Servicer Distress and Mortgage Renegotiations

Souphala Chomsisengphet and Chenfei Lu

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Abstract

We argue the financial health of lenders affects their renegotiation decisions. We connect proprietary data on mortgage loans and renegotiation outcomes to credit-default-swap data to investigate how the distress of lenders in late 2008 affected renegotiation outcomes. We exploit each lender's differential exposure to house-price shocks in regions outside the location of a distressed loan to account for unobservable shocks that may drive renegotiation outcomes. We show that during the peak of the financial crisis, more distressed mortgage lenders were more likely to foreclose on and less likely to modify troubled loans. A one-standard-deviation increase in lender distress in late 2008 was associated with a 3.6- to 13-percentage-point increase in the probability of foreclosure and a 3.0- to 4.7-percentage-point decrease in the probability of modification within one quarter. Evidence on short sales, time in foreclosure, and securitization status are consistent with the view that distressed banks change their renegotiation behavior to increase short-term financial health. Our findings suggest policies that seek to enhance renegotiation activity in times of economic distress should also consider the health of intermediaries engaged in such activity.[1]

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Souphala Chomsisengphet: Souphala.Chomsisengphet@occ.treas.gov; Chenfei Lu: clu0@chicagobooth.edu.

1 Introduction

The impact of the housing and foreclosure crisis of the late 2000s on the US economy was severe and far-reaching: from 2005 to 2008, the number of properties with foreclosure filings more than quadrupled from 532,000 to over 2.3 million.[2] Since the onset of the crisis, media and researchers have asked why, if foreclosures have direct costs and significant externalities (Campbell, Giglio and Pathak (2011); Mian, Sufi and Trebbi (2012)), the renegotiation of mortgage contracts hasn't been a more common response to the rise in mortgage delinquencies.

Shortly after the start of house-price declines in late 2006, mounting mortgage-related losses among financial institutions caused severe disruptions in various financial markets. Short-term lending markets and various large institutions bordered on the cusp of failure as capital losses and concerns about the value of banks' housing-related assets grew. In response to these tumultuous times, banks altered their behavior, with growing concerns about buffering their capital base and increasing liquidity. Recent research makes a connection between bank distress and behavior: Ivashina and Scharfstein (2010) and Cornett et al. (2011) show that banks more prone to liquidity runs during the 2008 financial crisis were more likely to decrease credit supply.

We study whether the financial health of these lenders affected their renegotiation decisions as well. In the United States, large financial institutions are also mortgage servicers, intermediaries that handle mortgage payments and resolve delinquent mortgages. We ask whether, during the height of the financial crisis in 2008, more distressed banks were more likely to foreclose on troubled mortgages. Distressed banks may become more concerned with increasing near-term liquidity and managing the riskiness of their assets. Because renegotiations are labor-intensive and costly, and foreclosures decrease the expected maturity of incoming cash flows, distressed banks may prefer to foreclose on loans instead of renegotiating them. Alternatively, a large literature on zombie lending shows that troubled banks may try to hide losses and gamble for self-cure because of regulatory pressure or to appear healthy (Hoshi and Kashyap (2004); Caballero, Hoshi and Kashyap (2008); Peek and Rosengren (2005); Bruche and Llobet (2014)). How the distress of lenders in the mortgage market affected their willingness to renegotiate is thus an open empirical question.

[2] "1.4 Million U.S. Properties with Foreclosure Filings in 2013 Down 26 Percent to Lowest Annual Total Since 2007." Realtytrac.com. http://www.realtytrac.com/news/foreclosure-trends/1-4-million-u-s-properties-with-foreclosure-filings-in-2013-down-26-percent-to-lowest-annual-total-since-2007/.

Although mortgage loans can be either bank-owned or securitized, in both cases, lenders have incentives to choose foreclosures when they become more distressed. For both types of loans, renegotiations of mortgage contracts, or modifications, are costly and require considerable investment in resources, such as trained staff. Additionally, lenders with bank-owned loans will prefer foreclosure when they are more distressed, because the liquidation proceeds from foreclosure will give them cash more quickly than the proceeds from a modified loan. Similarly, for securitized loans, servicers' compensation and cost structures give them incentives to favor foreclosures over modifications, because these servicers receive fees based on outstanding principal balance and events such as delinquency and foreclosure. Distress can thus influence servicers of securitized loans to favor the short-term gains from earning fees and forgoing expensive alternatives over long-term considerations, such as servicing reputation.

We use a large and rich loan-level data set from the Office of the Comptroller of the Currency (OCC) with data on loan performance, loan characteristics, and servicer identity to understand how lender distress, as measured by the servicer credit default swap (CDS) spread, affects the probability of a mortgage being foreclosed or modified. We focus on a cross section of loans that enter delinquency or loss-mitigation programs in the second half of 2008, and track the probability of loan outcomes within various time horizons.

We aim to compare loans with the same expected profitability and risks that differ only in the distress of their servicer. Thus, the null hypothesis that we test against is that lender-side factors do not influence the renegotiation decision. The main endogeneity concern is that more distressed banks have lower-quality loans that are more likely to be foreclosed. We first control for a rich set of borrower and loan characteristics. With these controls, we show distressed lenders are more likely to foreclose and modify a delinquent loan. To address endogeneity concerns associated with unobservable loan characteristics, and with the possibility that loan actions, such as foreclosures, are directly affecting bank distress, we use a measure of each bank's exposure to out-of-state house-price shocks as in Granja, Matvos and Seru (2015) as an instrument for bank distress. This instrument is strongly related to bank distress, and plausibly uncorrelated with local economic outcomes. We provide supporting evidence that the instrument is not positively correlated with unobservable loan quality: loans with more negative out-of-state house-price shocks are actually *less* likely to become delinquent.

In this instrumental variables (IV) framework, we find significant effects of distress on loan outcomes: a one standard deviation CDS spread increase is associated with a 3.6- to 13-percentage-point increase in the probability of foreclosing within three months, and 3.0- to 4.7-percentage-point decrease in the probability of modification. These effects are roughly 12%-45% and 20%-32% of the average foreclosure and modification probabilities of this time period, respectively. We believe we are the first to show an empirical link between bank distress and mortgage renegotiation.

These findings suggest that more distressed servicers are more impatient and choose outcomes that favor short-term gains or liquidity, which would lead them to prefer foreclosures over modifications. We find corroborating evidence for this hypothesis. First, we show that distress positively affects the probability of foreclosure for both securitized and bank-owned loans. Because the short-term benefits from liquidation of bank-owned loans are higher, we find suggestive evidence that the effect is larger for bank-owned loans.

Second, we explore the effect of distress on short sales. Short sales are negotiations between lenders and borrowers to sell the house to a third party, typically at less than the value of the outstanding mortgage debt, in exchange for liquidation proceeds to the lender and debt forgiveness for the borrower. Although banks don't often use short sales, we show that distress is positively associated with their likelihood, suggesting distressed lenders are more likely to accept a loss on the loan in exchange for immediate cash.

Finally, we investigate how distress affects outcomes after the initiation of the foreclosure process. We merge our mortgage data set with data on house-price transactions that allows us to track a house through the foreclosure process from the foreclosure initiation to the lender's liquidation of the house. We find distressed servicers take less time to complete the foreclosure process, suggesting they are acting more impatiently. We additionally show suggestive evidence that, conditional on liquidating the house, houses sell for a lower price when the lender is more distressed.

To conclude our paper, we show this driver of loan outcomes is important in explaining differences in foreclosure rates across local areas. For each Metropolitan Statistical Area (MSA), we compute an average of each lender's house-price instrument value, weighted by each lender's share of delinquent loans in that area. Lower values of this aggregated instrument indicate an MSA has more exposure to negative out-of-state house-price shocks. We find that MSAs with more distressed lenders had higher foreclosure initiation rates and foreclosure completion rates relative to

other MSAs in the same state. Consequently, we show suggestive evidence that MSAs with more distressed lenders also have modestly larger decreases in house prices from 2008 to 2009: when areas have more distressed lenders, they are more likely to experience more foreclosures, which drives down local house prices.

In addition to identifying the link between lender distress and mortgage delinquency outcomes, the empirical findings of this paper extend more generally to understanding lender-side factors that affect renegotiation. One baseline reason for why lenders don't amend all loans that could potentially benefit from renegotiation stems from possible effects on ex-ante incentives. Bolton and Scharfstein (1990) and Bolton and Scharfstein (1996) employ a model in which borrowers can strategically misrepresent their income to reduce their payments to their lenders. This insight is especially relevant in the context of residential mortgage markets, where a key lending friction is the inability to observe or contract on a homeowner's true ability to pay (Mayer et al. (2011), Riddiough and Wyatt (1994)). In this scenario, lenders use the threat of liquidation to keep borrowers from diverting available funds from their creditors. Thus, the ability and commitment of lenders to foreclose when borrowers become delinquent can induce borrowers to stay current on their loans when they are able to pay. Empirically, Adelino, Gerardi and Willen (2013) find this friction was a significant barrier to mortgage renegotiation during the 2000s.

However, although liquidation threats can prevent these types of strategic payment defaults, they also induce liquidation when homeowners default due to financial hardship. In recessionary times such as the late 2000s, when many borrowers experienced large negative economic shocks, whether lenders foreclosed on large numbers of houses to prevent strategic defaults is not clear. As a result, economists have explored other possible explanations. In particular, recent literature has identified frictions in the mortgage renegotiation process that made foreclosures more likely. Piskorski, Seru and Vig (2010), Agarwal et al. (2011), and Kruger (2014) show the mortgage securitization process introduces agency problems that incentivized lenders to be more likely to foreclose on securitized mortgages than bank-held loans, because the cost of renegotiating with borrowers can be significantly higher than systematically foreclosing on homes, and because the monitors of securitized loans may not directly benefit from engaging in these renegotiations.[3]

[3]Indeed, servicers have been charged with accusations of fraud, imposing illegal fees, and other behavior that led them to foreclose on a large number of borrowers. In the well-publicized "robosigning" scandal of 2010, several large servicers were accused of hastily signing foreclosure-related documents without verifying necessary information.

Papers have focused on how issues such as coordination problems among multiple creditors (Bolton and Scharfstein (1996), Gertner and Scharfstein (1991)) can lead to inefficient renegotiation outcomes. However, room remains to tie supply-side factors to ex-post and ex-ante debt renegotiation. To the extent that a lender's health can distort its incentives to maximize total value, we explore whether this distortion exists empirically, and at what magnitude. Our paper adds to this dialogue by providing empirical evidence that such factors play important roles, especially during financial crises.

Furthermore, this paper identifies another form of the indirect costs of financial distress among banks. Few studies directly show how firms' financial distress can affect firm value (Hortaçsu et al. (2013), Andrade and Kaplan (1998)). To the extent that lenders are imposing externalities through their renegotiation decisions, or that the financial distress of a bank causes the bank to choose renegotiation outcomes that would have more value in the absence of distress, we show leverage and financial distress matter as well in the interaction of firms and their networks more generally in a way that can affect value.

Finally, although this paper makes no welfare arguments, our findings can inform policymakers in various ways. Recent government intervention in the mortgage renegotiation process has encountered difficulties in achieving targets of total modifications and borrower performance. Agarwal et al. (2013) explores the effect of the largest federal mortgage modification program, Home Affordable Modification Program (HAMP), on mortgage renegotiation outcomes. They identify low servicer participation relative to program targets and considerable heterogeneity across servicers in their propensity to offer HAMP modifications, which is correlated with their pre-HAMP renegotiation intensity and organizational capacity to modify mortgages. Our paper supplements this paper and the area of mortgage renegotiation by further investigating one potential factor that may drive the heterogeneity in creditor incentives to renegotiate. Furthermore, understanding the mechanism through which supply-side factors affect incentives can allow us to think more carefully about how policy goals can be achieved, given the particular financial landscape.

The rest of the paper is as follows. In Section 2, we outline institutional details related to mortgage servicing. We describe the data in Section 3. Section 4 presents our baseline OLS regressions and our empirical methodology involving our house-price-exposure instrument. We explore the mechanism through which distress affects renegotiation outcomes in Section 5. Section

6 explores the aggregated effects of bank distress on local economies. Section 7 concludes.

2 Institutional Details

The mortgage market comprises many parties with various responsibilities. The originating lender is the primary organizer of the loan to prospective home borrowers. Some of these loans remain with the originating bank as a portfolio loan, whereas most mortgages in the 2000s were securitized, wherein these loans are sold to entities for the purpose of being pooled and then sold as securities to investors.[4]

The servicer plays the key role as the main liaison between the owners of the loan and the homeowners. In many cases, the servicer was also the originator of the loan, which is the case for slightly less than half of subprime loans.[5] If the loan is securitized, a trust holds the legal title to the loan, and the servicer acts on behalf of the trust. Servicers have two main functions. First, the servicer is responsible for collecting mortgage payments and remitting them to the owners of the loans' cash-flows rights. Second, servicers are responsible for resolving delinquent mortgages. In particular, servicers are responsible for monitoring the performance of the mortgage and collecting information to make a decision of whether and how to renegotiate with the homeowners to minimize loan losses. A servicer can perform the various actions to address a delinquent mortgage. First, it can start a legal foreclosure process. Once the process is complete, the borrower loses possession of the property, which is then sold to a third party. Liquidation proceeds are then distributed to the owners of the loan. Second, it can choose to renegotiate by modifying mortgage terms such as principal, interest rate, and maturity in order to lower monthly interest payments. Third, it can enter more short-term solutions such as repayment plans, which are plans that temporarily put off monthly payments into the future. Fourth, it can facilitate a refinance of the mortgage. Finally, it can pursue other forms of foreclosure alternatives, such as short sales or deed-in-lieu of foreclosure.

Servicers have different incentives depending on whether the loan is on their balance sheet or whether they are servicing a securitized loan for investors. In general, lenders have incentives to foreclose on both securitized and bank-owned loans when they become distressed.

[4] In 2009, 90% of mortgages were securitized.

[5] State Foreclosure Prevention Working Group Report No. 1.

Bank-owned loan incentives Bank-owned, or portfolio loans, are typically serviced by the bank that owns the loan. When the lender forecloses on the loan, it initiates a process that eventually transfers ownership of the loan to the lender's balance sheet, after which it must sell the home to a third party. In a loan modification, the lender and borrower agree to change various contract terms, often to lower monthly payments and/or extend the maturity of the loan. The expected value of each of these outcomes depends on various factors, such as indiviual and local economic conditions, which can affect the house liquidation value in foreclosure and the risk of redefault after a modification. However, the expected maturity of incoming cash flows from a foreclosure is significantly shorter than in a modification: whereas a lender may expect to receive liquidation proceeds within six months to three years, depending on economic conditions and foreclosure laws, a modified mortgage's stream of cash flows arrive monthly over the maturity of the loan. Foreclosure may also be less risky than a modified mortgage; whereas a lender bears exposure to local housing-market risk when trying to sell a foreclosed house, a lender of a modified loan also faces redefault risk, which may come from idiosyncratic borrower risk, as well as risk coming from local economic risks. Furthermore, conditional on redefault, lenders may face the same local economic risk when foreclosing. Thus, if distressed lenders are more likely to prefer more near-term liquidity and less risk exposure in their mortgage loans, they may be more likely to prefer to foreclose.

Securitized loan incentives Servicers of securitized loans manage mortgage renegotiations on behalf of the securitization trust.[6] Servicers are compensated with various fees. The primary revenue source is the monthly servicing fee: servicers receive roughly 25-50 bp annually on the total outstanding principal balance for loans. This payment comes directly from interest payments. If payments are delinquent, the servicer expects to receive these payments in the future when the borrower becomes current or when the loan becomes liquidated. This payment is senior to payments to investors. Next, servicers can impose fees on borrowers to compensate them for certain events, such as foreclosures and late fees. However, critics have argued these fees provide incentives for servicers to not renegotiate with borrowers and to collect fees from distressed borrowers.[7]

[6] Although goverment-sponsored enterprise (GSE) loans do have some different programs and guidelines for mortgage renegotiation for servicers, difficulties in the ability to distinguish between GSE and private-label loans lead us to consider them collectively.

[7] Other forms of compensation include income from the interest paid during the period between the homeowner paying the monthly payment to the servicer remitting that payment to the securitization trust. Also, servicers will

In general, various papers have discussed how aspects of the compensation structure and contract between servicers and investors give incentives for servicers to foreclose more often (Cordell et al. (2008), Thompson (2011), Levitin and Twomey (2011)). First, the aforementioned fee structure can give servicers incentives to charge fees in the event of foreclosure. Second, whereas costs related to foreclosures are typically reimbursed, costs related to modification are not. These costs can be significant, as an average direct cost of modification can range from $750 to $1000 (Mayer et al (2009)). Another cited reason is the existence in some private-label contracts of explicit mortgage modification restrictions.[8]

Indeed, in the midst of the foreclosure crisis, servicer behavior received heavy scrutiny. Both academics and media[9] blamed servicers for contributing to the rise in foreclosures due to their improper handling of distressed mortgages. Mortgage servicers have been blamed for foreclosing on too many homes and not renegotiating on them, because of structural restrictions, a lack of capacity, and misaligned incentives.

These revenues create incentives for private-label servicers to opt for sub-optimal behavior for investors of the loan. They have incentives to push for foreclosures over modifications, in order to increase fees and avoid modification costs. Distress may make banks more impatient and prefer to maximize short-term profits, possibly at the expense of maintaining their reputation and fiduciary duty to maximize the value of the loan. Thus, bank distress may exacerbates agency problems between investors and servicers.

3 Data

3.1 Data Description

We use OCC Mortgage Metrics, which is a panel data set that tracks loans serviced by OCC-regulated banks, representing 60% of all outstanding US mortgages. This data set allows us to track loan performance, borrower and loan characteristics, and mortgage renegotiation outcomes

sometimes retain junior tranches of the securitization pool to align incentives with investors. However, critics state these tranches are often out of the money, especially during times of severe housing downturns.

[8]These agreements, known as Pooling and Servicing Agreements, sometimes explicitly forbid modifications from taking place (Gelpern and Levitin (2009)). However, Hunt (2013) samples 65 PSAs and finds that only 8% of the agreements explicitly prohibit modifications.

[9]http://www.nytimes.com/2009/07/30/business/30services.html

over time.

Our full data set tracks troubled loans from seven banks that enter the sample from July 2008 to December 2011, though we focus primarily on the set of loans that enter trouble status in the third and fourth quarters of 2008. We keep loans that are in "trouble," which begins when a borrower becomes 60 days past due or voluntarily requests loan renegotiation via a loss-mitigation program. The former definition comprises 85% of our sample. Our sample of loans in 2008 represents roughly 10% of all outstanding loans in the full data set in this period. Using this concentrated set of loans allows us to focus on a more similar subsample of loans that would be affected by the most bank-level variation in CDS levels over the sample.[10] We supplement this data set with 5-year senior unsecured CDS spread data from Markit for the banks in our sample.

We merge our mortgage loan data with data on house-price transactions from Dataquick. This merging allows us to track for a subset of loans details of the sale of the foreclosed houses to the open market. We track loans that enter trouble status on or after the third quarter of 2008. Among the details of the sale are the sale price and the time of sale, which we measure. We keep the observations in Dataquick that we can identify as a foreclosed house being transferred to a lender or guarantor, such as Fannie or Freddie. Then we track that house over time to identify when that house is sold to a third party. We then match on house number, street name, and zip code. Between the two data sets, we receive a 30% match when matching on address and zip code. Although this match rate is low, we find no obvious reason why the relationship between bank distress and the foreclosure decision should differ depending on whether the house address matches.

Table 1a shows summary statistics for troubled loans in the sample. In general, loans tend to be relatively high quality for a delinquent mortgage. The median loan size is slightly less than $200,000 in size, and the median borrower has a FICO score of 664, which is above the typical cut-off of 620 for a subprime loan. However, when the loan enters the sample, the median FICO score is generally 50 points lower than the median FICO score at origination. Also of note is the large spread in CDS spreads for the servicer in Q3'2008, the height of the financial crisis. The standard deviation of CDS spreads at this time is 6%; this figure drops considerably in Q4'2008, but is still elevated relative to the long-run average CDS spread for these banks.

[10] Additionally, examining loan outcomes around this time period allows us to separate distress from the effect of large-scale modification programs such as the Home Affordable Modification Program.

Troubled loans can enter various renegotiation outcomes. The two most common outcomes, which are the main focus of our paper, are foreclosures and modifications. The key foreclosure event we track is the initiation, when a servicer refers the mortgage to an attorney for the purpose of initiating the foreclosure process. Modifications are changes to the various terms of the mortgage contract, including reductions of interest rates, term extensions, capitalization of arrears, and principal reductions and deferrals. Table 1b shows the probability of various renegotiation outcomes after entering the sample as either being delinquent or entering loss-mitigation. Foreclosure is the most likely outcome: 29% of all loans entering trouble status in Q3'08 or Q4'08 enter foreclosure initiations within one quarter, which is indicative of the poor performance of these loans. The next most common outcome is modification: roughly 15% of all trouble loans reach some modification within one quarter. Note these outcomes are not mutually exclusive; for example, we allow for loans to become modified and then eventually enter foreclosure. Other loan outcomes such as temporary repayment plans, short sales, and refinances, were uncommon for these loans at this time.

Figure 1 shows the probability of a loan reaching various outcomes as a function of quarters after entering the sample. The probability of a renegotiation outcome generally declines over time, with the highest probabilities of actions occurring within the first two quarters of entering the sample. Furthermore, we see the probability of foreclosure or modification is generally much higher than the other outcomes, especially in the first year. This plot motivates our focus of studying how distress affects the probability of these outcomes within a relatively short period of time around the date that the loan enters the sample, as this period encapsulates much of the renegotiation activity.

4 Empirical Methodology

We first describe the relationship between mortgage renegotiation outcomes and servicer distress through a baseline OLS regression before discussing how the IV framework addresses our main bias concerns.

4.1 Distress and Renegotiation Outcomes

We estimate the effect of servicer distress on mortgage renegotiation outcomes by reducing the data set to a cross section of observations at the loan level. For all loans that enter trouble status at time $t \in \{Q3'08, Q4'08\}$, we estimate the following cross-sectional regression:

$$Outcome_{ibst} = \alpha + \beta LogCDS_{b,Q3'08} + \Gamma X_{ibt} + \alpha_t + \alpha_s + \epsilon_{ibst} \tag{1}$$

where the *Outcome* is a (0,1) indicator of whether the loan reaches a foreclosure initiation or modification within three or six months of entering trouble status. i indicates the loan, b is the bank, s indicates the state (or MSA), and t represents the quarter in which a loan enters trouble status. α_t represents quarter fixed effects and α_s represents state fixed effects. Included in X are loan characteristics such as FICO score, interest rate, loan type (ARM or FRM), LTV, loan size, and maturity. Other controls include origination-year fixed effects and delinquency-date fixed effects, which control for cohort effects and time elapsed after delinquency. Our null hypothesis is that servicer distress has no impact on the renegotiation outcome, which would predict $\beta = 0$.

We exploit cross-sectional variation in bank distress across observations, which allows us to isolate the effect from time-varying aggregate changes to the macroeconomy. Additionally, we limit the sample of loans to entering delinquency in late 2008 in order to explore a time period when variation in bank distress was at its apex. This focus also helps us address issues with left and right censoring, because we can follow almost all loans from delinquency to resolution/liquidation in this set of loans.

The key biases are that lender distress may be correlated with many unobserved variables that can also affect the likelihood of foreclosure or modification. For example, aggregate trends in foreclosure rates could be correlated with aggregate movements in lender distress, or more distressed banks tend to lend to lower-quality borrowers in areas with more negative economic shocks.

Many controls in the regression to address these concerns, at least partly. Location and quarter fixed effects can address unobservable differences in local economic trends. We can control for the loan contract by including loan term, loan size, interest rate, and loan type (fixed-rate or adjustable-rate). Additionally, we can capture aggregate trends in borrower quality or lending standards using fixed effects for loan-origination year and the quarter of delinquency ("trouble date").

Table 2 shows the estimation results for Equation 1 for foreclosures. We find lender distress is positively correlated with the probability of foreclosure within three months. As we add loan controls from Columns (2) to (3), we find the coefficient declines slightly from 0.0861 to 0.0764, suggesting some correlation between distress and loan quality may have been present that drove the OLS results in (1) and (2) upwards. The coefficient in Column (3) is economically meaningful; using the log CDS standard deviation for this time period of 1.07, the estimates equate to a roughly 8-percentage-point increase in the probability of foreclosure within three months. This magnitude is significant, considering the average probability of foreclosure within this time window is 29%.

In Column (4), we replace state fixed effects with finer MSA fixed effects and find the coefficient increases. This larger estimate is most likely due to the sample reduction coming from data availability on MSAs, because it suggests the effect is stronger in MSAs than in more rural areas. Finally, in Columns (5) and (6), we find the effect holds when we look at six-month horizons and at the whole history of the loan. The fact that the coefficient in Column (6) is smaller than that of smaller time horizons suggests some of the effect of distress on foreclosures is coming from the timing of foreclosures: more distressed banks are also more likely to foreclose more quickly.

Table 3 shows the effect of distress on the probability of modification at various time horizons. We find that more distressed banks are actually more likely to modify a loan: using estimates in Columns (3) and (4), we find a standard-deviation increase in log CDS is related to a 1.7- to 2.2-percentage-point increase in the probability of modification in three months. This probability is small compared to the average probability of modification within this time window of 15%. This result is somewhat surprising, because modifications often delay or preclude the possibility of foreclosure.

Although the OLS regressions show evidence of a link between foreclosure and modification rates and lender distress, some important concerns still prevent us from making causal inferences. First, unobservable borrower and within-region variation may be correlated with lender distress and driving the renegotiation outcomes. Furthermore, mortgage losses have been identified as a large contributor to bank distress during the recession. This reverse causality may mechanically be driving the results we see.

The direction of the bias may be asymmetric between foreclosures and modifications. Although more distressed banks may have lower-quality loans, which can lead to more foreclosures, the effect

of loan quality on modifications is not necessarily monotonic. Better-quality loans might merit more modifications, but the best-performing loans among delinquent loans may be more likely to self-cure, and thus be less likely to get modified. Finally, we may be measuring distress via the CDS spread with considerable measurement error, because this variable may not capture all of the private and public information related to bank distress.

4.2 House-Price Instrument

The key worry in the regression of mortgage renegotiation outcomes on bank CDS spreads is that unobservable loan quality is correlated with bank distress. We follow an identification strategy based on Granja, Matvos and Seru (2015) that exploits differences in the geographic exposure of a bank's mortgage portfolio to house-price changes as an instrument for bank distress.

An important driver of bank distress leading up to the financial crisis was the declining performance of mortgage loans and mortgage-related securities, associated with a decline in house prices across the country. Although we cannot use mortgage losses directly, because they are partly driven by lender behavior, we can estimate a bank's exposure to negative house-price shocks in areas outside of the observation's state. We predict that banks that are more exposed to changes in local house prices will be more distressed, and we use variation in house prices orthogonal to observable loan and borrower characteristics. Let ω_{br} represent the share of bank b's mortgages that are in state r as of Q3'08, and $\Delta HP_{r,Q3'08}$ represents the change in house prices from Q4'06 to Q3'08 in state r. For state r, let M_r be the set of all states that do not border state r. Then the instrument is constructed as

$$HPI_{bs,Q3'08} = \sum_{r \in M_s} \omega_{br} \Delta HP_{r,Q3'08} = \sum_{r \in M_s} \omega_{br} \frac{HP_{r,Q3'08} - HP_{r,Q4'06}}{HP_{r,Q4'06}}. \tag{2}$$

A visual representation of this use of non-bordering states is shown in Figure 3. For all loans in Arizona, we calculate the loan shares of a loan's servicer for all non-bordering states, shown in light blue. As a more concrete example, this instrument can allow us to compare the renegotiation outcome of two loans in Arizona, serviced by two banks, A and B, that differ in geographic exposure. Bank A may have relatively more mortgage exposure in other states with large negative house-price shocks, such as Florida, so we would predict A would be more distressed than B. Thus, we expect

this cross-sectional variation in exposures across banks within a region to drive differences in lender health across banks.

The first stage is estimated in the cross-section for loan observations that enter delinquency in $t \in \{Q3'08, Q4'08\}$:

$$LogCDS_{b,Q3'08} = \gamma HPI_{bs,Q3'08} + \Gamma_1 X_{ibst} + u_{ibst}, \tag{3}$$

and the second stage is then estimated as

$$Outcome_{ibst} = \beta \widehat{LogCDS}_{b,Q3'08} + \Gamma_2 X_{ibst} + \epsilon_{ibst}, \tag{4}$$

where X contains a matrix of loan and borrower controls, state fixed effects, origination-year fixed effects, trouble-date fixed effects, and ownership-type fixed effects.

This instrument isolates the component of bank distress coming from differential exposure to house-price shocks. By construction, it uses variation in lender distress outside of that local area. Additionally, we exclude states bordering the observation's state, which allows us to address the concern that regional economic shocks may be driving the result. By using the lender's exposure to house-price shocks in other states, this instrument addresses the reverse-causality issue that foreclosing on a given loan could directly affect a lender's distress level. Furthermore, it provides an advantage over adding geographic fixed effects, because it avoids confounding effects coming from within-state or within-MSA variation.

We use the quarterly FHFA All-transactions House Price Index at the state level and collapse the monthly Mortgage Metrics data set into a quarterly frequency. We calculate state loan shares using all loan data (not just loans in trouble status).

Figure 2 shows the dispersion of select house-price changes since 2006 for various states and the United States as a whole. Since 2006, house prices in much of the country declined, with the trough arriving in roughly 2012. Most notably, there is wide dispersion in the the extent of the house-price change across areas. Banks have different exposure to these changes; we exploit this geographical variation as a driver of bank distress. Table 1a shows summary statistics for the house-price instrument, measured as the weighted average house-price change from Q4'2006 to Q3'2008. As expected, house prices on average fell considerably during this time, which explains

the average instrument value of -12%. Indeed, house prices continue to fall for these states until 2011. However, the change to 2008 is sufficient to explain cross-sectional variation in bank distress.

4.3 Results

Table 4 shows first-stage regression results of the instrument on log CDS spread. In these loan-level regressions, we regress the average log CDS spread in Q3'08 on the weighted average change in house prices for the bank from Q4'06 to Q3'08. Columns (1) and (2) show the relationship between the instrument and log CDS with and without loan controls. The regressions consistently show the house price is strongly negatively correlated with the instrument, suggesting the banks that had more negative exposure to house-price changes were the most distressed banks in 2008. Column (3) shows this relationship also holds using MSA fixed effects. In terms of magnitudes, a one-standard-deviation decline in the house-price instrument (0.039) predicts a one-point increase in the log CDS, which is 93% of the log CDS standard deviation. Hence, cross-sectional differences in house-price exposure are associated with considerable differences in log CDS across banks. We find similar results when using changes in house prices from Q4'06 to Q2'08, and different control specifications, including FICO bins and loan-type bins.

Table 5 shows the second-stage results, where the dependent variables are whether a loan enters foreclosure within one quarter or two quarters, respectively.[11] We find more distressed servicers are more likely to foreclose within three months. With state fixed effects in Column (2), we find a one-standard-deviation increase in log CDS leads to a 3.6% increase in the foreclosure probability. This effect represents 12% of the average foreclosure probability of 30% within three months. With MSA fixed effects, the coefficient increases considerably: a one-standard-deviation increase in log CDS is associated with a 13% increase in the foreclosure probability. At six-month horizons, we find similar results: more distressed servicers are more likely to foreclose within this time period.

Table 6 shows similar results for modifications. Column (2) shows an increase in log CDS leads to a decrease in the three-month modification probability. A one-standard-deviation increase in log CDS is related to a 4.7% decrease in the modification probability, which is 32% of the average probability of modification within this time window. Effects are smaller in magnitude with MSA fixed effects; a standard-deviation increase in log CDS is associated with a 3.0% decrease in the

[11] The Appendix contains results with reduced-form regressions of outcome variables directly on the instrument.

probability of modification. In a six-month time window, the effect declines, suggesting more distressed servicers may be more likely to modify loans more quickly, because they are moving forward modifications that would have been made from three to six months after delinquency. The difference in sign from the OLS estimates is consistent with the possibility that OLS estimates were biased upward, because more distressed banks could have lower-quality loans, which could lead their loans to be more likely to be modified than to have no action and be self-cured. One possible explanation is that distress is measured with considerable error, and OLS estimates are attenuated to zero.

Table 7 shows regressions that look closer at the margin of outcomes between which distress has an effect. We find more distressed banks are less likely to do nothing: a one-standard-deviation increase in log CDS increases the probability of any action by around 5%-7%. This result suggests distressed banks are acting more impatiently. Furthermore, we find evidence of a distress effect on both the intensive and extensive margins. Not only are distressed banks accelerating foreclosures and delaying modifications; we also see permanent changes in the probability of a loan ever becoming foreclosed or ever being modified, although the effect on modifications is weaker. These results seem to show zombie lending may not be the main driver of lender activity. Zombie lending would predict distressed lenders would choose not to perform any action on delinquent loans, because then they would have to recognize these loans as non-performing.

4.4 Effect of Instrument on Delinquency Probability

The house-price instrument could violate the exclusion restriction if the geographic composition of banks' mortgage portfolios is correlated with factors that explain renegotiation outcomes. For example, banks with high exposure to houses in areas with large negative house-price shocks could be more likely to have lower-quality loans on unobservables.

To address this concern, we test if the instrument predicts whether a loan is delinquent. If we find the negative instrument shocks are positively correlated with a loan's likelihood of being delinquent, we have reason to believe our instrument is negatively correlated with unobservable loan quality. This result would make our instrument invalid, because any effect of the instrument on foreclosures could be a result of lower-quality loans having more negative instrument values.

For this setup, we take a random sample of 1.7 million loans from Mortgage Metrics, uncon-

ditional on whether the loan is in delinquency. We then take the subsample of all loans serviced Q3'2008, which is the period from which we draw delinquent loans, and regress whether the loan is more than 60-days delinquent at any point in 2008 on the house-price instrument in Q3'2008. We exclude from the definition of delinquent those loans entering loss-mitigation programs, because these loans may not necessarily be of lower quality.

Table 8a shows the regression results. In Columns (1) and (2), we find that without loan controls, we do see a correlation: loans with more negative house-price shocks are more likely to be delinquent. However, once we add the loan controls in Columns (3) and (4), the sign flips. In fact, loans with more negative house-price shocks are actually less likely to become delinquent. This finding implies the instrument is most likely negatively correlated with unobservable loan quality, suggesting the IV estimates of the effect of distress on foreclosures might even be an underestimate.

Additionally, we correlate the instrument at the loan level with observable measures of loan and borrower quality. Table 8b shows the pairwise correlation coefficients. The instrument does seem moderately correlated with the loan size and is weakly correlated with other variables, such as FICO, interest rate at origination, and loan type. However, all other variables appear uncorrelated with the instrument. Thus, at least on observables, we do not see much difference between loans serviced by banks with high exposure and loans serviced by banks with low exposure.

5 Short-term Liquidity Hoarding

5.1 Hypothesis and other explanations

We now use these findings to distinguish between various hypotheses that could explain the effect.

First, liquidity may have played a factor for these servicers during the height of the financial crisis. Brunnermeier (2009) discusses how distressed lenders may choose to preserve liquidity in anticipation of negative shocks. This behavior is more prevalent when negative shocks are more likely and when obtaining funds through credit markets is difficult.

Second, poorly performing banks may want to keep bad loans on their balance sheets in order to delay recognition of losses. This idea of "pretend and extend" would mean banks would choose not to modify or foreclose loans, because both of those actions would force the loans to be revalued at fair value. However, our previous findings that foreclosures actually become more likely would

go counter to the prediction that banks would be more likely to perform no action. Thus, although this effect may exist empirically, a stronger countervailing effect must be present.

Financially distressed banks may also participate in a form of risk-shifting: because these banks benefit from limited liability, they may choose to gamble on the performance of the loans and hope the loans self-cure, as in Diamond and Rajan (2011), in which case, we would expect fewer modifications to occur. The effect on foreclosure rates is ambiguous: conditional on loan characteristics, banks could gamble on the performance of the loan by choosing not to foreclose and hoping the loan will self-cure. However, by not choosing to modify loans, the performance of the loan could deteriorate significantly; thus, loans could be in worse shape, which would propel banks to be more likely to eventually foreclose on that loan.[12] However, our findings go against the prediction that banks would choose to wait on these loans to self-cure: we show in Table 7 that more distressed banks are less likely to wait and do nothing to a delinquent loan.

5.2 Ownership Type

We next investigate how distress could affect both securitized and bank-owned loans. If liquidity and short-term gains influence distressed banks to foreclose more, then the effect of distress should be larger for bank-owned loans, because liquidating a bank-owned loan provides more near-term cash than liquidating a securitized loan.

First, we show the breakdown of observable borrower and loan characteristics in Table 9. In general, securitized loans are similar in many dimensions to bank-owned loans, including credit score, LTV, and owner occupancy. More of the securitized mortgages are fixed-rate, whereas bank-owned loans are slightly larger. Despite some similarities between these loans, we do see foreclosure probabilities within three months are much lower for bank-owned loans. This difference confirms previous research that has shown differences in negotiation activity between bank-owned and securitized loans (Agarwal et al. (2011); Piskorski, Seru and Vig (2010)).

In Table 10, we run reduced-form regressions of loan outcomes on the house-price instrument interacted with an indicator of whether a loan is bank-owned. In Columns (1) and (2), we see

[12]Research also discusses this possibility of risk-shifting in the context of securitized loans (Mayer and Gan (2006)): servicers often retain equity tranches of the securitization pool in an attempt to align the interests of servicers with those of investors. However, if the share going to servicers is sufficiently small, and if the expected losses from the mortgage pool are sufficiently large, servicers may be out of the money and have an incentive to gamble and extend the life of the loan.

bank distress matters more for bank-owned loans than securitized loans, although the effect is insignificant when we use MSA fixed effects. In terms of magnitudes, the estimates suggest a standard-deviation increase in log CDS makes foreclosure 1.5-4.0 percentage points more likely for bank-owned loans than securitized loans. This difference is considerable, especially considering that bank-owned loans have lower foreclosure rates. These differences may also be an underestimate, because we might expect bank-owned loans to be better than securitized loans on unobservables, if banks choose to keep better-quality loans.

5.3 Short sales

One additional way to test whether liquidity concerns are driving the effect of distress on renegotiation outcomes is to look at how distress affects the probability of a short sale. Short sales are another avenue through which lenders can liquidate a loan quickly. In a short sale, the borrower and lender agree to sell the property to a third party for less than the outstanding mortgage balance. This agreement typically benefits the borrower, because he/she usually is discharged from all mortgage obligations and receives a less negative impact on his/her credit score than with a foreclosure. It also benefits the lender who can avoid undergoing the cost of a foreclosure process, at the cost of taking an immediate loss on the loan. If distressed banks are more likely to choose renegotiation outcomes that benefit them more in the short term, we would expect short sales to be more likely. However, historically, short sales were not a common loan-resolution outcome. Lenders can be reluctant to engage in a short sale in order to maintain a liquidation threat to uphold ex-ante incentives for borrowers to make their payments. Additionally, borrowers may lack incentives to exert effort to maximize the sales price of the property (Clauretie and Daneshvary (2009)).

In Table 11, we perform the same cross-sectional regression, with the dependent variable being whether a loan led to a short sale within one quarter. Although short sales were a rare renegotiation outcome during this time (the average probability of reaching a short sale in three months was 0.5%), short sales are another avenue through which lenders can liquidate a loan quickly. Here, we find short sales are more likely when the lender is more distressed. A one-standard-deviation increase in log CDS translates to a roughly 21-basis-point increase in the probability of a short sale within one quarter, or 45% of the average short-sale probability. The small coefficients relate to the relatively few observations that led to a short sale during this time. However, although the overall effect is

miniscule, it does support the hypothesis that distressed servicers become more short-term minded in their renegotiation outcomes.

5.4 Distress and the Post-foreclosure Process

We have previously measured the effect of distress on the initiation of the foreclosure process. Next, we show evidence that servicer distress plays a role in the outcome of that loan after the foreclosure start. In particular, we ask if distressed banks are more likely to complete a foreclosure, and if so, whether the process occurs more quickly, and whether distress affects the price at which foreclosed properties are sold. Recent literature has shown that costs borne by servicers are increasing in time spent in foreclosure (Cordell and Lambie-Hanson (2015); Levitin and Twomey (2011)). More distressed lenders may be less willing to bear these costs and more willing to speed up the process to receive liquidation proceeds more quickly.

In particular, we aim to measure for house i in state s with lender b and trouble date t

$$TimeToSale_{isbt} = \beta_1 LogCDS_{b,Q3'08} + \Gamma_1 X_{ist} + \epsilon^1_{isbt} \tag{5}$$

$$LogPrice_{isbt} = \beta_2 LogCDS_{b,Q3'08} + \Gamma_2 X_{ist} + \epsilon^2_{isbt}, \tag{6}$$

where $LogCDS$ is the log CDS spread of the loan servicer as of Q3'08. This effect controls for house characteristics and loan characteristics, and contains fixed effects to control for local economic shocks and state-level or local-level laws and regulations. We test whether more distressed servicers sell their foreclosed properties more quickly and at lower prices.

We take the set of loans that become troubled in the second half of 2008. We track the effect of distress between each step of the foreclosure process. The first step we have seen is the time from entering the sample as a troubled loan to the time the servicer initiates the foreclosure process. Next, we track when the loan becomes available for REO sale by the bank. Before this point, the borrower may eventually self-cure and exit the foreclosure process. Once the house enters REO status, the servicer has a mandate to manage and sell the house to a third party. Banks often have limitations for how long a house can remain on its balance sheet. Finally, we track when this house is sold to a third party. Upon sale, the proceeds are remitted to the owners of the loan. For

securitized loans, many fees and reimbursements to servicers are paid when the house is liquidated, senior to the creditors.

Table 12 shows the IV regression results using the CDS of the loan servicer as of Q3'08. In Columns (1) and (2), we regress the number of months elapsed between the time a loan enters the troubled sample and when it is liquidated as an REO. We find the time is decreasing: foreclosed homes with distressed servicers tend to spend less time in the foreclosure process. A standard-deviation increase in log CDS decreases the number of months to liquidation by 2.6-4.4 months. In Columns (3) and (4), we show this effect is concentrated on the time from entering the trouble sample to when the bank takes possession of the house. Although state foreclosure laws and regulations can have large effects on the time in foreclosure, we show that within a given state, more distressed banks take less time to foreclose. This finding provides evidence that banks are attempting to speed up the foreclosure process to expedite the time until they can liquidate and receive cash. By contrast, if the busyness of the servicer were driving the effect of distress on foreclosures, we might expect the time spent in foreclosure to increase, because the bank would have to devote its resources to more properties.

Finally, in Columns (5) we examine the effect on prices. We find a small but negative effect of distress on the sale price of the house. Thus, although we find evidence that distressed banks move more quickly through parts of the foreclosure process, we do not see fire-sales behavior in the prices. Most likely this is because the distress of the lender is measured in 2008, which can be significantly earlier than the time when the house is sold.

We caution that although we have identified effects of distress on time spent in foreclosure, other channels might be affecting time to liquidation and sale prices. For example, if more distressed banks are more likely to foreclose, they could induce an increase in the supply of foreclosed homes, which could drive prices down.

6 Aggregated Effects of Bank Distress at the Local Level

We show this effect of distress on loan outcomes has aggregate effects for local economies. Although our loan-level analysis shows differences in loan outcomes as a function of lender distress, we can get a better grasp of the economic magnitude of bank distress by looking geographically to see if areas

with larger exposure to the house-price instrument had differences in foreclosure rates and other outcomes. To do so, we aggregate our data on foreclosures and the instrument at the MSA level. For simplicity, we consider only MSAs that lie entirely in one state. For each MSA, we calculate the share of each troubled loan in that area with each individual bank. In contrast to the construction of the instrument, which uses loan shares over all loans, we focus on lender shares of troubled loans, because this set of loans represents the relevant population of loans through which we identify our channel of lender distress. Using these lender shares, we calculate a weighted average of the value of that instrument. Let B_m be the set of banks with loans in MSA m. Define w_{rm} as the share of loans serviced by bank r in that MSA, and let HPI_{rst} be the value of the house-price instrument for that bank in state s at time t. Then we calculate the average HPI for that MSA as

$$AvgHPI_{mst} \equiv \sum_{r \in B_m} w_r HPI_{rst}. \tag{7}$$

This measurement calculates the exposure each MSA has to house-price shocks in other areas. Importantly, this analysis is performed using within-state variation: within a state, all areas have exposure to the same set of house prices, and differ only in the share of loans serviced by banks of differing house-price exposure. Within a state s, MSAs with more distressed banks servicing more of its loans will have, by construction, a more negative value of $AvgHPI$. We show MSA-level summary statistics in Table 13. Twenty percent of all delinquent loans begin foreclosure proceedings in 2008. Additionally, 2% of all loans are in trouble status. The completed foreclosure rate (per troubled loans) is 61%; this number is large because the rate includes completed foreclosures of all loans from 2008 to 2010 that become delinquent. The average HPI across all MSAs is negative. Whereas the standard deviation across the whole sample is 0.022, the within-state standard deviation is significantly smaller, at 0.00324.

We next measure the effect of this instrument on the foreclosure rate for that area using a cross-sectional regression, with each observation representing an MSA. We calculate this rate $FCRate$ as the number of initiated foreclosures in the MSA m in state s divided by the number of delinquent loans, and estimate the following regression:

$$FCRate_{zs,2008} = \beta AvgHPI_{zs,2008} + \Gamma_s + \epsilon_{zs}. \tag{8}$$

The state fixed effects imply that we are measuring cross-sectional differences in MSA-level foreclosure rates as a function of cross-sectional differences in house-price exposure.

Table 14a shows how the average instrument exposure correlates with foreclosure initiations. In Columns (1), we find MSAs with more exposure to house-price shocks during this time had higher foreclosure start rates. Using the within-state standard-deviation of the instrument of 0.00324, the estimates predict a 1.5 percentage point increase in the foreclosure rate for every standard-deviation decrease in the instrument. These results are moderately important, relative to the 20% average foreclosure rate across MSAs. In Column (2), we additionally control for the MSA-level Trouble Rate, or the fraction of loans that are 60 days past due or in loss-mitigation, and other MSA-level controls. These controls allow us to better adjust for economic conditions and differences in loan quality across MSAs. We find the coefficient declines with these controls, implying a 1.2-percentage-point increase in foreclosure rates for every standard-deviation decrease in the instrument. Finally, in Columns (3) and (4), we find the effects also hold when we look at foreclosures per outstanding mortgage. Thus, we show that differences in lender distress can partly explain differences in aggregate foreclosure starts across MSAs.

This effect is strongest during the height of the financial crisis. Figure 4 shows differences in foreclosure-start hazard rates between the top third and bottom third of MSAs, ranked by the house-price instrument in Q3'2008. We see that in 2008 and 2009, the disparity in foreclosure hazard rates is the highest. By 2011, the difference in hazard rates is small, even considering the overall decline in foreclosure rates over time.

In Table 14b, we explore the effect of $AvgHPI$ on the number of completed foreclosures in 2008 to 2010. We find negative out-of-state house-price shocks are associated with more completed foreclosures per delinquent loan. Using Column (2) estimates, a one-standard-deviation decrease in the average house-price instrument is associated with a 4.9-percentage-point increase in the completed foreclosures per delinquent loan across 2008 to 2010. Over all loans, the effect is statistically significant but small: the same movement in average HPI represents a 12-basis-point increase in the number of completed foreclosures per outstanding loan.

This effect of distress on completed foreclosures corroborates our previous connection between distress and foreclosure starts, because more foreclosure starts on average will lead to more completed foreclosures. However, the estimate gets less precise when we control for the delinquency

rate. Additionally, estimating the effect on foreclosures per mortgage becomes less precise, though the sign is in agreement with the other results.

Given these small effects on overall foreclosures, we would expect to see a small effect on house prices. Mian, Sufi and Trebbi (2012) show a rise in foreclosures in an area increases the supply of distressed houses and drives down house prices. Additionally, a large literature explores the negative externalities that a foreclosure can have on the value of nearby houses (Campbell, Giglio and Pathak (2011)). In Table 14c, we regress the MSA-level change in house prices from 2008 to 2009 on the value of the house-price instrument in 2008. As we increase the number of controls in the regression from Columns (1) to (3), we find diminishing significance and magnitude in the effect. Column (3) results are statistically insignificant and represent a 25-basis-point decrease in house prices, or 5% of the across-MSA house-price-change standard deviation, for every within-state standard-deviation increase in $AvgHPI$. Thus, we show some evidence that MSA-level exposure to lender distress can explain a modest amount of MSA-level house-price movement.

These reduced-form estimates incorporate many possible channels through which distress may affect these local areas. For example, bank distress may also affect each bank's credit supply, which can also affect local economies. Furthermore, foreclosure externalities could exacerbate the initial effects of distress on renegotiation outcomes. However, to the extent that MSA-level controls can pick up some of the economic factors through which distress affects credit supply, we still find lender distress via renegotiation matters for aggregate foreclosure outcomes.

7 Conclusion

We use detailed loan-level data to show that during the height of the financial crisis in 2008, more distressed banks were more likely to foreclose on a delinquent loan and less likely to modify a delinquent loan. This result holds even when we control for loan characteristics and a plethora of fixed effects. We exploit cross-sectional differences in banks' exposure to local house-price shocks to generate exogenous variation in distress that is uncorrelated with unobservable loan quality.

We then provide evidence that distress is primarily affecting banks through liquidity concerns. Short sales, an outcome that provides lenders faster extinguishing of the loan in exchange for accepting a loss, are also more prevalent when the servicer is distressed. We find distressed banks

move through the foreclosure process more quickly, and the effect is larger for bank-owned loans, for which the short-term benefits from foreclosing are higher.

We believe we are the first to demonstrate the link between servicer distress and mortgage renegotiation. We hope to catalyze further investigation into the implications of this connection between bank distress and mortgage renegotiation in various avenues. First, this paper identifies another factor in debt renegotiation that can affect not only ex-post resource allocations, but also ex-ante debt provision. If creditors anticipate large-scale delinquencies in states of the world when they themselves are distressed, and if they have stronger incentives in these states to liquidate their loans, then ex-ante contract terms and credit supply may also be affected.

Second, our paper's findings could inform policy in the mortgage market and bank regulation. Agency problems in the securitization chain that create incentives to foreclose on a more delinquent borrowers may become exacerbated in the presence of servicer distress. Furthermore, that bank distress may affect renegotiation outcomes in the mortgage market may also be informative to bank regulators who are interested in the ultimate effects of bank risk-taking. The rise in foreclosures in the late 2000s provoked a variety of government interventions in an attempt to reduce the number of liquidations. The findings of this paper could better inform policymakers for how to improve the efficacy of their interventions. Because distressed banks have been more likely to foreclose on delinquent borrowers, a policy that aims to minimize foreclosures may have to increase the financial incentives for such banks to get the same amount of compliance as with less distressed banks. The optimal policy in this scenario would depend on various factors, such as the objective function of policymakers, and the responsiveness of renegotiation to distress.

Finally, we make salient one of the many linkages in the macroeconomy between the financial and housing sectors. We provide empirical evidence of a channel through which bank balance sheets are negatively affected, which leads to loan liquidations and foreclosures, which can further depress real estate values and balance sheets.

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Figures and Tables

Figure 1: Probability of Outcome by Quarters Elapsed

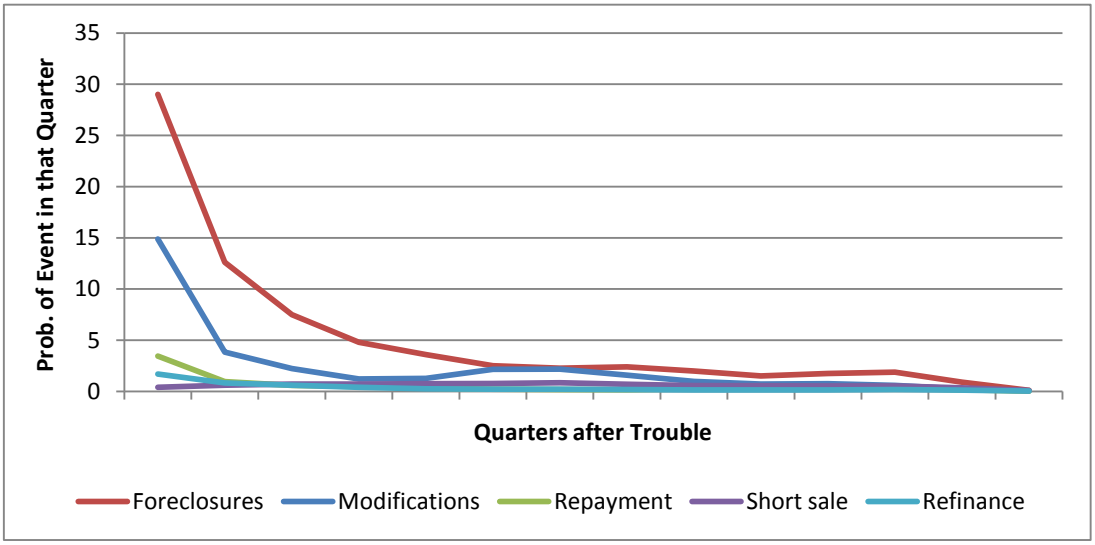


Figure 2: State-level House-Price Changes Since Q4'2006

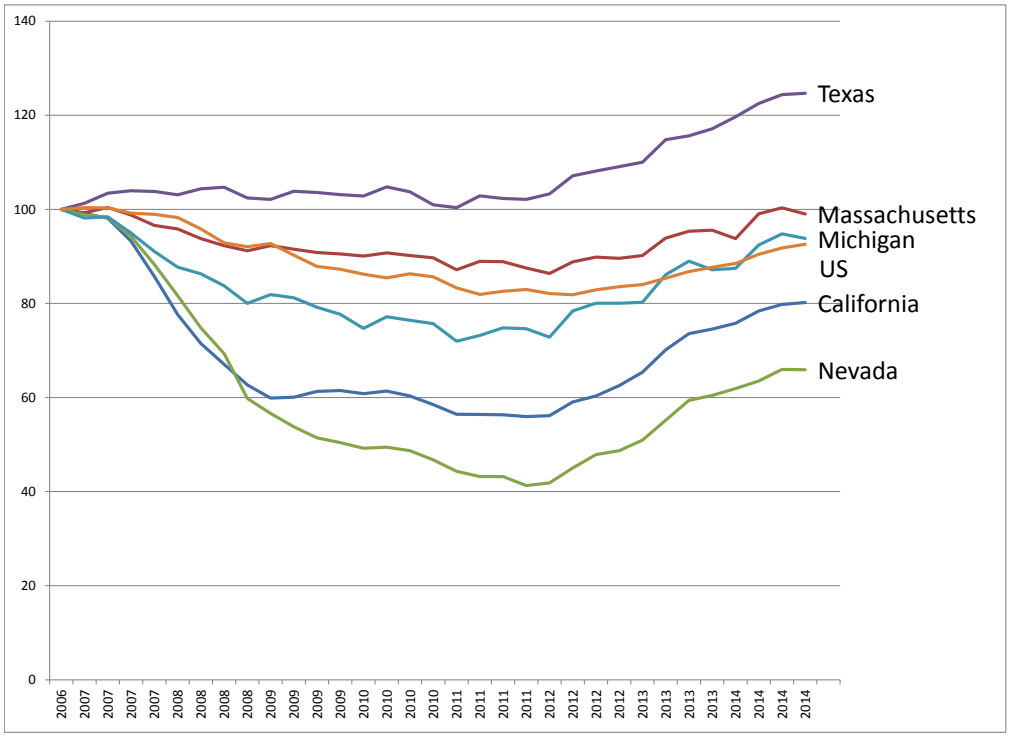
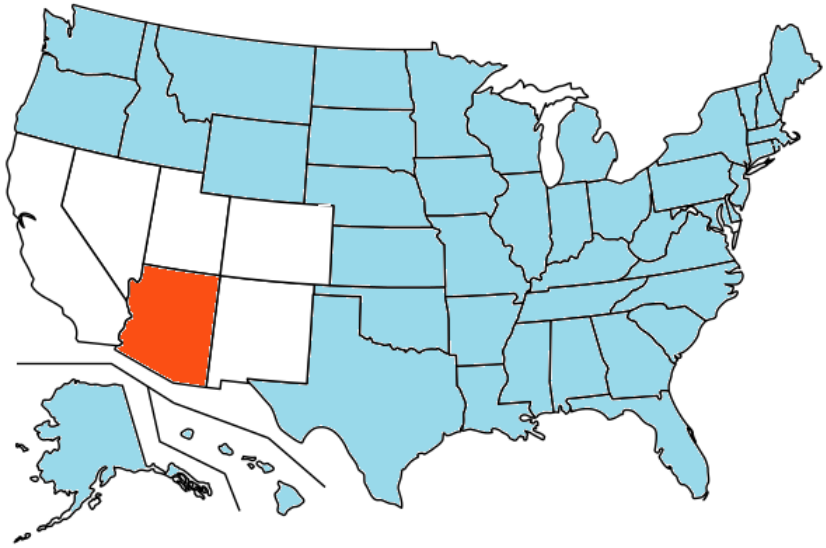
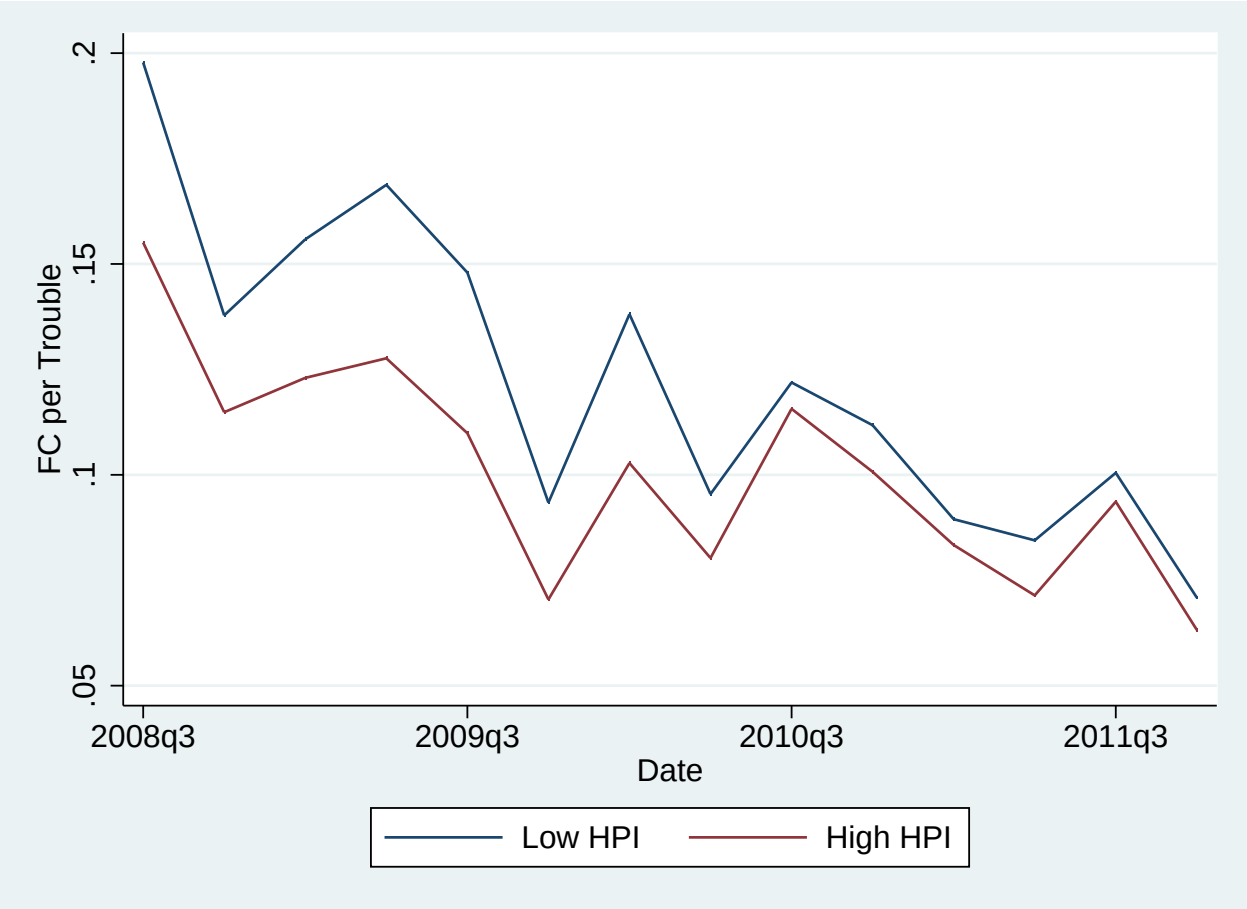


Figure 3: Example of States Used for House-Price Instrument Construction



For loans in Arizona (shown in orange), the house-price instrument takes an average of each loan's servicer's loan shares across all non-bordering states (shown in light blue).

Figure 4: Time Series: Foreclosure Initiation Hazard Rates between High HPI and Low HPI MSAs



Sample divided into MSAs in the upper and lower third of the distribution of the average house-price instrument as of Q3'2008. MSAs remain in their respective group for the entire graph period. Both y-axis and x-axis variables are demeaned by state.

Table 1: Summary Statistics

(a) Loan Characteristics

Loan Characteristics at Origination						
Variable	Num Obv.	Mean	SD	10th Pct	50th Pct	90th Pct
FICO Score At Origination	404904	659.996	65.372	569	664	744
LTV at Origination	414648	0.772	0.179	0.6	0.8	0.95
Interest Rate at Origination	410997	0.064	0.022	0.023	0.067	0.087
Loan Size	423083	240469	167984	75000	198000	454000
Loan Term	423085	363.389	52.746	360	360	360
Bank-owned Loan	423085	0.176				
Owner Occupied	423085	0.856				
Fixed Rate Mortgage	386517	0.495				
Full Documentation	422933	0.479				
Loan Characteristics at Trouble Date						
Variable	Num Obv.	Mean	SD	10th Pct	50th Pct	90th Pct
FICO Score at Trouble	376387	610.328	89.362	494	610	732
LTV at Trouble	238314	0.871	0.362	0.51	0.823	1.363
Interest Rate at Trouble	422993	0.071	0.014	0.058	0.069	0.09
CDS Spread at Trouble	423085	0.031	0.046	0.013	0.014	0.112
Q3'08 CDS	423085	0.047	0.061	0.011	0.013	0.164
Q3'08 Log CDS	423085	-3.761	1.075	-4.486	-4.371	-1.807
Q4'08 CDS	423085	0.018	0.018	0.013	0.015	0.015
Q4'08 Log CDS	423085	-4.170	0.434	-4.360	-4.228	-4.228
HP Instrument	423085	-0.12	0.039	-0.167	-0.119	-0.063
Log CDS at Trouble	423085	-3.983	0.818	-4.371	-4.297	-2.19
Q3'08 Trouble Date	423085	0.445				
Q4'08 Trouble Date	423085	0.556				

(b) Probability of Renegotiation Outcomes

	Foreclose	Modify	Repayment	Short Sale	Refinance
Outcome in 3 months	29.0%	14.9%	3.5%	0.4%	1.7%
Outcome in 6 months	41.6%	18.7%	4.4%	1.0%	2.5%
Outcome in 12 months	53.9%	22.1%	5.5%	2.5%	3.5%

Table 2: OLS Estimation: Foreclosures

	(1)	(2)	(3)	(4)	(5)	(6)
	FC 3M	FC 3M	FC 3M	FC 3M	FC 6M	FC Ever
Log CDS	0.0847***	0.0861***	0.0764***	0.0986***	0.0984***	0.0291***
	(0.0117)	(0.0119)	(0.0119)	(0.0112)	(0.0143)	(0.0078)
Log Loan Term			-0.134***	-0.0772***	-0.0636***	-0.0793***
			(0.0224)	(0.0173)	(0.0149)	(0.0274)
Log Loan Amt			0.0231***	0.0139**	0.0351***	0.0318***
			(0.0032)	(0.0053)	(0.0087)	(0.0058)
LTV at Orig.			-0.173***	-0.197***	-0.244***	-0.0742***
			(0.0338)	(0.0374)	(0.0479)	(0.0238)
Owner Occup.			-0.123***	-0.122***	-0.189***	-0.108***
			(0.0079)	(0.0146)	(0.0156)	(0.0110)
Fixed Rate			-0.0024	0.0356***	0.0586***	0.0132***
			(0.0052)	(0.0030)	(0.0044)	(0.0034)
Full Documentation			-0.0648***	-0.0695***	-0.0887***	-0.0476***
			(0.0093)	(0.0095)	(0.0070)	(0.0035)
Current FICO			0.000168***	0.000340***	0.000424***	-2.8E-05
			(0.0000)	(0.0000)	(0.0000)	(0.0000)
Current Int. Rate			1.810***	0.0955	0.681***	1.816***
			(0.1890)	(0.1080)	(0.1710)	(0.3280)
Unpaid Balance to Loan			0.185*	0.295***	0.188*	0.478***
			(0.1090)	(0.0496)	(0.1040)	(0.0369)
Observations	423085	423085	335054	285713	285713	285713
Adjusted R^2	0.040	0.069	0.118	0.172	0.188	0.089
Local FE	No	State	State	MSA	MSA	MSA
Ownership FE	No	No	Yes	Yes	Yes	Yes
Quarter FE	No	No	Yes	Yes	Yes	Yes
Orig FE	No	No	Yes	Yes	Yes	Yes

Observations are at the loan level. Standard errors clustered at the state level. The dependent variable is whether the loan enters foreclosure within various times from being 60 days delinquent or entering loss-mitigation. The independent variable is the log CDS spread for the loan's servicer in Q3'08. Period covers loans that enter trouble status in Q3'08 or Q4'08. Variables labeled "Current" indicate values of those variables at the date of entering the sample.

Table 3: OLS Estimation: Modifications

	(1)	(2)	(3)	(4)	(5)	(6)
	Mod 3M	Mod 3M	Mod 3M	Mod 3M	Mod 6M	Mod Ever
Log CDS	0.00137	0.00138	0.0158***	0.0206***	0.0249***	-0.00865***
	(0.0027)	(0.0026)	(0.0028)	(0.0026)	(0.0027)	(0.0023)
Log Loan Term			0.232***	0.256***	0.249***	0.232***
			(0.0446)	(0.0473)	(0.0479)	(0.0424)
Log Loan Amt			-0.0413***	-0.0421***	-0.0411***	-0.0115
			(0.0076)	(0.0085)	(0.0097)	(0.0087)
LTV at Orig.			0.178***	0.187***	0.222***	0.301***
			(0.0141)	(0.0142)	(0.0188)	(0.0336)
Owner Occup.			0.0834***	0.0728***	0.0892***	0.128***
			(0.0114)	(0.0102)	(0.0124)	(0.0097)
Fixed Rate			-0.0637***	-0.0915***	-0.0849***	-0.0624***
			(0.0088)	(0.0081)	(0.0078)	(0.0098)
Full Documentation			0.0418***	0.0416***	0.0513***	0.0521***
			(0.0026)	(0.0022)	(0.0022)	(0.0035)
Current FICO			-4E-05	-0.0000816***	-0.000226***	-0.000583***
			(0.0000)	(0.0000)	(0.0000)	(0.0001)
Current Int. Rate			-3.370***	-2.084***	-1.145*	-0.498
			(0.4410)	(0.6470)	(0.6390)	(0.6790)
Unpaid Balance to Loan			-0.266**	-0.377***	-0.407***	-0.234*
			(0.1000)	(0.0742)	(0.0889)	(0.1200)
Observations	423085	423085	335054	285713	285713	285713
Adjusted R^2	0.000	0.003	0.104	0.113	0.125	0.104
Local FE	No	State	State	MSA	MSA	MSA
Ownership FE	No	No	Yes	Yes	Yes	Yes
Quarter FE	No	No	Yes	Yes	Yes	Yes
Orig FE	No	No	Yes	Yes	Yes	Yes

Observations are at the loan level. Standard errors clustered at the state level. The dependent variable is whether the loan receives a permanent modification within various times from being 60 days delinquent or entering loss-mitigation. The independent variable is the log CDS spread for the loan's servicer in Q3'08. Period covers loans that enter trouble status in Q3'08 or Q4'08. Variables labeled "Current" indicate values of those variables at the date of entering the sample.

Table 4: First-Stage Estimation

	(1)	(2)	(3)
	Log CDS	Log CDS	Log CDS
Δ HP	-21.72***	-26.25***	-27.99***
	(2.173)	(1.441)	(2.583)
Log Loan Term		0.564***	0.691***
		(0.171)	(0.147)
Log Loan Amt		0.0403	0.0633
		(0.031)	(0.040)
LTV at Orig.		-1.589***	-1.602***
		(0.244)	(0.229)
Owner Occup.		-0.130**	-0.158**
		(0.062)	(0.067)
Fixed Rate		-0.356***	-0.418***
		(0.024)	(0.033)
Full Documentation		-0.0377***	-0.0422**
		(0.013)	(0.016)
Current FICO		0.00153***	0.00155***
		(0.000)	(0.000)
Current Int. Rate		2.303***	2.486***
		(0.809)	(0.905)
Unpaid Balance to Loan		0.0221	-0.399
		(0.406)	(0.468)
Observations	423084	335053	285711
Adjusted R^2	0.142	0.414	0.407
Local FE	State	State	MSA
Ownership FE	No	Yes	Yes
Quarter FE	No	Yes	Yes
Orig FE	No	Yes	Yes

Observations are at the loan level. Standard errors clustered at the state level. The dependent variable is the log CDS spread for the loan's servicer in Q3'08. The key explanatory variable is the house-price instrument as of Q3'08, which measures a loan's servicer's exposure to house prices in other states. Instrument excludes states bordering the observation's state. Period covers loans that enter trouble status in Q3'08 or Q4'08. Variables labeled "Current" indicate values of those variables at the date of entering the sample.

Table 5: IV Results: Foreclosures

	(1)	(2)	(3)	(4)	(5)
	FC 3M	FC 3M	FC 3M	FC 6M	FC 6M
$\widehat{LogCDS}$	0.0374**	0.0331*	0.123***	0.0342**	0.125***
	(0.0150)	(0.0176)	(0.0183)	(0.0144)	(0.0115)
Log Loan Term		-0.100***	-0.0946***	-0.0947***	-0.0831***
		(0.0217)	(0.0225)	(0.0182)	(0.0155)
Log Loan Amt		0.0254***	0.0125**	0.0479***	0.0335***
		(0.0040)	(0.0050)	(0.0057)	(0.0086)
LTV at Orig.		-0.254***	-0.153**	-0.297***	-0.195***
		(0.0397)	(0.0576)	(0.0522)	(0.0703)
Owner Occup.		-0.131***	-0.117***	-0.188***	-0.184***
		(0.0075)	(0.0140)	(0.0074)	(0.0147)
Fixed Rate		-0.0201***	0.0477***	-0.00341	0.0721***
		(0.0075)	(0.0072)	(0.0076)	(0.0080)
Full Documentation		-0.0657***	-0.0692***	-0.0832***	-0.0885***
		(0.0097)	(0.0092)	(0.0073)	(0.0067)
Current FICO		0.000253***	0.000298***	0.000303***	0.000377***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
Current Int. Rate		1.780***	0.0331	2.430***	0.612***
		(0.1860)	(0.1370)	(0.2590)	(0.2230)
Unpaid Balance to Loan		0.176	0.311***	0.0704	0.206**
		(0.1270)	(0.0502)	(0.1940)	(0.1010)
Observations	423084	335053	285711	335053	285711
Adjusted R^2	0.056	0.110	0.169	0.130	0.186
Local FE	State	State	MSA	State	MSA
Ownership FE	No	Yes	Yes	Yes	Yes
Quarter FE	No	Yes	Yes	Yes	Yes
Orig FE	No	Yes	Yes	Yes	Yes
F-stat	100.0	331.9	117.4	331.9	117.4

Observations are at the loan level. Standard errors clustered at the state level. The dependent variable represents whether the loan enters foreclosure within three months or six months of being 60 days delinquent or entering loss-mitigation, respectively. The key explanatory variable is the log CDS spread for the loan's servicer as of Q3'08. Log CDS is instrumented by the house-price instrument as of Q3'08, which measures a loan's servicer's exposure to house prices in other states. Instrument excludes states bordering the observation's state. Period covers loans that enter trouble status in Q3'08 or Q4'08. Variables labeled "Current" indicate values of those variables at the date of entering the sample.

Table 6: IV Results: Modifications

	(1)	(2)	(3)	(4)	(5)
	Mod 3M	Mod 3M	Mod 3M	Mod 6M	Mod 6M
$\widehat{LogCDS}$	-0.0396***	-0.0440***	-0.0278***	-0.0240***	-0.0259**
	(0.0101)	(0.0067)	(0.0098)	(0.0080)	(0.0102)
Log Loan Term		0.279***	0.291***	0.276***	0.286***
		(0.0538)	(0.0565)	(0.0518)	(0.0570)
Log Loan Amt		-0.0381***	-0.0393***	-0.0363***	-0.0382***
		(0.0056)	(0.0064)	(0.0073)	(0.0077)
LTV at Orig.		0.0670***	0.0977***	0.123***	0.129***
		(0.0188)	(0.0200)	(0.0219)	(0.0211)
Owner Occup.		0.0719***	0.0628***	0.0921***	0.0787***
		(0.0145)	(0.0140)	(0.0157)	(0.0163)
Fixed Rate		-0.0882***	-0.116***	-0.0766***	-0.111***
		(0.0106)	(0.0121)	(0.0094)	(0.0118)
Full Documentation		0.0405***	0.0412***	0.0491***	0.0509***
		(0.0031)	(0.0028)	(0.0029)	(0.0028)
Current FICO		0.0000775**	4.7E-06	-0.0000779**	-0.000136***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)
Current Int. Rate		-3.411***	-1.958***	-2.837***	-1.013
		(0.4540)	(0.6760)	(0.4240)	(0.6710)
Unpaid Balance to Loan		-0.279**	-0.409***	-0.307**	-0.441***
		(0.127)	(0.102)	(0.128)	(0.118)
Observations	423084	335053	285711	335053	285711
Adjusted R^2	-0.012	0.084	0.097	0.100	0.111
Local FE	State	State	MSA	State	MSA
Ownership FE	No	Yes	Yes	Yes	Yes
Quarter FE	No	Yes	Yes	Yes	Yes
Orig FE	No	Yes	Yes	Yes	Yes
F-stat	100.0	331.9	117.4	331.9	117.4

Observations are at the loan level. Standard errors clustered at the state level. The dependent variable represents whether the loan receives a permanent modification within three months or six months of being 60 days delinquent or entering loss-mitigation, respectively. The key explanatory variable is the log CDS spread for the loan's servicer as of Q3'08. Log CDS is instrumented by the house-price instrument as of Q3'08, which measures a loan's servicer's exposure to house prices in other states. Instrument excludes states bordering the observation's state. Period covers loans that enter trouble status in Q3'08 or Q4'08. Variables labeled "Current" indicate values of those variables at the date of entering the sample.

Table 7: IV Results: No Action and Foreclosures/ Modifications At Any Point

	(1)	(2)	(3)	(4)
	No Action 3m	No Action 6M	FC Ever	Mod Ever
$\widehat{LogCDS}$	-0.0491***	-0.0624***	0.0679***	-0.0192*
	(0.017)	(0.017)	(0.010)	(0.011)
Observations	335053	335053	335053	335053
Adjusted R^2	0.082	0.087	0.077	0.088
State FE	Yes	Yes	Yes	Yes
Ownership FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Orig FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Observations are at the loan level. Standard errors clustered at the state level. The dependent variable in Columns (1) and (2) are whether the servicer takes no action within three months or six months of being 60 days delinquent or entering loss-mitigation. The dependent variable in Columns (3) and (4) are whether that loan ever receives a foreclosure or modification. The key explanatory variable is the log CDS spread for the loan's servicer as of Q3'08. Log CDS is instrumented by the house-price instrument as of Q3'08, which measures a loan's servicer's exposure to house prices in other states. Instrument excludes states bordering the observation's state. Period covers loans that enter trouble status in Q3'08 or Q4'08.

Table 8: Robustness Tests

(a) Regression: Loan Delinquency Status on House-Price Instrument

	(1)	(2)	(3)	(4)
	Is Delinquent	Is Delinquent	Is Delinquent	Is Delinquent
Δ HP	-0.260***	-0.416***	0.385***	0.437***
	(0.0398)	(0.0422)	(0.0677)	(0.0811)
Observations	830915	788514	652761	619783
Adjusted R^2	0.009	0.015	0.233	0.227
Local FE	State	MSA	State	MSA
Ownership FE	No	No	Yes	Yes
Quarter FE	No	No	Yes	Yes
Orig FE	No	No	Yes	Yes
Controls	No	No	Yes	Yes

Sample includes a random sample of all loans in Q3'08 and Q4'08. Observations are at the loan-quarter level. Standard errors clustered at the state level. The dependent variable is whether a loan is 60 or more days past due in that quarter. The key explanatory variable is the house-price instrument as of Q3'08, which measures a loan's servicer's exposure to house prices in other states. Instrument excludes states bordering the observation's state.

(b) House-Price Instrument Correlation with Loan Characteristics

	FICO	FICO	Log Loan	Log Loan	LTV	Owner	Fixed	Full	Int. Rate	Int. Rate
	At Orig.	At Trouble	Term	Size	at Orig	Occup.	Rate	Doc.	at Orig.	At Trouble
ΔHP	0.1513*	0.1180*	0.0947*	0.3256*	-0.0596*	0.0207*	-0.1673*	-0.0664*	-0.1592*	-0.0498*

Table 9: Summary Statistics by Ownership Type

	Num Obv.	Mean	SD	10th Pct	50th Pct	90th Pct
Securitized						
FICO at Origination	333256	661	64	573	664	743
FICO at Trouble	311732	609	89	493	609	730
LTV at Origination	343412	0.77	0.17	0.61	0.80	0.95
Owner Occupied	348496	0.86	0.35	0.00	1.00	1.00
Fixed Rate Mortgage	314316	0.52	0.50	0.00	1.00	1.00
Full Documentation	348407	0.49	0.50	0.00	0.00	1.00
Interest Rate at Origination	339060	0.07	0.02	0.04	0.07	0.09
Interest Rate at Trouble	348451	0.07	0.01	0.06	0.07	0.09
Loan Size	348495	232653	156770	75200	194750	427000
Loan Term	348496	362	49	360	360	360
FC in 3 Months	348496	0.31	0.46	0.00	0.00	1.00
Mod in 3 Months	348496	0.12	0.32	0.00	0.00	1.00
FC in 6 Months	348496	0.44	0.50	0.00	0.00	1.00
Mod in 6 Months	348496	0.16	0.36	0.00	0.00	1.00
Bank-owned						
FICO at Origination	71648	655	70	551	661	745
FICO at Trouble	64655	617	90	501	617	742
LTV at Origination	71236	0.77	0.21	0.52	0.80	1.00
Owner Occupied	74589	0.83	0.37	0.00	1.00	1.00
Fixed Rate Mortgage	72201	0.38	0.49	0.00	0.00	1.00
Full Documentation	74526	0.45	0.50	0.00	0.00	1.00
Interest Rate at Origination	71937	0.06	0.03	0.01	0.06	0.09
Interest Rate at Trouble	74542	0.07	0.02	0.06	0.07	0.09
Loan Size	74588	276983	208847	72000	215600	562500
Loan Term	74589	369	67	360	360	480
FC in 3 Months	74589	0.20	0.40	0.00	0.00	1.00
Mod in 3 Months	74589	0.29	0.45	0.00	0.00	1.00
FC in 6 Months	74589	0.32	0.47	0.00	0.00	1.00
Mod in 6 Months	74589	0.33	0.47	0.00	0.00	1.00

Table 10: Reduced-Form Estimates on Foreclosures by Ownership

	(1)	(2)	(3)	(4)
	FC 3M	FC 3M	Mod 3M	Mod 3M
Δ HP	-0.312	-3.179***	1.051***	0.337
	(0.577)	(0.695)	(0.166)	(0.257)
ΔHP X Bankowned	-1.350**	-0.512	0.627***	0.894***
	(0.553)	(0.328)	(0.109)	(0.237)
Observations	335053	285711	335053	285711
Adjusted R^2	0.095	0.134	0.088	0.099
Local FE	State	MSA	State	MSA
Ownership FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Orig FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Observations are at the loan level. Standard errors clustered at the state level. The dependent variable is whether the loan enters a foreclosure within three months or six months of being 60 days delinquent or entering loss-mitigation. The key explanatory variable is the house-price instrument as of Q3'08, which measures a loan's servicer's exposure to house prices in other states. Instrument excludes states bordering the observation's state. Period covers loans that enter trouble status in Q3'08 or Q4'08.

Table 11: IV Results: Short Sales

	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
	Short sale 3M	Short sale 3M	Short sale 6M	Short sale 6M
$\widehat{LogCDS}$	0.000707***	0.00211***	0.00119***	0.00531***
	(0.0001)	(0.0007)	(0.0002)	(0.0016)
Observations	285713	285711	285713	285711
Adjusted R^2	0.002	0.000	0.004	0.000
Local FE	MSA	MSA	MSA	MSA
Ownership FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Orig FE	Yes	Yes	Yes	Yes
1st Stage F-stat		117.4		117.4

Observations are at the loan level. Standard errors clustered at the state level. The dependent variable is whether the loan enters a short sale within three months or six months of being 60 days delinquent or entering loss-mitigation. The key explanatory variable is the log CDS spread for the loan's servicer as of Q3'08. Log CDS is instrumented by the house-price instrument as of Q3'08, which measures a loan's servicer's exposure to house prices in other states. Instrument excludes states bordering the observation's state. Period covers loans that enter trouble status in Q3'08 or Q4'08.

Table 12: Effect of Distress on Length of Foreclosure Process and REO Prices

	(1)	(2)	(3)	(4)	(5)
	Mths to Liq.	Mths to Liq.	Mths to Poss.	Mths to Poss.	Log Price
$\widehat{LogCDS}$	-2.449***	-4.130***	-2.700***	-4.229***	-0.0216*
	(0.855)	(0.334)	(0.773)	(0.571)	(0.013)
Observations	28086	26486	27327	25764	27403
Adjusted R^2	0.297	0.342	0.312	0.344	0.783
Local FE	State	MSA	State	MSA	State
Owner FE	Yes	Yes	Yes	Yes	Yes
Orig FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
1st Stage	120.2	19.1	99.7	17.2	135.7
Dep. Variable Mean	31.6	31.6	21.1	21.1	11.6
Dep. Variable SD	12.8	12.8	9.6	9.6	0.9

Observations are at the loan level. Standard errors clustered at the state level. Mths to Liq. indicates the number of months between the date on which a loan enters trouble status and the date on which the foreclosed house is sold to a third party. Mths. to Poss. indicates the number of months between the date on which a loan enters trouble status and the date on which the servicer receives possession of the house. Log Price is the log transaction price for the third party REO sale. The key explanatory variable is the log CDS spread for the loan's servicer as of Q3'08. Log CDS is instrumented by the house-price instrument as of Q3'08, which measures a loan's servicer's exposure to house prices in other states. Instrument excludes states bordering the observation's state. Period covers loans that enter trouble status in Q3'08 or Q4'08.

Table 13: MSA-level Summary Statistics

	Num Obv.	Mean	SD	Min	10th Pct	50th Pct	90th Pct	Max
FC per Trb 2008	349	0.203	0.067	0.000	0.118	0.202	0.293	0.380
FC per Mtg 2008	349	0.004	0.003	0.000	0.002	0.004	0.009	0.024
FC Comp per Trb. 08-10	349	0.613	0.293	0.077	0.279	0.570	0.993	1.573
FC Comp per Mtg. 08-10	349	0.014	0.012	0.001	0.004	0.010	0.027	0.085
HP Chg 08-09	349	-0.044	0.053	-0.220	-0.122	-0.028	0.009	0.055
HP Chg 08-10	349	-0.062	0.073	-0.315	-0.175	-0.040	0.016	0.070
Trb Rate 2008	349	0.021	0.011	0.006	0.012	0.018	0.036	0.077
Avg HPI Q3'2008	349	-0.114	0.022	-0.147	-0.133	-0.120	-0.061	-0.058

Table 14: MSA-level Analysis

(a) Foreclosure Starts on House-Price Instrument

	(1) FC per Trb Rate	(2) FC per Trb Rate	(3) FC per Mtg Rate	(4) FC per Mtg Rate
Avg HPI	-4.762***	-3.729**	-0.286*	-0.139**
	(1.588)	(1.456)	(0.157)	(0.0593)
Trb Rate		1.139*		0.290***
		(0.593)		(0.0477)
Observations	345	328	345	328
Adjusted R^2	0.769	0.840	0.586	0.946
State FE	Yes	Yes	Yes	Yes
MSA Controls	No	Yes	No	Yes
Within-State HPI SD	0.00324	0.00324	0.00324	0.00324

(b) Foreclosure Completions on House-Price Instrument

	(1) FC Comp per Trb. 08-10	(2) FC Comp per Trb. 08-10	(3) FC Comp per Mtg. 08-10
Avg HPI	-7.099**	-15.11***	-0.378***
	(3.505)	(3.339)	(0.116)
Trb Rate		4.228**	0.956***
		(1.720)	(0.0582)
Observations	345	328	328
Adjusted R^2	0.833	0.912	0.963
State FE	Yes	Yes	Yes
MSA Controls	No	Yes	Yes
Within-State HPI SD	0.00324	0.00324	0.00324

(c) House-price Changes on House-price Instrument

	(1) HP Chg 08-09	(2) HP Chg 08-09	(3) HP Chg 08-09	(4) HP Chg 08-10
AvgHPI-Trb	3.693***	3.084***	0.803	0.879
	(1.313)	(0.812)	(0.780)	(1.793)
Trb Rate		-1.905***	-1.557***	-1.199***
		(0.0881)	(0.155)	(0.375)
Observations	345	345	328	328
Adjusted R^2	0.754	0.869	0.919	0.866
Local FE	Yes	Yes	Yes	Yes
MSA Controls	No	No	Yes	Yes
Within-State HPI SD	0.00324	0.00324	0.00324	0.00324

Observations are at the MSA level. Standard errors clustered at the state level. In Table 14a, "FC per Trb Rate" indicates the number of initiated foreclosures in 2008 divided by the number of troubled loans in 2008. "FC per Mtg Rate" indicates the number of initiated foreclosures in 2008 divided by the number of total loans in 2008. In Table 14b, "FC Comp per Trb 08-10" indicates the number of completed foreclosures in 2008 to 2010 divided by the number of troubled loans in 2008. "FC Comp per Mtg 08-10" indicates the number of completed foreclosures in 2008 to 2010 divided by the number of total loans in 2008. In Table 14c, dependent variables are changes in the MSA house-price index from Q3'2008 to Q3'2009 and from Q3'2008 to Q3'2010. The key explanatory variable is the average house-price instrument value as of Q3'2008, weighted by each bank's share of troubled loans in that MSA as of Q3'2008.

A Appendix: Reduced-Form Regression Results

Table 15: Reduced-Form Estimates

(a) Reduced-Form Estimates on Foreclosures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FC 3M	FC 3M	FC 3M	FC 6M	FC 6M	FC Ever	FC Ever
ΔHP	-0.813**	-0.870*	-5.768***	-0.898**	-3.502***	-1.783***	-1.697***
	(0.369)	(0.461)	(0.886)	(0.371)	(0.405)	(0.248)	(0.170)
Observations	423084	335053	285142	335053	285711	335053	285711
Adjusted R^2	0.029	0.094	0.147	0.117	0.162	0.083	0.088
Local FE	State	State	MSA	State	MSA	State	MSA
Ownership FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Orig FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes

(b) Reduced-Form Estimates on Modifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Mod 3M	Mod 3M	Mod 3M	Mod 6M	Mod 6M	Mod Ever	Mod Ever
ΔHP	0.861***	1.154***	0.777***	0.630***	0.711***	0.504*	1.674***
	(0.174)	(0.157)	(0.244)	(0.204)	(0.233)	(0.296)	(0.294)
Observations	423084	335053	285711	335053	335046	335053	285711
Adjusted R^2	0.005	0.105	0.111	0.109	0.109	0.090	0.105
Local FE	State	State	MSA	State	MSA	State	MSA
Ownership FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Orig FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes

Observations are at the loan level. Standard errors clustered at the state level. The dependent variable in panel (a) is whether the loan enters a foreclosure within three months, six months, or over the entire history, of being 60 days delinquent or entering loss-mitigation. The dependent variable in panel (b) is whether the loan receives a permanent modification within three months, six months, or over the entire history, of being 60 days delinquent or entering loss-mitigation. The key explanatory variable is the house price instrument as of Q3'08, which measures a loan's servicer's exposure to house prices in other states. Instrument excludes states bordering the observation's state. Period covers loans that enter trouble status in Q3'08 or Q4'08.

Table 16: Reduced-Form Estimates, Continued

(a) Reduced-Form Estimates on Short Sales

	(1)	(2)	(3)	(4)
	Short Sale 3M	Short Sale 3M	Short Sale 6M	Short Sale 6M
ΔHP	-0.0468***	-0.0590***	-0.113***	-0.149***
	(0.013)	(0.018)	(0.031)	(0.043)
Observations	335053	285711	335053	285711
Adjusted R^2	0.002	0.002	0.006	0.005
Local FE	State	MSA	State	MSA
Ownership FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Orig FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

(b) Post-Foreclosure Outcomes

	(1)	(2)	(3)
	Mths to Liq.	Mths to Poss.	Log Price
ΔHP	187.1***	192.9***	0.355
	(39.170)	(34.110)	(0.455)
Observations	19610	18916	19135
Adjusted R^2	0.342	0.345	0.807
Local FE	MSA	MSA	MSA
Owner FE	Yes	Yes	Yes
Orig FE	Yes	Yes	Yes
Qtr FE	Yes	Yes	Yes
House Controls	Yes	Yes	Yes
Loan Controls	Yes	Yes	Yes
Dep. Variable Mean	31.6	21.1	11.6
Dep. Variable SD	12.8	9.6	0.9

Observations are at the loan level. Standard errors clustered at the state level. The dependent variable in Panel (a) is whether the loan enters a short sale within three months, six months, or over the entire history, of being 60 days delinquent or entering loss-mitigation. The dependent variable in Panel (b) are the following: Mths to Liq. indicates the number of months between the date on which a loan enters trouble status and the date on which the foreclosed house is sold to a third party. Mths. to Poss. indicates the number of months between the date on which a loan enters trouble status and the date on which the servicer receives possession of the house. Log Price is the log transaction price for the third party REO sale. The key explanatory variable is the house price instrument as of Q3'08, which measures a loan's servicer's exposure to house prices in other states. Instrument excludes states bordering the observation's state. Period covers loans that enter trouble status in Q3'08 or Q4'08.