Does homeownership matter? The long-term consequences of losing a house during the Great Recession

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Abstract

This paper examines the long-term impact of keeping versus losing one's home following a mortgage delinquency in the aftermath of the Great Recession, studying the trajectory of homeownership, consumption, and financial well-being over the subsequent decade. Our research design leverages the substantial number of households that experienced temporary income shocks and the turbulence of the foreclosure crisis - we focus on individuals who were seriously delinquent on their mortgages and compare outcomes between those who received a mortgage modification and those who did not. These two groups exhibit highly similar pre-trends in financial outcomes prior and during the Great Recession but diverge by 36 percentage points in their short-term likelihood of retaining homeownership. More than half of this disparity persists nearly a decade later, translating into an average capital gain of $83,000 in the housing market. Surprisingly, despite these significant differences in homeownership and wealth accumulation, keeping a home does not appear to influence the path of creditworthiness, proxies for consumption, and the income rank of one's residential neighborhood.

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1 Introduction

Homeownership is widely considered a key pathway to wealth accumulation and improved access to credit (Goodman and Mayer 2018). However, homeowners are vulnerable to numerous employment and income risks, including economic recessions (Hoynes, Miller, and Schaller 2012), firm closures and mass layoffs (Davis and Von Wachter 2011), technological advancements (Acemoglu and Restrepo 2020), trade shocks (Autor, Dorn, and Hanson 2013), and health crises (Lenhart 2019). Although these economic shocks are often temporary, they can severely impair a household's ability to meet mortgage obligations, leading to delinquency and, ultimately, foreclosure. The loss of homeownership - along with the depletion of home equity and the potential deterioration of creditworthiness - is a well-recognized downside risk. Yet, our understanding of the long-term consequences of losing a home following an economic shock remains limited.

The causal effects of homeownership are of substantial importance, but quasi-experimental variation in homeownership status is rare. Sodini et al. (2023) provide evidence on the benefits of homeownership using a unique setting in which Swedish public housing occupants were quasi-randomly transitioned into homeownership. However, little is known about the consequence of *losing* a home, despite the fact that home loss is a common outcome during times of economic instability. There are two critical challenges to studying this aspect of homeownership. First, obtaining a comprehensive longitudinal dataset that captures income shocks, homeownership status, and related financial indicators for a large population is inherently difficult. Second, significant selection concerns arise: households facing negative income shocks may differ systematically from those with stable incomes, and furthermore, the ability to sustain homeownership in the aftermath of such shocks is often contingent on access to liquidity. As a result, retaining homeownership is likely correlated with a wide range of economic and financial factors that also shape long-term outcomes.

This paper overcomes these challenges to provide the first estimates of the long-run impact of losing one's home following a severe economic shock. Specifically, we examine how home loss in the aftermath of the Great Recession influences the long-run trajectory of homeownership, consumption, residential location, and financial well-being.

To address the first challenge, we utilize a unique dataset of 380,000 individuals from seven major U.S. markets who became homeowners or refinanced their mortgages between 2004 and 2008 (Bayer, Ferreira, and Ross 2016; Bayer, Ferreira, and Ross 2018). We obtained their credit reports at three-year intervals from June 2004 to June 2022, enabling us to track changes in homeownership,

delinquency, and foreclosure status over time, along with various financial and consumption-related indicators. These recent mortgage borrowers experienced high rates of economic distress during the Great Recession, leading to a significant number of delinquencies and foreclosures (Bayer, Ferreira, and Ross 2016; Chan, Haughwout, and Tracy 2015).

We tackle the selection issue by implementing a novel research design that compares two groups of homeowners who experienced similar negative income shocks but had different probabilities of retaining their homes due to mortgage modifications. This approach leverages three key stylized facts about the Great Recession and its foreclosure crisis. First, nearly all mortgage defaults during the Great Recession were driven by temporary income shocks (Ganong and Noel 2023). Second, mortgage servicers, while more likely to grant modifications to borrowers with stronger credit profiles, lacked the capacity to effectively evaluate and process the overwhelming volume of delinquent households in the aftermath of the Great Recession, leading to a chaotic modification approval process (Agarwal et al. 2011a; Cordell et al. 2008; Ross and Wang 2021). Indeed, as we show below, based on all available observable variables, the ability for severely delinquent borrowers to get a modification during this period appears to have been close to random. Third, mortgage modifications significantly reduced the short-term likelihood of home loss among financially distressed households during the crisis (Agarwal et al. 2017; Ganong and Noel 2020).

We focus specifically on distressed mortgage borrowers who experienced a 90-day delinquency at any point in the two years leading up to June 2010, which represent 18% of our overall sample. Within this group, we compare outcomes between the treated group—the 24% of individuals who received a mortgage modification within the following three years—and the control group, consisting of those who did not receive a modification. We find large effects on the short-term maintenance of homeownership: by June 2013, the likelihood of maintaining homeownership declined by 51 percentage points for the control group, compared to only 15 percentage points for the treatment group, meaning modifications helped preserve homeownership for 36% of these borrowers. We show that half of the reduction in homeownership for the control group is due to differences in foreclosure rates, with the other half likely attributable to variations in short sales (Ferreira and Gyourko 2015).

Next, we conduct a series of tests to validate our estimates and research design. We show that the treatment and control groups exhibit remarkably similar pre-trends in homeownership and a wide variety of other credit, consumption, and financial variables. We also provide evidence that selection into receiving a modification is minimal once the comparison is limited to homeowners who faced a 90-day mortgage delinquency. Specifically, our analysis of borrower characteristics reveals

that delinquent borrowers who received a modification were predicted to be slightly *less* likely to own a home in 2013 compared to those who did not, suggesting only modest selection effects. Consistent with minimal selection on observables, our main short-term homeownership effect of 36 percentage points is highly stable to a wide variety of controls, including a broad set of individual, house, loan, and neighborhood characteristics. It is also robust to using a national sample of Fannie Mae mortgages where we can observe even more detailed mortgage characteristics. Finally, houses in both treatment and control groups have almost perfect co-movement in price appreciation, which helps to rule out any potential endogeneity in modifications stemming from bank considerations of (i) recent house price depreciation, (ii) the household's current equity position, or, most interestingly, (iii) any expected future gains in house values.

Finally, we conduct a long-term analysis. We find that the substantial difference in homeownership rates in 2013 persists over time: in 2022, the treated group remain 19 percentage points more likely to be homeowners. This suggests the potential for considerable differential wealth accumulation between those who retained versus lost their homes. Capital gains calculations based on initial purchase price, purchase date, and local housing price appreciation indicate that if all borrowers had retained their homes, appreciation gains would have been similar across groups. However, accounting for home loss and relocation effects, by 2022, the modification group accumulated an average of $83,000 more in housing wealth compared to their non-modification counterparts, a sizable differential return on initial equity levels.

We also test for long-term outcomes beyond homeownership. We find that the credit scores of treatment and control groups followed nearly identical trajectories throughout the period—both before the delinquency and over the decade following it.[1] Further, trajectories for credit card balances, auto loan payments, and future credit delinquencies are strikingly similar. The groups also live in remarkably similar neighborhoods long-term, as measured by the income percentile of the ZIP of residence. Overall, the significant differences in homeownership status from 2013 to 2022 had little apparent impact on long-term financial conditions and neighborhood resources.

The lack of a consumption response may seem surprising at first given that owner-occupants during this period experienced significant capital gains and previous research shows that rising home values typically boost consumption - while Aladangady (2017) and Mian, Rao, and Sufi (2013), Gra-

[1]This consistency may seem surprising, as one might expect lower credit scores for households that lost their homes through foreclosure or short sale. We find that both groups experience major drops in creditworthiness at the time of delinquency. Mortgage-related major credit derogatories can include 90-day delinquencies and foreclosure notices, as well as losses from modifications, short sales, and foreclosure sales. As a result, any eventual foreclosure may have only a modest effect on credit score, over and above the impact of an initial severe delinquency and/or foreclosure notice.

ham, James, and Christos A. Makridis. 2023 find large wealth effects, other work find more muted responses, such as Browning et al, Disney et al. and Guren et al. A key mechanism for housing wealth effects is the easing of collateral constraints (DeFusco 2018; Sodini et al. 2023). However, our population of severely delinquent borrowers would have had relatively limited access to cash out refinance mortgages following the financial crisis, potentially limiting the ability to consume out of illiquid housing wealth.[2] A second possible explanation is the lasting behavioral impact of experiencing a significant negative income shock, a severe drop in home values, and the accompanying threat of foreclosure. Similar to how the Great Depression led to a more frugal generation (Malmendier and Nagel 2011), these experiences may have made households less willing to spend based on accumulated housing equity.

Taken together, our findings suggest that home loss does not necessarily cause long-term financial ruin. In the period surrounding the Great Recession, we find that homeowners were able to garner considerable additional wealth, but that households who lost their homes maintained similar trajectories in neighborhood income, consumption, and creditworthiness.

The rest of the paper is organized as follows. Section 2 provides background on the Great Recession as it relates to our analysis. Section 3 describes the data and research design, including validation exercises. Section 4 outlines our main results. Section 5 details the robustness of our results. Section 6 concludes.

2 Background

Housing prices in US metropolitan areas entered a period of rapid appreciation in the late 1990s and early 2000s, until they reached a peak around 2006 (Ferreira and Gyourko 2023), an increase accompanied by a growing housing supply, increasing mortgage transactions, and an increasing share of mortgages originated by subprime lenders (Chan, Haughwout, and Tracy 2015; Mayer, Pence, and Sherlund 2009). By late 2006, housing prices had begun to fall, the subprime sector started to contract, and foreclosure starts increased from close to zero to 0.6% in early 2007. Then, as the financial crisis worsened and the Great Recession began, housing prices fell rapidly, BLS-reported unemployment rates soared to 10% in 2009, and foreclosure starts more than doubled to 1.4% in early 2009 (Been et al. 2011a). Foreclosure starts remained at a high level throughout 2010 creating a large stock of seriously delinquent mortgages—in the 24 months preceding June 2010, as the Great Reces-

[2] For more details, see the discussion in section 4.4

sion built, 16% of households experienced a 90-day delinquency on their mortgage.[3] Many studies have also documented that the beginning of the foreclosure crisis was worse for minority and low-income borrowers and the neighborhoods in which they resided, e.g Bayer, Ferreira, and Ross (2014) and Bayer, Ferreira, and Ross (2016), Ghent, Hernández-Murillo, and Owyang (2014), Chan et al. (2013), and Fisher et al (2011).

The factors driving the increase in foreclosures during the Great Recession have been extensively discussed, including the decline in underwriting standards (Bhutta and Keys 2022; Mian and Sufi 2009), fraud (Jiang, Nelson, and Vytlacil 2014; LaCour-Little and Yang 2013), housing price declines (Palmer 2015), and lack of liquidity arising from temporary income shocks (Ganong and Noel 2020). While many of the early explanations focused on the features of subprime loans, the evidence suggests that other market forces were primary drivers of the overall foreclosure crisis.[4] The most recent research points to negative equity due to housing prices declines (Ferreira and Gyourko 2015; Palmer 2015) and temporary income shocks as the main drivers of the foreclosure crisis (Ganong and Noel 2020). Foote et al. (2008) and Campbell and Cocco (2015) note that even when a homeowner is in negative equity, the option value associated with potential future capital gains can be quite large, and households are unlikely to default on their mortgage unless they experience a significant income shock and face liquidity or borrowing constraints. Bhutta, Dokko, and Shan (2017) further suggest emotional attachment and various behavioral factors as another explanation for low rates of default. In this context, declining housing prices put households at risk of losing their home, but default was unlikely to occur unless the household experienced a significant income shock. Overall, Ganong and Noel (2020) conclude that 70 percent of foreclosures were driven solely by negative life events (i.e., cash-flow defaults), while 24 percent were driven by the interaction between negative life events and negative equity.

How did mortgage servicers respond to the crisis? Agarwal et al. (2011a) find that within six months of becoming seriously delinquent in 2008, more than half of mortgages had no recorded action related to either foreclosure or loss mitigation, which they attribute to an industry that was overwhelmed by the number of problem mortgages and the severe asymmetries of information faced

[3] These numbers and later Fannie Mae statistics cited in this section are based on Fannie Mae public loan performance data for mortgages issued between 2004 and 2008

[4] While rate resets of subprime adjustable rate mortgages were often highlighted as an important driver of foreclosure, LIBOR rates peaked in the second quarter of 2006 and fell rapidly starting in the third quarter of 2007. Foote et al. (2008) show that most subprime borrowers who defaulted, did it well before the rate reset date, also observing that defaults were more sensitive to house price declines than interest rates. Moreover, Ferreira and Gyourko (2015) show that home losses among subprime borrowers only exceeded losses among prime borrowers in the early stages of the crisis, prior to 2009. Early in 2009, home losses among prime borrowers grew rapidly and between 2009 and 2012 twice as many prime borrowers lost their homes as subprime borrowers.

during the loss mitigation process. Ross and Wang (2021) show that the fraction of borrowers with 150+ day delinquencies who did not have a foreclosure filing in their credit report increased substantially starting in 2006. Cordell et al. (2008) notes that considerable consolidation occurred during the run up to the housing crisis yielding labor savings from economies of scale. However, loss mitigation was labor intensive with minimal economies of scale compared to traditional servicing activities, and, as a result, servicers lacked both the staff and the technology to adequately support loan modification efforts. Not surprisingly, Agarwal et al. (2011b) and Reid, Urban, and Collins (2017) document substantial heterogeneity across servicers in whether modifications are even offered to borrowers. In fact, the fraction of Fannie Mae mortgages that received an initial modification was flat at less than 0.03% of all mortgages from the first quarter of 2008 at the start of the Great Recession to the first quarter of 2009.

The modification-related strain on servicers increased by at least an order of magnitude following the announcement of the Home Affordable Modification Program (HAMP). In publicly-available data on Fannie Mae loan performance, we observe a twenty-fold expansion in the volume of initial loan modifications per quarter by mid-2010, a little over a year following the announcement of the HAMP program in early 2009. Agarwal et al. (2017) exploit variation in the pre-HAMP modification experience of loan servicers to estimate the effect of HAMP, concluding that HAMP led to 1 million additional modifications. This rapid expansion in modifications was managed by an industry that was already overwhelmed and under-resourced.

In sum, the Great Recession represents an economic episode in which a substantial share of U.S. homeowners faced temporary incomes shocks, had negative equity in their homes, and, in many cases, had limited savings or access to credit to support continued mortgage payments. In response to federal policies, a rapid expansion of mortgage modifications occurred in a moment when loan servicers had minimal experience and insufficient resources to manage these circumstances effectively, leading to review and decision processes that were often characterized as cursory and chaotic. Further, most homeowners themselves had no experience with, or even prior knowledge of, the potential for mortgage modifications. Consistent with this context, in the research design section below, we show that there are minimal observable differences in levels and trends between seriously delinquent mortgage borrowers who received and did not receive a mortgage modification.

3 Data and Research Design

In this section, we present our novel individual level panel data and demonstrate how the unique context of the Great Recession supports our research design: a large fraction of the U.S. population were new homeowners, income shocks were pervasive, and loan modifications, though chaotically implemented, were ultimately effective at keeping people in their homes.

3.1 Sample and Data Sets

We begin with a sample of new mortgage originators, households that either purchased a new home or refinanced an existing mortgage between 2004 and 2008. This sample was originally developed in early 2009 by a subset of the authors, who used Home Mortgage Disclosure Act (HMDA) data and transaction and lien data from Dataquick Inc. to select a stratified, random sample of mortgages originated in seven key US housing markets, covering 50 large counties, from 2004 through 2008—see Bayer, Ferreira, and Ross (2016) and Bayer, Ferreira, and Ross (2018) for details.[5] These earlier papers linked this sample of borrowers and mortgages to credit data from 2009, examining how these households fared in the foreclosure crisis that occurred in the immediate aftermath of the Global Financial Crisis during the Great Recession. In the current paper, we follow this sample of borrowers through 2022, allowing us to examine how many aspects of their lives were affected in the medium to long run.

Specifically, the original sample includes 270,000 home purchase and refinance mortgages originated during the summers of 2004 through 2008 by a mix of single borrowers and co-borrowers, often married couples, for a total of 380,000 individual borrowers. To construct this sample, HMDA data were restricted to owner-occupied 1-4 family structures and the Dataquick data set eliminated non-arm's length transactions and transactions involving institutions rather than individual buyers and sellers, and was further restricted to transactions that occurred between May and September in each of the five sample years. HMDA loans and Dataquick assessor records were then matched using whether the mortgage was home purchase or refinance, year of transaction, loan amount, Census tract of the housing unit and the lender name. Finally, a subset of mortgages were randomly selected in equal numbers by site, by year, and by home purchase versus refinance mortgage.[6] These

[5] The seven broad housing markets include the Chicago, IL Consolidated Metropolitan Statistical Area (CMSA); Cleveland, OH Metropolitan Statistical Area (MSA); Denver, CO MSA; Los Angeles, CA CMSA; Miami, Ft. Lauderdale and Palm Beach MSA's; San Francisco, CA CMSA; and the Maryland portions of the Washington DC-Baltimore CMSA. These sites were selected based on the regional availability of the housing transaction and lien data—at the time, these were the only sites with information on refinance mortgages available through Dataquick back to 2004.

[6] There was also oversample of African-American borrowers; Hispanic borrowers; white borrowers who reside in low

resulting data contain the address of the property and the name(s) of the individual(s) involved, as well as characteristics of the house, loan, and borrower. The final data set provides a complete set of observable variables for 375,524 unique individuals. Summary statistics are provided in the first column of Table 1. Our sample has an average HMDA-reported income of $109,602. The average loan size is $224,100, with an average LTV of 0.77. The sample is 9.6% non-Hispanic Black, 16.6% Hispanic, and 7.9% non-Hispanic Asian.

We provided this sample to one of the major credit rating agencies, which used names and addresses to match borrowers to archival credit reporting data from June 30th of each year. June 30th was selected because this was the earliest archive month that contained demographic data for 2010. We received detailed credit reports in seven waves, every three years from 2004 to 2022. This panel provides rich information about each individual's financial circumstances before/during mortgage origination, and then for up to 18 years after origination. We define our matched sample as the set of individuals who had a credit score in the valid range $(300-850)$. There are 294,185 such individuals, which represents a match rate of 78.3%. The matched sample is observably similar to the full sample, as shown in the second column of Table 1. Average reported income in this sample is $111,144, with an average loan amount of $228,700. Borrowers are 9.1% non-Hispanic Black and 14.6% Hispanic, and 8.4% non-Hispanic Asian.

Because of our triennial waves of credit report data, some households with a delinquency appearing on their 2010 reports have also already lost their homes by June 2010—in a few cases there are reporting and recording lags in the credit rating agency. For this reason, in our main analysis, we constrain the sample to individuals who also still have an open mortgage on their 2010 credit report, in order to understand the impact of a subsequent modification—all main results below are robust to relaxing this constraint. The result of such constraint is shown in column 3 of Table 1 and has no substantial effect on any of the variables. Our final sample includes 231,128 individuals.

Finally, we supplement our panel credit data with neighborhood characteristics drawn from several sources. First, we match each house in the sample to a Census tract, and use the 2000 Decennial Census to calculate neighborhood characteristics for the house for which we originally observe a mortgage origination in 2004-2008. Second, the credit reporting agency provided the ZIP code of primary residence for each individual in each of the seven waves of credit data. For each ZIP code, we use FHFA house price indices to estimate house price growth over each three year period and IRS

income or minority neighborhoods; and high-cost loans, defined as rate spread loans in the HMDA data. Throughout our analysis in the current paper, we weight observations to account for this over-sampling, thereby matching the composition of newly originated mortgages of each type in each of our seven selected regions, giving each region equal weight.

income data to provide a measure of neighborhood income in each sample year. We use the former to estimate the house price appreciation that each household experienced if they owned a home during a given period.

3.2 Research Design

Our goal is to estimate the long-term impact of losing versus keeping one's home. Because nearly all mortgage defaults during the Great Recession were driven by negative income shocks (Ganong and Noel 2020), our research design begins by conditioning the sample to the occurrence of a severe (i.e., 90-day) mortgage delinquency. This sample constraint allows us to focus on the relevant set of individuals at risk of foreclosure. Next, we use the receipt of a mortgage modification as a treatment that shifts the probability of retaining one's home following said shock. Below we show empirically that seriously delinquent borrowers receiving a mortgage modifications and delinquent borrowers who did not were very similar on observables and experienced very similar financial circumstances during that period, suggesting that modification provides quasi-random variation in who was able to keep their homes.

Figure 1 shows the timeline on which we base our design. We observe households seven times from 2004 to 2022. All households either purchased a home or refinanced a home mortgage between 2004 and 2008. Next, we assign delinquency status in 2010 based on the presence of at least one 90-day delinquency in the previous 24 months. This is our definition of delinquency throughout the paper, as well as our sample-defining definition of distressed borrowers. A full 18% of the borrowers in our sample were delinquent in 2010. Then, we use the 2013 report to identify borrowers who received a mortgage modification in the previous 36 months (that is, in the period 2010 to 2013). 24% of delinquent borrowers had received a mortgage modification by June 2013.[7] Hereafter, we refer to delinquent households that received a modification as our treatment group, and delinquent households that did not receive a modification as our control group.

The year 2013 is also the credit report year for which we define our main short-term outcome, i.e., homeownership. Throughout the paper, we measure homeownership with the presence on the credit report of an open mortgage. Since our final sample is comprised entirely of new borrowers for which we observe an open mortgage in 2010, actual homeownership and measured homeownership in 2013 should correspond very closely to each other. Finally, as reported in Figure 1, we use the

[7] In the main analysis, we exclude the small number of households that already had mortgage modifications by June 2010. We show in a robustness exercise in Section 5.2 that estimated treatment effects are very similar for these modifications.

2016, 2019, and 2022 credit reports to measure long-term outcomes, such as homeownership and proxies for consumption, financial distress, neighborhood quality, and housing wealth.

An obvious concern is that mortgage modifications may not be randomly distributed through the population. Rather, both the borrower and lender must agree to the modification, so that selection may occur on either side. Indeed, as a first comparison, Figure 2 reports four variables (homeownership, Vantage credit score, credit card balance, and number of auto loans) that summarize relevant risk factors that would be observable to a lender making a modification decision. We report these variables for four groups of homeowners in our sample: Not delinquent and no modification, not delinquent and received a modification, delinquent and no modification, delinquent and received a modification. Panel (a) shows homeownership rates for all groups rising by 30% in 2007 from a base of around 55% in 2004, and then reaching 100% in 2010. Panel (b) shows that the group who do not become delinquent on their mortgages have high and stable credit scores. We also find that non-delinquent homeowners who receive modifications have slightly lower Vantage scores and also a drop in credit scores from 2007 to 2010, which is suggestive of a small negative income shock. These homeowners took advantage of modifications without incurring heavy delinquencies and/or large income shocks, and were potentially favored by lenders as having higher creditworthiness than other delinquent homeowners. Moreover, these cases are also much simpler to be analyzed by mortgage services. Given the selected nature of this group, we will exclude them from the analysis below.

The other two groups in Figure 2 are delinquent borrowers and constitute the main treatment and control groups. Panel (b) shows that they have much worse credit scores that also fall precipitously from 2007 to 2010 as the households fall behind on mortgage payments. But delinquent borrowers with and without modifications have remarkably similar financial observables in the years leading up to and containing their delinquencies. Credit card balances in panel (c) and auto loans in panel (d), which are standard credit profile proxies for consumption also show similar patterns. Similar credit score and consumption changes in 2010 are consistent with borrowers experiencing very similar income shocks. We show similar trends in Figure 3, which tracks delinquencies across credit cards, auto loans, student loans, and unsecured personal loans. For all four types of credit, the distressed borrowers differ from non-distressed borrowers in both levels and trends. However, the treatment and control groups are on almost-indistinguishable paths.

These descriptives imply that selection by lenders into modification for high delinquency borrowers is not a substantial threat to our identification. This lack of selection is consistent with the idea, discussed in Section 2, that during the 2010-2013 period, lenders were overwhelmed by the stock of

seriously delinquent mortgages and unable to distinguish, among this set of delinquent borrowers, who would have better income recovery or house value growth prospects.

Our main empirical specification is based on a version of the event study conducted by Sodini et al. (2023), which investigated the impact of gaining homeownership among a group of public housing renters in Sweden. In contrast, we adopt an inverse strategy, estimating the impact of losing homeownership for a large group of delinquent homeowners in the United States during the Great Recession. Specifically, we estimate the short-term effects of receiving a mortgage modification m between 2010 and 2013 on homeownership status y for individuals i residing in house h in year t according to the following equation:

$$y_{iht} = \beta_t\{m_i > 0\} + g(X_{ih}) + \epsilon_{iht} \tag{1}$$

We initially estimate equation (1) using data from 2013. Since all individuals were homeowners in 2010, the coefficient β_t represents the short-term impact of receiving a mortgage modification. The term $g(X_{ih})$ includes pre-modification characteristics of individuals and houses, such as location (metropolitan areas and neighborhood features), house attributes (size and quality), loan characteristics (loan size, interest rate, lender, etc.) and individual features (income, race, age, credit score, having a co-borrower, etc.). As we demonstrate below, the inclusion of this comprehensive set of controls has minimal effect on the estimation of β_t.

For long-term outcomes, our main tables and figures provide estimates from similar cross-sectional models for the years 2016, 2019, and 2022. We follow this procedure to allow the pre-modification controls to have differential effects across years.

3.2.1 Balance tests

Figure 4 provides a difference-in-means test for a larger set of covariates related to home and mortgage features, household characteristics, neighborhood variables, and credit information. Blue circles compare differences between households delinquent with modifications versus households without deliquencies and no modifications. Differences are generally large in many credit and household variables.[8] However, brown circles - which summarize the differences between delinquent households with a modification versus delinquent households without a modification - show observable

[8]The table version of Figure 2 (Appendix Table 1) shows that households with modifications are much more likely to be Black (26pp versus 12pp) and Hispanic (34pp versus 15pp), have lower average credit scores in 2007 (665 versus 737) and higher LTVs at origination (0.82 versus 0.76), and have higher mortgage payment to income ratios (0.35 versus 0.23).

differences that are dramatically smaller.[9]

The comparison on observables matches the results from Figures 2 and 3, and suggest that lenders are not engaging in dramatic selection when offering mortgage modification to high delinquency borrowers. As a formal test, we use the non-delinquent sample of borrowers to estimate a "homeownership index," using OLS to relate homeownership in 2013 to the suite of observables presented in the balance table. Next, we estimate out-of-sample fitted values of that regression for our delinquent sample, producing an estimated probability of homeownership based on observables. In Table 2, we report the average prediction by group. Indeed, we find that our modification sample are slightly negatively selected, with an expected homeownership rate of 70% compared to 71% in the delinquent sample who receive no modification. This level of selection is quite small compared to the selection arising when comparing our modification sample to all other mortgages, in which the average likelihood of homeownership in 2013 is 79%. This suggests that, conditional on 90-day delinquency by 2010, selection related to future (2013) homeownership is minor, and if present, biases against finding a treatment effect of mortgage modification.

Another potential concern is that some borrowers may be extremely attached to their homes, which could lead them both to put more effort into obtaining a modification, and also to be more likely to remain homeowners regardless of modification. Further, some borrowers may have private information on the severity and/or the permanence of their income shocks, and borrowers who know that they have a better chance to financially recover and keep their home may also put more effort into obtaining a modification. While we cannot measure borrower effort to receive a modification, we observe several characteristics that are likely correlated with attachment to the home and risk of permanent income shocks. Below we estimate short and long-term outcome models with and without detailed borrower and mortgage attributes. These controls include whether the borrower has a spousal co-borrower, since families may be more attached to their homes than single adults; and both the year of the home purchase mortgage and whether the loan is a purchase or refinance, which relate to time spent living in the home. In terms of income shocks, our controls include both region fixed effects and controls for borrower age, which are both commonly understood to be correlated with the permanence of income shocks during the Great Recession. Further, our controls also include credit score and whether the loan was a rate spread loan both of which are likely capture unobservables

[9]Appendix Table 1 reveals that in the subsample made up only of households with serious mortgage delinquencies, those with modifications are only slightly more likely to be Black (26pp versus 22p) and Hispanic (34pp versus 31pp), have very similar average credit scores in 2007 (665 versus 672) and similar LTVs at origination (0.82 versus 0.83), and have similar mortgage payment to income ratios (0.35 versus 0.33).

associated with income risk. We find virtually no impact on our estimated treatment effect (less than one percent) from the addition of these controls, which we discuss in Section 4.

In addition to the stability of our estimates, additional analyses support the conclusion of limited selection into modification for 90-day delinquent borrowers. First, if attachment to the home or financial feasibility of holding on to the home affected both modification and retention of ownership status, one would expect larger estimated treatment effects (due to bias) in subsamples with greater attachment or smaller income shocks. In our heterogeneity analyses, we examine treatment effects by coborrower to capture attachment to the home, and by declines in card balances between 2007 and 2010 as a proxy for income shocks. We find that the effects of the modification do not vary substantially. We show these results in Figure.... Second, in our discussion of housing wealth in Section 4, we show that the homes owned by the treatment and control groups followed similar price evolutions. Thus, lenders were not selecting on the path of future house prices when allowing a modification. Overall, the range of empirical tests lead us to conclude that unobservable selection by borrowers into treatment appears unlikely to drive the results presented below.

4 Main Results

4.1 Homeownership in the Short Run

In this section, we report estimates of the short-run impact of the modification treatment. Figure 5 shows the descriptive impact of receiving a mortgage modification on homeownership. By construction, because we require everyone in our main estimating sample to have an open mortgage in 2010, the homeownership rate for all groups is 100 percent. For our treated group, shown with the blue triangles in the figure, the homeownership rate dropped to about 85 percent in 2013. This drop is almost identical to the homeowners who never became delinquent, shown with orange squares.[10] By contrast, the decline in homeownership is much sharper for our control group, shown with green circles. For these households, homeownership rates drop to about 49 percent in 2013, a difference of 36 percentage points compared to the treated households.

Table 3 reports estimates of this short run difference in homeownership rates according to equation (1). The estimate reported in Column 1 includes no controls, corresponding to the values shown in Figure 5. Column 2 adds controls for the variables that stratify our original sample, by including

[10] This 15% decline over a three-year period may overstate transition out of homeownership due to the Great Recession given that some households may have transitioned out of homeownership due to job- or family-related moves.

fixed effects for groups defined by metropolitan area, year of origination, and loan type (purchase or refinance).[11] Column 3 adds additional controls for fixed household and housing attributes measured at the time of mortgage origination, including the size of the house, loan amount, and loan-to-value ratio; indicators for racial/ethnic groups and for the presence of jumbo loans, subordinate debt, rate spread, and a coborrower; and local neighborhood conditions including the fractions of the population in the house's Census tract that are Black, Hispanic, and low-income. Column 4 includes additional information on the borrower's recent credit history, including 2004 and 2007 values of credit scores, credit card balances, and number of auto loans. Finally, Column 5 adds lender fixed effects. The point estimates are remarkably stable, varying between 35.4 and 35.9 across these five specifications. The fact that the inclusion of this broad set of variables, including many that are otherwise strongly correlated with homeownership, has almost no impact on the point estimates reflects the quasi-random nature of receiving a mortgage modification between 2010 and 2013. Moreover, the fact that the estimates are so similar in specifications with and without lender fixed effects implies that the estimated short run impact of receiving a modification on homeownership is quite similar regardless of whether the variation in modifications is within or across lenders (over 65% of the conditional variation in modification is across lender in models without lender FEs).

Figure 6 shows the rate for each group of receiving a foreclosure notice in each year. Rates for all groups are low in 2004 and 2007. In 2010, both our treatment and control group are very likely to have received a foreclosure notice. The control group have slightly higher rates in 2010 (49% compared to 43%), but both groups far exceed the non-delinquent borrowers (0.3%). By 2013, large differences emerge between the treatment and control groups, with treated households having foreclosure notice 29% of the time and control households 47%, a difference of 18pp, which is approximately half our estimated short-term treatment effect for homeownership.

Overall, the estimates reported in Table 3 and shown in Figure 5 imply that the modification treatment had an enormous impact on a household's ability to keep its home. In the remainder of this section, we explore the impact of this increased likelihood of remaining homeowners through the Great Recession on a wide variety of outcomes, including long-run homeownership rates, credit and consumption measures, neighborhood, and the potential accumulation of housing wealth as of 2022.

[11] With 7 housing markets, 5 origination years, and 2 loan types, we have 70 groups. Standard errors are clustered at this level.

4.2 Homeownership over the Long Run

We now extend our analysis through 2022. Figure 7 plots point estimates and confidence intervals based on several cross-section estimates of Equation (1). Each series in the figure corresponds to a specification of the model, as we successively include controls for metro area, origination year, loan type; household and housing attributes; credit variables; and lender fixed effects, as in Table 3, again revealing only small differences between the model estimates in every year.

The estimates for the period between 2004 and 2013 mirror the short-run results shown in Figure 5: pre-trends are close to zero, then the treatment and control groups experienced a 36pp gap in homeownership in 2013. This homeownership gap gradually narrows over the subsequent decade, to about 30 percent in 2016, 22 percent in 2019, and about 19 percent in 2022. In this way, the estimated effect of remaining a homeowner by receiving a mortgage modification in the Great Recession is remarkably persistent, with a half-life that appears to last about a decade.

Figures 8 and 9 explore the heterogeneity in the impact of receiving a mortgage modification on homeownership by metropolitan area, race and ethnicity, and income. The results shown in Figure 8 reveal significant and lasting impacts in every metropolitan area, but also some notable heterogeneity. In particular, the estimated impact of receiving a mortgage modification is generally larger in both the short and long runs in coastal markets like San Francisco, Miami, and Los Angeles, i.e., the markets that experienced especially large housing booms and busts in the 2000s. The results shown in Figures 9 (a) and (b) reveal that the receipt of a mortgage modification also had a substantial impact in both the short and long run for households in all race/ethnicity and income categories. Interestingly, the relative impact for Hispanic households appears to be strengthening over time, with the estimate gaps between Hispanics and Asian, Black, and White borrowers increasing noticeably from 2013 to 2022. And, strikingly, by 2022, the estimated impact of receiving a mortgage modification is almost identical by income tercile, where income is measured at the time of mortgage origination. Overall, the results presented in Figures 8 and 9 show that while there is some heterogeneity across households and locations, the effect of receiving a mortgage modification was quite broad-based, with a substantial, persistent impact on homeownership rates for a wide variety of households who became delinquent on their mortgages during the Great Recession.

4.3 Credit, Consumption, and Neighborhood Outcomes

We now turn to a set of results that characterize the trajectories of a wide variety of credit, consumption, and neighborhood measures from 2004-2022. Conceptually, there are two ways to think about the meaning and magnitude of these results. First, and most directly, the estimated differences in these outcomes reflects the impact of receiving a mortgage modification between 2010 and 2013 for a set of marginal homeowners who were especially hard hit by the Great Recession. Second, and more interestingly, any long run differences in trajectories can be viewed as reflecting the impact of being able to remain a homeowner through the Great Recession, made possible through the quasi-random availability of a mortgage modification. This "instrumental" perspective requires the assumption that the short-run impact of receiving a mortgage modification came only through its impact on homeownership status.[12] In this case, any estimated long-run differences in outcomes need to be divided by 0.36, the estimated impact on homeownership in the short run, to estimate the long-run impact of maintaining homeownership status through 2013 on other outcome variables.

The four panels of Figure 10 report descriptive trajectories for four outcomes shown: (a) credit score, (b) credit card balances, (c) number of auto loans, and (d) neighborhood income percentile. Again, the blue triangles show estimates for delinquent households who received a modification by 2013, while the green circles represent delinquent households who did not receive a modification by 2013. For comparison, we also show estimates for households with an open mortgage in 2010 who were not delinquent on their mortgage payments.

Focusing first on Figure 10 (a), which shows the trajectories for credit score, reveals a remarkable similarity between delinquent households who did and who did not receive a mortgage modification. Consistent with having a mortgage delinquency by 2010, both groups experienced a sharp drop of almost 100 points on their credit scores between 2007 and 2010. Over the next decade, both groups recovered from this sharp drop in credit score: by 2019 and 2022 their credit scores had returned to levels above those in 2007, and by 2022 the gap with those households who did not have a mortgage delinquency in 2010 had closed to 2007 levels.

What is most remarkable about Figure 10 (a) is how similar the estimated credit score is for delinquent households with and without a mortgage modification in every sample year from 2004 through 2022. Consistent with the slight negative selection of households into mortgage modifications discussed in Section 3 above, households in the control group had very slightly higher scores

[12] The plausibility of this additional assumption is bolstered by the fact that we find no other short-run effects on credit, consumption, and other outcome variables below.

in 2004, 2007, and 2010. By 2022, the scores are essentially identical, suggesting at most a tiny long-run impact of receiving a mortgage modification and retaining homeownership between 2010 and 2013.

Credit card balances and auto loans have been established in the literature as good proxies for household consumption. The figures for these variables, shown in panels (b) and (c), follow a similar pattern to credit score, revealing almost identical levels for the treatment and control groups over the entire sample period. It is also easy to see the out-sized, negative impact of the Great Recession on these households compared to those who never became delinquent on their mortgages for both consumption measures. Figure 10 (d) shows results for neighborhood income percentile, as measured among the Census tracts within each metropolitan area. Again, consistent with the slight negative selection of households into mortgage modifications, control households lived in neighborhoods that were about 3 percentile points higher in 2004, 2007, and 2010. In both cases, these households were living in neighborhoods at about the 50th percentile of the neighborhood income distribution.[13] Strikingly, these differences change very little during and following the Great Recession, remaining at about 3-4 percentile points in every year through 2022.

Figure 11 shows the impact of treatment on these credit and consumption variables. In our fully saturated model, we find almost no impact of modification on these measures of consumption. Our largest estimated effect is that the treated group have credit scores in 2022 that are 5.1 points higher than the control group, on a base of 692 points.

In Figure 12, we turn to another set of variables measuring financial well-being: rates of delinquency. We show long-term rates for each group of 90-day delinquency on credit cards, auto loans, student loans, and unsecured personal loans. Panel (a) traces most dramatically the financial distress of our sample in 2010: rates of credit card delinquency were approximately 45% for both treatment and control groups. At the same time, rates of auto loan delinquency in Panel (b) were 10% for the treatment group and 12% for the control group, and rates of unsecured personal loan delinquency in Panel (d) were 3% for both groups. Student loan delinquency displayed in Panel (c) were less dramatic, peaking in 2013. The treatment and control groups stay on similar paths in 2013 and later, suggesting that the financial performance of the mortgage was not strongly tied to payment of other debt. We test this visual similarity in Figure 13, where we again find weak evidence that modification treatment impacted delinquency on these other forms of personal credit.

[13]The income distribution is calculated nationally, not only using the neighborhoods in which we observe our borrowers, so this fact is not simply mechanical.

Taken as a whole, the results shown in Figures 10 through 13 imply that the effect of receiving a mortgage modification between 2010 and 2013, while having an enormous impact on homeownership, had a negligible impact on these measures of credit, consumption, and neighborhood outcomes, as well as delinquency, in both the short and long run. Among the large set of variables available in the credit data, the only notable difference is higher rates of Chapter 7 bankruptcy among the no-modification group - see Figure 14. That is consistent with Chapter 7 being the form of bankruptcy directly linked to mortgage foreclosure (Li and White 2009).

4.4 House Price Appreciation and Housing Wealth

We close this section by examining the impact of receiving a mortgage modification on the potential accumulation of housing wealth in the decade following the Great Recession. For the analysis presented in this subsection of the paper, we remove refinance mortgages from our sample and focus on new home purchases, so that we can observe the initial purchase price and down payment (equity position) at the time of purchase. Importantly, because data limitations make tracking a household's exact mortgage terms and payments difficult, we focus on estimating subsequent housing wealth accumulation solely through house price appreciation and transitions into and out of homeownership.

The four panels of Figure 15 report estimates of potential housing wealth accumulation under a series of assumptions designed to isolate the role of changes in homeownership during different subperiods. The figures shown in Panel (a) serve as an important benchmark. These estimates show the potential real housing wealth (measured in 2022 dollars) had all homeowners maintained their homeowner status from the time of original purchase in 2004-2008 through 2022. The housing wealth estimates here include the initial down payment plus an estimate of house price appreciation based on applying changes in the FHFA price index for the associated ZIP code to the original home purchase price. In this way, then, Panel (a) shows the path of the *potential* real housing wealth that would have accrued for homeowners in each category from 2004-2022 before accounting for any changes in homeownership during the sample period. Many homeowners change ZIP codes of residence over this period. In such cases, we apply the FHFA price changes for their new ZIP of residence.

Not surprisingly, given initial down payments and the house price boom from 2004-2007, all three categories of homeowners had positive housing wealth levels in 2007. These levels fell precipitously from 2007-2010 for all households. The decline in home values was greater for the households in our sample that became delinquent on their mortgages compared to those that did not, but our treatment

and control groups experienced the same depreciation. Indeed, the treatment and control group's house price trajectories are virtually identical from 2007 through the end of the sample period in 2022. The almost perfect co-movement of these lines helps to rule out any potential endogeneity in modifications stemming from bank considerations of (i) recent house price depreciation, (ii) the household's current equity position, or, most interestingly, (iii) any expected future gains in house values.

After dropping sharply by 2010 and remaining low in 2013, home prices rebounded such that housing wealth estimates returned to close to 2007 levels by 2016. The period from 2016-2022 extended this sharp recovery in home values further, so that all three categories of households would have had between $289,000 and $322,000 in average housing wealth in 2022 if they had maintained homeownership status through the end of the study period. Interestingly, because price appreciation from 2013-2022 was higher for homes with greater depreciation in 2007-2010, the average realized appreciation across the entire sample period is very similar for all homeowners in our sample.

The results shown in the remaining panels of Figure 15 depict the estimates of potential housing wealth that make adjustments for changes in home ownership status. In particular, the results in Panel (b) account for home loss in the 2010-2013 period. Panel (c) accounts for home loss later, in 2013-2016 and 2016-2019; and Panel (d) accounts for subsequent new home purchases after losses.

The estimates reported in Panel (b) are calculated as follows. For any households that remain homeowners through 2013, we calculate their housing wealth in 2013 exactly as in Panel (a). For households who did not remain homeowners through 2013, we begin by calculating their estimated housing wealth as of 2010. If this is positive, we use this estimate as their measure of housing wealth in 2013. If this calculation is negative, we assign them zero housing wealth, i.e., we assume that they could have walked away from their mortgage without assuming any of the negative equity. As we move forward from 2013-2022, we then assume that (i) any households who remain homeowners as of 2013 retain these homes through 2022 and (ii) those households who became renters by 2013 remain renters through 2022. In this way, the only adjustment to housing wealth in panel (b) compared to panel (a) comes from changes in homeownership status that occurred in the 2010-2013 period.

The assumptions underlying the estimated shown in Panel (b) are designed to be conservative in measuring the potential benefits from receiving a mortgage modification in two key ways. First, the assumption that the bank inherits the entire negative equity position for homeowners who lost their homes between 2010-2013 ignores instances in which homeowners with negative equity positions may have sold their homes at a loss, taking that loss for themselves. Second, the assumption that

those who receive a mortgage modification had no adjustment to their negative equity position or no material gains from any improvements to their mortgage contracts ignores any potential wealth benefits due to the terms of the modification.

Turning to results shown in Panel (b), a first thing to notice then is that this calculation sharply improves the equity position of our control group in 2010-2013, as we reset to zero the position of a large set of homeowners who would have had negative equity in 2013 had they remained homeowners. Thus, the assumptions underlying the potential housing wealth calculation in Panel (b) initially favor the households who *did not* receive a mortgage modification. This initial advantage is reversed, however, as we move forward from 2013-2022. Because a higher fraction of households who receive mortgage modifications remain homeowners in 2013, their collective gains from the house price appreciation between 2013 and 2022 allow them to surpass the overall wealth position of those who did not receive a modification. By 2022, their estimated housing wealth is substantially greater—about $105,000—than those who did not receive a mortgage modification.

The results reported in Panel (c) incorporate losses of homeownership that occurred in both the 2013-16 and 2016-19 periods, and Panel (d) further incorporates any transitions back into homeownership from households that had earlier transition to renting earlier in the sample period, assuming a 20% down payment. For the most comprehensive results shown in Panel (d), the estimated difference in housing wealth by 2022 between our treatment and control groups is about $83,000. This slightly smaller difference compared to the estimate shown in Panel (b) reflects the fact that some households who lost their homes were able to become owners again later in the sample period.

This $83,000 housing wealth difference between treatment and control groups provides a measure of the treatment effect of receiving a mortgage modification. As mentioned above, converting this figure to an estimate of the causal effect of homeownership - and, in particular, the effect of being able to keep one's home through 2013 - requires dividing this point estimate by 0.355, the short run impact of receiving a modification on homeownership. The resulting larger estimate of $234,000 reflects a substantial additional amount of wealth which, not surprisingly, is of the same order of magnitude as the average house price appreciation of the original homes in our sample from 2013-22.

One could attempt to further refine this estimated difference in wealth accumulation by accounting for other differences between owners and renters. For example, one could attempt to estimate mortgage payments, rents, and potential gains from investing wealth held outside of housing in other financial markets for each household. Such calculations would require many additional assumptions

and we expect the large wealth difference in 2022 to remain for several key reasons. First, rents and home values experienced very similar rates of appreciation from 2007-2022 in the markets included in our sample.[14] As a result, renters did not gain any special advantage from differential lower rates of price growth over this time period. Second, homeowners had many opportunities between 2004-2022 to refinance their mortgages at very low interest rates, potentially sharply increasing the benefits of owning versus renting during the sample period. And, third, relative to investments in stocks, bonds, or other financial instruments, the housing market represents the primary way most households can take advantage of leverage when investing. Given the high rate of home price appreciation from 2013-2022, it is unlikely that alternative, unleveraged investments would have yielded anywhere near the same level of returns for the vast majority of households.

As noted earlier, the lack of consumption response to capital gains in housing appears inconsistent with the existing literature that demonstrates increased consumption in response to housing wealth gains. This literature implies effects on annual consumption ranging between 5 and 10% of the increase in housing wealth on the high end (Aladangady (2017) and Mian, Rao, and Sufi (2013), Graham, James, and Christos A. Makridis. 2023) and between near zero and 3% on the low end (Browning et al, Disney et al. and Guren et al.). Several of these studies point to larger effects for credit-constrained households suggesting a role of housing collateral in driving these consumption effects. Sodini et al. (2023) provide unique evidence on the collateral effect using an experiment where households relinquished a valuable rental subsidy in exchange for a subsidized housing purchase. The authors calculate that household experience an increase in housing collateral that was five times larger than the increase in wealth. As a result, their estimated consumption effects were consistent with annual consumption effects of 38% of the wealth gain, which is dramatically larger than the existing literature, while based on the collateral gains households spent only 7.5% of the gain per year, an effect size that is very similar (Aladangady (2017) and Mian, Rao, and Sufi (2013), Graham, James, and Christos A. Makridis. 2023). A key implication of their finding is that much of the effect of housing wealth could be due to collateral rather than the actual wealth gain.

Therefore, one possible explanation for why consumption did not respond to increases in housing prices is that households faced significant limitations in accessing housing wealth via lower interest, housing secured debt. Notably, between 2002 and 2006 leading up to the financial crisis, Mian and Sufi (2001) show that households on average increased debt by 25% of the gains in housing equity.

[14] We calculate ZIP-level percent changes in house value and rent using the 5-year ACS from 2007-2011 and 2018-2022. We find that in our sample areas, the mean percent change in home value is 49.3%, while the mean change in rent is 48.1%. The mean percent change in FHFA housing price index is 44.5%.

However, that may have been a unique period in US history - using a broader time frame from 1997-2012, (DeFusco 2018) estimates that household borrowing only increased by between 4 and 13% of the collateral gain, much smaller than the effects estimated during the height of the housing boom. Our sample of severely delinquent borrowers may have encountered a very challenging market for cash-out refinance loans during the years following the financial crisis. Pennington-Cross and Chomsisengphet (2007) demonstrate that the subprime sector played a dominant role in issuing cash-out refinance mortgage prior to the financial crisis, and those refinancing options essentially vanished following the crisis. Even focusing on GSE cash out refinancing, cash out refinancing declines substantially during the financial crisis with no meaningful recovery in loan volume until the pandemic in 2020 (Federal Housing Finance Agency 2021).[15] Similarly, Home Equity Lines of Credit (HELOC) and fixed amount Home Equity Loans (HEL) fell substantially during the financial crisis. While HELOC's started recovering in 2014, they only recover to just over half of the pre-crisis peak, and HEL volume remains at great recession levels until 2021 (Pradhan 2024).[16]

5 Robustness

In this section, we report the results of several supplemental analyses designed to test the robustness of our main results to various aspects of the sample selection and research design. We begin by conducting an analogous study of the short-term effects of receiving a mortgage modification on the ability to keep one's home using a publicly-available sample of loans from Fannie Mae. As we discuss below, this sample has several additional variables and details unavailable in our main sample, as well as national coverage, allowing us to explore the robustness of our main short run findings to these additions. We then explore several modifications of our baseline analysis.

5.1 Fannie Mae Sample

We accessed public loan performance data on 30-year fixed rate loans purchased by Fannie Mae. These data provide us with the opportunity to examine the effects of modifications in the national sample, using mortgages drawn from the largest segment of the market, although it is limited due to the omission of subprime, jumbo, alt-A and variable-rate prime loans. One advantage of these

[15] Annual loan volume falls from $350 billion to under $200 billion in 2011 and is still only just above $200 billion in 2019

[16] HELOC volume falls from a peak of $190 billion to $40 billion in 2009, but begins to grow again in 2014 plateauing at about $100 billion in 2017. HELOC volume fluctuates from $2.7 to $5.2 billion between 2010 and 2020 relative to a pre-crisis peak of $31 billion.

data are the availability of precise timing of any modifications and/or delinquencies. Furthermore, in these data we observe any mortgage termination that ends in a lender write down, due either to foreclosure or short sale. However, because these data follow loans rather than borrowers, we cannot examine any other credit or consumption outcomes or the future path of homeownership after termination.

We re-estimate our short-run models on this new sample, conditioning the sample on the mortgage having experienced a 90-day delinquency and having no modifications prior to June 30, 2010. Our left-hand side variable is an indicator for whether the mortgage was terminated via foreclosure or short sale between July 1, 2010 and June 30, 2013. Our key right-hand side variable is an indicator for whether the loan received a modification during this same time period. Table 5 presents these results following a structure similar to Table 3. Column (1) presents estimates with no additional controls. Column (2) adds indicator variables for bins defined by MSA, loan origination year and quarter, and loan type (purchase or refinance).[17] Column (3) adds a variety of observables on the borrower household, house, and credit. Column (4) adds lender and servicer fixed effects.[18] Column (5) adds a fixed effect for the month and year of the first 90-day delinquency. This last specification thus controls for the timing of the income shock, which is not possible in our main sample.[19]

The estimates are very similar to the estimates arising from our main sample. In the initial specification with no controls, the treatment reduces the likelihood of foreclosure by 40 perentage points, compared to 36pp in our main sample. As controls are added, the point estimate ranges from 40.0pp to 41.0pp, showing similar stability to the main sample.

5.2 Earlier Delinquency/Modification

Our primary analysis defines treatment and control groups by measuring from 2007-2010 and modification receipt from 2010-2013. While there were far fewer delinquencies and modifications in earlier periods, the structure of our data set allows us to estimate analogous models shifting all of the key

[17] The inclusion of these fixed effects leads to the elimination of a small number of singleton observations from the regression, who comprise less than 1% of the sample.

[18] The data separately identifies 19 lenders and 19 servicers, with about 20% of loans falling into the “other" categories, which we capture with a single fixed effect. Estimates are stable to the exclusion of this subsample so that all lenders/servicers are identified.

[19] We include quarter-by-year fixed effects rather than simply year because the Fannie Mae sample include loans originated throughout the year, while our main sample is restricted to May to September, the primary house-hunting season. We use an MSA indicator provided by Fannie Mae, and for non-metropolitan areas allow mortgage in these regions of each state to have their own fixed effect. Our additional controls in Column (3) include combined loan to value ratio, FICO credit score, debt to income ratio, logarithm of the original loan amount, whether the origination involved subordinate debt, whether the borrower was a first time home owner, whether there was a co-borrower, and property type dummy variables.

variables three years earlier. In particular, Figure 16 reports estimates the homeownership impact of recieing a modification from 2007-2010 after a delinquency in 2004-2007, analogous to Figure 7. While much noisier given the smaller number of observations, the short- and long-run results are remarkably similar: the point estimate implies that the initial short-run impact is about 40 percentage points in 2010, falling to 28-30 percentage points in 2013 and 2016, and eventually closing to about 10 percentage points in 2022, more than 12 years later.

5.3 Older vs Younger Generations

A potential concern about our analysis is that we use the existence of an open mortgage as our primary measure of homeownership. This measure might fail to capture homeownership, of course, in cases where home owners fully pay off their mortgage. In general, we think that it is unlikely that many households in our sample, all of whom originated a new mortgage at the beginning of the sample period, would have paid off their mortgages by 2022—and especially unlikely that those who became delinquent on their mortgages between 2007 and 2010 would have subsequently been able to fully pay off their mortgages without selling their homes by 2022. But, as a final robustness check (and heterogeneity analysis), we estimate the effect of receiving a mortgage modification on homeownership separately by age. This analysis is motivated by the idea that younger homeowners are especially unlikely to have paid off their mortgages.

Appendix Figure 17 shows estimates separately by generation, splitting homeowners into those who were born in 1964 or earlier (Baby Boom generation or older) and those who were born in 1965 or later (mostly Gen X and with a few members of Gen Y). Strikingly, the estimated impact of a mortgage modification on homeownership rates is remarkably similar by generation, in both the short and long runs. This again suggests that the impact of receiving a modification was quite broad-based and provides no indication of any obvious issues with using the existence of an open mortgage as a proxy for homeownership given for the set of households included in our sample.

6 Conclusion

In this paper, we provide the first causal evidence on the long-run effects of home loss. We use the Great Recession as a unique setting that provided two critical ingredients for studying this question: pervasive negative income shocks, and chaotic implementation of relief initiatives. We are thus able to study a large group of distressed homeowners, whose quasi-random receipt of a mortgage

modification generated large differences in their ability to retain their homes. These differences in homeownership, and the concomitant opportunities for wealth accumulation, persist more than 10 years later. Other than homeownership and the associated exposure to capital gains, we do not observe any other long-run differences over a wide array of credit profile outcomes that are indicative of consumption, access to credit and creditworthiness, and residential neighborhood environment.

The lack of consumption response may seem surprising given that owner-occupants during this period experienced significant capital gains. Even though previous research (e.g., Aladangady (2017) and Mian, Rao, and Sufi (2013)) has shown that rising home values typically boost consumption by easing collateral constraints (DeFusco 2018), some of those papers have more muted responses, and the value of nominal housing wealth for consumption may be fully dependent on being able to using cash-out refinances, which became harder to qualify after the Great Recession. Another possible explanation is the lasting behavioral impact of experiencing a severe drop in home values and the threat of foreclosure. Similar to how the Great Depression led to a more frugal generation (Malmendier and Nagel 2011), these experiences may have made households less willing to spend from housing equity.

Our results speak to the broader question of the effects of homeownership, summarized by Goodman and Mayer (2018). We complement Sodini et al. (2023) most closely in this regard, and show that the effects of losing a house are not symmetric with the effects of acquiring one. While we cannot directly address other literatures, such as the benefits for children (Haurin, Parcel, and Haurin 2002) and for the building of social capital (DiPasquale and Glaeser 1999), we find minimal impact of the modification-induced changes in homeownership on household consumption patterns that likely would include spending on children or on neighborhood quality, as reflected by the income percentile of the residential ZIP code. The lack of effects on neighborhood quality may appear surprising given the traditional role that homeownership plays in providing access to affluent, suburban neighborhoods. However, our population of distressed borrowers resides in lower income neighborhoods on average than the typical mortgage borrower. These results are consistent with more mixing of owner-occupied and rental housing in modest income neighborhoods. So, for homeowners who are more at risk of losing their homes to financial distress, homeownership may be a less important factor for increasing exposure to higher neighborhood income levels.

Our research also provides new evidence on the long-run effects of recessions, and the Great Recession in particular, on non-financial outcomes. Several studies examine the short-run effects of foreclosure during the great recession, including on education (Been et al. 2024; Been et al. 2011b),

health (Currie and Tekin 2015; Downing 2016; Downing et al. 2017), divorce and neighborhoods (Diamond, Guren, and Tan 2020). However, we know of little research on the long-term effects of exposure to severe economic downturns. Most of this long-term research studies the labor market, e.g. Oreopoulos, Wachter, and Heisz (2012), Schwandt and Wachter (2019), and Altonji, Kahn, and Speer (2016). An important difference between our findings and the existing research is that both our treatment and control groups experience similar negative economic shocks. We thus find effects not of the shock itself, but of interventions to preserve homeownership after the shock. As a result, our findings are very relevant when considering the unprecedented temporary assistance and mortgage forbearance provided in response to the COVID-19 pandemic, which helped families remain in their homes during the pandemic (Cherry et al. 2021; Goodman, Kaul, and Neal 2020).[20] Indeed, because our data comprise entirely new mortgage borrowers, we find treatment effects precisely for population most likely to be targeted by current and future policy interventions.

Taken together, our findings suggest more modest costs arising from the risk of transitioning into homeownership relative to the potential for long-term capital gains.[21] We show that the loss of one's house does not necessitate long-term financial ruin. As a result, in terms of individual financial outcomes, the benefits of public action to preserve homeownership during economic downturns appear primarily limited to preserving access to the capital gain opportunities created by homeownership. Of course, polimakers may have other objective in mind, such as limiting large macro negative externalities (cite Guren and McQuade, 2020).

[20] Mortgage forbearance programs successfully supported low-income and non-white homeowners without significant financial distress following the end of forbearance (RADAR Group 2023).

[21] Because we condition on the negative economic shock, we cannot speak to the homeownership risks of such shocks *per se*.

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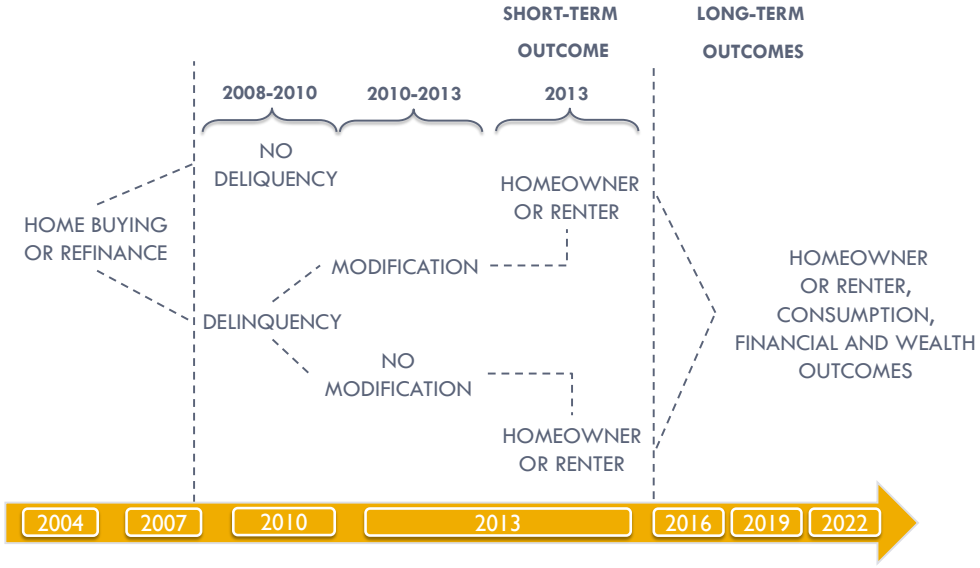
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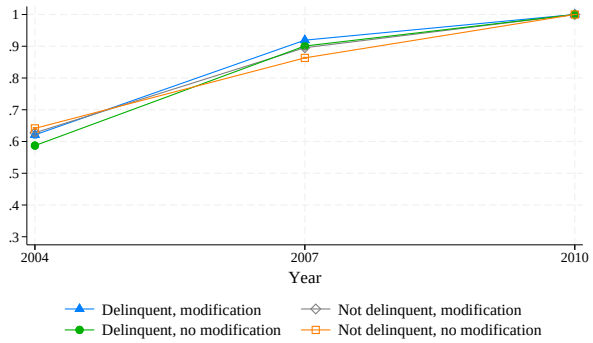
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Figure 1: Timeline

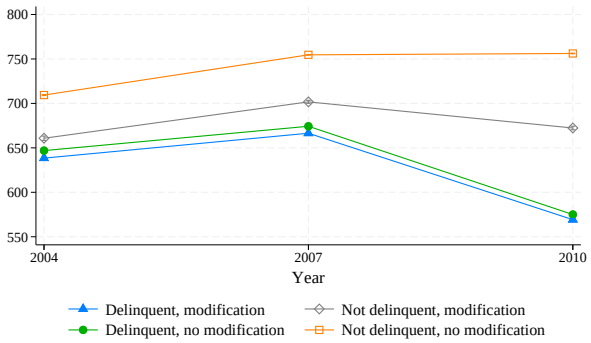


Notes: Figure displays the timeline of events for our 7 waves of credit data, every 3 years from 2004 to 2022. Borrowers purchase homes or refinance existing mortgages from 2004-2008. Delinquencies for our sample occur from 2008-2010. Modifications are received between 2010 and 2013.

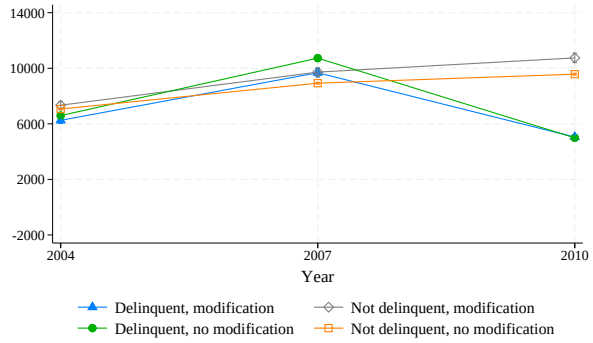
Figure 2: Pre-Trends in Homeownership and Credit Variables



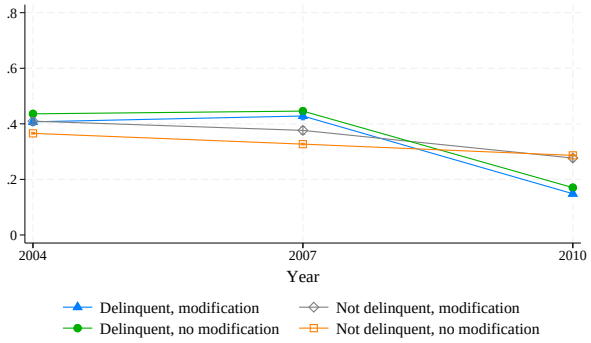
(a) Homeownership



(b) Vantage Score



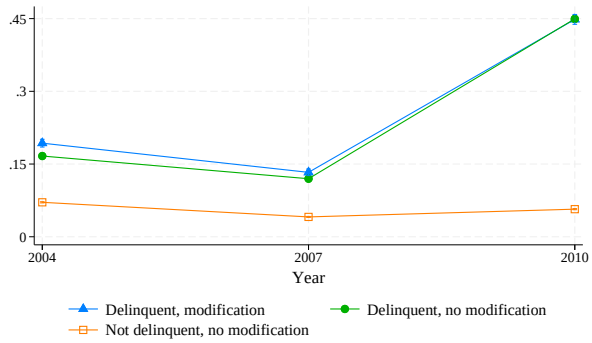
(c) Credit Card Balance



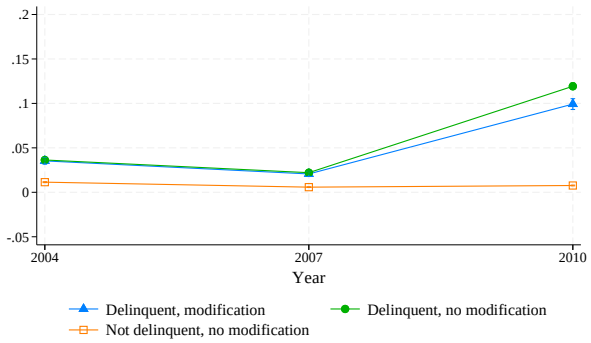
(d) Number of Auto Loans

Notes: Figures display groupwise averages for homeownership (measured by presence of an open mortgage), credit score, credit card balance over the last 3 months, and number of auto loans. Groups are defined by delinquency in the 24 months preceding June 2010 and by the receipt of a mortgage modification by 2013.

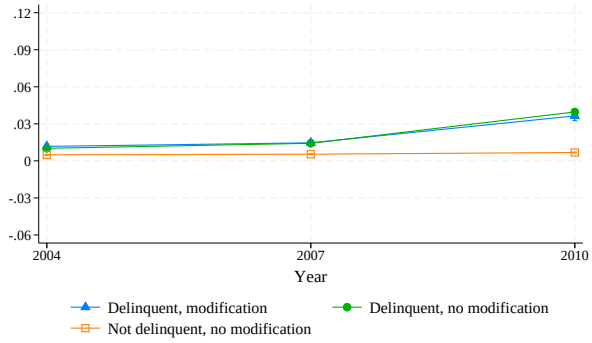
Figure 3: Pre-Trends in Delinquincies



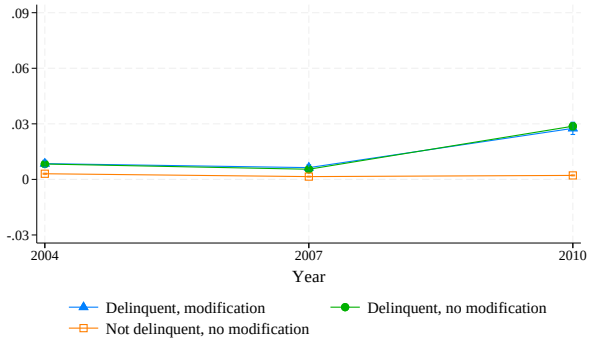
(a) Credit Card 90-Day Delinquency



(b) Auto Loan 90-Day Delinquency



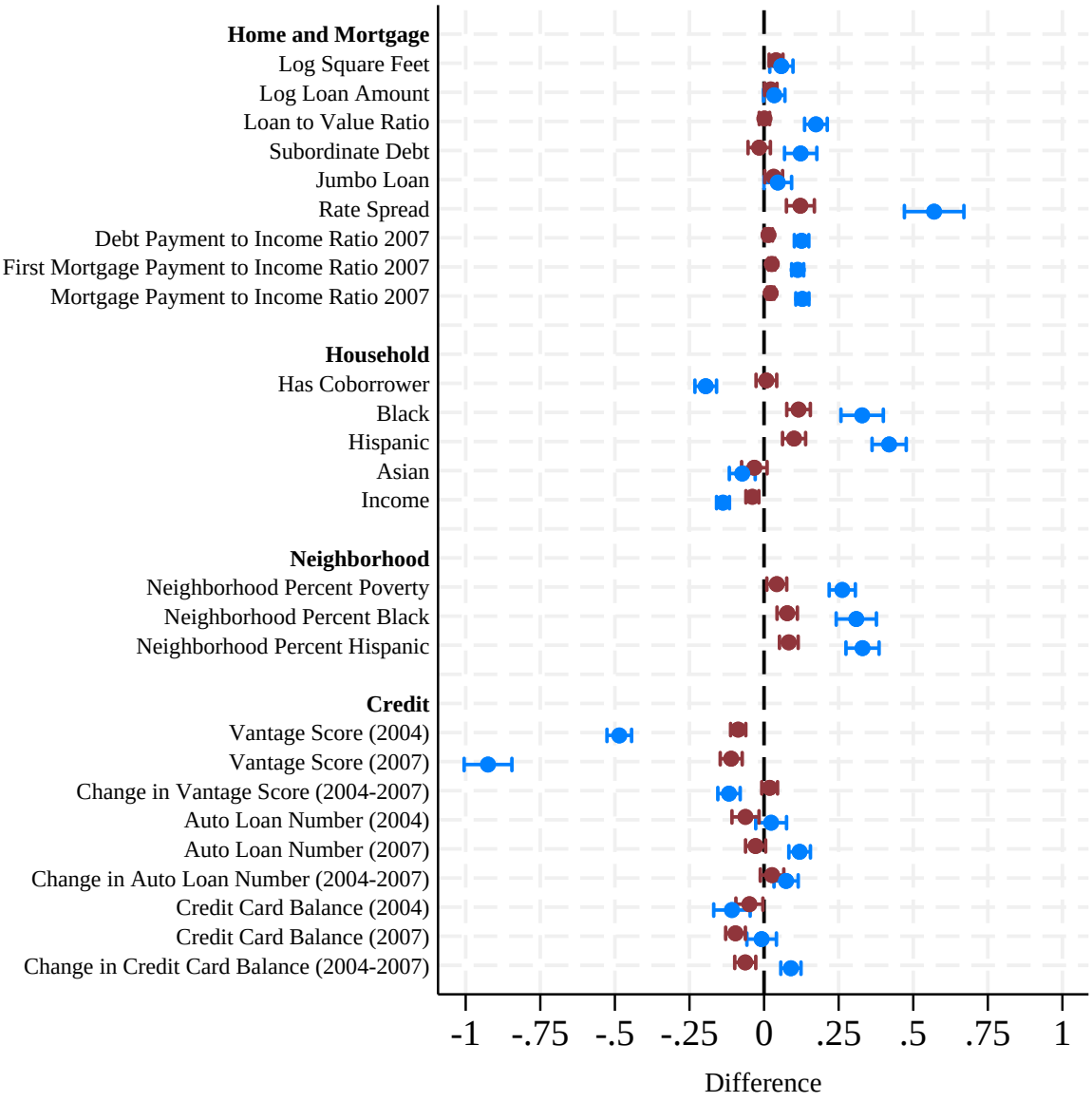
(c) Student Loan 90-Day Delinquency



(d) Unsecured Personal Loan 90-Day Delinquency

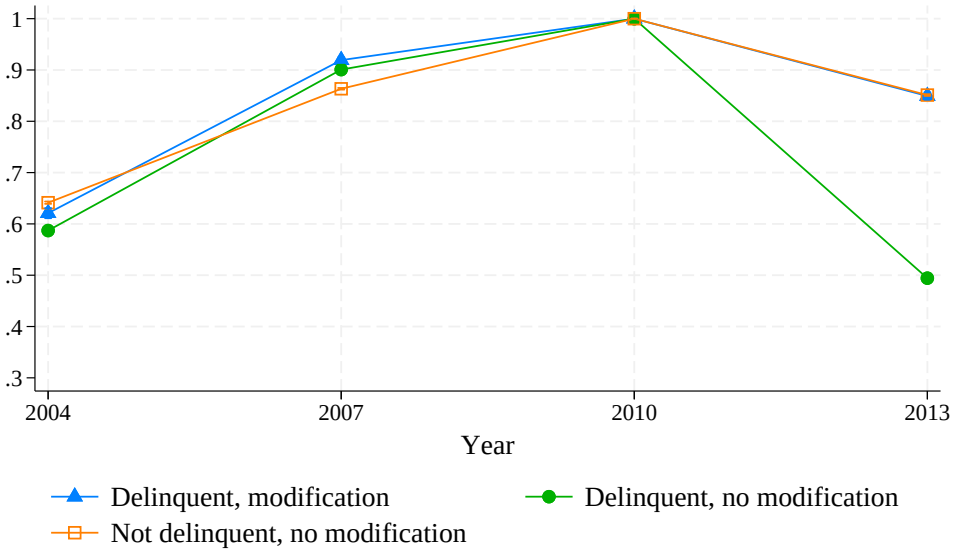
Notes: Figure displays groupwise average rates of 90-day delinquency in the last 24 months across four types of credit: credit cards, auto loans, student loans, and unsecured personal loans. Groups are defined by delinquency in the 24 months preceding June 2010 and by the receipt of a mortgage modification by 2013. Groups are defined by delinquency in the 24 months preceding June 2010 and by the receipt of a mortgage modification by 2013.

Figure 4: Balance Figure



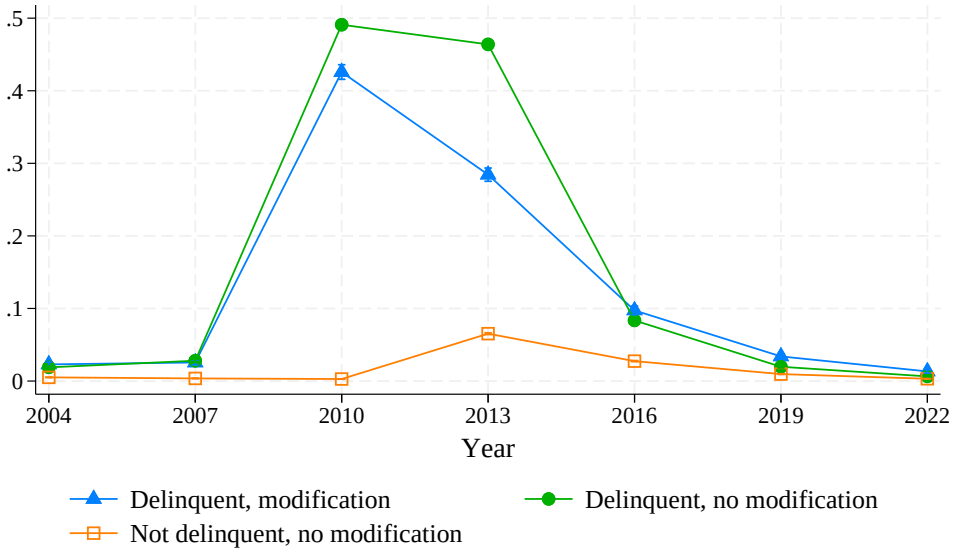
Notes: Figure displays balance on observables for two comparisons. Each row represents a regression of the displayed variable on the left on an indicator for receipt of a mortgage modification. Dots show point estimates and bars show 95% confidence intervals. The horizontal axis is in standard deviation terms for non-binary variables. Blue dots show a comparison of delinquent households with mortgage modifications (our treatment group) to a comparison group of all households with no mortgage modification, and show substantial selection. Brown dots show a comparison of delinquent households with a mortgage modification (our treatment group) to other delinquent households with no modification (our control group), largely abating selection. Full results are shown in Appendix Table 1.

Figure 5: Short-Run Changes in Homeownership



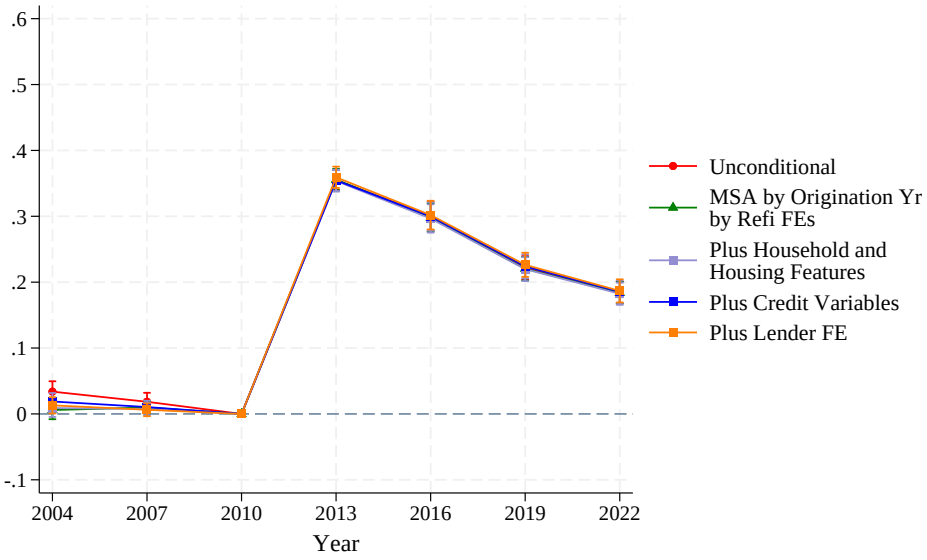
Notes: Figure displays groupwise averages for homeownership (measured by presence of an open mortgage). Groups are defined by delinquency in the 24 months preceding June 2010 and by the receipt of a mortgage modification by 2013.

Figure 6: Receipt of a Foreclosure Notice



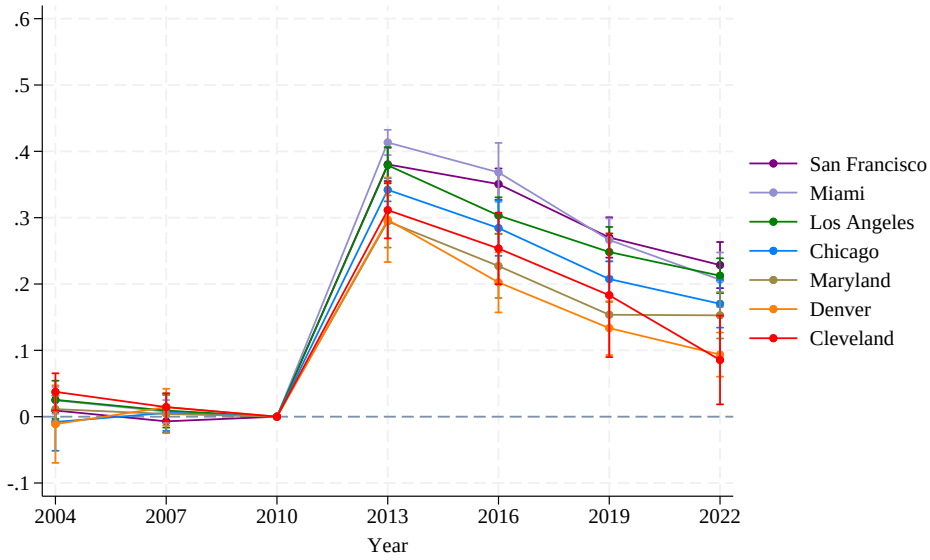
Notes: Figure displays groupwise averages rates of foreclosure notice. Groups are defined by delinquency in the 24 months preceding June 2010 and by the receipt of a mortgage modification by 2013.

Figure 7: Long-Run Impact on Homeownership by Model



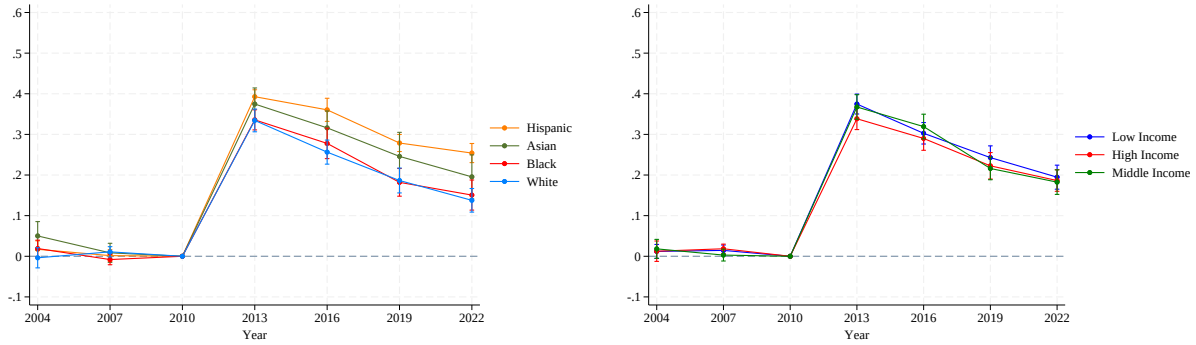
Notes: Each series displays the point estimates and confidence intervals for an estimation of Equation (1). The red dots display unconditional differences in homeownership between treatment and control groups in each year. Green triangles add fixed effects for bins defined by MSA, origination year of loan, and loan type (purchase versus refinance). Lavender squares add a vector of observable characteristics for the household and house, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic. Blue rectangles add a vector of observable characteristics for the household's recent credit. Credit variables include vantage score, number of auto loans, and credit card balance in 2004 and 2007. Orange rectangles add fixed effects for each lender. Standard errors are clustered by MSA, year of loan origination, and type of loan. Appendix Table 2 displays full results.

Figure 8: Long-Run Homeownership Estimates by MSA



Notes: The figure displays point estimates and confidence intervals for an estimation of Equation (1), separately by location. The model contains all fixed effects and controls from Column (5) of Table 2. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan. Full results are displayed in Appendix Table 3.

Figure 9: Long-Run Homeownership Estimates by Race/Ethnicity and Income

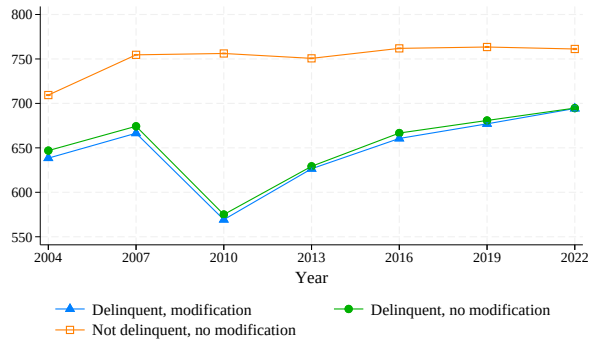


(a) Long-Run Homeownership Estimates by Race and Ethnicity

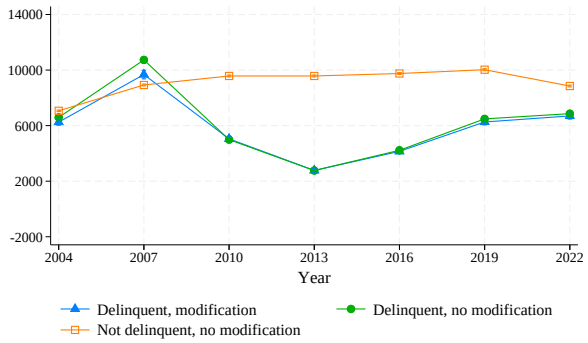
(b) Long-Run Homeownership Estimates by Income Terciles

Notes: The figure displays point estimates and confidence intervals for an estimation of Equation (1), separately by either race/ethnicity (left) or income (right). Income groups are defined by terciles of HMDA-reported income at the time of loan origination. The model contains all fixed effects and controls from Column (5) of Table 2. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan. Full results are displayed in Appendix Table 4 for heterogeneity by race/ethnicity and 5 for size of shock.

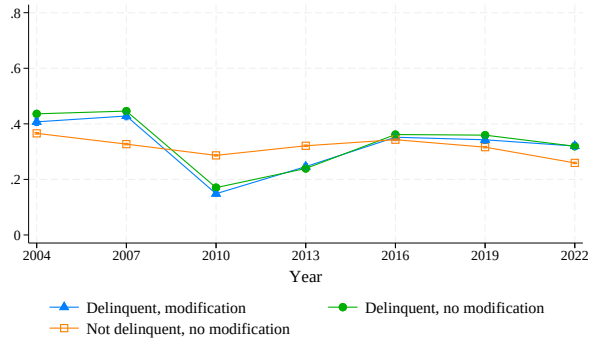
Figure 10: Evolution of Credit Variables and Neighborhood Income



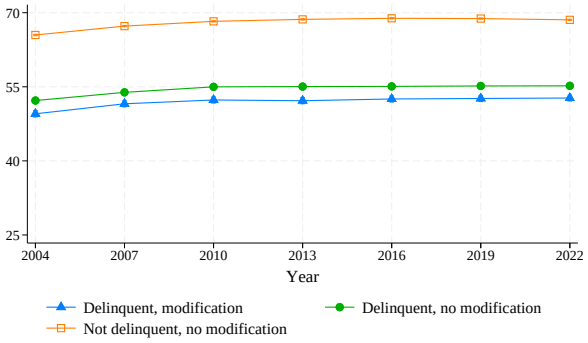
(a) Vantage Score



(b) Credit Card Balance



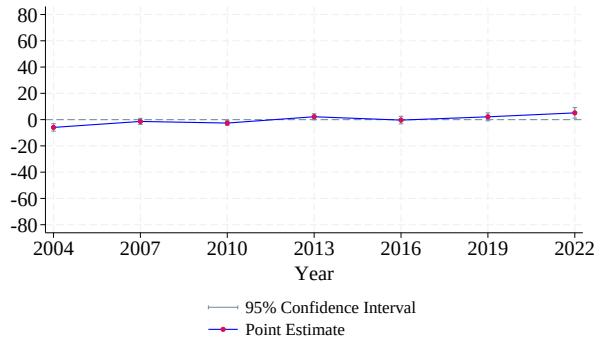
(c) Number of Auto Loans



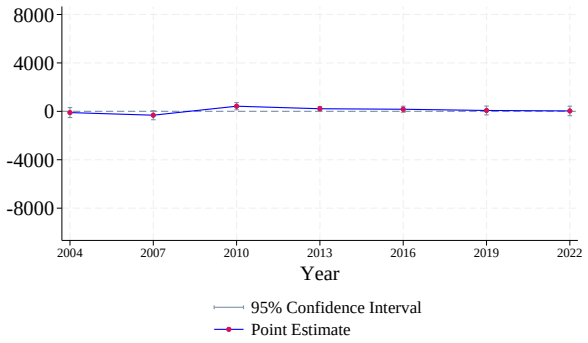
(d) Neighborhood Income Ranking

Notes: Figure displays groupwise averages for credit score, credit card balance in the previous 3 months, number of auto loans, and neighborhood income ranking. Neighborhood income rankings are defined by a ZIP code's nationwide percentile ranking of per capita income in 2010 and held fixed over time. Groups are defined by delinquency in the 24 months preceding June 2010 and by the receipt of a mortgage modification by 2013.

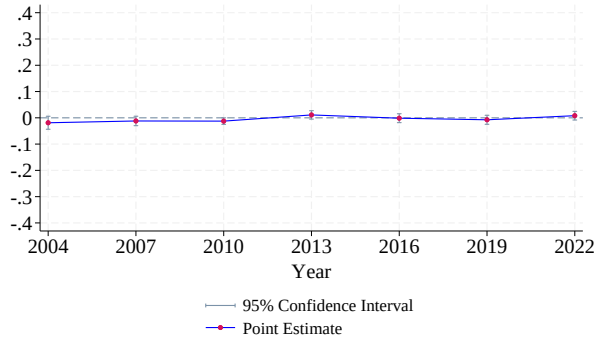
Figure 11: Long-Run Impact on Credit Variables and Neighborhood Income



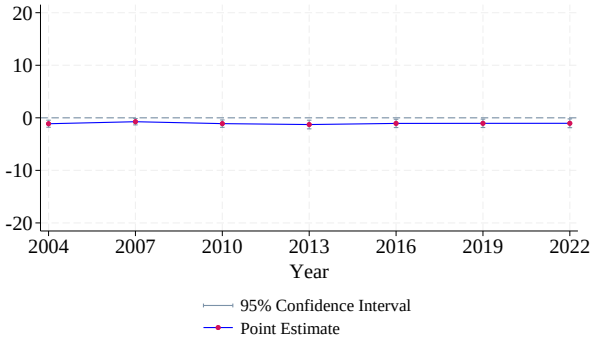
(a) Vantage Score



(b) Credit Card Balance



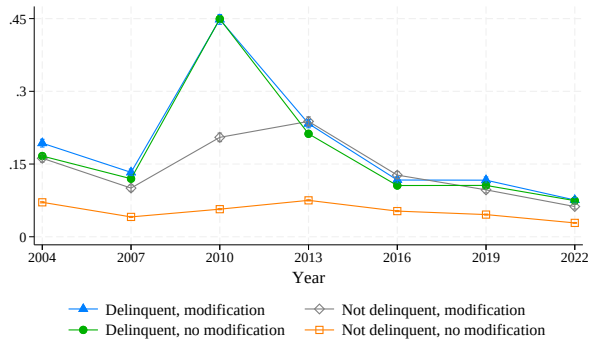
(c) Number of Auto Loans



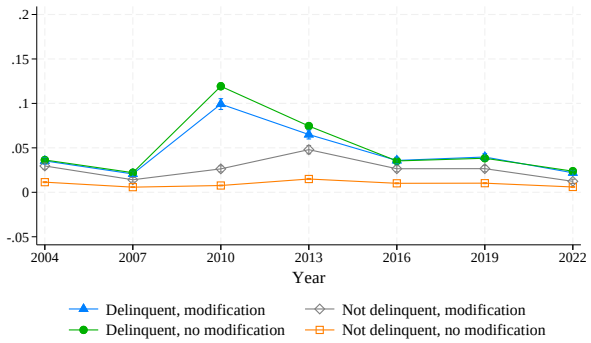
(d) Neighborhood Income Ranking

Notes: Figure displays point estimates and confidence intervals for an estimation of Equation (1). Coefficients represent the difference between treated and control groups in each year on credit score, credit card balances, number of auto loans, and neighborhood income ranking. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan. Full results are displayed in Appendix Table 6.

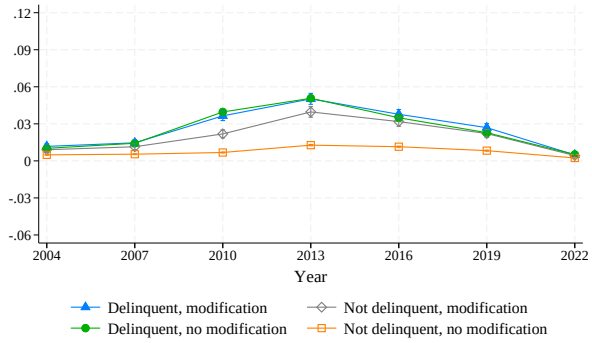
Figure 12: Evolution of Delinquencies



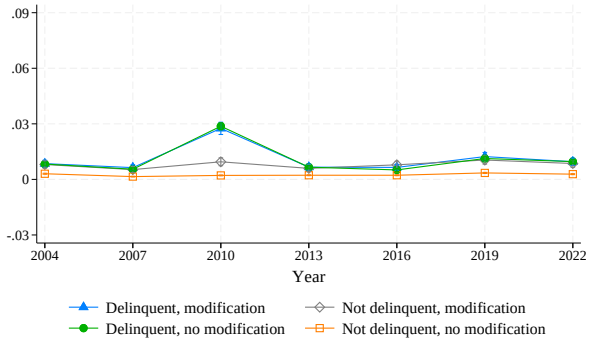
(a) Credit Card 90-Day Delinquency



(b) Auto Loan 90-Day Delinquency



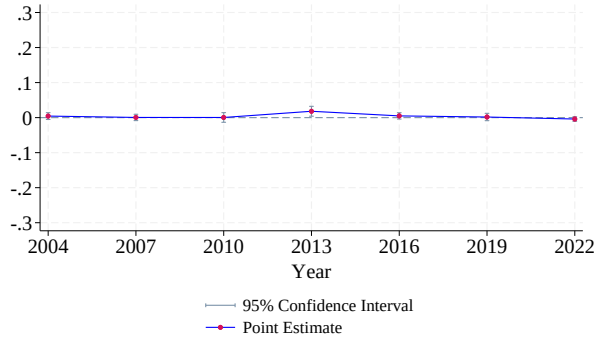
(c) Student Loan 90-Day Delinquency



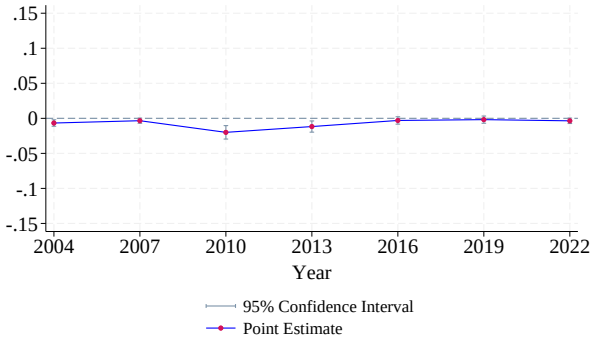
(d) Unsecured Personal Loan 90-Day Delinquency

Notes: Figure displays groupwise average rates of 90-day delinquency in the last 24 months across four types of credit: credit cards, auto loans, student loans, and unsecured personal loans. Groups are defined by delinquency in the 24 months preceding June 2010 and by the receipt of a mortgage modification by 2013. Groups are defined by delinquency in the 24 months preceding June 2010 and by the receipt of a mortgage modification by 2013.

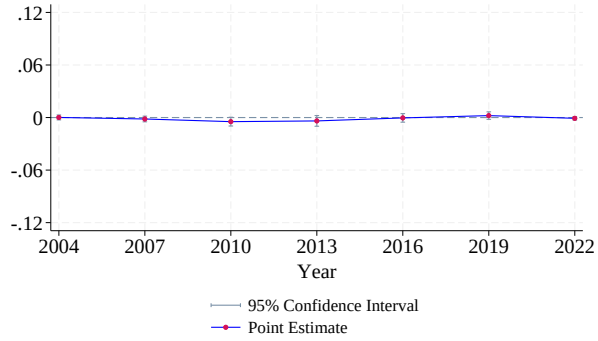
Figure 13: Long-Run Impact on Delinquency



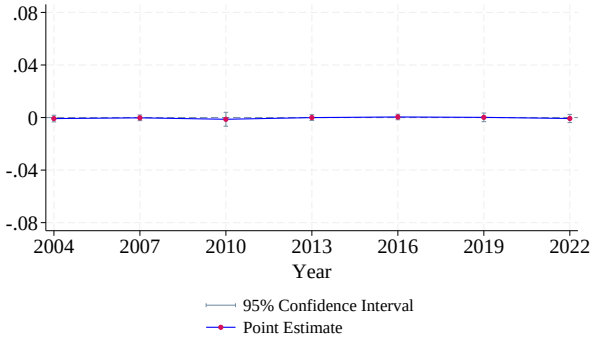
(a) Credit Card 90-Day Delinquency (Last 24 Months)



(b) Auto Loan 90-Day Delinquency (Last 24 Months)



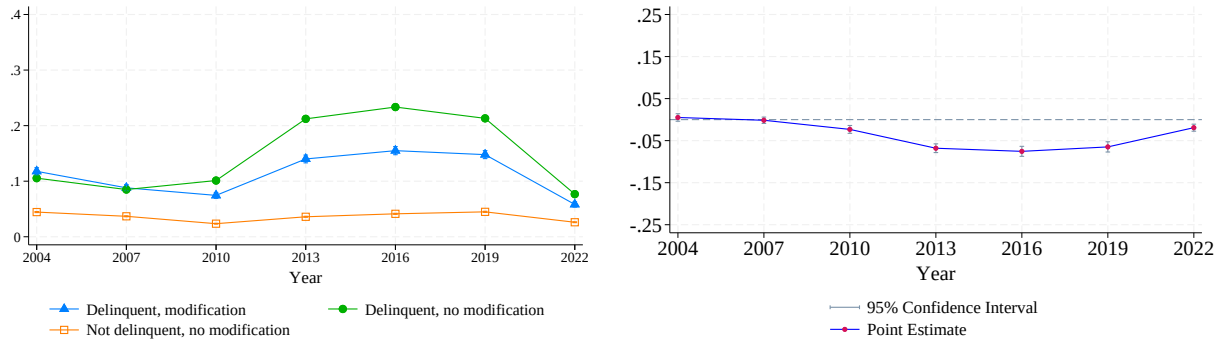
(c) Student Loan 90-Day Delinquency (Last 24 Months)



(d) Unsecured Personal Loan 90-Day Delinquency (Last 24 Months)

Notes: Figure displays point estimates and confidence intervals for an estimation of Equation (1). Coefficients represent the difference between treated and control groups in each year on rates of 90-day delinquency for four types of credit: credit cards, auto loans, student loans, and unsecured personal loans. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan. Full results are displayed in Appendix Table 7.

Figure 14: Chapter 7 Bankruptcy Results

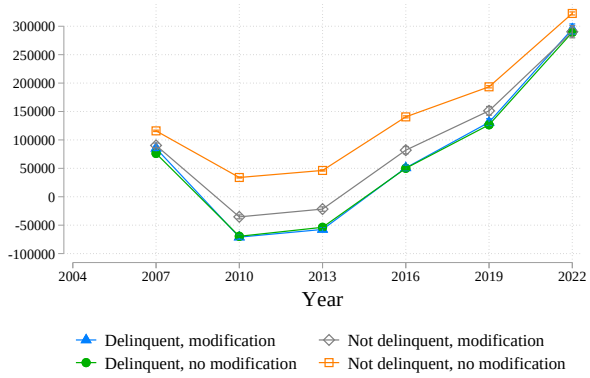


(a) Evolution of Chapter 7 Bankruptcy

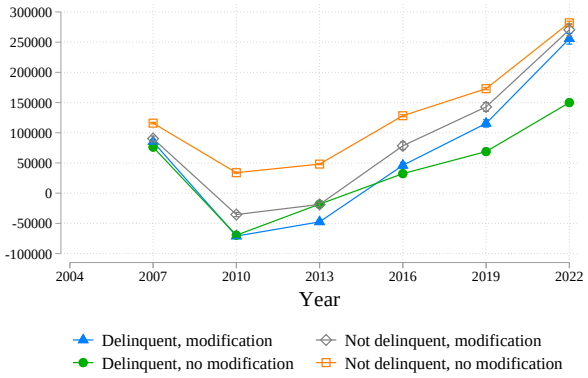
(b) Impact of Modification on Chapter 7 Bankruptcy

Panel (a) displays groupwise averages rates of Chapter 7 bankruptcy, which is the form of personal bankruptcy more commonly associated with home loss. Groups are defined by delinquency in the 24 months preceding June 2010 and by the receipt of a mortgage modification by 2013. Panel (b) displays point estimates and confidence intervals for an estimation of Equation (1). Coefficients represent the difference between treated and control groups in each year on rates of bankruptcy. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to- value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan. Full results are displayed in Appendix Table **??**.

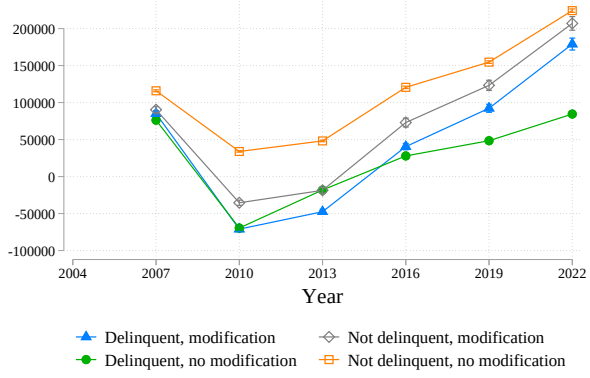
Figure 15: Evolution of Housing Wealth under Alternative Assumptions



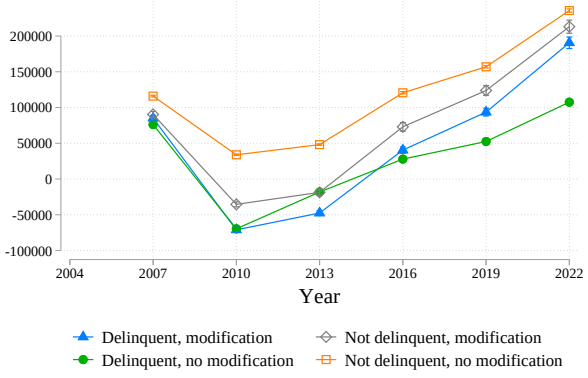
(a) House Price Appreciation



(b) Plus Home Loss 2010-2013



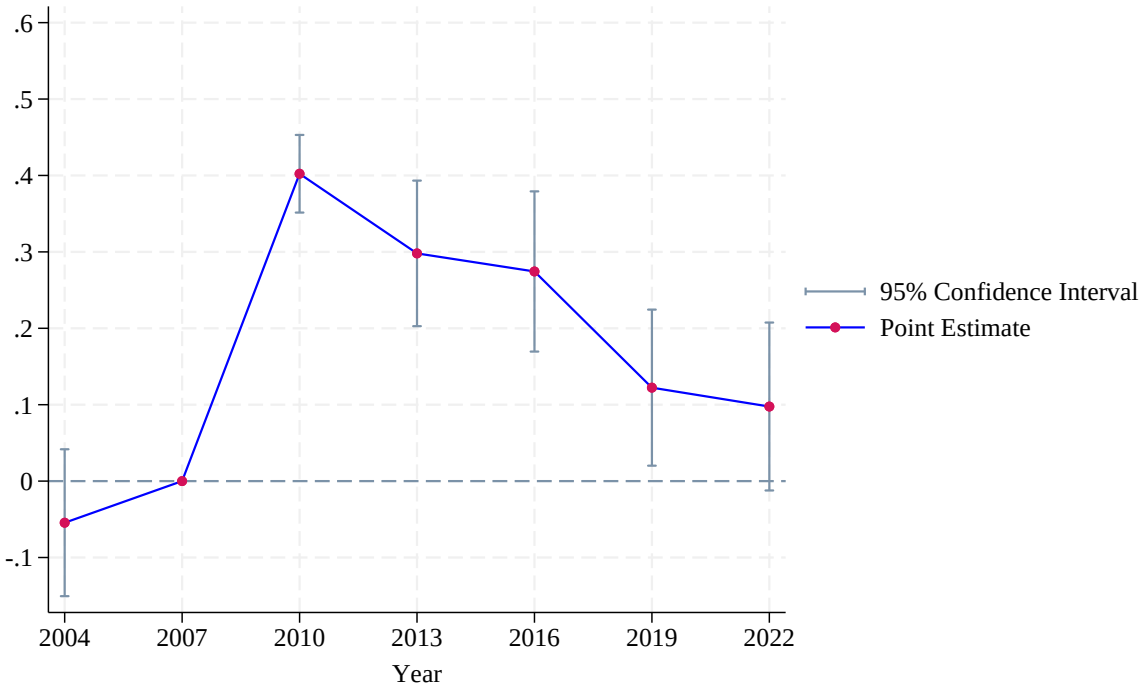
(c) Plus Home Loss 2016, 2019, or 2022



(d) Plus Home Acquisition 2016, 2019, or 2022

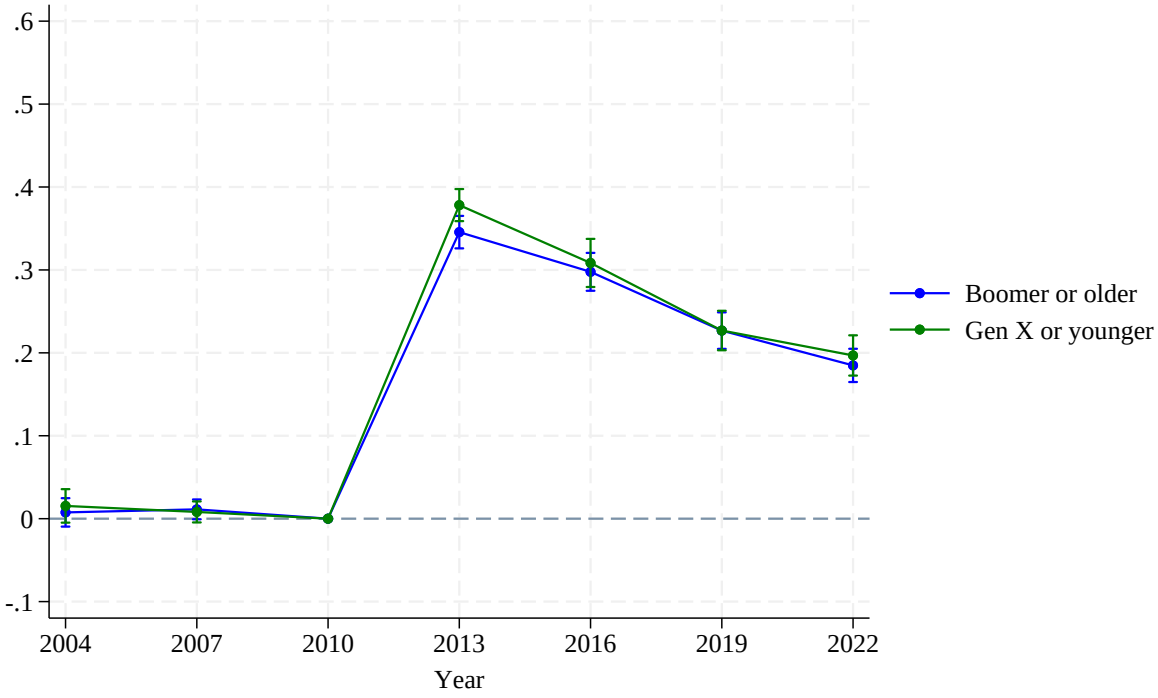
Notes: Panel (a) estimates the evolution of housing wealth under the asusmption that all households remain homeowners. Each year displays groupwise averages of the sum of initial equity (initial home value minus initial loan amount), times average house price appreciation in the ZIP code of residence in each year. Households that change ZIP codes receive appreciation in their new ZIP code. Panel (b) accounts for home loss in the 2010-2013 period. For those who lose homeownership status, if capital gain is positive, we attribute it the household but allow no further wealth accumulation. If capital gain is negative, we treat it as zero. Panel (c) follows the same procedure for home loss in later years. Panel (d) adds capital gain back for households who lose homeownership status then regain it in a later period. We assume a 20% down payment for such households. Households with coborrowers have gains split in half. These results are summarized in Table 4.

Figure 16: Long-Run Impact on Home-Ownership—Earlier Delinquency and Modification



Notes: The figure displays point estimates and confidence intervals for an estimation of Equation (1), for an earlier sample of distressed borrowers. Delinquencies occur in the 24 months preceding June 2007, and modifications are received by 2010. The model contains all fixed effects and controls from Column (5) of Table 2. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan. Full results are displayed in Appendix Table 8.

Figure 17: Homeownership by Generation



The figure displays point estimates and confidence intervals for an estimation of Equation (1), separately by borrower age. The model contains all fixed effects and controls from Column (5) of Table 2. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan. Full results are displayed in Appendix Table 9.

Table 1: Summary Statistics of Full, Matched, and Final Samples

	(1) Full Sample	(2) Matched Sample	(3) Final Sample
Refinance	0.538	0.535	0.527
Has Coborrower	0.593	0.600	0.597
Male	0.536	0.500	0.508
Black	0.096	0.091	0.088
Hispanic	0.166	0.146	0.132
Asian	0.079	0.084	0.088
HMDA Income (in $1,000s)	109.602	111.144	113.469
Home Size (Log Sq. Ft.)	6.751	6.746	6.736
Loan Amount (Log $)	12.320	12.340	12.346
LTV at Origination	0.770	0.767	0.763
Subordinate Debt	0.184	0.186	0.183
Jumbo Loan	0.223	0.230	0.233
Rate Spread	0.157	0.141	0.108
Neighborhood % Poverty	7.506	7.179	6.901
Neighborhood % Black	10.652	10.182	9.737
Neighborhood % Hispanic	15.725	14.901	13.935
Observations	375524	294185	231128

Notes: Figure displays summary statistics of the sample. Column (1) uses the full sample after removing repeated borrowers (same name and address). Column (2) displays individuals who were matched to credit data and for whom housing attributes are available, dropping individuals with missing or invalid credit scores or house size. Individuals are dropped if they are missing credit scores in 2004 or 2022, or both 2019 and 2022. Column (3) restricts to individuals with an open mortgage in 2010 and with no modification until 2013.

Table 2: Balance for Homeownership Index For the Main Balance Table Sample

Homeownership Index Year	No Modification All (1)	No Modification Delinquent (2)	Modification Delinquent (3)	Difference All (3)-(1)	Difference Delinquent (3)-(2)
2013	0.79	0.71	0.70	-0.087***	-0.012***
2016	0.73	0.47	0.46	-0.253***	-0.010***
2019	0.69	0.48	0.47	-0.201***	-0.003
2022	0.65	0.52	0.52	-0.122***	-0.003

Notes: The homeownership index in a given year is estimated on the sample of non-delinquent borrowers with no mortgage modification. The index regresses homeownership in the year on a set of control variables defined 3 years prior. The regression uses MSA by year of loan origination by type of loan (purchase or refinance) fixed effects, and clusters standard error by these variables. The control variables also include house square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, mortgage payment to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage Hispanic. The control variables also include credit variables (vantage score, number of auto loans, and credit card balance) before the current year. For each group, we calculate the average predicted value using the resulting coefficients and observables. These are in-sample predictions for non-delinquent, no-modification borrowers, and out-of-sample predictions for other groups. Columns (1)-(3) show groupwise averages of the index. Column (4) shows the difference between our treatment group and the sample of all non-modification households. Column (5) shows the difference between our treatment group and our control group.

Table 3: Short-Run Impact of Mortgage Modification on Homeownership

	(1)	(2)	(3)	(4)	(5)
Modification Indicator	0.355***	0.356***	0.354***	0.355***	0.359***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
MSA by Origination Yr by Refi FEs	N	Y	Y	Y	Y
Household and Housing Features	N	N	Y	Y	Y
Credit Variables	N	N	N	Y	Y
Lender Fixed-Effects	N	N	N	N	Y
Mean of Dependent Variable	0.578	0.578	0.578	0.578	0.578
R2	0.093	0.102	0.111	0.114	0.121
Observations	41440	41440	41440	41440	41118

Notes: Column (1) displays unconditional differences in homeownership between treatment and control groups in each year. Column (2) adds fixed effects for bins defined by MSA, origination year of loan, and loan type (purchase versus refinance). Column (3) adds a vector of observable characteristics for the household and house, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic. Column (4) adds a vector of observable characteristics for the household's recent credit. Credit variables include vantage score, number of auto loans, and credit card balance in 2004 and 2007. Column (5) adds fixed effects for each lender. Standard errors are clustered by MSA, year of loan origination, and type of loan.
$p < 0.10$, $^{**}p < 0.05$, *** $p < 0.01$

Table 4: Estimated House Wealth Differences in 2022 under Alternative Assumptions (in 2022 dollars)

Group	(1) House Price Appreciation	(2) Plus Not A Homeowner 2013	(3) Plus Not A Homeowner 2016-2022	(4) Plus Home -owner Again 2016-2019
Delinquent, modification	$ 295,127	$ 255,634	$ 179,069	$ 190,509
Delinquent, no modification	$ 289,266	$ 149,936	$ 84,482	$ 107,479
Not delinquent, no modification	$ 322,519	$ 281,971	$ 224,272	$ 235,590
Difference Modification vs Not	$ 5,862	$ 105,698	$ 94,587	$ 83,030

Notes: The table displays estimated house wealth differences in 2022 for different groups of homeowners. The first row are our treatment group. The second row are our control group. The third row represent other, non-distressed homeowners. The fourth row shows differences between treatment and control. Column (1) estimates the evolution of housing wealth under the assumption that all households remain homeowners. Each year displays groupwise averages of the sum of initial equity (initial home value minus initial loan amount), times average house price appreciation in the ZIP code of residence in each year. Households that change ZIP codes receive appreciation in their new ZIP code. Column (2) accounts for home loss in the 2010-2013 period. For those who lose homeownership status, if capital gain is positive, we attribute it the household but allow no further wealth accumulation. If capital gain is negative, we treat it as zero. Column (3) follows the same procedure for home loss in later years. Column (4) adds capital gain back for households who lose homeownership status then regain it in a later period. We assume a 20% down payment for such households. Households with coborrowers have gains split in half.

Table 5: Short-Run Effects in Fannie Mae Sample

	(1)	(2)	(3)	(4)	(5)
Modification Indicator	0.400***	0.410***	0.408***	0.408***	0.407***
	(0.018)	(0.023)	(0.023)	(0.023)	(0.023)
MSA by Origination Date by Refi FE's	N	Y	Y	Y	Y
Borrower and Loan Controls	N	N	Y	Y	Y
Servicer and Lender FE's	N	N	N	Y	Y
Month of first 90 Day Delinquency	N	N	N	N	Y
Mean of Dependent Variable	0.706	0.706	0.706	0.706	0.706
R2	0.193	0.296	0.317	0.318	0.321
Observations	318466	316033	316033	316032	316032

Notes: The sample includes Fannie Mae 30-year fixed rate mortgages, released as part of the Fannie Mae performance data base. We restrict the sample to mortgages that: (1) were originated and purchased between 2004 through 2008, (2) were still active at the end of June of 2010, (3) had experienced a 90-day delinquency by that same date, but (4) had not received a modification prior to that date. The dependent variable is equal to one if the mortgage was either still active in June 2013, or fully paid off. The dependent variable is zero if the loan was terminated *and* the lender experienced a loss at the point of termination, e.g. foreclosure or short sale. The modification indicator on the right-hand side is one if a modification was obtained between June 2010 and June 2013. Column (1) is unconditional. Column (2) includes fixed effects for bins defined by combinations of MSA (Fannie Mae geography, with non-metropolitan areas coded by state), origination date (year by quarter), and loan type (purchase or refinance). Column (3) adds borrower and loan controls, including combined loan to value ratio, credit score, debt to income ratio, whether the mortgage included subordinate debt, log of loan amount, whether a there is a coborrower and property type. Column (4) adds servicer and lender fixed effects, based on categories provided by Fannie Mae. Column (5) includes a fixed effect based on the first month that the loan experienced a 90 day delinquency. Standard errors are clustered at the MSA level.
$p < 0.10$, $^{**}p < 0.05$, *** $p < 0.01$

7 Appendix

Appendix Table 1: Balance Table

	No Modification All (1)	No Modification Delinquent (2)	Modification Delinquent (3)	Difference All (3)-(1)	Difference Delinquent (3)-(2)
Home and Mortgage					
Log Square Feet	6.75	6.83	6.92	0.124***	0.086***
Log Loan Amount	12.33	12.43	12.48	0.024*	0.016**
Loan to Value Ratio	0.76	0.83	0.82	0.049***	0.000
Subordinate Debt	0.18	0.29	0.26	0.048***	-0.006
Jumbo Loan	0.21	0.27	0.30	0.019*	0.013**
Rate Spread	0.14	0.34	0.39	0.204***	0.044***
Debt Payment to Income Ratio (2007)	0.31	0.42	0.44	0.113***	0.013**
First Mort Payment to Income Ratio (2007)	0.21	0.29	0.32	0.082***	0.019***
Mort Payment to Income Ratio (2007)	0.23	0.33	0.35	0.098***	0.017***
Household					
Has Coborrower	0.57	0.44	0.46	-0.097***	0.004
Black	0.12	0.22	0.26	0.110***	0.039***
Hispanic	0.15	0.31	0.34	0.153***	0.037***
Asian	0.08	0.07	0.06	-0.019***	-0.009
Income	114	109	106	-17***	-5***
Neighborhood					
Neighborhood Percent Poverty	7.54	10.03	10.20	1.922***	0.312**
Neighborhood Percent Black	11.21	17.09	18.63	6.384***	1.603***
Neighborhood Percent Hispanic	14.76	22.74	24.59	6.270***	1.576***
Credit					
Credit Score (2004)	690	635	630	-61***	-11***
Credit Score (2007)	737	672	665	-74***	-9***
Change in Credit Score (2004-2007)	48	36	35	-13***	2
Number of Auto Loans (2004)	0.36	0.40	0.37	0.014	-0.037***
Number of Auto Loans (2007)	0.34	0.44	0.42	0.070***	-0.017*
Change in Auto Loans (2004-2007)	-0.02	0.03	0.04	0.056***	0.020
Credit Card Balance (2004)	6550	5836	5516	-1,172***	-535**
Credit Card Balance (2007)	8563	9414	8649	-108	-1,281***
Change in Credit Card Balance (2004-2007)	2013	3578	3133	1,065***	-746***
Number of Observations	213007	31686	9754		

Notes: This table is visualized in Figure 4. Incomes used to generate income ratios are from the year of mortgage origination. Column (1) displays the mean of each variable for all households with no mortgage modification by 2013. Column (2) restricts to households with no mortgage modification who also experienced a 90-day mortgage delinquency, and represents our key control group. Column (3) displays variable means for households with a mortgage modification who also experienced a 90-day delinquency, and represents our treatment group. The final two columns show differences between groups, representing point estimates for a regression that has the variable of interest on the left-hand side, and a group indicator on the right-hand side, as well as fixed effects for bins defined by MSA, year of loan origination, and loan type (purchase or refinance). Standard errors are clustered by these bins.
$p < 0.10$, $^{**}p < 0.05$, *** $p < 0.01$

Appendix Table 2: Table of Long-Term Estimate Homeownership by Model

	(1)	(2)	(3)	(4)	(5)
2004	0.034***	0.006	0.009	0.019***	0.013**
	(0.008)	(0.007)	(0.007)	(0.007)	(0.006)
2007	0.018***	0.010*	0.008	0.010**	0.006
	(0.007)	(0.005)	(0.005)	(0.005)	(0.005)
2010	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2013	0.355***	0.356***	0.354***	0.355***	0.359***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
2016	0.300***	0.298***	0.297***	0.300***	0.302***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
2019	0.222***	0.220***	0.220***	0.224***	0.226***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
2022	0.184***	0.184***	0.182***	0.185***	0.187***
	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)
MSA by Origination Yr by Refi FEs	N	Y	Y	Y	Y
Household and Housing Features	N	N	Y	Y	Y
Credit Variables	N	N	N	Y	Y
Lender Fixed-Effects	N	N	N	N	Y
Observations	41440	41440	41440	41440	41118

Notes: This table is visualized in Figure 7. Column (1) displays unconditional differences in homeownership between treatment and control groups in each year. Column (2) adds fixed effects for bins defined by MSA, origination year of loan, and loan type (purchase versus refinance). Column (3) adds a vector of observable characteristics for the household and house, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic. Column (4) adds a vector of observable characteristics for the household's recent credit. Credit variables include vantage score, number of auto loans, and credit card balance in 2004 and 2007. Column (5) adds fixed effects for each lender. Standard errors are clustered by MSA, year of loan origination, and type of loan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 3: Table of Long-Term Estimate Homeownership by MSA

	Chicago	Cleveland	Denver	LA	Maryland	Miami	SFBA
2004	-0.008	0.037**	-0.011	0.025	0.011	0.025**	0.009
	(0.022)	(0.014)	(0.030)	(0.015)	(0.010)	(0.010)	(0.011)
2007	0.006	0.014	0.014	0.009	0.004	0.008	-0.007
	(0.014)	(0.011)	(0.014)	(0.013)	(0.015)	(0.009)	(0.009)
2010	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2013	0.342***	0.311***	0.297***	0.379***	0.294***	0.413***	0.380***
	(0.009)	(0.022)	(0.033)	(0.014)	(0.020)	(0.010)	(0.013)
2016	0.284***	0.254***	0.203***	0.303***	0.227***	0.368***	0.351***
	(0.021)	(0.028)	(0.023)	(0.014)	(0.025)	(0.023)	(0.012)
2019	0.207***	0.183***	0.134***	0.248***	0.154***	0.266***	0.270***
	(0.014)	(0.048)	(0.021)	(0.019)	(0.010)	(0.016)	(0.016)
2022	0.170***	0.086**	0.094***	0.213***	0.153***	0.206***	0.229***
	(0.018)	(0.034)	(0.017)	(0.013)	(0.018)	(0.021)	(0.018)
Origination Yr by Refi FEs	Y	Y	Y	Y	Y	Y	Y
MSA FE	N	N	N	N	N	N	N
Household and Housing Features	Y	Y	Y	Y	Y	Y	Y
Credit Variables	Y	Y	Y	Y	Y	Y	Y
Lender Fixed-Effects	Y	Y	Y	Y	Y	Y	Y
Observations	5075	2840	3401	8805	5707	7893	7397

Notes: This table is visualized in Figure 8. The model contains all fixed effects and controls from Column (5) of Table 2, and is estimated separately by location. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 4: Table of Long-Term Estimate Homeownership by Race and Ethnicity

	White	Black	Hispanic	Asian
2004	-0.004	0.019*	0.017	0.050***
	(0.013)	(0.010)	(0.011)	(0.018)
2007	0.011*	-0.008	0.002	0.008
	(0.007)	(0.007)	(0.008)	(0.012)
2010	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
2013	0.334***	0.336***	0.393***	0.375***
	(0.014)	(0.013)	(0.009)	(0.020)
2016	0.256***	0.278***	0.360***	0.316***
	(0.015)	(0.019)	(0.014)	(0.021)
2019	0.187***	0.182***	0.279***	0.246***
	(0.016)	(0.017)	(0.011)	(0.030)
2022	0.138***	0.151***	0.254***	0.196***
	(0.015)	(0.019)	(0.012)	(0.028)
MSA by Origination Yr by Refi FEs	Y	Y	Y	Y
Household and Housing Features	Y	Y	Y	Y
Credit Variables	Y	Y	Y	Y
Lender Fixed-Effects	Y	Y	Y	Y
Observations	14263	9343	12909	2704

Notes: This table is visualized in Figure 9. The model contains all fixed effects and controls from Column (5) of Table 2, and is estimated separately by race/ethnic group. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 5: Table of Long-Term Estimate Homeownership by Income

	Low Income	Middle Income	High Income
2004	0.012	0.018	0.012
	(0.009)	(0.012)	(0.013)
2007	0.014**	0.003	0.019***
	(0.007)	(0.007)	(0.006)
2010	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
2013	0.375***	0.367***	0.339***
	(0.013)	(0.015)	(0.014)
2016	0.303***	0.319***	0.290***
	(0.013)	(0.016)	(0.015)
2019	0.243***	0.216***	0.223***
	(0.015)	(0.014)	(0.017)
2022	0.195***	0.183***	0.186***
	(0.015)	(0.015)	(0.014)
MSA by Origination Yr by Refi FEs	Y	Y	Y
Household and Housing Features	Y	Y	Y
Credit Variables	Y	Y	Y
Lender Fixed-Effects	Y	Y	Y
Observations	14038	13557	13523

Notes: This table is visualized in Figure 9. The model contains all fixed effects and controls from Column (5) of Table 2, and is estimated separately by terciles of HMDA-reported income at loan origination. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 6: Long-Term Effects on Credit and Consumption Variables

	Vantage Score	Credit Card Balance	Number of Auto Loans	Neighborhood Income Ranking
2004	-5.933***	-101.887	-0.019	-1.126***
	(1.448)	(209.207)	(0.013)	(0.342)
2007	-1.394	-318.419	-0.012	-0.741**
	(1.188)	(193.014)	(0.009)	(0.309)
2010	-2.615***	423.921***	-0.013**	-1.105***
	(0.894)	(152.874)	(0.006)	(0.358)
2013	2.181*	214.202**	0.011	-1.280***
	(1.174)	(95.981)	(0.008)	(0.418)
2016	-0.354	172.181	-0.001	-1.063**
	(1.459)	(127.701)	(0.009)	(0.402)
2019	2.130	71.175	-0.007	-1.051**
	(1.525)	(186.218)	(0.009)	(0.406)
2022	5.128**	33.728	0.008	-1.042**
	(2.045)	(200.152)	(0.008)	(0.427)
MSA by Origination Yr by Refi FEs	Y	Y	Y	Y
Household and Housing Features	Y	Y	Y	Y
Credit Variables	Y	Y	Y	Y
Lender Fixed-Effects	Y	Y	Y	Y
Observations	41118	41118	41118	40578

Notes: This table is visualized in Figure 11. Neighborhood income rankings are defined by a ZIP code's nationwide percentile ranking of per capita income in 2010 and held fixed over time. The model contains all fixed effects and controls from Column (5) of Table 2, and is estimated separately by location. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 7: Table of Long-Term Delinquency Estimates (Last 24 months)

	Credit Card 90-Day Delinquency	Auto Loan 90-Day Delinquency	Student Loan 90-Day Delinquency	Unsecured Personal Loan 90-Day Delinquency	Chapter 7 Bankruptcy
2004	0.004	-0.007***	0.000	-0.001	0.005
	(0.005)	(0.002)	(0.001)	(0.001)	(0.005)
2007	0.001	-0.003*	-0.002	-0.000	-0.002
	(0.005)	(0.002)	(0.002)	(0.001)	(0.004)
2010	0.000	-0.020***	-0.005*	-0.001	-0.023***
	(0.007)	(0.005)	(0.003)	(0.003)	(0.005)
2013	0.018**	-0.012***	-0.004	-0.000	-0.068***
	(0.007)	(0.004)	(0.003)	(0.001)	(0.005)
2016	0.005	-0.003	-0.000	0.000	-0.075***
	(0.005)	(0.003)	(0.002)	(0.001)	(0.006)
2019	0.002	-0.002	0.002	0.000	-0.065***
	(0.005)	(0.003)	(0.002)	(0.002)	(0.006)
2022	-0.004	-0.004*	-0.001	-0.001	-0.019***
	(0.003)	(0.002)	(0.001)	(0.002)	(0.004)
MSA by Origination Yr by Refi FEs	Y	Y	Y	Y	Y
Household and Housing Features	Y	Y	Y	Y	Y
Credit Variables	Y	Y	Y	Y	Y
Lender Fixed-Effects	Y	Y	Y	Y	Y
Observations	41118	41118	41118	41118	41118

Notes: This table is visualized in Figure 12. Neighborhood income rankings are defined by a ZIP code's nationwide percentile ranking of per capita income in 2010 and held fixed over time. The model contains all fixed effects and controls from Column (5) of Table 2, and is estimated separately by location. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 8: Table of Long-Term Estimate Homeownership Conditioning On Delinquency in 2007

	Modification in 2010
2004	-0.054
	(0.049)
2007	0.000
	(0.000)
2010	0.402***
	(0.026)
2013	0.298***
	(0.049)
2016	0.274***
	(0.053)
2019	0.122**
	(0.052)
2022	0.098*
	(0.056)
MSA by Origination Yr by Refi FEs	Y
Household and Housing Features	Y
Credit Variables	Y
Lender Fixed-Effects	Y
Observations	6562

Notes: This table is visualized in Figure 16. The model contains all fixed effects and controls from Column (5) of Table 2, estimated for an earlier sample of distressed borrowers. Delinquencies occur in the 24 months preceding June 2007, and modifications are received by 2010. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 9: Table of Long-Term Estimate Homeownership by Generation

	Boomer or older	Gen X or younger
2004	0.008	0.015
	(0.009)	(0.010)
2007	0.011*	0.008
	(0.006)	(0.006)
2010	0.000	0.000
	(0.000)	(0.000)
2013	0.346***	0.378***
	(0.010)	(0.010)
2016	0.298***	0.308***
	(0.012)	(0.015)
2019	0.227***	0.227***
	(0.011)	(0.012)
2022	0.185***	0.197***
	(0.010)	(0.012)
MSA by Origination Yr by Refi FEs	Y	Y
Household and Housing Features	Y	Y
Credit Variables	Y	Y
Lender Fixed-Effects	Y	Y
Observations	21443	18735

Notes: This table is visualized in Figure 17. The model contains all fixed effects and controls from Column (5) of Table 2, separately by borrower age. Delinquencies occur in the 24 months preceding June 2007, and modifications are received by 2010. The model includes fixed effects for bins defined by MSA, year of loan origination, and type of loan (purchase or refi), as well as lender fixed effects. It includes controls for housing and household features and credit variables, including square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, total mortgage payment(s) to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic, as well as 2004 and 2007 levels of credit score, number of auto loans, and credit card balance. Standard errors are clustered by MSA, year of loan origination, and type of loan.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

8 Writing Appendix

Appendix Table 1: Table of Long-Term Descriptive Homeownership

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	0.580	0.540	0.608
2007	0.883	0.856	0.800
2010	1.000	1.000	1.000
2013	0.848	0.494	0.847
2016	0.723	0.418	0.798
2019	0.674	0.452	0.749
2022	0.660	0.472	0.685

Appendix Table 2: Table of Long-Term Descriptive Number of Auto Loans

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	0.373	0.405	0.354
2007	0.418	0.436	0.327
2010	0.155	0.172	0.292
2013	0.239	0.237	0.322
2016	0.353	0.355	0.345
2019	0.337	0.350	0.316
2022	0.316	0.312	0.262

Appendix Table 3: Table of Long-Term Descriptive Credit Card Balance

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	5,516	5,836	6,674
2007	8,649	9,414	8,414
2010	4,805	4,708	9,120
2013	2,679	2,620	9,154
2016	3,949	4,074	9,425
2019	6,031	6,214	9,821
2022	6,501	6,601	8,748

Appendix Table 4: Table of Long-Term Descriptive Vantage Score

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	630	635	699
2007	665	672	749
2010	568	573	751
2013	625	627	746
2016	658	664	758
2019	675	678	759
2022	693	692	758

Appendix Table 5: Table of Long-Term Descriptive Neighborhood Income Ranking

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	47	49	63
2007	49	51	65
2010	50	52	66
2013	50	53	66
2016	50	53	67
2019	51	53	67
2022	51	53	67

Appendix Table 6: Table of Long-Term Descriptive Foreclosure Notice

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	0.024	0.020	0.006
2007	0.026	0.029	0.004
2010	0.430	0.491	0.003
2013	0.293	0.470	0.072
2016	0.099	0.086	0.031
2019	0.035	0.020	0.011
2022	0.013	0.007	0.004

Appendix Table 7: Table of Long-Term Descriptive Homeownership without Limit on 2010

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	0.576	0.508	0.580
2007	0.882	0.848	0.736
2010	0.861	0.598	0.832
2013	0.800	0.338	0.740
2016	0.690	0.328	0.709
2019	0.648	0.383	0.676
2022	0.638	0.418	0.626

Appendix Table 8: Table of Long-Term Descriptive 90-Day Delinquency (Last 24 months)

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	0.043	0.035	0.012
2007	0.057	0.059	0.008
2010	1.000	1.000	0.000
2013	0.582	0.519	0.106
2016	0.233	0.137	0.049
2019	0.091	0.048	0.023
2022	0.041	0.022	0.010

Appendix Table 9: Table of Long-Term Descriptive Mortgage Modification

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	0.000	0.000	0.000
2007	0.000	0.000	0.000
2010	0.000	0.000	0.000
2013	1.000	0.000	0.000
2016	0.660	0.100	0.029
2019	0.501	0.092	0.030
2022	0.318	0.064	0.024

Appendix Table 10: Table of Long-Term Descriptive Chapter 7 Bankruptcy

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	0.112	0.107	0.048
2007	0.091	0.091	0.043
2010	0.077	0.100	0.028
2013	0.140	0.203	0.039
2016	0.153	0.221	0.042
2019	0.148	0.205	0.047
2022	0.061	0.077	0.029

Appendix Table 11: Table of Long-Term Descriptive Student Loan 90-Day Delinquency (Last 24 Months)

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	0.013	0.013	0.006
2007	0.016	0.016	0.007
2010	0.041	0.043	0.008
2013	0.054	0.054	0.015
2016	0.041	0.039	0.014
2019	0.027	0.026	0.010
2022	0.006	0.006	0.003

Appendix Table 12: Table of Long-Term Descriptive Auto Loan 90-Day Delinquency (Last 24 Months)

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	0.040	0.041	0.014
2007	0.023	0.024	0.007
2010	0.095	0.117	0.008
2013	0.067	0.076	0.017
2016	0.038	0.037	0.012
2019	0.043	0.041	0.012
2022	0.025	0.025	0.007

Appendix Table 13: Table of Long-Term Descriptive Credit Card Trade 90-Day Delinquency (Last 24 Months)

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	0.202	0.179	0.083
2007	0.132	0.122	0.046
2010	0.434	0.433	0.059
2013	0.230	0.212	0.080
2016	0.122	0.109	0.057
2019	0.119	0.110	0.050
2022	0.077	0.077	0.031

Appendix Table 14: Table of Long-Term Descriptive Unsecured Personal Loan 90-Day Delinquency (Last 24 Months)

	Delinquent modification	Delinquent no modification	Not delinquent no modification
2004	0.010	0.009	0.004
2007	0.006	0.005	0.002
2010	0.026	0.029	0.002
2013	0.007	0.007	0.002
2016	0.007	0.006	0.003
2019	0.012	0.012	0.004
2022	0.010	0.010	0.003

Appendix Table 15: Rent Index (Individual level)

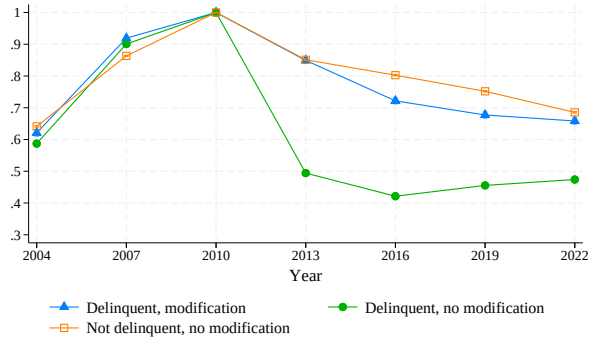
	count	mean	sd	min	max
% Change in House Value (ACS) 2007-2011 VS 2012-2016	230407	-1.839313	14.18182	-63.78378	141.6794
% Change in House Value (ACS) 2012-2016 VS 2018-2022	230395	55.92277	26.78482	-30.45752	203.6345
% Change in House Value (ACS) 2007-2011 VS 2018-2022	230440	53.84472	37.59455	-46.79537	297.955
% Change in Rent (ACS) 2007-2011 VS 2012-2016	229869	12.10942	11.29406	-49.52524	180.08
% Change in Rent (ACS) 2012-2016 VS 2018-2022	229266	35.19665	15.30248	-38.58897	161.9355
% Change in Rent (ACS) 2007-2011 VS 2018-2022	229414	51.65564	23.29845	-34.60439	302.1841
% Change in Housing Price Index (FHFA) 2007-2011 VS 2012-2016	226211	1.027627	14.14323	-34.6204	50.73403
% Change in Housing Price Index (FHFA) 2012-2016 VS 2018-2022	222215	45.89394	22.22881	-31.44272	160.3814
% Change in Housing Price Index (FHFA) 2007-2011 VS 2018-2022	222104	47.96787	35.50585	-18.94668	223.7861
Observations	230494				

Note: House value, rent, and housing price index all use nominal values.

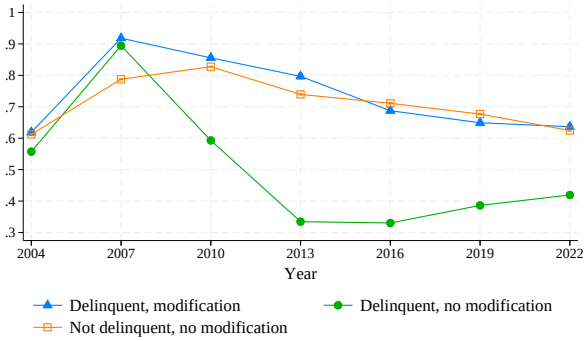
Appendix Table 16: Rent Index (Zip code level)

	count	mean	sd	min	max
% Change in House Value (ACS) 2007-2011 VS 2012-2016	2750	-1.440205	16.03373	-63.78378	141.6794
% Change in House Value (ACS) 2012-2016 VS 2018-2022	2744	51.90712	26.75013	-30.45752	203.6345
% Change in House Value (ACS) 2007-2011 VS 2018-2022	2751	49.31009	33.21629	-46.79537	297.955
% Change in Rent (ACS) 2007-2011 VS 2012-2016	2695	10.73337	14.54661	-49.52524	180.08
% Change in Rent (ACS) 2012-2016 VS 2018-2022	2665	34.08175	17.83263	-38.58897	161.9355
% Change in Rent (ACS) 2007-2011 VS 2018-2022	2673	48.13297	24.43232	-34.60439	302.1841
% Change in Housing Price Index (FHFA) 2007-2011 VS 2012-2016	2550	-1.071362	12.06428	-34.6204	50.73403
% Change in Housing Price Index (FHFA) 2012-2016 VS 2018-2022	2472	44.45443	21.72896	-31.44272	160.3814
% Change in Housing Price Index (FHFA) 2007-2011 VS 2018-2022	2471	42.61831	29.35071	-18.94668	223.7861
Observations	2767				

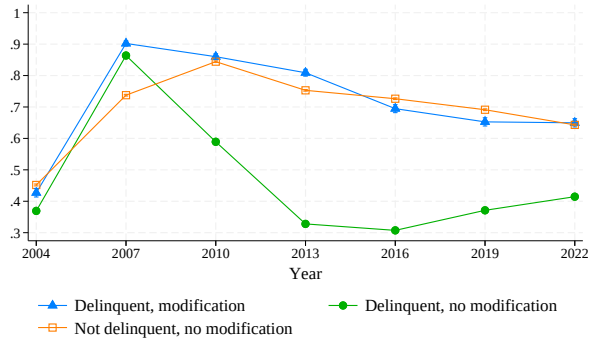
Appendix Figure 1



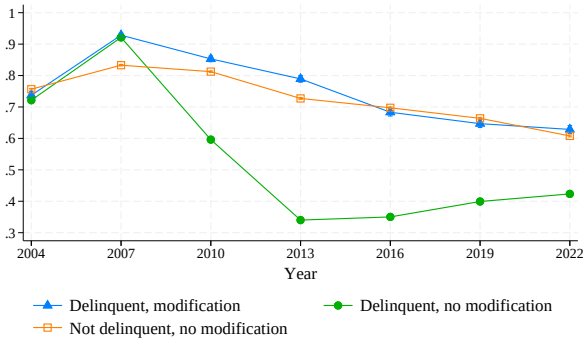
(a) Homeownership with Limit on 2010 - Total



(b) Homeownership without Limit on 2010 - Total



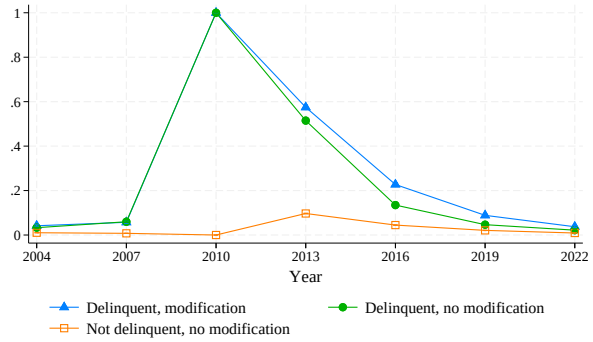
(c) Homeownership without Limit on 2010 - Purchase



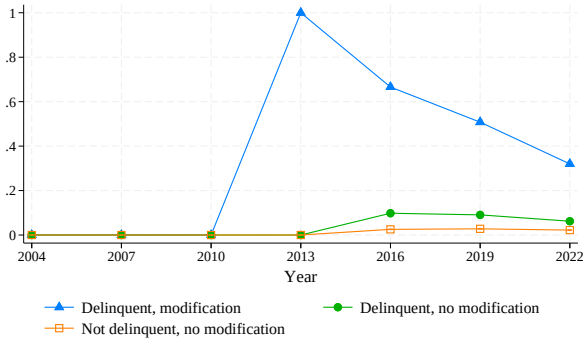
(d) Homeownership without Limit on 2010 - Refinance

Notes: Look at Appendix Tables 3 and 16 for point estimates.

Appendix Figure 2



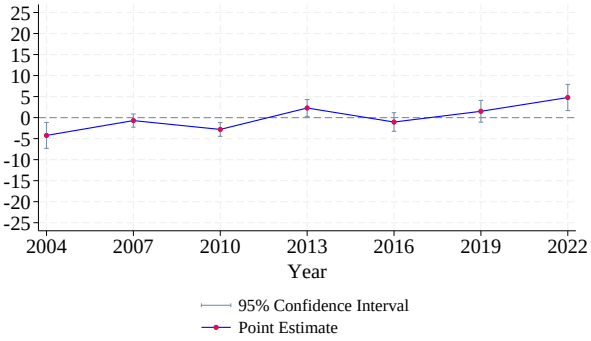
(a) 90-Day Delinquency (Last 24 Months)



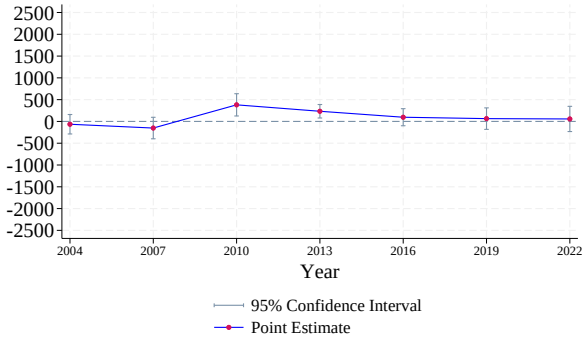
(b) Mortgage Modification

Notes: Look at Appendix Tables 17 and 18 for point estimates.

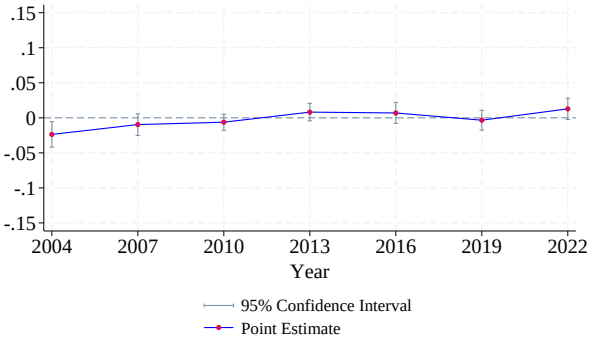
Appendix Figure 3: Figure 11 with different y-axis range (0.5 SD)



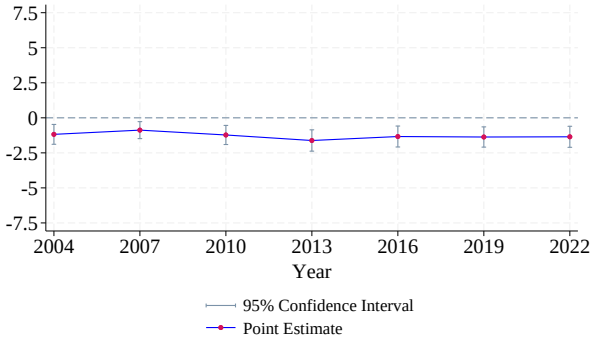
(a) Vantage Score



(b) Credit Card Balance



(c) Number of Auto Loans



(d) Neighborhood Income Ranking

Notes: Look at Appendix Table 14 for point estimates.
The model of estimate uses MSA, year of loan origination, type of loan, and lender-fixed effects. It clusters the standard error by MSA, year of loan origination, and type of loan. It controls for household and housing features and credit variables.

Appendix Table 17: Balance Table for Homeownership Index For Different Samples Based on Delinquency Years

Modification Year	No Modification All (1)	No Modification Delinquent (2)	Modification Delinquent (3)	Difference All (3)-(1)	Difference Delinquent (3)-(2)
2010	0.84	0.76	0.74	-0.101***	-0.020**
2013	0.79	0.71	0.70	-0.083***	-0.010***
2016	0.85	0.73	0.72	-0.125***	-0.017***
2019	0.87	0.82	0.81	-0.056***	-0.008***
2022	0.85	0.83	0.83	-0.015***	-0.003

Notes: Our main model is the modification year 2013. For 2013, we focus on the borrowers with open mortgages in 2010 and no modification until 2013. In the main model, the homeownership index is estimated by regressing homeownership in 2013 on a set of control variables on the sample not receiving modification in 2013. The regression uses MSA, year of loan origination, and type of loan fixed-effects and clusters standard error by these variables. The control variables include household and housing feature: square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, mortgage payment to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic. The control variables also include credit variables (vantage score, number of auto loans, and credit card balance) before the delinquent year, i.e. in 2004 and 2007 for the main model. For other modification years, we shift all conditions together with the modification year. For example, when the modification year is 2022, we focus on the borrowers with open mortgages in 2019 and no modification until 2022, and estimate homeownership index using open mortgages in 2022 and control variables (credit variables up to 2016).
The first three columns calculate the average homeownership index by different groups. No Modification All refers to all borrowers with no modification in the corresponding year (left-hand side of the table). No Modification Delinquent is a subsample from column one and refers to the borrowers who had no modification in the corresponding year and were delinquent three years ago. Modification Delinquent is the borrowers who had modification in the corresponding year and were delinquent three years ago. Column four, Difference All, estimates the difference between column three and column one by regressing the homeownership index on modification in the corresponding year for the borrowers who either had no modification in the corresponding year or had modification in the corresponding year and were delinquent three years ago. The regression also uses MSA, year of loan origination, and type of loan fixed-effects and clusters standard error by these variables. Column five, Difference Delinquent, uses the same model as column four but focuses on the borrowers who were delinquent three years ago.

Appendix Table 18

	(1) Foreclosure Notice
Modification Indicator	-0.189***
	(0.010)
MSA by Origination Yr by Refi FEs	Y
Household and Housing Features	Y
Credit Variables	Y
Lender Fixed-Effects	Y
Mean of Dependent Variable	0.690
R2	0
Observations	41118

Notes: Standard errors are clustered by MSA, year of loan origination, and type of loan. Household and housing features include square feet (log), initial loan amount (log), loan-to-value ratio, subordinate debt, jumbo loan, rate spread dummy, debt payment to income ratio in 2007, first mortgage payment to income ratio in 2007, mortgage payment to income ratio in 2007, presence of a co-borrower (spouse), race and ethnicity (Black, Hispanic, Asian), initial income, neighborhood poverty

rate, neighborhood percentage of African Americans, and neighborhood percentage of Hispanic. Credit Variables include vantage score, number of auto loans, and credit card balance in 2004 and 2007.