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The role of securitization in mortgage renegotiation ☆

Sumit Agarwal [a], Gene Amromin [a], Itzhak Ben-David [b,*], Souphala Chomsisengphet [c], Douglas D. Evanoff [a]

[a] Federal Reserve Bank of Chicago, United States
[b] Fisher College of Business, The Ohio State University, 2100 Neil Avenue, Columbus, OH 43210, United States
[c] Office of the Comptroller of the Currency, United States

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ABSTRACT

We study the effects of securitization on renegotiation of distressed residential mortgages over the current financial crisis. Unlike prior studies, we employ unique data that *directly* observe lender renegotiation actions and cover more than 60% of the U.S. mortgage market. Exploiting within-servicer variation in these data, we find that bank-held loans are 26–36% more likely to be renegotiated than comparable securitized mortgages (4.2–5.7% in absolute terms). Also, modifications of bank-held loans are more efficient: conditional on a modification, bank-held loans have 9% lower post-modification default rates (3.5% in absolute terms). Our findings support the view that frictions introduced by securitization create a significant challenge to effective renegotiation of residential loans. We also provide evidence supporting the affordability focus of recent policy actions, such as the Home Affordability Modification Program.

1. Introduction

With the recent boom and bust of the housing market and the resulting financial crisis, mortgage delinquency rates and consequent foreclosures have reached unprecedented levels (Mayer, Pence, and Sherlund, 2009; Mayer, 2010). The wave of foreclosures triggered an active debate among policymakers and academics about whether securitization impeded alternative loss mitigation practices such as renegotiation of distressed loans, thereby aggravating the housing crisis [e.g., Adelino, Gerardi, and Willen (2009a, 2009b) and Foote, Gerardi, Goette, and Willen (2009) vs. Piskorski, Seru, and Vig (2010), Posner and Zingales (2009), and Mayer (2010)]. The debate stems in part from the absence of direct data on renegotiations. The earlier studies approached this question indirectly, either by studying outcomes such as foreclosure rates (Piskorski, Seru, and Vig, 2010) or by using

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* Corresponding author. Tel.: +1 614 292 7843;
fax: +1 614 292 2418.
E-mail address: ben-david@fisher.osu.edu (I. Ben-David).

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heuristic algorithms to identify renegotiation (Adelino, Gerardi, and Willen, 2009a, 2009b; Foote, Gerardi, Goette, and Willen, 2009).

In contrast, our paper uses direct and precise data on renegotiation actions of lenders and, therefore, has the potential to clarify this issue and settle the debate. We find that distressed securitized loans are significantly less likely to be renegotiated (up to 36% in relative terms) than similar bank-held loans. Moreover, modifications of bank-held loans are more efficient—conditional on modification, bank-held loans have lower post-modification default rates (of about 9% in relative terms). Our results are consistent with the findings in Piskorski, Seru, and Vig (2010) and inconsistent with the results of Adelino, Gerardi, and Willen (2009a, 2009b) and Foote, Gerardi, Goette, and Willen (2009). Further, our study provides precise estimates on intensity and efficiency of mortgage renegotiations over a period when lenders and investors were free to pursue their own approaches.

We use a unique and detailed dataset known as the OCC-OTS Mortgage Metrics that contains precise loss mitigation and performance outcomes for about 64% of U.S. mortgages.[1] We primarily focus on loss mitigation resolutions that took place for mortgages that became "in trouble" (seriously delinquent or entered loss mitigation programs) in 2008, a period with virtually no government intervention in the private mortgage market. We track loans until May 2009 to examine the loss mitigation resolution. The dataset is a loan-level panel made up 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 delinquent loan undergoing modification, the dataset reports 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.

The thrust of our study is the evaluation of the choice between different loss mitigation practices. We classify resolution practices into four main categories: liquidation, modification, repayment plans, and refinancing. Liquidation includes foreclosure, deed-in-lieu, and short sales. 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, or term. Repayment plans are short-term programs that allow borrowers to repay late mortgage payments, typically, over a six- to twelve-month period. Refinancing occurs when a new loan is issued in place of the existing one.[2] While liquidation implies that the borrower loses the house, the three other renegotiation categories imply that the borrower can stay in the house.

As a preliminary analysis, we examine the distribution of mitigation outcomes for mortgages that became seriously delinquent. 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), 10.0% are modified, 2.6% enter a repayment plan, and 2.4% get refinanced. The rest (about 54%) have no recorded action. A year following delinquency, about half of borrowers are in liquidation, about 23% of loans have been renegotiated, and about 25% had no action. While the absolute levels of renegotiation rates might seem low, one needs to remember that no theoretical benchmark exists on the optimal number of loan renegotiations. In the absence of such a benchmark, it is hard to comment on whether the observed levels of renegotiations are too high or too low.

In our main analysis, we explore the effect of securitization on the likelihood of loans to be renegotiated, or more specifically—modified. This topic was the focus of a policy and academic debate,[3] and was empirically tested in some earlier papers. Piskorski, Seru, and Vig (2010) show that the foreclosure rate of portfolio-owned delinquent loans is 3–7% lower in absolute terms than that of comparable loans that are securitized (13–32% in relative terms). Further, they find that around the early pay default date, the foreclosure rate is lower for securitized loans that are repurchased by lenders than for securitized loans that remain with the lenders. They argue that the higher rate of foreclosure among securitized loans is evidence of securitization hampering renegotiation. Adelino, Gerardi, and Willen (2009a, 2009b) and Foote, Gerardi, Goette, and Willen (2009) also examine the question by algorithmically flagging loans that had interest rate reductions, term extensions, or loan balance changes as modifications. The algorithm was tested on mortgage data of Wells Fargo, and the authors find approximately 15% false positive and 15% false negative outcomes. Using their modification flag, the authors conclude that private level securitized loans were not any less likely to be modified.

Our unique data allow us to observe renegotiation actions (modification, refinance, and repayment) directly and, therefore, we can evaluate the rates of loan renegotiation and modification without any error. We find that the rate of renegotiation within six months of delinquency is 4.2–5.7 percentage points (26–36% in relative terms) higher for portfolio loans. We find that the rate of loan modification, which constitutes the lion's share (over 75%) of private

[1] Our data are more detailed than have been used in the literature so far (see Section 2). Moreover, the dataset is comprehensive and comparable to previous studies, as is explained in the validity tests in the Appendix, where we compare some basic regressions estimated in previous studies (e.g., Piskorski, Seru, and Vig, 2010) and our data.

[2] 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 Mac. The

(*footnote continued*)
program is limited to performing loans with high loan-to-value (LTV) ratios (up to 125%). More information is available athttp://makingho meaffordable.gov/refinance_eligibility.html.

[3] 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, Quercia, Ratcliffe, Ding, and Davis (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.

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renegotiation actions, is also significantly higher for portfolio loans. Specifically, portfolio-held loans are 4.2–5.8 percentage points (34–51% in relative terms) more likely to be modified. For refinancing and repayment plans, we find no consistent effect of securitization. Overall, our evidence is consistent with the argument of Piskorski, Seru, and Vig (2010) and with their estimates of the effect of securitization that suggest a 30% greater likelihood of liquidation for securitized mortgages than for mortgages held on servicers' books.

The results are robust across multiple specifications. In particular, our tests use a battery of controls for mortgage characteristics, credit quality, leverage, origination year, and zip code interacted with calendar quarter. Furthermore, we show that the results remain similar even when controlling for servicer fixed effects. The inclusion of these controls exploits within-servicer variation in renegotiation choices and suggests that capacity constraints cannot account for observed differences in portfolio and securitized loan outcomes. In addition, we find very similar results when we alter the length of the time horizon over which renegotiations are evaluated (9 and 12 months) or split our sample into two equal periods (2008/Q1–Q2 vs. 2008/Q3–Q4).

The results also hold for subsamples: (i) excluding mortgages that are guaranteed by Fannie Mae and Freddie Mac (collectively known as the government-sponsored enterprises or GSEs) since, relative to privately securitized loans, GSE loans are originated with stricter underwriting standards, carry no default risk for investors, and face different servicer incentives during renegotiations (see Levitin and Twomey, 2011), and (ii) for mortgages stratified on ex ante loan quality characteristics to account for unobservable heterogeneity. Importantly, our results are similar in magnitude for loans of high quality (FICO score above 680 and full documentation), where information asymmetries between originators and investors are minimized (Keys, Mukherjee, Seru, and Vig, 2010a, forthcoming). This suggests that our tests capture renegotiation impediments due to securitization, rather than unobserved loan quality associated with the likelihood of securitization.

Next, we analyze the effects of securitization on renegotiation terms. We find that although portfolio-held loans are more likely to be modified, the modification terms do not differ dramatically among portfolio and securitized loans, with the exception of principal deferrals that are exclusively done on portfolio loans and some actions, such as interest rate reductions, that appear less concessionary for portfolio loans.

Having direct data on renegotiations also allows us to examine the efficiency of modifications across securitized and bank-held loans without any classification error. We do so by assessing post-modification redefault across the two sets of loans. We show that within six months of modification, redefault rates are 3.5 percentage points lower for portfolio-held loans than for private-label securitizations (about 9% in relative terms). These findings suggest that servicers renegotiate mortgages that they own more efficiently than mortgages that are securitized.[4]

Finally, we show that affordability is a primary cause of redefault. We report a strong relationship between modification terms and subsequent probability of redefault. Specifically, greater reductions in loan interest rates (or monthly payments) are associated with sizable declines in redefault rates. As an illustration, reducing the monthly payment by 10% is associated with a 4.3 percentage point drop in the six-month redefault rate (the base rate redefault rate is 49%). This result supports the underlying assumption of the federal Home Affordable Modification Program (HAMP) that enhancing mortgage affordability reduces redefaults.

Overall, we believe that our results resolve the debate in the literature about the role of securitization in mortgage renegotiations. We show that securitization impedes mortgage renegotiations. Conditional on renegotiation, we find that portfolio-held loans are renegotiated more efficiently; their redefault rate is lower. Importantly, our results also provide out-of-sample evidence about the role of securitization in renegotiation beyond Piskorski, Seru, and Vig (2010), as we examine a later sample period than they do.

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 and renegotiation practices with respect to securitization status. 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 a unique dataset known as the OCC-OTS Mortgage Metrics. This dataset includes detailed origination and servicing information for large U.S. mortgage servicers owned by ten of the largest banks supervised by the Office of the Comptroller of the Currency (OCC), as well as large thrifts overseen by the Office of Thrift Supervision (OTS). The data consist of monthly observations of more than 34 million mortgages totaling $6 trillion, which make up about 64% of U.S. residential mortgages. The data allow us to differentiate among 19 servicing entities owned by ten large banks, each of which maintains effective autonomy in making loss mitigation decisions, regardless of its ultimate corporate ownership. The performance data available to us span the period from October 2007 to May 2009. There is no restriction on origination date.

Many 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.

[4] In a concurrent paper, Haughwout, Okah, and Tracy (2009) also study the relation between modification terms and redefault rate. (*footnote continued*) Although the focus of their paper is not on the role of securitization, they report results that are broadly consistent with ours.

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For modifications, the data contain information about the modified terms and subsequent repayment behavior. The ability to observe loan status on a monthly basis also allows us to evaluate post-modification mortgage performance.

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 their true financial condition at the time of delinquency. Furthermore, certain data fields (e.g., self-reported reasons for default) are reported by only a subset of servicers and even then the coverage is sporadic. Yet, on balance, the detail and precision of information on loss mitigation practices make this dataset 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, containing 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 during the period of January 2008 until May 2009. (For most of the regression analysis, we use only the subsample of loans that became in trouble in 2008.) Troubled mortgages are mortgages that became 60+ days past due or voluntarily entered the loss mitigation program. 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. After removing second lien mortgages, as well as mortgages insured by the Federal Housing Administration (FHA), U.S. Department of Veterans Affairs (VA), or Government National Mortgage Association (GNMA), we identify about 1.58 million individual first lien mortgages that become troubled during our sample period.

Next, we summarize the important outcomes, event dates, and characteristics of each troubled mortgage and its borrower. Finally, we collapse the panel data into a cross-sectional dataset. For example, each mortgage record includes its borrower and loan characteristics at the time of origination, the date on which it became in trouble, updated borrower and loan characteristics when it became in trouble, the first workout resolution pursued by the servicer, and the date of that action.

Table 1 presents summary statistics of our sample. Panel A shows that the flow into the set of "in trouble" loans is more or less stable over the sample period. Panel B provides a broad summary of the sample, highlighting borrower and loan characteristics at different times. 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 (2004–2007) 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 homes. Finally, 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 and lender categories, as about one-third of the loans are securitized by the GSEs and slightly more than one-quarter are securitized through private-label mortgage backed securities (MBSs). The rest are held in portfolio, i.e., owned by the servicing bank. As would be expected for a sample of distressed loans, our sample contains a disproportionate number of investor properties and loans underwritten with less than full documentation.

2.3. Validation of sample

We verify the validity of our sample by rerunning specifications that are close to those used in the previous literature. Similar to the Piskorski, Seru, and Vig (2010) sample, loans that we study were originated in the years leading to the crisis. First, we run regressions akin to their foreclosure and liquidation regressions (Table 3 in their paper). These logit regressions explore the determinants of liquidation within six months of delinquency. We present our results alongside theirs in Appendix A. The main variable of interest (the indicator variable for being a portfolio loan) has a similar magnitude: portfolio loans are 10.2 percentage points less likely to be liquidated in our sample (Column (2)), compared with 5.4 percentage points in their sample (Column (1)). Second, we run a regression that is similar in spirit to the Piskorski, Seru, and Vig Table 7A regression on cure rates. In our sample portfolio, loans are more likely to be renegotiated by 4.7% (Column (5)), while they document that portfolio loans "cure" at a rate 6.1% higher in absolute terms than similar loans that are securitized.[5] In sum, we conclude that our sample has similar properties to those used in previous related studies.

3. Loss mitigation and renegotiation practices and the role of securitization

3.1. Description of loss mitigation and renegotiation practices

Loss mitigation resolutions include four major types of actions that lenders and servicers typically take.[6] The loss mitigation process begins when a borrower becomes

[5] Our measure of renegotiations is more accurate than the indirect measure of renegotiation (cure rates) used by Piskorski, Seru, and Vig (2010). Nevertheless, the results are similar and suggest that a higher cure rate of portfolio loans documented in earlier work could be explained in part by their higher renegotiation rate.

[6] Brikmann (2008) and Crews-Cutts and Merrill (2008) provide an overview of the different types of interventions.

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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 ten largest banks in the U.S. (19 servicer entities). The sample tracks loan performance from October 2007 to May 2009. There is no restriction on the date of origination. "In trouble" loans are loans that are 60+ days past due (dpd) or entered loss mitigation programs. We require all "in trouble" loans to be current in the last quarter of 2007, Hence this quarter is excluded from the analysis. Panel A presents descriptive summary statistics of loans that became "in trouble" in 2008, broken down by ownership status. Panel B lists the number of loans that were first in trouble, per calendar quarter. Panel C presents summary statistics of the loans that were modified. Panel D presents a breakdown of the frequency of modification actions by calendar quarter and ownership status. Panel E shows a breakdown of frequency of redefault (i.e., default given modification) within six months per calendar quarter and ownership status. Redefault is defined as being 60+ dpd. As the regression tests in Table 3 onward examine loss mitigation practices within six months, Panels B, C, D, and E provide summary statistics for loans that became "in trouble" in 2008. GSE=government-sponsored enterprise; LTV=loan-to-value; ARM=adjustable-rate-mortgage.

Panel A: Breakdown of the number of loans in trouble, per calendar quarter

Quarter	Number of borrowers in trouble			
	All	Portfolio	Private label	GSE
2008 Q1	265,453	119,682	87,659	58,112
2008 Q2	285,234	106,722	84,590	93,922
2008 Q3	256,323	101,877	61,551	92,895
2008 Q4	308,072	106,444	74,075	127,553
2009 Q1	215,056	72,430	46,818	95,808
2009 Q2	246,678	62,297	58,622	125,759
Total	1,576,816	569,452	413,315	594,049

Panel B: Summary statistics (loans that entered "in Trouble" status in 2008)

Variable	All (n=1,115,044)		Portfolio held (n=569,452)		Private label (n=307,875)		GSE (n=372,482)	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Resolution: modification within six months	0.100	0.300	0.137	0.344	0.097	0.296	0.054	0.227
Resolution: repayment within six months	0.026	0.160	0.023	0.149	0.016	0.127	0.038	0.192
Resolution: refinance within six months	0.024	0.152	0.022	0.145	0.013	0.114	0.031	0.174
Resolution: liquidation within six months	0.073	0.260	0.073	0.260	0.069	0.253	0.038	0.190
FICO at origination (percent)	651.2	67.2	640.7	69.3	657.8	66.3	674.9	60.2
FICO at "in trouble" (percent)	573.5	79.6	565.6	79.2	578.0	79.5	590.7	82.2
LTV at origination (percent)	80.0	14.2	81.8	13.2	77.9	13.8	79.5	15.0
LTV at "in trouble" (percent)	86.4	26.0	88.7	26.6	86.9	24.0	77.6	20.2
Portfolio-held dummy	0.390	0.488	1.000	0.000	0.000	0.000	0.000	0.000
Securizer is private-label	0.276	0.447	0.000	0.000	1.000	0.000	0.000	0.000
Securitizer is GSE	0.334	0.472	0.000	0.000	0.000	0.000	1.000	0.000
Borrower is non-occupier	0.170	0.376	0.139	0.346	0.215	0.411	0.159	0.365
Low documentation mortgage	0.048	0.213	0.053	0.224	0.046	0.209	0.039	0.194
Stated income mortgage	0.223	0.416	0.250	0.433	0.313	0.464	0.140	0.347
Mortgage is ARM	0.425	0.494	0.496	0.500	0.644	0.479	0.132	0.339

Panel C: Summary statistics for modified mortgages (loans that entered "in Trouble" status in 2008)

Variable	Number	Mean	Standard deviation	Minimum	50th percentile	Maximum
FICO at "in trouble"	86,471	570.8	75.2	343.0	560.0	822.0
LTV pre-modification	64,514	89.3	25.2	30.0	85.0	199.6
Modification: principal deferred	105,760	0.030	0.169	0.0	0.0	1.0
Modification: principal write-down	105,760	0.007	0.083	0.0	0.0	1.0
Modification: interest capitalized	105,760	0.422	0.494	0.0	0.0	1.0
Modification: interest rate reduced	105,760	0.558	0.497	0.0	1.0	1.0
Modification: interest rate frozen	105,760	0.296	0.456	0.0	0.0	1.0
Modification: term extended	105,760	0.172	0.377	0.0	0.0	1.0
Modification: combination	105,760	0.626	0.484	0.0	1.0	1.0
Change in payment (percent)	19,506	−9.46	21.23	−76.9	−3.3	50.0
Change interest rates (bps)	105,153	−152.3	205.7	−1075.0	−1.0	467.5
Change in balance (percent)	105,749	0.890	2.351	−1.6	0.0	15.0
Change in term (months)	88,426	−0.065	2.721	−105.0	0.0	119.0
Redefault (60+ dpd) within six months (0/1)×100	105,760	40.56	49.10	0.0	0.0	100.0

Panel D: Modification type, by mortgage type and "In Trouble" quarter

Modification type	"In Trouble" quarter			
	2008 Q1	2008 Q2	2008 Q3	2008 Q4
All				
Principal deferred	0.01	0.02	0.07	0.02
Principal writedown	0.00	0.00	0.01	0.01

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Table 1 (*continued*)

Panel D: Modification type, by mortgage type and "In Trouble" quarter

Modification type	"In Trouble" quarter			
	2008 Q1	2008 Q2	2008 Q3	2008 Q4
Capitalization	0.28	0.31	0.47	0.48
Interest rate reduction	0.47	0.62	0.55	0.54
Interest rate frozen	0.16	0.26	0.33	0.32
Term extended	0.11	0.11	0.20	0.20
Combination	0.58	0.62	0.68	0.61
GSE				
Principal deferred	0.00	0.00	0.00	0.00
Principal writedown	0.00	0.00	0.00	0.01
Capitalization	0.53	0.57	0.58	0.72
Interest rate reduction	0.49	0.57	0.58	0.76
Interest rate frozen	0.28	0.36	0.24	0.19
Term extended	0.08	0.09	0.14	0.44
Combination	0.54	0.62	0.68	0.83
Portfolio				
Principal deferred	0.01	0.04	0.13	0.04
Principal writedown	0.00	0.00	0.03	0.01
Capitalization	0.12	0.18	0.32	0.24
Interest rate reduction	0.25	0.36	0.40	0.31
Interest rate frozen	0.06	0.15	0.25	0.18
Term extended	0.18	0.18	0.27	0.14
Combination	0.47	0.37	0.60	0.42
Private label				
Principal deferred	0.00	0.00	0.00	0.00
Principal writedown	0.00	0.00	0.00	0.00
Capitalization	0.32	0.34	0.69	0.79
Interest rate reduction	0.75	0.86	0.80	0.87
Interest rate frozen	0.21	0.33	0.51	0.65
Term extended	0.02	0.05	0.10	0.16
Combination	0.74	0.83	0.80	0.86

Panel E: Rates of modification redefault within six months, by "In Trouble" quarter

"In Trouble" quarter	Number	Percent 60+ dpd				Percent 90+ dpd			
		All	Portfolio	Private label	GSE	All	Portfolio	Private label	GSE
2008 Q1	6,823	41.5	38.0	34.7	60.3	31.6	29.8	26.0	44.5
2008 Q2	25,502	40.0	42.7	33.7	53.2	28.9	31.7	24.1	37.0
2008 Q3	24,407	51.7	51.7	51.2	53.0	36.9	37.5	36.1	36.0
2008 Q4	49,028	35.2	25.7	48.3	43.9	22.5	16.8	29.4	29.3
Total	105,760	40.6	36.2	43.2	49.1	27.9	25.6	28.8	33.6

seriously delinquent (typically 60+ days past-due (dpd)) 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. Fig. 1 illustrates the different potential workout paths.

The first class of interventions is liquidation. This includes loans that have been liquidated through a deed-in-lieu or short sale and completed foreclosures, as well as loans that are in the process of being liquidated through legal foreclosure proceedings. 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. Completed foreclosures include post-foreclosure sale and real estate owned (REO) properties. Distressed mortgages that are still in foreclosure proceedings are those for which the lender is in the process of pursuing its interest in the property through the courts.

The second loss mitigation practice is loan modification, which attracted considerable publicity in discussions leading up to the eventual implementation of HAMP and in its aftermath.[7] The distinguishing feature of loan modifications is the amendment of the original mortgage

[7] Several recent studies provide a historical perspective on government involvement in home mortgage loss mitigation programs. Rose (2010) discusses the Home Owners' Loan Corporation (HOLC) program, which bought delinquent loans from lenders in an attempt to stimulate the real estate market. He finds that the HOLC paid high prices for delinquent loans and, thus, primarily benefited lenders rather than borrowers. Ghent (2011) specifically studies loan modifications during the Great Depression and finds them to have been rare. Both of these studies are disadvantaged by the poor quality of the available data. Their applicability to current events is further limited by vast institutional differences in residential mortgage markets that occurred over the intervening period.

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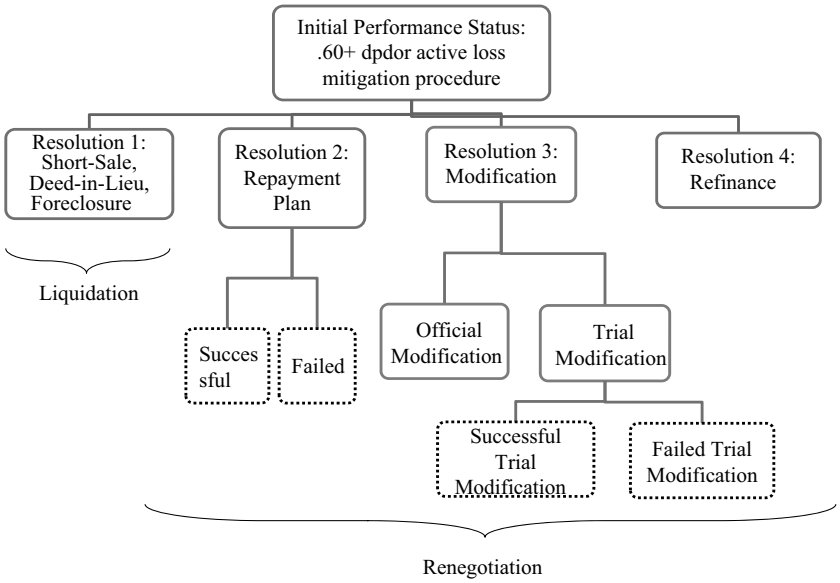

Fig. 1. Loss Mitigation Resolutions.

terms. The usual process has the lender independently offering the borrower a new set of loan terms or offering to negotiate new terms. This process can be lengthy as it requires collection of relevant documentary evidence and subsequent negotiations. Modification could also proceed in stages, with a borrower first committing to a trial offer for a certain period. Conditional on being able to fulfill the terms of a trial contract, the modification offer can be made permanent.

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

The final resolution type is refinancing. Refinancing of distressed loans is similar to a usual refinancing but it may need to be done on the basis of more forgiving underwriting criteria, such as higher-than-typical LTV ratios.[8] 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.

3.2. Breakdown of loss mitigation resolutions across mortgage types

We begin the empirical analysis by examining the renegotiation and liquidation rates across mortgage types and time horizons. Table 2 presents summary statistics about resolution types offered to borrowers by time elapsed since their mortgages entered the in trouble sample. Panel A shows statistics for the entire sample and for GSE loans. Panel B presents statistics for portfolio loans and for private-label securitizations.

A few interesting facts appear in the table. First, the most common loss mitigation resolution practice in 2008 was liquidation: within six months of delinquency, 31.3% of the delinquent loans are liquidated. Within 12 months of delinquency, over half of the troubled loans are liquidated. Liquidation rates are materially lower for GSE loans (about 39%) and highest for portfolio-held and private-label securitized loans (about 56%). Within a year, over two-thirds of the GSE loans that are in the liquidation process have been liquidated, with one-third remaining at some intermediate stage in the foreclosure process. The numbers are reversed for portfolio and securitized loans: there, about 60% of the loans remain in the foreclosure process, while only 40% have completed the liquidation.

Second, renegotiations take place in about 15% of all cases within six months and in about 23% of delinquent loans within 12 months. These figures are consistent with the low renegotiation rates found in previous studies (e.g., Brikmann, 2008; OCC-OTS quarterly reports 2010). Interestingly, it appears that portfolio loans have especially high rates of renegotiation within short windows. One possible explanation is that the direct ownership of these loans by servicers means they can make quick decisions with respect to renegotiations. For example, within three months of delinquency, renegotiation rates for portfolio-held loans are 12%, while the rates for GSE loans and for private-label securitized loans are 7% and 9%, respectively. Within a year of delinquency, the trends reverse: GSE loans and private-label securitizations are more likely to be unconditionally renegotiated (24% each) than portfolio-held loans (22%). Across all renegotiations, modifications take the lion's share, accounting for 64% of the total. Repayment plans and refinancing make up equal shares of

[8] Mayer and Hubbard (2010) suggestion to relax the leverage standards of refinance programs to allow homeowners to refinance, despite the fact that they are currently underwater.

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Table 2
Resolution Outcomes within a Given Time Frame, by Quarter.

The table presents the resolutions (or no action) of borrowers who became "in trouble" in a particular calendar quarter. The base sample is the universe of residential mortgages serviced by the ten largest banks in the U.S. (19 servicer entities). The sample tracks loan performance from October 2007 to May 2009. There is no restriction on the date of origination. "In trouble" loans are loans that are 60+ days past due (dpd) or entered loss mitigation programs. We require all "in trouble" loans to be current in the last quarter of 2007. Hence this quarter is excluded from the analysis. Panel A presents loss mitigation resolutions within three, six, nine and twelve months for all loans and for loans that were securitized through government sponsored enterprises (GSEs). Panel B presents similar outcomes for portfolio-held loans and for private-label securitizations.

Panel A: Loss resolution breakdown: all mortgages, and GSEs

	All mortgages loss resolution within				GSEs loss resolution within			
	3 months (1)	6 months (2)	9 months (3)	12 months (4)	3 months (1)	6 months (2)	9 months (3)	12 months (7)
Modification	0.066	0.100	0.124	0.149	0.027	0.054	0.086	0.109
Repayment	0.017	0.026	0.036	0.040	0.027	0.038	0.047	0.057
Refinancing	0.014	0.024	0.034	0.042	0.016	0.031	0.052	0.072
Total renegotiation	0.097	0.150	0.194	0.232	0.070	0.124	0.186	0.239
In foreclosure process	0.020	0.073	0.168	0.272	0.009	0.038	0.082	0.121
Liquidated	0.171	0.240	0.255	0.243	0.170	0.247	0.272	0.273
Total liquidation	0.191	0.313	0.423	0.515	0.179	0.285	0.355	0.394
No action	0.713	0.537	0.383	0.253	0.751	0.591	0.459	0.367
Sample	08 Q1–09 Q1	08 Q1–Q4	08 Q1–Q3	08 Q1–Q2	08 Q1–09 Q1	08 Q1–Q4	08 Q1–Q3	08 Q1–Q2
Number of loans in trouble	1,237,935	1,115,044	806,976	550,687	427,092	372,482	244,929	152,034

Panel B: Loss resolution breakdown: portfolio-held loans, and private-label securitizations

	Portfolio-held loans loss resolution within				Private label securitization loss resolution within			
	3 months (1)	6 months (2)	9 months (3)	12 months (4)	3 months (1)	6 months (2)	9 months (3)	12 months (7)
Modification	0.096	0.129	0.132	0.143	0.072	0.114	0.153	0.192
Repayment	0.013	0.024	0.037	0.040	0.009	0.015	0.021	0.026
Refinancing	0.013	0.023	0.029	0.037	0.010	0.016	0.021	0.023
Total renegotiation	0.123	0.176	0.199	0.219	0.092	0.144	0.195	0.241
In foreclosure process	0.022	0.091	0.197	0.336	0.029	0.090	0.218	0.322
Liquidated	0.149	0.204	0.234	0.228	0.205	0.282	0.266	0.236
Total liquidation	0.171	0.295	0.430	0.564	0.234	0.372	0.484	0.558
No action	0.706	0.529	0.371	0.217	0.674	0.484	0.321	0.200
Sample	08 Q1–09 Q1	08 Q1–Q4	08 Q1–Q3	08 Q1–Q2	08 Q1–09 Q1	08 Q1–Q4	08 Q1–Q3	08 Q1–Q2
Number of loans in trouble	475,378	434,687	328,247	226,404	335,465	307,875	233,800	172,249

about 17% each of all renegotiations, although their rates are higher for GSE loans.

Third, a large fraction of loans receive no recorded action from servicers. Within six months, about 54% of loans are not assigned to a loss mitigation path. Within 12 months of delinquency, this figure declines to 25% of troubled mortgages. Interestingly, the rate of "no action" is the highest for GSE loans (37%) and lowest for portfolio-held and securitized loans (22% and 20%, respectively).

3.3. The role of securitization

An important debate taking place in both academic and policy circles focuses on whether securitization affects resolution outcomes of delinquent loans. Piskorski, Seru, and Vig (2010) hypothesize that agency conflicts between servicers and investors could be an important determinant of whether delinquent loans are liquidated or renegotiated. They find that securitized loans are more likely to be foreclosed upon and deduce that renegotiation rates are lower for these mortgages. Adelino, Gerardi, and Willen (2009a, 2009b) and Foote, Gerardi, Goette, and Willen (2009) use an algorithm to identify renegotiations. Based on their algorithm—which the authors show has approximately 15% false positive and 15% false negative outcomes—they find no material difference in the rate of renegotiation between portfolio-held and securitized loans and conclude that securitization does not impede renegotiations. We provide a direct test of the proposition that renegotiation rates of securitized mortgages are lower, as our data enable us to identify modification directly from the servicers' reports, instead of inferring it from the prevalence of foreclosure resolutions or imputing it heuristically on the basis of possible changes in contract terms.

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Table 3
Determinants of renegotiation methods.

The table presents regressions of renegotiation type indicators on borrower, contract, and servicer information. The base sample is the universe of residential mortgages serviced by the ten largest banks in the U.S. (19 servicer entities). The sample tracks loan performance from October 2007 to May 2009. There is no restriction on the date of origination. "In trouble" loans are loans that are 60+ days past due (dpd) or entered loss mitigation programs. We require all "in trouble" loans to be current in the last quarter of 2007. Hence, this quarter is excluded from the analysis. The sample analyzed here includes only loans that became "in trouble" in 2008 (we use the period until May 2009 to monitor renegotiation actions). Loans that became "in trouble" in December 2008 have only five months horizon. Panel A presents regressions of a renegotiation indicator and of modification indicator on determinants. Panel B presents regressions of repayment plan indicator and of refinancing indicator on determinants. Panel C presents robustness tests in which the horizon within which the loss mitigation resolution is measured as either 9 or 12 months. Panel D presents regressions in which the sample is broken to low, "medium", and high-quality loans. The sample of non-government sponsored enterprise (GSE) loans consists of private-label securitizations and all portfolio loans. The sample of non-GSE-like loans is generated using a propensity score matching process. We regress GSE status indicator in a sample of all securitized loans (GSEs and private label) on loan and borrower characteristics at the time of origination. The non-GSE-like sample includes all private-label loans and portfolio loans with a propensity score that is lower than 0.5. Low-quality loans are loans taken by borrowers with FICO score of 620 or lower and with less than fully documented income. High-quality loans are loans with borrower FICO score of 680 or higher and with income that is fully documented. Medium-quality loans are all the rest. Panel E breaks the sample into quarters in which loans become "in trouble". All regressions include fixed effects: in-trouble FICO score buckets, in-trouble LTV (loan-to-value) buckets, zip code interacted with calendar quarter, and origination year. Regressions in panels C, D, and E have servicer fixed effects. *t*-statistics are presented in parentheses. Robust standard errors are clustered by servicer entity level. *, **, and *** denote two-tailed significance at the 10%, 5%, and 1% level, respectively. ARM = adjustable-rate mortgage.

Panel A: Determinants of all renegotiations and modifications

	All renegotiations within six months (0/1)				Modification within six months (0/1)			
	All (1)	Non-GSE (2)	Non-GSE (3)	Non-GSE-like (4)	All (5)	Non-GSE (6)	Non-GSE (7)	Non-GSE-like (8)
Mean dependent variable	0.149	0.162	0.162	0.162	0.100	0.122	0.122	0.122
Portfolio-held dummy	0.042***	0.042***	0.044***	0.059***	0.047***	0.024***	0.043***	0.059***
	(23.516)	(24.348)	(25.661)	(23.395)	(23.189)	(9.384)	(23.538)	(28.169)
Securitizer is GSE	0.011***				−0.012***			
	(3.184)				(−3.371)			
Borrower is non-occupier	−0.049***	−0.041***	−0.058***	−0.056***	−0.042***	−0.038***	−0.052***	−0.052***
	(−40.421)	(−26.864)	(−39.082)	(−36.139)	(−38.813)	(−25.753)	(−37.968)	(−36.754)
Low documentation mortgage	−0.018***	−0.023***	−0.029***	−0.029***	−0.025***	−0.013***	−0.027***	−0.026***
	(−7.027)	(−5.973)	(−8.150)	(−7.214)	(−11.748)	(−4.278)	(−8.285)	(−6.648)
Stated income mortgage	−0.020***	0.004**	−0.029***	−0.031***	−0.016***	0.018***	−0.022***	−0.024***
	(−13.962)	(2.353)	(−19.109)	(−19.472)	(−11.352)	(11.364)	(−14.082)	(−15.566)
Mortgage is ARM	−0.080***	−0.079***	−0.093***	−0.115***	−0.082***	−0.070***	−0.095***	−0.117***
	(−10.657)	(−9.209)	(−9.511)	(−8.634)	(−10.433)	(−6.825)	(−9.225)	(−8.335)
Servicer entity fixed effect	Yes	No	Yes	Yes	Yes	No	Yes	Yes
Number of observations	615,536	431,172	431,172	335,876	615,536	431,172	431,172	335,876
Adj. R^2	0.076	0.064	0.093	0.101	0.077	0.052	0.086	0.098

Panel B: Determinants of repayment plans and refinancings

	Repayment within 6 months (0/1)				Refinancing within 6 months (0/1)			
Sample	All (1)	Non-GSE (2)	Non-GSE (3)	Non-GSE-like (4)	All (5)	Non-GSE (6)	Non-GSE (7)	Non-GSE-like (8)
Mean dependent variable	0.026	0.020	0.020	0.017	0.024	0.020	0.020	0.018
Portfolio-held dummy	−0.005***	0.008***	−0.000	−0.001	0.000	0.010***	0.001	0.001
	(−9.346)	(16.191)	(−0.307)	(−0.942)	(0.674)	(6.056)	(1.426)	(0.653)
Securitizer is GSE	0.018***				0.004***			
	(23.998)				(6.147)			
Borrower is non-occupier	−0.011***	−0.007***	−0.008***	−0.006***	0.003***	0.004***	0.002***	0.002***
	(−20.779)	(−13.464)	(−15.345)	(−11.127)	(5.180)	(3.860)	(3.855)	(3.694)
Low doc mortgage	0.010***	−0.004***	0.001	−0.001	−0.002***	−0.006**	−0.003**	−0.002
	(7.752)	(−3.141)	(1.007)	(−0.722)	(−2.726)	(−2.334)	(−2.307)	(−1.489)
Stated income mortgage	0.001***	−0.004***	−0.000	−0.001*	−0.005***	−0.010***	−0.007***	−0.006***
	(2.963)	(−7.383)	(−0.847)	(−1.724)	(−9.106)	(−6.290)	(−10.905)	(−10.287)
Mortgage is ARM	−0.005***	−0.015***	−0.005***	−0.006***	0.006***	0.006***	0.007***	0.009***
	(−8.421)	(−22.705)	(−8.119)	(−8.822)	(10.162)	(3.527)	(8.948)	(8.850)
Servicer entity FE	Yes	No	Yes	Yes	Yes	No	Yes	Yes
Observations	615,536	431,172	431,172	335,876	615,536	431,172	431,172	335,876
Adj. R^2	0.071	0.034	0.056	0.052	0.125	0.042	0.135	0.118

Panel C: Determinants of renegotiation methods, by horizon

	All renegotiations within		Modification within		Repayment within		Refinancing within	
	9 months Non-GSE (1)	12 months Non-GSE (2)	9 months Non-GSE (3)	12 months Non-GSE (4)	9 months Non-GSE (5)	12 months Non-GSE (6)	9 months Non-GSE (7)	12 months Non-GSE (8)
Mean dependent variable	0.196	0.088	0.141	0.066	0.031	0.010	0.026	0.012
Portfolio-held dummy	0.060***	0.071***	0.060***	0.073***	−0.001	−0.002**	0.002	0.002
	(25.243)	(22.911)	(21.830)	(19.596)	(−1.542)	(−2.501)	(1.511)	(1.194)

Table 3 (*continued*)

Panel C: Determinants of renegotiation methods, by horizon

	All renegotiations within		Modification within		Repayment within		Refinancing within	
	9 months Non-GSE (1)	12 months Non-GSE (2)	9 months Non-GSE (3)	12 months Non-GSE (4)	9 months Non-GSE (5)	12 months Non-GSE (6)	9 months Non-GSE (7)	12 months Non-GSE (8)
Borrower is non-occupier	−0.080***	−0.099***	−0.072***	−0.092***	−0.011***	−0.011***	0.002***	0.003***
	(−40.425)	(−40.521)	(−39.031)	(−39.534)	(−14.826)	(−13.062)	(3.281)	(3.667)
Low documentation mortgage	−0.037***	−0.047***	−0.034***	−0.044***	−0.001	0.001	−0.003*	−0.005***
	(−7.957)	(−7.350)	(−7.778)	(−7.347)	(−0.439)	(0.350)	(−1.668)	(−2.627)
Stated income mortgage	−0.032***	−0.038***	−0.022***	−0.027***	−0.001*	−0.001	−0.008***	−0.010***
	(−16.195)	(−15.084)	(−11.230)	(−10.558)	(−1.698)	(−1.606)	(−11.199)	(−11.027)
Mortgage is ARM	−0.128***	−0.144***	−0.129***	−0.148***	−0.009***	−0.009***	0.010***	0.012***
	(−7.697)	(−5.441)	(−7.384)	(−5.388)	(−10.710)	(−8.141)	(9.136)	(9.171)
Number of observations	325,963	227,075	325,963	227,075	325,963	227,075	325,963	227,075
Adj. R^2	0.123	0.154	0.114	0.142	0.080	0.113	0.138	0.187

Panel D: Determinants of renegotiation methods, by loan quality

	All renegotiations within six months			Modification within six months		
	Low (1)	Medium (2)	High (3)	Low (4)	Medium (5)	High (6)
Mean dependent variable	0.198	0.172	0.119	0.159	0.137	0.068
Portfolio-held dummy	0.050***	0.044***	0.044***	0.050***	0.040***	0.051***
	(3.381)	(20.970)	(15.721)	(3.374)	(17.757)	(22.075)
Borrower is non-occupier	−0.059***	−0.056***	−0.042***	−0.058***	−0.052***	−0.034***
	(−5.062)	(−30.502)	(−16.619)	(−5.423)	(−29.750)	(−17.073)
Low documentation mortgage	−0.015	−0.057***		−0.012	−0.054***	
	(−1.250)	(−13.347)		(−1.148)	(−13.792)	
Stated income mortgage	−0.060***		−0.048***			
	(−32.108)		(−27.200)			
Mortgage is ARM	−0.265***	−0.105***	−0.039***	−0.274***	−0.111***	−0.034***
	(−8.904)	(−9.497)	(−10.673)	(−9.317)	(−9.564)	(−9.506)
Number of observations	20,434	310,156	100,582	20,434	310,156	100,582
Adj. R^2	0.094	0.091	0.131	0.084	0.083	0.082

Panel E: Determinants of renegotiation methods, by delinquency calendar quarter

	All renegotiations within six months				Modification within six months			
	2008/Q1–Q2		2008/Q3–Q4		2008/Q1–Q2		2008/Q3–Q4	
	All (1)	Non-GSE (2)	All (3)	Non-GSE (4)	All (5)	Non-GSE (6)	All (7)	Non-GSE (8)
Mean dependent variable	0.132	0.131	0.166	0.169	0.087	0.099	0.112	0.132
Portfolio-held dummy	0.039***	0.040***	0.027***	0.031***	0.043***	0.039***	0.037***	0.034***
	(17.716)	(19.540)	(11.282)	(11.898)	(16.071)	(18.546)	(16.332)	(13.913)
Securitizer is GSE	0.004		0.002		−0.011		−0.023***	
	(0.549)		(0.624)		(−1.637)		(−10.056)	
Borrower is non-occupier	−0.039***	−0.043***	−0.059***	−0.076***	−0.034***	−0.039***	−0.048***	−0.067***
	(−23.609)	(−22.251)	(−33.596)	(−32.608)	(−22.180)	(−20.321)	(−32.723)	(−32.503)
Low documentation mortgage	−0.034***	−0.031***	0.001	−0.018***	−0.029***	−0.027***	−0.016***	−0.020***
	(−10.922)	(−6.956)	(0.168)	(−3.411)	(−9.823)	(−6.654)	(−5.291)	(−4.160)
Stated income mortgage	−0.017***	−0.024***	−0.023***	−0.035***	−0.011***	−0.016***	−0.022***	−0.031***
	(−9.659)	(−13.798)	(−11.608)	(−13.416)	(−6.066)	(−8.760)	(−11.337)	(−12.387)
Mortgage is ARM	−0.072***	−0.085***	−0.081***	−0.094***	−0.077***	−0.088***	−0.081***	−0.096***
	(−5.112)	(−4.745)	(−19.022)	(−17.069)	(−5.308)	(−4.696)	(−17.677)	(−16.167)
Number of observations	301,710	227,075	313,826	204,097	301,710	227,075	313,826	204,097
Adj. R^2	0.089	0.103	0.109	0.133	0.072	0.085	0.114	0.127

Our main results are presented in Table 3. In this analysis, we estimate a simple OLS specification for each renegotiation outcome separately.[9] These regressions control for observable mortgage characteristics. In each specification, the latest FICO and LTV scores (i.e. scores at the time of entry into the in trouble sample) are discretized

[9] In an unreported robustness test, we rerun the analysis with probit regressions. Table 3 reports OLS estimates that are arguably more consistent in specifications with a large number of fixed effects.

(*footnote continued*)
The probit estimates are qualitatively similar and are available upon request.

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into buckets to allow greater flexibility in estimation.[10] We also include year of origination dummies[11] and interactions of zip code and calendar quarter fixed effects. In some specifications we include servicer fixed effects, in order to highlight within-servicer variation.

In Panel A, we regress a renegotiation type dummy on an indicator of whether the loan is held by the bank (portfolio-held), in addition to controls and fixed effects. First, we explore the determinants of all renegotiations that take place within six months of entering the in trouble sample.[12] This category includes all three renegotiation practices: modification, repayment, and refinance. The first regression, depicted in Column (1), presents the results for the entire sample. The regression shows that portfolio-held loans have a 4.2 percentage point greater likelihood of renegotiation (or 28% in relative terms). This effect is very significant, both statistically and economically.

We then conduct our analysis after removing all GSE loans from the sample. This is an important step because, relative to privately securitized loans, GSE loans are originated with stricter underwriting standards, carry no default risk for investors, and face different servicer incentives during renegotiations (see Levitin and Twomey, 2011). Further, this sample restriction facilitates comparison with existing studies, as it conforms to the specifications in Adelino, Gerardi, and Willen (2009a, 2009b), Foote, Gerardi, Goette, and Willen (2009), and Piskorski, Seru, and Vig (2010). The regression results are presented with and without servicer fixed effects in Columns (2) and (3), respectively. The results show that without servicer fixed effects, privately securitized loans have a 4.2 percentage point lower likelihood of renegotiation (a relative decline of 26%). With servicer fixed effects, the estimated effect increases to 4.4 percentage points and is strongly statistically significant. It remains robust, although servicer fixed effects have considerable explanatory power, as evidenced by the increase in the adjusted R^2 between Columns (2) and (3).

While the earlier analysis removed the loans securitized by GSEs, one issue remains. There may be some loans on a bank's portfolio that might be intended for sale to GSEs but remain on the lender's book for some reason. Including these might bias our findings, as bank-held loans intended for GSEs might be loans that are ex ante of better quality than privately securitized loans. The earlier analysis implicitly assumed there were no such bank-held loans when we excluded all loans sold to GSEs. We now relax this assumption and explicitly exclude portfolio loans that have characteristics similar to those of GSE loans.

To classify portfolio loans as GSE-like or non-GSE-like, we follow the propensity score matching procedure of Keys, Mukherjee, Seru, and Vig (forthcoming). In particular, we run a probit regression on a sample of all securitized loans (private label and GSE), in which the dependent variable is whether a loan is a GSE loan. The explanatory variables are FICO and LTV at origination (discretized into buckets), as well as indicators for year of origination, for whether a mortgage has adjustable interest rates, for non-owner occupancy, and for not fully documented loans (low or no documentation). Then, we predict the GSE dummy for each portfolio loan. We classify loans with a propensity score of 0.5 or more as GSE-like and the rest as non-GSE-like. The results of the restricted sample are presented in Column (4). The regression shows that the effect of securitization is stronger for this subset of loans. Portfolio-held loans have a 5.9 percentage point higher likelihood of renegotiation compared with private-label securitized loans (a 36% increase in relative terms).[13]

The robustness of results to the inclusion of servicer fixed effects suggests that the differences in renegotiation rates cannot be explained solely by servicer-specific characteristics, such as capacity constraints. Instead, we observe that even within individual servicers, the choice to renegotiate rather than liquidate a delinquent loan is systematically related to whether this loan is owned directly by the servicers or is being serviced on behalf of external investors.

The regressions also present evidence about other covariates affecting renegotiations. Loans owed by borrowers who do not occupy the property are less likely to be renegotiated. Also, loans with less than fully documented income and with adjustable interest rates are less likely to be renegotiated.

Next, we break the dependent variable (renegotiation dummy) into its components: dummies for modification, repayment, and refinancing. The results in Table 3, Panel A, Columns (5)–(8), show that modification, the largest class of renegotiations, is more likely to take place for portfolio loans. When the entire sample is considered (Column (5)), the effect of securitization is 4.7 percentage points (47% in relative terms). However, this magnitude is misleading because modification is less common for GSE loans, as other renegotiation methods are preferred by the GSEs. When GSE loans are removed from the sample, the effect declines to 2.4 or 4.3 percentage points (20% or 35% in relative terms), depending on whether servicer fixed effects are present (Columns (6) and (7)). Once again, we note that controlling for servicer identity preserves the economic and statistical significance of the securitization effect on the likelihood of modification. When restricting the sample to non-GSE-like loans (Column (8)) the coefficient estimate increases to 5.9 percentage points (48% in

[10] 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%+.

[11] The origination year dummies are: (1) before 2002, (2) 2002, (3) 2003, (4) 2004, (5) 2005, (6) 2006, (7) 2007, and (8) 2008–09.

[12] Because our sample ends in May 2009, the horizon for observations in December 2008 is five months instead of six months. The effect should be absorbed by the time dummies.

[13] We reexamine the results with a subsample that ascertains further that we are not biasing our results by comparing portfolio loans that have loans intended for both non-GSE and GSE with privately securitized loans. In an untabulated analysis, we test whether the difference between portfolio-held and private-label securitized loans exists for jumbo loans (loans with balance at origination above the GSE conforming loan limit); these loans—whether portfolio or privately securitized—are surely originated for the private market. Our results for the jumbo loan sample retain both the sign and the magnitude of the smaller renegotiations for securitized loans.

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relative terms). These results corroborate the findings of Piskorski, Seru, and Vig (2010) that renegotiations are less likely to take place for securitized loans sold to private investors relative to loans owned by the banks.

When examining repayment plans (Panel B, Columns (1)–(4)) and refinancing (Panel B, Columns (5)–(8)), we find that the effects of securitization are mixed. When servicer fixed effects are present, repayment plans are slightly less likely for portfolio loans while there is no observable difference in refinancing rates. When servicer fixed effects are omitted (Columns (2) and (6)), the portfolio-held loans are more likely to receive refinancing or repayment mitigations. This suggests that these two rare approaches to loss mitigation are likely to be concentrated at a handful of servicers with higher-than-average shares of portfolio loans. The positive coefficients on the GSE dummy in Columns (1) and (5) show that repayment plans and refinancing are the renegotiation methods that are favored by the GSE investors.

Servicer fixed effects appear to explain a great deal of loss mitigation choices. This is not surprising, given the substantial heterogeneity in servicer mitigation tools summarized in Fig. 2. The regressions in Table 3 highlight the fact that servicer identity is an important determinant of whether renegotiation takes place in a multivariate framework. This is evidenced by the comparison of adjusted R^2 in otherwise similar specifications with and without servicer fixed effects in Panels A and B. Adding servicer fixed effects increases the explanatory power of the regressions significantly (by more than 40%).

3.4. Robustness tests

Because our results pertain to an ongoing academic and policy debate, we provide additional robustness tests to underscore their validity. First, we verify that the effect is not mechanically driven by the horizon in which renegotiation is measured. These tests are motivated by the summary statistics in Table 2, in which portfolio-held loans appear to be renegotiated faster than are securitized loans. While in Table 3, Panel A, the horizon is fixed at six months, in Panel C, we lengthen the horizon to 9 and 12 months. The results across regressions demonstrate similar patterns to those in Panel A: renegotiations generally, and modifications specifically, are significantly more likely to take place for portfolio-held loans than for securitized loans, at a magnitude that increases with the horizon.

Second, we examine the differential effect of securitization across quality classes of loans. This test is useful in order to clarify whether we capture the effect of securitization, or potentially unobservable variables that are correlated with securitization status. More specifically, several studies have found that the quality of securitized loans is lower than that of loans kept on portfolio. (See evidence for higher default risk in non-agency securitized loans in Keys, Mukherjee, Seru, and Vig (2010a, forthcoming) and Rajan, Seru, and Vig (2008); and for higher prepayment risk in GSE securitized loans in Agarwal, Chang, and Yavas (2010). These studies argue that originators have soft information about mortgages, which they can exploit by securitizing poor-quality mortgages and keeping better ones. We conjecture that information asymmetry is minimized for high-quality loans (fully documented loans with high FICO scores), and thus, little room exists for adverse selection in these mortgages. If our test shows that high-quality securitized loans also have lower renegotiation rates, then one could infer that securitization impediments and not unobserved quality, explains the lower rate of renegotiation.

We categorize loans into three groups: low, medium, and high quality. Following earlier literature, we classify high-quality loans as loans with full documentation and FICO scores above 680. Low-quality loans are defined as loans that have low documentation and FICO scores below 620 at origination. The rest of the loans are deemed

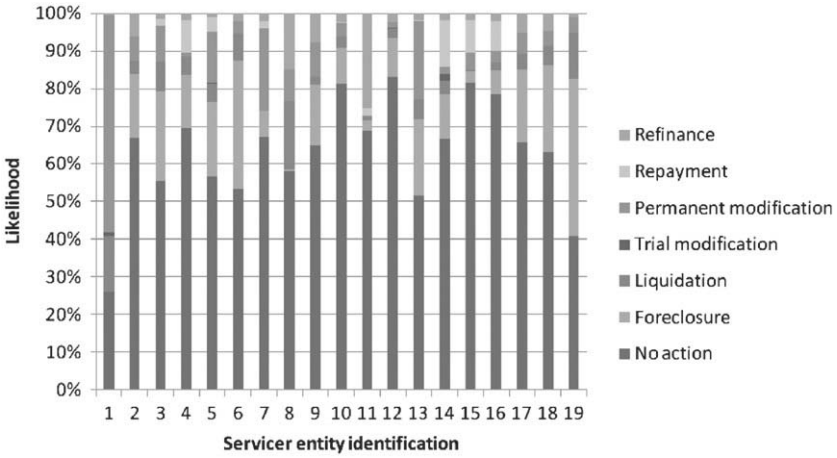

Fig. 2. Workout resolution within six months, by servicer entity.
The chart presents a breakdown of loss mitigation resolution methods by servicer entity. The sample tracks loans from October 2007 to May 2009. "In trouble" loans are loans that are 60+ days past due or entered loss mitigation programs. We require all "in trouble" loans to be current in the last quarter of 2007. Hence, this quarter is excluded from the analysis. The sample analyzed here includes only loans that became "in trouble" in 2008 (we use the period until May 2009 to monitor renegotiation actions).

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to be of medium quality. Table 3, Panel D, presents regressions for renegotiation and modification dummies for which the sample is split by loan quality. The results show that portfolio loans have consistently higher renegotiation and modification rates in each of the subsamples. In relative terms, the magnitude of the coefficient estimates is greatest in the subsample of highest quality loans. For those loans, being held in a portfolio is associated with a 37% greater likelihood of renegotiation and a 75% greater likelihood of modification.

These results suggest that the securitization bias is larger for high-quality borrowers. Overall, these findings support the view that securitization impedes renegotiation of loans due to factors such as servicers' compensation, legal constraints, and uncertainty induced by servicing contracts and dispersion of ownership resulting from coordination problems among MBS investors. Notably, the coordination problem makes it hard not only to renegotiate debt contracts, but also to correct the servicer incentive structure and the ensuing agency problem (see also Mayer, 2010).

It is also useful to note that we find higher renegotiation rates for portfolio-held loans even in the low-quality subsample. Interestingly, when Piskorski, Seru, and Vig (2010) examine the aggregate data, they find no differences in renegotiation rates between portfolio-held and securitized loans for their low-quality sample. They attribute this to the fact that low-quality loans are likely to be the ones with most severe unobserved heterogeneity. When they do account for unobserved heterogeneity using a quasi-experiment of "early pay default" loans (which are all low-quality), they find that securitized loans are less likely to be renegotiated.

Taken together with the above mentioned findings, our results on the low-quality sample are quite revealing. In particular, they suggest that our specification and controls (in particular, lender and servicer fixed effects) are accounting adequately for unobserved heterogeneity. We find this comforting; it suggests that, although we do not use a direct identification strategy, our stringent specification gives us results that are very much in line with those of a study that does use such a strategy.

Finally, we examine whether the effects are consistent over time. We split the sample by the period in which mortgages became in trouble, 2008/Q1–Q2 vs. 2008/Q3–Q4, and rerun the main specifications. The results are presented in Table 3, Panel E. They show that the effects in both periods are statistically and economically significant.[14,15]

Overall, these results uniformly show that renegotiations, and particularly modifications, are more likely to take place for portfolio-held rather than for securitized loans. These results support the claim that securitization is hampering renegotiation, potentially due to factors such as servicers' financial incentives (separation of ownership and control), legal constraints, and uncertainty induced by Pooling and Servicing Agreements and dispersed ownership of MBS securities, creating a coordination problem among investors.

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

4.1. Securitization and modification terms

In the preceding analysis, ownership status appeared to be a prime factor in renegotiation decisions. In this section, we explore the modification terms that servicers offer on behalf of their clients (investors) and the terms that they implement for mortgages they own. Following modifications, loan terms primarily change along one of the following three dimensions: interest rate (typically reduced), mortgage balance (typically increased to reflect capitalization of unpaid interest; sometimes decreased following principal forgiveness), and mortgage term (typically extended). Appendix A in Adelino, Gerardi, and Willen (2009b) provides a discussion of modification terms. Together, these three dimensions affect the monthly payment: decreases in interest rate, reductions in loan balance, and longer mortgage terms all translate to lower monthly payments.

Table 1, Panel D, presents summary statistics for the types of modification terms used in different sub-samples. Interest rate reduction and freezing, the most common modifications (55% and 27% on average, respectively), are used primarily for private-label securitizations and GSE loans and, to a lesser extent, portfolio-held loans. Principal deferral and write-down actions are relatively rare (3%, and 1% on average, respectively) and used exclusively for portfolio-held loans. Term extensions are less common (15% on average), and are used primarily for GSE and portfolio loans and less for private-label loans. Capitalization of unpaid interest is common (38% on average) and is used primarily for GSE loans and private-label securitizations.

In Table 4, Panel A, we systematically analyze how changes in the monthly payment and interest rate following modification are related to mortgage ownership status, as well as other controls. In Columns (1)–(3) we regress the change in monthly mortgage payment (measured as the percentage change relative to the original pre-delinquency payment) on a portfolio-held dummy. Column (1) restricts the sample to non-GSE loans and does not include servicer fixed effects. Column (2) uses the same sample, but adds servicer fixed effects. Column (3) removes portfolio-held loans that are GSE-like, using the propensity score technique described in Section 3.3, thereby leaving only non-GSE-like mortgages in the sample. The results in Columns (1) and (2) show that modified portfolio-held loans have smaller reductions in monthly payments. Whereas modified loans, on average, realize a 9.2% decrease in monthly payment, among portfolio-held loans the reduction is 3.3–3.7 percentage points less. However, when the sample is restricted to non-GSE-like loans (Column (3)), the magnitude of the

[14] We impose no restriction on origination date in our sample. However, our results are robust to limiting the sample to loans originated in a period that is closer to the crisis (e.g., 2005, 2006, and 2007).

[15] We also run separate regressions for each quarter of 2008—Q1, Q2, Q3, and Q4. In each of these quarters we find qualitatively similar results as resulted in Table 3 Panel A–E (results are available upon request). Specifically, our results show that securitized loans are less likely to be modified.

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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 ten largest banks in the U.S. (19 servicer entities). The sample tracks loan performance from October 2007 to May 2009. There is no restriction on the date of origination. "In trouble" loans are loans that are 60+ days past due (dpd) or entered loss mitigation programs. We require all "in trouble" loans to be current in the last quarter of 2007. Hence, this quarter is excluded from the analysis. The sample analyzed here includes only loans that became "in trouble" in 2008 (we use the period until May 2009 to monitor renegotiation actions). Loans that became "in trouble" in December 2008 have only a five month horizon. The regressions in the table include only loans that were modified and for which servicers reported their modification terms. The sample of non-government sponsored enterprise (GSE) loans consists of private-label securitizations and all portfolio loans. The sample of non-GSE-like loans is generated using a propensity score matching process. We regress GSE status indicator in a sample of all securitized loans (GSEs and private label) on loan and borrower characteristics at the time of origination. The non-GSE-like sample includes all private-label loans and portfolio loans with a propensity score that is lower than 0.5. Low-quality loans are loans taken by borrowers with FICO score of 620 or lower and with less than fully documented income. High-quality loans are loans with borrower FICO score of 680 or higher and with income that is fully documented. Medium-quality loans are all the rest. All regressions include fixed effects: in-trouble FICO score buckets, in-trouble LTV (loan-to-value) buckets, zip code interacted with calendar quarter, and origination year. Regressions in Panel C also have servicer fixed effects. *t*-statistics are presented in parentheses. Robust standard errors are clustered by servicer entity level. *, **, and *** denote two-tailed significance at the 10%, 5%, and 1% level, respectively. ARM = adjustable-rate mortgage.

Panel A: Determinants of modification terms (changes in payment and interest rates)

	Change in					
	payment (%)			interest rates (bps)		
	Non-GSE (1)	Non-GSE (2)	Non-GSE-like (3)	Non-GSE (4)	Non-GSE (5)	Non-GSE-like (6)
Mean dependent variable	−9.227	−9.227	−9.074	−168.578	−168.578	−193.338
Portfolio-held dummy	3.715***	3.293***	1.846	80.188***	58.935***	46.493***
	(3.988)	(3.456)	(1.598)	(26.901)	(18.075)	(11.432)
Borrower is non-occupier	2.153*	2.628**	2.598*	0.291	10.549**	12.532**
	(1.687)	(2.051)	(1.881)	(0.063)	(2.312)	(2.393)
Low documentation mortgage	−2.264	−2.301	−2.614	−27.321***	−11.219	−12.599
	(−0.872)	(−0.902)	(−0.969)	(−3.787)	(−1.505)	(−1.575)
Stated income mortgage	−1.048	−1.657	−1.610	−37.364***	−27.005***	−30.009***
	(−0.889)	(−1.361)	(−1.275)	(−6.498)	(−4.495)	(−4.830)
Mortgage is ARM	3.147*	4.668**	8.702***	−0.125	61.952***	85.089***
	(1.791)	(2.465)	(3.791)	(−0.012)	(5.428)	(6.277)
Servicer entity fixed effects	No	Yes	Yes	No	Yes	Yes
Number of observations	9,649	9,649	9,177	46,813	46,813	38,041
Adj. R^2	0.140	0.147	0.180	0.194	0.238	0.202

Panel B: Determinants of modification terms (changes in balance and mortgage term)

	Change in					
	balance (%)			term (months)		
	Non-GSE (1)	Non-GSE (2)	Non-GSE-like (3)	Non-GSE (4)	Non-GSE (5)	Non-GSE-like (6)
Mean dependent variable	0.846	0.846	0.866	−0.085	−0.085	−0.092
Portfolio-held dummy	−0.172***	−0.109***	−0.057	−0.351***	−0.602***	−0.560***
	(−6.267)	(−3.581)	(−1.611)	(−11.511)	(−11.182)	(−9.997)

Borrower is non-occupier	0.005	0.012	−0.009	−0.103***	−0.023	−0.041
	(0.119)	(0.290)	(−0.182)	(−3.275)	(−0.742)	(−1.363)
Low documentation mortgage	−0.021	−0.059	−0.042	−0.101***	−0.105***	−0.084***
	(−0.367)	(−0.999)	(−0.677)	(−3.067)	(−3.206)	(−2.751)
Stated income mortgage	0.029	0.082*	0.099**	−0.119***	−0.189***	−0.150***
	(0.609)	(1.724)	(2.031)	(−5.961)	(−6.459)	(−5.597)
Mortgage is ARM	−0.194***	−0.192***	−0.260***	−0.288***	−0.031	−0.023
	(−3.278)	(−2.777)	(−3.028)	(−11.569)	(−1.343)	(−1.093)
Servicer entity fixed effects	No	Yes	Yes	No	Yes	Yes
Number of observations	47,007	47,007	38,277	36,078	36,078	31,206
Adj. R^2	0.159	0.166	0.169	0.246	0.289	0.281

Panel C: Determinants of modification terms, per loan quality

	Change in payment (percent)			Change in rate (bps)			Change in balance (percent)			Change in term (months)		
	Low (1)	Medium (2)	High (3)	Low (4)	Medium (5)	High (6)	Low (7)	Medium (8)	High (9)	Low (10)	Medium (11)	High (12)
Mean dependent variable	−12.5336	−9.535	−5.8911	−253.825	−169.107	−103.632	1.43202	0.84885	0.3999	−0.07101	−0.06344	−0.25122
Portfolio-held dummy	2.234	3.622***	−6.288	31.411*	63.559***	33.038**	0.026	−0.107***	−0.215	−0.223**	−0.606***	−0.368*
	(0.369)	(3.220)	(−0.423)	(1.876)	(16.839)	(2.229)	(0.155)	(−2.873)	(−1.389)	(−2.355)	(−10.424)	(−1.862)
Borrower is non-occupier	−0.596	2.809**	−0.245	17.515	6.849	−0.294	−0.473**	0.021	−0.015	0.060	−0.029	0.266
	(−0.057)	(2.021)	(−0.015)	(0.754)	(1.258)	(−0.016)	(−2.022)	(0.414)	(−0.080)	(0.649)	(−0.836)	(0.905)
Low documentation mortgage	−2.120	1.330		16.433	7.718		−0.423**	−0.077		0.054	−0.191***	
	(−0.454)	(0.304)		(1.022)	(0.658)		(−2.365)	(−0.878)		(1.469)	(−3.493)	
Stated income mortgage		−1.017			−16.096**			0.054			−0.244***	
		(−0.698)			(−2.442)			(1.189)			(−6.376)	
Mortgage is ARM	24.543**	5.637***	−3.717	223.218***	68.462***	6.266	−0.776**	−0.185**	−0.024	0.051	−0.009	−0.319*
	(2.442)	(2.592)	(−0.226)	(5.178)	(5.815)	(0.347)	(−2.207)	(−2.545)	(−0.141)	(0.838)	(−0.354)	(−1.699)
Number of observations	808	7,660	1,181	4,396	36,717	5,700	4,435	36,853	5,719	3,519	28,710	3,849
Adj R^2	0.255	0.149	−0.042	0.242	0.215	0.185	0.104	0.149	0.112	0.599	0.231	0.488

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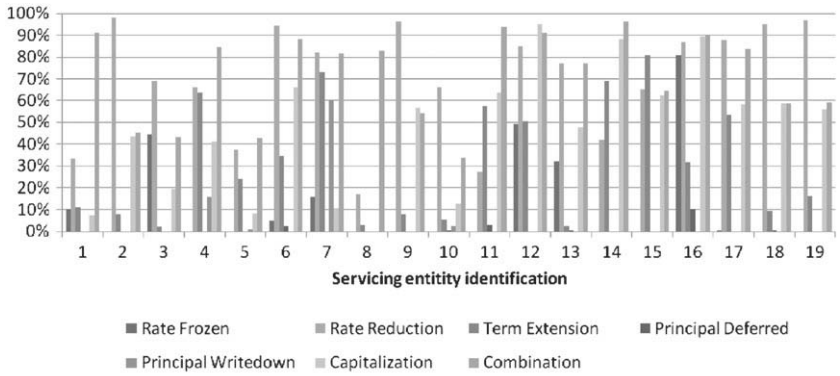

Fig. 3. Modification types, by servicer entity (Non-mutually exclusive).
The chart shows the fraction of modified mortgages in which servicer entities applied a specific modification method. The sample tracks loans from October 2007 to May 2009. "In trouble" loans are loans that are 60+ days past due or entered loss mitigation programs. We require all "in trouble" loans to be current in the last quarter of 2007. Hence, this quarter is excluded from the analysis. The sample analyzed here includes only loans that became "in trouble" in 2008 (we use the period until May 2009 to monitor renegotiation actions).

coefficient is cut in half and its statistical significance disappears ($t=1.6$).

When examining the association of the change in interest rates with the ownership status (Columns (4)–(6)), it appears that portfolio-held loans receive smaller interest rate concessions. Relative to securitized loans, interest rates on portfolio-held loans are lowered by 46–80 basis points less, depending on the sample and control choices (24–48% in relative terms).[16]

Next, in Panel B, we examine changes in the other loan attributes (mortgage balance and mortgage term) with respect to ownership status. On average, modified loans experience a slight increase in mortgage balance (0.8%) as principal write-downs are much less frequent than capitalization of arrears (Table 1, Panel D). Relative to that benchmark, portfolio-held loans offer slightly more generous concessions, although their economic magnitude appears limited. Modified portfolio-held loans also offer somewhat shorter extensions of mortgage terms by (0.6 months relative to the mean extension, which is approximately zero months (see Table 1, Panel C). However, during our sample period both changes in balance and mortgage terms are relatively rare events (Table 1, Panel D).

It appears, therefore, that portfolio-held loans receive less generous interest rate modification terms, relative to similar securitized loans. However, it is hard to estimate the impact of the differences on borrowers across securitized and portfolio loans, because a particular loan could potentially receive multiple concessions. This is also complicated by the fact that some modifications, such as principal deferrals, occur only for bank-held loans.

We further note that servicers have a strong influence on modification terms. This fact is demonstrated in the univariate chart in Fig. 3: each servicer appears to choose a unique combination of modification tools. Also in Table 4, Panels A and B, servicer fixed effects have an important explanatory power over modification choices, especially in determining interest rates and mortgage terms (see differences in adjusted R^2 in regressions with and without servicer fixed effects).

In Table 4, Panel C, we explore the changes in modification terms with respect to loan quality. Again, we split the non-GSE loans sample into three levels of loan quality according to the FICO scores and level of documentation. The results show that modified portfolio-held loans of medium-quality borrowers are those with the least favorable terms, relative to securitized loans; the changes in their monthly payments, interest rates, and mortgage terms offer the least amount of concessions. The only exception is the change in balance: mid-quality borrowers of portfolio-held loans receive the greatest principal forgiveness, although the economic magnitude, shown in Column (8), is very small at about 0.1%.

4.2. Redefault following modification

Our direct data on renegotiations also allow us to examine the efficiency of modifications across securitized and bank-held loans without any error. In this subsection, we explore this issue by examining the relation between the likelihood of redefault, ownership status, and modification terms. First, we note that redefault rates are very high for the population studied. In Table 1, Panel E, redefault rates are 40.6%, when redefault is defined as being 60+ days past due and 27.9% when redefault is defined as being 90+ days past due.[17] Redefault rates are particularly high for agency loans (49% are

[16] The difference in the magnitude in concessions is a potential source of bias for algorithms that identify modifications based on a threshold change in interest rates. For example, Adelino, Gerardi, and Willen (2009a, 2009b) use a 50 basis points threshold decline in interest rate as a trigger for identifying a modification. Since modifications of portfolio loans are less concessionary than modifications of securitized loans, the algorithm is more likely to identify modifications of securitized loans than it would for modifications of portfolio loans.

[17] Our redefault figures differ somewhat 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 in the last quarter of 2007, while the OCC and OTS reports do not have such a requirement.

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60+ dpd within six months); portfolio-held loans have the lowest redefault rates (36% are 60+ dpd within six months).

To explore the determinants of redefault, we turn to multivariate analysis. In Table 5, Panel A, Column (1), we regress an indicator for redefault within six months of modification on the portfolio-held dummy, in addition to the usual set of controls and fixed effects. This base regression shows that portfolio loans are 3.5 percentage points less likely to redefault in absolute terms (a relative improvement of 9.0% over the baseline). We also note that redefault is higher for borrowers who are non-occupants, for mortgages with less than full income documentation, and for adjustable interest rate mortgages.

The regression also includes the effects of FICO, LTV, and origination year (untabulated for brevity) and is available upon request. We find that the redefault rate almost monotonically decreases with FICO and increases with LTV and the origination year. There is also a strong effect of the year of origination, with more recently originated loans experiencing much higher redefault rates.

In Columns (2) through (5) of Table 5, Panel A, we explore the relation between redefault and modification terms in conjunction with ownership status. Column (2) shows that the change in payment is a significant determinant of redefault. A 10% reduction in monthly payment is associated with a 4.3 percentage point lower likelihood of redefault (or 11% in relative terms). The strength of the estimated effect underscores the importance of mortgage affordability in achieving a successful modification. This finding supports the heavy emphasis on affordability in the federal HAMP efforts.

The change in the monthly payment is an amalgam of changes in individual loan terms. The rest of the table thus analyzes individual modification components. In Column (3), we focus on the change in interest rates and an interaction with ownership status to the regression. The results show that the redefault rate is higher when the interest rate concession is smaller (i.e., less negative). A decrease in interest rate of 1 percentage point is associated with a 5.4 percentage points drop in redefault rate (or 13.8% in relative terms). However, the sensitivity is slightly lower for portfolio-held mortgages. Column (4) shows that changes in balance have no material effect on the likelihood of redefault following modification. Column (5) shows that longer loan terms in modifications are associated with a higher likelihood of redefault.

The results on modification terms and the redefault rates suggest that modifications of portfolio-held loans are more efficient. Specifically, conditional on modification, portfolio-held loans receive smaller concessions (Table 4, Panel A). Yet, their post-modification performance is stronger (Table 5, Column (1)). Taken together, it appears that servicers renegotiate their own loans more efficiently than they do loans owned by outside investors.

Finally, Table 5, Panel B, explores the effects of ownership status on the redefault rate with respect to loan quality. At a first glance, the results in Columns (1) to (6) indicate that the redefault rate of high-quality loans is somewhat more sensitive to concessions in payment and interest rates. However, the sample size for these regressions is small enough to substantially weaken the statistical power of these tests.

5. Conclusion

In this paper, we use precise data on loss mitigation actions by servicers and lenders to settle the debate about the role of institutions and, in particular, securitization in mortgage renegotiations. Our results show that securitization reduces the likelihood of renegotiation and increases the likelihood of foreclosure. The effect is large: securitized loans are 4.2–5.9 percentage points less likely to be renegotiated (26–36% in relative terms) than portfolio loans. Importantly, the findings hold for high-quality loans (where information asymmetry is minimized), suggesting that they are not likely to be driven by unobservable characteristics that are correlated with ownership status.

These results are consistent with the findings and empirical estimates of Piskorski, Seru, and Vig (2010). It is worth reiterating that our flexible specification and controls (in particular, lender and servicer fixed effects and zip code × calendar quarter fixed effects) are likely absorbing most of the underlying unobserved heterogeneity of loans. This is reinforced by the fact that our stringent specification gives us results that are in line with the Piskorski, Seru, and Vig (2010) study that uses an identification strategy based on early pay default loans to arrive at similar estimates.

While the absolute levels of renegotiation rates may seem low, one needs to remember that there is no theoretical benchmark for the optimal number of loan renegotiations, given the unprecedented nature of the crisis (see Mayer, 2010; Posner and Zingales, 2009). In the absence of such a benchmark, it is difficult to say whether the observed unconditional levels of renegotiations are too high or too low. This would potentially require a structural approach and is left for future research.

To understand whether securitization has further effects on renegotiations, we explore the efficiency of modifications. The results suggest that, conditioned on modification, bank-held loans have a significantly lower redefault rate than similar securitized loans (about 3.5% in absolute terms and 9% in relative terms). This increased efficiency of bank-held modifications is likely due to servicers having better information about borrowers whose loans they own directly, rather than service on behalf of investors in a mortgage pool.

This paper adds to our understanding of the effects of securitization on the lending process. While securitization has a positive influence on certain aspects of credit markets—for example, by increasing the supply of credit (Mian and Sufi, 2009) and lowering the cost of capital (Pennacchi, 1988; Gorton and Pennacchi, 1995)—it also may give rise to various undesired outcomes. Mian and Sufi (2009) show that securitization-fueled credit expansion is associated with the house price boom and consequent bust. Keys, Mukherjee, Seru, and Vig (2010a) find that securitization leads to lenders shirking on borrower screening. Our paper extends this literature by showing directly for the first time that securitization results in lower

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Table 5
Redefault following modification.

The table presents regressions of redefault indicator [becoming 60+ days past due (dpd) within six months] on modification terms, in addition to borrower, contract, and servicer information. The base sample is the universe of residential mortgages serviced by the ten largest banks in the U.S. (19 servicer entities). The sample tracks loan performance from October 2007 to May 2009. There is no restriction on the date of origination. "In trouble" loans are loans that are 60+ dpd or entered loss mitigation programs. We require all "in trouble" loans to be current in the last quarter of 2007. Hence, this quarter is excluded from the analysis. The sample analyzed here includes only loans that became "in trouble" in 2008 (we use the period until May 2009 to monitor renegotiation actions). Loans that became "in trouble" in December 2008 have only a five month horizon. The sample includes only loans that are private-label securitizations or portfolio-held loans. Low-quality loans are loans taken by borrowers with FICO score of 620 or lower and with less than fully documented income. High-quality loans are loans with borrower FICO score of 680 or higher and with fully documented income. Medium-quality loans are all the rest. All regressions include fixed effects: in-trouble FICO score buckets, in-trouble LTV (loan-to-value) buckets, zip code interacted with calendar quarter, origination year and servicer fixed effects. *t*-statistics are presented in parentheses. Robust standard errors are clustered by servicer entity level. *, **, and *** denote two-tailed significance at the 10%, 5%, and 1% level, respectively. ARM = adjustable-rate mortgage.

Panel A: Determinants of redefault following modification

	Redefault (60+ dpd) within six months (0/1) × 100				
	(1)	(2)	(3)	(4)	(5)
Mean dependent variable	39.0	39.0	39.0	39.0	39.0
Change in payment (percent)		0.430***			
		(8.332)			
× portfolio held dummy		−0.031			
		(−0.400)			
Change in rate (basis points)			0.054***		
			(20.625)		
× portfolio-held dummy			−0.030***		
			(−8.832)		
Change in balance (percent)				−0.349	
				(−1.554)	
× portfolio-held dummy				−0.208	
				(−0.649)	
Change in term (months)					3.991**
					(2.306)
× portfolio-held dummy					2.629
					(1.415)
Portfolio-held dummy	−3.503***	0.376	−12.378***	−3.400***	−5.458***
	(−4.150)	(0.167)	(−12.227)	(−4.111)	(−4.718)
Borrower is non-occupier	3.339***	2.458	3.303***	3.348***	3.315***
	(3.392)	(0.888)	(3.559)	(3.397)	(2.878)
Low documentation mortgage	1.063	5.052	2.184	1.060	2.173
	(0.748)	(1.098)	(1.549)	(0.749)	(1.474)
Stated income mortgage	2.408**	3.314	4.503***	2.394***	1.977*
	(2.553)	(1.418)	(5.562)	(2.582)	(1.752)
Mortgage is ARM	11.572***	4.354	11.048***	11.524***	15.860***
	(9.142)	(1.623)	(11.992)	(9.285)	(9.988)
Number of observations	47,017	9,649	46,813	47,007	36,078
Adj R^2	0.112	0.160	0.144	0.113	0.149

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Panel B: Determinants of redefault following modification, per loan quality

Dependent variable: redefault (60+ dpd) within six months (0/1) × 100

	Payment (percent)			Rate (basis points)			Balance (percent)			Term (months)		
	Low (1)	Medium (2)	High (3)	Low (4)	Medium (5)	High (6)	Low (7)	Medium (8)	High (9)	Low (10)	Medium (11)	High (12)
Mean dependent variable	45.4	38.6	37.1	45.4	38.6	37.1	45.4	38.6	37.1	45.4	38.6	37.1
Change in X	0.221	0.437***	0.913	0.044***	0.054***	0.056***	−0.033	−0.317	−0.561	9.971***	6.461***	0.242
	(1.041)	(7.391)	(1.278)	(7.101)	(19.488)	(3.760)	(−0.074)	(−1.121)	(−0.491)	(3.087)	(5.909)	(0.077)
× portfolio-held dummy	0.036	−0.017	−0.339	−0.014	−0.030***	−0.030	−1.240	−0.159	0.112	−2.167	1.708	4.540
	(0.068)	(−0.183)	(−0.341)	(−1.407)	(−8.257)	(−1.390)	(−1.328)	(−0.390)	(0.062)	(−0.568)	(1.485)	(1.252)
Portfolio-held dummy	11.859	0.647	17.876	−5.655	−12.940***	−9.565*	4.498	−3.768***	−3.265	0.190	−5.458***	−2.735
	(0.579)	(0.241)	(0.601)	(−1.304)	(−11.162)	(−1.935)	(1.165)	(−3.874)	(−0.805)	(0.052)	(−4.045)	(−0.498)
Borrower is non-occupier	2.127	3.250	15.469	1.431	5.066***	1.434	2.012	4.970***	1.035	0.417	5.159***	−2.496
	(0.104)	(0.994)	(0.457)	(0.276)	(3.996)	(0.302)	(0.378)	(3.696)	(0.221)	(0.080)	(3.184)	(−0.384)
Low documentation mortgage	3.549	1.367		3.911	−0.078		−0.543		4.189	1.288		
	(0.327)	(0.188)		(1.034)	(−0.042)		(−0.289)		(1.234)	(0.650)		
Stated income mortgage	1.300		0.576		−4.483	−1.125		−0.268				
	(0.400)		(0.551)		(−1.301)	(− −0.966)		(−0.185)				
Mortgage is ARM	12.896	6.697**	−1.071	16.199*	14.327***	17.609***	26.946**	15.184***	17.195***	30.735***	18.378***	15.982**
	(0.397)	(1.978)	(−0.031)	(1.706)	(12.467)	(3.667)	(2.547)	(10.247)	(3.468)	(2.920)	(9.373)	(2.176)
Number of observations	808	7,660	1,181	4,396	36,717	5,700	4,435	36,853	5,719	3,519	28,710	3,849
Adj R^2	0.161	0.181	0.134	0.188	0.151	0.163	0.156	0.119	0.141	0.192	0.161	0.178

renegotiation rates and—under the assumption that bank-held loans are being renegotiated efficiently—less efficient renegotiation outcomes. Further, relative to the papers that discuss mitigation practices during the Great Depression (Rose, 2010; and Ghent, 2011), our work sheds light on policy issues that are most relevant to the current institutional setting.

An important policy issue that arises from our paper is the relation between modification terms and redefault rates. We find statistically significant and economically sizable results showing that redefault rates are higher when borrowers have lower credit quality and mortgages are less affordable. Specifically, redefault rates decrease with pre-modification FICO scores and with payment and interest rate concessions. Conversely, we find only a weak effect of leverage and balance increases and concessions on redefault. These results are consistent with the driving idea behind the Home Affordable Modifications Program (HAMP), which provides incentives for servicers and lenders to increase mortgage affordability as much as possible. However, the benefits of this approach need to be contrasted with the cost to investors (or lenders) resulting from lower payments. We leave the study of the effectiveness of HAMP for future research.

Appendix A

To validate our sample, we replicate the results of two tests in Piskorski, Seru, and Vig (2010). We restrict the sample to have only portfolio loans and private-label securitizations. The sample tracks loans from October 2007 to May 2009. “In trouble” loans are loans that are 60+ days past due (dpd) or that entered loss mitigation programs. We require all “in trouble” loans to be current in the last quarter of 2007, hence this quarter is excluded from the analysis. Further, as we require a window in which we monitor loss mitigation actions, we restrict the sample to loans that became “in trouble” in 2008 only.

We perform two sample validation regressions, which are presented in the table below (Table A1). First, we replicate the results in Table 3 of Piskorski, Seru, and Vig (2010), which shows quarterly foreclosure logit regressions. The averaged coefficients from those regressions are presented in the top row. We estimate a similar logit regression

Table A1
Validation of the sample used in the study.

Regression	Coefficient: I (portfolio loan)
Default regressions	
Piskorski, Seru, and Vig (2010), Table 3: average coefficients (logit/marginal)	−0.054***
	(−10.57)
Our sample: liquidated within six months (logit/marginal)	−0.102***
	(−17.23)
Cure/renegotiations regressions	
Piskorski, Seru and Vig (2010), Table 7A: original coefficients (Cox/odds ratios)	1.129***
	(17.15)
Piskorski, Seru and Vig (2010), Table 7A: transformed coefficients (Cox/probabilities)	0.061***
	(17.15)
Our sample: renegotiated within six months (ordinarly least squares)	0.047***
	(19.25)

where the dependent variable is whether a loan was liquidated within six months and present the marginal effect. Second, we run a regression that studies the determinants of renegotiations ("cure" regressions in Piskorski, Seru, and Vig, 2010, Table 7, Panel A). Their original coefficient on the portfolio loan indicator is presented in the third row. While they use a Cox-proportional hazard model, we are restricted by the structure of the dataset and run an OLS regression. We transform Piskorski, Seru, and Vig's (2010) coefficients so that they will be comparable to ours. Our coefficients from the OLS regression are presented in the last row of Table A1. All regressions include the following controls: FICO score, indicator for FICO score lower than 620, indicator for FICO score between 620 and 680, loan-to-value ratio, loan-to-value ratio squared, origination loan amount, origination loan amount squared, indicator for fixed rate mortgage, indicator for 15-year term mortgage, indicator for 20-year term mortgage, mortgage age at delinquency, and zip code fixed effects interacted with calendar quarter fixed effects.

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