender over the subsequent five years from \$1,583 to \$2,780. Less than a quarter of borrowers who make some form of repayment have it lead to long-term contractual performance on their debt.

Such high failure (redefault) rates are consistent under a traditional financial framework as long as the average realized benefit is sufficiently positive. As previously discussed, from a theoretical ex-ante perspective, a direct benefit to foreclosure is not necessarily expected from repayment. A second lienholder lacks the financial incentive to foreclose when its claim has no collateral value backing it, which is the case for most of these loans. There is no reason to expect direct benefits to credit score, as, by construction, credit scores do not benefit from sporadic payments that leave a loan's default status unchanged, and by completing this modification and essentially creating a new loan, a settlement of the old debt is reported to credit bureaus, lowering a borrower's credit score. If these aspects of credit scores are surprising to the reader, they may also surprise the typical borrower.

Empirically, Table 6 finds no effect of offering debt forgiveness on foreclosure proceedings, bankruptcy filings, or credit scores, testing each outcome separately using purely experimental variation. Contrary to observing benefits, we observe statistically insignificant estimated increases of 5% and 4% in foreclosure and bankruptcy, respectively, associated with treatment, and a statistically significant and negative treatment effect of -15 points to credit score.²³ The point estimates of effects on foreclosure and bankruptcy compare to control means of 34% and 18% respectively. The estimated effect on credit score also appears small, compared to an in-sample standard deviation of 62 points and a potential range from 300 to 850.²⁴

Table 7 introduces additional defaulted loans to the analysis (in the design described in Section 3). Point estimates are closer to zero and standard errors decrease in size. Benefits

²³A potential concern with the credit score result is that treatment and consequent repayment activity somehow alter the timing of credit reporting by the servicer. I test and find no difference in score dates.

²⁴A difference of 15 FICO points is more significant, however, for borrowers close to an economically relevant boundary such as the score of 600 required for a Federal Housing Authority (FHA)-insured loan.

to foreclosure and bankruptcy continue to be empirically absent, and the point estimate for an effect on credit score appears more realistic if only considering direct effects of any modifications (it is a negative but smaller point estimate). One of the point estimates in one specification (bankruptcy filings) shows a marginally statistically significant—but small—increase of 4% associated with treatment. Point estimates for foreclosure are smaller in magnitude, change sign, and remain statistically insignificant. As a robustness check, I narrow the sample of accounts to those less than 5 years delinquent to confirm that findings are not driven by extreme values of delinquency length. I also employ robust bias-corrected local polynomial regression discontinuity designs to compare outcomes on either side of the 10-month cut-off used for selection into the experiment. I continue to find no statistically observable benefit to borrowers in keeping their home or filing for bankruptcy.

5.2 Heterogeneity in Effects of Modification Offers

I next ask if modification offers differentially impact borrowers according to how financially distressed they are pre-treatment. Do borrowers who are not as upside down on their investment and not as far behind in their payments benefit from receiving a modification offer? Modification offers could have a positive indirect effect by encouraging borrowers to work out their first mortgage, the mortgage that matters to foreclosure outcomes over this time period. This could be more likely to occur if the borrower has not fallen too far behind in payments first. Table 8 tests for heterogeneity in treatment effects by interacting a treatment indicator variable with an indicator for whether a borrower is estimated to have a less than 125% CLTV at the beginning of the experiment and if their length of contractual delinquency is less than 2 years.²⁵

The estimated differences to credit score or bankruptcy outcomes when a borrower is

²⁵Government-led programs often targeted borrowers in bad, but not terrible, equity positions by implementing leverage cutoffs: 125% was a cutoff eventually used in the federal (FHA) streamline refinance program, which performed the economic equivalent of a modification program offering interest rate reductions. I choose two years of delinquency as a salient cutoff close to the median delinquency length of 27 months.

in a less financially distressed position, ex-ante, are beneficially signed but not statistically significant. The magnitude of estimated heterogeneity in foreclosure activity is large. If a borrower is in a better equity position and less than 2 years delinquent, treatment is associated with a 31% decrease in the probability of observing foreclosure activity. This estimate is of marginal statistical significance, with a p-value of 0.08. Interestingly, when payment and modification responses are examined as dependent variables, the interaction is not statistically significant.

5.3 Examining Borrower Payment Response and Redefault

If borrowers were responding in order to minimize the lender’s potential claim to the collateral at the lowest cost, they should repay exactly the stipulated amount, complete the paperwork, then stop repayment. Instead, we find that borrowers who are successful in modification, largely treat the modified loan as a new obligation. They continue to pay and redefault only gradually over time. Only a few (<5%) borrowers who modify pursue this “ruthless” claim-minimisation strategy. The amount of dollars repaid and modification success rates also do not lend themselves to a purely rational financial interpretation.²⁶

A plausible explanation for why borrowers repay more than the standard financial model predicts is that they feel the repayment of debt is the ethically correct action. A critical implication of simply overvaluing repayment—compared to the standard model—is that failures should still be purely monetary in nature. Examining the servicing data, we do observe failures to meet monetary requirements, as illustrated by Figure 3, but we also observe many borrowers fail to meet non-monetary requirements (completing paperwork),

²⁶Treatment is associated with a \$1560 increase in average repayment over the first three years. An estimate of the maximum potential average benefit from the collateral value of debt-forgiveness is \$929. This estimate assumes a subjective discount rate of 0%, no foreclosures (any in process do not complete, no new foreclosures), and all contractually current loans at the end of 3 years continue to perform until the property value recovers to the original combined lien amount at which time a borrower immediately sells the collateral. This maximum benefit would be approximately halved if those properties with foreclosure activity had their foreclosure completed. Extinguishing an economically unsecured second lien through bankruptcy (“lien-stripping”) would offer full forgiveness for many borrowers at a lower monetary cost to the borrower, but entail other costs such as stigma.

as illustrated in Figure 4.

Borrowers appear to struggle at every stage of repayment attempts. Many borrowers (58%), after having made timely payments, fail to complete legal paperwork while keeping payments current under the new terms. Between registering and making the first payment, 19% of borrowers fail to make the first payment, then out of those who make the first payment, 13% do not continue to meet the second payment requirement, and 28% of borrowers who make the second payment fail to make the third and final payment. These failure rates are surprisingly high, but are very similar to those observed in the government-led modification, the Making Homes Affordable Modification Program (HAMP). In HAMP, less than one third of trial-periods—typically of three months duration—were successfully completed, and more than half of the failures reported by servicers were non-monetary in nature. The magnitude of the paperwork failures in this experiment is of interest: as many borrowers continue to repay beyond the third payment but fail to complete the legal documentation as the number of borrowers who manage to successfully return the paperwork.

Small frictions appear to matter. The subjective costs of a paperwork task may be underappreciated. This is not new: [Tasoff and Letzler \(2014\)](#) find expected completion rates of mailing in a rebate form exceed actual completion rates by 49 percentage points. Out of the treatments they deploy, only reducing the transactional burden of the task reduces the gap. [Bettinger et al. \(2012\)](#) find that paperwork is a significant barrier to low-income individuals gaining student aid and that providing assistance with paperwork ultimately increases college attendance by more than 30%.

Financially distressed households may face additional limits to completing a paperwork task. For example, previous work has suggested that financial distress might impede cognitive ability ([Mani et al., 2013](#)). Without completing the legal paperwork, borrowers do not start to receive monthly notices/reminders of loan payments. Memory has been previously found to play a role in debt repayment ([Cadena and Schoar, 2011](#); [Hundtofte, 2012](#); [Karlan](#)

et al., 2012). If any payment is delayed, a borrower is no longer eligible for modification. Resources already limited by financial distress could interact poorly with an initial failure to complete paperwork and stay on the program.

Table 9 tests if response and redefault (failure) out of the modification program is correlated with the same financial variables related to default in recent models such as Bajari et al. (2008). Columns 1 and 2 examine the initial payment response, interacting a treatment indicator with ex-ante loan characteristics such as a borrower’s CLTV and the affordability of the mortgage (the log of the monthly payment amount), while columns 3 and 4 examine the probability of completing a modification, conditional on receiving an offer and making at least one payment. For each outcome, I use a linear control for CLTV in columns 1 and 3 and dummy variables for various CLTV ranges in columns 2 and 4. Given the conditional nature of redefault rates, the appropriate comparison to make for the same variable across the two different outcomes is to compare the interacted term in column 1 or 2 with the coefficient a row higher in columns 3 or 4.

Table 9 finds the following fundamental variables are statistically related to an initial payment response: the size of the original monthly payment, length of delinquency, original interest rate, and whether the borrower previously received a foreclosure notice. Collateral and legal variables that under the traditional model should be most relevant have statistically insignificant interactions: CLTV, and indicators for whether the state legally treats the debt as non-recourse²⁷ or has a material homestead exemption in bankruptcy. The lack of statistical significance of the estimated coefficients for these legal indicator variables suggests that variation in borrower responses does not reliably vary by concern over legal recourse.

For a one percent greater original monthly payment, a treated borrower is 0.08% less likely to respond with repayment. Previous foreclosure activity is related to a 6% lower likelihood of repayment response to treatment. For each month of contractual delinquency

²⁷I define a state as non-recourse when it has a statute barring lenders from pursuing borrowers on the deficiency from a foreclosure (the remainder that they are owed after the collateral proceeds).

a treated borrower is 0.25% less likely to repay. And a 1% higher original interest rate corresponds to a 0.8% greater likelihood of making a repayment in response to treatment. This relationship with a high original loan interest rate is consistent with responding borrowers being less credit-worthy borrowers when the loans were originated.

Interestingly, Columns 3-4 of Table 9 find that the fundamental variables which are relevant to response are no longer relevant to redefault, and that CLTV is now statistically significantly and positively related to successful modification (conditional on a repayment attempt). This is the opposite relationship to that typically found when studying default rates of national modification programs, where the higher the CLTV, the greater the likelihood of redefault (Schmeiser and Gross, 2014). Borrowers in worse equity positions are more likely to succeed if they try to modify. Column 3 estimates a doubling of CLTV is associated with a 7% lower likelihood of redefault. A simple model rationalises key empirical moments of this experiment and the relationship between CLTV and modification failure rates (illustrated non-parametrically in Figure 5), by allowing borrowers to have biased evaluations of repayment benefits, and assuming ability to repay is orthogonal to borrower leverage, conditional on other loan observables. In such a model, a wider range of borrowers respond at lower CLTVs, as they expect to greater benefits from modification if successful. I estimate such a model of borrower repayment using Simulated Method of Moments to illustrate this dynamic in Appendix III. Under its simplifying assumptions, the model also argues for an overvaluation of benefits over optimism in one's ability as better explaining the data.

6 Discussion of Potential Mechanisms and Policy Implications

To respond optimally to a modification offer would present a challenge for the ordinary mortal. It requires a borrower to have an understanding of their mortgage, an expert

assessment of the current value of a property, accurate expectations (of future price paths, future ability to repay or complete paperwork), and consistent willingness to complete any modification. A contingent modification offer is a contract with which borrowers are likely to have little experience or appropriate training.

I summarize the various facts in Table 11 and review how they might be explained under alternative hypotheses: the standard model, lack of financial sophistication, overconfidence, time-inconsistency (Heidhues and Kszegi, 2010; Loewenstein et al., 2000; O'Donoghue and Rabin, 1999), and morality/social preferences to do the right thing by others (Andreoni et al., 2011; Cain et al., 2014).

Regardless of the source of error, under some straightforward assumptions, if some borrowers overestimate the value of responding to a modification offer, a new contract offer can select for mistaken borrowers. Inaccurate perceptions have been found to explain the empirical puzzle of advantageous selection and a zero/negative correlation between risk and coverage in many insurance markets, the extent of which appears to vary by cognitive ability (Fang et al., 2006; Huang and Luo, 2015; Spinnewijn, 2013). In the setting of a mortgage modification, borrowers may be mistaken in their expectation of benefits from repayment.

Past studies find U.S. households do not display perfect rational belief-formation across a number of dimensions relevant to mortgage default. Forecasts of future economic outcomes exhibit inefficiently large errors, with lower income and racial minority respondents displaying larger errors (Souleles, 2004). The average magnitude of error in households' estimates of the market value of their homes is 15%, and the average bias is an overestimate of 6%-8% on average (Bentez-Silva et al., 2010; Goodman and Ittner, 1992). Even without a systematic population-wide bias, relative optimists in a population may respond to an offer of debt-forgiveness in greater numbers.

Borrowers could be persistently overconfident in their ability to recover from a negative shock. For example, the newly unemployed expect an unemployment duration of 6.8

weeks on average rather than the 23.0 weeks they eventually experience on average (Spinnewijn, 2015). Overconfidence, or optimism in one's own ability, is distinct from unbiased error (mean-zero over time) at the borrower-level, which I interpret as general inaccuracy and categorize as a lack of financial sophistication. In addition to fixed positive errors, individuals often display unrealistically positive illusions or "wishful thinking" about the future in response to adverse conditions (Taylor and Armor, 1996). Positive illusions can be reconciled in an economic model as sacrificing an increased chance of disappointment in the future for a positive gain in outlook today (Brunnermeier and Parker, 2005; Mayraz, 2011). Excessive optimism in the face of adversity would only exacerbate over-repayment by financially distressed households in response to modification offers.

In untabulated analysis, I test for, and fail to find evidence consistent with a persistent overconfidence in ability—that is, I test if borrowers who have tried and failed in the past to make regular payments (i.e. they have made sporadic payments) are more likely to redefault. The recency of a borrower's last payment does not have incremental predictive power compared to contractual delinquency.

Of course, borrowers might not only repay their debts for financial reasons. Many of the results could be driven by moral concerns or social preferences such as stigma. However, morality concerns do not explain why many borrowers are tripped up by the non-monetary friction of completing, notarising, and sending paperwork to the correct address while remaining current on repayments. Morality concerns also need to be affected by the offer of forgiveness, for example they must take the slightly more specific form of reciprocity or guilt, as borrowers can make partial payments on their debt at any time in the absence of treatment. Lastly, while stigma is likely important factor for borrowers overall, the fact we are looking at an already defaulted population might select for lower subjective costs to default, such as stigma.

Models of time-inconsistency can predict that borrowers postpone a previously planned repayment when it comes time to make it, as debt repayment is an immediate cost with

longer-term benefits. Procrastination, overconfidence, or a lack of sophistication can explain surprisingly large failure rates at a paperwork task. If borrower preferences to repay vary over time, this can also contribute to failure rates. But time-inconsistency by itself cannot explain errors of commission such as getting an address on a letter wrong,²⁸ or making payments in the absence of the expected financial benefits a ruthless borrower would demand in the traditional framework.

Table 10 examines if default is related to variables likely to be correlated with the previously outlined psychologically realistic alternatives. Columns 1-2 of Table 10 estimate regressions of failing for any reason, and columns 3-4 examine the clearer ex-post mistake of not filing paperwork correctly after meeting the minimum repayment criteria. Table 10 uses the original (as-of origination) value of the property as a proxy for borrower income, as origination incomes are not widely unavailable. Income is correlated with financial sophistication (Campbell et al., 2011). Overconfidence has been found to positively correlate with male gender in other financial settings (Barber and Odean, 2001; Huang and Kisgen, 2013). Overconfidence has also been found negatively correlated with age (Bruine de Bruin et al., 2012). Table 10 therefore examines age and gender, interacting gender with an indicator for a co-borrower being on the loan to allow for an interaction with a co-borrower such as a spouse. In addition to these borrower fixed effects, Table 10 tests if historical servicer-borrower interactions (such as making payments when a servicer successfully contacts the borrower) are related to borrower response. Columns 2 and 4 control for all the fundamental variables used in Table 9, using dummy variables for CLTV ranges.

Table 10 presents evidence that borrowers most likely to redefault after attempting to modify—owing to any form of failure (columns 1-2), but paperwork failures especially (columns 3-4)—are likely to be lower income borrowers. A 1% increase in the original appraisal value of the property is associated with an estimated 0.07%-0.23% greater likelihood of avoiding redefault for any reason. This is statistically significant in both specifications

²⁸This has been anecdotally observed but I have not (yet) quantitatively tested the magnitude of this form of error.

examining the “clear” ex-post mistake (columns 3-4) and when examining any redefault without additional controls (column 1). Gender is statistically significant in one specification without additional financial controls (males are 15% more likely to fail an attempt), while in the other specification with additional controls, younger borrowers are more likely to fail (0.7% per year) with marginal statistical significance. In the absence of important unobservables that covary with these variables, these results are consistent with a lack of sophistication contributing to borrower failures.

I find that the primary explanation of “borrowers lack financial sophistication and do not understand their debts, the outcomes associated with default, nor do they act perfectly strategically in the absence of this knowledge” best fits the various results of the experiment. There are other instances in the literature of borrowers repaying their debts in the absence of positive expected financial payoffs. 42% of borrowers continued to repay their second mortgage after defaulting on the first mortgage ([Goodman et al., 2010](#); [Jagtiani and Lang, 2010](#)), and borrowers with worse original credit scores were more likely to do so. The first authors to document this puzzle suggested borrowers were acting strategically to maintain access to lines of credit and to delay reductions to credit scores. The experimental setting of this paper rules out any direct benefit to credit score, and the survey results argue against an interpretation that households are sophisticated in their understanding of capital structure. I instead suggest that many borrowers, especially the less financially sophisticated, follow simple heuristics and make mistakes. This is a similar explanation to the “behavioral cash-management” alternative suggested by [Lee et al. \(2012\)](#).

In light of the experiment’s results, key considerations when implementing a mortgage intervention as a policy response to the distress of ordinary borrowers are: some borrowers do not repay debts according to informed financial trade-offs, non-choice aspects of any intervention such as administrative tasks, and a likely selection bias for the unsophisticated as the objectively measured value of a contract offer goes down. Policy suggestions to

improve borrower welfare then are to screen borrowers on their behalf for intended benefits—as an average mistake of zero is not sufficient to warrant inaction—and to front-load or avoid operational frictions.

7 Conclusion

In this paper, I have presented novel experimental evidence on economic and non-economic factors affecting mortgage outcomes. I find that modifications offering debt forgiveness promote the repayment of debt by delinquent borrowers. However, many of these borrowers should not have responded to the offers if they were perfectly informed and ruthless. They frequently fail in their modification attempts, and on average repayment is missing the rewards we usually associate with mortgage repayment, such as keeping one’s home or improving one’s credit reputation.

This paper contributes two empirical insights. First, a material portion of ordinary households may not manage their default as standard models predict. Second, borrower deviations from “optimal” behavior are correlated with attributes typically associated with financial sophistication such as wealth and ex-ante credit-worthiness. This is similar to sub-optimal exercise of the other significant option embedded in a mortgage: that of prepayment, whose suboptimal exercise has been found to correlate with attributes such as income and credit score.

Lenders may know more than borrowers about the legal and credit details surrounding default. It is reasonable to expect that lenders may apply this knowledge in a more sophisticated manner than the average U.S. household. Borrowers may not make correct inferences based on the contracts they are offered. Testable implications of this view are that we should find en-masse offers of debt-forgiveness on other consumer debts and typical distressed U.S. households may “default better” when provided with independent, sophisticated assistance. We do, on both counts. Lenders broadly use debt-forgiveness,²⁹ and

²⁹While publicly available data is scant on “bilateral workout plans” (Wilshusen, 2011) employed in credit

recent evidence indicates that borrowers are more likely to make a clean break and default when provided with counseling (Collins and Schmeiser, 2013). Just because a lender offers debt forgiveness does not necessarily imply that it benefits the consumer.³⁰ Financially distressed U.S. households, as in other financial settings, may benefit from assistance in negotiating and evaluating their options.

card collections, a recent example of a mass settlement offer is provided in an enforcement action involving GE Capital. GE Capital offered 45-75% debt forgiveness to all credit card borrowers satisfying delinquency criteria (CFPB, 2014).

³⁰The DOJ described the national mortgage settlement, which implemented more than 200,000 modifications similar to those in this experiment, as “the largest consumer financial protection settlement in United States history.”

8 Tables and Figures

Figure 1 Diagram of Steps to Modification

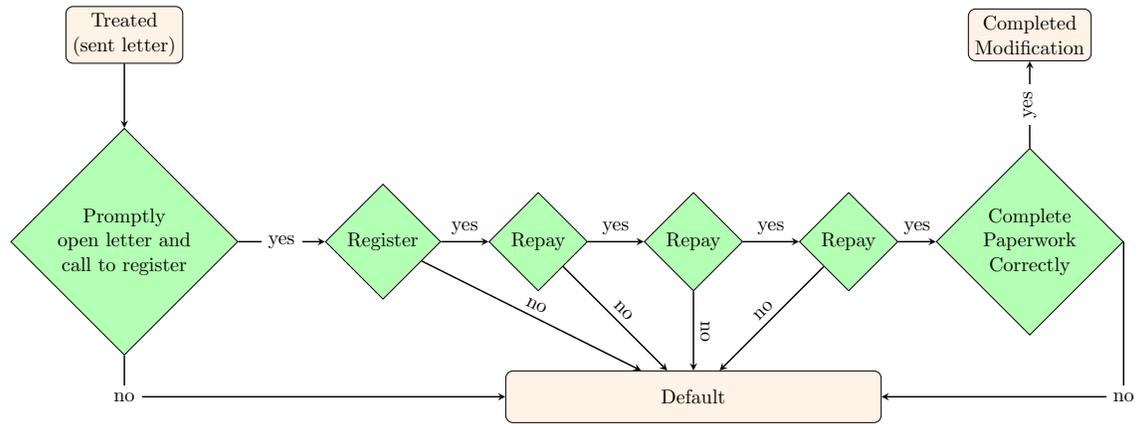
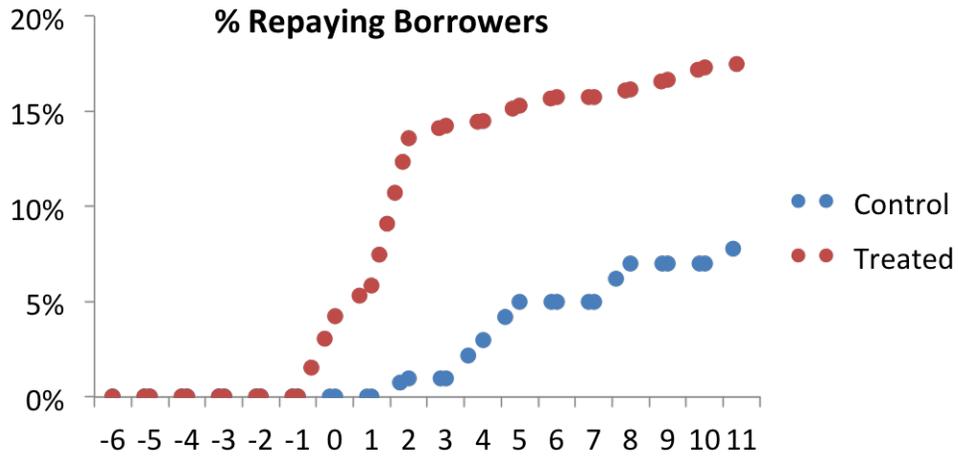
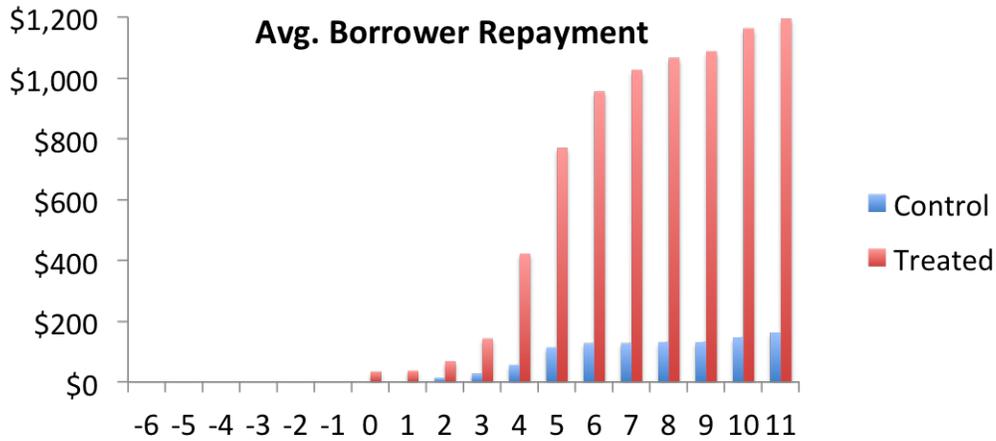


Figure 2 Illustration of Initial Borrower Response to Treatment

The x-axis variable for both graphs (“Months after Treatment”) equals zero in the calendar month in which offer letters were sent (on the 22nd of that month). 2 plots the average of “Any Repayment by Borrower” since the beginning of the time period shown, where the binary indicator variable equals 1 if a borrower makes at least one payment over that period, 0 otherwise. 2 plots the average of the cumulative dollars received by the lender over the time period shown. Average outcomes are calculated by treatment group: “Treated” refers to a letter being sent to borrowers.



2.a



2.b

Figure 3 Failures to Meet Repayment Criteria

Flows (arrows) from each node sum to 100%. Percentages presented conditional on treatment and registration by March 2011.

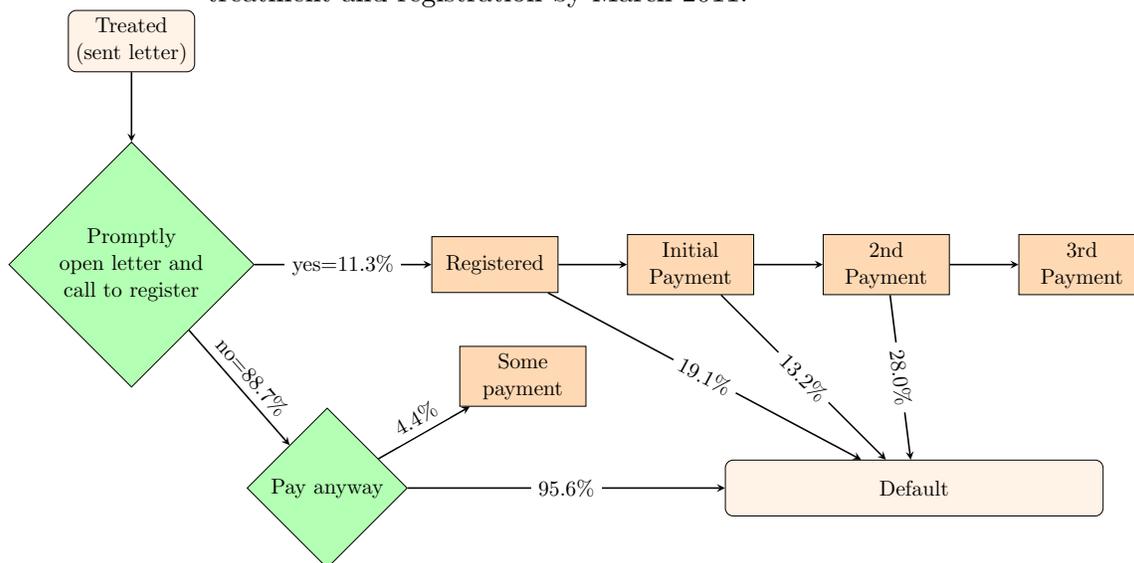


Figure 4 Failures to Re-perform and Modify, By Initial Repayment Response

Flows from each node sum to 100%. All figures conditional on treatment.

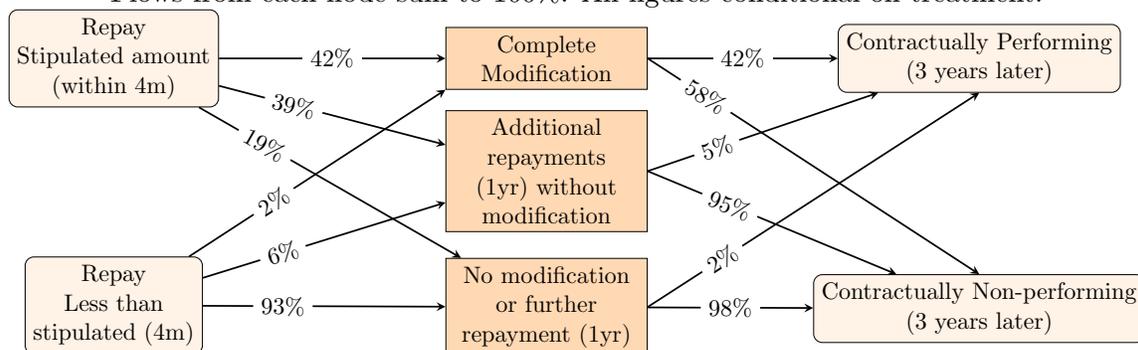


Figure 5 Modification Failure Rates by CLTV Offered through Modification

Y-axis plots failure rates, conditional on positive initial repayment response (within four months of treatment). X-axis plots the CLTV of the modified loan if modification was successful, censored at 5th and 95th percentiles. Lowess-smoothed graph, bandwidth= 0.8.

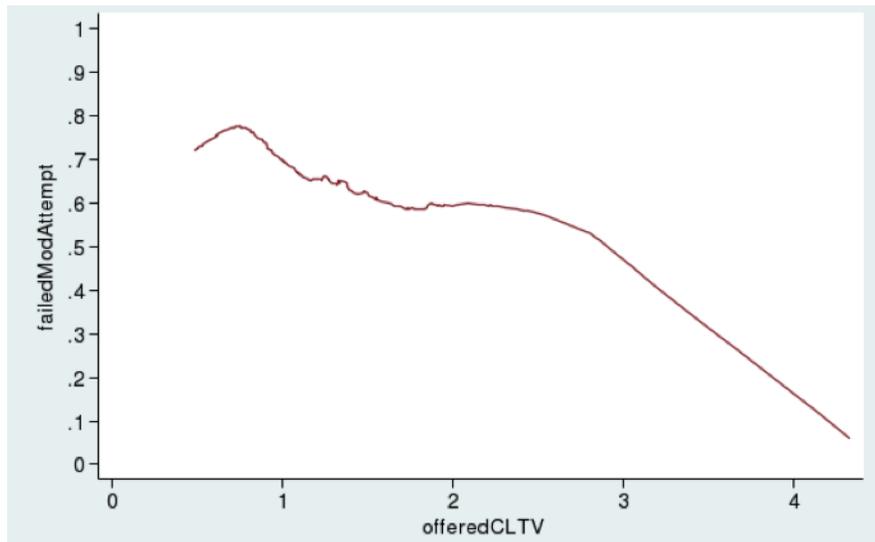


Table 1 Summary Statistics of Loan and Borrower Population

Characteristic	Count	Mean	SD	Min	Max	(treated - control)	t-stat
Unpaid Principal Balance (\$)	1,673	41,957.65	36,689.73	23.32	393,090.1	3,916.2	1.04
Monthly Payment (\$)	1,673	416.42	334.92	27.93	3,658.96	33.69	0.98
Interest Rate	1,673	0.11	0.03	0	0.25	0	0.47
Delinquency (months)	1,673	32	17	10	137	-0.5	-0.28
Age of loan (years)	1,673	6.19	2.88	3.5	26.63	0.28	0.08
$\mathbb{1}\{\text{Purchase Loan}\}$	1,673	0.76	0.43	0	1	-0.05	-1.15
Original Appraisal Value (\$)	1,673	233,328	184,204	9,153	2,368,714	25,769	1.69
Updated Loan-To-Value (1st lien only)	1673	1.64	1.22	0.03	12	-0.14	-1.13
Combined Loan-To-Value (CLTV)	1,673	1.99	1.5	0.04	13	-0.18	-1.15
$\mathbb{1}\{\text{Loan in non-recourse state}\}$	1,673	0.36	0.48	0	1	-0.03	-0.6
$\mathbb{1}\{\text{Male primary borrower}\}$	1,673	0.68	0.47	0	1	0.08	1.69
Age of primary borrower	1,673	48.5	10.15	27.27	95.08	0.7	0.67
1st lien balance (\$)	1,673	189,361	151,760	0	2,310,214	-21,721	-1.38
1st lien interest rate	1,100	0.074	0.015	0.01	0.128	0	0.37
$\mathbb{1}\{\text{1st lien adjustable rate}\}$	1,081	0.72	0.45	0	1	0.04	0.72
$\mathbb{1}\{\text{1st lien is Purchase Loan}\}$	1,170	0.75	0.43	0	1	-0.004	-0.1
1) $\mathbb{1}\{\text{Previously made promises}\}$	1,673	0.15	0.35	0	1	-0.06	-1.68
2) $\mathbb{1}\{\text{Failed a previous promise}\}$	1,673	0.13	0.34	0	1	-0.04	-1.25
3) $\mathbb{1}\{\text{Previously payment elastic to contact}\}$	1,673	0.06	0.24	0	1	0.03	1.1
4) $\mathbb{1}\{\text{Cheques (or similar) bounced and fees charged}\}$	1,673	0.17	0.38	0	1	0	-0.07

Notes: All dynamic values are presented as of the beginning of the experiment, representing the latest values available to the loan servicer prior to treatment. First lien information provided by Core Logic reporting (where search successful/property records available) as of the beginning of the experiment, first lien balances from loan servicer records where Core Logic data missing. Differences in 1st lien data availability between treated and control is statistically insignificant (t-stat of -0.91).

Table 2 Geographic Distribution of Mortgages

State	Count	% of Properties
California	237	14.7
Florida	222	13.3
Texas	163	9.7
Michigan	97	5.8
Ohio	76	4.5
Other (43 states)	878	47.5
Total	1673	100.00

Table 3 Immediate Effects of Debt Forgiveness Offers

Coefficients are presented from estimating regressions of initial borrower response to treatment. All regressions are estimated using least squares. The unit of observation is a given individual. The dependent variable is a binary indicator variable: “Incoming Call” indicates if at least one borrower-generated call is observed over a four month period subsequent to treatment, and “Payment” equals 1 if any repayment occurs over the same four month period, 0 otherwise. “Debt Forgiveness Offer” is a binary indicator variable that equals 1 if the individual received the treatment, 0 otherwise.

	(1) Incoming Call	(2) Payment
Debt Forgiveness Offer	0.10** (0.033)	0.12*** (0.013)
Constant	0.11*** (0.031)	0.010 (0.010)
N	1673	1673
R^2	0.0036	0.0076

Standard errors clustered by state in parenthesis
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 Immediate Effects of Debt Forgiveness Offers—Including Accounts which Narrowly Miss Selection for Potential Treatment

This table presents estimates of regressions of initial borrower response to treatment as specified in equations (2) and (3), including additional defaulted loans that were less than 10 months delinquent and hence narrowly missed selection criteria for selection into the experiment population. All regressions are estimated using least squares. The unit of observation is a single loan/individual. The dependent variable is a binary indicator variable: “Incoming Call” indicates if at least one borrower-generated call is observed over a four month period subsequent to treatment, “Payment” equals 1 if any repayment occurs over the same four month period, 0 otherwise. “Debt Forgiveness Offer” is a binary indicator variable that equals 1 if the individual received the treatment, 0 otherwise.

	(1)	(2)	(3)	(4)
	Incoming Call		Payment	
Debt Forgiveness Offer	0.064** (0.023)	0.11*** (0.030)	0.16*** (0.017)	0.12*** (0.021)
Linear Control for Months Delinquency		Y		Y
4th Order Polynomial Controls for Months Delinquency	Y		Y	
Controls for Other Loan Observables	Y	Y	Y	Y
Constant	0.17*** (0.046)	0.16** (0.048)	0.0062 (0.036)	0.033 (0.038)
N	2170	2170	2170	2170
R^2	0.018	0.024	0.039	0.047

Standard errors clustered by state in parenthesis
⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5 Longer-term Effects of Treatment on Borrower Performance

Coefficients are presented from estimating regressions of borrower responses to treatment, as specified in equation (1). All regressions are estimated using least squares. The unit of observation is a given individual. “Contractually Performing” is a binary indicator variable which equals 1 if a borrower is contractually performing at the end of the five year period, 0 otherwise. “Completed Modification” is a binary indicator variable which equals 1 if the borrower shows as having completed the debt-forgiveness modification, 0 otherwise. “Repayments (\$)” equals the dollar value of repayments over the 5 years following treatment. “Debt Forgiveness Offer” is a binary indicator variable that equals 1 if the individual received the treatment, 0 otherwise.

	(1) Completed Modification (1yr)	(2) Contractually Performing (5yr)	(3) \$ Repayments (5yr)
Debt Forgiveness Offer	0.050*** (0.004)	0.026+ (0.014)	1,198* (524)
Constant	0.000 (0.004)	0.020 (0.014)	1,583** (466)
N	1673	1673	1673
R^2	0.003	0.001	0.001

Standard errors clustered by state in parentheses

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6 Long-term Estimates of Treatment Effects on Borrower Credit Outcomes

This table estimates equations (1). The unit of observation is a given individual. FICO Score is the credit score recorded for the borrower three years after treatment; Bankruptcy filing is a dummy variable set to 1 if the borrower filed bankruptcy over three years, 0 otherwise; Foreclosure is a dummy variable set to 1 if any foreclosure activity is observed on the loan, 0 otherwise. Debt Forgiveness Offer is a binary indicator variable that equals 1 if the individual received the treatment, 0 otherwise. Controls for other loan observables include: interest rate, principal balance, payment amount. All regressions are estimated using least squares. Standard errors clustered by property state in parenthesis. $+p < 0.1$, $* p < 0.05$, $** p < 0.01$, $***p < 0.001$

	(1) Credit Score	(2) Bankruptcy	(3) Foreclosure
Debt Forgiveness Offer	-15.77** (5.09)	0.051 (0.040)	0.042 (0.049)
Constant	543.8*** (7.77)	0.18*** (0.045)	0.34*** (0.047)
N	1592	1673	1673
R^2	0.004	0.001	0.000

Table 7 Long-term Estimates of Treatment Effects on Borrower Credit Outcomes—Including Accounts which Narrowly Miss Selection for Potential Treatment

This table estimates equations (2) and (3). This table includes additional defaulted loans accounts that were less than 10 months delinquent and as a result missed the delinquency cut-off for selection into potential treatment. The unit of observation is a given individual. “FICO Score” is the credit score recorded for the borrower three years after treatment; “Bankruptcy filing” is a dummy variable set to 1 if the borrower filed bankruptcy over three years, 0 otherwise; “Foreclosure” is a dummy variable set to 1 if any foreclosure activity is observed on the loan, 0 otherwise. “Debt Forgiveness Offer” is a binary indicator variable that equals 1 if the individual received the treatment, 0 otherwise. Controls for other loan observables include: interest rate, principal balance, payment amount. Standard errors clustered by state in parenthesis. $+p < 0.1$, $* p < 0.05$, $** p < 0.01$, $***p < 0.001$

	(1)	(2)	(3)	(4)	(5)	(6)
	Credit Score		Bankruptcy		Foreclosure	
Offer	-8.6* (3.5)	-7.1+ (4.3)	0.043+ (0.023)	0.019 (0.032)	-0.012 (0.028)	-0.028 (0.038)
Linear Control for Months Delinquency		Y		Y		Y
4th Order Polynomial Controls for Months Delinquency	Y		Y		Y	
Controls for Other Loan Observables	Y	Y	Y	Y	Y	Y
Constant	526.3*** (7.52)	526.2*** (8.39)	0.21*** (0.045)	0.22*** (0.047)	0.28*** (0.050)	0.29*** (0.052)
N	2067	2067	2170	2170	2170	2170
R^2	0.025	0.027	0.018	0.019	0.024	0.024

Table 8 Heterogeneity in Estimated Benefits by CLTV and Delinquency

The unit of observation is a given individual. “FICO Score” is the credit score recorded for the borrower three years after treatment; “Bankruptcy filing” is a dummy variable set to 1 if the borrower filed bankruptcy over three years, 0 otherwise; “Foreclosure” is a dummy variable set to 1 if any foreclosure proceedings (whether new or continuing) are observed, 0 otherwise; “Debt Forgiveness Offer” is a binary indicator variable that equals 1 if the individual received treatment, 0 otherwise. Standard errors clustered by state in parenthesis. $+p < 0.1$, $* p < 0.05$, $** p < 0.01$, $***p < 0.001$

	FICO Score	Bankruptcy	Foreclosure
Debt Forgiveness Offer (T)	-16.24*** (5.96)	0.064 (0.058)	0.079 (0.034)
$\mathbb{1}\{\text{Less than 125\% CLTV and less than 2 years delinquent}\}$	-5.28 (15.32)	0.080 (0.175)	0.182 (0.158)
$T * \mathbb{1}\{\text{Less than 125\% CLTV and less than 2 years delinquent}\}$	3.50 (15.30)	-0.110 (0.179)	-0.314+ (0.180)
N	1592	1673	1673
R^2	0.004	0.002	0.008

Table 9 Variation in Response by Pre-Treatment Fundamental Variables

This table presents coefficients from estimating regressions of borrower credit outcomes over the 12 months following treatment. The unit of observation is a given borrower/loan pair. “Payment” is a dummy variable which equals 1 if a borrower made any payment within 4 months of offers being sent, 0 otherwise. “Completed Modification Attempt” is a dummy variable which equals 1 if a modification was completed in the first year, 0 otherwise. Columns 3 and 4 present results conditional on treatment and “Payment” equaling 1. Columns 2 and 4 use four indicator variables for each quartile of “CLTV”. CLTV is the outstanding balance of both first and second liens on the property, divided by the latest updated property value; “Monthly Payment” is the contractually scheduled monthly payment in \$; “Previous Foreclosure Notice” equals 1 if a foreclosure notice was received on the loan the previous 2 years; “Contractual Delinquency” is the delinquency of the loan in months; “Non-recourse state” equals 1 if the state in which the mortgage was written does not allow pursuit of the borrower after a foreclosure is complete, 0 otherwise; “Refinance loan” refers to the purpose of the loan, if it was used to refinance a previous loan, then the deficiency is pursuable, even in an non-recourse state. “BK Homestead Exemption” equals 1 if the state has an unmarried exemption for a homestead of greater than \$100,000. Standard errors clustered by state in parenthesis. $+p < 0.1$, $*p < 0.05$, $**p < 0.01$, $***p < 0.001$

	(1)	(2)	(3)	(4)
	Payment		Completed Modification	
Offer (T)	0.58*** (0.13)	0.58*** (0.16)		
CLTV	-0.013 (0.010)		0.069* (0.034)	
T*CLTV	-0.0037 (0.014)			
Ln(Payment)	0.029 (0.022)	0.035 (0.024)	0.059 (0.052)	0.044 (0.048)
T*Ln(Payment)	-0.077** (0.028)	-0.077* (0.034)		
Previous Foreclosure Notice	-0.011 (0.012)	-0.010 (0.012)	0.071 (0.11)	0.085 (0.099)
T*Previous FC	-0.061* (0.024)	-0.059* (0.022)		
Delinquency	0.00018 (0.00019)	0.000027 (0.00021)	-0.00025 (0.0022)	-0.00015 (0.0023)
T*Delinquency	-0.0024*** (0.00051)	-0.0024*** (0.00058)		
Interest Rate	-0.22 (0.15)	-0.21 (0.13)	0.11 (1.04)	0.58 (1.13)

T*Interest Rate	0.78+	0.73+		
	(0.41)	(0.39)		
$\mathbb{1}\{\text{non-recourse}\}$	-0.023	-0.033	-0.054	-0.019
	(0.015)	(0.021)	(0.090)	(0.11)
T* $\mathbb{1}\{\text{non-recourse}\}$	0.028	0.034		
	(0.025)	(0.032)		
$\mathbb{1}\{\text{Refinance}\}*\mathbb{1}\{\text{non-recourse}\}$	-0.0062	0.0022	0.20	0.15
	(0.0089)	(0.017)	(0.17)	(0.18)
T* $\mathbb{1}\{\text{Refinance}\}*\mathbb{1}\{\text{non-recourse}\}$	0.052	0.049		
	(0.034)	(0.031)		
$\mathbb{1}\{\text{BK Homestead exemption}\}$	0.023	0.024+	0.088	0.095
	(0.015)	(0.014)	(0.066)	(0.069)
T* $\mathbb{1}\{\text{BK Homestead exemption}\}$	-0.022	-0.023		
	(0.027)	(0.027)		
CLTV quartile controls		Y		Y
Constant	-0.11	-0.15	-0.15	-0.16
	(0.095)	(0.12)	(0.33)	(0.33)
N	1673	1673	206	206
R ²	0.044	0.045	0.077	0.087

Table 10 Variation in Response by Borrower Characteristics

This table presents coefficients from estimating regressions of borrower outcomes over the 12 months following treatment, conditional on making any payment in response to treatment within 4 months. The unit of observation is a given borrower/loan pair. “Completed Modification Attempt” is a dummy variable which equals 1 if a modification was completed in the first year, 0 otherwise. “Avoided Paperwork Failure” is a dummy variable which equals 1 if stipulated payment criteria were met and a borrower completed modification, 0 otherwise. The covariates “Male” and “Age” refer to the gender and age of the primary borrower on the loan. “Co-borrower” indicates if there is a co-signer on the loan. “Previous Promises” is a dummy variable which equals 1 if the borrower is recorded as having made a promise to pay the servicer in the last two years, 0 otherwise. “Previously payment-responsive to contact” is a dummy variable which equals 1 if a borrower made a payment in a month following a call made by the servicer after having fallen seriously delinquent. “Previously broken promises” is a dummy variable which equals 1 if previous promises to pay were left unfulfilled, 0 otherwise. “Previously bounced cheques” is a dummy variable which equals 1 if “insufficient funds” fees are recorded as having been charged on the account in its entire lifetime, these fees are charged when scheduled debits fail. The controls used in columns 2,4,6 are all ex-ante loan characteristics from column 2 of Table 9. Standard errors clustered by state in parenthesis. $+p < 0.1$, $*p < 0.05$, $**p < 0.01$, $***p < 0.001$

	(1)	(2)	(3)	(4)
	Completed Modification		Avoided Paperwork Mistake	
$\mathbb{1}\{\text{Male}\}$	-0.15* (0.06)	-0.12 (0.07)	-0.065 (0.10)	-0.068 (0.11)
$\mathbb{1}\{\text{co-borrower}\}$	0.0031 (0.19)	0.073 (0.20)	0.21 (0.18)	0.23 (0.19)
$\mathbb{1}\{\text{Male}\}*\mathbb{1}\{\text{co-borrower}\}$	0.071 (0.17)	0.02 (0.20)	-0.16 (0.17)	-0.13 (0.18)
Age	0.0053 (0.00)	0.0067+ (0.00)	0.0058 (0.00)	0.0039 (0.00)
Ln(Original Appraisal)	0.14** (0.04)	0.072 (0.07)	0.084* (0.04)	0.23** (0.07)
$\mathbb{1}\{\text{Previously broken promises}\}$	0.041 (0.18)	0.014 (0.20)	0.0064 (0.28)	-0.07 (0.34)
$\mathbb{1}\{\text{Previous promises}\}$	0.04 (0.17)	0.08 (0.20)	0.018 (0.26)	0.11 (0.32)
$\mathbb{1}\{\text{Previously bounced cheques}\}$	0.1 (0.09)	0.14 (0.10)	0.13 (0.08)	0.19* (0.09)
$\mathbb{1}\{\text{Previously payment responsive to servicer contact}\}$	0.053 (0.10)	0.078 (0.10)	-0.1 (0.10)	0.0052 (0.10)
All Variables of Table 9		Y		Y

Constant	-1.61** (0.52)	-1.16 (0.78)	-0.76 (0.46)	-1.38+ (0.71)
N	206	206	206	206
R ²	0.071	0.137	0.046	0.1

Table 11 Empirical Findings and Potential Explanations of Borrower Behavior

Finding	Standard Model	Time-inconsistency	Social-preferences/Morality	Lack of Financial Sophistication	Overconfidence in Ability
High failure rates	Large benefit to repayment, $E[Benefit] > 0$	Preferences change	Overvalue benefits owing to morals/stigma	Overestimate costs to default; Forecast error	Overestimate repayment ability
Lack of ex-ante financial benefit for most responding borrowers	×	Moral obligation; Reciprocity	Misestimated benefits; overall debt-repayment heuristic		
Failures to complete paperwork task	×	Procrastination	Misestimate cost; navete w.r.t. future behavior		Overestimate ability to complete task
Many continue to pay after third payment then fail paperwork task	×	Procrastination	Lack of learning; unsophisticated beliefs		Persistent overestimates of ability
Borrowers do not stick to required timing, nevertheless repay	Negotiating strategy change	Preferences change	Borrowers experience difficulties/cognitive limitations		

I Sample Modification Offer

<<Date>>

<<Account ID>>

<<Name>>

<<Address>>

<<City>>, <<State>>, <<Zip>>

**This Holiday Season, Take Advantage of [REDACTED]
New Year Modification**

Dear <<Borrower Name>>:

Happy Holidays! In this season of giving, [REDACTED] is offering a special opportunity for a fresh start on your home mortgage loan with a New Year Modification.

[REDACTED] New Year Modification will:

- (1) Reduce your monthly payment to <<New P&I>>
- (2) Forgive your past arrearages of <<Amount Forgiven>>
- (3) Permanently reduce your principal balance to <<New UPB>>

Simply make a mortgage payment of <<New P&I>> for January, February and March at any time before the close of that month and you will automatically qualify for the New Year Modification!

To participate in the New Year Modification, you first need to:

- (1) Confirm your participation by speaking with an Agent at the number below by <<Expiration Date>> and make sure to mention the "New Year" program;
- (2) Make the above stated mortgage payment for January, February and March at any time before the close of that month; and
- (3) Execute a loan modification agreement (provided after the last payment's receipt).

[REDACTED] will also waive late fees during this period as long as you make each monthly mortgage payment by the end of that month.

Should you not take advantage of this offer or fail to comply with the above requirements, all of the terms and conditions of your current loan will continue to be in force. We are not obligated to renew this offer. For more information and to confirm your participation, call us at [REDACTED] no later than <<Expiration Date>>.

Sincerely,

[REDACTED]
Executive Vice President and
Director Servicing Division

[REDACTED] servicing is provided by [REDACTED]⁴⁷

FEDERAL LAW REQUIRES US TO INFORM YOU THAT THIS IS AN ATTEMPT TO COLLECT A DEBT AND ANY INFORMATION OBTAINED WILL BE USED FOR THAT PURPOSE

II Illustrative Online Survey

All surveys conducted using Google surveys. Screening questions noted for each and filtering answers shown in bold. Answer order was randomized. Those 24 or younger were excluded from Survey 1, and those 34 or younger were excluded from Survey 2 in order to meet minimum response rates.

II.1 Survey 1

Q1 (Screening question, filter answer in bold): Which of the following best describes you?

- I rent
- I own where I live and have one mortgage
- **I have more than one mortgage**

Q2 A Second Lien is:

junior to a first lien *45.7%*

senior to a first lien *22.9%* ← *correct answer*

I am less than 80% sure *30.0%*

other (1 respondent: "I own two properties") *1.4%*

II.2 Survey 2

Q1 (Screening question, filter answers in bold): Have you ever bought a home?

- I never have
- **I have/had one mortgage**

- **I have/had two mortgages on the same home**
- Something else

20% of initial respondents have/had second mortgages in the filtering question above. All questions below allowed for multiple answers, including a no answer option. Three single-answer questions are unreported - Q8: 27.28% respond they were delinquent on loan payments previously. Q3: median estimated home value was between 200,000–300,000. Q2: 20% answer that a single payment after a year's delinquency improves credit score.

Q7 What do you think realistically happens before someone falls behind on mortgage payments?

- Max out all their credit cards *39%*
- End up in default without planning to *37%*
- Get expert financial advice *24%*
- Talk to a lawyer *19%*
- Figure out the value of their home *17%*
- Study the loan documents *9%*

Q6 Imagine someone was not paying on a mortgage. What would help to get them to start paying again?

- Monthly payment is made more affordable *65%*
- Their home appreciates (goes up in value) *14%*
- The legal situation becomes more severe *14%*
- Credit score is likely to improve *9%*

- The laws regarding bankruptcy change 9%

Q5 What usually happens when someone stops paying on an unsecured debt (such as a credit card)

- Credit score goes down 59%
- Annoying phone calls and letters 47%
- Legal stuff (they eventually get sued) 44%

Q4 What happens when someone stops paying on a second mortgage if up-to-date on repaying the first mortgage on the same property?

- Credit score goes down 35%
- Foreclosure (lose property) 35%
- They eventually get sued by lender 28%
- Annoying phone calls and letters 16%
- Depends on market value of property 15% (*only 2nd mortgage borrower re-sponses:16.7%*)

Survey 1 had 70 responses, Survey 2 had 100 respondents.

III A Simple Model of Borrower Response

I present a simplified model of borrower choice to reconcile repayment attempts, subsequent modification rates, and the negative correlation observed between leverage (debt/property value) and borrower redefault. The negative correlation observed between leverage and modification failure is, on the surface, an unusual relationship, as we typically observe the opposite correlation between CLTV and default on mortgage loans: higher CLTV loans redefault at higher rates.³¹

I impose an option-like payoff profile depending on the CLTV offered by the modification. Estimation recovers the parameters to the payoff profile. The key identifying assumption is that the heterogeneity in borrowers' current ability to repay and complete a modification is orthogonal to CLTV. I then estimate the model using Simulated Method of Moments (SMM) with key cross-sectional moments in the data. I find selection into and subsequent failure out of the program can be explained with reasonable parameter values.

III.1 Setup

There are two dates, $t = 0, 1$. Borrowers receive a modification offer at $t = 0$ and decide whether to accept (attempt to repay) or disregard the offer (remain in default). An upfront cost of δ , which I assume any borrower can pay,³² is paid at $t = 0$ if the agent chooses 'accept.' At $t = 1$, successful modification depends on some borrower ability π_i . A logit of borrower ability to complete the modification is drawn from a normal distribution, i.i.d., and ability is independent of the other borrower attribute, their CLTV. "Ability" in this simple model represents any factor relevant to modification such as income, memory, and

³¹To the best of my knowledge previous studies of modification redefaults which also found this relationship only examine redefaults of modifications *after* the loans are legally completed.

³²The timing of the introduction of the campaign at the very end of December was to coincide with households receiving the Earned Income Tax Credit (EITC) through their tax returns, which can be as high as \$6,000 for families.

the ability to complete and return paperwork correctly.

Individuals associate a net benefit with completing the modification, B , at time $t = 1$. The payoff B_i represents the payoff associated with a successful modification by borrower i relative to continued default. I allow for a flexible payoff structure, as if borrowers have some call option dependent on their equity position in the property. A borrower's subjective estimate of B_i is defined as a function of his CLTV position:

$$\hat{B}_i(CLTV_i) = a + \max(0, c + m * CLTV_i) \quad (4)$$

As argued previously, on an ex-ante basis for high CLTV second mortgages at this time, the relative payoff (under a “ruthless” standard model) is typically non-positive. Hence I refer to this model as allowing for mistaken perceptions of payoffs by allowing borrowers to hold values for a materially different from zero. For simplicity, I ignore discounting over the trial program's duration, assume narrow-framing of the problem, and linear utility in payoffs. In this version of the model I assume, unrealistically, that borrowers know their ability to complete the modification (π_i) with perfect accuracy. Later, I relax this constraint and empirically compare this model against an unrestricted model allowing for mistaken beliefs. With probability $(1 - \lambda)$ borrowers open the letter to consider the offer. Per-period utility flows u_t are defined as follows with the choice variable x :

$$x = 1 \text{ if the borrower participates, } 0 \text{ otherwise}$$

$$\tilde{x} = x \text{ with probability } \lambda, 0 \text{ otherwise}$$

$$u_0^i(\tilde{x}) = -\tilde{x} * \delta$$

$$u_1^i(\tilde{x}) = \tilde{x}_i * \hat{B}_i \text{ with probability } \pi_i, 0 \text{ otherwise}$$

This gives the following objective function which borrowers maximize at $t = 0$:

$$\max_{x \in \{0,1\}} U_0^i(\tilde{x}) = E^i \left[\sum_{t \in \{0,1\}} u_t^i(\tilde{x}) \right] \quad (5)$$

At $t = 0$, agent i accepts the modification offer if the benefits outweigh the costs, giving the Participation Constraint:

$$-\delta + \pi_i * B_i > 0 \tag{6}$$

III.2 Estimation

I use Simulated Method of Moments (SMM) to estimate the model by fitting behavioral “attempt” and “complete” moments of treated borrowers in the data. With the assumption that the ability to complete a modification is orthogonal to CLTV, variation in borrower leverage informs us of the value borrowers place on modification outcomes under this model. I use cross-sectional means of “attempt” and “complete” for each quartile of CLTV to separately identify beliefs about the benefits versus ability to modify, the mean and standard deviation (μ_π, σ_π) parameters of the logit-normal distribution of probability to complete the modification. The a, c, m parameters determine the relative benefit $B_i(CLTV_i)$ which borrowers place on successful debt forgiveness, as approximated by equation (4).

In addition to the estimated parameters, I take $\lambda=0.7$ from survey responses in [Custers \(2015\)](#), assuming 30% of borrowers fail to open the letter and consider the modification offer in time. I calibrate a number of other parameters from the data: the up-front cost of the modification, δ , is set to match the average three months of payments in the data, and I fit a lognormal distribution of CLTV to the observed distribution of CLTVs in the data, drawing simulated agents from this distribution.

Table 12 shows the best-fitting parameters and the simulated moments of the data, and compares these to actual moments in the data. The simulated moments are a close fit. The simulated completion rate of the best and worst CLTV quartiles are 25% and 47%, compare to actual completion rates in the data of 16% and 51% respectively. The positive relationship between CLTV and completion rates is mimicked in the simulated

data, with a slightly less positive gradient. As found in the data, at high CLTVs, only the most able borrowers respond (in the model, this must be the case in order for them to participate), whereas at lower CLTVs we are more likely to see failures to modify as lower-ability borrowers find it worthwhile to respond. Estimating a linear regression of modification success on CLTV across simulations gives a 0.068 regression coefficient, which is a similar magnitude to the coefficient of 0.073 estimated in the actual data (Table 8).

Estimated parameter values imply a mean probability to completing a modification of approximately 25% amongst borrowers, and a minimum net benefit value (a) of approximately \$2200. Under this model even borrowers with the highest CLTVs associate an estimated +\$2200 value to successful modification relative to default. Combining this with the estimated intercept and slope (approximately \$11,000 and -\$4,000 respectively), implies that a borrower who is offered a new CLTV of 100% associates successful modification with an approximately \$9,500 value, or a little less than half the offered average dollar amount of debt forgiveness in the experiment, which appears reasonable as a first-order approximation for debt in general or heuristic.

I compare the fit of this model against an alternative specification which introduces heterogeneity and allows for imperfect private information about the ability to repay. In this “error in ability beliefs” model, the parameter for the minimum payoff, a , is constrained to zero and now two parameters μ_e and σ_e , represent Gaussian noise in borrower beliefs around their true ability and are no longer constrained to zero. This specification leads to a selection for the relatively overconfident in modification attempts, exacerbating failure rates. The fit worsens under this “error in ability beliefs” alternative—the error (criterion function) more than doubles—and the model is formally rejected under the nested test of the fully unrestricted model. The “mistaken payoffs” model, which only increases the error in fit by a small amount, is not rejected by the unrestricted model.

Table 12 SMM Estimated Parameter Values and Moments

This table shows estimated parameter values (Panel A) and moments (both behavior and testing) from the data and the estimated model (Panel B). Estimation is performed by simulated method of moments using Matlab’s `fminsearch` routine with 10000 simulated agents and 20 simulations. A two step procedure is used for estimating the efficient weighting matrix. In the Mistaken Payoffs model, a constant minimum benefit to modification, a , is allowed to vary whereas in the benchmark model this is constrained to 0. In the Error in Ability model, borrowers no longer have perfect information on their ability to complete the modification, and a logit of their belief in their ability (π) is perturbed by a draw from a normal distribution (μ_e, σ_e) .

Panel A: Estimated Parameter Values

	Mistaken Payoffs		Error In Ability Beliefs	
	Mean	Std Err	Mean	Std Err
$a(\$)$	2,165	-843		
$c(\$)$	11,204	-6,918	7,755	-7,058
$m(\frac{\$}{CLTV})$	-3,921	-2,496	-1,965	-2,499
μ_π	-4.47	-0.88	-4.96	-7.16
σ_π	2.49	-0.62	2.95	-5.32
μ_e			0.47	-2.55
σ_e			0.43	-2.73

Panel B: Moments

CLTV/Equity	Moments in Data		Mistaken Payoffs		Error in Ability Beliefs	
	Try	Succeed	Try	Succeed	Try	Succeed
Quartile 1 (Best)	0.179	0.028	0.175	0.038	0.179	0.047
Quartile 2	0.157	0.046	0.155	0.037	0.167	0.047
Quartile 3	0.12	0.041	0.134	0.037	0.146	0.047
Quartile 4 (Worst)	0.068	0.035	0.070	0.028	0.06	0.024

Error criterion function is 33.2 for “Mistaken payoffs,” 65.5 for “Error in ability,” and 27.6 for the (unshown) unrestricted specification.

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