Why Don’t Lenders Renegotiate More Home Mortgages?  
Redefaults, Self-Cures and Securitization

Manuel Adelino\textsuperscript{a}, Kristopher Gerardi\textsuperscript{b,}\textsuperscript{*}, Paul S. Willen\textsuperscript{c}

\textsuperscript{a}Duke’s Fuqua School of Business, Duke University, 100 Fuqua Drive, Durham, NC 27708, USA  
\textsuperscript{b}Federal Reserve Bank of Atlanta Department of Research, Federal Reserve Bank of Atlanta, 1000 Peachtree St. NE, Atlanta, GA 30309, USA  
\textsuperscript{c}Federal Reserve Bank of Boston Research Department and NBER, Federal Reserve Bank of Boston, 600 Atlantic Avenue, Boston, MA 02210, USA

Abstract

A leading explanation for the lack of widespread mortgage renegotiation is the existence of frictions in the mortgage securitization process. This paper finds similarly small renegotiation rates for securitized loans and loans held on banks’ balance sheets that become seriously delinquent, in particular during the early part of the financial crisis. We argue that information issues endemic to home mortgages, where lenders negotiate with large numbers of borrowers, lead to barriers in renegotiation. Consistent with the theory, renegotiation rates are strongly negatively correlated with the degree of informational asymmetries between borrowers and lenders over the course of the crisis.

Keywords: Securitization, Mortgage, Foreclosure, Renegotiation, Modification, Asymmetric information

\textit{JEL: D11, D12, G21}

1. Introduction

Many commentators have attributed the severity of the foreclosure crisis in the United States to the unwillingness of lenders to renegotiate mortgages. Almost every major policy action to date in the housing market has involved encouraging lenders, in one way or another, to renegotiate loan terms in order to reduce borrower debt loads. The appeal of renegotiation is simple to understand. If a lender makes a concession to a borrower, it may prevent a foreclosure. This is a good outcome for the borrower, and possibly good for the lender as well: the lender loses money only if the reduction in the value of the

\textsuperscript{*}Corresponding author. Tel: +1 404 498 8561

Email addresses: manuel.adelino@duke.edu (Manuel Adelino), Kristopher.Gerardi@atl.frb.org (Kristopher Gerardi), Paul.Willen@bos.frb.org (Paul S. Willen)
loan exceeds the loss the lender would otherwise sustain in a foreclosure. According to its proponents, renegotiation, or as it is known in industry parlance, modification of home mortgages is a win-win-win scenario, in that it helps both borrowers and lenders at little or no cost to the government.\footnote{See the discussions of Congressional Oversight Panel (2009), Zingales (2008), and Geanakoplos and Koniak (2008) for examples.}

In light of its intuitive appeal, it is surprising to find that lenders generally renegotiate a relatively small fraction of their delinquent mortgages. Our estimates show that over the period 2005 to 2011, in the year after the first 60-day delinquency, lenders reduced monthly payments for about ten percent of all borrowers. Over two years, that fraction was a quarter of all delinquent borrowers. In the early stages of the financial crisis lenders modified an even smaller fraction of their delinquent mortgages. Figure\ref{fig:1} shows that during the onset of the subprime mortgage crisis in 2007, one-year modification rates were less than two percent while two-year modification rates were less than ten percent of delinquent loans. Modification rates did increase significantly as the crisis evolved, but even at the peak of the crisis in 2009 only about 20 percent of borrowers were helped in the first year and almost two-thirds of borrowers who became 60 days delinquent received no help from their mortgage lender over the two years following delinquency.

Theories have emerged to explain the paucity of modifications. By far the most popular is the “institutional theory,” which poses that frictions in the mortgage market prevent lenders from renegotiating loans even when it is in their interest to do so. Securitization plays a central role in this narrative because the renegotiation decision is not made by the owner of the loan but by an independent agent called the servicer. As Eggert (2007) puts it, “with the loan sliced and tranched into so many separate interests, the different claimants with their antagonistic rights may find it difficult to provide borrowers with the necessary loan modifications, whether they want to or not.” Proponents of the institutional theory have maintained that, because servicers do not internalize the losses on a securitized loan, they may not behave optimally. Policymakers and researchers have also argued that the pooling and servicing agreements (PSAs), which govern the conduct of servicers when loans are securitized, place limits on the number and type of modifications a servicer can perform, and that the rules by which servicers are reimbursed for expenses may provide a perverse incentive to foreclose rather than modify.\footnote{For examples of this view see, Piskorski et al. (2010), Mayer et al. (2009) and Congressional Oversight Panel (2009) (Section III.B.2.d.i.)}

The data casts significant doubt on the institutional theory. The dashed line in Figure\ref{fig:1} labeled “1-year mod rate (Portfolio loans)” plots the time-series evolution of the modification rate associated with mortgages held in the portfolio of the lender, which is almost indistinguishable from the corresponding modification rate for the total population of loans. Indeed, at the peak of the crisis, portfolio loans were slightly less likely...
to receive modifications. Of course, not all securitization is the same, and the principal focus of the institutional theory has been the private or non-agency securitization market, which consists of mortgages securitized by private sector institutions rather than the Government Sponsored Enterprises (GSEs), Fannie Mae and Freddie Mac. Thus, we distinguish between whether the loan was held in portfolio, securitized by the GSEs, or securitized by a private firm (hereafter referred to as “Private Label Securities” or PLS loans). The bottom panel of Figure 1 shows the modification rates of the two types of securitized loans relative to portfolio loans and while there are differences, no clear pattern emerges. Early in the crisis, PLS loans were more likely to receive modifications while GSE loans were less likely to receive them, and later in the crisis, their respective positions switched. The “institutional theory” cannot explain these patterns, given that the GSEs hold all credit risk, much like banks in the case of portfolio loans.

Section 3 systematically analyzes the differences in modification rates across portfolio, PLS, and GSE loans. Here, the role of government policy potentially clouds our findings. After the Lehman Brothers bankruptcy in September of 2008, the federal government took a much more active role in the financial system in general and in the mortgage market in particular. Through the Troubled Asset Relief Program (TARP), the government took equity stakes in most of the large mortgage servicers, and then with the Home Affordable Modification Program (HAMP), it directly intervened in the modification process. For that reason, our focus is on loans that became delinquent prior to the end of 2008, as loss mitigation efforts can be observed in the absence of government intervention. In that period, a multivariate regression analysis that controls for most of the observable underwriting characteristics of loans confirms the findings in the bottom panel of Figure 1: prior to the government interventions in the mortgage market, servicers were no more likely to modify portfolio loans than PLS loans. This finding is quite robust, and holds in a number of alternative specifications and subsamples.

An alternative explanation, the “information theory”, which is modeled explicitly in Section 4, is that, in the presence of uncertainty, foreclosure can trump renegotiation even when the losses from foreclosure exceed the direct cost of renegotiation to the lender. As Wang et al. (2001) point out, most models of debt renegotiation address the case of a distressed firm facing multiple debt holders, whereas the relevant setup for understanding mortgage renegotiation is one where debt holders face a large group of potential defaulters. The underlying issue is simple: The mortgage borrower has

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3The GSEs purchase loans from originating banks and securitize those loans in mortgage-backed securities. Unlike PLS, however, when those loans default, the GSEs buy them back from the loan pool and then manage the delinquent loans themselves. The investors in agency mortgage-backed securities are thus never subject to the risk of delinquency of the mortgages in the pool.

Wang et al. (2001) and Riddiough and Wyatt (1994) both argue that information issues specific to the mortgage setting make foreclosure a better option from the lender’s perspective, and that is also the perspective of our paper. There is a long literature on the renegotiation of debt contracts in the corporate
private information about his or her current financial state and willingness to repay
the mortgage, which the lender and servicer do not observe. For example, researchers
and policy makers have pointed to the moral hazard problem whereby borrowers may
deliberately default to obtain a lower mortgage payment despite being able to afford
their stipulated payment. We show robust examples to illustrate that even when the
borrower truly cannot afford the stipulated mortgage payment but could afford a smaller
mortgage with higher net present value to the lender than the recovery from foreclosure,
foreclosure can still be the profit maximizing course of action for the lender.

The data are generally consistent with the information theory. According to the
theory, lenders weigh the benefits of preventing a particular foreclosure with the cost of
providing that same concession to all observationally equivalent borrowers. These costs
include the possibility that borrowers will “self-cure” without a modification (i.e. that
they exit delinquent status without assistance) or that borrowers will redefault after
receiving a modification. According to our data, at the beginning of the foreclosure
crisis in 2007 over 50 percent of seriously delinquent borrowers cured their delinquency
without receiving a modification. This means that if lenders could not screen borrowers
well, a large percentage of the money spent on loan modifications would have been wasted
because most borrowers would have become current on their loans without assistance.
High self-cure rates in the initial stages of the crisis are thus consistent with the low
modification rates during this time period. However, with the onset of the recession and
the corresponding increase in the unemployment rate, self-cure rates fell dramatically.
As Figure 1 shows, self-cure rates fell from almost 70 percent in 2006 to 25 percent in
2009. Consistent with the information theory, there is a substantial negative correlation
between self-cure rates and modification rates in the aggregate time-series, so that as
self-cure rates dropped over the course of the crisis, modification rates increased. In
addition, this negative correlation also holds for the differences in self-cure rates between
PLS and portfolio loans, as these are highly negatively correlated with differences in
modification rates between the two loan types.

Section 5 discusses the interpretation of our findings. The empirical evidence suggests
that information issues between borrowers and lenders are first-order in understanding
the willingness of lenders to renegotiate loans (both the aggregate trends and the relative

setting, with a particular focus on the effects of dispersed ownership (see, for example Rajan (1992),
Asquith et al (1994), and Bolton and Scharfstein (1996)). The recent European crisis has also revived a
literature on the renegotiation of sovereign debt contracts, with recent examples on this topic including

For a broad survey of bargaining with incomplete information, see Ausubel et al (2002).
Mayer et al (2013) report evidence that defaults increased after Countrywide introduced a modification
program and FHFA Director DeMarco wrote that, “A key concern with principal forgiveness has
always been the borrower incentive effects, in particular, whether borrowers who are current on their
loans and have the ability to pay will claim a hardship or actually become delinquent to capture the
differences between investors holding the loans, as shown in Figures 1 and 4. As for the
importance of the institutional theory, the weight of the empirical evidence in this paper
as well as the previous literature suggests that it played a minor role at best. First, in
the pre-intervention sample, securitization simply has no economically meaningful effect
on the probability of a modification. Second, to the extent that differences emerge in
modification rates between PLS and portfolio loans after 2009, it is not clear how they
should be interpreted. Relative to the large upward trend in the time-series of modifi-
cation rates for all types of loans over the sample period, the differences in modification
rates between PLS and portfolio loans is small. In addition, there is no direct evidence
from the previous literature that those differences are due to frictions inherent in the
securitization process as opposed to simply unobserved differences in the original quality
of loans and/or unobserved differences in the financial situation of delinquent borrowers
across the loan types. Furthermore, the model in Section 4 shows that depending on
self-cure and redefault risk, foreclosure can be more profitable for a lender than modifi-
cation. As a result, one cannot interpret higher modification rates as evidence of higher
efficiency nor can one interpret lower modification rates as evidence of frictions. Finally,
we review institutional evidence on the servicing agreements and SEC filings of servicers
of PLS loans and argue that contracts did not give incentives to servicers to foreclose
when modification was in the interest of investors.

2. Loan Modifications in the Data: 2006-2011

The dataset for this paper comes from Lender Processing Services (LPS). This is a
loan-level dataset that covers approximately 60 percent of the U.S. mortgage market and
contains detailed information on the characteristics of both purchase-money mortgages
and mortgages used to refinance existing debt. This dataset includes mortgages that
are securitized in “private-label” trusts, loans purchased and securitized by the GSEs,
and loans held in lenders’ portfolios. The variable that identifies the mortgage holder is
included as a time-varying characteristic of each loan in the data.

The main sample in the analysis consists of loans that reached 60 day delinquency
status at least once. In other words, a loan enters the sample when it first becomes 60
days delinquent and remains there until the loan terminates either through foreclosure,
prepayment or right-censoring.

2.1. Measuring Loan Modifications

We measure the frequency of mortgage modifications using a “contract-change al-
gorithm,” which is the standard approach used in the industry. The contract-change

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7For a more detailed discussion of the LPS data, please see [Foote et al.] (2009).
algorithm exploits direct, loan level information about changes in the mortgage contract, including changes in the interest rate, principal balance, and term of each loan. Table shows two examples of modifications in the data. In the first example, the servicer cuts the interest rate, capitalizes arrears into the balance of the loan, and extends the term of the loan to 40 years. In the second example, the servicer just capitalizes arrears into the balance of the loan. In both cases the loan is reported as “current” after the modification, whereas before it was reported as 90+ days delinquent.

The reason for the popularity of the contract-change approach in the industry is that it ensures that the definition of modification is consistent both over time and across different institutions. Until recently, there were no agreed upon conventions for reporting loan modifications and, as a result, different servicers reported them in different ways. One prominent example of the difficulty in obtaining consistent data on modifications directly from servicers is the difference in the aggregate numbers reported by the Office of the Comptroller of the Currency (OCC) Mortgage Metrics Reports and those shown in Hope Now’s modification reports. The OCC and Hope Now reports base their modification counts on information directly from mortgage servicers. For the third quarter of 2012, Hope Now shows a total of 143 thousand HAMP permanent modifications completed during the first three quarters of the year, compared to approximately 98 thousand HAMP completed modifications and another 74 thousand HAMP trial-period plans in the OCC report. There are similar discrepancies for the overall number of modifications performed.

In contrast, the reporting of rates, terms, balances, payments and delinquency status, the inputs into the contract change algorithms, follow decades old conventions and, as a result, are roughly constant across firms and over time. Prominent industry analyst Laurie Goodman wrote in 2009 that “it is difficult to compile a global picture via loan modification reports across different trustees given significant variance in formats.” Instead, she argues that “(...) modification can be identified by tracking any meaningful changes in interest rates, monthly payment and/or outstanding principal payments.”

Overall, comparisons of servicer-reported and contract-change modification counts

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8The Hope Now Alliance is a cooperative effort between several institutions including the U.S. federal government, housing counselors, mortgage-backed security investors, and mortgage originators, whose goal is to help homeowners that are unable to stay current on their mortgage payments. Hope Now was created in 2007 in response to the subprime mortgage crisis, and maintains a database on mortgage modifications.


suggest that the two methods do not systematically diverge. The LPS data do not include servicer reported modifications, but our algorithm was tested using data from the Columbia Collateral files, put together by Wells Fargo’s CTSLink service, which includes a similar set of variables to those in the LPS dataset (on performance of the loans and characteristics of the borrower at origination) but also includes explicit flags for modifications provided by the servicer. If one assumes, counterfactually, that the servicer data is the truth, the contract-change algorithm generates 17 percent false negatives (that is, approximately 17 percent of the modifications in the CTSLink data are not identified by the algorithm) and around the same percentage of false positives (that is, approximately 17 percent of the modifications identified by the algorithm are not flagged as modifications in the CTSLink data). The contract-change algorithm is especially likely to miss interest rate freezes on ARMs, as well as forebearance agreements. Other researchers have reported similar findings: Government Accountability Office (2012) shows that a contract-change algorithm based on the algorithm used in this paper identified 96 percent of the modifications reported by servicers in the Mortgage Metrics data provided by the Office of Thrift Supervision (OTS) in collaboration with the OCC. Anderson et al. (2012) argue that the differences between the modification rates derived from contract-change algorithms and servicer reports has narrowed dramatically over time, going from 31% of loan modifications identified by the servicers prior to 2008 to 66% in 2008 and 78% by 2011. Larry Barnett, CEO of BlackBox Logic, another large mortgage data provider, also argues that “trustees (...) vastly improved the reporting of loan modifications since 2008.” These findings are particularly relevant for this paper as the focus of the analysis is on the period prior to intense government intervention in the mortgage market in late 2008.

A comparison of the results in Agarwal et al. (2011) that uses only servicer reported modifications from the OCC/OTS Mortgage Metrics data and our results confirms that, by 2008, servicer reported data and contract-change algorithms had converged. Agarwal et al. (2011) focus exclusively on 2008 and 2009, and when we limit our sample to that time period, our results match both in terms of the modification frequencies and estimated regression coefficients.

### 2.2. Types of Renegotiation

The paper explores three different definitions of “renegotiation” in the data. The first is the narrowest definition, and consists of concessionary modifications that serve

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11The parameters of the algorithm were chosen to minimize the size of the false negative and false positive error rates. The online appendix provides details of a robustness check that changes some of the parameters of the modification algorithm to lower the false negative rate (at the expense of increasing the false positive rate). The results are not sensitive to this change.

12Both are discussed in detail in the Online Appendix to the paper.

13See [http://www.mortgageorb.com/e107_plugins/content/content.php?content.6622](http://www.mortgageorb.com/e107_plugins/content/content.php?content.6622)
to reduce a borrower's monthly payment. These are reductions in the principal balance, reductions in the interest rate, extensions of the term, or combinations of all three. This first definition of renegotiation is a key focus of the analysis because there is a consensus among many market observers that concessionary modifications are the most, and possibly only, effective way of preventing foreclosures. As the Congressional Oversight Panel for the Troubled Asset Relief Program (TARP) has written, “Any foreclosure mitigation plan must be based on a method of modifying or refinancing distressed mortgages into affordable ones. Clear and sustainable affordability targets achieved through interest rate reductions, principal write-downs, and/or term extensions should be a central component of foreclosure mitigation.”

The second definition of renegotiation is broader and includes any modification, regardless of whether it lowers the borrower’s payment. Modifications are often thought to require concessions to the borrower, but many, and in certain subperiods (especially before the onset of the financial crisis), most modifications involve the capitalization of arrears into the balance of the loan, and thus lead to increased payments.

Finally, in the unlikely event that there is a widely used type of renegotiation that the contract-change algorithm does not identify but that is used differently by servicers of PLS, portfolio, and GSE loans, the third definition of renegotiation corresponds to any instance in which a borrower “cures” after becoming 60 days delinquent (i.e. the cure rate). The definition of a cure corresponds to the case in which a loan is either current, 30 days delinquent, or prepaid following the first 60 day delinquency. Since virtually all modifications involve the lender mechanically setting the delinquent mortgage to current, this definition will pick up any form of renegotiation that the contract-change algorithm misses. For example, forms of forbearance, which are often called “repayment plans” in the industry, would not be identified by the algorithm, but would be picked up by the cure rate. It is important to stress, however, that differences in servicer renegotiation behavior are only one potential explanation for differences that may exist in cure rates and, in fact, the vast majority of instances in which a borrower becomes current are not the result of a renegotiation between the borrower and the lender. That is, differences in cure rates are a necessary condition for significant differences in renegotiation behavior, but they are not a sufficient condition. Hence, we view the parts of the analysis that use this definition as a robustness test against the possibility that important differences in renegotiation behavior between PLS and portfolio loans is not identified by the contract-change algorithm.

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14See Congressional Oversight Panel (2009, 49). This view is widely held; the main focus of the Obama Administration’s Making Home Affordable foreclosure-prevention plan was to encourage servicers to modify loans to reduce monthly payments to 31 percent of income.

15PSAs do not contain restrictions on repayment plans because such plans do not involve changing the terms of the mortgage, but the intention was to adopt the most conservative measure of modification for robustness.
2.3. Summary Statistics

Figure 3 reports the number of modifications performed each quarter from the first quarter of 2006 through the third quarter of 2011. The salient feature of the figure is the dramatic increase in the number of modifications which went from less than 10,000 per quarter in 2006 and 2007 to a peak of 150,000 per quarter in the first quarter of 2010. As far as modification types go, until 2008, almost no modifications involved principal or interest rate reductions. Indeed, almost all modifications involved principal balance increases. While this may seem perverse, delinquent borrowers have substantial arrears and if the lender wants to report the loan as current, those arrears must be paid. The easiest way for the lender to do this is simply to add the arrears to the balance of the loan. Starting in 2008, lenders started reducing interest rates, and in 2010 they started reducing principal as well, although on a relatively small scale.

The bottom panel of Figure 3 shows that until 2008, the overwhelming majority of modifications increased the mortgage payment whereas the reverse was true after 2008. Payment increasing modifications may seem illogical but they make sense for borrowers who have suffered transitory shocks like a completed spell of unemployment. These borrowers may be able to afford a higher mortgage payment but not a lump sum repayment of the arrears. Once lenders started reducing payments, the cuts were quite substantial with the average payment reduction coming in consistently at over 30 percent.

Overall, the statistics reported in Figure 3 correspond fairly closely to those reported, especially after 2008, by the OCC and OTS in their Mortgage Metrics publication. As mentioned above, LPS covers only about 60 percent of the universe of loans and the modification counts in Figure 3 are roughly 60 percent of the corresponding numbers in Mortgage Metrics after 2008.

Table 2 contains summary statistics of the characteristics at origination of both the sample of modified mortgages and the sample of all loans in the LPS dataset. The sample of modified mortgages is characterized by substantially lower credit scores, higher LTV ratios, and slightly higher debt-to-income ratios. The discrepancy in LTV ratios may be underestimated, since the percentage of mortgages with an LTV ratio of exactly 80 percent is significantly higher in the modification sample than in the full sample. This dip in modifications in the beginning of 2009 reflects the start of the Home Affordable Mortgage Program (HAMP), which introduced what were known as “trial modifications” in which the lender did not actually modify the loan but rather temporarily lowered the payments while the borrower attempted to qualify for a permanent modification. As the many borrowers who were denied permanent modifications can attest, trial modifications are not really modifications and are not recorded as such in any dataset. These are borrowers who are more likely to have taken out second mortgages, as the requirement for mortgage insurance occurs at LTV ratios above 80 percent. Our experience with other more complete datasets indicates that many of these borrowers are likely to have second mortgages that bring the cumulative LTV ratio up to 100 percent. The LPS dataset does not provide information on second mortgages, so it is not possible to construct a combined LTV ratio at origination.
likely implies a larger fraction of highly leveraged borrowers, whose second liens are not observable in the data. In addition, the modification sample includes a higher fraction of mortgages with non-traditional amortization schedules, such as interest-only loans, option ARMs, hybrid ARMs, and subprime loans.

3. Differences in Modification Behavior

This section addresses the question of whether the incidence of modification is impeded by the process of securitization. The primary estimation sample includes loans originated after January of 2005 through 2007. The performance of these loans is tracked until the end of the third quarter of 2008. The logit models presented below consider loans that become 60 days delinquent at any point between January 2005 and September 2007 and track each loan for modifications or cures for 12 months. As discussed above, this is to ensure that the significant government intervention in the mortgage market that began in late 2008 does not bias the estimates.

The estimation sample excludes loans that enter the database more than three months after being originated, as well as those with missing FICO scores, origination amounts, interest rate information, and loan-to-value (LTV) ratios, as well as those missing information about loan type (subprime or prime, and whether the purpose was for purchase or refinance).

PLS loans, portfolio loans, and loans held or securitized by the GSEs are found to be modified with similar frequency, both unconditionally and when observable differences between the loan types are taken into account.

3.1. Unconditional Renegotiation Rates

The first important fact in the data is the very low frequency of modifications for all three types of investors – Portfolio, PLS and GSEs. Panel A of Table 3 shows that, during the sample period of interest, less than 2 percent of 60 day-delinquent loans received concessionary modifications in the 12 months following the first serious delinquency; and only about 8 percent of the delinquent loans received any type of modification in the same period. These are low levels of modifications compared to the frequency of foreclosure (foreclosure proceedings were completed for almost 30 percent of the sample). Furthermore, the differences in modification frequency between the three types of loans are very small in absolute terms. There is a difference of approximately 0.5 percentage points between the lowest and the highest frequencies of concessionary modifications for the three investor types. These small differences suggest that contract frictions do not play an economically important role in inhibiting the renegotiation process for loans in securitized trusts.

The third column of Table 3 shows that cure rates in our sample are large (around 55 percent for PLS and portfolio loans, and over 67 percent for GSE loans). Given that
the unconditional modification probability is about 8 percent, this implies that many
loans cured without any intervention on the part of servicers. The second important
observation regarding cure rates is that the cure probabilities for portfolio loans and PLS
loans are quite similar, and that a larger difference only emerges for the group of GSE
loans.

3.2. Canonical Specification Results

Panel B of Table displays the estimated marginal effects from a set of logit models for
the two different modification definitions and for the cure rates. The dependent variable
is 1 if a 60 day-delinquent loan is modified at any point in the 12 months following
the first delinquency (and 0 otherwise). The first column considers payment-reducing
(concessionary) modifications, the second column includes both payment-reducing and
payment-increasing modifications, and the third column contains instances in which the
loans became current or prepaid. Standard errors are clustered at the zip code level to
account for the fact that loans in the same geographical area are likely to suffer correlated
(unobserved) shocks.

The controls in the regressions include the contract interest rate at origination, the
credit score of the borrower at origination, the loan-to-value ratio of the mortgage at
origination (not including second or third liens), the logarithm of the nominal dollar
amount of the loan, an indicator for whether the purpose of the loan was to refinance
a previous mortgage or to purchase a home, an indicator for whether the loan was
considered to be subprime, a measure of the amount of equity in the property at the
time of delinquency, specified as a percentage of the original loan balance and updated
by state-level house-price indices calculated by the Federal Housing Finance Agency
(FHFA), an indicator for a borrower who is in a position of negative equity at the time
of delinquency, where the value of the mortgage exceeds the value of the home, and the
unemployment rate of the county in which the borrower resides, calculated by the Bureau
of Labor Statistics (BLS). Also included but not reported is a set of cohort dummies
that control for the quarter when the mortgage was originated, information regarding the

18These high cure rates could, in theory, be the result of forbearance agreements or repayment plans,
but according to statistics from Agarwal et al. (2011), repayment plans constituted only a very small
fraction of loss mitigation efforts in the 2008–2009 time period.
19The 12-month horizon implies that only mortgages that become delinquent before September 2007
are considered in the logit estimation.
20Because of the lack of information on second liens in the LPS data and the prevalence of second
mortgages as a way to avoid paying mortgage insurance, the regressions include an indicator variable if
the LTV ratio is exactly equal to 80 percent. This is a proxy for whether borrowers have a second lien.
21This definition of subprime comes from the mortgage servicers that contribute to the LPS dataset.
22House prices are measured at the state level using the FHFA index. Using Case–Shiller house-price
indices measured at the MSA level produces almost identical results. The regressions use the FHFA
prices for our primary specifications because of their greater sample coverage.
23Equity and periods of unemployment are important determinants of a borrower’s decision to default
and thus should also be important factors in the modification decision.
amortization schedule of the mortgage (interest-only or negative amortization, including mortgages commonly referred to as option ARMs), an indicator for mortgages above the GSE conforming-loan limits, an indicator for primary residence, and an indicator for adjustable-rate mortgages that contain a reset provision (so-called “hybrid ARMs”).

The first column of Panel B of Table 3 shows that PLS loans were about as likely to receive concessionary modifications as loans held in portfolio, and GSE loans were about 0.2 percentage points more likely to receive this type of modification than portfolio loans. When all modifications are considered the point estimate becomes 0.6 percentage points for PLS loans and a negative 0.4 percentage points for agency loans. In the third specification, PLS loans are an estimated 1.8 percentage points more likely to cure (statistically significant at the 1 percent level), which is approximately 3 percent of the unconditional average cure rate for PLS loans. GSE loans are 7.7 percentage points more likely to cure than portfolio loans.

Censoring is an important issue in any loan-level dataset, as many loans remain active past the observed time period and could receive a modification after they drop out of the dataset. In addition, there is a small fraction of loans that are transferred to servicers that do not contribute to the LPS data, meaning that the loans drop out of the dataset. For these reasons, we estimate a Cox proportional hazard model of the transition from serious delinquency to modification. The results of the Cox estimation, expressed as hazard ratios, are reported in Panel C of Table 3.

The hazard ratio estimates are consistent with the results reported for the logits in the previous panel. The coefficient estimates are statistically significant but economically small in magnitude.

3.3. Subsample Results

Table 4 contains results for various subsamples of interest. The second column of this table reports results for the sample of subprime loans. The advantage of focusing on subprime mortgages is that the GSEs were unlikely to be the marginal investor, so it is less likely that portfolio and private-label subprime loans differ significantly on unobservable characteristics. The third column reports results from the sample of LPS mortgages for which the borrower had a FICO score of less than 620, since automated

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24The Cox model is very common in the survival-analysis literature because it is flexible in terms of functional form, since the baseline hazard function can be treated as an incidental parameter, and it is easy to estimate in terms of computational requirements. A hazard ratio less than 1 indicates that PLS or GSE loans were less likely to receive a modification compared to portfolio loans, while a ratio greater than 1 signifies the opposite.

25For example, the hazard ratio of 0.885 corresponding to concessionary modifications (first column) implies that a PLS loan with average characteristics is about 12 percent less likely on average to receive a modification than an otherwise identical portfolio loan over the sample period. Given the extremely low average modification rates for both PLS and portfolio loans in the sample period, this is an economically tiny effect (applied to the average PLS modification rate of 1.5 percentage points, this suggests that PLS loans are about 0.18 percentage points less likely to receive a modification on average).
underwriting systems generally instruct lenders to engage in increased scrutiny for such
loans because of the increased default risk. The fourth and fifth columns contain results
for samples of loans that contain the most information regarding the borrowers, in order
to try to minimize the amount of unobservable heterogeneity that could potentially bias
the results. The fourth column includes loans for which both the debt-to-income (DTI)
ratio and the documentation status contain non-missing values, while the fifth column
contains results for only the loans that were fully documented (in terms of income and
assets) at the time of origination.

The results are largely consistent with those reported in Table 3. The difference in
modification frequencies between the three groups of mortgages is small, and the esti-
mated marginal effects are not statistically different from zero for concessionary mod-
difications. The results for all modifications generally show slightly higher modification
rates for PLS loans and lower rates for GSE loans.

Columns 2–5 in Panel C of Table 4 shows the estimation results from the logit and
Cox proportional hazard models for cure rates for the subsamples of interest. In all of
the subsamples PLS loans were more likely to cure compared to portfolio loans, while
GSE loans were more likely to cure relative to both PLS and portfolio loans.

3.4. Redefault Probabilities

One concern regarding the results may be that contract frictions in securitization
trusts do not result in differences in the frequency of modifications (the “extensive”
margin) but do result in significant differences in the degree or type of modifications
which are performed (the “intensive” margin). In order to evaluate differences in the
quality of the modifications, we compare redefault rates of PLS and GSE modified loans
with those of portfolio loans. Redefault is defined to be a loan that is 60 days or more
delinquent, in the foreclosure process, or already foreclosed and owned by the lender
(REO for “real-estate-owned”) six months after the time of the modification. If there are
important differences between the manner in which servicers modify mortgages, there
should be significant differences in the subsequent performance of modified loans.

Table 5 shows that the unconditional probability that a modified mortgage redefaults
in this six-month period is large: about 42–50 percent for concessionary modifications
and about 46–58 percent for all modifications. For concessionary modifications there are
statistically significant differences between the redefault rates of PLS loans and those of
portfolio loans in the logit specification, but these differences disappear in the hazard
specification for all of the subsamples. There are even larger differences for GSE loans
in the logit specifications, which contradicts the hypothesis that securitization frictions
drive differences in performance between loans held by different investors. The differences

See Bubb and Kaufman (2009) for a more detailed discussion.
between investor types is present in redefault rates for all modifications in both the logit model and in the hazard specification, but the magnitudes are relatively small (a difference of 2.9 percentage points between PLS and portfolio loans is just 5 percent of the baseline redefault rate of 58 percent for PLS mortgages). This shows that there are no substantial differences in either the type of modification employed or in the care and effort expended by different types of servicers.

4. A Model of Renegotiation

If securitization does not prevent renegotiation, then why is it so rare? This section, discusses the incentives behind the renegotiation decision from the lender’s point of view, which, in a stylized way, mirrors the net present value (NPV) calculation that servicers are expected to perform when deciding whether to offer a borrower a modification. Servicer uncertainty about the true ability or willingness of borrowers to repay their loans (and thus their ability to cure without a modification), as well as about whether the borrower will redefault even after renegotiation, dramatically affects the NPV calculation. In fact, in the presence of asymmetric information foreclosure can dominate renegotiation even when the explicit costs of foreclosure far exceed the proposed concession by the lender, ruining what a naïve observer might think of as a “win-win” deal for the borrower and lender. In addition, moral hazard may play an important role in the lender’s modification decision. Specifically, as a lender offers a more generous modification to its eligible borrowers, it creates a financial incentive for ineligible borrowers to take hidden actions in order to gain eligibility.

Figure 2 shows a slide from a presentation by an executive from IndyMac, a mortgage lender involved in a high-profile program to renegotiate mortgages. What the flow chart on the slide illustrates is that lenders take into account two important facts: (i) not all borrowers who renegotiate avoid foreclosure and (ii) some borrowers who fail to obtain modifications still manage to avoid foreclosure. The next subsection offers a simple model of modification decisions that shows how both of these “errors” make renegotiation less attractive from the perspective of the lender.

4.1. A Simple Model of Loss Mitigation

This section develops a model of a lender’s decision to modify a delinquent mortgage. There are three periods: \( t = 0, 1, 2 \). The borrower owes a mortgage payment of size \( m \) at time 1 and is due to repay the loan balance \( M \) in period 2. The mortgage is

\[ \text{Our model shares some similarities with } \text{Bai and Zhang (2012) where the borrowing government knows the creditors' distribution of reservation values, although the model here has one lender facing many borrowers, as opposed to one borrower with multiple creditors. Our approach is also similar to Ambrose and Caponel (1996), who also identify a role for self-cure risk in assessing the profitability of a loss mitigation action.} \]
collateralized by a house, which is worth $P_1$ and $P_2$ in periods 1 and 2, respectively. In period 0, the lender has to make a decision to either modify the loan, or do nothing. If the lender fails to modify the loan, then, with probability $\alpha_0$, the borrower will default in period 1, and the lender will foreclose and recover $(P_1 - \lambda)$, where $\lambda$ is the cost of foreclosing on the property. Thus, $(1 - \alpha_0)$ corresponds to self-cure risk in the model, or the probability that a borrower behind on his mortgage will cure the delinquency without any assistance from his lender. If the borrower does not default next period, then the lender receives the periodic payment $m$ in period 1, and the borrower repays the loan in full in period 2. The value to the lender of the loan without modification equals the present discounted value of the cash flow:

$$\alpha_0 \times \min[(P_1 - \lambda), M] + (1 - \alpha_0)[m + \frac{1}{R}M],$$

ignoring discounting for the first period because there is no income in period 0. If the lender modifies the loan, by assumption the borrower makes a reduced periodic payment $m^*$ in period 1 with certainty, but then either defaults with probability $\alpha_1$ or repays a modified amount $M^*$ in period 2. Thus, the value to the lender of the modified loan is:

$$m^* + \frac{1}{R} \alpha_1 \times \min[(P_2 - \lambda), M^*] + (1 - \alpha_1) \frac{1}{R}M^*.$$  

Taking the difference between expressions (2) and (1) yields the following proposition:

**Proposition 1** The lender will modify when:

$$\alpha_0 \times \min[(P_1 - \lambda), M] + (1 - \alpha_0)[m + \frac{1}{R}M] - \min[(P_1 - \lambda), M] + (1 - \alpha_1) \frac{1}{R}M^* > 0.$$  

To interpret equation (3), assume that there is a large population of ex-ante identical borrowers, and divide the population of borrowers into three groups. The first group, with mass of $(\alpha_0 - \alpha_1)$ are borrowers who will repay in full with a modification but who will default otherwise. For this group, the lender gains the difference between the present value of the modified repayment $(m^* + \frac{1}{R}M^*)$ and the recovery given foreclosure, $\min[(P_1 - \lambda), M]$. The second group, with mass $(1 - \alpha_0)$, includes borrowers who will repay whether or not they receive a modification. For this group, the lender loses the difference between full repayment and the modified repayment. Gerardi and Willen (2009) refer to the first two terms as Type I error and Type II error, respectively, in analogy with the statistical concepts. In this context, Type I error corresponds to the cost of not renegotiating loans that need modifying, while Type II error corresponds to the cost of modifying loans that would be repaid in the absence of assistance. The third term, with mass $\alpha_1$, includes borrowers who will default regardless of whether they receive a
modification. For these borrowers, modification yields a periodic payment, but postpones
foreclosure. Whether this is good or bad for the lender depends on the evolution of house
prices and the rate at which the lender discounts the cash flow.

4.2. Model Implications

To illustrate the implications of the model, it is instructive to compute some simple
comparative statics. All else being equal, an increase in \( \alpha_0 \), makes modification more
attractive to the lender, while an increase in \( \alpha_1 \) makes modification less attractive. Intu-
itively, a higher \( \alpha_0 \) means higher Type I error and lower Type II error, and a higher \( \alpha_1 \)
implies higher Type II error. Since, in general, one would think that \( \alpha_0 \) and \( \alpha_1 \) would
move in the same direction across borrowers, it is useful to note that an increase in the
gap, \( \alpha_0 - \alpha_1 \), makes modification more attractive to the lender.

There are three important takeaways from the model. First, when looking at the
data, it is not sufficient to show that one would recover more from a modified loan than
from foreclosure \textit{ex post}, to prove that modification is \textit{ex ante} optimal. To prove that
a modification makes sense from the perspective of the lender, one must show that the
Type I error, the value of the modified loans that would have defaulted, exceeds the
Type II error, the value of the modified loans that would have paid off in the absence of
modification. \cite{White2009}, among many others, focus solely on Type I error.

It is informative to consider an extreme example with \( \alpha_1 = 0 \), which would correspond
to a level of modification \( M^{**} \) in which all borrowers would be able to repay their loans.
For simplification ignore discounting and intermediate payments \( m \) and \( m^* \), and let
\( P_1 > M^{**} > (P_1 - \lambda) \) since such an assumption ensures that borrowers have an incentive
to repay the modified loan amount, and that the bank prefers the modified repayments to
foreclosing. In this example, the gain to the large modification relative to no modification
equals

\[
\alpha_0 [M^{**} - (P_1 - \lambda)] - (1 - \alpha_0) (M - M^{**}). \tag{4}
\]

With \( \alpha_0 \) sufficiently low (high self-cure risk), modification will not make sense to the
lender. To be clear, this result does not depend on the modified loans defaulting, as the
assumption is that the modified loans will pay off in full. On the other hand, if \( \alpha_0 = 1 \)
(no self-cure risk), it may still be optimal for the lender to foreclose on some borrow-
ers. Assume that the lender is choosing between the modification amount \( M^{**} \) where
there are no foreclosures (all borrowers repay the modified amount) and an intermediate
modification amount \( M^* \) for which \( \alpha_1 > 0 \) (i.e. some borrowers redefault and experience
foreclosure). In this case, the lender prefers the more modest modification \( M^* \) if

\[
\alpha_1 \times (P_1 - \lambda - M^{**}) + (1 - \alpha_1) \times (M^* - M^{**}) > 0 \tag{5}
\]
If too many borrowers redefault after receiving the intermediate modification $M^*$, then the lender prefers to offer the larger modification, $M^{**}$. If, however, most borrowers repay the more modest modification $M^*$, then the smaller payment reduction is preferred and foreclosures will still be observed in the data. The optimal behavior on the part of the lender depends fully on the parameters.

The second point here is that both the rate at which lenders discount future payoffs and the evolution of prices affect the gains to modification. For mass $(1 - \alpha_1)$ of borrowers, modification will simply delay foreclosure. In that case, the lender will receive some extra income from any mortgage payments these borrowers make before redefaulting, but the lender has to wait longer to obtain the final payout and thus will receive less if home prices decline.

The third point is that the lender’s information set plays a crucial role here, and one could argue that it should only contain information outside the control of the borrower. This would limit the set to the origination characteristics of the loan, prices, and interest rates. Employment status, income, and marital status all present problems, although they can be partially overcome—as in the case of unemployment insurance. To the extent that income can be verified (at least imperfectly), the inclusion of income into the set of characteristics used by lenders to make modification decisions can create a disincentive for borrowers to increase their income (by moving to a better job, for example). This has been highlighted by Mulligan (2009) and Herkenhoff and Ohanian (2011). Our model indicates that the harder it is to verify information, the less these disincentives matter for employment choice by households. Delinquency status, which seems like another natural candidate, is a difficult issue. On one hand, a borrower has virtually complete control over it. On the other hand, it is a costly signal, as a 60 day delinquency does adversely affect one’s credit history and future access to credit markets. Thus, when considering ways to design a profitable modification program, which implies attempting to maximize $\alpha_0$ and minimize $\alpha_1$, a lender must restrict its information set to a relatively small set of variables that are contemporaneously exogenous to the borrower.

The full problem of asymmetric information is, however, even worse than the previous paragraphs suggest, because up until now the maintained assumption has been that self-cure and redefault risks are invariant to the size of the modifications offered. However, if more generous modifications induce otherwise healthy borrowers to default then that will lead to an increase in the self-cure rate. In other words, the decision to offer more generous terms in renegotiation induces some borrowers who previously did not seek renegotiation to do so—for example, by deliberately becoming delinquent on their loans. This problem is well known in the industry and is the moral-hazard problem of modifications. As one mid-sized servicer described it in an article in the *ABA Banking Journal*, “We are wary of the consequences of being known as a bank that forgives principal...” we have not
to date forgiven any principal.”

5. Interpreting the evidence

Even if securitization is not of first-order importance in explaining the paucity of renegotiation during the crisis, some have maintained that there is evidence that it did inhibit renegotiation to some extent and that policy makers should impose a different incentive structure on servicers of loans going forward. Our interpretation of the empirical evidence does not support such claims.

First, the relevant period to focus on for the analysis is prior to the bankruptcy of Lehman Brothers. In that period, regression analysis shows no effect of securitization on renegotiation. Piskorski et al. (2010) concur with this argument and similarly limited their sample, writing, “the behavior of participants in the market may have changed after several government interventions subsequent to this time period (e.g., Bear Sterns bailout or the Obama Administration’s Making Home Affordable Program).”

Second, lenders did not randomly assign loans to PLS securities but rather selected which loans to sell and which to keep. The endogeneity of the securitization decision necessarily clouds an interpretation of the estimated coefficient on PLS as a pure treatment effect of securitization.

Third, interpreting the estimated coefficient on PLS as evidence that securitization inhibits renegotiation requires the assumption that more modifications are always better for investors than fewer modifications. As Section 4 shows, such an assumption is wrong as a matter of economic theory. If lenders have imperfect information, it is possible to modify too many loans. The model shows that this is theoretically possible, and there is anecdotal evidence that this may be an issue in practice. This was, in fact, the allegation investors made in one of the few documented cases of mortgage servicing malfeasance.

Finally, there is significant evidence that lenders modified relatively few loans in periods before securitization became a major source of mortgage financing. Ghent (2011) shows that lenders rarely modified loans during the Great Depression, despite the fact that virtually all of the loans were held in portfolio. More recently, in 1975, Touche Ross surveyed loss mitigation activities at savings and loans and found that “[l]enders... were unwilling to either modify loans through extended terms or refinancing to a lower

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29For a more detailed discussion of this issue, and an alternative instrumental variables analysis see Adelino et al. (forthcoming).

30Mortgage-backed security investors accused Carrington, a hedge fund that serviced a series of deals, of modifying loans to avoid a delinquency trigger that would have rendered the low-rated tranches in the deals, which they happened to own, worthless (Horwitz, 2011). For the case of commercial mortgages, Liu and Quan (2011) write that “a special servicer’s compensation structure results in an incentive for her to extend a loan beyond the time desired by the bondholders.”.
rate” (Capone, 1996, 21). In the 1990s, when private-label securitization was still rare, a report commissioned by Congress to study foreclosure alternatives said, “Along with loan modifications, long-term forbearance/repayment plans are the most underutilized foreclosure avoidance tool currently available in the industry” (Capone (1996)).

5.1. Supportive Evidence of the Information Hypothesis

Overall, there is evidence that the information asymmetry between borrowers and lenders is the first-order explanation for why lenders renegotiated so few mortgages during the crisis. The constructive evidence for the information theory appears in the pattern of renegotiation over time. The top panel of Figure 1 shows that lender behavior changed over time and it did so in exactly the way that the theory in Section 4 would predict. When self-cure rates were above 60 percent, lenders essentially never reduced payments; between January of 2007 and November of 2008, the self-cure rate fell from 60 percent to 30 percent and there is a corresponding 10 fold increase in the likelihood of a borrower receiving a payment-reducing modification. When self-cure rates started to rise after the end of the recession in mid-2009, the modification rate started to fall again. Servicers did not simply avoid modifying loans at all costs but rather responded to the changing economic environment exactly how theory would predict if the main problem they faced was imperfect information about the true situation of the borrower.

To expand on the link between self-cure rates and renegotiation behavior, we explore differences across the investor types and find similar patterns. The top panel of Figure 4 compares the difference in self-cure rates and modification rates between portfolio and PLS loans. Before the crisis, there was little difference in self-cure rates and little difference in modification rates between the two loan types. Early in the crisis, self-cure rates on PLS loans rose relative to portfolio loans and PLS modification rates fell relative to portfolio. Starting in the beginning of 2008, self cure rates on portfolio loans started to fall relative to PLS and, just as one would expect, the pattern of modification activity reversed itself, with PLS modification rates rising relative to portfolio. The lower panel of Figure 3 shows a similar pattern for the difference between GSE and PLS loans. Thus, differences in self-cure rates between loan types are significantly negatively correlated with differences in modification rates, exactly as expected if information asymmetries between borrowers and lenders played an important role in the modification decision.

31 The paper focuses on self-cure rates because the predictions with respect to redefault rates are less straightforward to test empirically. In fact, the model suggests considering redefault rates conditional on the “quality” of a modification, i.e. redefaults are endogenous to the behavior of the lender itself. While this is true also for self-cures, it is less of a problem because, by definition, self-cures happen in the absence of lender intervention. 12-month redefault rates increase from 35 percent to 77 percent between 2006 and 2008 and then drop to 25 percent by the end of the first quarter of 2011 (unreported tables). This pattern generates a negative correlation with overall modification rates, consistent with the model.
The second reason why the information hypothesis is a more convincing explanation for low renegotiation rates than the securitization story is the low modification rates associated with portfolio loans through most of the crisis period. The line labeled portfolio in the bottom panel of Figure 1 is inconsistent with a theory that puts securitization at the heart of the story. Even for portfolio loans only, such a theory would have to explain why lenders renegotiated only 10 percent of loans on average, and, even at the peak of the recession, less than 20 percent. The data shows that servicers of securitized loans were granting only slightly fewer modifications than portfolio lenders, and that this difference is swamped by the time series variation in overall modification rates.

5.2. Institutional evidence on servicer incentives

The conventional wisdom about mortgage renegotiation is that the servicing contracts contain perverse incentives to foreclose when modification would benefit the investor. Our reading of the evidence is that many of the claims to that effect are speculative and that the record actually shows that servicers have powerful incentives to modify loans. As an executive from Ocwen, a major subprime servicer, wrote:

"[Foreclosures are] expensive, time consuming, and draining. (...) On the other hand, modifications (...) make financial sense for servicers when they are done prudently and carefully. (...) in most cases, a modified loan, even one in which the principal has been adjusted, generates more income for a servicer than a foreclosure."

To see why servicers actually have an incentive to modify loans, one must consider the economics of servicing. On the revenue side, a servicer of a loan receives a fixed fraction of the unpaid principal balance of each loan. This stream of payments is analogous to an Interest-Only (IO) strip, a security that pays interest but no principal, and is thus highly sensitive to duration. Anything that extends the duration of the loan increases the value of the Mortgage Servicing Right (MSR). Since foreclosures terminate loans and thus shorten duration, all else equal, a modification that prevents a foreclosure will increase the value of the MSR. Also, if a modification lowers the payment enough, it reduces the incentive of the borrower to refinance or sell, further extending the life of the loan.

From a cost perspective, foreclosures are also not any cheaper than modifications. Some have suggested that servicers can bill investors for the costs of foreclosure but

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33 This payment is typically 25 basis points per year for prime loans and 50 b.p. for subprime loans.
34 According to Nationstar, another subprime servicer, “...modifications (...) positively impact cash flows by extending the expected life of the (...) MSR and potentially producing additional revenue opportunities” (Nationstar Mortgage LLC, 10-Q for 2011:Q3, filed 2011-11-14, page 50.)
not the costs of modifications (see, for example, Piskorski et al. (2010)). The evidence shows the opposite to be the case. While servicers can recover out-of-pocket costs like legal fees and home appraisals, servicers cannot recover general administrative costs, which are typically quite large. A loan in foreclosure costs approximately $1,500 a year, and since the typical foreclosure lasts about 21 months, the unreimbursed costs of a foreclosure are approximately $2,600.\(^3\) The highest quoted figure for the out-of-pocket cost of a modification is $1,000, so that taking into account out-of-pocket costs alone, modification dominates foreclosure. Additionally, while servicers cannot bill investors for modifications, they can charge fees to borrowers which are either paid directly or added to the balance of the loan.

Another common misconception is that servicers need to obtain approval from investors to perform a modification. This is not the case, and there is no analogy here to corporate bankruptcy negotiations where debtors must negotiate with a large number of bondholders. Indeed, in almost all cases, the contract that governs the relationship between servicers and MBS investors gives the servicer broad latitude to act “in the best interests of investors” and does not require the servicer to obtain the permission of any investors to modify a loan.\(^3\)

Finally, there are a number of factors that limit renegotiation for portfolio lenders as well. Accounting rules force lenders (i) to take writedowns at the time of the modification, (ii) to identify modified loans as troubled debt restructurings (under FAS 15), and (iii) to impose burdensome reporting requirements on modified loans, including loan-specific allowances for potential losses (under FAS 114). Finally, payments made by borrowers for loans that are subject to “troubled debt restructurings” are recognized only as principal repayments and generate no interest income until the bank can demonstrate that a borrower is “performing.”

5.3. Comparison with related work

In comparing the empirical results in this paper with related work, there is a certain dissonance. On one hand, our results are consistent with previously published work. Piskorski et al. (2010) focus on the period prior to the Lehman bankruptcy and find a similarly small difference in conditional cure rates. Agarwal et al. (2011) use data on delinquent mortgages in the 2008-2009 sample period, but use servicer reported modifications rather than an algorithm. They estimate a marginal effect of -2.4 percentage points

\(^3\)The foreclosure cost and modification cost figures are from Ocwen Financial Corp. 2011 10-K, filed 2012-02-29, page 34. Foreclosure length is from LPS Mortgage Monitor, Dec. 2011.

\(^3\)Hunt (2009) conducts an exhaustive review of PSAs and concludes that “large-scale modification programs may be undertaken without violating the plain terms of PSAs in most cases.” Also, none of the more than 800 lawsuits filed by subprime-mortgage investors through the end of 2008 involved the right of a servicer to modify a loan (Navigant report, Congressional Oversight Panel (2008)).
associated with the PLS indicator variable, whereas our regressions show a marginal effect of -2.7 percentage points for the same sample period (regression shown in the Online Appendix to the paper).

However, despite the consistent empirical findings, when it comes to the implications we part ways. Whereas Piskorski et al. (2010) and Agarwal et al. (2011) both conclude securitization prevented renegotiation on a wide scale, and thus played a major role in the crisis, this paper argues the exact opposite. There are three reasons for this difference, two technical and one conceptual. First, the post-Lehman sample period used by Agarwal et al. (2011) is contaminated by government intervention. In our choice of the sample period, this paper concurs with Piskorski et al. (2010). Second, the relevant measure of renegotiation is modifications, not all cures. While Piskorski et al. (2010) use the same sample period and same dataset, they draw their conclusions from foreclosure and cure rates rather than modification rates.

Whereas this paper concurs with Piskorski et al. (2010) on the appropriate sample period, in our use of modification rates our view is the same as Agarwal et al. (2011). Piskorski et al. (2010) justify looking at cure rates on the grounds that by looking only at modifications, one might overlook other loss mitigation techniques like repayment plans and forbearance agreements. Agarwal et al. (2011) show that alternatives to modification were rare, ineffective, and their use did not differ at all across different forms of ownership. For example, borrowers with PLS loans were just as likely to obtain repayment plans as borrowers with portfolio loans.

The deeper reason for our different conclusions on the question at hand is our focus on the economic significance of the differences that emerge, whereas the focus of the previous literature has mostly been on the statistical significance of the empirical findings. Even ignoring the endogeneity problems discussed above, the estimated marginal effect associated with securitization in Agarwal et al. (2011) is 2.4 percentage points. Out of every 100,000 borrowers who became seriously delinquent during the worst recession in 75 years, 85,000 received no assistance from their lenders; taking the estimated coefficient as a pure treatment effect, securitization can explain why 2,400 people did not receive modifications who should have, but that explanation is silent about the other 82,600.

6. Conclusion

There is widespread concern that an inefficiently low number of mortgages have been modified during the recent financial crisis and that this has led to excessive foreclosure levels, leaving both families and investors worse off. This paper considers whether delinquent loans have different probabilities of renegotiation depending on their securitization status.

The first finding is that renegotiation in mortgage markets during this period was rare. In our preferred sample of data, less than 2 percent of the seriously delinquent
borrowers received a concessionary modification, while approximately 8 percent received some type of modification.

The second finding is that a comparison of renegotiation rates for PLS and portfolio loans yields economically small and statistically insignificant differences. Similar conclusions are reached for loans securitized by the GSEs. These findings hold for a battery of robustness tests, including various definitions of modification, numerous subsamples of the data (such as those for which unobserved heterogeneity is less of an issue), and consideration of potential differences along the intensive margin of renegotiation.

Since contract frictions in securitization trusts are not a significant problem, this paper argues that the data are consistent with a situation in which, on average, lenders expect to recover more from foreclosure than from a modified loan. The model proposed here points in particular to two types of risks that can dramatically increase the cost of modifying a mortgage. The first is “self-cure risk,” which refers to the situation in which a lender renegotiates with a delinquent borrower who does not need assistance. The second cost comes from borrowers who default again after receiving a loan modification. This group of “redefaulters” is large, as our results show that a large fraction (between 40 and 60 percent) of borrowers who receive modifications end up back in serious delinquency within six months. In addition, consistent with the simple model of renegotiation developed in this paper, there is a significant negative correlation between self-cure rates and modification rates that holds in the aggregate time-series as well as in cross-sectional differences across loan types. As self-cure rates decreased and the informational asymmetries between borrowers and lenders became less severe over the course of the crisis, renegotiation rates increased dramatically, rising from approximately 3 percent of delinquent mortgages in early 2007 to approximately 20 percent in early 2010.

If the presence of self-cure risk, redefault risk, and moral hazard stemming from asymmetric information do make renegotiation less appealing to investors, the number of easily “preventable” foreclosures may be far smaller than many commentators believe. Additional evidence for these assertions can be ascertained from an analysis of the success of HAMP, the Obama administration’s signature foreclosure-prevention program. Earlier versions of this paper (Adelino et al. (2009)) argued that HAMP would not succeed at preventing large numbers of foreclosures because it largely focused on the institutional obstacles to renegotiation and ignored informational frictions. At the time of our earlier writing, HAMP was in its infancy; two years later, HAMP was widely perceived to be a failure. This failure is strong evidence that institutional factors cannot explain why lenders renegotiate so few mortgages.

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References


Fig. 1. Loan modifications, 2005-2011. Modifications are measured over the period (one year or two years) following the month that a loan becomes 60 days delinquent. See Section 2 for a full discussion of the methodology. “Portfolio” refers to loans held on banks’ balance sheets, GSE refers to loans securitized by the government sponsored enterprises, and “Privately Securitized” are loans in private label trusts. Shaded areas indicate the period of heavy government intervention starting with the Lehman bankruptcy. The top panel shows trends as a fraction of all delinquent loans, and the second panel shows the rate of modifications for securitized loans as a fraction of the rate of modification of portfolio loans.
Fig. 2. Slide From a Presentation About the IndyMac Foreclosure Prevention Program
Fig. 3. Loan modifications, 2007-2011. Modifications are measured over the year following the first 60 day delinquency. See Section 2 for a full discussion of the methodology. The top panel shows the total number of modifications and also a time series of the number of loans that receive a principal reduction or an interest rate reduction. The bottom panel shows the number of modifications for loans that become 60 days delinquent in each month where the payment increased and where the monthly payment was reduced, as well as the percentage change in payment for each of those types of modifications.
Fig. 4. Relative changes in self-cures and modifications. Modifications are measured over the year following the first 60 day delinquency. See Section 2 for a full discussion of methodology. “Portfolio” refers to loans held on banks’ balance sheets, GSE refers to loans securitized by the government sponsored enterprises, and “Private Label” are loans that are privately securitized. Each line tracks the difference in modification rates by month between types of loans, so “PLS-Portfolio” shows the difference in 12-month modification rates between PLS and portfolio loans that become delinquent in each month. The bottom panel shows the same calculation for GSE and PLS loans.
Table 1
Examples of Modifications in the Data

Example 1: Servicer cuts interest rate, capitalizes arrears in the balance of the loan, and extends term to 40 years.

<table>
<thead>
<tr>
<th>Date</th>
<th>Delinquency Status</th>
<th>Interest Rate</th>
<th>Monthly Payment</th>
<th>Outstanding Balance</th>
<th>Remaining Term in Months</th>
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</tbody>
</table>

Example 2: Servicer capitalizes arrears into the balance of the loan but otherwise leaves the loan unchanged.

<table>
<thead>
<tr>
<th>Date</th>
<th>Delinquency Status</th>
<th>Interest Rate</th>
<th>Monthly Payment</th>
<th>Outstanding Balance</th>
<th>Remaining Term in Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008m5</td>
<td>6</td>
<td>9.25</td>
<td>1,726</td>
<td>208,192</td>
<td>346</td>
</tr>
<tr>
<td>2008m6</td>
<td>9</td>
<td>9.25</td>
<td>1,726</td>
<td>208,192</td>
<td>346</td>
</tr>
<tr>
<td>2008m7</td>
<td>9</td>
<td>9.25</td>
<td>1,726</td>
<td>208,192</td>
<td>346</td>
</tr>
<tr>
<td>2008m8</td>
<td>C</td>
<td>9.25</td>
<td>1,815</td>
<td>218,316</td>
<td>341</td>
</tr>
<tr>
<td>2008m9</td>
<td>C</td>
<td>9.25</td>
<td>1,815</td>
<td>218,184</td>
<td>340</td>
</tr>
</tbody>
</table>

Notes: The table shows two examples of modifications in the data. The second column of each panel shows the delinquency status as it appears in the LPS data. “6” represents a 60 day delinquent loan, “9” represents 90-day delinquency and “C” means that a loan is current. Interest rate is a percentage, monthly payment and monthly balance are shown in dollars.
Table 2
Loan Characteristics of Modified Mortgages

Panel A: Distribution of key indicators

<table>
<thead>
<tr>
<th>Level at Origination</th>
<th>All Loans</th>
<th>Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># of obs.</td>
<td>Mean</td>
</tr>
<tr>
<td>FICO</td>
<td>4,250,249</td>
<td>670</td>
</tr>
<tr>
<td>LTV</td>
<td>4,600,462</td>
<td>82%</td>
</tr>
<tr>
<td>DTI</td>
<td>3,291,954</td>
<td>39%</td>
</tr>
<tr>
<td>Mortgage balance</td>
<td>4,651,258</td>
<td>$237k</td>
</tr>
</tbody>
</table>

Panel B: Share of loans with key characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All Loans</th>
<th>Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTV = 80</td>
<td>15.3%</td>
<td>14.7%</td>
</tr>
<tr>
<td>Subprime</td>
<td>12.1%</td>
<td>15.9%</td>
</tr>
<tr>
<td>Fixed</td>
<td>67.0%</td>
<td>70.5%</td>
</tr>
<tr>
<td>Hybrid ARM</td>
<td>15.1%</td>
<td>14.0%</td>
</tr>
<tr>
<td>IO-ARM</td>
<td>11.5%</td>
<td>9.3%</td>
</tr>
<tr>
<td>IO-Fixed</td>
<td>4.1%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Owner</td>
<td>91.0%</td>
<td>97.0%</td>
</tr>
<tr>
<td>Investor</td>
<td>6.5%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Vacation Home</td>
<td>3.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Purchase</td>
<td>49.5%</td>
<td>44.0%</td>
</tr>
<tr>
<td>Low/No Documentation</td>
<td>30.1%</td>
<td>30.3%</td>
</tr>
</tbody>
</table>

Notes: These statistics were computed using a 100 percent sample of the LPS data for mortgages and modifications that occurred before October 2008. The column headings p25, p50, and p75 denote the 25th, 50th, and 75th percentiles, respectively. FICO is the credit score of the borrower, LTV stands for loan-to-value ratio, DTI stands for debt-to-income ratio, “Fixed” refers to fixed-rate mortgages, “ARM” refers to adjustable-rate mortgages, “IO” stands for interest-only mortgages. Hybrid ARMs have an initial period with a fixed rate and then become adjustable-rate mortgages. Option-ARMs and Option-Fixed mortgages offer the borrower alternative payment options during an initial period, often including the possibility of “negative amortization” (that is, not making the full interest payment). “Owner,” “Investor,” and “Vacation Home” refer to the status of the property as being owner-occupied, not occupied by the owner, or a vacation home.
### Table 3
Modifications (Main Sample)

#### Panel A: Unconditional Percentage of Modified Delinquent Loans

<table>
<thead>
<tr>
<th></th>
<th>Concessionary Mods</th>
<th>All Mods</th>
<th>Cures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio</td>
<td>0.013</td>
<td>0.084</td>
<td>0.558</td>
</tr>
<tr>
<td>PLS</td>
<td>0.015</td>
<td>0.081</td>
<td>0.535</td>
</tr>
<tr>
<td>GSE</td>
<td>0.010</td>
<td>0.063</td>
<td>0.675</td>
</tr>
</tbody>
</table>

#### Panel B: Logit Regressions (12-month horizon)

<table>
<thead>
<tr>
<th></th>
<th>Concessionary Mods</th>
<th>All Mods</th>
<th>Cures</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLS</td>
<td>0.001</td>
<td>0.008***</td>
<td>0.018***</td>
</tr>
<tr>
<td>(0.85)</td>
<td>(4.37)</td>
<td>(6.83)</td>
<td></td>
</tr>
<tr>
<td>GSE</td>
<td>0.002***</td>
<td>-0.004**</td>
<td>0.077***</td>
</tr>
<tr>
<td>(2.81)</td>
<td>(2.50)</td>
<td>(27.38)</td>
<td></td>
</tr>
<tr>
<td>Initial Rate</td>
<td>0.002***</td>
<td>-0.001**</td>
<td>-0.039***</td>
</tr>
<tr>
<td>(10.64)</td>
<td>(2.46)</td>
<td>(52.18)</td>
<td></td>
</tr>
<tr>
<td>LTV Ratio</td>
<td>0.000*</td>
<td>0.000</td>
<td>-0.004***</td>
</tr>
<tr>
<td>(1.66)</td>
<td>(0.95)</td>
<td>(5.21)</td>
<td></td>
</tr>
<tr>
<td>FICO</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.002***</td>
</tr>
<tr>
<td>(1.33)</td>
<td>(0.23)</td>
<td>(9.87)</td>
<td></td>
</tr>
<tr>
<td>Log (Original Amount)</td>
<td>0.002***</td>
<td>0.009***</td>
<td>-0.041***</td>
</tr>
<tr>
<td>(4.50)</td>
<td>(9.91)</td>
<td>(16.61)</td>
<td></td>
</tr>
<tr>
<td>Equity at Delinquency</td>
<td>0.000</td>
<td>-0.006***</td>
<td>0.030</td>
</tr>
<tr>
<td>(0.00)</td>
<td>(4.54)</td>
<td>(1.04)</td>
<td></td>
</tr>
<tr>
<td>Negative Equity</td>
<td>-0.001</td>
<td>-0.013***</td>
<td>-0.074***</td>
</tr>
<tr>
<td>(0.93)</td>
<td>(4.47)</td>
<td>(9.09)</td>
<td></td>
</tr>
<tr>
<td>Unemployment</td>
<td>0.000</td>
<td>-0.001***</td>
<td>-0.007***</td>
</tr>
<tr>
<td>(0.73)</td>
<td>(3.83)</td>
<td>(6.09)</td>
<td></td>
</tr>
<tr>
<td>Refinance</td>
<td>0.002***</td>
<td>0.009***</td>
<td>0.053***</td>
</tr>
<tr>
<td>(5.38)</td>
<td>(9.33)</td>
<td>(19.34)</td>
<td></td>
</tr>
<tr>
<td>Subprime</td>
<td>0.001**</td>
<td>-0.011***</td>
<td>-0.034***</td>
</tr>
<tr>
<td>(2.61)</td>
<td>(9.53)</td>
<td>(13.99)</td>
<td></td>
</tr>
<tr>
<td>Other Controls</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td># Mortgages</td>
<td>445,431</td>
<td>445,431</td>
<td>445,431</td>
</tr>
</tbody>
</table>

#### Panel C: Duration Model

<table>
<thead>
<tr>
<th></th>
<th>Concessionary Mods</th>
<th>All Mods</th>
<th>Cures</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLS</td>
<td>0.885***</td>
<td>1.029**</td>
<td>0.959**</td>
</tr>
<tr>
<td>(5.84)</td>
<td>(2.37)</td>
<td>(8.56)</td>
<td></td>
</tr>
<tr>
<td>GSE</td>
<td>1.117***</td>
<td>0.829***</td>
<td>1.104***</td>
</tr>
<tr>
<td>(4.44)</td>
<td>(14.75)</td>
<td>(19.45)</td>
<td></td>
</tr>
<tr>
<td># Mortgages</td>
<td>1,040,494</td>
<td>1,040,494</td>
<td>1,040,494</td>
</tr>
</tbody>
</table>

Notes: *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Panel B shows the marginal effects of logit regressions with a 12-month horizon; t-statistics shown below the coefficients. Standard errors are clustered at the zip code level. Panel C shows hazard-ratio estimates from a Cox proportional hazard model. The dependent variable in the first column (“concessionary mods”) is an indicator for modifications where the borrower received a reduction in the monthly payment. The second column (“all mods”) includes concessionary modifications as well as modifications that increase the borrower’s monthly payment. The column labeled “cures” refers to a loan that becomes either current, 30 days delinquent, or prepaid 12 months after the first 60 day delinquency. “PLS” is an indicator variable for whether the loan was privately securitized (as opposed to being on a bank’s balance sheet) at the time that it became seriously delinquent. FICO is the credit score of the borrower and LTV stands for loan-to-value ratio at origination. “Equity at Delinquency” is the difference between the outstanding balance of the loan and the estimated value of the house at the time of delinquency, based on state-level house-price indices calculated by the Federal Housing Finance Agency (FHFA). “Negative Equity” is an indicator for a borrower whose outstanding balance exceeds the value of the home. “Unemployment” is the rate of unemployment at the county level. Other controls include “LTV = 80,” which is an indicator variable for whether the LTV ratio at origination is exactly 80 percent; FICO squared; indicator variables for FICO scores below 620 and FICO scores between 620 and 680; indicators for jumbo mortgages (those above the GSEs’ conforming-loan limit); Option, Hybrid, and Interest-Only mortgages (see detailed description in the notes to Table 2); and indicators for condos and multifamily homes.
<table>
<thead>
<tr>
<th>Panel A: Concessionary Modifications</th>
<th>All Loans</th>
<th>Subprime FICO &lt; 620</th>
<th>Non Missing Documentation and DTI</th>
<th>Full Documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Mean</td>
<td>0.013</td>
<td>0.015</td>
<td>0.012</td>
<td>0.011</td>
</tr>
<tr>
<td>PLS Mean</td>
<td>0.015</td>
<td>0.017</td>
<td>0.018</td>
<td>0.015</td>
</tr>
<tr>
<td>GSE Mean</td>
<td>0.010</td>
<td>0.017</td>
<td>0.011</td>
<td>0.010</td>
</tr>
<tr>
<td>PLS Mg. Eff. (Logit)</td>
<td>0.001</td>
<td>0.000</td>
<td>0.001</td>
<td>0.062**</td>
</tr>
<tr>
<td>GSE Mg. Eff. (Logit)</td>
<td>0.002**</td>
<td>0.002</td>
<td>0.008***</td>
<td>0.005***</td>
</tr>
<tr>
<td></td>
<td>(2.51)</td>
<td>(9.94)</td>
<td>(3.65)</td>
<td>(3.81)</td>
</tr>
<tr>
<td>PLS (Hazard Ratio)</td>
<td>0.885***</td>
<td>0.933**</td>
<td>0.898***</td>
<td>0.947**</td>
</tr>
<tr>
<td></td>
<td>(4.37)</td>
<td>(1.47)</td>
<td>(4.73)</td>
<td>(7.38)</td>
</tr>
<tr>
<td>GSE (Hazard Ratio)</td>
<td>1.117***</td>
<td>0.483***</td>
<td>1.427***</td>
<td>1.499**</td>
</tr>
<tr>
<td></td>
<td>(4.44)</td>
<td>(24.24)</td>
<td>(9.03)</td>
<td>(12.03)</td>
</tr>
<tr>
<td># Mortgages</td>
<td>445,431</td>
<td>206,752</td>
<td>177,491</td>
<td>246,398</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: All Modifications</th>
<th>All Loans</th>
<th>Subprime FICO &lt; 620</th>
<th>Non Missing Documentation and DTI</th>
<th>Full Documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Mean</td>
<td>0.084</td>
<td>0.077</td>
<td>0.079</td>
<td>0.082</td>
</tr>
<tr>
<td>PLS Mean</td>
<td>0.081</td>
<td>0.084</td>
<td>0.095</td>
<td>0.088</td>
</tr>
<tr>
<td>GSE Mean</td>
<td>0.063</td>
<td>0.074</td>
<td>0.075</td>
<td>0.062</td>
</tr>
<tr>
<td>PLS Mg. Eff. (Logit)</td>
<td>0.006***</td>
<td>-0.004</td>
<td>0.013***</td>
<td>0.010***</td>
</tr>
<tr>
<td>GSE Mg. Eff. (Logit)</td>
<td>-0.004**</td>
<td>-0.007</td>
<td>0.005**</td>
<td>-0.013**</td>
</tr>
<tr>
<td></td>
<td>(2.50)</td>
<td>(10.93)</td>
<td>(1.68)</td>
<td>(6.56)</td>
</tr>
<tr>
<td>PLS (Hazard Ratio)</td>
<td>1.029**</td>
<td>0.933***</td>
<td>1.117***</td>
<td>1.046**</td>
</tr>
<tr>
<td></td>
<td>(2.37)</td>
<td>(3.67)</td>
<td>(5.51)</td>
<td>(2.92)</td>
</tr>
<tr>
<td>GSE (Hazard Ratio)</td>
<td>0.820**</td>
<td>0.483***</td>
<td>0.830***</td>
<td>0.765**</td>
</tr>
<tr>
<td></td>
<td>(14.75)</td>
<td>(24.24)</td>
<td>(8.61)</td>
<td>(15.45)</td>
</tr>
<tr>
<td># Mortgages</td>
<td>445,431</td>
<td>206,752</td>
<td>177,491</td>
<td>246,398</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel C: All Cures</th>
<th>All Loans</th>
<th>Subprime FICO &lt; 620</th>
<th>Non Missing Documentation and DTI</th>
<th>Full Documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Mean</td>
<td>0.558</td>
<td>0.532</td>
<td>0.597</td>
<td>0.555</td>
</tr>
<tr>
<td>PLS Mean</td>
<td>0.535</td>
<td>0.552</td>
<td>0.626</td>
<td>0.565</td>
</tr>
<tr>
<td>GSE Mean</td>
<td>0.675</td>
<td>0.692</td>
<td>0.717</td>
<td>0.698</td>
</tr>
<tr>
<td>PLS Mg. Eff. (Logit)</td>
<td>0.018***</td>
<td>0.056***</td>
<td>0.055***</td>
<td>0.040***</td>
</tr>
<tr>
<td>GSE Mg. Eff. (Logit)</td>
<td>0.077***</td>
<td>0.083***</td>
<td>0.078***</td>
<td>0.079**</td>
</tr>
<tr>
<td></td>
<td>(27.38)</td>
<td>(12.91)</td>
<td>(17.84)</td>
<td>(22.27)</td>
</tr>
<tr>
<td>PLS (Hazard Ratio)</td>
<td>0.959***</td>
<td>1.049***</td>
<td>1.020**</td>
<td>1.037**</td>
</tr>
<tr>
<td></td>
<td>(5.56)</td>
<td>(4.29)</td>
<td>(5.56)</td>
<td>(4.44)</td>
</tr>
<tr>
<td>GSE (Hazard Ratio)</td>
<td>1.184***</td>
<td>1.118***</td>
<td>1.095***</td>
<td>1.144**</td>
</tr>
<tr>
<td></td>
<td>(19.45)</td>
<td>(9.21)</td>
<td>(11.03)</td>
<td>(20.29)</td>
</tr>
<tr>
<td># Mortgages</td>
<td>445,431</td>
<td>206,752</td>
<td>177,491</td>
<td>246,398</td>
</tr>
</tbody>
</table>

Notes: *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. The first three rows of each panel refer to portfolio and PLS unconditional probabilities of modification in each sample; the fifth and seventh rows show marginal effects computed from logit models with a 12-month horizon that include all the controls described in Table 3; the fifth and seventh rows in each panel show hazard ratios computed from Cox proportional hazard models with the same controls as in Table 3; t-statistics are reported below the marginal effects and z-statistics are shown below the coefficients from the Cox models. Standard errors are clustered at the zip code level. The dependent variables follow the same definitions as those in Table 3. “PLS” is an indicator variable for whether the loan was privately securitized (as opposed to being on a bank’s balance sheet) at the time that it became 60 days delinquent. The first set of results in all three panels includes all loans, the second set has only subprime loans, the third set includes only loans with a credit score below 620, the fourth set has observations where debt-to-income and documentation status are non-missing in the data, and the last column in each panel includes only loans that have full documentation; each set includes only loans that have become 60 days delinquent.
Table 5
Redefault Conditional on Modification

<table>
<thead>
<tr>
<th></th>
<th>Concessionary Mods</th>
<th>All Mods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Loans</td>
<td>FICO &lt; 620</td>
</tr>
<tr>
<td>Portfolio Mean</td>
<td>0.419</td>
<td>0.449</td>
</tr>
<tr>
<td>PLS Mean</td>
<td>0.495</td>
<td>0.487</td>
</tr>
<tr>
<td>GSE Mean</td>
<td>0.471</td>
<td>0.541</td>
</tr>
<tr>
<td>PLS Mg. Eff. (Logit)</td>
<td>0.069***</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>(6.47)</td>
<td>(0.40)</td>
</tr>
<tr>
<td>GSE Mg. Eff. (Logit)</td>
<td>0.120***</td>
<td>0.171***</td>
</tr>
<tr>
<td></td>
<td>(8.24)</td>
<td>(7.09)</td>
</tr>
<tr>
<td>PLS (Hazard Ratio)</td>
<td>0.943</td>
<td>1.116</td>
</tr>
<tr>
<td></td>
<td>(0.25)</td>
<td>(0.23)</td>
</tr>
<tr>
<td>GSE (Hazard Ratio)</td>
<td>1.248</td>
<td>1.505</td>
</tr>
<tr>
<td></td>
<td>(0.97)</td>
<td>(0.86)</td>
</tr>
<tr>
<td># Mortgages</td>
<td>23,156</td>
<td>10,858</td>
</tr>
</tbody>
</table>

Notes: *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. The dependent variable in all regressions in this table is “redefault” defined as loans that are 60 days delinquent, 90 days delinquent, in the process of foreclosure, or in REO 6 months after a modification. The first three rows refer to portfolio, PLS, and GSE, unconditional probabilities of redefault in each sample; the fourth and sixth rows show marginal effects computed from logit models with a 6-month horizon that include all the controls described in Table 3; the eighth and tenth rows show hazard ratios computed from Cox proportional hazard models with the same controls as in Table 3; t-statistics are reported below the marginal effects and z-statistics are shown below the coefficients from the Cox models. Standard errors are clustered at the zip code level.