Mortgage Servicing and Household Financial Distress

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December 24, 2022

Abstract

Debt servicers directly interact with household borrowers, make key decisions about creditor leniency, and have been utilized to help alleviate financial distress by regulators during the 2008 financial crisis and the COVID-19 pandemic. However, servicers often have misaligned incentives. Using the 2013 introduction of mortgage servicing regulations by the Consumer Financial Protection Bureau (CFPB), we study whether requiring servicers to communicate with borrowers about foreclosure avoidance and to wait a minimum of 120 days before foreclosure filing improves consumer outcomes. We find that servicing regulations significantly decrease foreclosure filing and increase the probability that a loan is current. Treated borrowers have higher credit scores and utilize more credit. We show that servicer-driven, rather than household-driven, shifts in loan performance allow households to spend more during times of financial distress. Our results imply that servicer regulation has the potential to alleviate debt burdens and facilitate consumption in both crisis and non-crisis environments.

Keywords: Household finance, Debt relief, Mortgage regulation, Law and economics

JEL Codes: D00, D14, D18, G00, G23, G38, G51, K00, K22

*Corresponding email: mpadi@berkeley.edu. Padi acknowledges financial support for this project from the Washington Center for Equitable Growth and from the National Science Foundation through a Social, Behavioral, and Economic Sciences grant. The views expressed are those of the authors and do not necessarily reflect those of the Consumer Financial Protection Bureau or the United States. Many thanks to Abhay Aneja, Bobby Bartlett, Salil Gadgil, and participants in the NYU/Penn Law Empirical Contracts Workshop as well as the American Law and Economics Association Annual Meeting for helpful comments.

1 Introduction

Debt servicers interact directly with borrowers and make key decisions about loan performance, including forbearance, modification, and repossession. Servicers' key role in providing debt relief has been utilized by policymakers during financial crises, including both the 2008 recession (Piskorski and Seru (2021)) and the 2020 COVID-19 pandemic (Cherry et al. (2021)). Even during non-crisis times, however, servicers regularly provide discretionary debt relief to borrowers (Piskorski et al. (2010)). Indeed, differential behavior by debt servicers towards borrowers from disadvantaged backgrounds may be a significant contributor to social inequality (Kermani and Wong (2021), Padi (2021), An et al. (2022)). Servicers also impact mortgage holders and investors whose returns are lower when repossessions are too aggressive (Aiello (2021)). Little evidence exists about the drivers of private debt relief, and its role in improving loan performance and the household's balance sheet.

This project fills the gap by studying the effect of mortgage servicing requirements in 2013 by the Consumer Financial Protection Bureau, which gave servicers the incentive to offer private debt relief. Introduced after the 2008 financial crisis, the mortgage servicing rule required servicers to delay foreclosure filings and to communicate with borrowers about foreclosure avoidance. Moreover, servicers were required to attempt to establish early and continuous live contact with delinquent borrowers. Unlike the mortgage forbearance introduced during the COVID-19 pandemic, there was no requirement that servicers avoid foreclosure. Servicers could comply by simply delaying foreclosure, or could communicate with borrowers proactively to offer modifications, forbearance, or help borrowers cure their default. Although the second approach is more costly (Bandyopadhyay (2022)), there are significant benefits. Foreclosures have been associated with worsened physical health (Currie and Tekin (2015)), lower neighborhood house prices(Anenberg and Kung (2014)), and higher crime rates (Ellen et al. (2013)). Moreover, foreclosure can have devastating pecuniary impacts on households (Diamond et al. (2020)).

First, we document the significant differences between distressed mortgage borrowers who enter the foreclosure process and those who cure and become current on their loan. The patterns show that household finances of borrowers who ultimately face foreclosure begin to differ from those of borrowers who become current well before default, meaning pre-existing shocks such as job loss

are primary drivers of loan performance. Mortgage servicers can intervene in borrower outcomes only after delinquency, because that is when distress is observable. Therefore, simply comparing cured and foreclosed loans will not be informative for policymakers considering mechanisms for foreclosure avoidance. In theory, foreclosure avoidance could help individuals and communities avoid the negative consequences of foreclosure, and can provide borrowers added liquidity for short term consumption or investment in durables. On the other hand, foreclosure avoidance policy could have no impact, since it cannot target the underlying drivers of financial distress.

To identify the causal effect of foreclosure avoidance policies, we study the effect of the CFPB mortgage servicing rule. The identification strategy relies on variation in the application of the CFPB rule for mortgages owned or serviced by the government sponsored entities (GSEs). Since 2008, the GSEs have been run by the Federal Housing Finance Authority under conservatorship, which established guidelines in 2011 for servicers that largely mirror the later CFPB regulation. Therefore, GSE mortgages were already subject to the "treatment" generated by CFPB regulations, leaving only non-GSE loans to be treated in 2013. Since contemporaneous regulations targeted originations (Defusco et al. (2020)), we limit the sample to mortgages that were originated prior to the crisis (2000-2006), following their performance until 2018. We compare GSE to non-GSE loan performance before and after the 2013 regulation using both a linear probability model and a discrete time duration model to estimate the impact of regulation on foreclosure and loan modifications.

Results show that servicing regulations significantly improved loan performance. Primarily, the rule caused a significant and persistent drop in foreclosure rates. Though the rules encourage servicers to process loan modifications more quickly, we do not see an increase fraction of loans in loss mitigation. Instead, the rate of loan modifications decreases, along with the rate of "dual tracked" mortgages that are in the foreclosure process while simultaneously being considered for a loan modification. These shifts in performance resulted in a large increase in the fraction of mortgages considered "current" by creditors, meaning that borrowers were able to cure. Ultimately, the CFPB rule decreases the number of foreclosure sales.

Servicing effects spillover onto other credit lines as well. Treatment causes an increase in credit score, higher propensity to take on auto or student loan debt, and higher credit limits. Examining

heterogeneous impacts across the population, we find that borrowers with the lowest credit scores receive disproportionately high benefits from this regulation. Moreover, the effects seem to be driven by communication requirements as well as foreclosure delay.

We then isolate the impact of the servicer-driven decrease in foreclosure filing on credit outcomes. Using the predicted probability from the duration model, we create an instrument for foreclosure filing that is uncorrelated with unobservable borrower characteristics and is driven only by regulatory changes. We regress credit outcomes on observed foreclosure filing, instrumenting with predicted foreclosure, and interpret the results as the causal impact of servicer-driven foreclosure decisions. Results show that foreclosure lowers auto expenditures and student loan balances. There is no causal effect of foreclosure filing on credit scores and bankruptcy filings, suggesting that underlying drivers of financial distress such as job loss and death are still of first order importance. The results suggest that avoiding foreclosure filing due to servicer regulation facilitates consumption and provides targeted relief to distressed borrowers. The results suggest that COVID-19 forbearance programs not only prevented the negative effects of foreclosure for households and communities - they also encouraged households to take on thousands of dollars of additional debt to finance auto purchases and education.

This paper contributes to several strands of literature. We quantify the impact of servicer regulations on indebted households, following previous work on modification and refinancing programs (Piskorski et al. (2010), Agarwal et al. (2015), Ganong and Noel (2020), Abel and Fuster (2021)). The nature of the regulatory intervention is different here. CFPB rules were less costly than modification and refinancing programs that began during the 2008 crisis. We also aim to assess the causal impact of foreclosure, though the mortgage servicing regulation most directly shifts foreclosure filing rather than sale. Our results are comparable with the causal effect of foreclosures as assessed by Diamond et al. (2020) for homeowners, landlords and tenants. We also show some similar effects to the impact of eviction on renters demonstrated by Collinson et al. (2022).

We shed new light on the COVID-19 forbearance policies instituted in 2020 by studying a related policy instituted in *non-crisis* times. In comparison, Cherry et al. (2021), Golding et al. (2021), Kim et al. (2021), Shi (2021) and Bandyopadhyay (2022) demonstrate how forbearance policy acted as an

essential source of emergency liquidity during crisis times, albeit with heterogeneous distributional impacts. Finally, this paper relates to micro level research in finance on mortgage servicing rights during non-crisis times (Mayock and Shi (2019), Lin et al. (2006), Sandler (2021), Aiello (2021)). Of these, the most similar piece is Sandler (2021), who studies the same servicing intervention. Our results largely agree with Sandler's results, though the identification strategy in this paper depends more heavily on comparing treated non-GSE loans to GSE loans. Our contribution to the literature is in documenting servicers' response to regulation, and using that response to study the causal effects of foreclosure filing on distressed borrowers.

2 Data and Empirical Strategy

Our analysis utilizes CRISM data, which includes loan level McDash mortgage performance data, collected from large servicers, merged with a panel of credit records from Equifax. To study the effect of servicer regulation on foreclosure avoidance and subsequent impacts on credit outcomes, we restrict to a sample of loans where origination characteristics would be unaffected by regulation. First, we limit our data to loans that were originated in advance of the financial crisis, at which time post-crisis servicer regulations were not widely contemplated or expected. This restriction limits any anticipation effects that could cause differential selection into treated loans. Second, we limit our sample to 30 year, fixed rate mortgages. This limitation excludes loans with high risk features such as balloons, interest only loans and negative amortization that were restricted around the 2008 crisis by state and federal rules. Adjustable rate mortgages (ARMs) were excluded because a contemporaneous CFPB rule was introduced in 2013 that required disclosures to be sent to borrowers when ARMs were reset. Third, all our analyses include controls for state, origination year, interest rate, credit score at origination, and total loan amount. Our results can therefore be interpreted as the impact of servicing regulations on performance and credit outcomes, holding fixed origination characteristics.

The final analysis sample includes more than 249 million observations, at the loan-month level. There are approximately 8.1 million loans in the data, which includes every month in which the mortgage loan was active, as well as six months before and after the loan was originated or exited the

sample. Loans are originated between 2000 and 2007 and performance data runs from 2010-2018.

The size of the data makes estimation on the full sample impossible. To run our analysis, we split the sample into 200 random subsamples and perform the analysis on each sample separately. We then report the mean of the resulting distribution as the point estimate, and the 90th or 95th percentile interval of the empirical distribution of estimates as the confidence interval. All our specifications are reported with the full distribution of results across the 200 samples.

The empirical strategy has three stages of analysis. First, we report patterns in the raw data of financial distress. These patterns show evidence of selection into foreclosure, conditional on default, that begin early in the life of a loan. Then, we study the causal impact of the 2013 regulation on loan performance and credit outcomes. The primary comparison is a difference-in-differences, comparing loan performance before and after 2013, for GSE and non-GSE loans. We report these results in two ways. First, we show event study graphs reporting the difference-in-differences effect each quarter in the 12 quarters before and after the rule was announced in January 2013. The event study shows pre-trends and detects trend breaks as well as level effects. Then, we aggregate the results to report a standard difference-in-differences coefficient, pooling the effect across quarters.

The event study is estimated as:

$$y_{lt} = \alpha d_{lt}^{nonGSE} + \Sigma_{q\in\{-12,12\}} \beta_q d_{lt}^{q} d_{lt}^{nonGSE} + X'\zeta + \epsilon_{lt} \tag{1}$$

where l is a loan, t is a month, and the primary outcomes of analysis y_{lt} are loan performance variable, including dummies for foreclosure, loss mitigation, dual tracking and for a loan being coded as current in a particular month. Controls ζ include mortgage balance at origination, original credit score, interest rate, and state and time fixed effects.

The difference-in-differences is estimated as:

$$y_{lt} = \alpha_1 d_{lt}^{post2013} + \alpha_2 d_{lt}^{nonGSE} + \alpha_3 d_{lt}^{post2013*nonGSE} + X'\zeta + \epsilon_{lt} \tag{2}$$

We then study how credit variables changed for these populations around treatment using both event study and difference in difference approaches, estimating Equations 2 and 1. We focus on key credit outcomes that describe a household's credit score, debt burden and other indicators of financial health. Specifically, C_{lt} includes current credit score as measured by the "Vantage Score" formula, an indicator for a significant increase in auto loans (greater than $3000), the unpaid fraction of bank card balances, and an indicator for bankruptcy filing. These indicators provide a relatively complete picture of consumption, credit availability, and financial distress.

The linear difference-in-differences estimates the likelihood of a loan being a particular status in any given month, conditional on the loan having remained in the dataset until that month. However, this approach can be subject to survival bias, since loans that survive are already less likely to be subject to financial distress. To generate an estimate robust to survival bias, we use a duration model. The duration approach deals with two limitations of our data - first, loan performance indicators are not observed after 2018 and second, performance indicators are not observed before a servicer acquires the right and after a loan is disposed of due to payoff, foreclosure sale or servicing transfer. Moreover, we observe a discrete change in the hazard rate of foreclosure filing after 2013, but only for non-GSE loans. Discrete time duration models are ideally suited for this setting because there is no need to assume a parametric baseline hazard rate that could smooth over the treatment effect (Han and Hausman (1990)).

Time to foreclosure is a discrete random variable T that takes the values $t_1 < t_2 < ...$ with probabilities $f(t_j) = f_j = \Pr[T = t_j]$. The survival function is defined as the probability that foreclosure occurs after time t_j as follows:

$$S(t_j) = S_j = \Pr[T \geq t_j] = \sum_{k=j}^{\infty} f_j$$

For estimation, we assume that the baseline survival function S_0 is scaled exponentially by

time-invariant covariates X and time varying covariates W. The empirical survival function can therefore be written as

$$S(t_j \mid X_i, W_{ij}) = S_0(t_j)^{\alpha_1 d_{lt}^{post2013} + \alpha_2 d_{lt}^{nonGSE} + \beta_1 d_{lt}^{post2013 * nonGSE} + X'\zeta)}$$

A complementary log-log transformation linearizes the estimating equation:

$$\log(-\log(1 - \lambda(t_j \mid X_l, d_{lj}))) = \alpha_1 d_{lt}^{post2013} + \alpha_2 d_{lt}^{nonGSE} + \beta_1 d_{lt}^{post2013 * nonGSE} + X'\zeta \qquad (3)$$

where $\alpha_j = \log(-\log(1 - \lambda_0(t_j)))$,the transformed baseline hazard rate. To operationalize this, we utilize our observable hazard rate and assume a nonparametric baseline hazard to run maximum likelihood estimation:

$$\lambda(t_j \mid X_i, W_{ij}) = 1 - \exp(-\exp(\alpha_j + X'\beta + W'\psi))$$

$$L(\beta, \psi \mid X, W) = \prod_j \left(\lambda(t_j) \prod_{k=1}^{j-1} (1 - \lambda(t_k)) \right)^{y_i} \left(\prod_{k=1}^{j} (1 - \lambda(t_k)) \right)^{1 - y_i}$$

where y is an indicator for foreclosure filing.

Finally, to assess the causal effect of foreclosure filing on credit outcomes, we utilize the results from the duration model estimated in Equation 3 to generate a "first stage" instrument for filing that is correlated with servicer response to regulation but is uncorrelated with unobservable loan characteristics. We can generate a predicted probability of transition into foreclosure, $\hat{\lambda}$. This predicted probability acts as an instrument for the true probability of transition into a particular status, y, as long as there is significant predicted power from the covariates in the first stage regression. The predicted probability $\hat{\lambda}$ is uncorrelated with financial outcomes directly, especially conditional on loan characteristics and time fixed effects, since there is no anticipation effect for lenders who originated loans between 2000 and 2006, and the regulations were not announced more than a few quarters prior to final promulgation. Moreover, as we show below, there is no borrower reaction directly to the regulation.

The second stage is a linear instrumental variables regression where measures of financial distress D, taken from the Equifax credit data, are regressed on a dummy for foreclosure filing, as well as controls.

$$y_i = \eta\hat{\lambda} + X'\beta_1 + \epsilon_1 \tag{4}$$

$$D_i = \gamma y_i + X'\beta_2 + \epsilon_2 \tag{5}$$

The coefficient of interest here is the causal effect of foreclosure filing on other indicators of financial health, η.

3 The Impact of Servicers on Borrower Outcomes

In many household contexts, including mortgages, the right to service a debt is assigned and traded separately from ownership of the loan. Ownership of securitized loans is further distributed across investors. Figure 1 is a stylized illustration of the relationships between parties in a mortgage transaction. Though the lender approves and disburses funds to the borrower, ownership of the mortgage is split between the note and the servicing right. Owners or investors have the right to the stream of payments from borrowers, but servicers have the right to *collect* these payments. Servicers therefore have the authority to begin repossession proceedings and act as a liaison between the note's owner and the payee. As such, they are the first point of contact for distressed borrowers. Servicers do not have a share in interest payments or a right to claim the proceeds of a foreclosure sale. Instead, they are typically compensated with a flat fee per loan, as required by contracts with the loan's owner or the debt securitization vehicle. When borrowers stop making payments, servicers are required to advance payments on their behalf to the owners or investors until foreclosure can occur or the servicing right can be sold. The compensation structure creates a conflict of interest between servicers and lenders - servicers have an incentive to repossess property or sell underperforming loans quickly in order to minimize their costs, even if that may damage the ultimate resale value

of property, leading to losses for both the borrower and lender (Levitin and Twomey (2011), Aiello (2021)).

Despite this risk, servicers can play a key role in minimizing the burden of household financial distress. Figure 2 shows the timeline of decisions made by distressed borrowers and servicers. After origination, borrowers choose whether or not to make a payment each month. Once a payment is missed, servicers have an opportunity to intervene and help a borrower make payments, collectively referred to as "loss mitigation." First, servicers may choose to do nothing, also known as providing forbearance. Forbearance entails pausing collection activity and avoiding filing for foreclosure. Second, servicers can offer informal loan modifications. Informal modifications include repayment plans that allow borrowers to repay arrears, sometimes tailored to borrowers' specific circumstances. Third, servicers can formally modify the mortgage. Formal modifications involve a change in outstanding principal, interest rate, term, or monthly payments. These modifications are usually provided through formal loss mitigation programs, for which the borrower submits a written application. Each of these options can give borrowers breathing room to resolve the loan and avoid foreclosure.

Once a borrower is in default, meaning more than three months behind on payments, servicers may begin the foreclosure filing process. Usually, this begins with a notice of default or a notice of acceleration of the loan. At this point, the servicer works with a lawyer to comply with local, state, and federal rules for foreclosure processes. Note that is it possible that the loan enters the loss mitigation process after foreclosure filing. Ultimately, the property is sold at foreclosure auction or is repossessed directly by the lender and held until sale. Prior to the foreclosure filing, the borrower has the right to cure her default, meaning that the borrower can decide at any time to sell the property or refinance the loan. After the filing, the borrower may still dispose of the property through short sale, but has less bargaining power to remain in possession of the property.

Despite servicers having the legal right to start and complete foreclosure proceedings, not every default results in a foreclosure sale. Figure 3 shows that propensity of defaulted borrowers to cure their default, engage in loss mitigation, face a foreclosure filing, or experience a foreclosure sale in the months after default. Even three years after a default, only 60% of loans in default have

faced a foreclosure action. Fewer than 40% have reached the point of being sold at a foreclosure auction. Many loans, nearly 20%, are engaged in loss mitigation programs with their servicers. Note that loss mitigation is self-reported by servicers, and is coded as 1 if any attempt is being made to help the borrower recover from default. Finally, nearly 30% of defaulted loans are cured, which is defined as returning to being current with no remaining delinquency.[1]

Regulation may influence the choices servicers make when facing borrowers in default. However, servicers may intervene too late to influence real outcomes, since borrowers typically begin to experience financial distress months before defaulting on their mortgage. We demonstrate this difference in Figure 4, which plots credit outcomes around mortgage default separately for loans that end in foreclosure and those that are ultimately cured.

Figure 4a shows that credit scores decline well before mortgage default, with those who eventually foreclose experiencing a larger drop in credit scores than defaulters whose loans cure to become current. Credit scores recover slowly after default. Collinson et al. (2022) create similar graphs with credit outcomes by time to eviction filing, divided by whether the eviction was carried out. Similar to our finding for people who default on their mortgage, they find that credit scores for evicted and non evicted people diverged several months before any legal action was taken.

Other credit outcomes show similar patterns Figure 4b shows increases in auto debt of at least $3000, a proxy for financing a new car. While both defaulters whose loans end in foreclosure and those who cure (become current) experience a decline in the likelihood of financing a car, the decline is more gradual for those who end in foreclosure, including a small spike in purchases right before default. Cherry et al. (2021) find that mortgage forbearance put in place for the Covid-19 pandemic is associated with an increase in auto debt, perhaps suggesting that those who cured would have experienced a larger decline in auto debt in the absence of treatment. Auto debt rebounds more quickly for borrowers who experience a foreclosure filing, suggesting a more inelastic demand for liquidity by foreclosed borrowers relative to those who cure their default.

Figure 4c shows that borrowers that become current after default become more likely to take on

[1]Each loan may be in multiple status in a particular month. Loss mitigation and foreclosure filing, for example, can regularly coexist, and is called "dual tracking"

student debt up to 12 months *before* default. The trend continues after default, with the difference being .01 in the post-default period for our sample. Figure 4d shows that a borrower who ultimately faces foreclosure has a lower likelihood of filing for bankruptcy pre-default, but has a significant increase after default, while borrowers who cure experience a smaller change. Figure 4e shows that borrowers who ultimately face foreclosure have higher credit limits prior to default than borrowers who become current. After default, credit limits for the two groups converge.

These graphs show that policy intervention in the repossession process occurs much later than the primary indicators of distress, which appear well before non-payment. Analogous to the discussions in Collinson et al. (2022) and Diamond et al. (2020), we document significant and systematic differences between borrowers who cure their default and those who face foreclosure, even before they default. Foreclosed borrowers have higher credit scores, take on more auto debt, are less likely to take out a student loan, are less likely to file for bankruptcy and have higher credit card limits before default. Yet, despite lower credit scores and higher student debt before default, borrowers that cure are able to recover effectively after default. The empirical challenge is isolating the role servicers play in mitigating household financial distress.

3.1 Timeline of Regulatory Intervention

We utilize changes in servicer regulation as a natural experiment to identify the effect of servicer behavior on consumer outcomes. Inefficiencies in servicing came into focus during the 2008 financial crisis, when mortgage servicers failed to work with borrowers to avoid foreclosure when house prices dropped. Relatively few loans were modified, and many were "dual tracked," meaning that they were considered for a modification after a foreclosure filing. Foreclosure rates spiked, lowering house prices further and accelerating downturns in sectors of the economy overly exposed to mortgage risk through mortgage backed securities. In the initial foreclosure spike, evictions were temporarily frozen while rules were introduced by the government sponsored entities (GSEs) to encourage foreclosure avoidance in publicly owned or insured mortgages. The GSEs sustained significant losses due to the Financial Crisis, and in 2008 the Federal Housing Finance Authority was appointed as conservator to avoid liquidation. Starting at the end of 2010, each of the GSEs promulgated

a servicing guide that was incorporated into their agreements with servicers, specifying certain actions that servicers must take to minimize inefficient foreclosures. The guidelines specified how servicers must attempt to establish live contact, encourage loss mitigation applications, and avoid dual tracking by delaying foreclosure filings.

At the same time, the CFPB was authorized by Dodd Frank to make permanent rules regarding mortgage servicing. The CFPB did not issued a notice for proposed rulemaking in September 2012, and the final rule was promulgated in January 2013 and was effective in January 2014.

The CFPB rules modified provisions under Regulation X (12 CFR 1024), originally promulgated under the Real Estate Settlement Procedures Act (RESPA) and Regulation Z (12 CFR 1026), originally promulgated under the Truth in Lending Act (TILA). Changes to TILA included requirements to send regular statements, provide information on how past payments had been credited, and changes to the error resolution process that was intended to ensure servicers were properly accounting for payment attempts. Changes to RESPA included requirements that servicers wait until 120 days of delinquency to begin foreclosure proceedings and establishes a process for evaluating loss mitigation applications in a timely manner. Moreover, it included a suite of communications requirements that were intended to give distressed borrowers early and regular contact with their servicers. Servicers are required to attempt to "establish live contact" with borrowers by the 36th day of delinquency, provide written information about loss mitigation by the 45th day of delinquency, and establish continuity of conduct by, for example, assigning a single point of contact for borrowers from that point onwards.

These rules applied to all mortgages in the country, with exceptions for small servicers and other special cases, but in practice did not bind equally on all loans. The rules were explicitly to harmonize with existing GSE guidelines, in order to limit any additional regulatory burden on GSE servicers in complying with CFPB rules. Despite this, the requirements of the two sets of rules are not identical - GSE guidelines went into more specific detail about compliance by specifying the timing of phone calls but did not come with explicit enforcement authority. GSE guidelines were incorporated into the contract between the GSEs, servicers, and investors. Servicer violations would have to be detected through lawsuits or other unusual actions. CFPB rules, however, were

enforced through regular servicer examinations or through borrowers' private right of action.

We report the impact of both interventions separately. GSE guidelines had a smaller overall impact, and those results are reported in the appendix. CFPB rules had a larger impact, with spillovers to other credit lines, and we focus most of our discussion on those results. However, most results are qualitatively similar between the two rules.[2] The shifts induced by the CFPB rules create a random shifter for foreclosure filing, offering an alternative to judge assignment IVs used in related work (Collinson et al. (2022), Diamond et al. (2020)).

Therefore, we use the impact of the CFPB rules to estimate the pecuniary spillovers from the COVID-19 mortgage forbearance and eviction moratoria. In 2022, the federal government introduced forbearance programs for both mortgages and student loans, pausing the collection of mortgage payments until late 2021 and the student loan payments until 2022. Existing work has assessed the direct impact and distributional consequences of the COVID-19 forbearance (Cherry et al. (2021)). We focus on the secondary effects of forbearance by identifying the effect of foreclosure avoidance on borrowers' other credit lines.

4 Causal Effects of Regulating Servicers

We begin by plotting the raw data, comparing loan performance and credit outcomes for treated and control loans over time. The plots include each key time period in servicer regulation. The dotted red line marks the January 2011 implementation of the GSE guidelines. In this intervention, the GSE loans in blue are the treated group. The lighter gray period marks the quarter during which the proposed rule was announced. Then, the darker gray period marks the time between the final rule's promulgation and its enforcement.

Figures 5 and 6 show these plots for all our outcomes. Figure 5a demonstrates the main result of the paper - foreclosure rates for non-GSE loans drop proportionally more than rates for GSE loans after the CFPB rule. In 2010, GSE and non-GSE loans are on relatively parallel trends. Between 2011 and 2013, non-GSE loans experience a larger increase and drop in foreclosure filings, consistent

[2]The only outcome on which they diverge is in loss mitigation, which we discuss in the following section

with a drop in GSE foreclosures after the 2011 Guidelines. After the CFPB rule's introduction in 2013, non-GSE loans experience a drop in foreclosure rates. The rates remain similar and parallel after the 2014 enforcement of the rule begins. Similar patterns exist in loans being current, shown in Figure 5b. GSE loans had higher rates of current before the CFPB rule, but the gap decreased sharply between 2013 and 2014, persisting over the post-treatment period.

Figure 5c shows the counterintuitive effects of the CFPB rule on loss mitigation. Non-GSE loans experience a drop in the rate of loans in loss mitigation throughout the pre-treatment and treatment period. There is a small rise in loss mitigation in GSE loans after the 2011 Guidelines. The rates of dual tracking drop for non-GSE loans during the treatment period, as shown in Figure 5d, following a drop in GSE loan dual tracking after the 2011 Guidelines. Foreclosure sales exhibit a more complex pattern. Before the CFPB rules, non-GSE loans have more sales than GSE loans, with a spike in 2012. During the treatment period, non-GSE sale rates drop below GSE foreclosure sale rates. However, in 2015, the trend reverses again, with GSE foreclosure rates once again dropping below non-GSE rates.

Credit outcomes also change significantly with the introduction of the CFPB rules. Notably, current credit scores, proxied by Vantage Score, are shown in Figure 6a. They increase by 15-25 points for both treatment and control groups during the time of the reform, but the difference is significantly smaller after treatment. Differences in auto debt increases are difficult to see in Figure 6b due to significant seasonality in car purchases, but trends look parallel before treatment with a slight divergence starting in 2012. Student loan debt looks quite different for GSE and non-GSE mortgagors. Figure 6c show that non-GSE borrowers have higher student borrowing before the CFPB rules are implemented, and the trend stays high while GSE student loan balances drop.

Bankruptcy rates are largely parallel across treatment and control groups both before and after treatment, as shown in Figure 6d, but there appears to be a slight convergence in bankruptcy rates after the CFPB rules were introduced. Finally, credit card limits vary significantly during the pre- and post-treatment periods. GSE and non-GSE loans are on similar trends before the 2011 Guidelines. At that point, GSE credit limits are slightly higher than non-GSE limits. The trend reverses during the treatment period, with non-GSE credit limits being nearly $2000 higher than

GSE credit limits in 2013. By 2016, however, the difference has lessened significantly.

4.1 Event Study

To estimate the causal effect of servicing regulation, we estimate event studies (Equation 1), difference-in-difference (Equation 2), and duration models (Equation 3). GSE and non-GSE loans are different prior to treatment because they include different pools of borrowers and loans of different sizes. To deal with this, we control for the loan's original interest rate, loan amount, and the original credit score of the borrower. We also deal with seasonality and macroeconomic fluctuations by including time fixed effects, both for current quarter and origination year. Finally, we include state fixed effects to deal with differences in state foreclosure laws and variation in local housing markets.

Figure 7 shows the impact of servicing regulation on mortgage performance outcomes, conditional on controls. Figure 7a shows that treated loans are on a parallel trend with control loans until the 2011 Guidelines. Between 2011 and 2013, non-GSE foreclosure filings are higher than GSE filings, consistent with GSE loans experiencing "treatment." Then, there is a sharp drop in the probability of non-GSE loans being in foreclosure in 2013, with a total decrease of about 2% in foreclosure filing rates. By itself, this could be evidence of a delay in foreclosures or an increase in loss mitigation, as alternatives to cure. Figure 7b shows that loss mitigation cannot account for the drop. The servicing rule is in fact associated with a decrease in the rate of loss mitigation. Since the 2011 Guidelines were introduced, non-GSE loans were on a parallel trend with GSE loans. The drop in loss mitigation in 2013 is sustained in 2014 and onwards, suggesting that foreclosure is not being replaced by loss mitigation. Similarly, there is a small but significant drop in dual tracking of slightly less than .5%, as shown in 7c.

The largest impact of the servicing rule on loan performance is in returning loans to "current" status. Figure 7d shows that the rule caused more than a 3% increase in the fraction of loans considered current on payment. Note that the 2011 Guidelines were associated with a decrease in non-GSE loans being current relative to GSE loan. This effect was consistent with GSE loans being subject to an analogous treatment"in 2011. The difference in current status is flat between 2011

and 2013, but jumps up in 2013. The difference is sustained after the treatment period. Figure 7e shows that these shifts resulted in a small but sustained drop in foreclosure sales of about .002. Note that these persistent effects on loans becoming current and avoiding foreclosure sale are not driven by loan modifications that changed the principal and interest due each month - Figure A5 shows that the loan performance results look similar for the subsample of loans with no change in monthly payments. Taken together, these results show that the rule lowered foreclosures by increasing the probability that the loan was in "current" status rather than raising the probability that a delinquent loan was placed in loss mitigation.

Figure 8 shows event study results for credit outcomes. Current credit scores show a small drop after the 2011 Guidelines, and a significant increase after the 2013 CFPB rule's implementation, as shown in Figure 8a. Non-GSE loans had a lower credit score by 5 points than GSE loans during the 2011-2013 period, but after the rule was implemented, the treatment group experienced a relative increase in credit scores of about 10 points. The "auto increase" variable showing in Figure 8b measures whether there has been an increase of $3000 or more in a consumer's auto balance, suggesting that they purchased a car. Though there is a slight increase across most quarters after 2014, the coefficient in the first quarter of 2014 is highly positive and statistically significant, suggesting a more temporary jump in durable car purchases after the implementation of the rule.

Figure 8c shows that the fraction of borrowers with student loan balances were equal between GSE and non-GSE groups before the 2013 rule. Afterwards, non-GSE loans have a 1% higher rate of student loan borrowing. The difference decreases from 2014 onwards. Figure 8d shows a small but statistically insignificant drop in bankruptcy filings after the CFPB rule was introduced, mirroring an even smaller increase after the 2011 Guidelines. Finally, credit card limits shown in Figure 8e show parallel trends before the 2013 rules but a significant and sustained increase from 2013 onwards.

4.2 Difference-in-Difference Results

To run a difference-in-difference with two staggered treatments, we estimate two separate models. To study the effect of the GSE guidelines, we assign GSE loans to be the treatment group, the

2010 outcomes to be the control time period, and the 2011-2012 time period to be the treated time period. The results of these regressions are reported in the Appendix, in Figures A1 and A2. Then, we separately estimate the effect of the 2013 CFPB rules, using the non-GSE loans as the treatment group, 2011-2013 as the pre-treatment period, and 2013-2018 as the post-treatment period. The results from those regressions are reported in Figures 9 and 10.

The results from the difference-in-differences models parallel the event study results. Each panel shows a histogram of the coefficients of the models from the 100 samples, with the mean, 90 and 95% confidence intervals highlighted. Figure 9a shows that treated loans after the rule experienced a relative decrease in the probability of being in the foreclosure process in a given month of about .017. Given that in the overall sample, the probability of a given loan being in the foreclosure process in a given month is 3.8%, this result suggests about a 44% reduction in the probability of being in the foreclosure process in a given month. Figure 9b shows that the probability of a treated loan being in loss mitigation after the rule's implementation dropped by about .013. Given the average probability of a loan being in loss mitigation is 2.4% , this is nearly a 50% reduction.

Figure shows a drop of 0.0031 in the probability of a treated loan being in dual tracking after the rule, a drop of more than 50% compared to the mean of 0.6%. A loan is defined as being "dual tracked" by being put both in loss mitigation and the foreclosure process in any given month. Dual tracking can place borrowers in worse bargaining positions and was implicated in fraudulent or unethical behavior by servicers throughout the crisis. The CFPB regulations were implemented in part to target this issue (Dewar (2013)). Figure 9d shows an increase of .037, or a 4.3% increase relative to a .86 baseline rate of current status. The size of this increase is even larger than the drop in foreclosure filings, suggested that many loans that otherwise would have been in foreclosure were cured, while others that would never have made it to foreclosure also cured. Finally, Figure 9e shows that foreclosure sales decreased by .0007, or about 44% relative to the average foreclosure sale rate of .0016. The effect is precisely the same size as the foreclosure filing effect, suggesting that fewer filings resulted in fewer sales.

Figure 10 quantify the effect of the CFPB rule on credit outcomes. Figure 10a shows that treatment is associated with a nearly 11 point increase in credit scores, relative to a base mean

credit score of 687. Figure 10b shows that treatment increases car purchases by .001, about a 9% increase relative to the average rate of car purchase. Figure 10c shows that the fraction of borrowers with positive student loan balances increases by .011, which translates to a 7.8% increase over the baseline average. There is no statistically significant effect on bankruptcies as shown in Figure 10d, though there is a noisy negative effect on filings. Finally, Figure 10e shows that credit limits increase by $1333, or a 5% increase relative to the baseline.

Overall, the results are consistent with very large shift in loan performance, and smaller spillovers onto other credit lines. The effect of the 2013 CFPB rules are largely similar but larger than the 2011 Guidelines for most outcomes. The main exception to this is the effect of the 2011 Guidelines on loss mitigation. Figure A1b shows that the rate of loss mitigation increases due to the Guidelines by .006, or 25% relative to the average rate of loss mitigation. One possible explanation may be differences in the implementation of the Home Affordable Mortgage program between GSE and non-GSE loans, which was in the process of expansion in the pre-2013 period.

Other outcomes react to the 2011 Guidelines similarly to the 2013 CFPB rules. Figure A1a shows an effect on foreclosure filings that is less than half the size of the CFPB rules, and statistically insignificant. Figure A1c shows that there is no effect of the Guidelines on dual tracking. Figure A1d shows that more loans are current after the Guidelines, but the effect is not statistically significant. Figure A1e shows that the effect on foreclosure sales is a precise zero. Finally, the plots in Figure A2 show that the effect of the Guidelines on credit outcomes is statistically insignificant, suggesting that the shift was not large enough to spill over across credit lines.

4.3 Duration Model

The linear regression results are subject to survival bias, meaning that outcomes are observed only for loans that survive until a particular time period. Our loan performance outcomes of interest may be highly correlated with exit from the sample, since distressed borrowers are likely to sell or refinance the property.[3]

[3]Credit outcomes are provided for several months after the loan is not observed in our data, attenuating the effect of survival bias.

We estimate a duration model for each performance outcome to quantify the unconditional change of the probability of *entering* a particular status in any given month. Each estimate also includes controls for loan characteristics, as well as year of origination and state fixed effects. The marginal effects from this estimation are plotted in Figure 11. Figure 11a shows that the treated loans have a .07% lower chance of having a foreclosure filed against them in each month of the loan's life. Aggregated over the months in which the loan is at risk for foreclosure, the size of the effect is comparable to the linear probability model. Similarly the effects on loss mitigation, dual tracking and being current on payments are about a tenth of the size of the linear probability models. Loss mitigation (Figure 11b) and dual tracking (Figure 11c) both see significant decreases. The effect on the loan being current (Figure 11d) is smaller and not significant, because it can be estimated only on the subsample of loans that are "at risk" of cure, meaning delinquent loans.

Finally, Figure 11e shows the duration model results for foreclosure sale, which is also significant and approximately similar in magnitude to the linear probability model estimate. Based on these results, we proceed with the linear model that is easier to estimate and interpret.

5 Distributional Impact

To study the drivers of these results, we consider whether any subcategories of mortgages are largely responsible for the loan performance outcomes we observe. To begin, we merge our data with zip code level indicators of race and average income. Estimating a triple difference specification, we see no statistically significant differences in the effect on foreclosure, loss mitigation, dual tracking, or current status in disproportionately Black or poor areas.[4]

5.1 Heterogeneity by Credit Score

Then, we look at heterogeneous effects across individuals' original credit score as a proxy for race and income. The treatment does have a significant differential impact across credit score categories, as shown in Figures 12 and 13. Figure 12a shows that drops in foreclosure filing are similar across

[4]Results are available from the authors on request

credit score categories, but are largest for credit scores between 650 and 750. Note that mortgage borrowers in our sample are likely to be prime, limiting precision in lower credit score categories. Figure 12b shows a similar flat impact for the drop in loss mitigation, though the point estimate is largest for borrowers with credit scores around 600. Figure 12c shows that similar borrowers are most heavily impacted by the drop in dual tracking.

The effect of CFPB rules on loans being current, however, look quite different across categories. Figure 12d shows that the lowest credit scores see the largest increase in the probability of being current, with an increase of .1. In contrast, higher credit score borrowers see an effect that is half that size. The effect of the 2013 rules on foreclosure sales is shown in Figure 12e. Foreclosure sales are averted at nearly double the rate for borrowers with credit scores of 550 than for borrowers with higher credit scores.

Figure 13a shows the differential effect of treatment on borrowers' *current* credit scores, separately by original credit score. Borrowers with original credit scores around 550 see a 25 point increase due to servicing regulation, with the size of the effect decreasing as credit score increases. Subprime borrowers, meaning those with credit scores below 650, see credit score increases of more than 20 points, while prime borrowers see smaller increases. Figure 13b show a similar pattern in car purchases, though with less statistical precision. The point estimate for the lowest credit score borrowers is .003, relative to .001 for the highest credit score borrowers. Figure 13c also shows a similar, albeit noisier, pattern in the probability of having a student loan.

Figure 13d shows a slightly different effect across credit scores in bankruptcy filings. Low credit score borrowers appear to see a large but noisy decrease in filings of about .025 due to servicing rules, while other credit score groups see precise zero effects. Finally, Figure 13e shows a different pattern across credit card limits. Here, the highest credit score borrowers with scores around 800 see the largest increases in credit limits, of up to $3000, while lower credit score borrowers have noisy increases of about $1000.

5.2 Heterogeneity by Timeline

Finally, we study whether shifts in loan performance were driven primarily by expansions in foreclosure timeline. Literature on foreclosure delay (Calem et al. (2017), Cordell et al. (2015)) suggest that longer timelines to foreclosure are more borrower friendly, increasing liquidity and improving consumer outcomes in the short run. States had different foreclosure timelines prior to the servicing rule. We create an continuous variable categorizing the average timeline to foreclosure by state in 2010, prior to servicing interventions. States with average timelines of 115 days are likely to be delayed by servicing regulations. States with timelines that were already 120 days or longer would be impacted by the communication requirements but not the timeline changes. We interact the categorical variable with the non-GSE and post-2013 indicators, and plot the results in Figures A3 and A4.

Figure A3a shows that the regulation's impact was larger for short timeline states. States with average timelines of 115 days or less saw drops in foreclosure filings of .03, relative to a drop of .01 for states with medium timelines. States with long timelines of 140 days or higher experienced higher rates of foreclosure filing after the CFPB rule was introduced, consistent with the regulation standardizing foreclosure timelines around the 120 day focal point. Figure A3b shows that the pattern is less clear for loss mitigation - the drop in loss mitigation is concentrated in states with timelines around 135 days. Dual tracking results in Figure A3c mirror that pattern. The effect on loans being current, shown in Figure A3d, includes both these patterns. The regulation caused more loans to become current in both short (115 day) and long (135 day) timeline states. Foreclosure sales drop in both these states as well, as shown in A3e. In fact, foreclosure sales dropped the most in states with longer 135 day timelines.

These mixed patterns persist in credit outcomes. States with short timelines appear to be driving the effects of servicing regulation on credit scores (Figure A4a) and credit limits (Figure A4e). On the other hand, longer timeline states appear to drive the effects on auto debt (Figure A4b) and student loans (Figure A4c).

Taken together, these results suggest that the servicing rule effects are not driven by delays alone.

Recent research describes the key role of communication in efficient servicing (Bandhyopadhyay (2022)). The results suggest that regulation providing incentives to share soft information, alongside delays in foreclosure filing, can improve loan performance.

6 Isolating the Effect of Foreclosure Filing

During the COVID-19 pandemic, mortgage forbearance was one of several policies first introduced by the CARES Act to limit economic harms from the pandemic. Distressed homeowners who contacted their servicers had the right to a pause of 180 days on mortgage payments, which was eventually extended as the pandemic persisted. Similar foreclosure freezes were attempted in the 2008 crisis. As a policy tool, forbearance has the benefit of being low cost and has had a successful trial during the COVID-19 pandemic. We use the 2013 servicing regulation as a shifter of foreclosure filing to estimate the impact of forbearance, or avoidance of a foreclosure filing, on distressed borrowers. Given the context in which we are estimating, our estimate should be interpreted as the effect of servicing regulation-style forbearance on compliers - that is, we do not account for heterogeneous treatment effects generated by legal or economic differences that would change the relevant characteristics of borrowers.

Our instrument is predicted foreclosure generated from the duration model, which is robust to survival bias in the data. To be a valid instrument, the predicted foreclosure measure must be correlated with observed foreclosure ("relevance") and should not directly influence outcomes except through shifting the instrumented variable ("exclusion restriction"). Figure 14a plots predicted and actual foreclosure probabilities, showing a significant correlation between predicted foreclosure and actual foreclosure. The first stage F statistic is 6538, well above even conservative thresholds for weak instrument test statistics (Lee et al. (2021)). Moreover, our model is just-identified, since duration model covariates are combined to generate a predicted foreclosure probability. Just-identified models are more robust to weak instrument bias than models with many weak instruments (Angrist and Kolesár (2022).

Since the prediction is generated based on loan characteristics, including the loan's status as non-

GSE and the performance date being past 2013, it should be uncorrelated with any unobservable borrower traits. The exclusion restriction would be violated if borrowers were aware of the rule's introduction and changed their behavior in direct response to the policy. Figures 14b and 14c show that borrower behavior, both in choosing to miss one payment or to default by missing more than 3 payments, do not appear to be directly impacted by the regulation. Treatment has no effect on delinquency at all. Default, if anything, appears to decrease slightly after treatment. This is consistent with early communication and intervention by servicers.

It is important to note that there is no documented evidence of strategic default, despite the incentives created by the regulatory delay. Strategic default is defined as the decision to stop making mortgage payments despite having the ability to pay. As documented by Gerardi et al. (2013), Ferreira and Gyourko (2015), Mayer et al. (2009), there was a large uptick in defaults during the Great Recession, with Guiso et al. (2013) documenting that 35% of defaults were strategic. If borrowers were defaulting in response to less aggressive servicing, we would be concerned that the regulation could impact credit outcomes directly through changes in savings or spending behavior. There is no evidence here of delinquency or default responding strategically to servicing regulation, suggesting that mortgage servicing regulation would impact credit outcomes only by shifting servicer-driven loan performance variables.

We then use the predicted foreclosure instrument to study the causal effect of being in the foreclosure process on credit outcomes, with results shown in Figure 15. Figure 15a shows that the causal effect of being in the foreclosure process on credit score is not statistically significant, though the point estimate is positive. Figure 15b demonstrates that being in the foreclosure process lowers the probability of taking on new car debt by about .04. Figure 15c shows that being in foreclosure lowers the probability of having student debt by .64. Figure 15d shows no significant effect of foreclosure filing on bankruptcy. Finally, Figure 15e shows no significant effect of foreclosure filing on credit limits, though the point estimate is negative. These results are quite different from the direct effect estimated with event study and difference-in-difference methods, suggesting that servicing regulation had impacts on credit separate from foreclosure avoidance. For instance, the difference-in-difference results could be driven by loans who return to current from delinquency, without being at risk of foreclosure.

The IV results show that avoidance of foreclosure filing increases household leverage and utilization of credit, but not availability of credit. There is no significant effect on credit scores or on bankruptcy filings. Our results are consistent with existing theories about the causal effect of repossession, as demonstrated by Collinson and Reed (2199). In essence, borrowers' distress is caused by an underlying financial shock such as job loss, divorce, illness, or death. Borrowers then go into default on mortgages and other debts, leading to worse financial circumstances such as lowered credit scores and higher bankruptcy filing rates. Foreclosure filing itself, therefore, does little to impact these outcomes.

What mechanism is driving the IV results? We consider three alternative explanations: a supply side explanation driven by credit access, a demand side explanation driven by debt overhang, and a demand side explanation driven by precautionary savings. First, our credit results could be driven by a drop in credit access due to foreclosure. The drop in auto loans and student loans observed in the IV regressions could be driven by lack of access to new credit, meaning that foreclosure filing limits the availability of auto loans, and causes borrowers to utilize existing credit lines more heavily despite being unable to make additional payments. However, this contradicts the statistically insignificant effect of foreclosure filing on credit scores and credit card limits.

Another potential explanation for our results would be household debt overhang. A broad literature on debt overhang shows that high household debt burdens can decrease consumption (see Ogawa and Wan (2007), Dynan (2012), Dynan and Edelberg (2013), Mian and Sufi (2010), Mian et al. (2013), Cooper (2012) Olney (1999) Albuquerque and Krustev (2018)). This theory would predict that before foreclosure, households would experience a drop in consumption. Post-foreclosure, as the debt burden is relieved, households would receive a positive liquidity shock. However, this would mean that the causal effect of foreclosure filing on auto loans would be positive, since most car purchases are made with credit. At least, the effect would be zero, since Melzer (2017) shows that household quarterly spending on automobiles is not elastic with respect to negative equity and default risks. However, our data shows that foreclosure causes auto debt to drop. The same dynamics would impact student loan borrowing, but do not appear in the data.

Therefore, we are left with the interpretation that foreclosure filing limits household leverage

by increasing expected costs and causing households to save in response. Conversely, forbearance that limits foreclosure filing causes more spending and increased leverage on other credit lines. A large scale forbearance policy, such as the one implemented after COVID-19, has the potential to provide households with significant liquidity. An average individual in our data who randomly receives forbearance instead of a foreclosure filing will have a .04 increase in spending at least $3000 on an auto purchase, and will have a positive student loan balance with .64 higher probability. Since the average student debt in our sample is $4633, a conservative estimate of the total increase in indebtedness for a complier in our sample is $3085. Note that this number is likely an underestimate because it accounts only for two trade lines, and covers a population of borrowers who qualify for 30 year, fixed rate, purchase mortgage loans - in other words, the safest population of borrowers.

7 Conclusion

This paper shows that mortgage servicing regulations lower foreclosure rates and significantly improve loan performance, as well as positively impacting credit outcomes. We utilize the introduction of the CFPB's mortgage servicing rule in 2013. The rule required servicers to wait 120 days before foreclosure, to establish early and continuous contact with borrowers, and to work with borrowers to consider loss mitigation strategies. Introduction of the rule caused a persistent drop in foreclosure rates and a significant uptick in loans that were current on payment. Moreover, the mortgage servicing effects spill over onto other credit lines, causing higher credit scores, higher credit limits and more auto and student debt. These effects are driven by improvements in the financial health of borrowers with the lowest credit scores, and appear to be due to communication requirements as well as foreclosure delays.

Assessing the causal effect of foreclosure on credit outcomes, we show that foreclosure avoidance increases household leverage without impacting their credit scores or bankruptcy filings. These results are consistent with debt relief acts as a source of temporary liquidity for distressed households, even in non-crisis periods. Subsidizing the provision of private debt relief through forbearance policies or debt collection policies could improve household welfare by specifically targeting the most vulnerable borrowers.

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A Appendix

Figure 1: Servicing Relationships

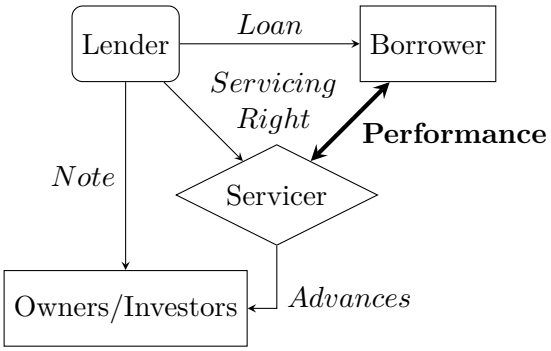


Figure 2: Decision Timeline

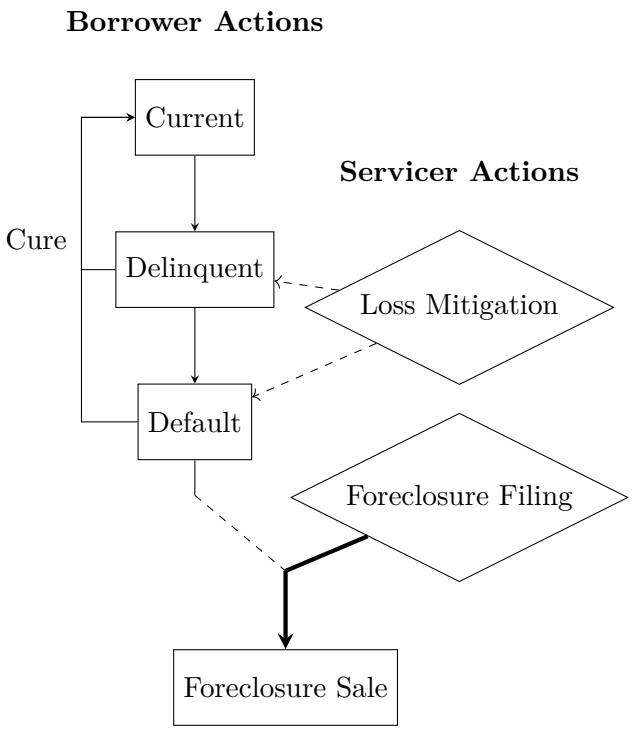


Figure 3: Hazard Rate Post-Default Outcomes

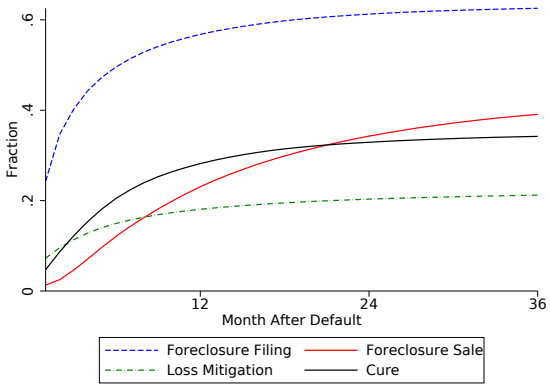
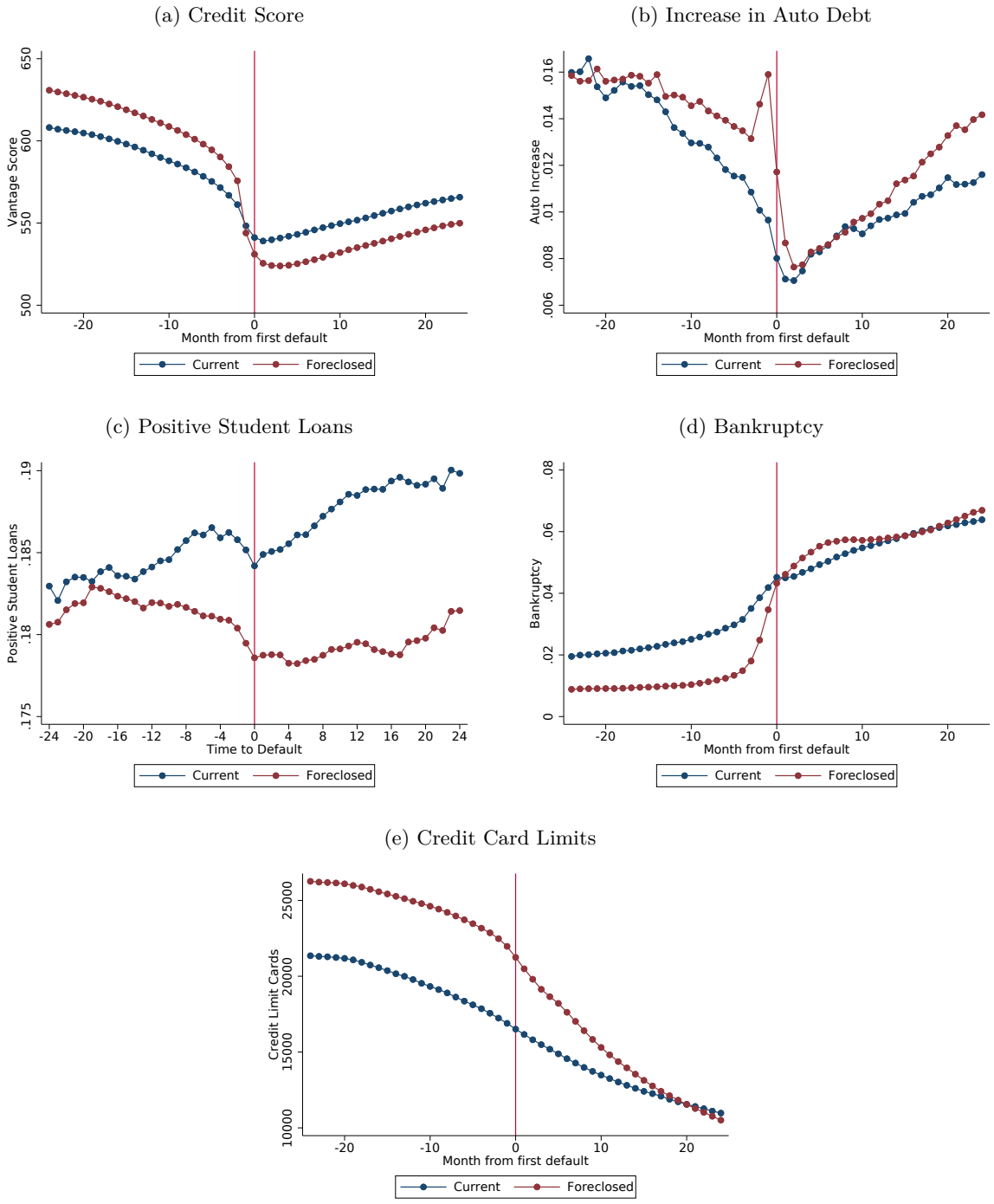
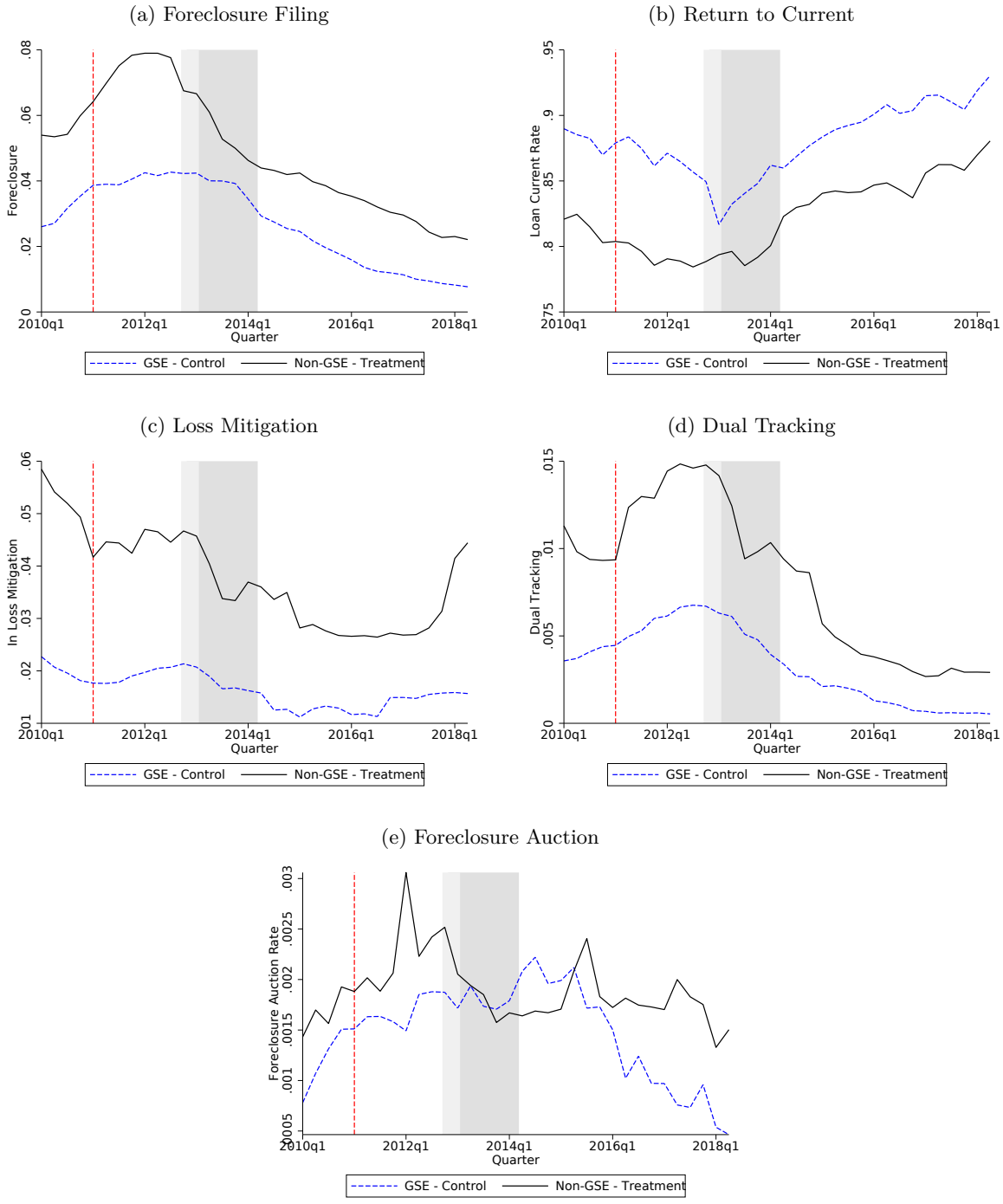


Figure 4: Credit Outcomes Around Default for Foreclosed vs. Current Loans



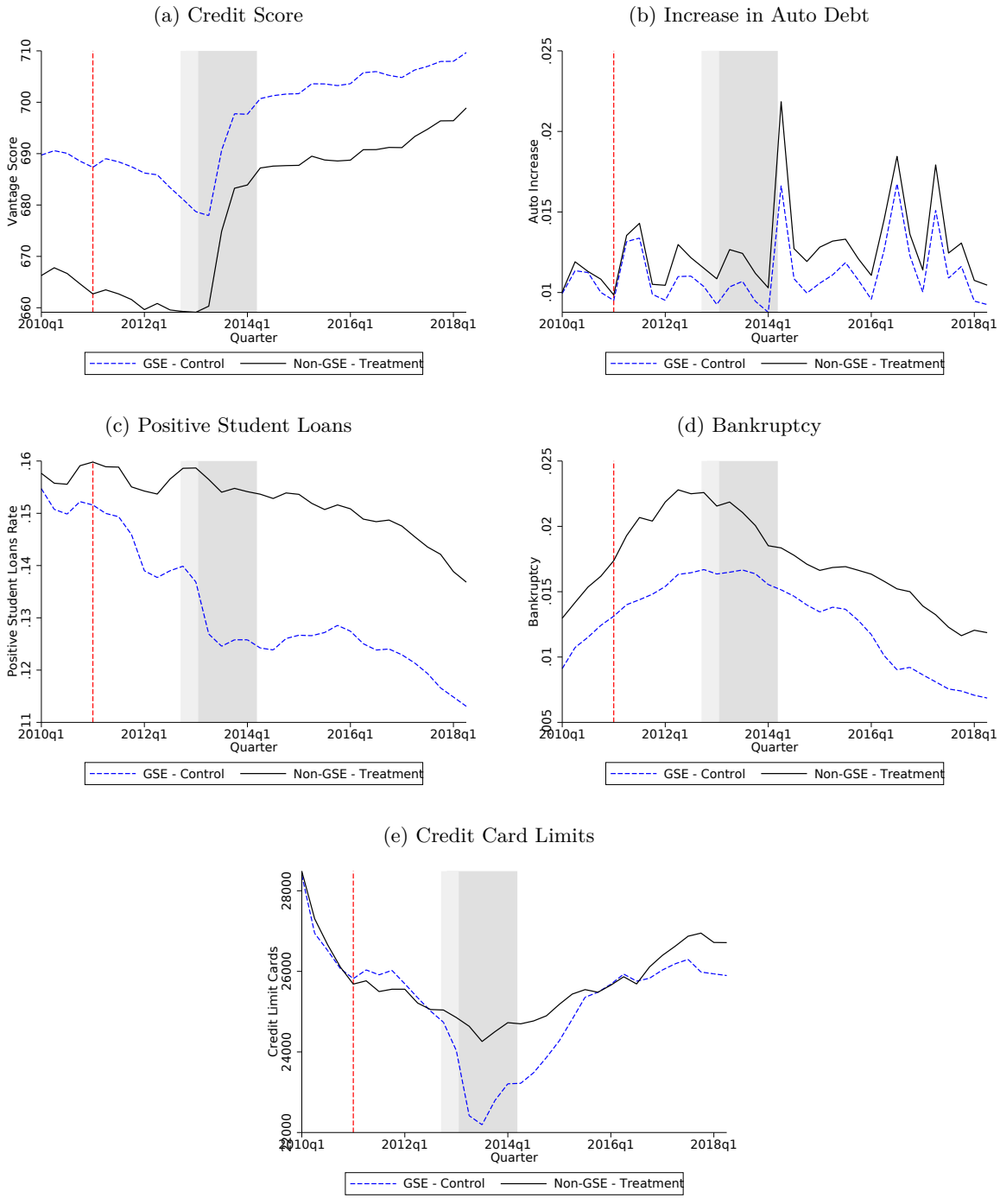
Notes: Graph shows raw averages of outcomes in the month relative to default for loans ending in foreclosure and loans ending in return to current.

Figure 5: Mortgage Outcome Time Series for Treatment and Control Loans



Notes: Graph shows raw averages of outcomes in each quarter for GSE and non-GSE loans. The first red line marks the passage of the final rule in January 2013, and the second red line marks the date of implementation in January 2014.

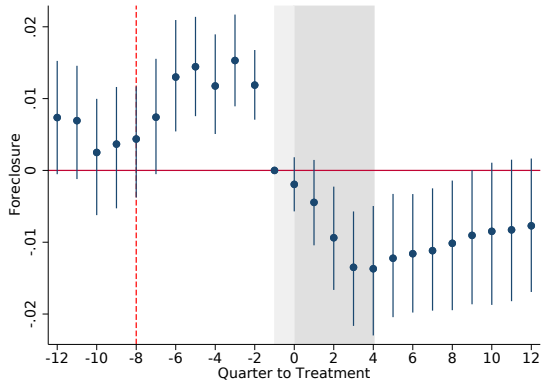
Figure 6: Credit Outcome Time Series for Treatment and Control Loans



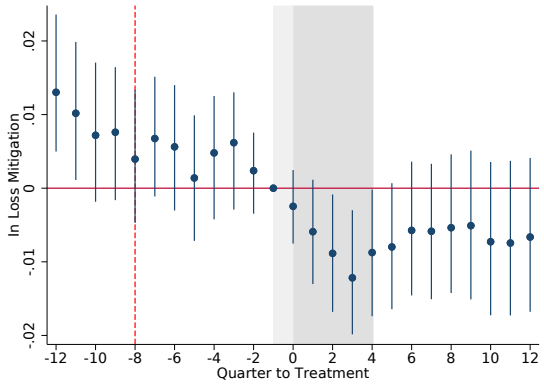
Notes: Graph shows raw averages of outcomes in each quarter for GSE and non-GSE loans. Graph shows raw averages of outcomes in each quarter for GSE and non-GSE loans.

Figure 7: Event Study Graphs for Loan Performance

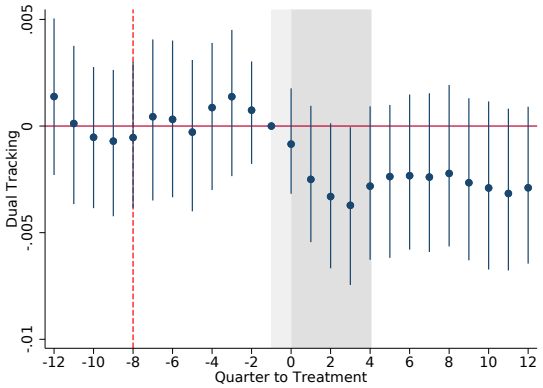
(a) Foreclosure Filing



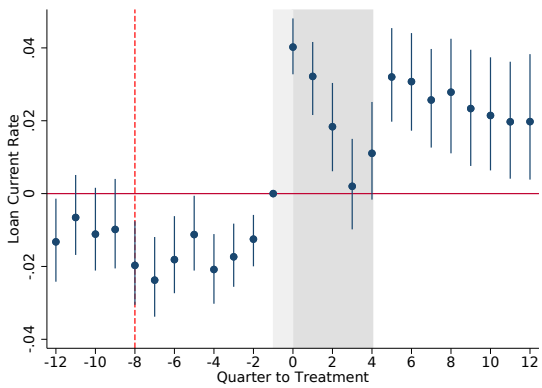
(b) Loss Mitigation



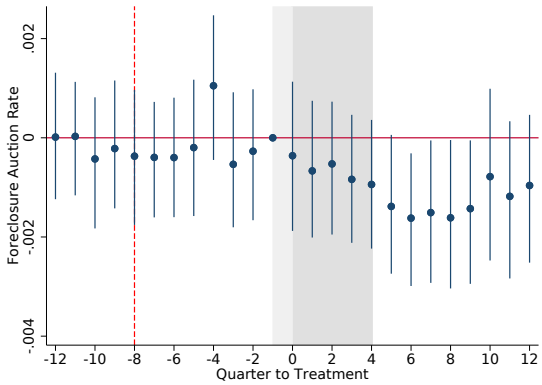
(c) Dual Tracking



(d) Current on Payment



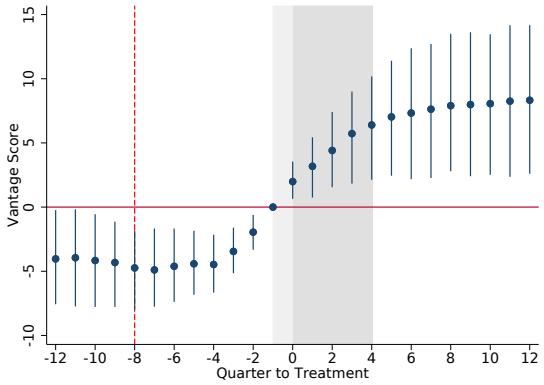
(e) Foreclosure Auction



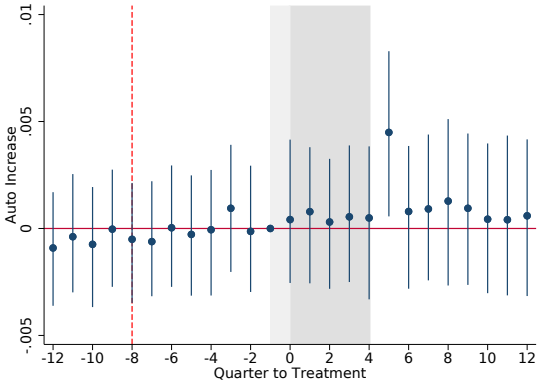
Notes: Quarters from Q1 2013 to Q1 2014 are shaded, showing the time from announcement to implementation of the servicing rule. Controls include interest rate, borrower credit score and loan amount at origination, and state and origination year fixed effects. The error bars shown are the 5th and 95th percentiles of the empirical distribution of the coefficients from the 200 samples, estimating equation 1. Sample includes all purchase loans originated between 2000 and 2006, with fixed interest rate and 30 year term, resulting in a sample size of 442,250,189 loan months. Figure 7a is relative to pre-treatment mean foreclosure rate of 0.044. Figure 7b is relative to pre-treatment loss mitigation rate of 0.035. Figure 7c is relative to pre-treatment mean dual tracking rate of 0.009. Figure 7d is relative to a pre-treatment mean current rate of 0.85.

Figure 8: Event Study Graphs for Credit Outcomes

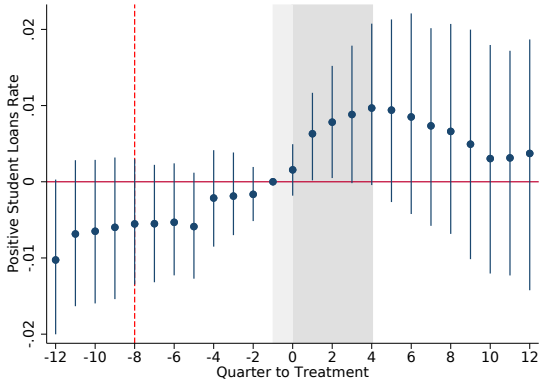
(a) Current Credit Score



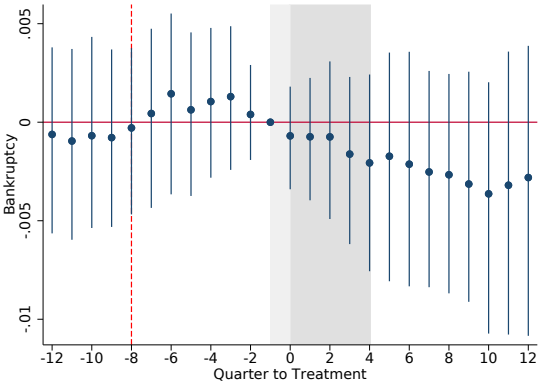
(b) Increase in Auto Debt



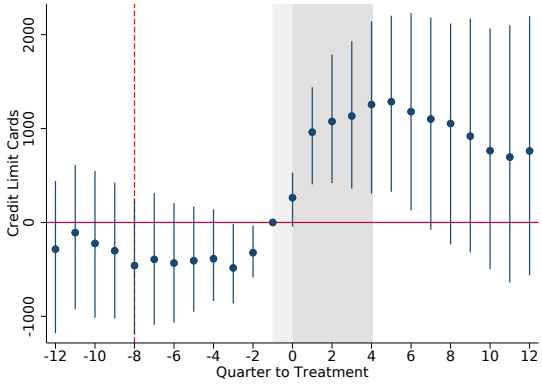
(c) Positive Student Loans



(d) Bankruptcy Filing



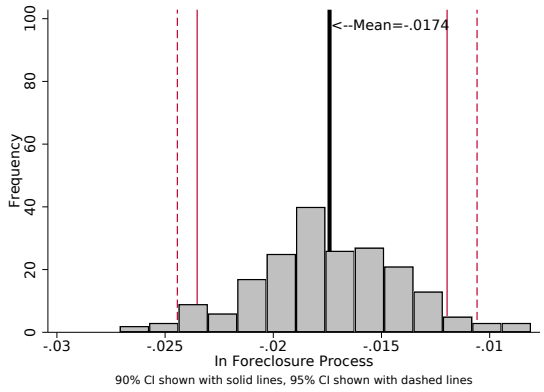
(e) Credit Card Limits



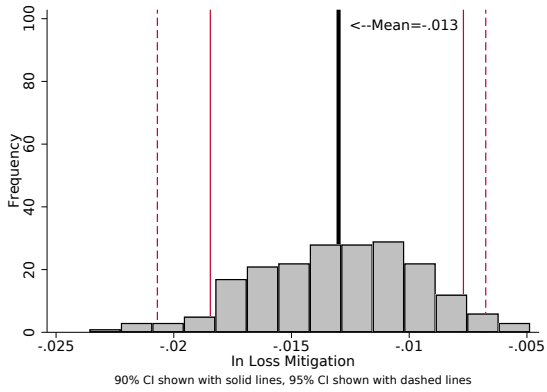
Notes: Quarters from Q1 2013 to Q1 2014 are shaded, showing the time from announcement to implementation of the servicing rule. Controls include interest rate, borrower credit score and loan amount at origination, and state and origination year fixed effects. The error bars shown are the 5th and 95th percentiles of the empirical distribution of the coefficients from the 200 samples, estimating equation 1. Sample includes all purchase loans originated between 2000 and 2006, with fixed interest rate and 30 year term, resulting in a sample size of 442,250,189 loan months. Figure 8a is relative to pre-treatment mean credit score of 670. Figure 8b is relative to a pre-treatment mean rate of 0.012. 8d is relative to a pre-treatment mean bankruptcy rate of 0.012.

Figure 9: Difference-in-Difference - Loan Performance

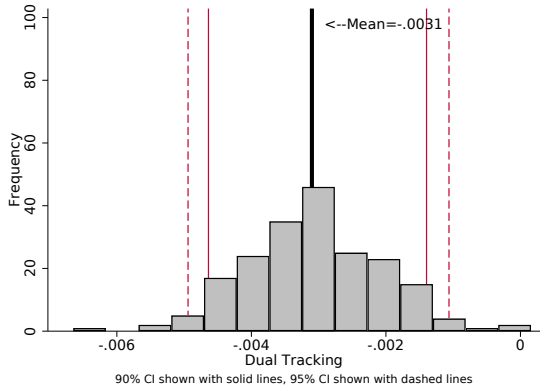
(a) Foreclosure Filing



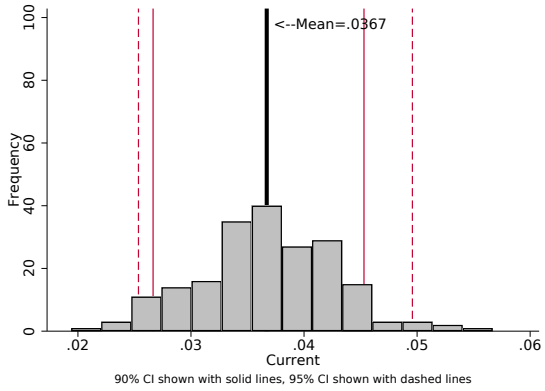
(b) Loss Mitigation



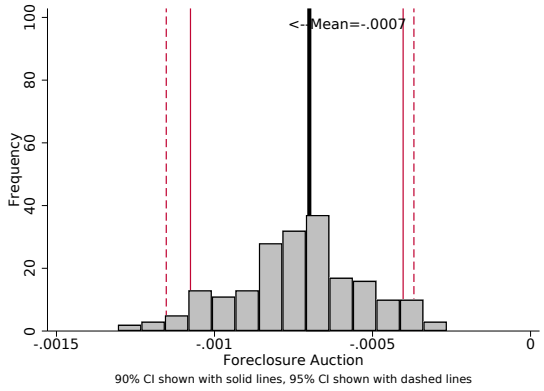
(c) Dual Tracking



(d) Current on Payment



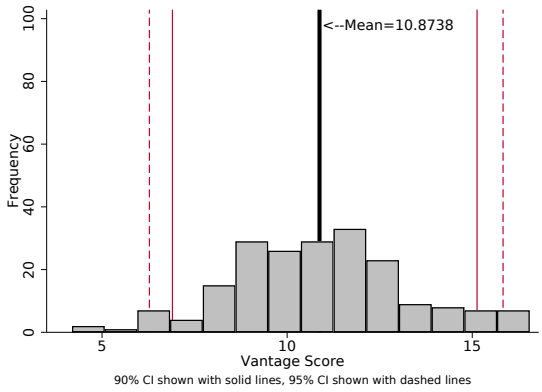
(e) Foreclosure Auction



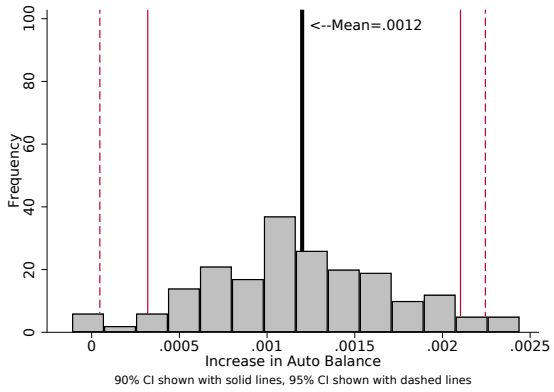
Notes: Each histogram shows the distribution of the Post2013*Non-GSE coefficients for the 200 samples, estimating equation 2. The 95% confidence interval of the empirical distribution of coefficients is shown with dashed lines and the 90% confidence interval is shown with solid lines. Controls include loan amount and borrower credit score at origination, interest rate, and fixed effects for origination year, current quarter and state. Sample includes all purchase loans originated between 2000 and 2006, with fixed interest rate and 30 year term, resulting in a sample size of 8.2 million loan months. Figure 9a is relative to pre-treatment mean foreclosure rate of 0.027. Figure 9b is relative to a pre-treatment mean loss mitigation rate of 0.014. Figure 9c is relative to a pre-treatment mean dual tracking rate of 0.004. Figure 9d is relative to pre-treatment mean current rate of 0.85.

Figure 10: Difference-in-Difference - Credit Outcomes

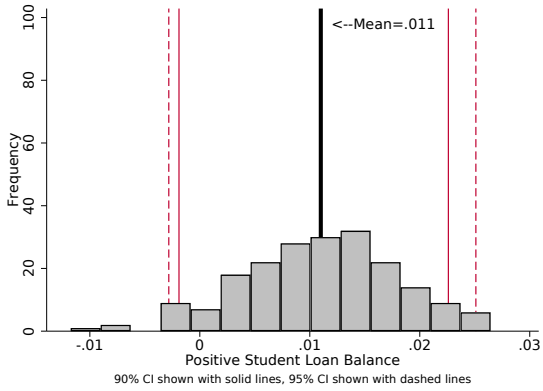
(a) Current Credit Score



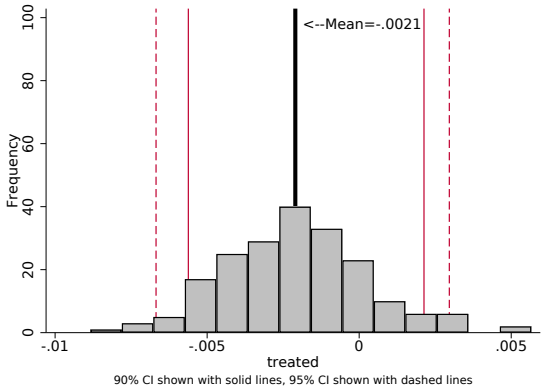
(b) Increase in Auto Debt



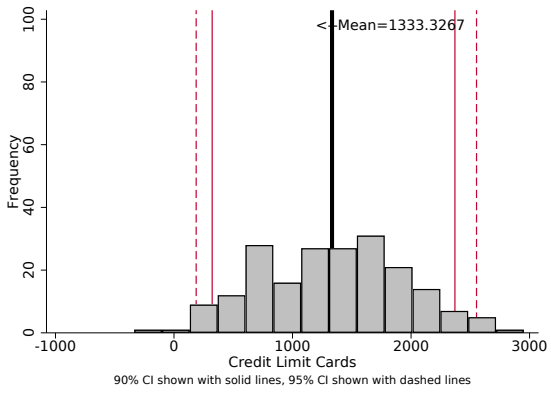
(c) Positive Student Loans



(d) Bankruptcy Filing



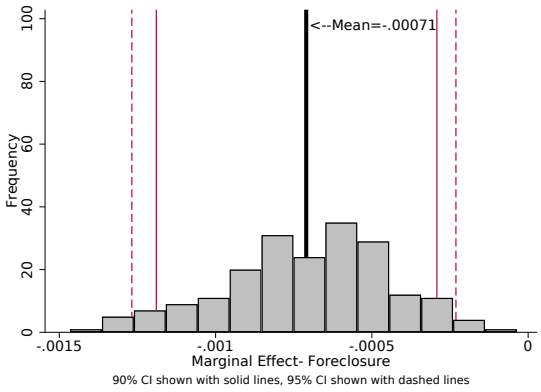
(e) Credit Card Limits



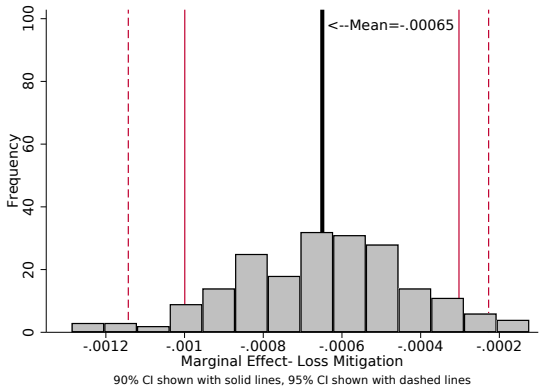
Notes: Each histogram shows the distribution of the Post2013*Non-GSE coefficients for the 200 samples, estimating equation 2. The 95% confidence interval of the empirical distribution of coefficients is shown with dashed lines and the 90% confidence interval is shown with solid lines. Controls include loan amount and borrower credit score at origination, interest rate, and fixed effects for origination year, current quarter and state. Sample includes all purchase loans originated between 2000 and 2006, with fixed interest rate and 30 year term, resulting in a sample size of 8.2 million loan months. Figure 10a is relative to a mean of 689. Figure 10b is relative to a mean of .012. Figure 10c is relative to a mean of .144. Figure 10d is relative to a mean of .01.

Figure 11: Duration Model Coefficients

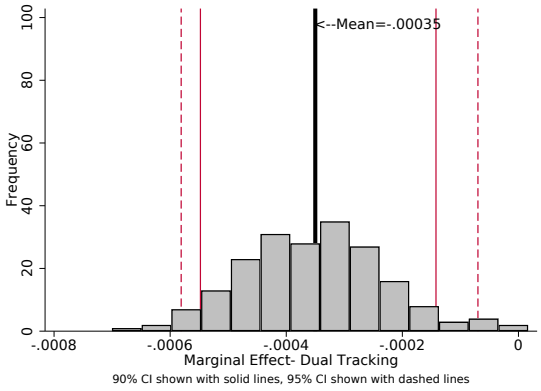
(a) Foreclosure Filing



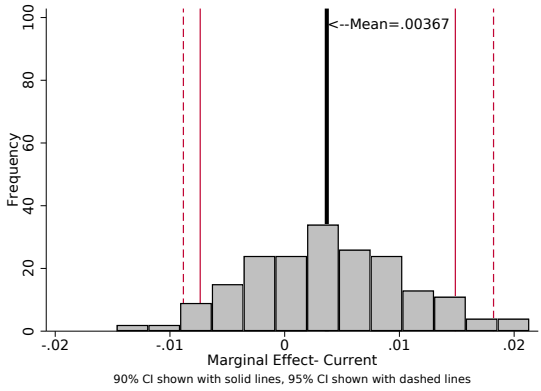
(b) Loss Mitigation



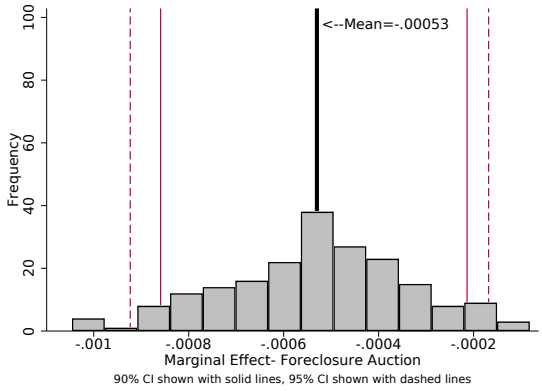
(c) Dual Tracking



(d) Current on Payment



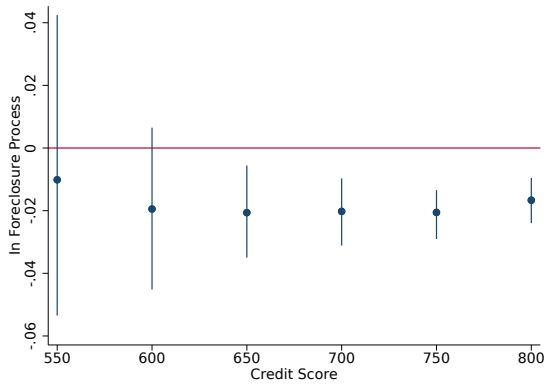
(e) Foreclosure Auction



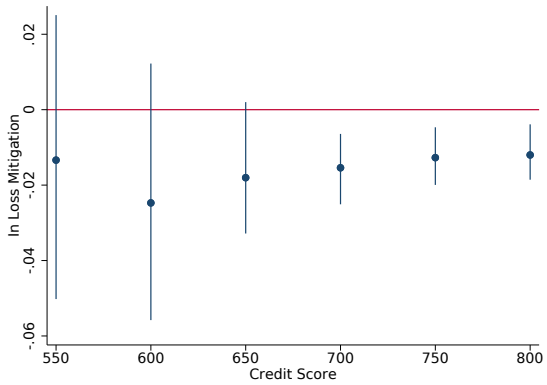
Notes: The histogram shows the distribution of the Post2013*Non-GSE marginal effects for the 200 samples, estimated as shown in equation 3. The 95% confidence interval of the empirical distribution of coefficients is shown with dashed lines and the 90% confidence interval is shown with solid lines. Controls include loan amount and borrower credit score at origination, interest rate, and fixed effects for origination year, current quarter and state. Sample includes all purchase loans originated between 2000 and 2006, with fixed interest rate and 30 year term, resulting in a sample size of 8.2 million loan months. Note that the Current on Payment estimate is run on a sample of delinquent loans only, in which time to Current can be well defined. Marginal effects can be interpreted as the ratio in the likelihood of transition into each status for treated, relative to control, loans in any given month.

Figure 12: Heterogeneous Loan Performance by Credit Score

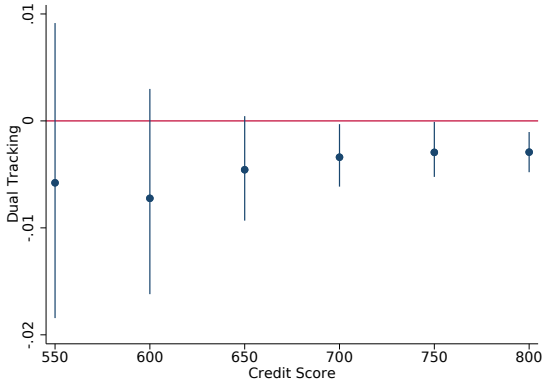
(a) Foreclosure Filing



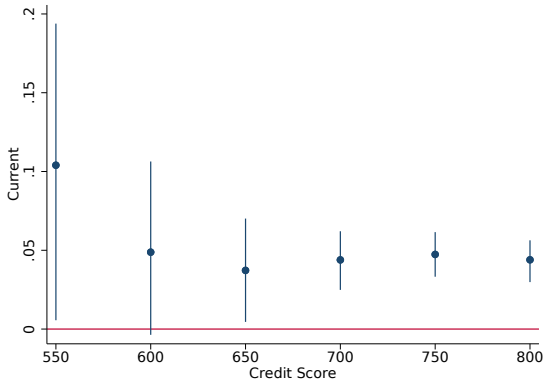
(b) Loss Mitigation



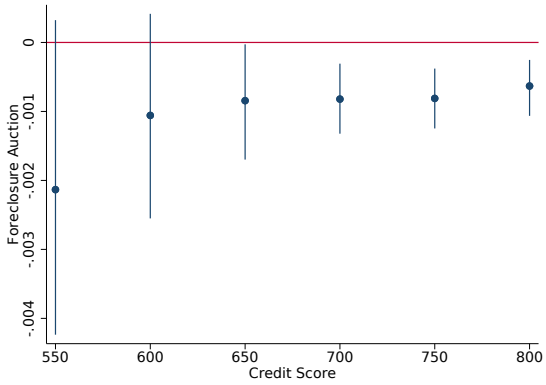
(c) Dual Tracking



(d) Current on Payment



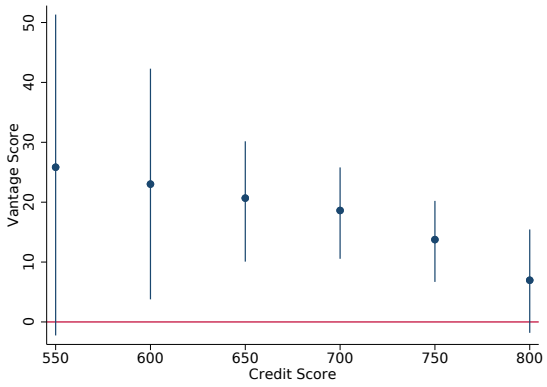
(e) Foreclosure Auction



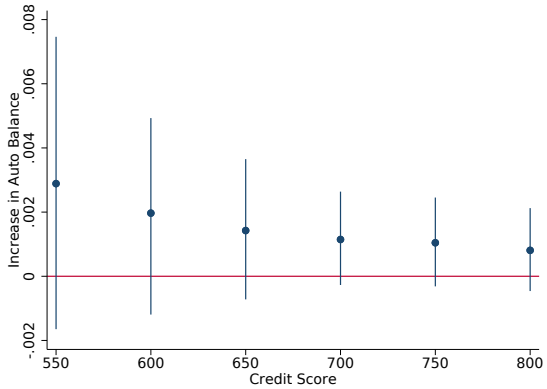
Notes: Each graph shows the point estimate and confidence intervals of the Post2013*Non-GSE treatment interacted with credit score category dummies. Controls include loan amount and borrower credit score at origination, interest rate, and fixed effects for origination year, current quarter and state. Sample includes all purchase loans originated between 2000 and 2006, with fixed interest rate and 30 year term, resulting in a sample size of 8.2 million loan months.

Figure 13: Heterogeneous Credit Outcomes by Credit Score

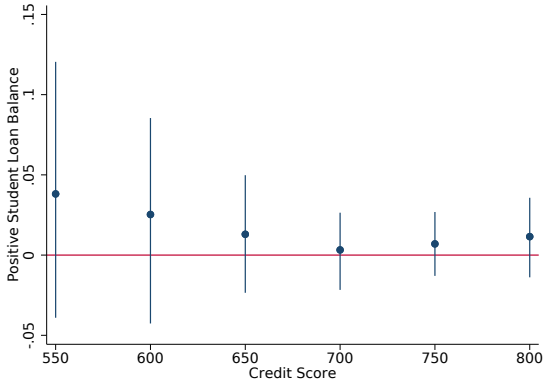
(a) Current Credit Score



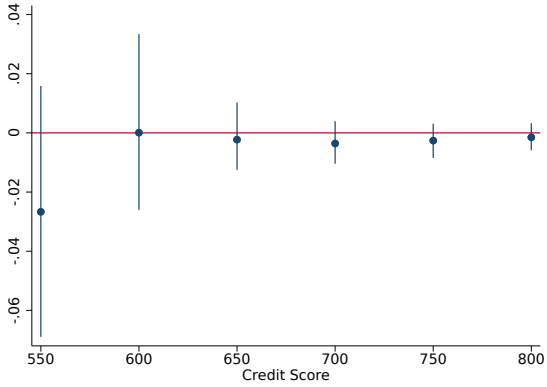
(b) Increase in Auto Debt



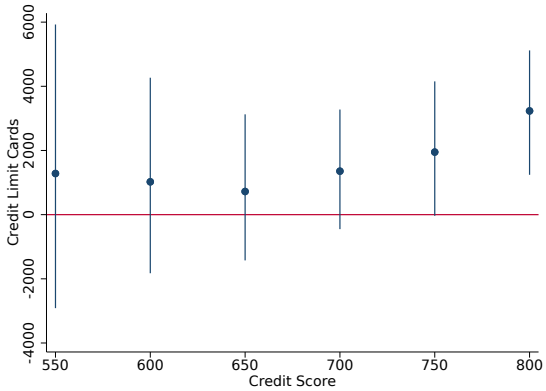
(c) Positive Student Loans



(d) Bankruptcy Filing



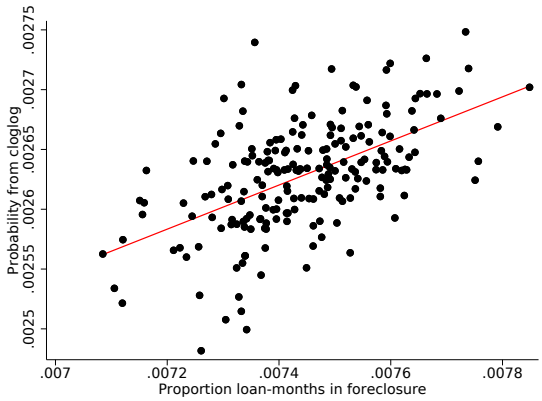
(e) Credit Card Limits



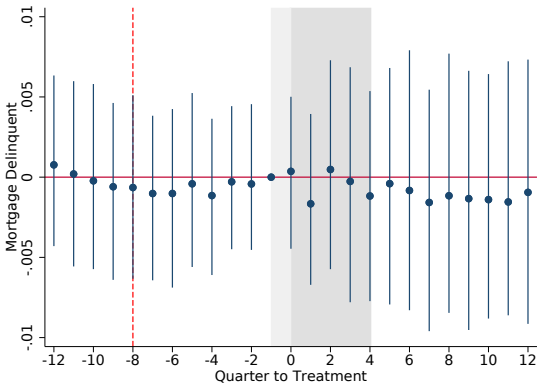
Notes: Each graph shows the point estimate and confidence intervals of the Post2013*Non-GSE treatment interacted with credit score category dummies. Controls include loan amount and borrower credit score at origination, interest rate, and fixed effects for origination year, current quarter and state. Sample includes all purchase loans originated between 2000 and 2006, with fixed interest rate and 30 year term, resulting in a sample size of 8.2 million loan months.

Figure 14: IV Assumptions

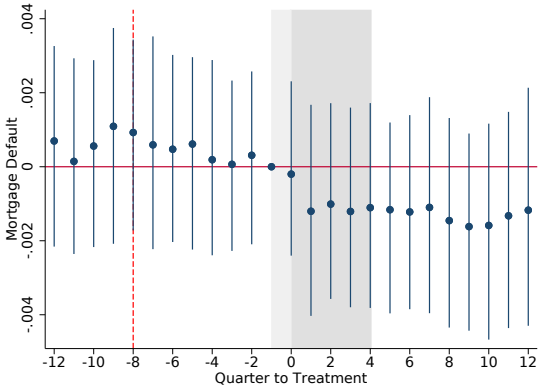
(a) Relevance of IV



(b) Event Study, 30 Day Delinquent

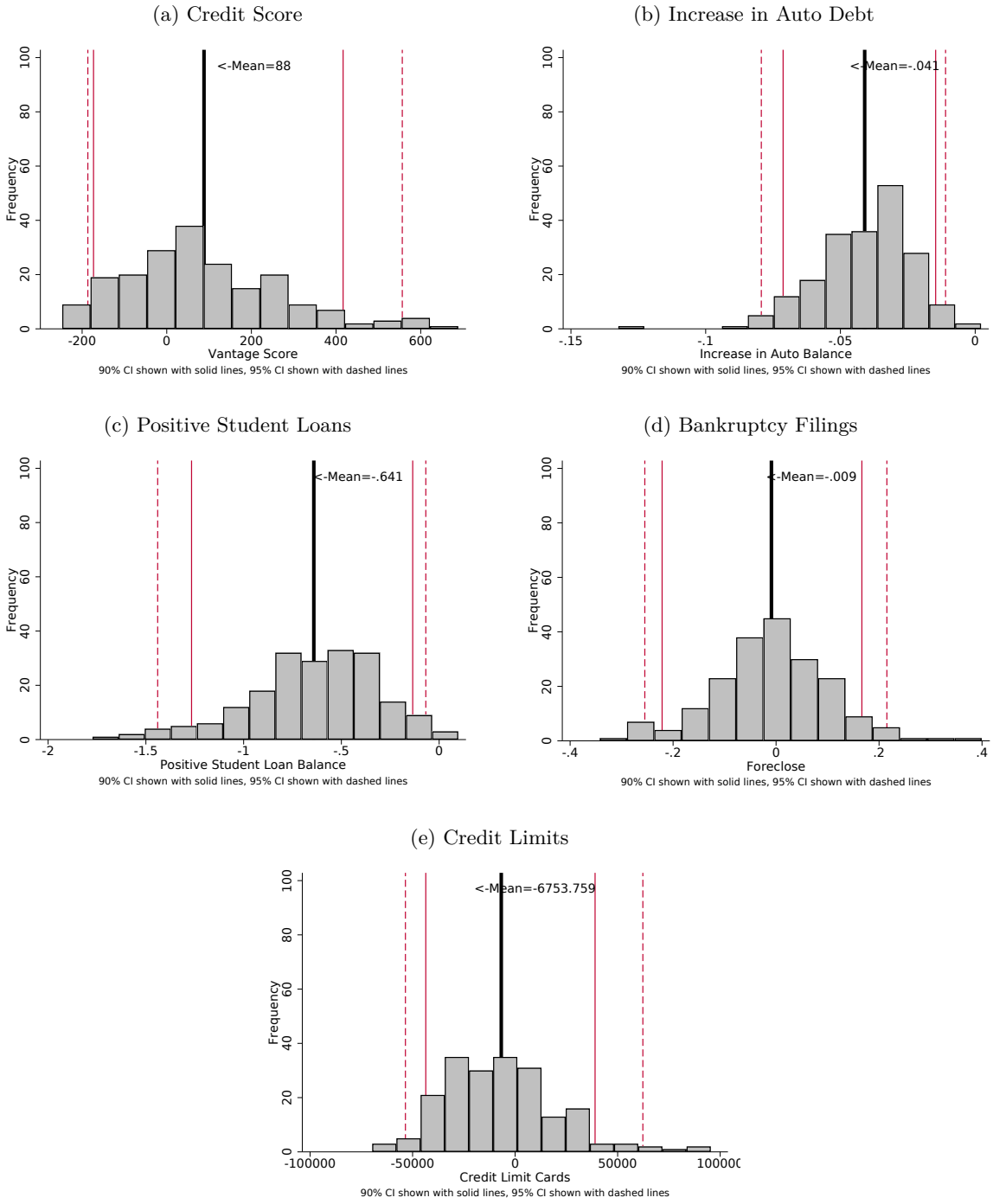


(c) Event Study, 90 Day Default



Notes: Figure 14a plots the average predicted foreclosure rate vs. actual foreclosure rate for each of the 200 samples in the data, along with a best fit line. In Figures 14b and 14c, quarters from Q1 2013 to Q1 2014 are shaded, showing the time from announcement to implementation of the servicing rule. Controls include interest rate, borrower credit score and loan amount at origination, and state and origination year fixed effects. The error bars shown are the 5th and 95th percentiles of the empirical distribution of the coefficients from the 200 samples, estimating equation 1. Sample includes all purchase loans originated between 2000 and 2006, with fixed interest rate and 30 year term, resulting in a sample size of 442,250,189 loan months.

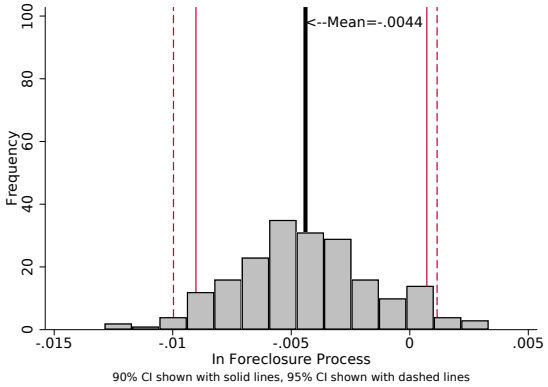
Figure 15: IV Coefficients



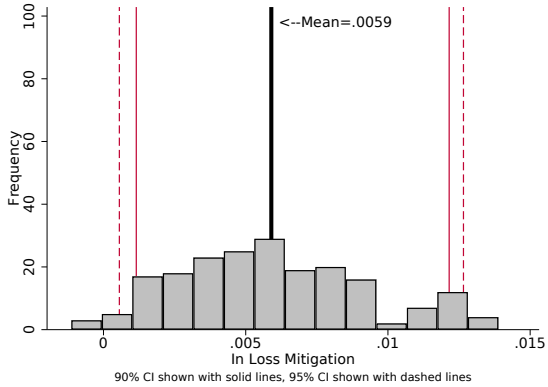
Notes: Each graph shows the distribution of the IV regressions from each of 200 samples, estimating equation 5. Controls include interest rate, borrower credit score and loan amount at origination, and state and origination year fixed effects. The error bars shown are the 5th and 95th percentiles of the empirical distribution of the coefficients from the 200 samples. Sample includes all purchase loans originated between 2000 and 2006, with fixed interest rate and 30 year term, resulting in a sample size of 442,250,189 loan months. Figure 15a is relative to pre-treatment mean credit score of 670. Figure 15b is relative to a pre-treatment mean rate of 0.012. 15d is relative to pre-treatment mean bankruptcy rate of 0.012.

Figure A1: Guideline Diff-in-Diff - Loan Performance

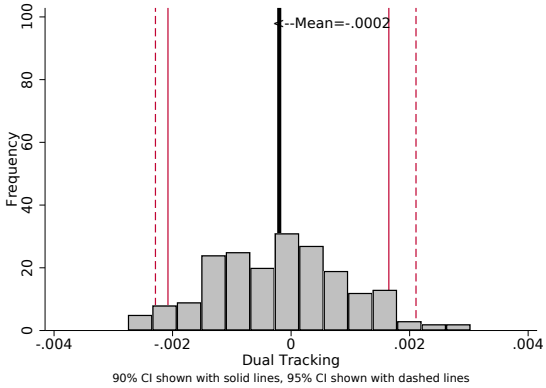
(a) Foreclosure Filing



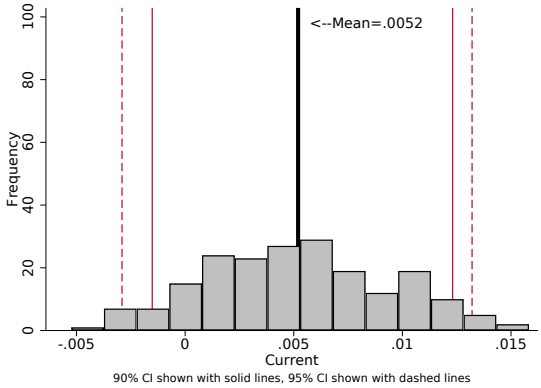
(b) Loss Mitigation



(c) Dual Tracking



(d) Current on Payment



(e) Foreclosure Auction

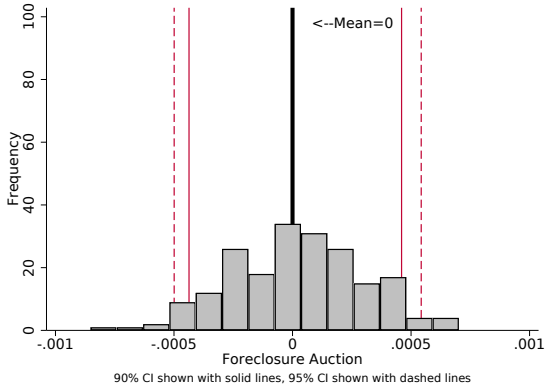
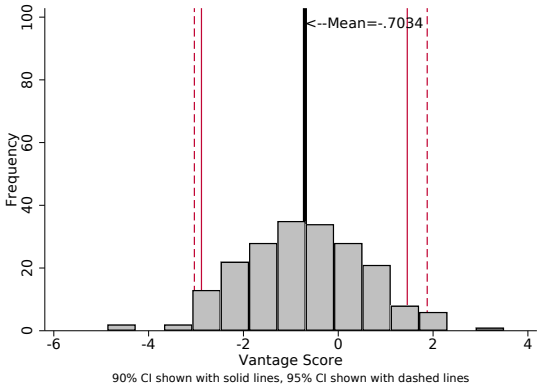
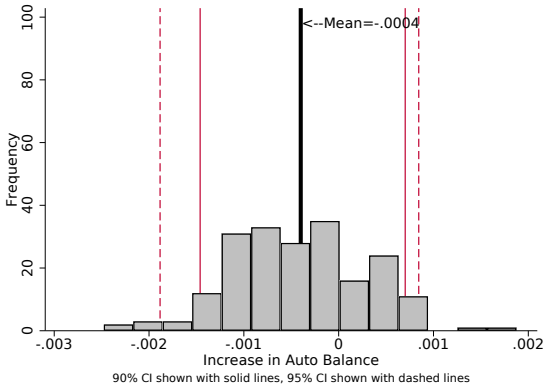


Figure A2: Guideline Diff-in-Diff - Credit Outcomes

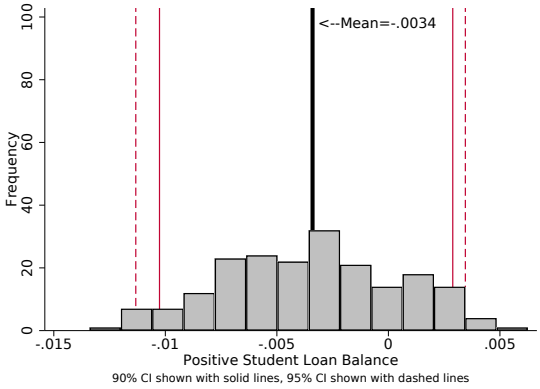
(a) Current Credit Score



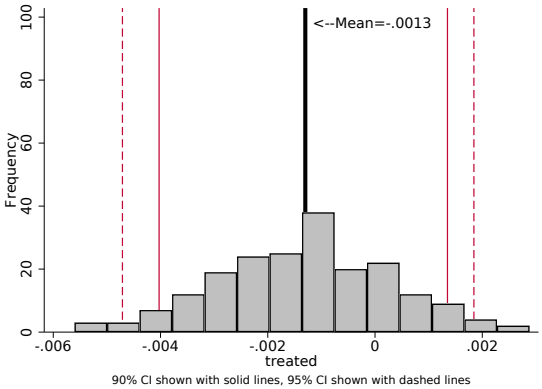
(b) Increase in Auto Debt



(c) Positive Student Loans



(d) Bankruptcy Filing



(e) Credit Card Limits

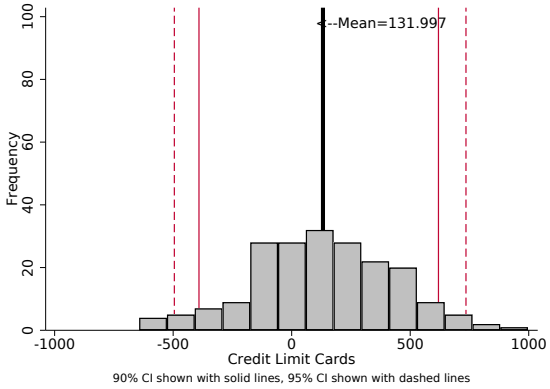
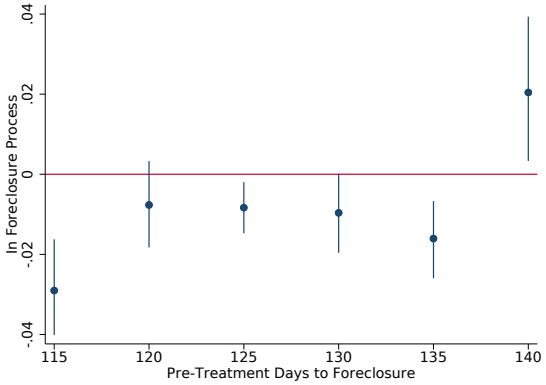
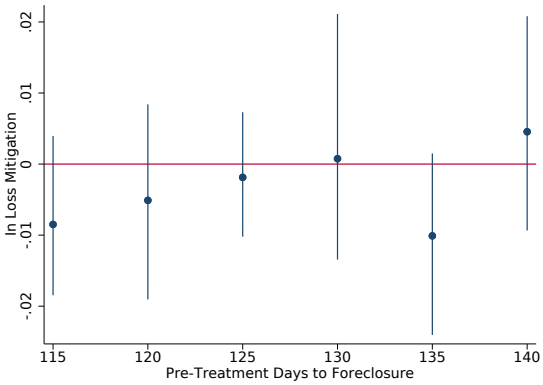


Figure A3: Heterogeneous Loan Performance by Prior Timeline

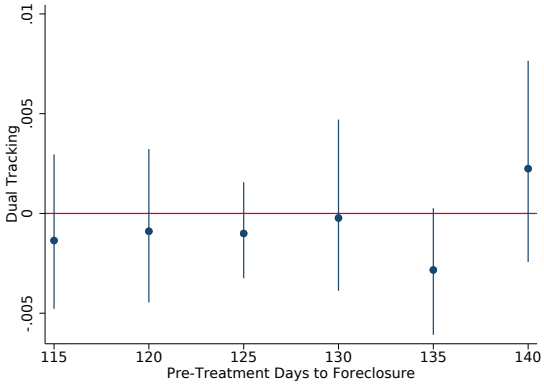
(a) Foreclosure Filing



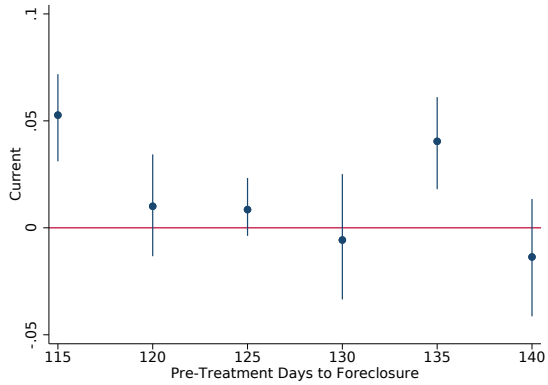
(b) Loss Mitigation



(c) Dual Tracking



(d) Current on Payment



(e) Foreclosure Auction

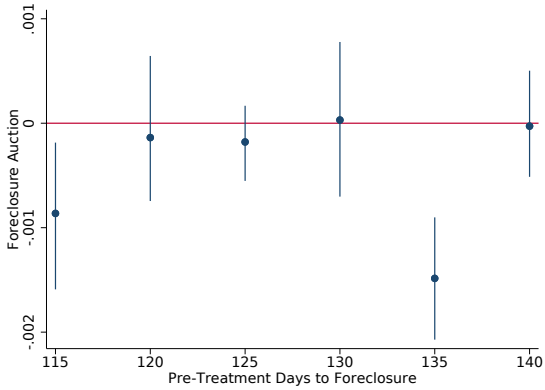
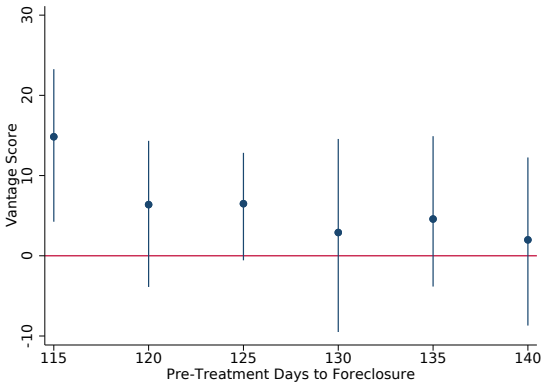
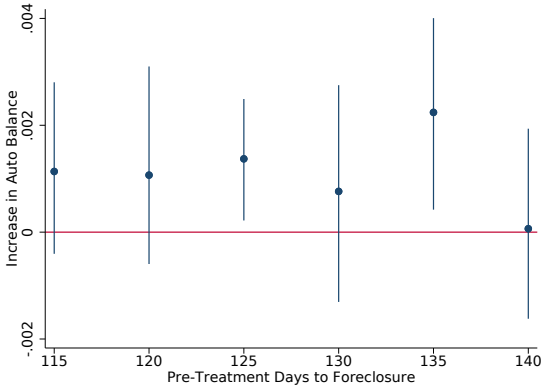


Figure A4: Heterogeneous Credit Outcomes by Credit Score

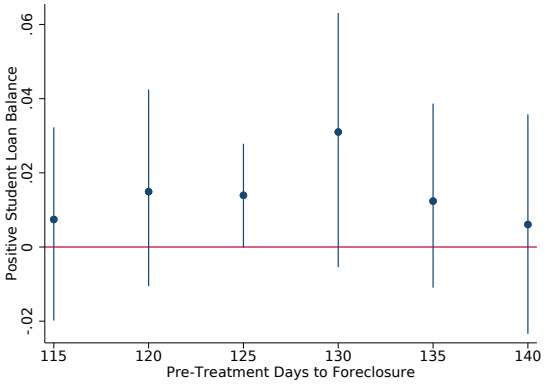
(a) Current Credit Score



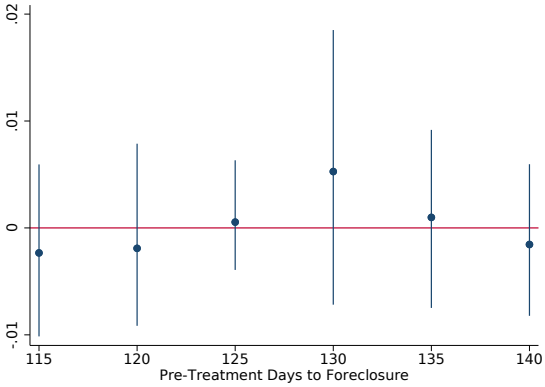
(b) Increase in Auto Debt



(c) Positive Student Loans



(d) Bankruptcy Filing



(e) Credit Card Limits

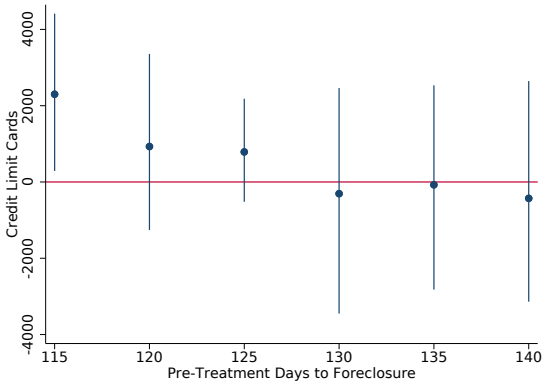
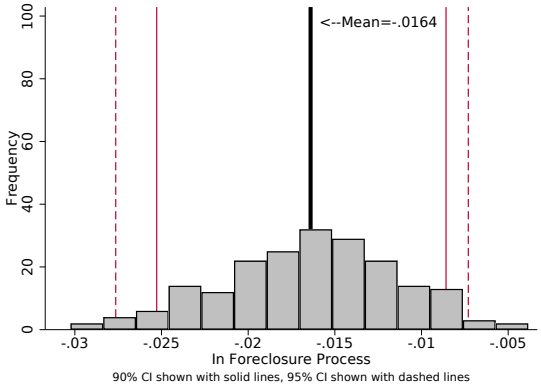
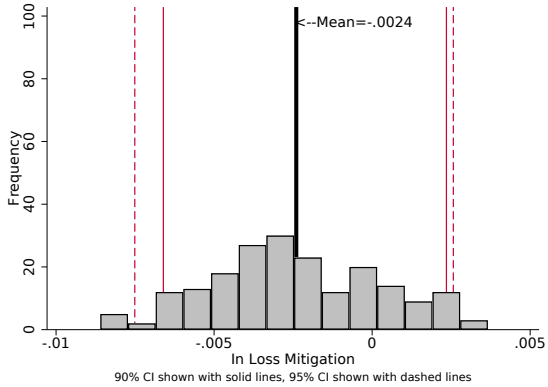


Figure A5: Heterogeneous Loan Performance by Modification Status

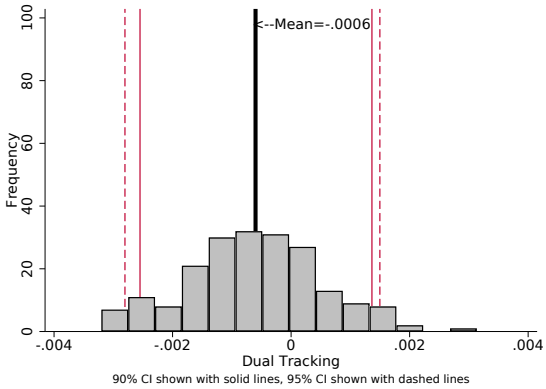
(a) Foreclosure Filing



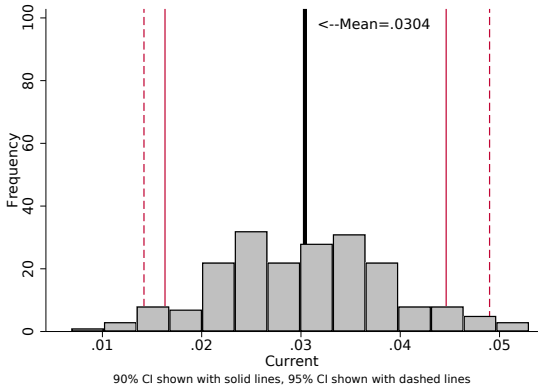
(b) Loss Mitigation



(c) Dual Tracking



(d) Current on Payment



(e) Foreclosure Auction

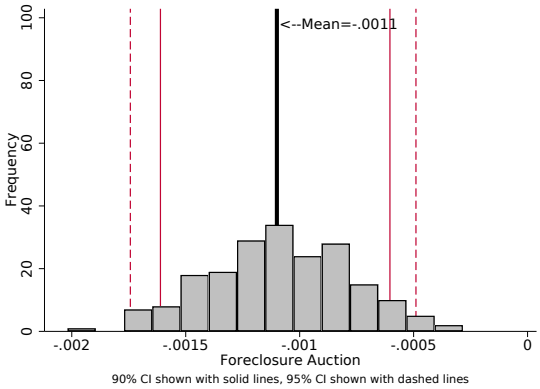
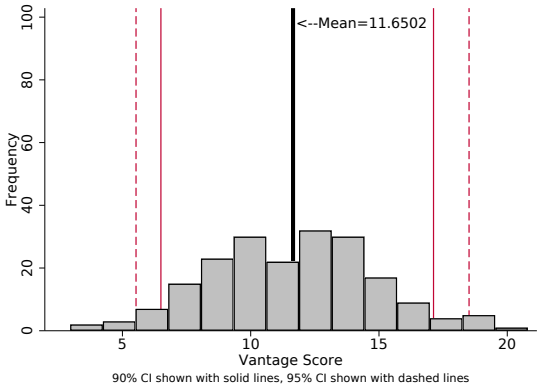
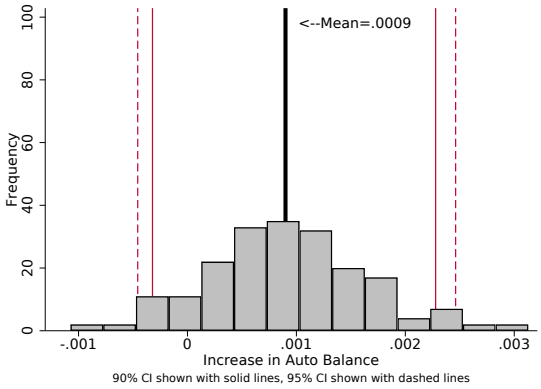


Figure A6: Heterogeneous Credit Outcomes by Modification Status

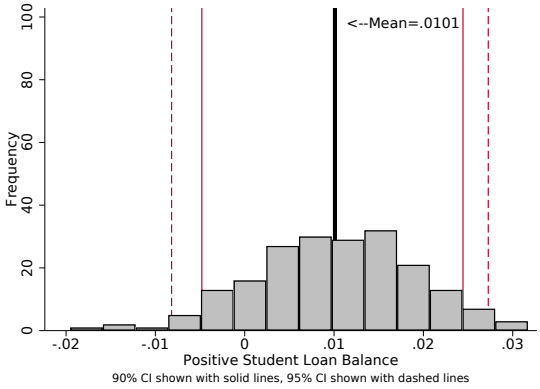
(a) Current Credit Score



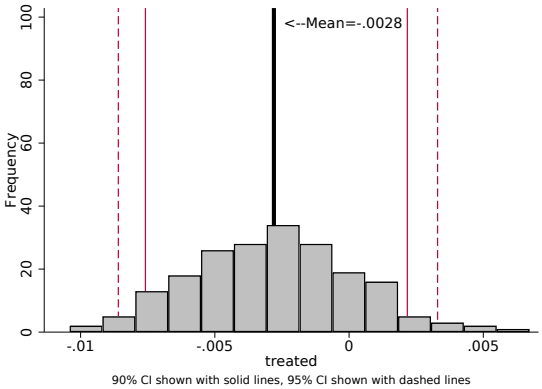
(b) Increase in Auto Debt



(c) Positive Student Loans



(d) Bankruptcy Filing



(e) Credit Card Limits

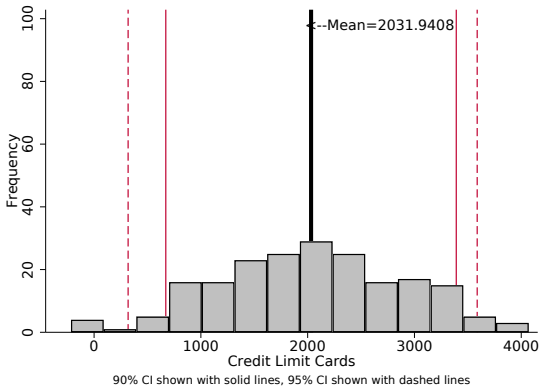


Table 1: Summary Statistics

	mean	p10	p50	p90
Loan Characteristics				
Origination Year	2004.78	2002	2005	2007
Interest Rate	.0631652	.055	.0625	.0725
Credit Score	717.0597	635	724	790
Loan Amount	167589.6	62000	134000	308000
Mortgage Status				
Foreclose	.0386315	0	0	0
Loss Mitigation	.0236792	0	0	0
Current on Payment	.8578324	0	1	1
Preforeclose	.0206348	0	0	0
Dual Tracking	.0057454	0	0	0
Foreclosure Sale	.0016216	0	0	0
Credit Outcomes				
Increase in Auto Debt	.0112956	0	0	0
Total Card Credit Limit	25555.27	0	17600	61672.75
Positive Student Loans	.1435007	0	0	1
Vantage Score	686.4221	540	711	810
Bankruptcy Filed	.0145571	0	0	0