



Federal Reserve Bank of Chicago

**Market-Based Loss Mitigation
Practices for Troubled Mortgages
Following the Financial Crisis**

*Sumit Agarwal, Gene Amromin, Itzhak
Ben-David, Souphala Chomsisengphet, and
Douglas D. Evanoff*

WP 2011-03

Market-Based Loss Mitigation Practices for Troubled Mortgages Following the Financial Crisis

Sumit Agarwal[#]
Gene Amromin[#]
Itzhak Ben-David^{*}
Souphala Chomsisengphet[§]
Douglas D. Evanoff[#]

October 2010

ABSTRACT

The meltdown in residential real-estate prices that commenced in 2006 resulted in unprecedented mortgage delinquency rates. Until mid-2009, lenders and servicers pursued their own individual loss mitigation practices without being significantly influenced by government intervention. Using a unique dataset that precisely identifies loss mitigation actions, we study these methods—liquidation, repayment plans, loan modification, and refinancing—and analyze their effectiveness. We show that the majority of delinquent mortgages do not enter any loss mitigation program or become a part of foreclosure proceedings within 6 months of becoming distressed. We also find that it takes longer to complete foreclosures over time, potentially due to congestion. We further document large heterogeneity in practices across servicers, which is not accounted for by differences in borrower population. Consistent with the idea that securitization induces agency conflicts, we confirm that the likelihood of modification of securitized loans is up to 70% lower relative to portfolio loans. Finally, we find evidence that affordability (as opposed to strategic default due to negative equity) is the prime reason for redefault following modifications. While modification terms are more favorable for weaker borrowers, greater reductions in mortgage payments and/or interest rates are associated with lower redefault rates. Our regression estimates suggest that a 1 percentage point decline in mortgage interest rate is associated with a nearly 4 percentage point decline in default probability. This finding is consistent with the Home Affordable Modification Program (HAMP) focus on improving mortgage affordability.

Keywords: loan modifications, financial crisis, household finance, mortgages, securitization
JEL classification: D1, D8, G1, G2

We would like to thank Gadi Barlevy, Jeff Campbell, Scott Frame, Dennis Glennon, Victoria Ivashina, Bruce Krueger, Mark Levonian, Chris Mayer, Nick Souleles, James Wilds, Paul Willen, and Steve Zeldes for helpful comments and suggestions. Regina Villasmil and Ross Dillard provided excellent research assistance. The authors thank participants in the Wharton/FIRS pre-conference, the FIRS conference (Florence), the Federal Reserve Bank of Chicago, Nationwide Insurance Company, and the NBER Household Finance meeting for comments. The views presented in the paper do not necessarily reflect those of the Federal Reserve Bank of Chicago, the Federal Reserve System, the Office of the Comptroller of the Currency, or the U.S. Department of the Treasury.

[#] Federal Reserve Bank of Chicago

^{*} Fisher College of Business, The Ohio State University

[§] Office of the Comptroller of the Currency

1. Introduction

With the recent boom and bust of the housing market and the subsequent financial crisis, mortgage delinquency rates have reached unprecedented levels. In an attempt to mitigate losses, lenders and servicers have pursued several resolution practices including liquidation, repayment plans, loan modifications, and refinancing.¹ Although delinquency rates increased dramatically as early as mid-2007, the first coordinated large-scale government effort—the “Making Home Affordable” program—was unveiled only in February 2009. An explicit goal of one of the key components of this effort—the Home Affordable Modification Program (HAMP)—is to induce lenders and servicers to prefer loan modifications over liquidations.²

In this paper, we explore the practices chosen by lenders and servicers *before* the HAMP in order to study the market-based approaches to stem mounting mortgage losses. Specifically, we focus on loans that became seriously delinquent in the six calendar quarters starting in Q1, 2008. Using a unique and detailed dataset of loss mitigation practices, we attempt to understand the driving forces for decisions made by lenders and servicers as they responded to deteriorating market conditions, without the influence of government intervention. The data also allow us to resolve the ongoing academic debate about the role of securitization in loan modification. Furthermore, the rich variation in loss mitigation policies in the pre-HAMP regime allows us to measure the effects of modification terms on post-modification mortgage performance.

We use the OCC-OTS MortgageMetrics dataset that contains precise loss mitigation and performance outcomes for about 64% of U.S. mortgages. The dataset is a loan-level panel comprised of monthly servicer reports of the payment history as well as detailed information about loss mitigation actions taken for each distressed mortgage. By way of example, for a

¹There exist a number of alternative policy proposals for addressing mortgage market problems. Hubbard and Mayer (2010) focus on household inability to refinance their mortgages which impedes their ability to continue making payments. They consequently propose a streamlined and concerted effort on part of the GSEs to effect refinancing of mortgages guaranteed by the federal government. Posner and Zingales (2009) propose a plan in which the lenders reduce the principal for troubled borrowers and in exchange take an equity position in the home. Foote, Fuhrer, Mausekopf, and Willen (2009) propose a government payment-sharing plan to help unemployed homeowners avoid foreclosure.

² Previous efforts included the voluntary Hope Now Alliance, the FHA HOPE for Homeowners program originated under the Housing and Economic Recovery Act of 2008 (HERA), the FDIC pilot program of systematic modification of loans held by IndyMac, which subsequently formed the basis for the agency’s “Mod in a Box” blueprint for modifications.

delinquent loan undergoing modification, the dataset contains information on specific changes in original loan terms, reduction in interest rate, amount of principal deferred or forgiven, extension of the repayment period, etc. To our knowledge, this is the only comprehensive data source on loss mitigation efforts and mortgage performance.

We first describe the process of loss mitigation in the context of the financial crisis and study the determinants of each of the resolution methods. For modified loans, we further study the factors influencing changes in contractual terms. Finally, we evaluate the effect of various modification terms on mortgage performance post-modification.

An evaluation of the choice between different loss mitigation practices is the thrust of our study. We classify resolution practices into four main categories: liquidation, repayment plans, modification, and refinancing. Liquidation includes foreclosure, deed-in-lieu, and short sales. Repayment plans are short-term programs that allow borrowers to repay late mortgage payments, typically, over a six to twelve month period. In modifications, mortgage terms are altered. Modification programs sometimes begin with a trial period of a few months, at the end of which, conditional on success, modification becomes permanent. Modifications could result in lenders altering the mortgage interest rate, balance, and/or term. Refinancing occurs when a new loan is issued in place of the existing one.³ While liquidation implies that the borrower loses his house, the three other resolution categories imply that the borrower can stay in the house.

We find that within six months after becoming seriously delinquent, about 31% of the troubled loans that enter our sample in 2008 are in liquidation (either voluntary or through foreclosure), 2.4% enter a repayment plan, 2.2% get refinanced, and 10.4% are modified. The rest (about 54%) have no recorded action. The staggering amount of delinquent loans that see no action from lenders/investors is consistent both with the idea of an industry overwhelmed by the wave of problem mortgages and with the difficulty in overcoming the severe asymmetries of information that inhibit active loss mitigation.

³ Among wide-scale government initiatives, the Home Affordable Refinance Program (HARP) initiated in March 2009 offers refinancing of loans owned or guaranteed by the Fannie Mae or Freddie Mae. The program is limited to performing loans with high LTV ratios (up to 125%). More information is available at http://makinghomeaffordable.gov/refinance_eligibility.html.

The distribution of loss mitigation choices and outcomes varies substantially over time. Approximately a third of all loans that become distressed during the first quarter of 2008 are in liquidation within six months of entering the sample. Half of those loans complete the liquidation process within this time frame. Although the same share of 2008:Q4 distressed loans find themselves in liquidation, only one in eight of those loans completes the liquidation process within six months. This, again, is suggestive of a resolution system struggling to cope with the volume of troubled loans. Although modifications and other non-liquidating methods of loss mitigation become more prevalent over time, they remain a distant third in the set of outcomes for troubled loans behind the extremes of liquidations and inaction.

A common theme in both the academic and popular press has been commenting on the scarcity of loan modifications relative to foreclosures in loss mitigation approaches. Much of the existing research has focused on the conflicts between servicers and lenders/investors to explain low modification rates.⁴ Piskorski, Seru, and Vig (2010) analyze transaction-level data and show that portfolio loans experience lower foreclosure rates, which the authors attribute to more intensive renegotiation efforts on the part of portfolio lenders. Our data allow us to evaluate the likelihood of loan modification directly. We indeed find evidence in support of the Piskorski, Seru, and Vig (2010) hypothesis. In particular, we show that securitized mortgages that become troubled are less likely than portfolio loans to end up in modification, as opposed to other forms of loss mitigation. This holds true for mortgages securitized by private entities and even stronger for mortgages securitized through the GSEs. The estimated reductions in the likelihood of modification relative to portfolio loans (3.1 percentage points in private-label and 6.6 percentage points for GSE securitizations) are economically very large, given the unconditional rates of these loss-mitigation practices in our sample of 9.4 percent (see Table 1, Panel A).⁵

⁴ Stegman, Quercia, Ratcliffe, Ding, and Davis (2007) and Gelpern and Levitin (2009) argue that securitization contracts are written in a way that does not allow easy modification. Stegman et al. (2007) also find large variation in servicer ability to cure delinquencies, implying that poor servicing quality translated into higher default rates. The theme of conflicting servicer and investor incentives is echoed in Eggert (2007) and Goodman (2009). Magder (2009) goes farthest in claiming that these conflicts of interest are *the* reason for low modification rates.

⁵ A caveat to the result of low modification rate by the GSEs is that it appears that GSEs have strong preference to refinance their troubled mortgages rather than to modify them. We find that the likelihood of refinance is higher by 3.5% for GSE loans, where the base probability is 1.85%.

Another hypothesis regarding the preference of foreclosures over modifications by lenders is that they may not bear the negative externalities of their actions (Adelino, Gerardi, and Willen 2009). The extent of such externalities is quantified by Campbell, Giglio, and Pathak (2010) who find direct losses of about 30% on foreclosed homes, which is in addition to negative spillover effects on the prices of neighboring homes. We are able to address this hypothesis by testing whether loss mitigation choices vary with lender exposure to the local housing markets (i.e., mortgage holdings in a given housing market, defined as a zip code area). In our analysis, we do not find evidence that lender behavior changes when they may be affected by this externality.

Whatever the role of these explanations in explaining low modification rates, high redefault rates of modified loans exert a more direct influence on lender and servicer choices. We show that within six months of modification, redefault rates are 34% when redefault is defined as 60+ days past due (dpd), or 22% when redefault is defined as 90+ dpd. Industry reports (OCC-OTS 2009) document that modified loans in the recent wave of modifications exhibit extremely high redefault rates—close to 50% within six months of modification. Dugan (2008) reports that nearly 58% of loans modified in the first quarter of 2008 were again in default eight months later. The extremely high redefault rates in the current crisis contrast sharply with the experience from loan modifications in a more placid environment. For instance, loans modified between 1995 and 2000 had redefault rates of 20% after five years according to Crews-Cutts and Merrill (2008).

To understand the drivers of high redefault rates, and means by which modification success can be improved, we analyze the determinants of redefault and the relation between modification terms and redefault after controlling for a number of key borrower and loan characteristics.⁶ We find that redefault rate is higher for low documentation loans. Further, redefault rate declines with FICO score and increases with loan-to-value. We note, however, that the association of FICO with redefault is 2.5 times larger than the effect of leverage on redefault.

⁶ It is likely that modification terms and redefault are both driven by borrower characteristics that are observable to the servicers, but not to the econometrician. The resulting endogeneity can be ameliorated through instrumental variables techniques. We experimented with a number of instruments based on servicer practices. The results are available upon request.

Next, we analyze the determinants of modification terms and their association with post-modification default. While we find some variation in the characteristics of borrowers at loan origination and at the time they enter the loss mitigation process, this variation is dwarfed by differences in servicer modification practices and redefault rates following modification. In fact, servicer fixed effects explain at least as much variation in modification terms as do borrower characteristics. This strongly suggests that servicer loss mitigation choices are driven by institutional factors, as well as by variation in their underlying borrower populations. We also document that over the course of the period studied, there is some convergence in modification terms across servicers, which may perhaps be attributed to learning. Interestingly, concessions in modification terms are more generous for borrowers with weaker characteristics (e.g. FICO scores and LTV ratios) at the time of becoming delinquent.

Furthermore, we find a strong relationship between modification terms and subsequent probability of redefault. In particular, greater reductions in loan interest rates (or monthly payments) are associated with sizable declines in redefault rates. As an illustration, a reduction of 1% point in the interest rate is associated with a 3.9% point drop in six-month redefault rate. Given that modification terms are more favorable to weaker borrowers, we view this effect as a likely lower bound for the causal effect of affordability on the likelihood of redefault.

Overall, our results suggest that affordability is a prime driver of redefault following modifications. These results provide support for the motivation behind the Home Affordable Modification Program (HAMP) initiated in 2009. According to Cordell, Dynan, Lehnert, Liang, and Mauskopf (2009), the advantages of the HAMP over foreclosures is that the program can be best suited for households that struggle with affordability.

The rest of the paper is organized as follows. Section 2 describes the data source and the organization of the database. Section 3 analyzes loss mitigation practices over time and across servicers. Section 4 analyzes the effects of loan modification terms on redefault and Section 5 concludes.

2. Data

2.1. Data sources

For this paper we use the OCC/OTS Mortgage Metrics dataset. This dataset includes origination and servicing information for large US mortgage servicers owned by large banks supervised by the OCC, as well as large thrifts overseen by the OTS. The data consist of monthly observations of over 34 million mortgages totaling \$6 trillion, which make up about 64% of US residential mortgages. About 11% of these loans are held in portfolio—i.e., are originated by the servicing bank—and 89% are being serviced for other lenders. The data allow us to differentiate among 19 servicing entities, each of which maintains effective autonomy in making loss mitigation decisions, regardless of their ultimate corporate ownership. The study spans the period between October 2007 and May 2009. We anticipate the data reporting to continue and the dataset to be updated regularly.

The origination details in the dataset are similar to those found in other loan-level data (e.g., First CoreLogic LoanPerformance or LPS data). The servicing information is collected monthly and includes details about actual payments, loan status, and changes in loan terms. Critically, the dataset also contains detailed information about the workout resolution for borrowers that are in trouble. For modifications, the data contains information about the modified terms and repayment behavior. The ability to observe loan status on a monthly basis also allows us to evaluate post-modification mortgage performance.

It should be noted, however, that the Mortgage Metrics dataset has certain limitations. For instance, it lacks information on combined loan-to-value ratios (CLTV) making it difficult to accurately estimate distressed borrowers' equity position. The data are not linked to outside sources on the rest of borrowers' debt obligations, which masks borrowers' true financial positions when they run into mortgage trouble. Furthermore, certain data fields (e.g., self-reported reasons for default) are reported by only a subset of servicers and even then do not appear to follow a common set of data rules. Yet, on balance, the detail and precision of information on loss mitigation practices in this dataset is unique, potentially leading to a better understanding of an important policy question.

2.2. Identifying “in trouble” mortgages

When analyzing the transaction data, we focus on troubled mortgages. The original OCC-OTS dataset is an unbalanced panel. Thus, it contains information on 34 million mortgages per month. We transform this dataset into a cross-section of mortgages in two steps. First, we extract the subsample of loans that become troubled at any point in the sample. Troubled mortgages are mortgages that became 60+ days past due since the first quarter of 2008 or entered a loss mitigation program in 2008 or later. To ensure that our analysis correctly captures the timing of loss mitigation actions, we require all mortgages in our universe to be current in the last quarter of 2007. Out of the 34 million monthly mortgage observations, we identify about 1.8 million individual mortgages which become troubled at some point between January 2008 and May 2009. Second, we summarize the important outcomes, event dates, and characteristics for each mortgage and then collapse the Panel Data into a cross-section dataset. For example, each observation includes its characteristics at origination, the date in which it became “in trouble”, its characteristics when it became “in trouble”, the first action taken by the lender and the date of that action, etc.

Table 1, Panel A provides a broad summary of the sample, highlighting borrower and loan characteristics at different points in time. The average FICO score of troubled borrowers drops by 60 points between origination and the time of entry into the sample, indicating considerable financial stress. The loan-to-value (LTV) ratios tell a similar story of deteriorating financial position, although the averages mask considerable variation in home equity positions. In particular, a substantial fraction of mortgages originated during the boom years (2004-07) enter the sample with negative home equity, while many of the longer held mortgages have fairly low LTV values. The distribution of LTV values further suggests that a majority of troubled borrowers have at least some positive equity stake in their houses. Finally, as mentioned earlier, these figures under-represent total leverage because they often fail to capture second-lien loans taken on the same property.

The sample represents all major investor/lender categories, as about a third of the loans are owned by the GSEs and slightly more than a quarter are securitized through private-label MBS. As would be expected for a sample of distressed loans, it contains a disproportionate

number of investor properties, second-lien loans, and loans underwritten with less than full documentation.

3. Loss Mitigation Practices

3.1. Description of loss mitigation resolution types

Loss mitigation resolutions include four major types of actions that lenders and servicers typically take.⁷ Figure 1 presents a summary chart of different resolution types. The loss mitigation process begins when a borrower becomes seriously delinquent (typically 60 days past-due) or when a borrower voluntarily contacts the lender and requests to renegotiate the loan. Both of these types of borrowers are considered “troubled” in our analysis.

The first class of interventions is liquidation. This includes liquidation of the property in agreement with the borrower through deed-in-lieu or short sale, as well as completed foreclosures. Deed-in-lieu is the process in which the borrower transfers the property interest to the lender, and thus avoids the legal process of forced foreclosure through the courts. In a short sale, the lender and borrower agree to sell the property (typically at a loss) and transfer the proceeds to the lender who then writes off the balance of the mortgage loan. In foreclosures, the lender takes legal steps to pursue its interest in the property through the courts.

The second type of loss mitigation identified in the data is repayment plans. Under a repayment plan, delinquent borrowers commit to pay back the missing payments over several months (typically 3 to 6 months). Once the arrears are paid off, the lender reinstates the borrower status as current. In this type of intervention, the terms of the original loan are maintained.

The next loss mitigation practice depicted in the diagram is loan modification, which attracted considerable publicity in discussions leading up to the eventual implementation of HAMP and in its aftermath. The distinguishing feature of loan modifications is the amendment of the original mortgage terms. The usual process has the lender independently offering the borrower a new set of loan terms, or negotiating new terms with the borrower. This process can be quite lengthy as it requires collection of relevant documentary evidence and subsequent

⁷ Crews-Cutts and Merrill (2008) provide an overview of the different types of interventions.

negotiations. Modification may also proceed in stages, with a borrower first committing to a trial offer for a certain period of time. Conditional on being able to fulfill the terms of a trial contract, the modification offer can be made permanent. These stages are reflected in Figure 1.

The final two resolution types presented in Figure 1 are refinancing and the catch-all category of “other”, less common, workout approaches, such as claim advances from the mortgage insurance company. Refinancing of distressed loans is similar to usual refinancing but may need to be done on the basis of more forgiving underwriting criteria, such as higher-than-typical LTV ratios. In principle, refinancing is similar to a loan modification, as it effectively replaces an existing contract with a new one. However, it may allow the lender greater flexibility in selling off the loan.

Table 2 presents summary statistics about resolution types offered to troubled mortgages by vintage, i.e., the quarter in which mortgages entered the sample. The panel shows two main results: (i) the majority of loans in the troubled sample do not enter any loss mitigation process within 6 months and (ii) liquidations play by far the dominant role in observed loss mitigation practices.⁸

For instance, among loans that enter our sample in 2008:Q1, about 15 percent find themselves in ongoing foreclosure proceedings within 3 months (Panel A). An additional 6 percent have gotten liquidated through a formal loss mitigation process, and a similar fraction has been modified. Repayment plans and refinancing are very rare, accounting for less than 3 percent of all troubled loan resolutions. More strikingly, nearly 70 percent of all loans in sample are not in any resolution process—liquidating or not—within the first 3 months.

As the horizon for workout resolutions increases to 6 months (Panel B), the share of completed liquidations through loss medication programs rises rapidly to 16 percent. Other workout resolutions increase as well, with modifications reaching 9.4 percent of all loans. Yet,

⁸ Since our data only extends to May of 2009, our ability to track loan status depends on the time at which a loan becomes troubled. For loans that become troubled during the first or the second quarter of 2008, we observe resolutions over the subsequent 12-month window. However, for 2009 vintage troubled loans, only immediate resolutions can be recorded. Since a 6-month observation window is available for almost all loans that become troubled throughout 2008, we focus on this combination of troubled loan vintage and time window in our analysis.

even six months later, more than half of all troubled loans (54 percent) are not in loss mitigation or foreclosure proceedings.

Loss mitigation liquidations of the 2008:Q1 vintage loans accelerate further to 35 percent by the end of the 12-month window (Table 2, Panel D), and modifications rise to nearly 15 percent. At that point, nearly three-quarters of all troubled loans are being acted upon, with the lion's share of resolutions—71 percent (or .188+.348 of .75 of loans)—coming in the form of loan liquidations.

A qualitatively similar picture emerges for other vintages of troubled loans. One important difference, however, lies in the speed at which foreclosure proceedings become converted into liquidating resolutions. This contrast is illustrated by comparing shares of resolved and unresolved foreclosure proceedings over a six-month window (Table 2, Panel B) for loans that become troubled at the beginning and the end of 2008. Among 2008:Q1 troubled loans, an equal share (16 percent) get resolved through liquidation or are in the process of foreclosure. Among the 2008:Q4 vintage, however, 28 percent of loans are still in foreclosure proceedings, while only 4 percent reach a liquidating resolution. This is strongly suggestive of a system that has trouble resolving the flood of non-performing loans through existing loss mitigation channels. Each subsequent vintage brings in more troubled loan than the number that could be addressed in any fashion during the preceding period. The resulting build-up clogs up the system even further. Arguably, it may also take away resources from the more labor- and information-intensive loss mitigation approaches that result in keeping troubled borrowers in their homes, such as modifications and repayment plans.

Turning back to borrower characteristics, the OCC/OTS Mortgage Metrics data allow us some limited insight into reasons for borrower default, summarized in Table 1, Panel C. The largest share of borrowers with a stated reason for default (about 8 percent) point is due to “excess debt”, likely deriving from the sharp decrease in house prices and the inability of borrowers to refinance their mortgages. The next largest group (about 6 percent) point attribute their distress to job loss. Unfortunately, very high non-response rate and the dominance of the vague “other” category in listed reasons for default make it difficult to learn much from these data.

3.2. Heterogeneity across servicing entities

While lenders/investors determine policy guidelines for loss mitigation resolution, the implementation and loan-level decision-making typically reside with servicers. For securitized mortgages, servicer activities are guided by Pooling and Service Agreements (PSAs). For portfolio loans serviced in-house, servicers follow internal policies for loss mitigation. Our data allow us to examine loss mitigation practices pursued by each servicer. Banks reporting to the OCC/OTS Mortgage Metrics database may own multiple servicing entities that may specialize in certain loan types or channels of originations. To be more precise in our analysis, we focus on 19 such entities, each of which exercises considerable autonomy in loss mitigation decisions, regardless of their ultimate corporate ownership.⁹ Since an important part of this analysis focuses on loss mitigation resolutions within a six month window, we limit our attention to loans that become troubled during the 2008 calendar year.

We start with a rough summary of differences in the key underlying borrower and loan characteristics across servicers. Table 1, Panel D presents servicer-level means of FICO scores and LTV ratios at origination. Due to data confidentiality issues, servicers are presented in a *random* order and the number of loans serviced by each entity is suppressed. The panel shows variation across servicers. For example, mean LTVs at origination vary between 73 and 90 percent, with lower numbers typically associated with servicers with greater share of refinancing transactions. Similarly, servicer-level FICO averages range between 623 and 697. Although this range appears low relative to the general borrower population, it is not surprising for a subset of loans in default, which is what is summarized in the panel.

Next, we examine heterogeneity in loss mitigation practices across servicers. Table 1, Panel E, summarizes the distribution of servicer-level resolutions attained within six months of entry into the troubled loan sample. The data are also summarized in Figure 2. Again, there is considerable variation across servicers. Whereas some servicers report virtually no loan modifications, others modify about a quarter of their troubled loans, and one servicer reports a staggering modification rate of close to 60 percent. A similar degree of dispersion can be

⁹ For ease of reference, “servicer entities” and “servicers” are used interchangeably from this point on.

observed for every loss modification mode. Importantly, we also observe substantial heterogeneity in post-resolution redefault rates. Ignoring the zero redefault rate reported for loans from one of the servicing entities, the shares of loans in redefault vary between 16 and 61 percent for 60+ days past due loans, and between 9 and 42 percent using the more stringent definition of 90+ days past due.

3.3. A multivariate perspective on loss mitigation choices

To better quantify the importance of servicer-specific approaches to loss mitigation, we turn to a multivariate analysis, the results for which are presented in Table 3. In this analysis, we estimate simple OLS and probit specification for each of the resolution choices in turn.¹⁰ These regressions control for observable investor and mortgage characteristics (FICO score and LTV ratio at the time of entering the troubled loan sample, type of lender, etc.), as well as macroeconomic characteristics (changes in county-level unemployment, change in MSA home prices, etc).^{11,12} In each specification, the latest FICO and latest LTV scores are discretized into buckets to allow greater flexibility in estimation.¹³ We also include year of origination dummies and calendar month fixed effects.¹⁴

¹⁰ Table 3 reports OLS estimates that are arguably more consistent in specifications with a large number of fixed effects. The probit estimates are qualitatively similar and are available upon request.

¹¹ Changes in home prices are taken from the Office of Federal Housing Enterprise Oversight (OFHEO). In a previous version of the study, we used multinomial logit that modeled the choice of lenders. While the multinomial logit specification models the choice more accurately, the interpretation of the coefficients was convoluted, and in several cases, the regression did not converge due to the fixed effects. In the cases where we had convergence, the coefficients were qualitatively similar.

¹² The number of observations drops in some regressions because of lack of variation in the right hand side variables. For example, since some lenders servicers do not modify loans at all, when we introduce their fixed effects, the left hand side variable (e.g., whether a loan was modified or not) has a correlation of 100% of the fixed effects, and the observation is dropped.

¹³ The FICO buckets are: (1) 300-499, (2) 500-524, (3) 525-549, (4) 550-569, (5) 570-599, (6) 600-629, (7) 630-659, (8) 660-699, (9) 700-749, and (10) 750-800. The LTV buckets are: (1) <60%, (2) 60% to <70%, (3) 70% to <75%, (4) 75% to <80%, (5) 80% to <85%, (6) 85% to <90%, (7) 90% to <95%, (8) 95% to <100%, (9) 100% to <110%, and (10) 110%+.

¹⁴ The origination year dummies are: (1) before 2002, (2) 2002, (3) 2003, (4) 2004, (5) 2005, (6) 2006, (7) 2007, (8) 2008-2009.

Furthermore, we add variables that capture the servicer entity's aggregate unpaid mortgage balance in the local housing market (zip code) and the one-month lagged share of modifications in the zip code for the servicer. The first of these variables is meant to control for spillover externalities of servicer's actions on their outstanding loans. The second attempts to capture path dependence in mitigation choices. The idea there is that loan modification requires an upfront investment on the part of the servicer. This information- and resource-intensive process also benefits from learning-by-doing, and thus past choices of loan modifications may be indicative of future loss mitigation approaches.

Each of the loss mitigation choice regressions is estimated with a number of different fixed effects for the owner/servicer of a loan. The first specification for each choice allows for a servicing entity fixed effect, while the second specification also puts in securitizer fixed effects. The latter delineates the identity of the securitizing entity (Fannie Mae, Freddie Mac, GNMA, private-label) or identifies a loan as being held by its originator.

Panel A of the table presents results for the six-month likelihood of a troubled loan ending up in a loss mitigation process that results in the borrower leaving the house. For completeness, we show the likelihood of a completed liquidation process (Columns (3)-(4)), that of an initiated foreclosure proceeding (Columns (5)-(6)), as well as the joint likelihood of either liquidating resolution (Columns (1)-(2)). Panel B follows the same layout for resolutions that result in the borrower staying in their house: repayment plan, loan modifications, refinancing, as well as the joint likelihood of any non-liquidating resolution.

The table presents several interesting results. First, we note that borrower and mortgage characteristics are important determinants of loss mitigation resolution. Troubled loans that were not underwritten on the basis of full documentation (low documentation and stated income loans) are generally less likely to receive loan modifications, and are more likely to be liquidated. The same applies to loans issued for non-owner-occupied properties. Investor properties, on average, are less likely to be a part of any loss mitigation practice that results in the borrower's continuing ownership of the property. In terms of magnitudes of the estimated coefficients, second lien loans are the least likely to be modified, controlling for all other loan characteristics. This is hardly surprising, as junior liens likely suffer most severe losses in modifications.

Macroeconomic variables also have a very strong effect on the likelihood of choosing to liquidate as the means of loss mitigation. We find much higher propensity to liquidate in areas with greater increases in the rate of unemployment. The same holds true in MSAs with lower cumulative price appreciation since origination (Panel A, Columns (1)-(2)).

We estimate weak path dependence in the likelihood of modification. Columns (5)-(6) in Panel B show that higher past modifications marginally increase the propensity to modify loans in the current period. We also find that past modifications positively affect the likelihood of completed liquidations and negatively affect the likelihood of ongoing foreclosure proceedings. This is consistent with the interpretation of workout resolutions—whether through liquidation or modification—requiring substantial local resources on part of servicers. Locations in which servicers have been able to complete more modifications are also locations that have more completed foreclosures or short sales and fewer unfinished foreclosure proceedings.

Figure 3 presents a graphical summary of coefficient estimates on FICO score and LTV buckets. The omitted category for the FICO score at the time of trouble is group 6 (score between 600 and 630). The coefficients for the LTV ratio at the time of trouble are shown relative to group 5 (ratio values between 80 and 85). The dotted lines depict 5% confidence intervals. The top panel presents “stay in the house” resolutions, while the bottom panel shows resolutions of the “leave the house” variety.

Turning to borrower creditworthiness (the top row of charts in Panel A), we find that borrowers with the highest FICO scores at the time of troubled sample entry are somewhat less likely to get their loans modified. This is consistent with the argument in Adelino, Gerardi, and Willen (2009), since such borrowers likely have the highest self-cure rates, making the servicers less willing to offer concessions. On the other hand, we observe that high-FICO are considerably more likely to be able to refinance their loans. Again, this is consistent with expectations of higher self-cure rates among this group of troubled borrowers. Refinancing effectively allows the lender/investor to “extend-and-pretend” loans with greater self-cure probabilities. This theme is repeated for LTV bucket coefficients. In particular, we observe much greater likelihood of refinancing and less likely loan modifications for troubled loans with low LTV ratios. We speculate that such refinancings are accompanied by equity cashouts that improve household ability to service the new loan without making permanent concessions inherent in modifications.

Looking at liquidating resolutions in Panel B, we document greater likelihood of low-FICO borrowers and high-LTV loans entering the liquidation process first. This is evidenced by their higher propensity to complete the liquidation process within 6 months of default. As a result, there are fewer high-LTV loans and low-FICO borrowers in the foreclosure queue. Loans with the lowest LTV ratios at time in trouble are less likely to be liquidated, although lenders would appear to realize lower losses on such properties. The likelihood of being in the foreclosure process (the middle column) may appear to present a conflicting story. For instance, high FICO borrowers, have greater propensity of being in foreclosure proceedings. We believe that a part of this finding may be due to automatic filing of foreclosure notices that is independent of borrower or property characteristics that is *followed* by more concerted resolution efforts. Such efforts would be better reflected in completed liquidations or modifications/refinancings, which is where we prefer to focus our attention.

In Table 3, Panel C, we examine the determinants of loans that have no action within the six-month window.¹⁵ These mortgages that owned by owner-occupiers and fully documented. These houses are located in areas of good employment opportunities, and high past home price growth. Figure 3C shows that no action takes place for borrowers in low FICO score category and with both extreme low and extreme high leverage ratios. Based on these results, we speculate that delinquencies have no action when there is a prospect of self-cure (low unemployment, high home prices, low LTV), or in cases in which lenders decide to wait potentially for the market to turn (high LTV).

Below we address specific theories concerning loan modifications that have been discussed in the literature.

3.4. Agency conflicts between servicers and lenders

Piskorski, Seru, and Vig (2010) hypothesize that agency conflicts between servicers and investors pose an important hurdle to whether loans are liquidated or modified when they become delinquent. We test this proposition in our data, which has the advantage of enabling us

¹⁵ “No action” is the residual category; therefore, there is no new information in this panel. Nevertheless, we present it for expositional purposes in order to facilitate characterization of mortgages that enter the “no action” group.

to identify modification directly from the servicers' reports, rather than having to infer it from the prevalence of foreclosure resolutions or imputing it from observed changes in contract terms.

The results in Table 3, Panel B show that loans owned by private investors are indeed less likely to become modified than portfolio loans with identical characteristics (Column (5)). The OLS coefficient estimate is -0.031, which is both statistically and economically significant given the unconditional six-month modification rates of less than 10 percent. This result supports the claim of Piskorski et al. (2010) that securitization is hampering modification due to legal complications. In a similar flavor to this result, we find that loans which are second lien (piggybacks) are less likely to become modified. Again, the magnitude is large: -0.113. We attribute this result to the conflict of interest between lenders.

We find also lower likelihood of modification for loans securitized by the GSEs, with an even greater negative coefficient (-0.066). This result may appear surprising at first given the government pressure towards modifications. We propose several explanations. First, the precarious financial position of the GSEs in 2008 prior to their conservatorship may have made it difficult for them to engage in modifications and the attendant loss recognition. Second, it appears that GSEs favor refinancing as a resolution method that keeps the borrower in the house. Table 3, Panel B, Column (2) shows that securitization of a loan by a GSE increases the likelihood of its being refinanced by 3.5 percentage points.

3.5. Strategic behavior by lenders

A few studies hypothesize that the rate of modification is low because lenders do not realize the entire adverse effect from foreclosures and thus liquidate in areas in which they do not suffer the externalities of liquidation (Frame 2010). We can test this by evaluating whether the servicer's behavior differs if they are more 'invested' in the local market. If so, they may be more apt to be affected by the adverse externalities resulting from local foreclosures. To test this hypothesis, we compute the log of the total unpaid balance held by the servicer in the local market—defined as the zip code. The hypothesis is that the servicer is more likely to internalize the losses due to liquidation in areas in which their stakes are higher. However, the results do not

show support for this hypothesis, as they fail to pick up the effect of this variable on any of the resolution choices.

3.6. Is servicer heterogeneity explained by borrower and loan characteristics?

Regressions in Table 3 include a long list of covariates that capture a number of key observable characteristics of borrowers and loans, as well as some macroeconomic factors. The simplest way to test whether differences across servicers are explained by those characteristics is to compare the goodness of fit achieved in specifications that incorporate servicing entity fixed effects and those that exclude them. This comparison is shown on the bottom two rows of Panels A and B. For each individual resolution choice—liquidation, foreclosure initiation, repayment, modification, or refinance—we observe a considerable improvement in fit after the addition of servicer fixed effects. The improvement in adjusted R^2 is much more muted for the aggregate categories, as can be expected from the effects of the adding-up constraint on resolution choices.

We interpret these results as evidence of diverse servicer-specific approaches to loss mitigation during the early part (2008) of the unprecedented volume of troubled loans. These differences cannot be explained by variation in the borrower population or the mix of loans at the servicing entity level. To a certain degree, these differences likely reflect the absence of an established uniform solution to loss mitigation. They may also reflect differences in servicer valuation models, their exposure to loss mitigation practices of the GSEs, history of mergers and acquisitions, etc. In the following section, we focus on differences in servicer approaches circa 2008 to a particular loss mitigation practice—loan modification—that was standardized in the Treasury’s HAMP program in the early 2009. In particular, we will focus on the relationship between differences in modification terms and the subsequent performance of modified loans.

4. Modification terms and their effect on the likelihood of redefault

4.1. Servicer choices of loan modification terms

Evidence presented earlier highlighted considerable variation in resolution practices across servicers (see, for example, Figure 2). There also exists a similar degree of heterogeneity

in terms offered to borrowers within a particular class of loss mitigation resolution—loan modifications. This variation is summarized graphically in Figure 4. The figure presents the relative frequency of major types of modified loan terms within each servicing entity. These types include interest rate reductions or freezes, principal writedowns or deferrals, capitalization of arrears, and extensions of loan term. Most loan modifications combine several of these changes; for example, and extension in the loan term could be accompanied by a reduction in the interest rate and capitalization of arrears into the principal.

The pattern in Figure 4 is hardly surprising. Prior to the crisis, mortgage servicing was a relatively low margin, technology driven, commodity business. Although modifications did occur, there were relatively few workout specialists on the payroll. When the crisis started, there was no central guidance like that provided by the HAMP, and limited information on what modification approaches could be more effective. Hence, some servicers preferred to capitalize unpaid interest into the loan balance (e.g., #12 and #14). Others favored rate reductions (e.g., #2 and #9). Yet others (#7 and #15) preferred to combine rate reductions with extensions in loan repayment periods. A few (#4 and #7) incorporated principal writedowns into their menu of loan term modifications.

Servicers differ not only in the terms they chose to modify, but also in the extent of modifications offered to distressed borrowers. Figure 5 provides some evidence in this regard. For loans that became troubled in the first quarter of 2008, the average reduction in interest rate spanned an enormous range between 0 and more than 350 basis points. Although much of the dispersion is accounted for by three outliers, its magnitude is all the more surprising since it refers to servicer averages. Figure 5 also shows convergence to a narrower band of rate changes by the second quarter of 2009. This is suggestive of learning that may have occurred in the industry following the onset of the financial crisis. Figure 6 shows the same convergence pattern across types of owners (or securitizers) of troubled loans. The tentative reduction over time in the magnitude of modified terms requires a more thorough analysis, which we defer to future work.

The analysis in Table 4 explores how modification terms vary with borrowers' FICO score when in trouble, LTV when in trouble, and lender and servicer identities. The set of regression covariates is the same as in Table 3. The dependent variables presented in Table 4 include changes in the monthly mortgage payment (measured in percentage point terms), in the

mortgage interest rate (basis points), in the mortgage principal balance (percent change), and in the mortgage term (months). The results in general show some systematic variation in modification terms with observable covariates. Since the reduction in the monthly payment is an amalgam of all other changes, we concentrate on it first. Although loan payments decrease less for investment loans conditional on modification (a positive coefficient partially offsets a negative unconditional mean), their decline is greater for low documentation loans. Low LTV loans (graph not shown) on average experience smaller changes in payment. This is again consistent with expectations of greater self-cure rates requiring smaller lender concessions. The coefficients on GSE and private-label securitized loans in Column (3) confirm the results in Figure 6 in a multivariate setting. Namely, relative to portfolio-held loans, loans securitized by the GSEs receive smaller reductions in interest rates upon modification, while those securitized by third parties receive greater interest rate reductions.

While there is no evidence of correlation between FICO buckets and changes in the monthly payment and mortgage terms (also not shown), the picture is a bit clearer for interest rate and balance changes. Figure 7 presents plots of the dummies for Columns (2) and (3) of Table 4. Both higher FICO groups and lower LTV groups receive smaller reductions in interest rates. This evidence suggests that servicers provide greater term improvements for weaker borrowers.

We further find that the identity of servicing entities is an important determinant of modification terms. For each of the four types of changes reported in Table 4, there is a substantial increase in adjusted R^2 associated with the inclusion of servicer fixed effects. In each case, servicer fixed effects raise the adjusted- R^2 by about 50 percent.

4.2. Redefault following modification

In this subsection we exploit substantial differences in the modification terms and the unobserved servicer characteristics to assess the relationship between the magnitude of such changes and post modification loan performance.

Redefault rates following loan modification have been very high during our sample period. Table 1, Panel F, shows that redefault rates (defined as 60+ dpd within six months) vary

between 30% and 46% for the 2008 vintage.¹⁶ A more restrictive definition of redefault (90+ dpd within six months) has lower rates, but still very high in absolute levels: 20% to 30% for the 2008 vintage.

Redevelopment rates also vary by the type of loan modification. In Panel G of Table 1, we present the redefault rate by modification type. The panel shows that capitalization of arrears and interest rate reductions are associated with the highest redefault rates. Curiously, freezing rather than reducing interest rates is associated with a lower -redit default rate. This evidence reinforces the point we made earlier: modification terms are endogenous and tailored to the borrower.

We also note the wide variation in redefault rates across servicers, presented in Panel E of Table 1. This variation may result from different decision rules for offering modification programs, differences in modification terms, and differences in the troubled population. Consequently, we need to control for observable borrower characteristics as well as servicer-specific effects in analyzing redefault rates.

We study the determinants of redefault within six months since modification in a multivariate regression framework in Table 5. At the outset, in column (1) we focus on the effect of borrower and loan characteristics at the time of modification on redefault. Subsequent columns (2-5), explicitly evaluate the effect of modification *terms*. In all specifications, the dependent variable is a default indicator multiplied by 100.

The results in column (1) show higher redefault rates by for low documentation loans. Somewhat surprisingly, we also find a strong positive effect of past home price increases in a geographic area on redefault rates. The same holds for loans serviced by servicers who modified many loans in the same zipcode. High past appreciation makes loans less likely to be underwater, and it is possible that servicers rushed to modify loans in such areas first.

Figure 8 presents the coefficients on the FICO, LTV, and year dummies associated with column (1). The figure shows that redefault almost monotonically decreases with FICO, and increases with LTV and the origination year. When comparing the magnitude of the effect of

¹⁶ Our redefault figures somewhat differ from the OCC and OTS (2009) reports although the average level is similar. The average redefault rate in the OCC and OTS report from the second quarter of 2009 is 42%, while ours is 40.6%. One potential reason for the difference is that we require borrowers to be current on the last quarter of 2007, while the OCC and OTS reports do not have such a requirement.

FICO scores and LTV, it appears that FICO has a stronger effect. By estimating the average slope on the charts we can assess the economic magnitude of the variables. On average, one standard deviation change in FICO scores (77.3) maps into a change of 2.5% points in redefault rate (0.1 standard deviations). One standard deviation change in LTV (24.7%) translates to about 1.0% points in redefault rate (0.04 standard deviations). Further, there is a strong effect of the year of origination on the likelihood of redefault. Loans that were originated in 2006 (2007, 2008-2009) are more likely to redefault by 6% points (8% points, 12.4%).

4.3. Measuring of the Effects of Modification Terms on Redefault

Since reducing loan redefault rates following modification is a prime objective of lenders, investors, and policymakers, it is important to understand the relationship between the terms of modification and the likelihood of redefault. The likelihood of redefault partially depends on reasons for borrower default. For example, one argument is that borrowers redefault because of affordability, i.e., they do not have the cash flow to afford the modified loan. Another argument is that the redefaults actually are based on strategic behavior resulting from the borrower's realization that the loan is underwater and an unattractive long-term investment.¹⁷ Efforts to keep the owner in the house may differ under the two alternatives and may suggest a preference by lenders to forgive principal rather than adjust the mortgage terms to increase affordability.

Federal policy regarding modifications appears to have taken a stand in this debate. In 2009, the Administration introduced the Home Affordable Modification Program (HAMP), at the center of which is a series of incentives for lenders and servicers to modify loans to increase mortgage affordability. Hence, the question of whether affordability is significantly important in reducing redefault is of paramount importance in determining current housing policy.

The natural test to evaluate the importance of affordability is to regress an indicator of redefault on changes in monthly payment or changes in the interest rate along with the other controls utilized in Tables 3 and 4. Since modification terms are not determined randomly, but rather may reflect some unobserved borrower and loan characteristics, such regression estimates

¹⁷ Foote, Gerardi, and Willen (2009) provide evidence on the relative importance of these factors in the context of mortgage defaults during the early 1990's.

may be biased. As mentioned in Footnote 5, we considered a number of instrumental variable specifications to address this concern. The current version of the paper, however, focuses on describing an associative relationship between modification terms and redefault. We note, however, that since modification terms are generally more favorable towards weaker borrowers, as has been shown in Section 4.1, the bias is likely to go against finding a positive correlation between redefault rate and improvements in borrower affordability and loan balance terms.

The results of this exercise are presented in Table 5, where redefault is measured as 60+ days past due within 6 months after modification. Although we have about 220,000 loan modifications in the overall sample, the regressions are estimated on a much smaller subset of observations. Part of the attrition is due to exclusion of loans that enter modification programs in 2009, since their outcomes are censored. Another part is due to incomplete reporting of modification terms and time-of-default loan characteristics.

Column (2) presents the results for change in the monthly mortgage payment. We find a very strong positive relationship between the magnitude of payment reductions and lower subsequent redefault rates. In particular, a coefficient of 0.284 implies that a 15 percent reduction in a monthly payment (the average in the sample of modified loans) is associated with redefault rates that are about 4.5% percent lower. Since the baseline rates of redefault hover around 40%, this decline is economically sizable.

Among other covariates, we find a monotone relationship between redefault rates and borrower FICO scores and LTV ratios at the time of sample entry. As expected, redefaults decline with FICO scores and rise with LTV ratios. Redefault rates are also higher among loans originally underwritten with less than full documentation, and are marginally higher for investor loans.

Column (3) shows the results for the most common element of loan modifications—the change in the loan interest rate. Once again, the result is strongly statistically significant and economically important. A reduction of 200 basis points (about the sample average) implies an 8 percentage point reduction in the likelihood of redefault. Columns (4) and (5) fail to pick up a significant association between redefaults and principal balance reductions and loan term

extensions. Given the relative paucity of these modification approaches, the lack of statistical power is not surprising.

5. Conclusion

In this paper, we study the loss mitigation practices used by mortgage servicers and lenders prior to the increased role of government intervention through the HAMP. Our results show that the majority of loans in trouble end up in liquidation, although the importance of liquidation has diminished somewhat over time. We also find that securitized loans are less likely to be modified, consistent with the idea that agency conflicts inhibit aggressive corrective actions. In addition, we document that there is wide variation in the loss mitigation practices of servicers and that this variation converged somewhat over time, possibly due to learning.

An important policy issue is determining the effect of modification terms on redefault rates. We find a statistically significant and economically sizable association between greater reductions in monthly payments and/or loan interest rates and subsequent redefault. These results are consistent with the driving idea behind the Home Affordable Modifications Program (HAMP). In this program, servicers and lenders are incentivized to increase mortgage affordability as much as possible. However, this advantages of this program need to be contrasted with the cost to investors (or lenders) resulting from the lower payment. We leave the study of the effectiveness of the HAMP for future research.

References

- Adelino, Manuel, Kristopher Gerardi, and Paul S. Willen, 2009, Why Don't Lenders Renegotiate More Home Mortgages? Redefaults, Self-cures, and Securitization, Working Paper.
- Campbell, John Y., Stefano Gilio, and Parag Pathak, 2010, Forced Sales and House Prices, forthcoming, *American Economic Review*.
- Cordell, Larry, Karen Dynan, Andreas Lehnert, Nellie Liang, and Eileen Mauskopf, 2009, Designing Loan Modifications to Address the Mortgage Crisis and the Making Home Affordable Program, Federal Reserve Board Working Paper.
- Clauret, Terrence M., and Mel Jameson, 1995, Residential Loan Renegotiation: Theory and Evidence, *Journal of Real Estate Research* 10(2), 153-162.
- Crews Cutts, Amy and William A. Merrill, 2008, Interventions in Mortgage Default: Policies and Practices to Prevent Home Loss and Lower Costs, Freddie Mac Working Paper.
- Das, Sunjiv R., 2009, Saving Homes and Banks: Optimal Modification of Distressed Home Loans, Working Paper.
- Dugan, John C., 2008, Remarks before the OTS 3rd Annual National Housing Forum, 8 December 2008, p. 2, available at <http://www.occ.treas.gov/ftp/release/2008-142a.pdf>.
- Eggert, Kurt, 2007, Comment on Michael A. Stegman et al.'s "Preventive Servicing Is Good for Business and Affordable Homeownership Policy": What Prevents Loan Modifications?, *Housing Policy Debate* 18(2), 279-297.
- Foote, Christopher, Kristopher Gerardi, and Paul S. Willen, 2008, Negative Equity and Foreclosure: Theory and Evidence, *Journal of Urban Economics*, 64(2): 234-245.
- Foote, Christopher, Jeff Fuhrer, Eileen Mauskopf, and Paul S. Willen, 2009, A Proposal to Help Distressed Homeowners: A Government Payment-Sharing Plan, Working Paper.
- Frame, W. Scott, 2010, Estimating the Effect of Mortgage Foreclosures on Nearby Property Values: A Critical Review of the Literature, Federal Reserve Bank of Atlanta Survey Paper, April 2010.
- Frank, Barney, 2009, Frank Statement on the Progress of Reducing Foreclosures, Press Release July 29 2009.
- Gelpern, Anna, and Adam J. Levitin, 2009, Rewriting Frankenstein Contracts: Workout Prohibitions in Residential Mortgage-Backed Securities, *Southern California Law Review* 82, 1075-1152.
- Goodman, 2009, Lucrative Fees May Deter Efforts to Alter Loans, New-York Times, 30 July 2009.
- Gorton, Gary B., and George G. Pennacchi, 1995, Banks and Loan Sales: Marketing Nonmarketable Assets, *Journal of Monetary Economics* 35, 389-411.
- Office of the Comptroller of the Currency and Office of Thrift Supervision, 2009, OCC and OTS Mortgage Metrics Report, Quarterly reports.

Magder, Dan, 2009, Mortgage Loan Modifications: Program Incentives and Restructuring Design, Working Paper.

Mayer, Christopher, and R. Glenn Hubbard, 2010, House prices, interest rates, and the mortgage market meltdown, Working Paper, Columbia University.

Mulligan, Casey B., 2009, Means-Tested Mortgage Modification: Homes Saved or Income Destroyed?, Working Paper.

Piskorski, Tomasz, Amit Seru, and Vikrant Vig, 2010, Securitization and Distressed Loan Renegotiation: Evidence from the Subprime Mortgage Crisis, *Journal of Financial Economics* 97(3), 369-397.

Posner, Richard, and Luigi Zingales, 2009, A Loan Modification Approach to the Housing Crisis, *American Law and Economics Review* 11(2), 575-607.

Stegman, Michael A., Roberto G. Quercia, Janneke Ratcliffe, Lei Ding, and Walter R. Davis, 2007, Preventive Servicing is Good for Business and Affordable Homeownership Policy, *Housing Policy Debate* 18(2), 243-278.

Table 1. Descriptive Statistics

The table presents descriptive statistics of the sample studied. The base sample is the universe of residential mortgages serviced by the largest 19 banks in the U.S. The subsample that we study here contains observations of mortgages that became 60+ days past due (dpd) or entered loss mitigation programs (collectively called “loans in trouble”) between January 2008 and May 2009. Panel A presents descriptive summary statistics of loans in trouble as well as of the subset that were modified. Panel B lists the number of loans that were first in trouble, per calendar quarter. Panel C presents a breakdown of the reasons for default for loans that entered the loss mitigation process. Panel D presents a breakdown of the delinquency status of loans that enter the loss mitigation process. Panel E presents means of LTV and FICO per servicer at the time of origination. Panel F presents a breakdown of resolutions and redefault rates per servicer. Panel G presents redefault (within 6 months) rates of modified loans per calendar quarter. Panel H shows that a breakdown of the modification types per calendar quarter.

Panel A: Summary Statistics

"In trouble" loans								
Variable	N	Mean	Std Dev	Min	p25	p50	p75	Max
Resolution: Repayment 6 months	1766209	0.0258	0.1585	0.0000	0.0000	0.0000	0.0000	1.0000
Resolution: Modification 6 months	1766209	0.0941	0.2919	0.0000	0.0000	0.0000	0.0000	1.0000
Resolution: Refinance within 6 months	1766209	0.0185	0.1348	0.0000	0.0000	0.0000	0.0000	1.0000
Resolution: Liquidation within 6 months	1766209	0.2643	0.4410	0.0000	0.0000	0.0000	1.0000	1.0000
FICO at origination	1500559	658.9097	66.5949	300	617	661	706	850
FICO at "in trouble"	1467238	599.4463	89.2020	335	528	590	667	850
LTV at origination	1491279	81.6321	14.4214	30.0000	75.0000	80.0000	91.4900	156.5000
LTV at "in trouble"	1126936	85.8682	23.9206	30.0000	73.4140	81.4000	97.0000	199.9993
Securitizer is GSE	1766209	0.3364	0.4725	0.0000	0.0000	0.0000	1.0000	1.0000
Securitizer is private	1766209	0.2564	0.4366	0.0000	0.0000	0.0000	1.0000	1.0000
log(sum(unpaid balance per lender-zip code))	1766209	11.2750	8.6041	0.0000	0.0000	16.7964	18.3423	21.1100
Share of servicer's modified loans in zipcode	1766209	0.0620	0.1767	0.0000	0.0000	0.0000	0.0000	1.0000
Change in unemployment	1766209	0.2277	0.4053	-4.3000	0.1000	0.2609	0.4000	8.1000
Change in home prices since origination	1766209	-0.0126	0.2319	-0.5912	-0.1320	-0.0134	0.0283	2.8599
Borrower is non-occupier	1762806	0.1568	0.3636	0.0000	0.0000	0.0000	0.0000	1.0000
Second lien	1766207	0.0956	0.2940	0.0000	0.0000	0.0000	0.0000	1.0000
Low doc mortgage	1766209	0.0471	0.2118	0.0000	0.0000	0.0000	0.0000	1.0000
Stated income mortgage	1766209	0.2181	0.4130	0.0000	0.0000	0.0000	0.0000	1.0000
Mortgage is ARM	1755818	0.3613	0.4804	0.0000	0.0000	0.0000	1.0000	1.0000

Table 1. Descriptive Statistics (Cont.)

Panel A: Summary Statistics (Cont.)

Modified loans:								
Variable	N	Mean	Std Dev	Min	p25	p50	p75	Max
FICO at "in trouble"	188283	572.8638	77.3266	343	514	561	629	837
LTV pre-modification	138749	91.4427	24.6815	30.0000	78.0000	88.0000	100.0000	199.6400
LTV post-modification	130422	90.4192	24.2434	30.0000	78.0000	88.0000	100.0000	171.0000
Modification: Principal deferred	220496	0.0312	0.1739	0.0000	0.0000	0.0000	0.0000	1.0000
Modification: Principal write-down	220496	0.0252	0.1568	0.0000	0.0000	0.0000	0.0000	1.0000
Modification: Interest capitalized	220496	0.4843	0.4998	0.0000	0.0000	0.0000	1.0000	1.0000
Modification: Interest rate reduced	220496	0.6701	0.4702	0.0000	0.0000	1.0000	1.0000	1.0000
Modification: Interest rate frozen	220496	0.3277	0.4694	0.0000	0.0000	0.0000	1.0000	1.0000
Modification: Term extended	220496	0.2969	0.4569	0.0000	0.0000	0.0000	1.0000	1.0000
Modification: Combination	220496	0.7053	0.4559	0.0000	0.0000	1.0000	1.0000	1.0000
Change in payment (%)	69460	-15.1356	21.0665	-76.9850	-30.2535	-14.5938	0.0000	50.0000
Change interest rates (bps)	217564	-172.2595	210.7178	-1120.0000	-300.0000	-100.0000	0.0000	510.0000
Change in balance (%)	220400	1.0088	2.3832	-1.6482	0.0000	0.0000	0.2416	15.0000
Change in term (months)	175864	2.3254	16.8552	-110.0000	0.0000	0.0000	0.0000	120.0000
Change in unemployment (%)	220115	0.4047	0.5547	-0.0150	0.0000	0.0210	1.1879	1.1879
Change in home prices since origination (%)	220496	0.0324	0.0553	-0.0920	0.0000	0.0332	0.0332	0.6926
Redefault (60+ dpd) within 6 months (0/1) × 100	220496	34.3226	47.4787	0.0000	0.0000	0.0000	100.0000	100.0000

Panel B: Breakdown of the Number of Loans in Trouble, per Calendar Quarter

# Borrowers	
Quarter	in trouble
2008Q1	309,356
2008Q2	322,498
2008Q3	287,799
2008Q4	341,935
2009Q1	238,475
2009Q2	266,146
Total	1,766,209

Panel C: Breakdown of Reasons of Default

Reason for default	Percentage
Excess debt	7.8%
Medical	2.0%
Unemployment	5.8%
Death	0.2%
Other	29.0%
Unknown	55.2%
Total	100.0%

Table 1. Descriptive Statistics (Cont.)

Panel D: Mean LTV and FICO at Origination, by Servicer Entity

Servicer entity	LTV	FICO
1	85.0	648.7
2	89.8	670.4
3	79.3	665.3
4	73.2	688.2
5	82.8	622.7
6	82.1	687.6
7	83.7	650.4
8	81.6	697.4
9	83.4	674.3
10	81.6	671.9
11	79.5	643.3
12	81.9	687.8
13	78.7	625.4
14	79.4	692.1
15	80.2	691.2
16	85.3	661.1
17	83.4	681.5
18	81.7	658.8
19	85.9	673.8

Table 1. Descriptive Statistics (Cont.)

Panel E: Resolution and Rates of Redefault within 6 Months, by Servicer Entity

Servicer entity	Resolution within 6 months									Redefault	
	Leave the house			Stay in the house					60+ dpd	90+ dpd	
	No Resolution	Foreclosure process	Liquidation	Modification			Repayment	Refinance			
				All	Trial	Permanent					
1	18.8%	2.1%	16.6%	59.7%	2.1%	59.5%	0.0%	0.5%	16.7%	9.4%	
2	57.9%	19.6%	6.9%	7.8%	0.0%	7.8%	0.0%	7.8%	48.5%	31.3%	
3	25.3%	39.1%	30.2%	4.2%	0.0%	4.2%	0.0%	1.2%	21.1%	21.1%	
4	47.2%	26.0%	11.4%	2.8%	0.0%	1.4%	11.4%	2.2%	48.2%	32.7%	
5	42.5%	20.9%	12.9%	16.7%	0.2%	16.2%	5.8%	1.4%	16.4%	12.4%	
6	41.6%	35.8%	16.1%	4.0%	0.0%	4.0%	0.0%	2.5%	36.7%	25.7%	
7	58.5%	10.5%	0.5%	25.5%	0.0%	25.5%	2.3%	2.7%	30.3%	26.4%	
8	43.0%	8.4%	22.0%	9.8%	0.0%	9.8%	0.0%	16.8%	17.6%	12.5%	
9	56.6%	18.8%	4.0%	10.8%	0.0%	10.8%	0.0%	9.8%	55.0%	32.1%	
10	64.1%	15.4%	13.5%	4.0%	0.2%	3.9%	0.6%	2.5%	39.5%	28.9%	
11	50.0%	3.6%	1.5%	0.1%	0.0%	0.1%	2.5%	42.2%	60.6%	42.4%	
12	62.9%	22.1%	5.9%	4.7%	0.1%	3.8%	0.0%	4.4%	44.1%	31.7%	
13	34.7%	21.4%	17.6%	24.4%	0.4%	24.0%	0.2%	1.7%	32.4%	22.2%	
14	43.9%	23.3%	9.3%	5.2%	2.7%	2.6%	16.3%	2.2%	45.7%	39.8%	
15	63.2%	12.5%	7.0%	6.7%	0.0%	6.6%	9.0%	2.0%	26.2%	15.6%	
16	34.6%	26.3%	16.6%	18.1%	0.0%	16.2%	2.6%	1.9%	50.5%	36.1%	
17	56.9%	15.4%	7.2%	6.5%	0.0%	6.4%	11.4%	2.7%	33.7%	21.9%	
18	55.4%	23.1%	6.9%	7.5%	0.0%	7.5%	0.0%	7.1%	47.7%	39.1%	
19	54.3%	25.6%	9.3%	4.9%	0.0%	4.9%	0.0%	5.8%	0.0%	0.0%	

Panel F: Rates of Modification Redefault within 6 Months, by Modification Quarter

Modification quarter	N	% 60+ dpd	% 90+ dpd
2008Q1	14,323	48.4%	23.4%
2008Q2	28,746	38.3%	27.6%
2008Q3	27,418	51.0%	36.0%
2008Q4	53,995	34.4%	21.7%
Total	124,482	40.6%	26.4%

Panel G: Rates of Redefault within 6 Months, by Modification Type

Modification type	Quarter			
	2008Q1	2008Q2	2008Q3	2008Q4
Interest Rate Frozen	8.1%	24.5%	31.8%	31.2%
Interest Rate Reduction	24.9%	62.7%	54.0%	53.2%
Term Extended	6.2%	11.2%	23.4%	19.8%
Principal Deferred	0.3%	1.4%	6.5%	2.1%
Principal Writedown	0.0%	0.1%	1.3%	0.7%
Capitalization	15.1%	32.9%	46.5%	46.9%
Combination	30.1%	63.1%	65.8%	59.7%

Table 2. Resolution outcomes within a given time frame, by quarter of entry into sample

The table presents the resolutions (or no action) of borrowers who became “in trouble” in a particular calendar quarter. Panel A (B, C, D) present the outcomes within 3 (6, 9, 12) months. The base sample is the universe of residential mortgages serviced by the largest 19 banks in the U.S. The subsample that we study here contains observations of mortgages that became 60+ days past due (dpd) or entered loss mitigation programs (collectively called “loans in trouble”) between January 2008 and May 2009.

Panel A: Resolutions within 3 months

Quarter:	2008Q1	2008Q2	2008Q3	2008Q4	2009Q1
# Borrowers in trouble in cohort:	309,356	322,498	287,799	341,935	238,475
In Forclosure process	14.6%	13.1%	11.6%	20.2%	23.9%
Liquidation	6.1%	0.6%	0.5%	0.6%	0.9%
Total "Leave the house"	20.7%	13.8%	12.1%	20.8%	24.8%
Repayment	1.5%	0.9%	1.1%	1.9%	3.7%
Modification	6.9%	6.4%	4.9%	9.7%	9.2%
Refinance	1.3%	1.3%	1.1%	1.2%	1.7%
Total "Stay in the house"	9.7%	8.6%	7.1%	12.8%	14.7%
No action	69.6%	77.7%	80.8%	66.4%	60.5%

Panel B: Resolutions within 6 months

Quarter:	2008Q1	2008Q2	2008Q3	2008Q4	Total 2008
# Borrowers in trouble in cohort:	309,356	322,498	287,799	341,935	1,261,588
In Forclosure process	16.4%	19.5%	23.9%	28.4%	22.2%
Liquidation	16.1%	9.1%	5.0%	3.8%	8.4%
Total "Leave the house"	32.5%	28.6%	28.9%	32.2%	30.6%
Repayment	2.0%	1.8%	2.6%	3.2%	2.4%
Modification	9.4%	9.7%	9.4%	12.7%	10.4%
Refinance	2.1%	2.5%	1.8%	2.2%	2.2%
Total "Stay in the house"	13.5%	14.0%	13.8%	18.1%	15.0%
No action	54.0%	57.4%	57.3%	49.7%	54.4%

Table 2. Resolution outcomes within a given time frame (Cont.)

Panel C: Resolutions within 9 months

	Quarter:	2008Q1	2008Q2	2008Q3
# Borrowers in trouble in cohort:		309,356	322,498	287,799
In Foreclosure process		17.7%	23.0%	30.1%
Liquidation		26.7%	17.3%	10.4%
Total "Leave the house"		44.3%	40.3%	40.5%
Repayment		2.9%	2.8%	4.1%
Modification		12.1%	13.5%	12.5%
Refinance		2.8%	3.2%	3.2%
Total "Stay in the house"		17.8%	19.5%	19.9%
No action		37.8%	40.2%	39.7%

Panel D: Resolutions within 12 months

	Quarter:	2008Q1	2008Q2
# Borrowers in trouble in cohort:		309,356	322,498
In Foreclosure process		18.8%	25.8%
Liquidation		34.8%	22.0%
Total "Leave the house"		53.6%	47.7%
Repayment		3.6%	3.7%
Modification		14.7%	15.7%
Refinance		3.2%	4.4%
Total "Stay in the house"		21.6%	23.8%
No action		24.9%	28.5%

Table 3. Determinants of Loss Mitigation Resolution

The table presents regressions of resolution type indicators on borrower, contract, and servicer information. The base sample is the universe of residential mortgages serviced by the largest 19 banks in the U.S. The subsample that we study contains observations of mortgages that became 60+ days past due (dpd) or entered loss mitigation programs (collectively called “loans in trouble”) between January 2008 and May 2009. Panel A presents regressions of resolutions in which the borrower leaves the house. Panel B presents regressions of resolutions in which the borrower stays in the house. Panel B presents regressions of no action. *t*-statistics are presented in parentheses. Robust standard errors are clustered by servicer entity level. *, **, *** denote two-tailed significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Likelihood of resolutions that result in the borrower leaving the house

	"Leave the house" within 6 months (0/1)		Liquidation within 6 months (0/1)		Foreclosure initiation within 6 months (0/1)	
	(1)	(2)	(3)	(4)	(5)	(6)
Securitizer is GSE	-0.003 (-0.092)		-0.004 (-0.238)		0.002 (0.100)	
Securitizer is private	-0.001 (-0.037)		-0.038 (-0.609)		0.037 (0.976)	
Second lien	0.107 (1.265)	0.104 (1.261)	0.125* (1.840)	0.130* (1.895)	-0.018 (-0.395)	-0.026 (-0.618)
Borrower is non-occupier	0.082*** (5.437)	0.085*** (5.259)	0.027*** (4.003)	0.034*** (5.128)	0.055*** (6.014)	0.051*** (4.547)
Low doc mortgage	0.032 (1.676)	0.035 (1.658)	0.022 (1.458)	0.017 (1.090)	0.010 (0.772)	0.018 (1.694)
Stated income mortgage	0.051*** (5.931)	0.056*** (6.465)	0.013* (1.950)	0.014** (2.503)	0.038** (2.933)	0.042*** (3.473)
Mortgage is ARM	0.081*** (5.092)	0.084*** (5.413)	0.031** (2.692)	0.029** (2.299)	0.050*** (5.923)	0.055*** (6.295)
Change in unemployment	0.091*** (3.350)	0.095*** (3.429)	0.038* (1.940)	0.046** (2.394)	0.053** (2.285)	0.049** (2.164)
Change in home prices since origination	-0.144*** (-4.907)	-0.141*** (-4.808)	-0.032* (-2.058)	-0.030* (-2.041)	-0.112*** (-3.309)	-0.111*** (-3.187)
log(sum(unpaid balance per lender-zip code))	0.001 (1.455)	0.001 (1.436)	0.000 (1.225)	0.000 (0.867)	0.001 (1.387)	0.001 (1.539)
Share of servicer's modified loans in zipcode	-0.019* (-1.895)	-0.019* (-1.858)	0.010*** (4.279)	0.010*** (5.152)	-0.028** (-2.580)	-0.028** (-2.651)
In trouble FICO score bucket FE	Yes	Yes	Yes	Yes	Yes	Yes
In trouble LTV bucket FE	Yes	Yes	Yes	Yes	Yes	Yes
Origination year FE	Yes	Yes	Yes	Yes	Yes	Yes
Calendar month FE	Yes	Yes	Yes	Yes	Yes	Yes
Servicer entity FE	Yes	Yes	Yes	Yes	Yes	Yes
Securitizer FE	No	Yes	No	Yes	No	Yes
Observations	834944	834944	834944	834944	834944	834944
Adj. R ²	0.149	0.155	0.151	0.184	0.190	0.197
Adj. R ² without servicer entity FE	0.075		0.132		0.128	

Table 3. Determinants of Loss Mitigation Resolution (Cont.)

Panel B: Likelihood of resolutions that result in the borrower staying in the house

	"Stay in the house" within 6 months (0/1)		Repayment within 6 months (0/1)		Modification within 6 months (0/1)		Refinance within 6 months (0/1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Securitizer is GSE	-0.029 (-1.645)		0.035* (2.136)		-0.066** (-2.688)		0.002 (0.618)	
Securitizer is private	-0.024 (-1.383)		0.010 (1.379)		-0.031** (-2.178)		-0.002 (-0.839)	
Second lien	-0.142*** (-5.161)	-0.150*** (-5.517)	-0.029 (-1.481)	-0.030 (-1.758)	-0.113*** (-3.150)	-0.119*** (-3.520)	-0.001 (-0.482)	-0.002 (-0.634)
Borrower is non-occupier	-0.051*** (-9.340)	-0.054*** (-11.455)	-0.011** (-2.219)	-0.011** (-2.235)	-0.042*** (-5.568)	-0.044*** (-7.880)	0.002* (1.832)	0.002 (1.581)
Low doc mortgage	-0.009 (-0.682)	-0.017 (-1.549)	0.024* (1.988)	0.007 (1.296)	-0.029*** (-3.208)	-0.021** (-2.259)	-0.004 (-1.420)	-0.003 (-0.897)
Stated income mortgage	-0.021*** (-4.252)	-0.021*** (-3.554)	0.003 (0.722)	-0.001 (-0.381)	-0.016*** (-4.073)	-0.013*** (-4.843)	-0.008** (-2.374)	-0.007** (-2.178)
Mortgage is ARM	-0.083** (-2.447)	-0.082** (-2.442)	-0.007 (-0.971)	-0.010 (-1.287)	-0.080** (-2.189)	-0.077* (-2.079)	0.004* (2.121)	0.004* (2.110)
Change in unemployment	0.016 (0.783)	0.013 (0.686)	0.001 (0.192)	0.003 (0.370)	0.018 (0.833)	0.015 (0.727)	-0.003 (-0.466)	-0.004 (-0.498)
Change in home prices since origination	0.029 (1.585)	0.028 (1.522)	0.018* (1.938)	0.017* (1.919)	-0.007 (-0.487)	-0.007 (-0.468)	0.018 (1.087)	0.018 (1.076)
log(sum(unpaid balance per lender-zip code))	-0.001 (-1.618)	-0.001 (-1.563)	-0.000 (-1.417)	-0.000* (-2.088)	-0.000 (-0.269)	0.000 (0.151)	-0.001 (-1.746)	-0.001 (-1.741)
Share of servicer's modified loans in zipcode	0.017 (1.340)	0.017 (1.335)	0.007 (1.043)	0.006 (0.991)	0.010* (2.118)	0.010* (2.083)	0.000 (0.023)	0.000 (0.044)
In trouble FICO score bucket FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
In trouble LTV bucket FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origination year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calendar month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Servicer entity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Securitizer FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	834944	834944	834944	834944	834944	834944	834944	834944
Adj. R ²	0.083	0.074	0.055	0.064	0.075	0.082	0.112	0.113
Adj. R ² without servicer entity FE	0.047		0.030		0.031		0.017	

Table 3. Determinants of Loss Mitigation Resolution (Cont.)

Panel C: Likelihood of “No action”

	"No action" within 6 months (0/1)	
	(1)	(2)
Securitizer is GSE	0.031 (1.239)	
Securitizer is private	0.025* (1.920)	
Second lien	0.035 (0.478)	0.045 (0.650)
Borrower is non-occupier	-0.031** (-2.169)	-0.032* (-1.931)
Low doc mortgage	-0.023 (-1.671)	-0.018 (-1.550)
Stated income mortgage	-0.030** (-2.588)	-0.034** (-2.814)
Mortgage is ARM	0.003 (0.101)	-0.002 (-0.065)
Change in unemployment	-0.106*** (-4.847)	-0.108*** (-4.659)
Change in home prices since origination	0.115** (2.611)	0.113** (2.524)
log(sum(unpaid balance per lender-zip code))	-0.000 (-0.552)	-0.000 (-0.651)
Share of servicer's modified loans in zipcode	0.002 (0.223)	0.002 (0.308)
In trouble FICO score bucket FE	Yes	Yes
In trouble LTV bucket FE	Yes	Yes
Origination year FE	Yes	Yes
Calendar month FE	Yes	Yes
Servicer entity FE	Yes	Yes
Securitizer FE	No	Yes
Observations	834944	834944
Adj. R ²	0.083	0.088
Adj. R ² without servicer entity FE	0.074	

Table 4. Determinants of Modification Terms

The table presents regressions of modification terms on borrower, contract, and servicer information. The base sample is the universe of residential mortgages serviced by the largest 19 banks in the U.S. The subsample that we study contains observations of mortgages that became 60+ days past due (dpd) or entered loss mitigation programs (collectively called “loans in trouble”) between January 2008 and December 2008. The regressions in the table include only loans that were modified and which servicers report their modification terms. *t*-statistics are presented in parentheses. Robust standard errors are clustered by servicer entity level. *, **, *** denote two-tailed significance at the 10%, 5%, and 1% levels, respectively.

	Change in ...							
	payment (%)		interest rates (bps)		balance (%)		term (months)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Securitizer is GSE	1.459 (0.544)		67.662** (2.497)		0.665*** (5.976)		0.490* (1.782)	
Securitizer is private	-1.458*** (-8.082)		-53.518*** (-9.068)		0.131* (1.874)		0.603** (2.233)	
Second lien	-4.766 (-0.681)	-4.731 (-0.683)	-16.292 (-0.289)	-15.248 (-0.271)	0.006 (0.073)	0.015 (0.239)	0.057 (1.063)	0.047 (1.003)
Borrower is non-occupier	1.647*** (4.563)	1.604*** (4.184)	6.551 (1.038)	6.533 (1.028)	0.040 (1.584)	0.045* (1.829)	0.000 (0.003)	0.011 (0.493)
Low doc mortgage	-5.194*** (-15.596)	-5.250*** (-12.444)	-11.983 (-0.572)	-12.549 (-0.610)	-0.028 (-0.347)	-0.085*** (-3.321)	-0.104** (-2.531)	-0.072* (-1.955)
Stated income mortgage	-0.945 (-0.844)	-0.955 (-0.826)	-13.960 (-0.648)	-14.437 (-0.663)	0.054 (1.589)	0.046 (1.087)	-0.174** (-2.356)	-0.144* (-1.839)
Mortgage is ARM	-3.353 (-1.552)	-3.359 (-1.555)	6.463 (0.146)	7.256 (0.163)	-0.112 (-0.809)	-0.115 (-0.902)	0.019 (0.447)	0.040 (0.958)
Change in unemployment (%)	-0.129 (-0.175)	-0.179 (-0.253)	-5.707** (-2.790)	-6.101** (-2.758)	-0.092 (-1.643)	-0.087 (-1.569)	-0.062 (-0.962)	-0.055 (-0.897)
Change in home prices since origination (%)	0.261 (0.108)	0.254 (0.123)	-12.035 (-0.222)	-14.108 (-0.260)	0.841 (0.921)	0.777 (0.895)	-1.500*** (-6.932)	-1.294*** (-6.852)
log(sum(unpaid balance per lender-zip code))	0.002 (0.026)	-0.004 (-0.064)	-0.046 (-0.208)	-0.054 (-0.247)	-0.008 (-1.675)	-0.008 (-1.705)	-0.004* (-1.871)	-0.003* (-1.831)
Share of servicer's modified loans in zipcode	1.198*** (3.297)	1.177*** (3.441)	1.911 (1.215)	1.900 (1.174)	0.052 (1.137)	0.051 (1.117)	-0.075** (-2.184)	-0.081** (-2.401)
In trouble FICO score bucket FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
In trouble LTV bucket FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Origination year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Calendar month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Servicer entity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Securitizer FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	14337	14337	62808	62808	63166	63166	47352	47352
Adj. R ²	0.228	0.229	0.314	0.315	0.199	0.204	0.059	0.066
Adj. R ² without servicer entity FE	0.150		0.222		0.138		0.026	

Table 5. Redefault following Modification

The table presents regressions of redefault indicator (becoming 60+ dpd within 6 months) on modification terms, in addition to borrower, contract, and servicer information. The base sample is the universe of residential mortgages serviced by the largest 19 banks in the U.S. The subsample that we study contains observations of mortgages that became 60+ days past due (dpd) or entered loss mitigation programs (collectively called “loans in trouble”) between January 2008 and December 2008. *t*-statistics are presented in parentheses. Robust standard errors are clustered by servicer entity level. *, **, *** denote two-tailed significance at the 10%, 5%, and 1% levels, respectively.

	Redefault (60+ dpd) within 6 months (0/1) × 100				
	(1)	(2)	(3)	(4)	(5)
Change in payment (%)		0.284*** (10.029)			
Change in rate (bps)			0.039*** (9.047)		
Change in balance (%)				0.062 (0.145)	
Change in term (months)					1.328 (1.287)
Securitizer is GSE	1.851 (0.623)	-1.311 (-0.352)	-1.259 (-0.550)	1.434 (0.432)	2.990 (0.815)
Securitizer is private	0.304 (0.166)	1.425 (0.755)	1.907 (0.877)	-0.144 (-0.070)	1.543 (0.548)
Second lien	0.825 (0.594)	0.046 (0.019)	1.399 (0.700)	0.897 (0.540)	0.255 (0.090)
Borrower is non-occupier	2.353 (1.653)	2.821*** (4.919)	1.597 (1.469)	1.838 (1.547)	1.784 (1.332)
Low doc mortgage	2.472** (2.875)	2.597** (2.683)	4.115*** (3.403)	3.416*** (3.530)	3.232*** (3.691)
Stated income mortgage	-0.121 (-0.183)	-0.250 (-0.198)	0.652 (0.585)	0.062 (0.078)	-0.681 (-0.857)
Mortgage is ARM	8.520 (1.590)	6.481** (2.888)	8.502* (2.035)	8.792 (1.631)	9.429 (1.428)
Change in unemployment (%)	-1.411 (-1.435)	-1.212 (-0.793)	-1.103 (-1.331)	-1.358 (-1.513)	-2.477*** (-3.136)
Change in home prices since origination (%)	27.334** (2.322)	23.402** (2.371)	30.289** (2.597)	29.867** (2.331)	17.638 (0.965)
log(sum(unpaid balance per lender-zip code))	-0.067 (-0.825)	-0.100 (-0.968)	-0.045 (-0.619)	-0.048 (-0.712)	-0.146** (-2.145)
Share of servicer's modified loans in zipcode	1.880** (2.183)	3.431*** (4.594)	1.869** (2.233)	1.967** (2.292)	1.519 (1.488)
In trouble FICO score bucket FE	Yes	Yes	Yes	Yes	Yes
In trouble LTV bucket FE	Yes	Yes	Yes	Yes	Yes
Origination year FE	Yes	Yes	Yes	Yes	Yes
Calendar month FE	Yes	Yes	Yes	Yes	Yes
Servicer entity FE	Yes	Yes	Yes	Yes	Yes
Observations	63174	14337	62806	63164	63164
Adj R ²	0.121	0.110	0.135	0.116	0.116
Adj. R ² without servicer entity FE	0.073	0.082	0.096	0.067	0.075

Figure 1. Loss Mitigation Resolutions

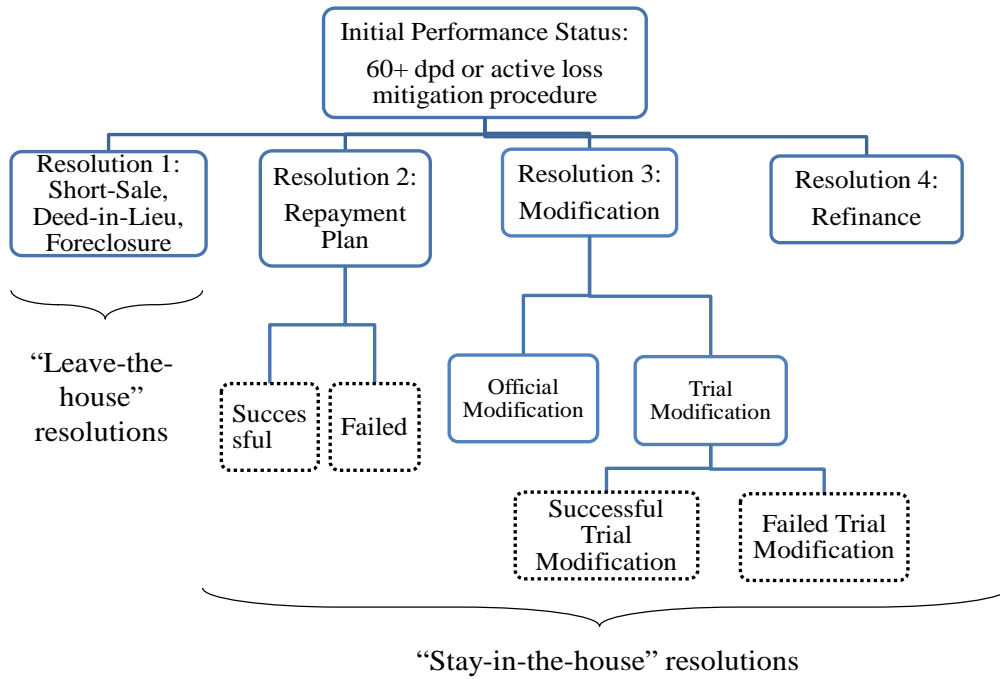


Figure 2. Workout Resolution within 6 Months, by Servicer Entity

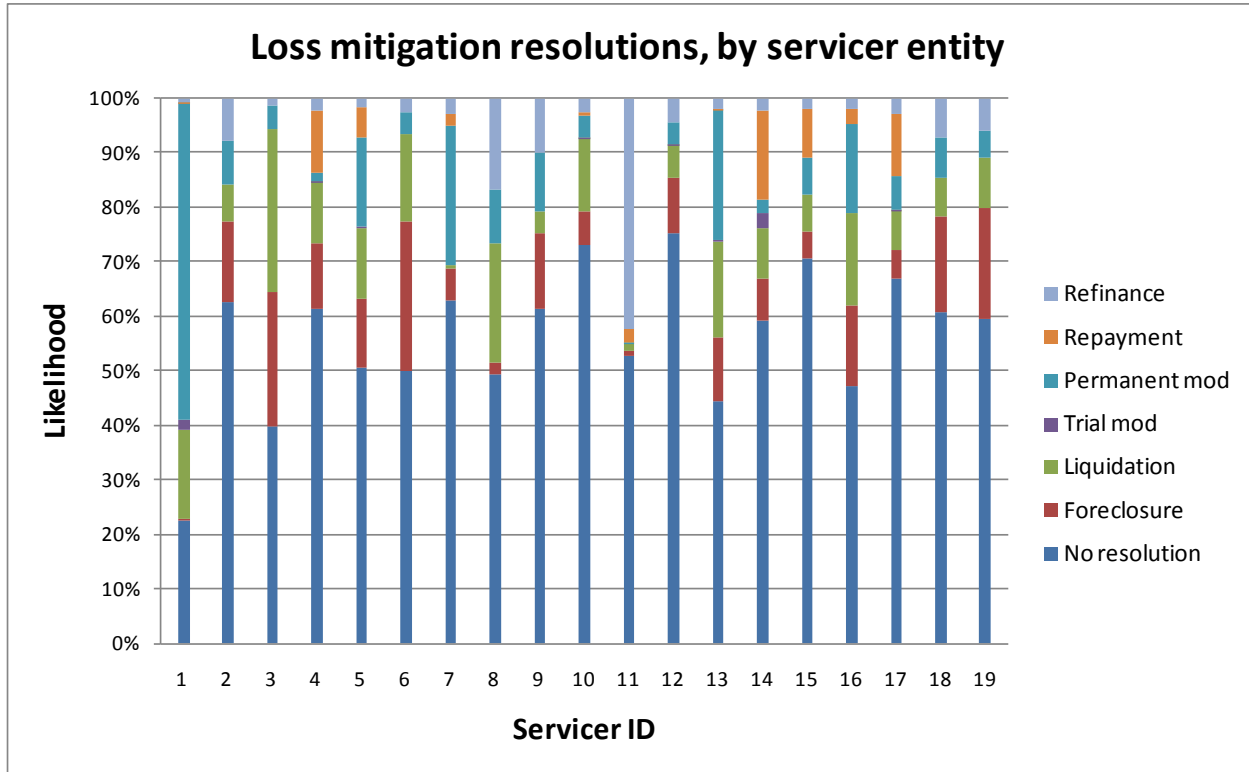
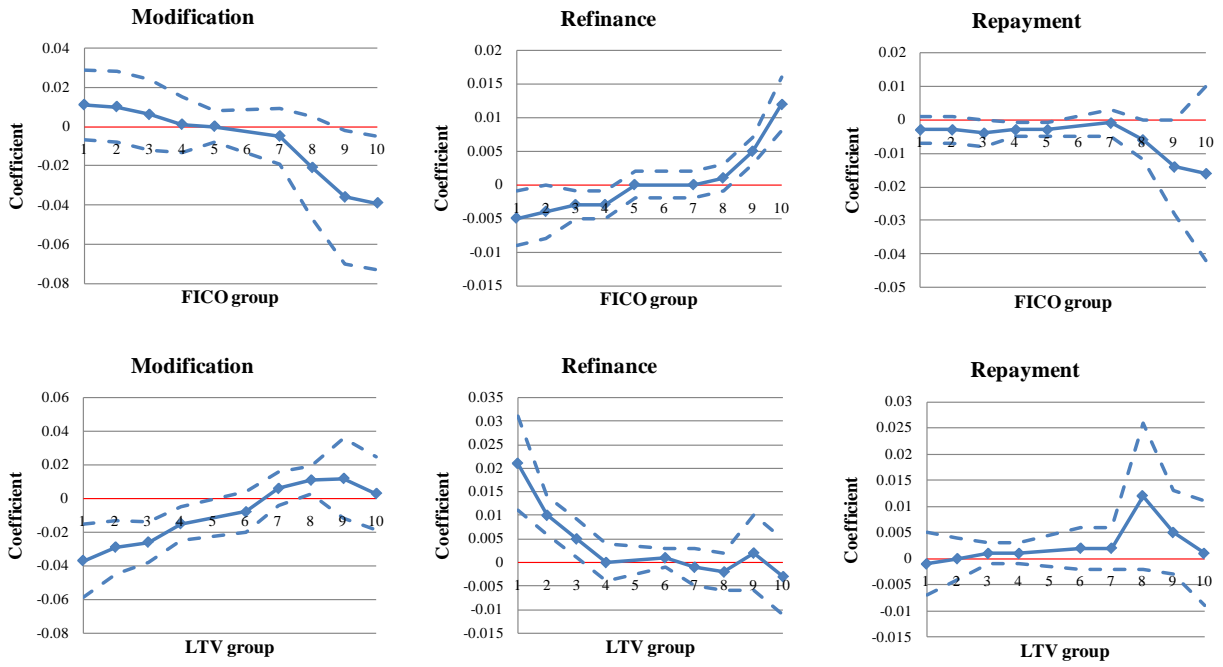


Figure 3. FICO and LTV Bucket Coefficients in Resolution Choice Regressions

A. “Stay-in-the-house” resolutions



B. “Leave-the-house” resolutions

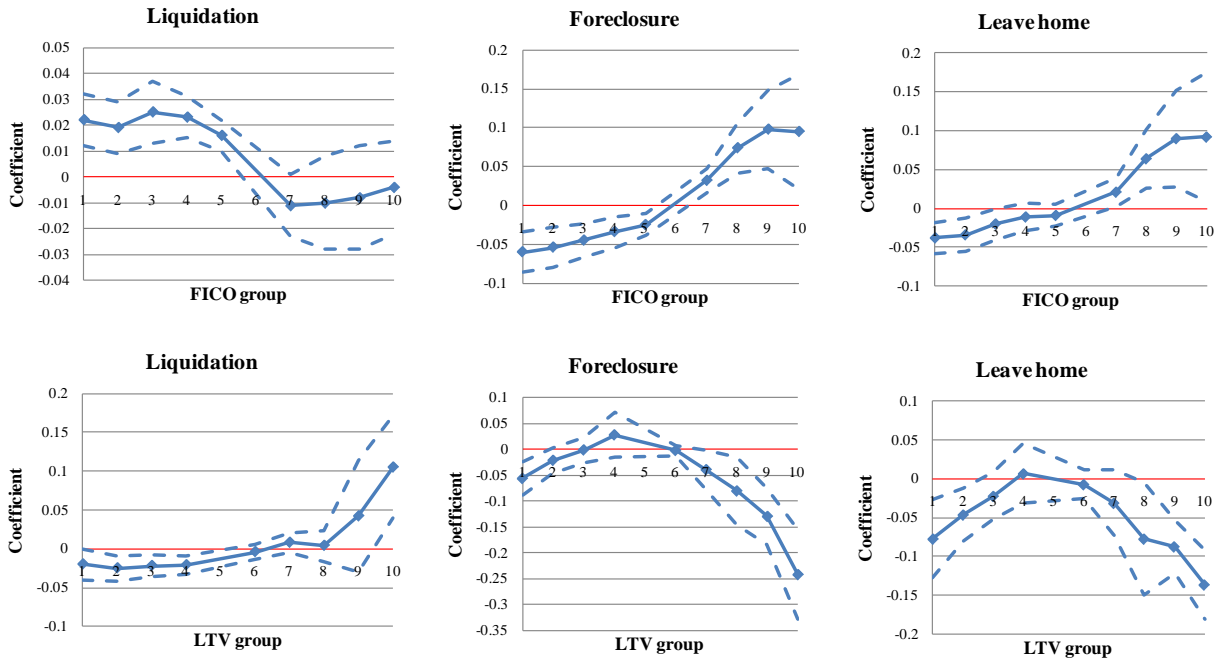


Figure 3. FICO and LTV Bucket Coefficients in Resolution Choice Regressions (Cont.)

C. “No action”

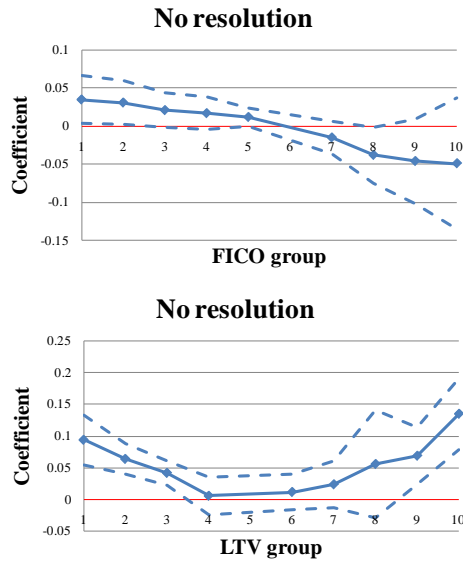
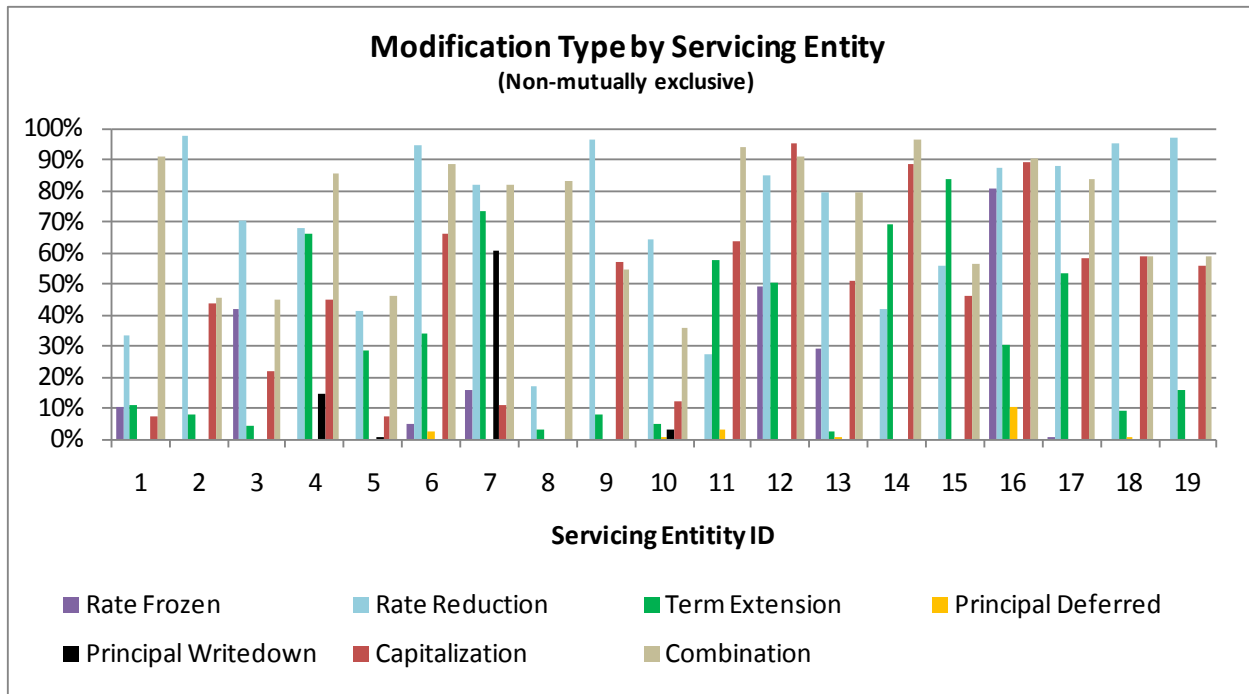
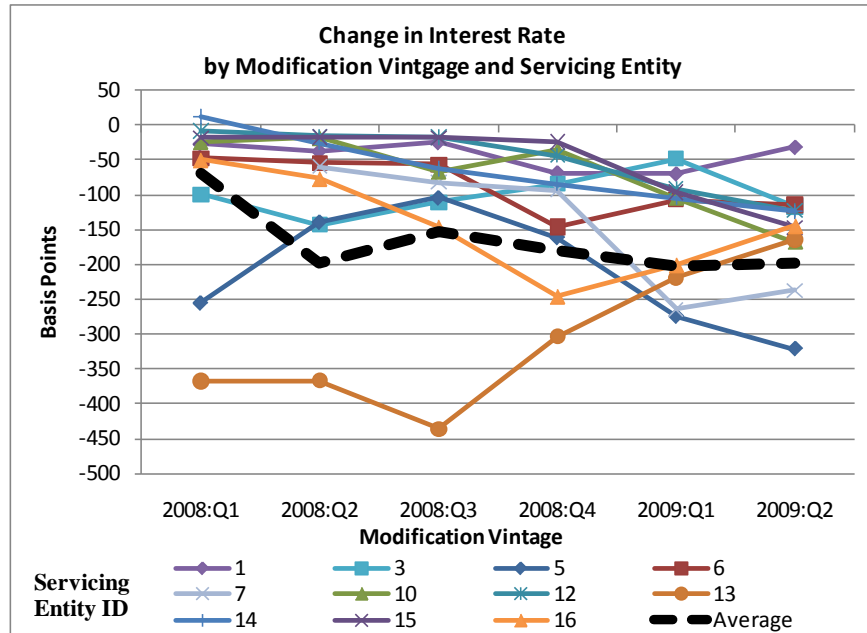


Figure 4. Modification Types, by Servicer Entity



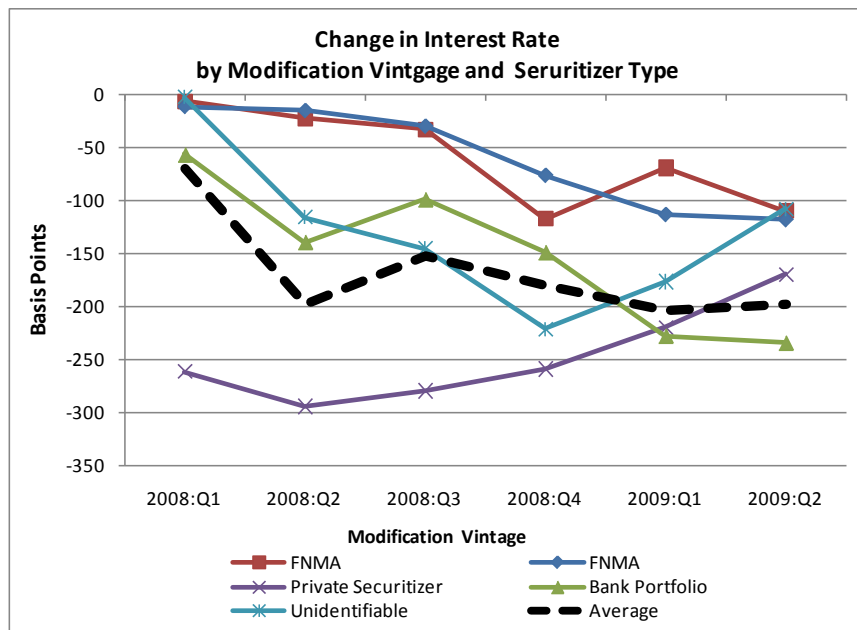
The chart shows the fraction of modified mortgages in which servicer entities applied a specific modification method.

Figure 5. Average Change in Interest Rates, by Servicer



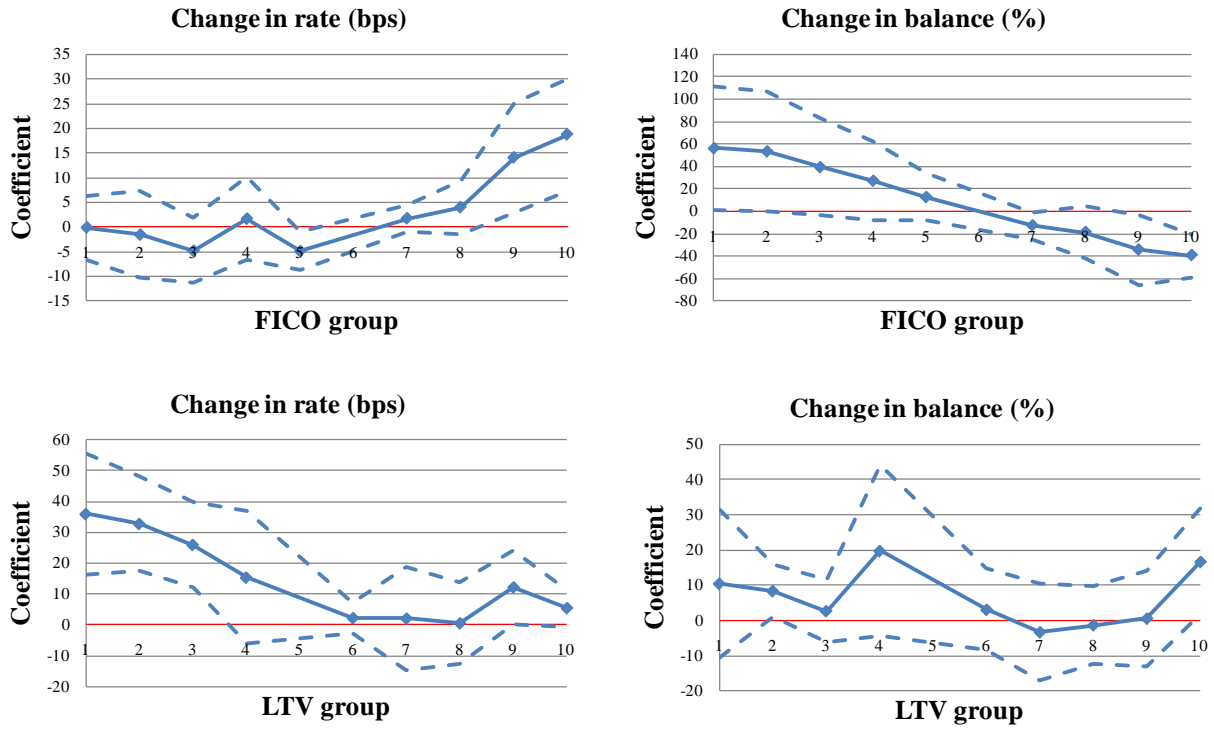
The chart shows the average change in interest rates for modified loans, per calendar quarter of entrance into the troubled loan sample, by servicer entity.

Figure 6. Average Change in Interest Rates, by Securitizer



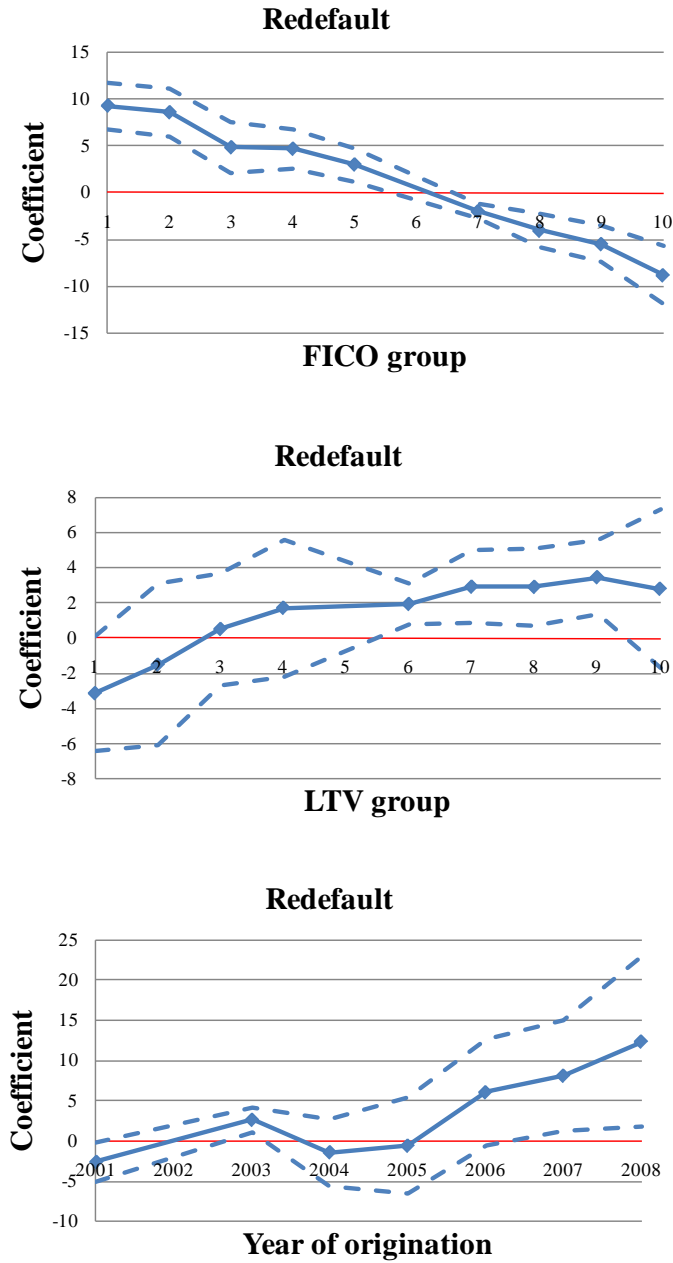
The chart shows the average change in interest rates for modified loans, per calendar quarter of entrance into the troubled loan sample, by type of investor/secritizer.

Figure 7. Determinants of changes in interest rates and modified balance



The charts show the sensitivity of the change in modification terms (from Table 4, Columns (2) and (3)) to FICO and LTV group dummies. The omitted group for FICO group dummies is (6). The omitted group for LTV group dummies is (5). Group dummy buckets are listed in Footnote (12). The solid line shows that point estimate and the dashed lines present two standard errors around the point estimate.

Figure 8. Determinants of Redefault



The charts show the sensitivity of redefault (from Table 5, Column (1)) to FICO, LTV and origination year group dummies. The omitted group for FICO group dummies is (6). The omitted group for LTV group dummies is (5). The omitted group for origination year dummies is (2). Group dummy buckets are listed in Footnotes (12) and (13). The solid line shows that point estimate and the dashed lines present two standard errors around the point estimate.

Working Paper Series

A series of research studies on regional economic issues relating to the Seventh Federal Reserve District, and on financial and economic topics.

A Leverage-based Model of Speculative Bubbles <i>Gadi Barlevy</i>	WP-08-01
Displacement, Asymmetric Information and Heterogeneous Human Capital <i>Luojia Hu and Christopher Taber</i>	WP-08-02
BankCaR (Bank Capital-at-Risk): A credit risk model for US commercial bank charge-offs <i>Jon Frye and Eduard Pelz</i>	WP-08-03
Bank Lending, Financing Constraints and SME Investment <i>Santiago Carbó-Valverde, Francisco Rodríguez-Fernández, and Gregory F. Udell</i>	WP-08-04
Global Inflation <i>Matteo Ciccarelli and Benoît Mojon</i>	WP-08-05
Scale and the Origins of Structural Change <i>Francisco J. Buera and Joseph P. Kaboski</i>	WP-08-06
Inventories, Lumpy Trade, and Large Devaluations <i>George Alessandria, Joseph P. Kaboski, and Virgiliu Midrigan</i>	WP-08-07
School Vouchers and Student Achievement: Recent Evidence, Remaining Questions <i>Cecilia Elena Rouse and Lisa Barrow</i>	WP-08-08
Does It Pay to Read Your Junk Mail? Evidence of the Effect of Advertising on Home Equity Credit Choices <i>Sumit Agarwal and Brent W. Ambrose</i>	WP-08-09
The Choice between Arm's-Length and Relationship Debt: Evidence from eLoans <i>Sumit Agarwal and Robert Hauswald</i>	WP-08-10
Consumer Choice and Merchant Acceptance of Payment Media <i>Wilko Bolt and Sujit Chakravorti</i>	WP-08-11
Investment Shocks and Business Cycles <i>Alejandro Justiniano, Giorgio E. Primiceri, and Andrea Tambalotti</i>	WP-08-12
New Vehicle Characteristics and the Cost of the Corporate Average Fuel Economy Standard <i>Thomas Klier and Joshua Linn</i>	WP-08-13
Realized Volatility <i>Torben G. Andersen and Luca Benzoni</i>	WP-08-14
Revenue Bubbles and Structural Deficits: What's a state to do? <i>Richard Mattoon and Leslie McGranahan</i>	WP-08-15

Working Paper Series *(continued)*

The role of lenders in the home price boom <i>Richard J. Rosen</i>	WP-08-16
Bank Crises and Investor Confidence <i>Una Okonkwo Osili and Anna Paulson</i>	WP-08-17
Life Expectancy and Old Age Savings <i>Mariacristina De Nardi, Eric French, and John Bailey Jones</i>	WP-08-18
Remittance Behavior among New U.S. Immigrants <i>Katherine Meckel</i>	WP-08-19
Birth Cohort and the Black-White Achievement Gap: The Roles of Access and Health Soon After Birth <i>Kenneth Y. Chay, Jonathan Guryan, and Bhashkar Mazumder</i>	WP-08-20
Public Investment and Budget Rules for State vs. Local Governments <i>Marco Bassetto</i>	WP-08-21
Why Has Home Ownership Fallen Among the Young? <i>Jonas D.M. Fisher and Martin Gervais</i>	WP-09-01
Why do the Elderly Save? The Role of Medical Expenses <i>Mariacristina De Nardi, Eric French, and John Bailey Jones</i>	WP-09-02
Using Stock Returns to Identify Government Spending Shocks <i>Jonas D.M. Fisher and Ryan Peters</i>	WP-09-03
Stochastic Volatility <i>Torben G. Andersen and Luca Benzoni</i>	WP-09-04
The Effect of Disability Insurance Receipt on Labor Supply <i>Eric French and Jae Song</i>	WP-09-05
CEO Overconfidence and Dividend Policy <i>Sanjay Deshmukh, Anand M. Goel, and Keith M. Howe</i>	WP-09-06
Do Financial Counseling Mandates Improve Mortgage Choice and Performance? Evidence from a Legislative Experiment <i>Sumit Agarwal, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet, and Douglas D. Evanoff</i>	WP-09-07
Perverse Incentives at the Banks? Evidence from a Natural Experiment <i>Sumit Agarwal and Faye H. Wang</i>	WP-09-08
Pay for Percentile <i>Gadi Barlevy and Derek Neal</i>	WP-09-09
The Life and Times of Nicolas Dutot <i>François R. Velde</i>	WP-09-10
Regulating Two-Sided Markets: An Empirical Investigation <i>Santiago Carbó Valverde, Sujit Chakravorti, and Francisco Rodriguez Fernandez</i>	WP-09-11

Working Paper Series *(continued)*

The Case of the Undying Debt <i>François R. Velde</i>	WP-09-12
Paying for Performance: The Education Impacts of a Community College Scholarship Program for Low-income Adults <i>Lisa Barrow, Lashawn Richburg-Hayes, Cecilia Elena Rouse, and Thomas Brock</i>	WP-09-13
Establishments Dynamics, Vacancies and Unemployment: A Neoclassical Synthesis <i>Marcelo Veracierto</i>	WP-09-14
The Price of Gasoline and the Demand for Fuel Economy: Evidence from Monthly New Vehicles Sales Data <i>Thomas Klier and Joshua Linn</i>	WP-09-15
Estimation of a Transformation Model with Truncation, Interval Observation and Time-Varying Covariates <i>Bo E. Honoré and Luojia Hu</i>	WP-09-16
Self-Enforcing Trade Agreements: Evidence from Antidumping Policy <i>Chad P. Bown and Meredith A. Crowley</i>	WP-09-17
Too much right can make a wrong: Setting the stage for the financial crisis <i>Richard J. Rosen</i>	WP-09-18
Can Structural Small Open Economy Models Account for the Influence of Foreign Disturbances? <i>Alejandro Justiniano and Bruce Preston</i>	WP-09-19
Liquidity Constraints of the Middle Class <i>Jeffrey R. Campbell and Zvi Hercowitz</i>	WP-09-20
Monetary Policy and Uncertainty in an Empirical Small Open Economy Model <i>Alejandro Justiniano and Bruce Preston</i>	WP-09-21
Firm boundaries and buyer-supplier match in market transaction: IT system procurement of U.S. credit unions <i>Yukako Ono and Junichi Suzuki</i>	WP-09-22
Health and the Savings of Insured Versus Uninsured, Working-Age Households in the U.S. <i>Maude Toussaint-Comeau and Jonathan Hartley</i>	WP-09-23
The Economics of “Radiator Springs:” Industry Dynamics, Sunk Costs, and Spatial Demand Shifts <i>Jeffrey R. Campbell and Thomas N. Hubbard</i>	WP-09-24
On the Relationship between Mobility, Population Growth, and Capital Spending in the United States <i>Marco Bassetto and Leslie McGranahan</i>	WP-09-25
The Impact of Rosenwald Schools on Black Achievement <i>Daniel Aaronson and Bhashkar Mazumder</i>	WP-09-26

Working Paper Series *(continued)*

Comment on “Letting Different Views about Business Cycles Compete” <i>Jonas D.M. Fisher</i>	WP-10-01
Macroeconomic Implications of Agglomeration <i>Morris A. Davis, Jonas D.M. Fisher and Toni M. Whited</i>	WP-10-02
Accounting for non-annuitization <i>Svetlana Pashchenko</i>	WP-10-03
Robustness and Macroeconomic Policy <i>Gadi Barlevy</i>	WP-10-04
Benefits of Relationship Banking: Evidence from Consumer Credit Markets <i>Sumit Agarwal, Souphala Chomsisengphet, Chunlin Liu, and Nicholas S. Souleles</i>	WP-10-05
The Effect of Sales Tax Holidays on Household Consumption Patterns <i>Nathan Marwell and Leslie McGranahan</i>	WP-10-06
Gathering Insights on the Forest from the Trees: A New Metric for Financial Conditions <i>Scott Brave and R. Andrew Butters</i>	WP-10-07
Identification of Models of the Labor Market <i>Eric French and Christopher Taber</i>	WP-10-08
Public Pensions and Labor Supply Over the Life Cycle <i>Eric French and John Jones</i>	WP-10-09
Explaining Asset Pricing Puzzles Associated with the 1987 Market Crash <i>Luca Benzoni, Pierre Collin-Dufresne, and Robert S. Goldstein</i>	WP-10-10
Prenatal Sex Selection and Girls’ Well-Being: Evidence from India <i>Luoqia Hu and Analía Schlosser</i>	WP-10-11
Mortgage Choices and Housing Speculation <i>Gadi Barlevy and Jonas D.M. Fisher</i>	WP-10-12
Did Adhering to the Gold Standard Reduce the Cost of Capital? <i>Ron Alquist and Benjamin Chabot</i>	WP-10-13
Introduction to the <i>Macroeconomic Dynamics</i> : Special issues on money, credit, and liquidity <i>Ed Nosal, Christopher Waller, and Randall Wright</i>	WP-10-14
Summer Workshop on Money, Banking, Payments and Finance: An Overview <i>Ed Nosal and Randall Wright</i>	WP-10-15
Cognitive Abilities and Household Financial Decision Making <i>Sumit Agarwal and Bhashkar Mazumder</i>	WP-10-16
Complex Mortgages <i>Gene Amromin, Jennifer Huang, Clemens Sialm, and Edward Zhong</i>	WP-10-17

Working Paper Series *(continued)*

The Role of Housing in Labor Reallocation <i>Morris Davis, Jonas Fisher, and Marcelo Veracierto</i>	WP-10-18
Why Do Banks Reward their Customers to Use their Credit Cards? <i>Sumit Agarwal, Sujit Chakravorti, and Anna Lunn</i>	WP-10-19
The impact of the originate-to-distribute model on banks before and during the financial crisis <i>Richard J. Rosen</i>	WP-10-20
Simple Markov-Perfect Industry Dynamics <i>Jaap H. Abbring, Jeffrey R. Campbell, and Nan Yang</i>	WP-10-21
Commodity Money with Frequent Search <i>Ezra Oberfield and Nicholas Trachter</i>	WP-10-22
Corporate Average Fuel Economy Standards and the Market for New Vehicles <i>Thomas Klier and Joshua Linn</i>	WP-11-01
The Role of Securitization in Mortgage Renegotiation <i>Sumit Agarwal, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet, and Douglas D. Evanoff</i>	WP-11-02
Market-Based Loss Mitigation Practices for Troubled Mortgages Following the Financial Crisis <i>Sumit Agarwal, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet, and Douglas D. Evanoff</i>	WP-11-03