Securitization and Distressed Loan Renegotiation: Evidence from the Subprime Mortgage Crisis*

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Abstract

We examine whether securitization affects renegotiation of loans by servicers focusing on their decision to foreclose a delinquent loan. We show that securitization induces a foreclosure bias in this servicing decision. Conditional on a loan becoming seriously delinquent, we find a significantly lower foreclosure rate associated with loans held by the bank when compared to similar loans that are securitized: the likelihood of a bank-held delinquent loan foreclosure is lower in absolute terms between 3.8% to 7% (18% to 32% in relative terms). In addition, bank-held delinquent loans resume making payments on average at a rate 7.9% higher in absolute terms relative to comparable securitized loans (20.8% in relative terms). This suggests that the lower foreclosure rate on bank-held loans is not likely to be driven by bank's unwillingness to recognize losses or some other institutional reasons. Finally, consistent with the economic arguments that suggest that loans of better credit quality are most likely candidates for renegotiation, we find that foreclosure bias is larger among loans of better credit quality as measured by initial creditworthiness of the borrowers. Our findings lend support to the view that foreclosure bias in decisions of servicers of securitized loans may have exacerbated the foreclosure crisis.

I Introduction

Financial intermediaries serve an important purpose by channeling funds between savers and users of funds. They are able to do so since they can screen (loan origination) and monitor (loan servicing) users of funds. The recent boom in securitization has seen these core activities taken outside the purview of the "traditional" bank. Loan origination, once conducted primarily by loan officers inside the bank, have shifted to mortgage brokers outside the bank. Similarly, servicing of the loans once they are originated is often no longer done by the final bearer of the risk. Thus, securitization adds a new set of actors to the supply chain of credit and thereby introduces a new array of agency issues and incentive problems.

The recent unprecedented housing and foreclosure crisis has focused the attention of policy makers on the servicing decisions of mortgages. Their concern is driven by the notion that the rise in foreclosures may create deadweight costs and negative externalities that can further depress housing prices and exacerbate the crisis.[1] At the core of the crisis are privately securitized mortgages (i.e., those by non-government-sponsored entities), having accounting for more than one-half of foreclosure starts, even though they account for only about 15% of all outstanding mortgages.[2] Since servicers make the crucial decision of whether to foreclosure a delinquent loan, there is a policy debate on the extent to which frictions that preclude loan renegotiation by servicers of privately securitized mortgages may have contributed to the surge in foreclosures.

This paper adds to this debate by empirically investigating the impact of securitization on renegotiation decision of loan servicers, focusing on their decision to foreclose a delinquent loan. Using a large database of delinquent mortgages, either held on the banks' balance sheets or securitized, we track whether or not every delinquent loan was subsequently foreclosed and find that securitization does induce a foreclosure bias. Controlling for contract terms and regional conditions, we find that seriously delinquent loans that are held by the bank (henceforth called "portfolio" loans) have between 3.8% to 7% lower foreclosure rate in absolute terms (18% to 32% in relative terms) than comparable securitized loans. In addition, we find that the likelihood

[1] For instance, Federal Reserve Chairman Ben Bernanke has repeatedly called on lenders to aid struggling homeowners by reducing their principal and the sum of money they borrowed to lessen the likelihood of foreclosure.

[2] These numbers are as of January 2009. Source: Federal Reserve Bank of New York, Credit Conditions in the United States, http://www.newyorkfed.org/regional/subprime.html.

of a bank-held delinquent loan resuming payments a year after delinquency is 7.9% higher in absolute terms (20.8% in relative terms) than comparable securitized loans. We conduct several tests which suggest that these results are not driven by unobservable heterogeneity between bank-held and securitized loans.

There are several reasons why securitized loans might be serviced differently from those directly held on the banks' balance sheets. First, servicers may have different incentives to service securitized loans relative to the portfolio loans as, in the latter case, a servicer fully internalizes the costs and benefits of the decision to foreclose a delinquent loan (Jensen and Meckling 1976). In the case of a securitized loan, the servicer is an agent of the investors, and its rights, duties and compensation are set out in a "Pooling and Servicing Agreement" (PSA). Typically, servicers are compensated by fees which are annually on the order of 20-40 basis points of the outstanding loan balance. Moreover, they are reimbursed for costs incurred during the foreclosure process but typically are not reimbursed for costs incurred during renegotiation of loans – benefiting only through the extension of servicing fees. In general, these renegotiation costs may be quite substantial and can easily cost as much as $1,000 per loan. Thus, to break even on a $100,000 mortgage loan can take anywhere between 3-5 years absent any re-default or prepayment.[3] In other words, servicers may incur up-front costs in exchange for uncertain fees when they renegotiate a loan. Foreclosure, by contrast, allows servicers an immediate, low-cost exit. In addition, PSAs may legally restrain servicers from performing certain types of renegotiation.[4]

Second, securitization brings about a shift from concentrated debt to dispersed debt, from single creditor to multiple creditors, and from relationship lending to arm's-length contracting. These features may make it harder for the servicer to renegotiate the mortgage with the borrower or for investors to change the nature of servicing contracts due to coordination problems between several classes of dispersed investors (Gilson, John and Lang 1990; Asquith, Gertner

[3]Industry studies estimate that loan renegotiation cost can be as high as $ 1,000 per loan; (see Barclays 2008 Global Securitization Annual).

[4]Some outstanding subprime and Alt-A mortgages have explicit restrictions that forbid services to alter the loan contract terms. Even when there are no explicit restrictions, the servicer is required to follow some vaguely specified instructions when deciding to renegotiate a mortgage (e.g., "best interest of certificate holders").

and Scharfstein 1994; Franks and Tourus 1994; Bolton and Scharfstein 1996; Zingales 2008).

It is of course possible that borrowers and investors are able to circumvent these frictions and as a result securitization does not affect decisions of servicers to foreclose a delinquent loan. Ultimately, whether securitization affects this decision is an empirical question, one which we investigate in this paper. We do so by examining differences in servicing of securitized loans at risk of foreclosure relative to the loans held on the banks' balance sheets for every loan originated in 2005 and 2006. The main test of the paper assesses whether differences in foreclosure rates of delinquent loans depend on their securitization status.

Since loans that are securitized might differ on observables (such as credit scores) from those banks keep on their balance-sheet, it is important to control for ex-ante characteristics of the loan (i.e., when loans are originated). Our dataset provides rich information for each loan in the sample, allowing us to use a relatively flexible specification with a host of loan and borrower characteristics and regional dummies. We estimate the regressions separately for each quarter to alleviate concerns about changing macroeconomic conditions. Conditional on a loan becoming seriously delinquent, we find a lower foreclosure rate associated with loans held by the bank as compared to loans that are securitized. The differences are statistically significant and economically large: the likelihood of a portfolio loan foreclosure is lower in absolute terms by around 3.8-7% (18-32% in relative terms). Though the results are consistently present in all the eight quarters of our sample, they become significantly stronger in quarters when house prices have declined appreciably. This is consistent with the view that house prices eroded borrowers ability to renegotiate their contract through refinancing, thereby aggravating the foreclosure bias.

Our estimate of foreclosure bias in servicing of securitized loans is measured relative to foreclosures by banks. As banks are likely to fully internalize the costs and benefits of the decision to foreclose a delinquent loan, it is natural to interpret our results as suggesting that securitization has imposed renegotiation frictions that have resulted in a higher foreclosure rate than would be desired by investors. However, one could also hypothesize that bank held loans that are being foreclosed at a lower rate due to unwillingness of banks to recognize losses or some other institutional reasons. To shed light on this alternative hypothesis, we investigate

the rate at which delinquent loans resume making payments depending on their securitization status. In particular, we find that bank-held delinquent loans resume making payments at a 7.9% higher rate in absolute terms relative to comparable securitized loans (20.8% in relative terms). Therefore, our results show not only that bank-held delinquent loans are less likely to be foreclosed than securitized loans but also that bank-held delinquent loans are more likely to resume making payments relative to comparable securitized loans.

Of course, besides observable differences, loans may also differ in unobservable characteristics due to information lenders obtain when ex-ante screening borrowers or when ex-post monitoring them. These differences might also create differences in foreclosure rates between securitized and portfolio delinquent loans. It is worth noting that our focus on the sample of delinquent loans should alleviate this concern to some degree. If lenders obtain signals about the likelihood of delinquency only during the origination process or through subsequent monitoring, differences in foreclosure rates of delinquent securitized and portfolio loans cannot be attributed to unobservables. However, it is plausible that lenders also have private information about the likelihood of subsequent foreclosure of the loan. To assuage these concerns, we restrict our analysis to a sample of loans that are better quality on the dimension of hard information characteristics such as credit score and documentation level. The reason to focus on these loans is that several studies provide evidence that potential screening on unobservables is less important for these types of loans (Keys et al. 2009; Rajan et al. 2008). Our results suggest that the foreclosure bias due to securitization is larger among better quality loans. The bank-held loans of better initial credit quality are foreclosed at the rate up to 47% lower in relative terms and resume making payment at the rate 35.8% higher in relative terms as compared to similar loans that were securitized. This finding is consistent with the view that loans of better initial credit quality are the most likely candidates for renegotiation (Bolton and Rosenthal 2002; Piskorski and Tchistyi 2008).

We also condition our results on the credit score of the borrower and the loan-to-value ratio of the loan *at the time of* delinquency for a sub-sample of loans with this information. Since it takes on average about one and half years for a borrower to become delinquent in our sample, we expect credit scores and loan-to-value ratios at the time of delinquency to capture some of the information regarding quality of the borrower (that lender may gather at the time of screening) that is revealed between origination and delinquency. We find that doing so does not affect the

nature of our results.

Finally, we also examine how the difference in foreclosure rates of securitized and portfolio loans vary with creditor foreclosure laws, i.e., laws that govern foreclosure and house repossession. Since the foreclosure data is right censored, it is plausible to expect that the difference between foreclosure rates of securitized and portfolio loans should be accentuated in states where laws allow servicers to foreclose quickly (i.e., in creditor friendly or strong states). Consistent with this view we find that, conditional on being seriously delinquent, the difference in foreclosure rates is much higher for those loans that are originated in states with creditor-friendly laws, i.e., states that allow for quick foreclosure and house repossession. This test provides an additional support for our results being driven by the differential servicers' incentives since it shows that foreclosure bias due to securitization is stronger in states where it is legally easier (and faster) to foreclose.

It is worth emphasizing that our analysis does not suggest securitization is ex-ante inefficient. In general, the arguments for and against loan renegotiation are complicated by the incentive effects of renegotiation on current and possibly future borrowers. Even though the borrower's default might be costly to the lender, debt forgiveness or renegotiation can have perverse ex-ante incentive effects. From this perspective, securitized loans are more efficient since they make renegotiation of loans difficult. However, it is plausible that, in times of big macro shocks, debt forgiveness and renegotiation can create value (Bolton and Rosenthal 2002; Kroszner 2003; Piskorski and Tchistyi 2008). We discuss these issues in more detail in Section VII.

Our paper contributes to the research studying incentives of loan servicers. The paper closest to ours is Adelino et al. (2009) which uses the same dataset and attempts to identify the use of one of the renegotiation tools (explicit modifications) used by servicers. They interpret their findings as showing that explicit modifications of contractual terms were employed infrequently by servicers, independent of the securitization status of the loan. We discuss our findings in light of their research in Section V.A. In related research, Pennington-Cross and Ho (2006) find that the servicer affects the likelihood of default to a strong degree and the possibility of prepayment to a lesser, but still substantial, degree. Gan and Mayer (2006) reviewed the actions of servicers to determine when they operate most efficiently and concluded that they alter their behavior

depending on whether they own a first-loss position for the loans they service. More broadly, we contribute to the literature that debates the costs and benefits of securitization (Dell'Ariccia et al. 2008; Demyanyk and Van Hemert 2009; Keys et al. 2009; Loutskina 2006; Loutskina and Strahan 2007; Mian and Sufi 2009; Morrison 2005 and Parlour and Plantin 2007). Finally, the paper is also related to the literature that empirically examines renegotiation (see for instance, Benmelech and Bergman 2008 and Roberts and Sufi 2008 in the context of corporate default and Matvos 2009 for renegotiation in NFL contracts).

The rest of the paper is organized as follows. A brief overview of lending in the subprime market and the role of servicers is provided in Section II. Data and sample construction are described in Section III. We discuss our empirical specification in Section IV. Our main empirical findings are presented in Sections V and VI. Section VII discusses the interpretation of our findings and the possible sources of renegotiation friction. Section VIII concludes.

II Data

The data for this study come from LPS (formerly called McDash Analytics) and include loan-level data reported by mortgage servicing firms. The dataset has detailed information on the loan at the time of origination, such as the loan amount, term, LTV ratio, credit score, and interest rate type - data elements that are typically disclosed and form the basis of contracts for both securitized and portfolio loans.

We now describe some of these variables in more detail. The borrower's credit quality is captured by a summary measure called the FICO score. The FICO score has increasingly become the most recognizable measure used by lenders, rating agencies, and investors to assess borrower quality (Gramlich, 2007). The software used to generate the score from individual credit reports is licensed by the Fair Isaac Corporation (FICO) to the three major credit repositories - TransUnion, Experian, and Equifax. These repositories, in turn, sell FICO scores and credit reports to lenders and consumers.

FICO scores provide a ranking of potential borrowers by the probability of having some negative credit event in the next two years. Probabilities are rescaled into a range of 400-900, though nearly all scores are between 550 and 800, with a higher score implying a lower

probability of a negative event. The negative credit events foreshadowed by the FICO score can be as small as one missed payment or as large as bankruptcy. Borrowers with lower scores are proportionally more likely to have all types of negative credit events than are borrowers with higher scores.

Borrower quality can also be gauged by the level of documentation collected by the lender when taking the loan. The documents collected provide historical and current information about the income and assets of the borrower. Documentation in the market (and reported in the database) is categorized as full, limited or no documentation. Borrowers with full documentation provide verification of income as well as assets. Borrowers with limited documentation provide no information about their income but do provide some information about their assets. No-documentation borrowers provide no information about income or assets.

The data also provide information on the features of the loan contracts. Specifically, we have information on the type of mortgage loan (fixed rate, adjustable rate, balloon or hybrid), and the loan-to-value ratio (LTV) of the loan, which measures the amount of the loan expressed as a percentage of the value of the home. To better account for regional conditions, such as local house price variation, we focus only on loans originated in the Metropolitan Statistical Areas (MSAs) for which we have such information. Information about the geography where the loan is located (MSA) is also available in the database. Finally, LPS provides information on whether the loan is securitized or a portfolio loan.

We restrict our sample to first-lien non-agency mortgages originated in 2005 and 2006. We drop loans that have incomplete information about original credit scores, original interest rates, origination amounts, and property values. We focus on loans with maturities of 15, 20 and 30 years since this constitutes most of the sample. To avoid survivorship bias, we limit our sample to those loans that entered the LPS database within four months of the origination date. To exclude outliers and possible data errors, we only consider loans with FICO scores between 500 and 850 and LTV less than 150. In addition, we also exclude loans in Alaska, Hawaii and other non-continental areas.

We also exclude loans whose servicing rights were transferred to servicers outside LPS cov-

erage.[5] The reason is that subsequent payment history is missing of these loans (i.e., we do not observe either foreclosure or borrower payment behavior subsequent to the transfer date). Though delinquent loans that are transferred are more likely to be bank-held loans, we believe excluding these loans does not bias our results for several reasons. First, we find that our results are robust to inclusion of payment history that we observe till the transfer date of these loans.[6] Second, there are at least two large servicers (Ocwen Loan Servicing and Litton Loan Servicing) who are widely known to renegotiate substantial amount of loans that are not in the LPS database.[7] Consequently, not including a sample of largely bank-held loans that might be transferred for renegotiation to these servicers might actually make it harder for us to demonstrate that portfolio loans are renegotiated more intensively. Finally, our conversations with the data vendor (LPS) confirmed that loans that are transferred are not typically done so for the purpose of foreclosing them. Consequently we decide to exclude these loans from the analysis as ascribing any specific outcome (foreclosed or not; resume payments or not) to the transferred loans seems arbitrary.

We focus on loans originated in or after 2005 since the LPS coverage prior to this year is less representative.[8] After filtering out the dataset as described above, there were approximately 6.2 million unique mortgages. From here, we split the data into quarters, giving between 650,000 and one million loans in each quarter. Of these loans, roughly 75% were portfolio loans, i.e., the loans that were not securitized.

For our regressions, we consider a subsample of the loans defined above that become 60+

[5]Conversation with the data vendor suggest that there are several loans where servicing transfers that occur within the set of servicers who provide information to LPS. We do not exclude these loans since subsequent payment history is available for these loans.

[6]More precisely, we re-estimated the current regressions we describe in Section V.B that allow comparison between the rate at which delinquent bank-held loans resume making payments as compared to securitized loans at different horizons. At each different horizon we include all the transfer loans that leave the database after a given horizon so that their payment history is available. See Appendix A.II for more details and discussion of these results.

[7]According to the April 2009 Credit Suisse Group analysis of the home loan modification performance by mortgage servicers.

[8]As our data coverage extends to the end of first quarter of 2008, we focus on loans originated till the end of 2006 in order to have sufficient data to evaluate subsequent loan performance.

days delinquent as reported by the servicers. In the paper, we use the Mortgage Bankers Association's definition of 60+ days delinquency, though all our results hold if we used the Office of Thrift Supervision's definition of 60+ delinquency instead. A loan is 60+ days delinquent if the borrower is behind by two mortgage payments. The missed payments do not necessarily have to be consecutive. There were about 327,000 delinquent loans in our entire sample. For these loans we record their ownership status, that is whether they are securitized or bank-held (portfolio), at the first time of their 60+ days delinquency. About 11.3% of these loans were bank-held as of the time of delinquency. A loan is considered foreclosed when it enters foreclosure post-sale or REO (real estate owned) status during the course of the loan's payment history.[9]

In our analysis we also consider a sub-sample of higher-quality loans with full documentation and FICO credit score of at least 680. Using this classification, there were about 1.3 million such loans in the subsample (125,000 to 200,000 per quarter). This sample contains approximately 16,500 delinquent loans, of which 20.4% were portfolio held at the time of delinquency.

We also examine variation in foreclosure rates across states with different liquidation laws.[10] A state is defined as *tough* if the historical average number of days to process foreclosures is less than or equal to the median (about 117 days).[11] Twenty-five states and the District of Columbia were classified as tough states. Alabama was the toughest state, with an average of 25 days to process a foreclosure. At the other end of the spectrum, the average time to process a foreclosure was 445 days in New York. The "median" state is California, which took an average of 117 days to process foreclosures.

[9]Since loans frequently transition from portfolio to securitization, one might worry that our definition of bank-held loans might generates a bias in how we measure our foreclosure results (if banks bought some delinquent securitized loans after delinquency). Note, that if banks were to subsequently purchase some of the delinquent securitized loans to modify them later, these loans would still be treated as securitized loans in our analysis. Therefore, if this selection is at play, it makes it harder for us to show that bank-held loans are serviced differently relative to securitized loans – since some of the loans that are serviced as bank-held are treated as being securitized by us.

[10]We use state foreclosure rules as reported by Mortgage-Investements.com (http://www.mortgage-investments.com/borrow-money/foreclosure-laws.htm)

[11]We interchangeably refer to these states as creditor friendly or as having strong creditor rights.

III Empirical Methodology

Servicers of mortgages make the crucial decision whether to foreclose a delinquent mortgage. In our empirical analysis we want to estimate the impact securitization has on this servicing decision. The most simple approach to doing this would be to use the following specification:

$$Pr(Y_i = 1|Delinquency) = \Phi(\alpha + \beta \times Portfolio_i + \gamma.X_i + \delta_m + \epsilon_i), \tag{1}$$

where the dependent variable is an indicator variable for a *delinquent* loan i that takes a value of 1 if the loan is foreclosed and 0 otherwise. Conditioning on delinquency of a loan seems natural given that we are interested in servicer's decision to renegotiate or foreclose a distressed loan. X_i is a vector of loan and borrower characteristics that includes variables such as FICO scores, interest rate, loan-to-value ratio (LTV) and origination amount and γ a vector of coefficients. *Portfolio* is an dummy variable that takes the value 1 if the delinquent loan was held on lender's balance sheet and 0 if the loan was securitized. In this specification, β would measure the impact of securitization on servicer's decision to foreclose the delinquent property or engage in a workout.

The causal interpretation of these results would rely on the assumption that, conditional on observables, there is a random assignment of portfolio and securitized loans at the time of delinquency. Following this, we ensure that the empirical specification conditions on a plethora of explanatory variables that might be important. In particular, besides the observables listed above, we also use the term length, whether the loan was fixed term, whether it was insured, and the age of the loan at the time of delinquency. To account for regional factors we include MSA fixed effects (δ_m). Moreover, we make the specification (1) very flexible by including squares of LTV ratio and loan amount as well as dummies of different FICO range.

It is nevertheless possible that after conditioning on a host of observables, the assumption of random assignment may be violated, making the estimate β biased. In particular, if lenders collect unobservable private information about borrower quality at the time of origination and securitize loans of worse quality, β would be biased, i.e., securitized loans would foreclose at a higher rate. Notably, restricting the analysis to the sample of delinquent loans alleviates this concern to some degree. Specifically, if lenders obtain signals about the likelihood of delinquency

only during the origination process (i.e., the signals are of short-term prospects), differences in foreclosure rates of delinquent securitized and portfolio loans cannot be attributed to selection on unobservables at the time of origination. However, it is conceivable that lenders might also obtain long-term signals when they screen the borrower. We circumvent this issue by restricting our analysis to borrowers for whom such information is likely to be less valuable at the time of loan origination, i.e., borrowers that are better quality on the dimension of hard information characteristics, such as credit score and documentation level. The reason to focus on these loans is that studies show that screening on unobservables is less important for these types of loans (Keys et al. 2009).

It is also plausible to conjecture that lenders obtain additional information about the borrower and the property between origination and delinquency. The differences in foreclosure rates between delinquent securitized and portfolio loans might simply reflect worse information obtained for securitized loans. We alleviate this concern by conditioning on the credit score and loan-to-value ratio of the borrower *at the time* of delinquency for a sub-sample of loans with this information. Since it takes on average about one and half years for a borrower to become delinquent (see Table 1), we expect credit scores and loan-to-value ratios at the time of delinquency to capture some of the information regarding quality of the borrower that is revealed between origination and delinquency.[12] If the conjecture is true, this test should reduce the bias in β (i.e., reduce the magnitude of β).

IV Descriptive Statistics and Main Tests

IV.A Descriptive Statistics

We start the empirical analysis by providing summary statistics of some of the key variables used in our analysis in Tables 1 and 2. We use all the delinquent loans in Table 1 while only delinquent loans that were of high-quality at the time of origination (fully documented loans with FICO > 680) are considered in Table 2.

As can be observed from Panel A of Tables 1 and 2, there seem to be differences in the

[12] Fair Isaac reports that credit scores get updated on average every three months.

proportion of loans that are securitized depending on the riskiness of the loans. About 11.2% in the sample of all delinquent loans are held on portfolio, compared with 20.3% of the fully documented loans (averaged over the sample period). In addition to higher FICO scores, the fully documented loans had slightly lower LTV ratios and larger origination amounts on average. In both samples, the origination amounts increase from 2005 Q1 through 2006 Q4. In most quarters, the sample of all loans foreclosure more often than the sample of fully documented loans. A loan is considered foreclosed when it enters foreclosure post-sale or REO (real estate owned) status during the course of the loan's payment history. Foreclosures mechanically fall as we get closer to the end of the sample (2006 Q3 and 2006 Q4 origination vintages) since a long history for these loans is not available.[13]

Panels B of Tables 1 and 2 split the respective samples by securitization status at the time of delinquency. The panels show that portfolio loans have higher FICO scores and lower interest rates than securitized loans. On the other hand, portfolio loans usually have slightly higher LTV ratios and origination amounts. In both the sample of all loans and the subsample of fully documented loans, loans held on portfolio foreclose less often than securitized loans. However, portfolio loans take less time to become delinquent than do securitized loans. Since these are univariate statistics, we next turn to multivariate regressions to assess what differences exist in foreclosure rates between portfolio and securitized loans after we condition for observables of the loan.

IV.B Comparing Foreclosure Rates of Securitized and Portfolio Loans

We now describe the results from our first test. We estimate equation (1) and report the marginal effects of a logit regression performed for the entire sample in Table 3. The dependent variable is whether or not the loan is foreclosed conditional on the loan becoming delinquent. We estimate the regressions separately for each quarter to alleviate concerns that macroeconomic conditions might have changed substantially during our sample period. MSA fixed effects are included in all the specifications to account for regional variation across the country.

[13]Note that our data runs till the end of 2008 Q1, and as a result loans in 2006 Q3 and 2006 Q4 are tracked for less than two years.

As can be seen in Columns (1) to (8), the coefficient on (*Portfolio*) dummy is consistently negative and significant for all quarters. This suggests that, conditional on being delinquent, a loan on lender's balance sheet is less likely to be foreclosed than a loan that is securitized. The effects are large: keeping all the variables at their mean values, being on portfolio reduces the likelihood of foreclosure for a delinquent loan in absolute terms by around 3.8% to 7% (between 18% and 32% relative to the mean foreclosure rate).

The coefficients on most other variables are also as expected. For instance, loans with higher LTV ratios are more likely to foreclose. Interestingly, the coefficient on FICO suggests that, conditional on being delinquent, loans with lower FICO default less. This is in contrast to the negative relationship one typically observes between FICO and delinquencies.[14] One interpretation of this finding is that if a high FICO loan becomes seriously delinquent, it is most likely that the borrower has received a larger credit shock, given initial credit quality. As a result, conditional on delinquency, a higher credit score may be proxying for the size of the credit shock in these regressions.

IV.B.1 Effect of Ease of Refinancing

It is reasonable that during periods of house price appreciation borrowers accumulated a positive equity in the house and so are able to refinance themselves out of trouble. Consequently, the foreclosure bias in decision of loan servicers should be weaker in magnitude if we move into a period when refinancing was easier. We now investigate whether this is the case in our sample.

Before doing so, we first examine how house prices moved during the sample period. Figure 1 plots the house price index over the years and shows that it slows down towards the end of 2005 and starts falling around mid 2006. To assess how this decline in house prices translated into difficulty that borrowers faced when refinancing out of this market, we plot the prepayment rates of borrowers across vintages. Since LPS does not report data reliably before 2005, we rely on First American Loan Performance database to get the prepayment rates for all the securitized subprime borrowers from 2001 to 2006. As is shown in Figure 2, during periods of house price

[14] In unreported tests, we confirm that there is a strong negative relationship between FICO and the likelihood of a loan becoming delinquent.

appreciation (2001-2004) borrowers in the non-agency market were able to voluntarily prepay their loans and refinance them at a significantly faster rate than when the house prices declined (2005-2006).

The evidence above suggests that we can make comparisons between our estimates towards the end of the sample period when house prices were declining (2006 Q3 and 2006 Q4) with estimates in the beginning of the sample period when house prices were not declining (2005 Q1 and 2005 Q2). Comparing these from Table 3 suggests that the magnitude of our results are stronger in the periods of house price declines. For instance, from Column (7) of Table 3, we can observe that a delinquent loan on the portfolio of a bank forecloses by about 32% relative to the mean. In contrast, in earlier years this estimate is about 18% (for instance 2005 Q1). It is important to note that since we do not have enough time series on delinquent loans towards the end of the sample, the estimates in Columns (7) and (8) are likely to be even higher once more data is collected.

IV.C High Quality Loans

As discussed in Section III, though we have controlled for all the relevant observable characteristics of the loans, differences in foreclosure rates between securitized and portfolio loans could be driven by some unobservable information about quality that lenders obtain at the time of origination. While focusing on the sample of financially distressed loans, under some assumptions, would alleviate some of these concerns, we examine a subset of the data where we believe this would be less of a concern. We focus on a sub-sample of loans of higher quality: loans that are fully documented and also have good initial credit quality as represented by FICO credit score of at least 680 (about more than half of the fully documented loans have FICO more than 680). We do so since any selection on unobservables at the time of origination is likely to be of less concern for these types of loans (Keys et al. 2009).

We present the estimates using the specification (1) for this sub-sample in Table 4. As can be observed from Columns (1) to (8), the coefficient on the portfolio dummy is negative and significant for all but one quarter. In other words, conditional on being delinquent, loans that are of higher quality at the time of origination foreclose at a rate that depends on the securitization

status of the loan. The estimates are, once again, economically meaningful. For example, in 2006 Q4, being on portfolio decreases the probability of foreclosure in absolute terms by about 4.5%, nearly a 31% decrease relative to the mean foreclosure rate of 14.5%. Similarly, in 2006 Q3, the probability of foreclosure for portfolio loans is lower by about 47% in relative terms. The estimates on other variables are qualitatively similar to those reported in Table 3.

We also find that, similar to the entire sample, the magnitude of our results is stronger in the periods of house price declines. For instance, the difference between foreclosure rates of portfolio and securitized loans is about 18% in relative terms in 2005 Q1 and 2005 Q2 – a significantly smaller number when compared to 47% and 31% in 2006 Q3 and 2006 Q4. This evidence again suggests that borrowers were able to undo some of foreclosure bias in servicing of securitized loans during the period of house price increases.

Overall, the magnitude of our findings for the sample of higher quality loans are larger than what we obtained for the entire sample. We discuss in Section V.B what possible economic reasons might drive these differences.

IV.D Credit Score and Loan-To-Value at Time of Delinquency

Even though we have addressed concerns about selection on unobservables at the time of origination of the loan, some selection concerns remain. In particular, it is possible that lenders obtain information about the borrower between origination and delinquency. Consequently, it is possible that differences in foreclosure rates between delinquent securitized and portfolio loans might simply reflect worse information obtained for securitized loans.

To address this concern, we note that LPS provides time series information on updated credit scores for a number of loans in our sample.[15] In particular, for these loans we are able to obtain the FICO score *at the time* of delinquency. Since it takes on average about one and half years for a borrower to become delinquent (see Table 1), we expect credit scores at the time

[15]Tests comparing the observables at the time of origination for loans for which updated credit score is reported with those for loans for which this information is missing reveals limited differences. For instance, the interest rate on loans with information on updated FICO is about 7.8% vs. 7.7% for loans with no such information. Similarly, LTV ratios are 82% vs 80% and FICO scores are on average 625 vs. 635. Conversations with the data vendor suggest that this field is randomly reported.

of delinquency to capture some of the information regarding borrower quality that is revealed *between* origination and delinquency.

We conduct the test using loans for which we have information on the credit score at the time of delinquency and using updated FICO score in addition to other controls in specification (1). The results of this estimation are visually presented in Figure 3 where we report β, the coefficient on *Portfolio* and its 95% confidence interval. As can be observed, β is negative and significant for all the quarters in our sample, even though the sample size is substantially reduced (about $1/10^{th}$ the sample size of Table 3 in each quarter).

In addition to updated credit score information, information about borrower quality may also be revealed through loan-to-value ratio at the time of delinquency. For instance, one can argue that a delinquent borrower is less likely to eventually foreclose if the property value at the time of delinquency is large relative to the mortgage the borrower owes. While LPS does not directly report the loan-to-value ratio of the borrower at the time of the delinquency, we are able to compute this ratio using the reported outstanding balance at the time of delinquency in the database and the MSA house price index (HPI) from OFHEO. In particular, we inflate/deflate the original property value with the HPI to calculate the updated house value. This updated house value is then divided by the outstanding principal to obtain the loan-to-value at the time of delinquency.

We first use updated loan-to-value ratios to investigate whether there are systematic differences between securitized and portfolio loans in the decision to foreclose delinquent loans. Figure 4 plots the cumulative distribution function of foreclosed loans as a function of the loan-to-value ratio as of the time of delinquency. As we observe, not only are securitized loans foreclosed more often than the portfolio ones, but also securitized loans that are foreclosed have on average lower updated loan-to-value at the time of delinquency relative to portfolio loans.

We then conduct a more formal test for loans with information on the credit score at the time of delinquency and with updated loan-to-value values using updated FICO and loan-to-value ratio in addition to other controls in specification (1). As before, the results are presented in Figure 5 where we report β, the coefficient on *Portfolio* and its 95% confidence interval. β is still negative and significant for all the quarters in our sample.

IV.E Role of Liquidation Laws

Many U.S. states protect borrowers by imposing restrictions on the foreclosure process. Since the foreclosure data is right censored, it is plausible to expect that the difference between foreclosure rates of securitized and portfolio loans should be accentuated in states where laws allow servicers to foreclose quickly (i.e., in creditor unfriendly or *weak* states). This forms the basis of our test in this section.

Accordingly, we re-estimate our regressions separately for states where foreclosure laws are creditor friendly (called *tough* states) and for states where these laws are creditor unfriendly (called *weak* states). We find that, conditional on being seriously delinquent, the difference in the foreclosure rates between securitized and portfolio loans is much higher for those loans that are originated in states with creditor-friendly laws, i.e., states that allow for quick foreclosure and house repossession.

In particular, Tables 5 and 6 report the estimates for all loans originated in weak and tough creditor-right states. Note that, as should be expected, on average delinquent loans in states with tough liquidation laws are about twice as likely to foreclose as delinquent loans in states with weak liquidation laws (28.0% vs. 14.2%). More importantly for our purpose, we find that the coefficient on the portfolio dummy is negative and significant in both weak and tough states. Moreover, the estimated portfolio coefficient in tough states is either quite similar or larger in most quarters.

We also conduct the test using the sample of high-quality loans we used earlier to address selection concerns and report the results in Tables 7 and 8 for loans originated in weak and tough states respectively. Again, as is expected, the mean foreclosure rate for high-quality delinquent loans is higher in tough states as compared to weak states (29% vs. 12%). More importantly, the portfolio coefficient is insignificant in the sample of high-quality loans originated in weak states for all but one quarter. In contrast, the portfolio effect is large and significant in the sample of high-quality loans originated in tough states for all the quarters. On average, Table 8 suggests that being held on portfolio reduces the foreclosure rate of a high-quality delinquent loan originated in states with tough laws by as much as 17.1% (about 54.2% relative to the mean).

IV.F Other Tests

We now discuss some additional tests which confirm the robustness of our findings. These tests are unreported for brevity and are available upon request. First, there might be concerns that some of the results might be sensitive to the particular definition of delinquency we have chosen. To alleviate this concern, we estimated our regressions using alternative MBA definitions of delinquency (30+ and 90+). Our results are qualitatively and quantitatively very similar.

Second, even though we controlled for regional dummies, there may be concerns that the house price index changed quite dramatically during the sample period, which might not be reflected in the MSA fixed effects. For instance, one might be worried that perhaps borrowers with securitized and portfolio loans belonged to very different neighborhoods and faced different house price changes over the sample period. To address this concern, we re-estimate the baseline regressions controlling for house price movements at the MSA level and for *zip-code level fixed effects*. In running this specification, note that we are unable to estimate zip-code regressions quarter by quarter since the do not have enough power to capture within zip-code variation. More specifically, the number of delinquent loans per quarter, (there are about 9,300 delinquent loans on average per quarter) are small relative to parameters being estimated in a zip-code fixed regression (there are about 13,293 unique zip zipcodes on average spanned by our delinquent loans). However, we are able to exploit within zip-code variation between bank-held and securitized loans using data from all the quarters in a pooled regression. As is reported in Columns (1) and (2) of Table A.I in the appendix, we find that the results are similar to those obtained in the paper. In particular, we find that delinquent bank-held loans are more likely to be foreclosed by about 5.7% in absolute terms as compared to delinquent securitized loans (24.5% in relative terms) and that these effects are larger for higher quality loans.

Third, as a robustness check, we also expanded the definition of foreclosure to include foreclosure starts in addition to foreclosure complete, foreclosure postsale and REO. Using this more liberal definition of foreclosure, we re-estimate our regressions and for brevity report these results in Columns (3) and (4) of Table A.I in the appendix. As can be observed, we still find a negative and significant effect (at 1% level) on the portfolio estimate: the bank held delinquent loans are foreclosed at the 9% lower rate (16% lower in relative terms) compared to similar

securitized mortgages.

Fourth, we investigate whether omission of information on second liens in LPS omits might impact our results. Note that this bias may affect our estimates if delinquent securitized loans had more CLTV relative to comparable bank-held loans – since this would make delinquent securitized loans more risky and therefore more likely to foreclose. To address this concern, we re-estimated our results including a dummy that takes a value 1 if the loan has a LTV of 80% (LTV=80%). The reason to do so stems from the notion that since most loans in subprime market had a combined LTV of excess of 80%, it is plausible that a loan with LTV of 80% on its first lien is likely to have other liens. In other words, such loans are more likely to have a combined LTV which is not reported. If so, this dummy variable should capture some effects due to omission of combined LTV in our foreclosure regressions. Correspondingly, including this dummy variable should reduce the magnitude and significance of *Portfolio* dummy in the foreclosure regression. As shown in Columns (5) and (6) of Table A.I in the appendix, our results are virtually unchanged when we include the LTV=80% dummy suggesting that omission of second liens might not be biasing our estimate.

Finally, we also re-estimate our regressions defining high-quality loans using different FICO breakpoints (e.g., FICO of 700 instead of FICO of 680), using a more flexible specification (squares and cubes of all variables) and adding more explanatory variables, and in each instance find results qualitatively similar to those reported in the paper.

V Discussion

V.A Comparison with Other Evidence

While our analysis focuses on establishing foreclosure bias in the servicing of securitized loans relative to bank-held loans, it cannot comment on what tools servicers might be using to achieve this. In other words, we focus on measuring servicing output rather than servicing input. In principle, there are a variety of tools servicers may use when renegotiating troubled mortgages: repayment plans, forbearance, short-sales, foreclosure moratoria, refinancing borrowers into more affordable loan and explicit modification of contractual terms (like principal reduction, term

extension or adjustment of the mortgage rate).[16] The difference in foreclosure rates could come from different tools employed in servicing of bank loans relative to servicing of securitized loans, or similar tools being used in servicing with different intensity and/or efficiency. We are not able to comment on this aspect since we do not directly observe the use of any of these tools in the data. Moreover, it is difficult if not impossible to reliably back out which of these tools are being used by servicers in our data.

We start by providing a quantitative assessment of how many additional renegotiations lenders would need to perform on bank-held loans to justify our result on foreclosure bias of securitized loans i.e., the 5.4% lower foreclosures in bank-held loans in absolute terms as compared to securitized loans. Of all the loans originated in LPS data between 2005 Q1 and 2006 Q4 in our sample, there are 36,820 delinquent portfolio loans. A 5.4% lower foreclosure rate on bank-held loans in absolute terms would mean that lenders would need to successfully renegotiate about additional 1,990 delinquent bank-held loans in our data as compared to securitized loans.

In a recent study Adelino et al. (2009), attempt to identify the use of one of these renegotiation tools in a 10% sample of LPS data consisting of non-agency mortgages originated from 2005 that become seriously delinquent till the end of 2007. Using an algorithm to back out explicit modifications of contractual terms based on loan payment history, they find that these occurred roughly at the same rate among portfolio and securitized loans.[17] They interpret their findings as suggesting that explicit modifications of contractual terms were infrequently employed by servicers, independent of the securitization status of the loan.

Though servicers may use other tools besides explicit modifications to achieve a lower foreclosure rate, nevertheless we attempt to assess how the additional successful renegotiations we require to explain lower foreclosure rate on bank-held loans compare with the results of this study. First, since their algorithm has Type I and Type II errors, each in excess of 15%[18], and since they focus only on a 10% sample of the data, it is plausible that some additional

[16] For more details on what these tools are, see Cutts and William (2008).

[17] They are largely unable to identify interest rate freezes for subprime adjustable rate mortgages, which reset after two or three years.

[18] Specifically, the study reports that their algorithm failed to identify around 17% of modifications and that approximately 17% of modifications that were identified by the algorithm were not flagged as such.

successful modifications required to explain lower foreclosure rate on bank-held loans using all the LPS data might well be within the margin of the error of this study. In addition, the errors in their algorithm are computed using data on only securitized loans. These errors may also differ systematically for bank-held loans, especially if tools used by servicers vary between securitized and bank-held loans as some other reports suggest (OCC and OTS Mortgage Metrics Report (2009c)). If so, this may also explain some differences in foreclosure rate that we document. Notwithstanding, if there are still some differences in foreclosure rate that remain unexplained by explicit modifications, they can potentially be explained by tools other than loan modifications that servicers may use when servicing these loans as mentioned above.

Given the difficulty one faces in reliably backing out which of the renegotiation tools are being used by servicers using our data, it is therefore crucial to contrast our results with the reports from agencies (Mortgage Bankers Association and OCC and OTS), which have access to data on actual number and type of renegotiations performed by servicers. Three facts emerge from these reports:(a) other renegotiation tools besides loan modifications were commonly employed; (b) though loan modifications were used less frequently relative to other renegotiation tools during our sample period, the numbers are still more than sufficient to account for our results and (c) there are substantial differences in types of renegotiation tools and how efficiently they are used when bank loans are serviced relative to securitized loans.

For example, Mortgage Bankers Association (2008) reports that in the third quarter of 2007, servicers used approximately 183,000 repayment plans; in contrast loan modifications to the interest rate, principal balance, or loan duration were less common, occurring in 54,000 loans.[19] Note that these are large number of renegotiations in just one quarter – many more than additional 1,990 renegotiations on bank-held loans that are required to account for differences in foreclosure rates that we document over more than three years. Finally, an indication of differences in efficiency of tools used on bank loans as compared to securitized loans can be obtained from the re-default rate (i.e., default rate conditional on renegotiating the loan) on bank loan loans relative to securitized loan. For example, the OCC and OTS Mortgage Metrics

[19]Similar evidence is reported the OCC and OTS Mortgage Metrics Report (2009a), which finds that during 2008 Q1 portfolio lenders implemented about 136,874 repayment plans (14.6% of all seriously delinquent loans) but modified the mortgage terms in 72,877 loans (7.9% of all seriously delinquent loans).

Report (2009b) documents significant differences in success of renegotiation depending on the loan securitization status: the re-default rate for securitized loans was 70% higher compared to portfolio loans during the six months after renegotiation.

One downside of the reports discussed above is that while they report aggregate renegotiations, they do not provide a breakup of how many of these renegotiations were done on bank-held loans vs. securitized loans. A recent OCC and OTS Mortgage Metrics Report (2009c), however, provides this breakup for the first time. During 2009 Q1, bank-held loans were renegotiated to a much large degree relative to securitize loans. In this quarter, explicit modification occurred in 57,733 bank-held loans and 102,079 non-agency securitized loans. Assuming this data has a similar ratio of delinquent non-agency securitized loans for every delinquent portfolio loan as the entire LPS data as of April 2009 (roughly 3 delinquent securitized loans per delinquent bank-held loan), these numbers suggest that bank-held loans were renegotiated at least 50% more relative to securitized loans.[20]

Equally important, this report shows that principal write-downs and other aggressive renegotiations were done far more often on bank-held loans as compared to securitized loans. A simple statistic reveals how stark the differences are: during 2009 Q1, portfolio lenders wrote down principal in over 3,300 mortgages; servicers of securitized loans did this in only 3 mortgages. Similarly, over 28,000 portfolio mortgages were modified through term extension while the same happened for only 4,000 securitized loans. While this report does not control for differences in risk characteristics of bank-held and securitized loans when reporting these statistics, it seems unlikely that such large differences in renegotiations between bank and securitized loans could be entirely accounted for differences in observables between the two samples.

To summarize, based on the available evidence, larger intensity or effectiveness of direct modifications performed on portfolio loans may explain at least part of the foreclosure bias due to securitization in our sample period. Moreover, the differences in foreclosure rates might well be accounted for by different intensity and/or efficiency of other renegotiation tools, such as repayment plans or foreclosure moratoria, employed in servicing of bank-held loans. The

[20]Since securitization rate was at its peak during 2005 and 2006, in our data there are about 8 delinquent securitized loans for every delinquent bank-held loan. This ratio would imply an even larger number of renegotiations on bank-held loans relative to securitized loans.

findings in OCC and OTS Mortgage Metrics Reports (2009a-c) are consistent with this view.

V.B Interpreting Findings

Our estimate of foreclosure bias in servicing of securitized loans is measured relative to foreclosures by banks. As banks are likely to fully internalize the costs and benefits of the decision to foreclose a delinquent loan, it is natural to interpret our results as suggesting that securitization has imposed renegotiation frictions that have resulted in a higher foreclosure rate than would be desired by investors. However, one could also hypothesize that the securitized loans are being foreclosed at a rate that is desired by investors and in fact it is bank-held loans that are being foreclosed at a lower rate due to unwillingness of banks to recognize losses on their loans. Alternatively, banks might be capacity constrained and might have deferred foreclosing loans that they own. Both these scenarios would be consistent with our findings so far while not being consistent with the presence of renegotiation frictions in servicing.

It is difficult to fully investigate this alternative hypothesis as it would require knowledge of expected recovery for foreclosed loans as well as expected repayment in case of renegotiation. It is, however, possible to shed some light on this hypothesis. We do this by investigating the payment behavior of the borrowers of seriously delinquent loans in our sample, focusing on the rate at which borrowers of bank-held loans resume making payments relative to borrowers of comparable securitized loans (i.e., these loans become more current). We note that investors ultimately care about overall profitability of renegotiation action, which depends on the rate at which delinquent loans that resume making payments.

More specifically, we estimate a logit regression with the dependent variable being a dummy variable that indicates whether or not a 60+ delinquent loan's payment history becomes better than 60+ (i.e., becomes more current than 60+) at the end of a pre-specified window. Similar regression has been estimated before in Adelino et al. (2009).[21] We choose two different windows

[21]Note that the Adelino et al. find no substantial difference in current rates between bank-held and securitized loans which is contrary to our findings reported in this section. The difference is due to their treatment of loans whose servicing rights are transferred to servicers who do not report to LPS data and as a result the payment history subsequent to the transfer is missing for these loans. More specifically, they assume that all of the transferred loans for whom subsequent payment history is not available would never become current. On the

to track the payment history of a 60+ delinquent loan: (a) six months after the loan becomes 60+ delinquent and (b) twelve months after the loan becomes 60+ delinquent. The regression includes FICO, LTV, interest rate, origination amount, squared terms of these variables, insurance and maturity dummies, age of the loan at delinquency and MSA and quarter fixed effects. As before, the coefficient of interest is on *Portfolio* dummy.

In order to map our results with findings presented earlier, we present results in Table 9 with the first two columns using all the loans in our sample and the last two columns using only high quality loans as defined in Section IV.C. Our results across specifications consistently show that 60+ delinquent borrowers with loans that are bank-held are more likely to resume making payments (current rate) relative to borrowers of comparable securitized loans. For instance, in the entire sample of loans, the rate at which the 60+ delinquent bank-held loans become current a year after delinquency is 7.9% higher in absolute terms relative to comparable securitized loans (20.8% in relative terms). The differences in current rate between bank-held loans and securitized loans is even higher for better quality loans. These 60+ delinquent bank-held loans become current a year after delinquency at the rate 14.1% higher in absolute terms relative to comparable securitized loans (36.1% in relative terms).

To summarize, bank-held loans resume making payments at a significantly higher rate relative to comparable securitized loans. These results suggest that it is unlikely that lenders delayed foreclosures due to their unwillingness to recognize losses on loans held on their balance sheets or some other institutional reasons.[22]

Next, to get a better sense of magnitudes, we examine the rate at which delinquent loans resume making payments relative to the rate at which loans foreclose. As we know from Table 3, bank-held delinquent loans foreclose at a rate 5.4% lower in absolute terms (averaged across quarters) relative to comparable securitized loans. Correspondingly, the rate at which delinquent bank-held loans become current is higher in absolute terms by 7.9% a year after delinquency

other hand, we decided to exclude these loans from our analysis as ascribing any specific outcome (foreclosed or not; resume payments or not) to the transferred loans seems arbitrary (see Section III and Appendix A.II for more details).

[22]We also examine the rate at which delinquent loans move from 30+ to 60+ and 60+ to 90+. Consistent with results in this section, we find that the transition rates to worst delinquency state are always smaller for bank-held loans.

relative to comparable securitized loans.[23]

Taken together, these results show that bank-held delinquent loans not only foreclose at a lower rate as compared to securitized loans but also that bank-held delinquent loans resume making payments at a much higher rate. As a result, higher estimates on differences in current rates relative to differences in foreclosure rates (e.g., for the entire sample 7.9% vs. 5.4%), suggest that lower foreclosure rate on bank-held loans can *at most* explain about 68% of the difference in the rate at which bank loans resume making payments as compared to securitized loans.[24] This evidence is consistent with servicing performed on bank-held loans being more effective relative to that performed on securitized loans, a view reflected in the OCC and OTS Mortgage Metrics Reports (2009a-c). Overall, our results suggest that investors might have obtained appreciable benefits if loans in mortgage pools were serviced similar to bank-held ones during our sample period.

V.C More Cross-Sectional Evidence

We end our analysis by discussing how relevant our results are for the entire distribution of loans in the sample. To see this more clearly, we estimate the difference in current and foreclosure rates between bank and securitized loans from regressions of the form (1) for different sub-samples and present the results in Table 10. More concretely, we divide the loans based on their initial creditworthiness into three groups: lowest credit quality (with FICO credit score less than 620), medium credit quality (with FICO credit score between 620 and 680), and highest credit quality (with FICO credit greater than 620).

Two facts emerge: (a) current rate differences between bank and securitized loans (with higher current rates for bank loans) show up only if there are large differences in foreclosure rates between bank and securitized loans (with lower foreclosure rates for bank loans) and (b)

[23]Similarly, from Table 4, foreclosure rate for high quality bank-held delinquent loans is on average lower in absolute terms by 6.4% relative to comparable securitized loans. Correspondingly, the rate at which high quality bank-held delinquent loans become current is higher by 14.1% a year after delinquency relative to comparable securitized loans.

[24]Note that the 68% number assumes that all the delinquent bank-held loans that are not foreclosed relative to securitized loans become current.

the difference in current rates and foreclosure rates are larger for loans that are of better initial credit quality. As can be observed, the difference in both current and foreclosure rates between portfolio and securitized loans increases with initial creditworthiness of the borrower. There is virtually no statistical difference in foreclosure and current rates for loans of the lowest initial credit quality. In contrast, for loans with medium initial credit quality these differences are large and significant. For instance, in loans with medium initial credit quality the foreclosure rate for bank-held loans is lower in absolute terms by 8.6% (21% in relative terms) and the rate at which loans become current is higher by 8.7% (26% in relative terms) a year after delinquency. The differences are even larger for loans with highest initial credit quality: the foreclosure rate for bank-held loans is lower in absolute terms by 10.1% (21.5% in relative terms) and the rate at which loans become current is higher by 14.6% (43% in relative terms) a year after delinquency.[25]

The first fact highlights the value of understanding differences in current rates between delinquent bank-held and comparable securitized loans in conjunction with differences in the foreclosure rates between these loans. Clearly, in the sub-sample of worst initial quality, there are no consistent differences in current rates between bank and securitized loans. However, for the same sub-sample, there is no difference in foreclosure rates. Conversely, current rates and foreclosure rates are consistently different in loans of medium or high initial quality. Together, these findings are consistent with absence of foreclosure bias in servicing decisions for securitized loans for loans on lowest initial credit quality while being present in loans of medium and higher initial credit quality.[26]

The second fact illustrates a larger foreclosure bias due to securitization among better quality loans. This finding is consistent with the view that these loans are the most likely candidates for renegotiation. In short, there are at least two reasons why lenders might be more willing to renegotiate better quality loans. First, it is plausible that potential benefits of renegotiation are larger for borrowers of better initial credit quality due to their lower expected probability of re-

[25]We also find very similar results when we conduct these tests on a sample restricted to fully documented loans (unreported).

[26]Note that the sample used in our main tests consists of more than 50% of loans that have initial credit score greater than 620. The analysis in this section shows that the sample of loans with medium or high initial creditworthiness largely drive the differences between foreclosure and current rates among securitized and portfolio loans that we find when we use the entire sample.

default. Second, theories such as Bolton and Rosenthal (2002) and Piskorski and Tchistyi (2008) suggest that renegotiation should be undertaken more aggressively for borrowers for whom it is more easily established that delinquency is due to a verifiable adverse macro shock (such as decline in house values) rather than liquidity reasons. The reason is that lenders would be less willing to renegotiate with borrowers of worse credit quality due to moral hazard concerns stemming from potential adverse impact on incentives of other borrowers to pay. To sum up, there are economic reasons to believe that lenders should renegotiate more aggressively loans that are better ex-ante on hard information characteristics. Our analysis finds results that are consistent with these reasons.

V.D Further Evidence from Quasi-Experiment

While our battery of tests might alleviate concerns about selection, they may not be able to fully account for unobservables. As a result, our estimates may still be biased. It is worth noting that in a recent paper Piskorski, Seru and Vig (2009) exploit a particular institutional feature of the securitization market ('early pay default' loans) in order to identify the casual impact of securitization on decision to foreclose a delinquent loan. The Early Pay Default (EPD) legally obligate the originators to purchase back any securitized loans that become delinquent typically within 90 days of the loan being securitized. Piskorski, Seru and Vig (2009) use this feature to construct two groups: securitized loans that become delinquent just before 90 days and are taken back by the originator form the treatment group since these loans are subsequently serviced as bank-held loans; securitized loans that become delinquent just after 90 days form the control group since these loans continue to be serviced as securitized loans. Since both these loans are securitized to start with, the early pay default feature provides them with a plausibly exogenous variation in the securitization status of a delinquent loan.

Piskorski, Seru and Vig (2009) compare the foreclosure and current rates of loans in the treatment and control groups, controlling for observables, and examine whether securitization does causally induce a bias in the renegotiation decision of servicers. They find that delinquent securitized loans that are taken back on the bank's balance sheet foreclose at a rate that is 6.2% lower in absolute terms (18.2% in relative terms) as compared to similar delinquent securitized

loans that continue to be securitized. In addition, loans in the treatment group resume making payments at a rate 8% higher in absolute terms (21.6% in relative terms) as compared to loans in the control group. They also conduct several tests to check if their identification assumption – the incidence of delinquency being random around the three-month threshold – is satisfied in the data. In particular, they first find that the rate of delinquency is smooth through the EPD cutoff supporting the identification assumption of no manipulation around the threshold. Moreover, they remove loans from the control group that are most likely ones that lenders kept on life support just to ensure they crossed the EPD cutoff. Their results are qualitatively similar even though by removing some of the worse (foreclosed) loans from the control group, they bias against finding that treatment loans are foreclosed at a lower rate.

While their estimates based on the EPD tests should be interpreted locally (i.e., it is a local average treatment effect, LATE), it does convey information about what the effect for an average delinquent loan (i.e., the average treatment effect, ATE) is likely to be. Piskorski, Seru and Vig (2009) report that relative to an average delinquent borrower, an average delinquent borrower for the EPD test tends to be of worse credit quality. As we discussed in Section V.D there are compelling arguments that renegotiation is likely to be undertaken more aggressively for borrowers with higher initial credit quality. Consequently, the average treatment effect is likely to be similar if not higher than the estimates obtained for EPD loans. This is indeed the case when we compare the results of Piskorski, Seru and Vig (2009) with the ones presented in this paper. Overall, the findings from the EPD quasi-experiment are in line with our estimates and suggest that the effects we document in the aggregate data are likely to represent a casual impact of securitization on loan servicing.

VI Conclusion

We investigate whether securitization affects renegotiation of loans by servicers focusing on their decision to foreclose a delinquent loan. Controlling for contract terms and regional conditions, we find that seriously delinquent loans are foreclosed at a higher rate if they are securitized as compared to loans that are held directly by the lenders.

Our estimate of foreclosure bias in servicing of securitized loans is measured relative to

foreclosures by banks. As banks are likely to fully internalize the costs and benefits of the decision to foreclose a delinquent loan, it is natural to interpret our results as suggesting that securitization has imposed renegotiation frictions that have resulted in higher foreclosure rate than would be desired by investors. This is true only to the extent that banks do not face the same coordination, incentive or institutional constraints as do servicers of securitized loans. Moreover, if banks do face soft budget constraints, different regulation or political pressures than servicers of securitized loans, the differences in foreclosure rates we document would not necessarily indicate inefficient renegotiation of securitized loans. While it is difficult to fully investigate this alternative hypothesis, as it would require knowledge of expected recovery for foreclosed loan as well as expected repayment in case of renegotiation, it is possible to shed some light on this hypothesis. We demonstrate not only that bank-held delinquent loans are less likely to be foreclosed than securitized loans but also that bank-held delinquent loans are significantly more likely to resume making payments relative to borrowers of comparable securitized loans. The magnitudes of these effects suggest that it is unlikely that differences in foreclosure rates that we document are due to banks inefficiently delaying foreclosures for institutional reasons.

Our findings suggest that there may be a role for government intervention for at least two reasons. First, there are compelling arguments that in times of significant adverse macro shocks, debt forgiveness and loan renegotiation can create value for borrowers and investors (Bolton and Rosenthal 2002; Piskorski and Tchistyi 2008).[27] It is plausible that the magnitude of the foreclosure bias induced by securitization was not fully anticipated by investors and borrowers before the current crisis (Hart and Zingales 2008). While investors and borrowers may be aware of this bias, they may not be able to change the nature of servicing contracts due to coordination problems between several classes of dispersed investors. Therefore, government initiatives facilitating renegotiation of securitized loans could benefit some borrowers and investors. Second, during a crisis, foreclosures can exert significant negative externalities, such as negative neighborhood effects and the reduction in collateral prices that can further aggravate financial distress (Campbell et al. 2009). As a result, the foreclosure bias in decisions of servicers of securitized loans may have exacerbated these social costs of the crisis warranting intervention.

In the end, relative merits of any policy intervention should depend on a careful evaluation

[27] See Kroszner 2003 for evidence on value creation due to debt forgiveness.

of its social benefits as well as its potential costs. This task is complicated by the need to take into account the impact of policy intervention on incentives of current borrowers to repay as well as on the behavior of borrowers and lenders in the future. Our paper contributes to this policy debate by documenting that securitization induces foreclosure bias in decisions of loan servicers and by quantifying the magnitudes related to this bias.

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Table 1: Summary Statistics of All Loans

The sample only includes first lien loans. The investor is either private (securitized) or portfolio (bank balance sheet) at the time of first observed month of 60+ days delinquency. Delinquent is defined as 60+ days MBA delinquent. Default is defined as a loan that enters into foreclosure post-sale or REO status. Age at Delinquency is the number of months since origination when a loan becomes 60+ days delinquent. All loans in the sample are originated between 2005 to 2006.

Panel A: Delinquent Loans

Origination Quarter	**2005 Q1**	**2005 Q2**	**2005 Q3**	**2005 Q4**	**2006 Q1**	**2006 Q2**	**2006 Q3**	**2006 Q4**
% Portfolio	13.8%	12.5%	13.5%	10.7%	8.9%	8.6%	10.4%	11.7%
Original Credit Score	628.0	630.9	639.8	638.0	637.6	636.6	634.4	632.8
LTV	80.1	80.3	79.8	79.1	79.6	80.0	79.9	80.5
Original Interest Rate	7.02%	7.13%	7.13%	7.56%	8.08%	8.26%	8.45%	8.29%
Original Loan Amount	217,526	231,752	252,690	254,366	251,435	256,711	261,184	272,667
Age at Delinquency	17.5	16.9	16.9	15.4	13.4	12.0	10.6	9.17
% Default	24.19%	23.52%	22.73%	24.70%	26.27%	22.29%	19.93%	16.18%
N	35,585	46,521	46,907	45,133	42,978	42,354	37,386	30,574

Panel B: Delinquent Loans by Investor Status

Portfolio	**2005 Q1**	**2005 Q2**	**2005 Q3**	**2005 Q4**	**2006 Q1**	**2006 Q2**	**2006 Q3**	**2006 Q4**
Original Credit Score	639.2	656.2	656.3	662.9	664.7	660.1	634.0	641.6
LTV	78.9	79.2	79.4	79.1	80.3	81.3	82.2	83.2
Original Interest Rate	6.16%	6.29%	6.50%	6.67%	6.97%	7.54%	7.97%	7.64%
Original Loan Amount	248,033	282,570	271,062	305,099	297,276	286,659	249,147	264,680
Age at Delinquency	17.4	16.9	14.9	14.2	12.8	11.0	9.0	8.0
% Default	19.22%	19.26%	18.80%	20.00%	22.63%	19.18%	16.01%	15.35%
N	4,921	5,837	6,313	4,811	3,822	3,654	3,892	3,570

Private	**2005 Q1**	**2005 Q2**	**2005 Q3**	**2005 Q4**	**2006 Q1**	**2006 Q2**	**2006 Q3**	**2006 Q4**
Original Credit Score	626.2	627.2	637.2	635.0	634.9	634.4	634.4	631.6
LTV	80.3	80.5	79.9	79.1	79.5	79.9	79.7	80.2
Original Interest Rate	7.15%	7.26%	7.23%	7.67%	8.19%	8.32%	8.50%	8.37%
Original Loan Amount	212,631	224,461	249,833	248,313	246,960	253,884	262,583	273,723
Age at Delinquency	17.5	16.9	17.2	15.6	13.5	12.1	10.8	9.3
% Default	24.99%	24.14%	23.35%	25.27%	26.62%	22.58%	20.38%	16.29%
N	30,664	40,684	40,594	40,322	39,156	38,700	33,494	27,004

Table 2: Summary Statistics of High Quality Loans
(Full Documentation and FICO of at least 680)

The sample only includes first lien loans. The investor is either private (securitized) or portfolio (bank balance sheet) at the time of first observed month of 60+ days delinquency. Delinquent is defined as 60+ days MBA delinquent. Default is defined as a loan that enters into foreclosure postsale or REO status. Age at Delinquency is the number of months since origination when a loan becomes 60+ days delinquent. All loans in the sample are originated between 2005 to 2006.

Panel A: Delinquent Loans

Origination Quarter	2005 Q1	2005 Q2	2005 Q3	2005 Q4	2006 Q1	2006 Q2	2006 Q3	2006 Q4
% Portfolio	17.6%	20.8%	21.5%	19.3%	20.7%	21.2%	17.8%	24.2%
Original Credit Score	716.5	718.3	718.8	718.5	717.6	716.2	715.6	717.8
LTV	79.9	80.2	79.6	78.7	78.4	79.1	79.0	79.4
Original Interest Rate	6.09%	6.29%	6.12%	6.53%	6.86%	7.16%	7.31%	7.19%
Original Loan Amount	250,483	256,730	280,300	276,557	276,597	297,623	311,906	320,919
Age at Delinquency	21.2	20.0	19.4	17.8	15.8	13.5	11.7	9.8
% Default	25.45%	25.08%	20.02%	21.01%	23.48%	20.44%	16.95%	13.67%
N	2,008	2,911	2,452	2,228	1,793	2,099	1,793	1,207

Panel B: Delinquent Loans by Investor Status

Portfolio	**2005 Q1**	**2005 Q2**	**2005 Q3**	**2005 Q4**	**2006 Q1**	**2006 Q2**	**2006 Q3**	**2006 Q4**
Original Credit Score	723.2	726.0	727.6	728.2	721.9	722.4	719.9	722.0
LTV	80.5	80.5	80.5	79.4	78.5	80.1	81.8	79.5
Original Interest Rate	5.13%	5.66%	5.44%	6.18%	6.54%	6.76%	6.89%	6.65%
Original Loan Amount	257,893	266,009	292,939	290,574	273,631	294,194	305,043	342,780
Age at Delinquency	21.1	20.6	18.5	15.9	14.7	12.3	10.7	9.4
% Default	19.26%	19.64%	14.61%	14.22%	18.28%	13.03%	8.44%	10.96%
N	353	606	527	429	372	445	320	292

Private	**2005 Q1**	**2005 Q2**	**2005 Q3**	**2005 Q4**	**2006 Q1**	**2006 Q2**	**2006 Q3**	**2006 Q4**
Original Credit Score	715.1	716.3	716.4	716.2	716.4	714.6	714.7	716.5
LTV	79.8	80.2	79.4	78.5	78.4	78.9	78.3	79.4
Original Interest Rate	6.29%	6.46%	6.31%	6.62%	6.94%	7.27%	7.40%	7.36%
Original Loan Amount	248,903	254,290	276,839	273,214	277,374	298,546	313,397	313,942
Age at Delinquency	21.2	19.8	19.6	18.3	16.2	13.8	11.9	10.0
% Default	26.77%	26.51%	21.51%	22.62%	24.84%	22.43%	18.81%	14.54%
N	1,655	2,305	1,925	1,799	1,421	1,654	1,473	915

Table 3: Logit Regression of Default Conditional on 60+ Days Delinquency (All Loans)

This table reports the marginal effects of a logit regression. Coefficients on discrete variables represent the effect of moving from 0 to 1. Coefficients on continuous variables represent the effect of moving one standard deviation from the mean. Portfolio is a dummy which indicates that the loan was bank held at the time of first 60+ days delinquency. Age at Delinquency is the age of the loan at the time of first 60+ days delinquency. The excluded variables are private investor, FICO >= 680, 30-year term and missing insurance information. Standard errors are clustered at MSA level and resulting t-statistics are reported in parentheses. All loans in the sample are originated between 2005 to 2006. ***, ** and * represents significance at 1%, 5% and 10% respectively.

Origination Quarter	**2005 Q1**	**2005 Q2**	**2005 Q3**	**2005 Q4**	**2006 Q1**	**2006 Q2**	**2006 Q3**	**2006 Q4**
Dependent Variable: Foreclosure								
Mean Securitized	0.2499	0.2414	0.2335	0.2527	0.2662	0.2258	0.2038	0.1629
Portfolio (d)	-0.046***	-0.048***	-0.046***	-0.070***	-0.059***	-0.060***	-0.066***	-0.038***
	(-8.12)	(-8.86)	(-8.21)	(-10.91)	(-8.21)	(-12.99)	(-12.97)	(-14.25)
FICO < 620 (d)	-0.109***	-0.133***	-0.127***	-0.145***	-0.155***	-0.124***	-0.108***	-0.069***
	(-11.15)	(-18.42)	(-17.92)	(-23.61)	(-19.81)	(-15.24)	(-16.43)	(-12.51)
620 <= FICO < 680 (d)	-0.025***	-0.037***	-0.034***	-0.038***	-0.042***	-0.030***	-0.028***	-0.017***
	(-3.57)	(-8.01)	(-6.36)	(-8.01)	(-7.82)	(-6.41)	(-4.97)	(-4.37)
LTV	0.579***	0.280***	0.501***	0.535***	0.553***	0.401***	0.100***	0.055***
	(6.47)	(4.50)	(7.10)	(6.68)	(7.37)	(5.14)	(3.56)	(3.18)
LTV Squared	-0.405***	-0.163***	-0.342***	-0.361***	-0.373***	-0.265***	-0.035	-0.015
	(-5.73)	(-3.24)	(-6.20)	(-5.53)	(-6.16)	(-4.17)	(-1.45)	(-1.04)
Origination Amount	-0.003	0.000	-0.001	-0.003	0.001	0.007	0.003	0.009**
	(-0.47)	(0.08)	(-0.19)	(-0.84)	(0.09)	(1.08)	(0.62)	(2.21)
Origination Amount Squared	0.009	0.001	-0.002	-0.001	0.001	-0.011	-0.008	-0.016**
	(1.64)	(0.26)	(-0.28)	(-0.16)	(0.19)	(-1.52)	(-1.42)	(-2.12)
Original Interest Rate	0.015***	0.012***	0.020***	0.018***	0.021***	0.015***	0.013***	0.010***
	(6.71)	(5.40)	(9.89)	(8.89)	(8.44)	(9.01)	(9.04)	(8.13)
FIX (d)	-0.081***	-0.070***	-0.058***	-0.060***	-0.053***	-0.046***	-0.036***	-0.026***
	(-15.34)	(-12.52)	(-13.62)	(-13.93)	(-7.24)	(-10.27)	(-7.55)	(-6.97)
15 Year Term (d)	0.013	-0.047**	-0.074***	-0.060***	-0.108***	-0.028	0.114***	0.072*
	(0.48)	(-2.21)	(-3.12)	(-2.69)	(-5.50)	(-1.06)	(3.59)	(1.94)
20 Year Term (d)	0.022	-0.053	-0.073*	-0.074	-0.086	-0.104***	-0.046	-0.050***
	(0.35)	(-1.27)	(-1.88)	(-1.47)	(-1.32)	(-3.31)	(-0.87)	(-2.91)
No Insurance (d)	-0.018***	-0.016***	-0.002	0.004	0.013**	0.024***	0.014**	-0.002
	(-3.53)	(-2.81)	(-0.37)	(0.64)	(2.32)	(4.42)	(2.23)	(-0.59)
Insurance (d)	-0.019	-0.011	-0.015	0.009	-0.005	-0.019	-0.013	-0.004
	(-1.55)	(-0.98)	(-1.40)	(0.64)	(-0.27)	(-1.06)	(-0.99)	(-0.38)
Age at Delinquency	-0.085***	-0.096***	-0.109***	-0.135***	-0.163***	-0.136***	-0.127***	-0.097***
	(-13.51)	(-17.02)	(-26.89)	(-32.76)	(-44.74)	(-51.75)	(-60.27)	(-126.99)
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	35,365	46,279	46,636	44,904	42,789	42,050	37,008	29,939

Table 4: Logit Regression of Default Conditional on 60+ Days Delinquency (High Quality Loans)

This table reports the marginal effects of a logit regression. Coefficients on discrete variables represent the effect of moving from 0 to 1. Coefficients on continuous variables represent the effect of moving one standard deviation from the mean. Portfolio is a dummy which indicates that the loan was bank held at the time of first 60+ days delinquency. Age at Delinquency is the age of the loan at the time of first 60+ delinquency. The excluded variables are private investor, FICO >= 760, 30-year term and missing insurance information. Standard errors are clustered at MSA level and resulting t-statistics are reported in parentheses. All loans in the sample are originated between 2005 to 2006. ***, ** and * represents significance at 1%, 5% and 10% respectively.

Origination Quarter	2005 Q1	2005 Q2	2005 Q3	2005 Q4	2006 Q1	2006 Q2	2006 Q3	2006 Q4
Dependent Variable: Foreclosure								
Mean Securitized	0.2677	0.2651	0.2151	0.2262	0.2484	0.2243	0.1881	0.1454
Portfolio (d)	-0.039	-0.057***	-0.041**	-0.066***	-0.079***	-0.096***	-0.089***	-0.045***
	(-1.29)	(-3.04)	(-1.98)	(-3.85)	(-2.88)	(-4.81)	(-7.20)	(-3.25)
680 <= FICO < 720 (d)	-0.028	0.002	0.050*	0.027	-0.023	0.037	-0.028	0.010
	(-0.87)	(0.06)	(1.89)	(1.20)	(-0.59)	(1.27)	(-1.15)	(0.35)
720 <= FICO < 760 (d)	-0.005	0.024	0.113**	0.026	-0.013	0.046	-0.028	0.010
	(-0.15)	(0.76)	(2.49)	(1.05)	(-0.32)	(1.25)	(-1.25)	(0.33)
LTV	0.529**	0.007	0.448***	0.213**	0.236**	0.351**	0.112*	-0.045
	(2.37)	(0.10)	(4.71)	(2.07)	(2.04)	(2.00)	(1.85)	(-1.48)
LTV Squared	-0.439**	0.034	-0.355***	-0.143	-0.157	-0.281*	-0.067	0.058**
	(-2.19)	(0.55)	(-4.14)	(-1.56)	(-1.48)	(-1.74)	(-1.07)	(1.98)
Origination Amount	-0.055	0.008	0.003	0.057	0.006	0.025	0.009	0.059**
	(-1.48)	(0.65)	(0.18)	(1.51)	(0.33)	(1.18)	(0.54)	(2.14)
Origination Amount Squared	0.164***	-0.012	0.001	-0.162*	0.002	-0.025	-0.010	-0.070*
	(2.63)	(-1.48)	(0.09)	(-1.73)	(0.10)	(-1.23)	(-0.64)	(-1.80)
Original Interest Rate	0.022	0.036***	0.026***	0.034***	0.007	0.040***	0.015*	0.015**
	(1.45)	(3.53)	(2.57)	(3.53)	(0.74)	(3.58)	(1.96)	(2.37)
FIX (d)	-0.085***	-0.108***	-0.049**	-0.053***	-0.078***	-0.006	-0.036**	0.001
	(-3.71)	(-6.34)	(-2.35)	(-2.83)	(-3.15)	(-0.38)	(-2.32)	(0.08)
15 Year Term (d)	-0.040	-0.145***	-0.018	-0.103**	-0.067	-0.086	0.489**	0.040
	(-0.28)	(-3.03)	(-0.16)	(-2.31)	(-0.55)	(-1.23)	(2.12)	(0.43)
20 Year Term (d)		0.041	-0.074	-0.032				
		(0.32)	(-0.85)	(-0.31)				
No Insurance (d)	-0.014	-0.055**	-0.022	-0.041**	-0.006	0.011	-0.001	0.000
	(-0.58)	(-2.30)	(-1.22)	(-2.27)	(-0.25)	(0.39)	(-0.09)	(-0.01)
Insurance (d)	-0.040	-0.017	-0.024	-0.072***	0.091	-0.003	-0.028	-0.048**
	(-0.62)	(-0.45)	(-0.59)	(-2.89)	(0.93)	(-0.06)	(-0.62)	(-2.24)
Age at Delinquency	-0.100***	-0.104***	-0.109***	-0.121***	-0.183***	-0.139***	-0.130***	-0.089***
	(-6.40)	(-9.09)	(-18.96)	(-16.17)	(-23.29)	(-23.59)	(-35.71)	(-30.00)
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,758	2,631	2,123	1,978	1,555	1,826	1,518	905

Table 5: Logit Regression of Default Conditional on 60+ Delinquency and Weak Liquidation Laws (All Loans)

This table reports the marginal effects of a logit regression. Coefficients on discrete variables represent the effect of moving from 0 to 1. Coefficients on continuous variables represent the effect of moving one standard deviation from the mean. A state is classified as having weak liquidation laws if the average foreclosure processing time is greater than 117 days. Portfolio is a dummy which indicates that the loan was bank held at the time of first 60+ days delinquency. Age at Delinquency is the age of the loan at the time of first 60+ days delinquency. The excluded variables are private investor, FICO >= 680, 30-year term and missing insurance information. Standard errors are clustered at MSA level and resulting t-statistics are reported in parentheses. All loans in the sample are originated between 2005 to 2006. ***, ** and * represents significance at 1%, 5% and 10% respectively.

Origination Quarter	**2005 Q1**	**2005 Q2**	**2005 Q3**	**2005 Q4**	**2006 Q1**	**2006 Q2**	**2006 Q3**	**2006 Q4**
Dependent Variable: Foreclosure								
Mean Securitized	0.1761	0.1613	0.1495	0.1637	0.1732	0.1376	0.1145	0.0716
Portfolio (d)	-0.044***	-0.036***	-0.033***	-0.049***	-0.023**	-0.035***	-0.032***	-0.011***
	(-5.64)	(-4.73)	(-6.37)	(-5.48)	(-2.40)	(-6.28)	(-7.90)	(-5.25)
FICO < 620 (d)	-0.063***	-0.069***	-0.053***	-0.071***	-0.080***	-0.053***	-0.039***	-0.016***
	(-6.71)	(-9.53)	(-7.89)	(-11.07)	(-10.66)	(-7.22)	(-5.78)	(-5.68)
620 <= FICO < 680 (d)	-0.018**	-0.013**	-0.003	-0.017***	-0.016***	-0.017***	-0.010	-0.003
	(-2.50)	(-2.25)	(-0.52)	(-3.64)	(-3.21)	(-3.61)	(-1.46)	(-1.09)
LTV	0.300***	0.077**	0.167***	0.310***	0.186***	0.077*	0.046	0.011
	(3.99)	(2.01)	(4.57)	(7.99)	(4.13)	(1.74)	(1.61)	(1.17)
LTV Squared	-0.241***	-0.039	-0.126***	-0.252***	-0.141***	-0.047	-0.027	-0.003
	(-3.56)	(-1.13)	(-3.93)	(-7.28)	(-3.48)	(-1.18)	(-1.06)	(-0.28)
Origination Amount	-0.006	-0.006	0.000	-0.004	-0.004	0.009**	-0.001	0.000
	(-0.68)	(-0.88)	(0.03)	(-1.04)	(-0.73)	(2.29)	(-0.35)	(0.02)
Origination Amount Squared	0.012	0.007*	-0.002	0.002	0.000	-0.006***	-0.001	-0.002
	(1.49)	(1.79)	(-0.23)	(0.65)	(0.07)	(-2.68)	(-0.36)	(-0.33)
Original Interest Rate	0.017***	0.007**	0.017***	0.016***	0.021***	0.009***	0.004***	0.002*
	(4.40)	(2.24)	(5.80)	(6.24)	(6.32)	(3.94)	(2.74)	(1.78)
FIX (d)	-0.043***	-0.038***	-0.023***	-0.026***	-0.016**	-0.024***	-0.012***	-0.010***
	(-5.41)	(-6.12)	(-4.14)	(-5.47)	(-2.41)	(-5.45)	(-3.20)	(-4.03)
15 Year Term (d)	0.016	-0.016	-0.049***	-0.015	-0.001	-0.035	0.071*	0.053*
	(0.62)	(-0.65)	(-3.64)	(-0.62)	(-0.02)	(-1.27)	(1.81)	(1.89)
20 Year Term (d)	0.071	0.050	-0.051	-0.041				-0.008
	(0.78)	(1.00)	(-1.55)	(-0.89)				(-0.45)
No Insurance (d)	-0.009*	-0.017**	0.001	0.002	0.006	0.004	0.003	-0.003
	(-1.79)	(-2.35)	(0.20)	(0.36)	(0.97)	(0.70)	(0.58)	(-1.29)
Insurance (d)	-0.010	-0.011	-0.012	0.017	-0.009	-0.025***	-0.007	-0.005
	(-0.81)	(-1.04)	(-0.94)	(1.28)	(-0.75)	(-2.93)	(-0.66)	(-1.05)
Age at Delinquency	-0.077***	-0.081***	-0.081***	-0.094***	-0.118***	-0.090***	-0.071***	-0.040***
	(-20.13)	(-24.13)	(-18.26)	(-52.36)	(-64.09)	(-58.98)	(-66.25)	(-24.61)
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	13,217	17,249	16,679	15,746	16,087	16,290	14,273	11,872

Table 6: Logit Regression of Default Conditional on 60+ Delinquency and Tough Liquidation Laws (All Loans)

This table reports the marginal effects of a logit regression. Coefficients on discrete variables represent the effect of moving from 0 to 1. Coefficients on continuous variables represent the effect of moving one standard deviation from the mean. A state is classified as having tough liquidation laws if the average foreclosure processing time is less than or equal to 117 days. Portfolio is a dummy which indicates that the loan was bank held at the time of first 60+ days delinquency. Age at Delinquency is the age of the loan at the time of first 60+ days delinquency. The excluded variables are private investor, FICO >= 680, 30-year term and missing insurance information. Standard errors are clustered at MSA level and resulting t-statistics are reported in parentheses. All loans in the sample are originated between 2005 to 2006. ***, ** and * represents significance at 1%, 5% and 10% respectively.

Origination Quarter	**2005 Q1**	**2005 Q2**	**2005 Q3**	**2005 Q4**	**2006 Q1**	**2006 Q2**	**2006 Q3**	**2006 Q4**
Dependent Variable: Foreclosure								
Mean Securitized	0.2945	0.2897	0.2794	0.3013	0.3238	0.2829	0.2602	0.2249
Portfolio (d)	-0.048***	-0.057***	-0.056***	-0.080***	-0.087***	-0.080***	-0.092***	-0.069***
	(-5.98)	(-7.87)	(-6.26)	(-8.93)	(-8.47)	(-10.81)	(-9.74)	(-12.82)
FICO < 620 (d)	-0.135***	-0.171***	-0.173***	-0.187***	-0.202***	-0.179***	-0.164***	-0.125***
	(-8.90)	(-16.70)	(-19.79)	(-24.46)	(-20.42)	(-15.88)	(-18.58)	(-13.13)
620 <= FICO < 680 (d)	-0.028**	-0.050***	-0.052***	-0.050***	-0.057***	-0.038***	-0.041***	-0.033***
	(-2.46)	(-8.11)	(-7.60)	(-7.01)	(-7.45)	(-5.34)	(-5.53)	(-4.43)
LTV	0.431***	0.254***	0.402***	0.329***	0.410***	0.366***	0.081***	0.065***
	(5.39)	(4.05)	(5.88)	(4.91)	(5.98)	(4.81)	(2.93)	(2.79)
LTV Squared	-0.329***	-0.168***	-0.307***	-0.232***	-0.300***	-0.269***	-0.020	-0.017
	(-4.76)	(-2.97)	(-5.14)	(-3.80)	(-4.91)	(-3.96)	(-0.78)	(-0.81)
Origination Amount	-0.006	0.002	-0.002	-0.003	0.004	0.002	0.006	0.021**
	(-0.66)	(0.22)	(-0.16)	(-0.52)	(0.41)	(0.15)	(0.68)	(2.30)
Origination Amount Squared	0.010*	0.000	-0.002	-0.002	0.002	-0.007	-0.010	-0.021**
	(1.75)	(-0.03)	(-0.25)	(-0.33)	(0.28)	(-0.75)	(-1.32)	(-2.11)
Original Interest Rate	0.020***	0.020***	0.033***	0.029***	0.032***	0.033***	0.031***	0.030***
	(5.05)	(4.62)	(7.80)	(6.57)	(6.25)	(8.87)	(9.44)	(10.60)
FIX (d)	-0.105***	-0.093***	-0.082***	-0.083***	-0.082***	-0.060***	-0.055***	-0.040***
	(-14.46)	(-11.54)	(-15.04)	(-12.74)	(-7.81)	(-8.63)	(-7.05)	(-5.56)
15 Year Term (d)	0.011	-0.072**	-0.090**	-0.093***	-0.183***	-0.024	0.138***	0.077
	(0.24)	(-2.47)	(-2.11)	(-2.97)	(-7.07)	(-0.63)	(3.41)	(1.27)
20 Year Term (d)	-0.025	-0.127**	-0.089	-0.094	0.005	-0.128**	0.006	-0.108***
	(-0.31)	(-2.56)	(-1.43)	(-1.21)	(0.03)	(-2.08)	(0.05)	(-3.97)
No Insurance (d)	-0.023***	-0.013*	-0.004	0.004	0.019**	0.043***	0.025**	0.001
	(-3.11)	(-1.80)	(-0.48)	(0.55)	(2.13)	(6.00)	(2.38)	(0.12)
Insurance (d)	-0.022	-0.006	-0.013	-0.003	0.005	0.008	-0.017	0.000
	(-1.08)	(-0.37)	(-0.87)	(-0.11)	(0.13)	(0.23)	(-0.66)	(-0.01)
Age at Delinquency	-0.089***	-0.108***	-0.134***	-0.166***	-0.201***	-0.181***	-0.183***	-0.168***
	(-9.15)	(-12.72)	(-24.09)	(-27.41)	(-31.80)	(-41.92)	(-34.35)	(-54.37)
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	22,122	29,013	29,953	29,125	26,662	25,703	22,694	18,035

Table 7: Logit Regression of Default Conditional on 60+ Days Delinquency and Weak Liquidation Laws (High Quality Loans)

This table reports the marginal effects of a logit regression. Coefficients on discrete variables represent the effect of moving from 0 to 1. Coefficients on continuous variables represent the effect of moving one standard deviation from the mean. A state is classified as having weak liquidation laws if the average foreclosure processing time is greater than 117 days. Portfolio is a dummy which indicates that the loan was bank held at the time of first 60+ days delinquency. Age at Delinquency is the age of the loan at the time of first 60+ days delinquency. The excluded variables are private investor, FICO >= 760, 30-year term and missing insurance information. Standard errors are clustered at MSA level and resulting t-statistics are reported in parentheses. ***, ** and * represents significance at 1%, 5% and 10% respectively.

Origination Quarter	**2005 Q1**	**2005 Q2**	**2005 Q3**	**2005 Q4**	**2006 Q1**	**2006 Q2**	**2006 Q3**	**2006 Q4**
Dependent Variable: Foreclosure								
Mean Securitized	0.1391	0.1569	0.1310	0.1405	0.1207	0.1199	0.1281	0.0349
Portfolio (d)	0.015	0.005	0.004	-0.028	0.020	-0.015	-0.068***	-0.001
	(0.49)	(0.24)	(0.31)	(-1.43)	(0.66)	(-0.88)	(-5.17)	(-0.17)
680 <= FICO < 720 (d)	0.057*	0.011	0.011	-0.008	-0.017	0.033	-0.009	-0.001
	(1.86)	(0.38)	(0.80)	(-0.38)	(-0.82)	(1.24)	(-0.41)	(-0.22)
720 <= FICO < 760 (d)	0.079	0.021	0.048**	-0.006	-0.030**	0.052	-0.002	-0.001
	(1.38)	(0.54)	(2.21)	(-0.26)	(-2.29)	(1.00)	(-0.10)	(-0.11)
LTV	0.305**	0.009	0.190**	0.115	0.316***	-0.020	0.062	-0.007
	(2.03)	(0.13)	(2.35)	(1.14)	(3.78)	(-0.32)	(1.06)	(-1.02)
LTV Squared	-0.258*	0.002	-0.160**	-0.081	-0.256***	0.039	-0.050	0.010
	(-1.84)	(0.04)	(-2.28)	(-0.91)	(-3.44)	(0.62)	(-0.78)	(1.35)
Origination Amount	-0.039	-0.007	0.028	0.034	0.018	0.040	-0.001	0.028*
	(-1.50)	(-0.43)	(1.18)	(1.57)	(0.57)	(1.27)	(-0.03)	(1.72)
Origination Amount Squared	0.032**	-0.002	-0.113***	-0.047*	-0.045	-0.037	0.002	-0.044*
	(2.30)	(-0.12)	(-2.65)	(-1.81)	(-0.61)	(-0.99)	(0.14)	(-1.85)
Original Interest Rate	0.020*	0.019*	0.009	0.024**	0.013**	0.027***	0.004	0.000
	(1.74)	(1.66)	(1.40)	(1.97)	(1.99)	(3.47)	(0.71)	(0.58)
FIX (d)	-0.016	-0.019	-0.007	0.003	-0.022	0.002	-0.010	0.000
	(-0.79)	(-1.13)	(-0.71)	(0.13)	(-1.41)	(0.09)	(-0.82)	(0.07)
15 Year Term (d)	0.029							
	(0.20)							
20 Year Term (d)		0.123						
		(0.79)						
No Insurance (d)	-0.011	-0.047**	-0.024**	-0.029	0.007	-0.011	-0.044**	0.002
	(-0.52)	(-2.47)	(-2.37)	(-1.39)	(0.43)	(-0.62)	(-2.54)	(0.47)
Insurance (d)	-0.014	-0.032	0.004	-0.034*	0.076	-0.036***	0.014	-0.001
	(-0.29)	(-0.99)	(0.17)	(-1.66)	(0.99)	(-3.82)	(0.31)	(-0.18)
Age at Delinquency	-0.064***	-0.071***	-0.034***	-0.056***	-0.058***	-0.057***	-0.067***	-0.009*
	(-8.78)	(-7.69)	(-2.80)	(-9.44)	(-4.76)	(-10.08)	(-7.46)	(-1.76)
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	582	929	696	634	520	588	486	313

Table 8: Logit Regression of Default Conditional on 60+ Days Delinquency and Weak Liquidation Laws (High Quality Loans)

This table reports the marginal effects of a logit regression. Coefficients on discrete variables represent the effect of moving from 0 to 1. Coefficients on continuous variables represent the effect of moving one standard deviation from the mean. A state is classified as having tough liquidation laws if the average foreclosure processing time is less than or equal to 117 days. Portfolio is a dummy which indicates that the loan was bank held at the time of first 60+ delinquency. Age at Delinquency is the age of the loan at the time of first 60+ days delinquency. The excluded variables are private investor, FICO >= 760, 30-year term and missing insurance information. Standard errors are clustered at MSA level and resulting t-statistics are reported in parentheses. ***, ** and * represents significance at 1%, 5% and 10% respectively.

Origination Quarter	**2005 Q1**	**2005 Q2**	**2005 Q3**	**2005 Q4**	**2006 Q1**	**2006 Q2**	**2006 Q3**	**2006 Q4**
Dependent Variable: Foreclosure								
Mean Securitized	0.3349	0.3315	0.2589	0.2718	0.3151	0.2808	0.2206	0.2210
Portfolio (d)	-0.086**	-0.097***	-0.068**	-0.088***	-0.171***	-0.147***	-0.101***	-0.104***
	(-2.19)	(-3.16)	(-2.30)	(-3.32)	(-4.80)	(-4.75)	(-5.53)	(-4.04)
680 <= FICO < 720 (d)	-0.088**	0.005	0.064*	0.048	-0.028	0.024	-0.039	0.031
	(-1.97)	(0.14)	(1.68)	(1.37)	(-0.49)	(0.55)	(-1.04)	(0.53)
720 <= FICO < 760 (d)	-0.050	0.036	0.123*	0.051	0.019	0.031	-0.045	0.034
	(-1.12)	(0.84)	(1.85)	(1.33)	(0.29)	(0.63)	(-1.31)	(0.51)
LTV	0.649**	-0.025	0.522***	0.265*	0.276*	0.776***	0.200	-0.076
	(2.02)	(-0.28)	(4.09)	(1.75)	(1.74)	(4.47)	(1.58)	(-1.10)
LTV Squared	-0.538*	0.081	-0.405***	-0.173	-0.180	-0.680***	-0.129	0.093
	(-1.88)	(1.00)	(-3.58)	(-1.30)	(-1.22)	(-4.25)	(-1.05)	(1.43)
Origination Amount	-0.088	0.025	0.033*	0.067	-0.004	0.015	0.011	0.083
	(-1.11)	(1.20)	(1.65)	(0.99)	(-0.16)	(0.57)	(0.51)	(1.63)
Origination Amount Squared	0.339	-0.027*	-0.015	-0.221	0.022	-0.017	-0.012	-0.101
	(1.47)	(-1.91)	(-1.00)	(-1.18)	(1.04)	(-0.74)	(-0.54)	(-1.56)
Original Interest Rate	0.018	0.047***	0.030**	0.036***	-0.007	0.046***	0.022*	0.033**
	(0.86)	(3.23)	(2.02)	(2.92)	(-0.48)	(2.78)	(1.71)	(2.12)
FIX (d)	-0.137***	-0.177***	-0.072**	-0.089***	-0.104***	-0.003	-0.049**	0.005
	(-3.74)	(-7.23)	(-2.11)	(-3.47)	(-2.81)	(-0.14)	(-2.08)	(0.14)
15 Year Term (d)	-0.128	-0.190**	0.013	-0.141*		-0.137		0.037
	(-0.62)	(-1.98)	(0.06)	(-1.75)		(-1.60)		(0.25)
20 Year Term (d)		-0.015	-0.109	-0.032				
		(-0.09)	(-0.90)	(-0.21)				
No Insurance (d)	-0.011	-0.061	-0.008	-0.050*	-0.023	0.031	0.025	-0.002
	(-0.31)	(-1.64)	(-0.30)	(-1.83)	(-0.62)	(0.74)	(1.22)	(-0.05)
Insurance (d)	-0.039	-0.009	-0.080*	-0.097**	0.012	0.143	-0.061	-0.112***
	(-0.38)	(-0.15)	(-1.66)	(-2.31)	(0.11)	(1.31)	(-0.89)	(-2.84)
Age at Delinquency	-0.110***	-0.122***	-0.132***	-0.159***	-0.242***	-0.190***	-0.164***	-0.173***
	(-4.79)	(-7.55)	(-15.54)	(-12.25)	(-16.43)	(-19.82)	(-30.86)	(-20.28)
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,169	1,676	1,411	1,332	1,024	1,233	1,018	586

Table 9: Logit Regression of Current Rate (rate at which delinquent loans resume making payments) of Portfolio Loans Relative to Securitized Loans for All Loans and High Quality Loans

This table reports the estimates (marginals) on Portfolio dummy using a specification and controls similar to Table 3. The dependent variable is a dummy variable that indicates whether or not a 60+ delinquent loan's payment history becomes better than 60+ at the end of a pre-specified window. We choose two different windows to track the payment history of a 60+ delinquent loan (reported on the X axis): (a) six months after the loan becomes 60+ delinquent and (b) twelve months after the loan becomes 60+ delinquent. The regression includes FICO, LTV, interest rate, origination amount, squared terms of these variables, insurance and maturity dummies, age of the loan at delinquency and MSA and origination quarter fixed effects (similar to Table 3). Coefficients on discrete variables represent the effect of moving from 0 to 1. Standard errors are clustered at MSA level and resulting t-statistics are reported in parentheses. ***, ** and * represents significance at 1%, 5% and 10% respectively.

Dependent Variable: Current Rate

	All Loans		High Quality Loans	
	6 month	12 month	6 month	12 month
Mean Portfolio	0.48	0.50	0.52	0.57
Mean Securitized	0.37	0.38	0.38	0.39
Portfolio (d)	0.064***	0.079***	0.106***	0.141***
	(11.38)	(12.36)	(6.33)	(6.82)
Time Fixed Effects	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes
Other Controls (similar to Table 3)	Yes	Yes	Yes	Yes
Clustering Unit	MSA	MSA	MSA	MSA
N	222,743	165,558	9,484	6,813
Pseudo R-square	0.08	0.14	0.17	0.24

Table 10: Logit Regression of Foreclosure and Current Rates (rate at which delinquent loans resume making payments) of Portfolio Loans Relative to Securitized Loans for Different Sub-samples

This table reports the estimates (marginals) on Portfolio dummy using a specification and controls similar to Table 3. The dependent variable in Panel A is a dummy variable that indicates whether or not a 60+ delinquent loan's payment history becomes better than 60+ at the end of a pre-specified window. We choose two different windows to track the payment history of a 60+ delinquent loan (reported on the X axis): (a) six months after the loan becomes 60+ delinquent and (b) twelve months after the loan becomes 60+ delinquent. In Panel B, the dependent variable is Foreclosure. The regression includes all the controls that were used in Table 3. Time and MSA fixed effects are included in all specifications. Coefficients on discrete variables represent the effect of moving from 0 to 1. Standard errors are clustered at MSA level and resulting t-statistics are reported in parentheses. ***, ** and * represents significance at 1%, 5% and 10% respectively.

Panel A: Current Rate (All Loans)

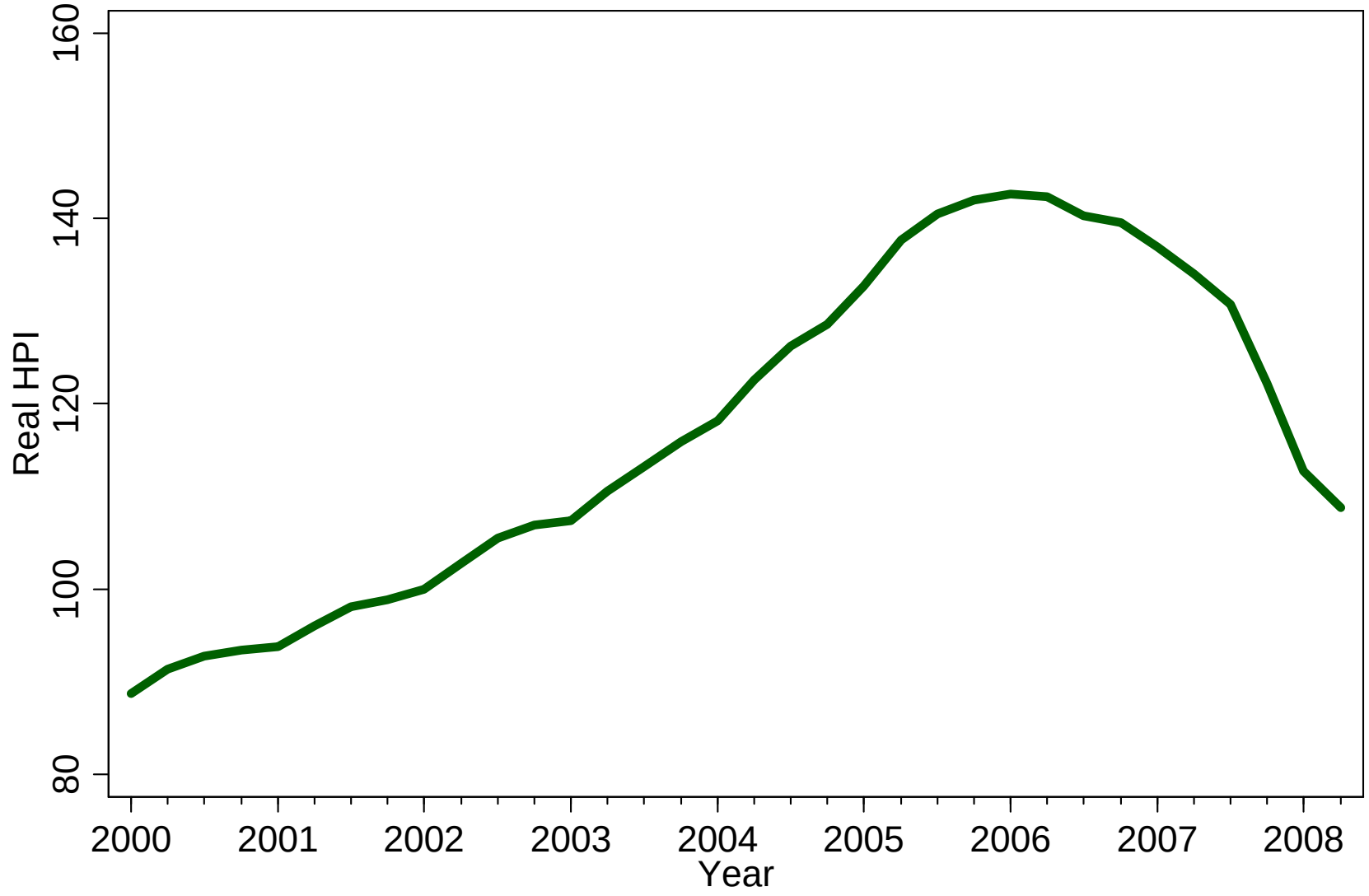
	6 months			12 months		
	FICO < 620	620 < FICO < 680	FICO > 680	FICO < 620	620 < FICO < 680	FICO > 680
Mean Portfolio	0.45	0.47	0.52	0.45	0.49	0.56
Mean Securitized	0.42	0.33	0.34	0.43	0.33	0.34
Portfolio (d)	0.018**	0.069***	0.109***	0.012	0.087***	0.146***
	(2.26)	(8.07)	(14.33)	(1.48)	(9.08)	(15.74)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls (similar to Table 3)	Yes	Yes	Yes	Yes	Yes	Yes
Clustering Unit	MSA	MSA	MSA	MSA	MSA	MSA
N	101,286	75,577	45,731	76,624	54,885	33,876
Pseudo R-square	0.06	0.10	0.16	0.11	0.16	0.24

Panel B: Foreclosure (All Loans)

	6 months			12 months		
	FICO < 620	620 < FICO < 680	FICO > 680	FICO < 620	620 < FICO < 680	FICO > 680
Mean Portfolio	0.082	0.102	0.121	0.209	0.266	0.301
Mean Securitized	0.083	0.147	0.172	0.231	0.411	0.470
Portfolio (d)	0.001	-0.019***	-0.021***	0.009	-0.086***	-0.101***
	(0.25)	(-6.46)	(-8.11)	(1.31)	(-8.65)	(-9.53)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
MSA Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Other Controls (similar to Table 3)	Yes	Yes	Yes	Yes	Yes	Yes
Clustering Unit	MSA	MSA	MSA	MSA	MSA	MSA
N	105,944	84,542	52,075	85,604	62,668	38,227
Pseudo R-square	0.20	0.22	0.23	0.22	0.28	0.34

Figure 1: Real House Price Index

This figure reports the real House Price Index from the beginning of 2000 to second quarter of 2008. The figure clearly highlights the rapid increase in house prices from 2000 till about 2006 followed by a decline.



Current as of Quarter 2, 2008
Source: Case-Shiller and St. Louis Federal Reserve Economic Data
Real US Housing Price Index

Figure 2: Cumulative Prepayment Speeds

The figure presents the data for cumulative dollar balance of Voluntary Prepayments as a percent of the balance at the time of origination of the loans broken by Loan Age and Vintages. Voluntary Prepayments are described as the prior non-zero balance for those loans which paid out in full in the current month with a zero loss. Balance at the time of the origination is the original balance of all the loans that were originated in a particular vintage. As can be observed prepayment rates slow down radically in 2005 and 2006 as compared to periods immediately preceding this. Data is from 2001 to 2006 from First American Loan Performance.

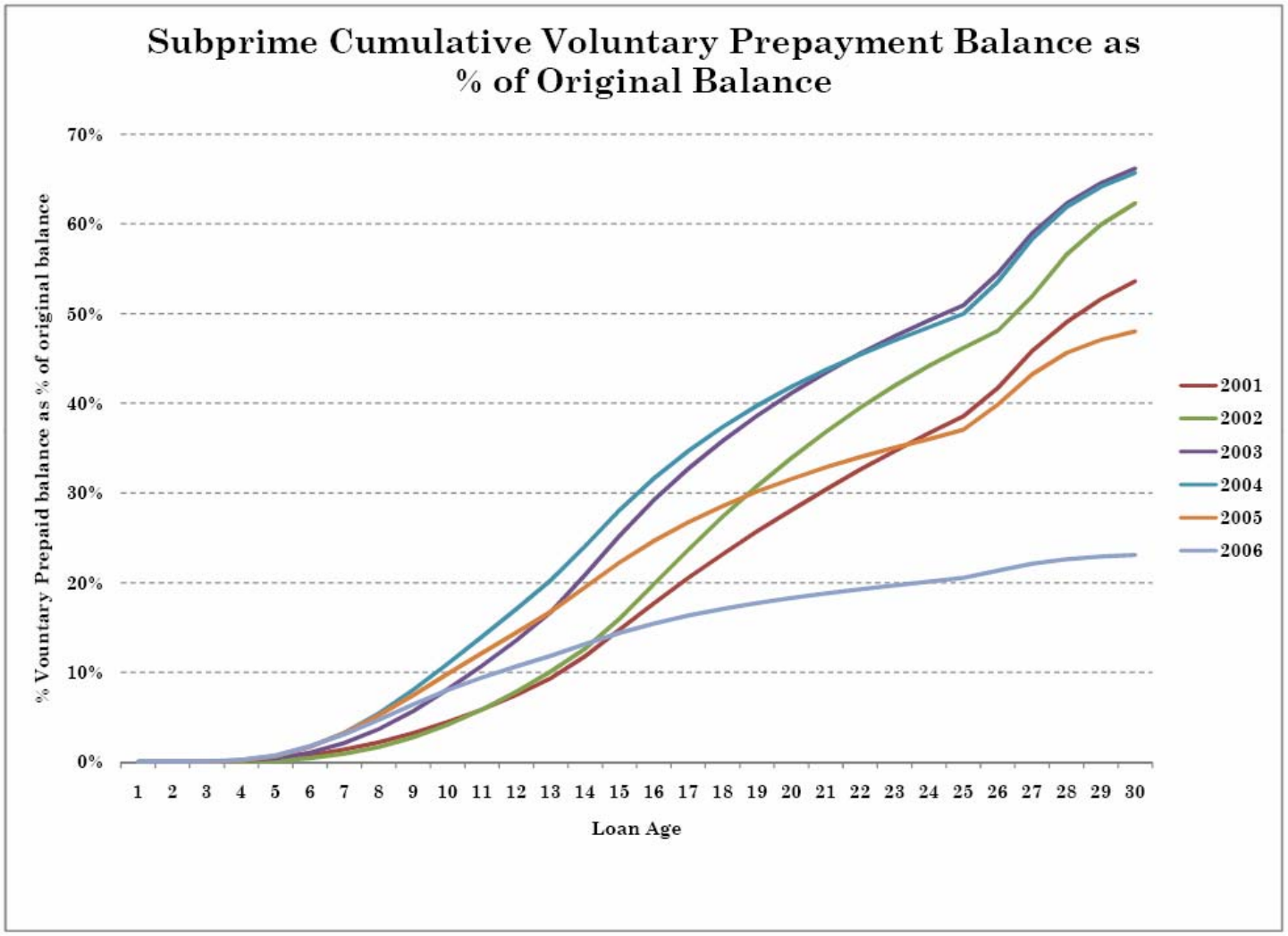


Figure 3: Estimates on Portfolio from Logit Regression using Credit Scores *At* Time of Delinquency

This figure reports the estimate (marginals) on Portfolio dummy using a specification similar to Table 3. We use FICO scores *at the time* of delinquency instead of using credit scores at the time of origination as in Table 3. Also plotted in the graph are the 95% confidence interval bands around the estimate. The estimate is significant in all the specifications at 1% level.

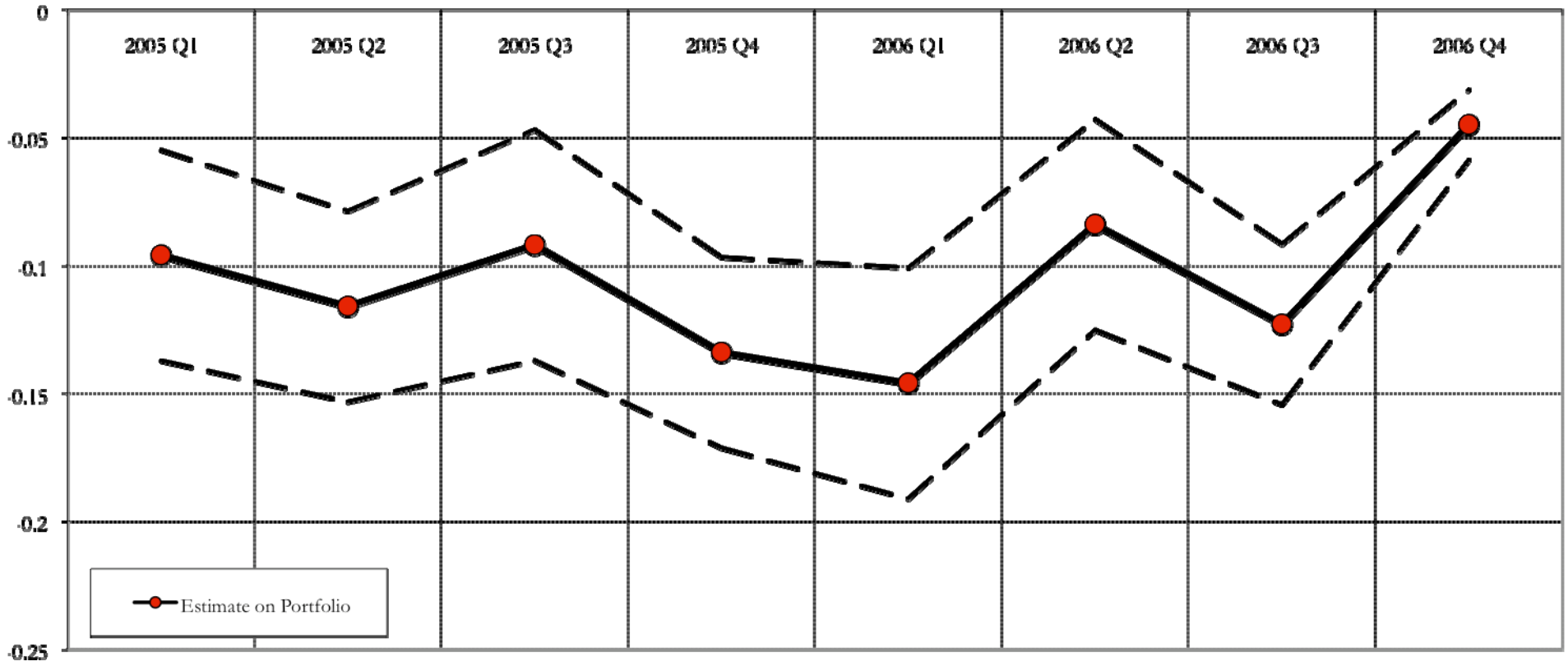


Figure 4: Cumulative Distribution Frequency of LTV at Time of Delinquency

This plot shows the cumulative distribution frequency of LTV of the loans *at the time of delinquency*. As is visible, among foreclosed loans, a greater share of securitized loans had lower LTV ratios at the time of delinquency as compared to portfolio loans.

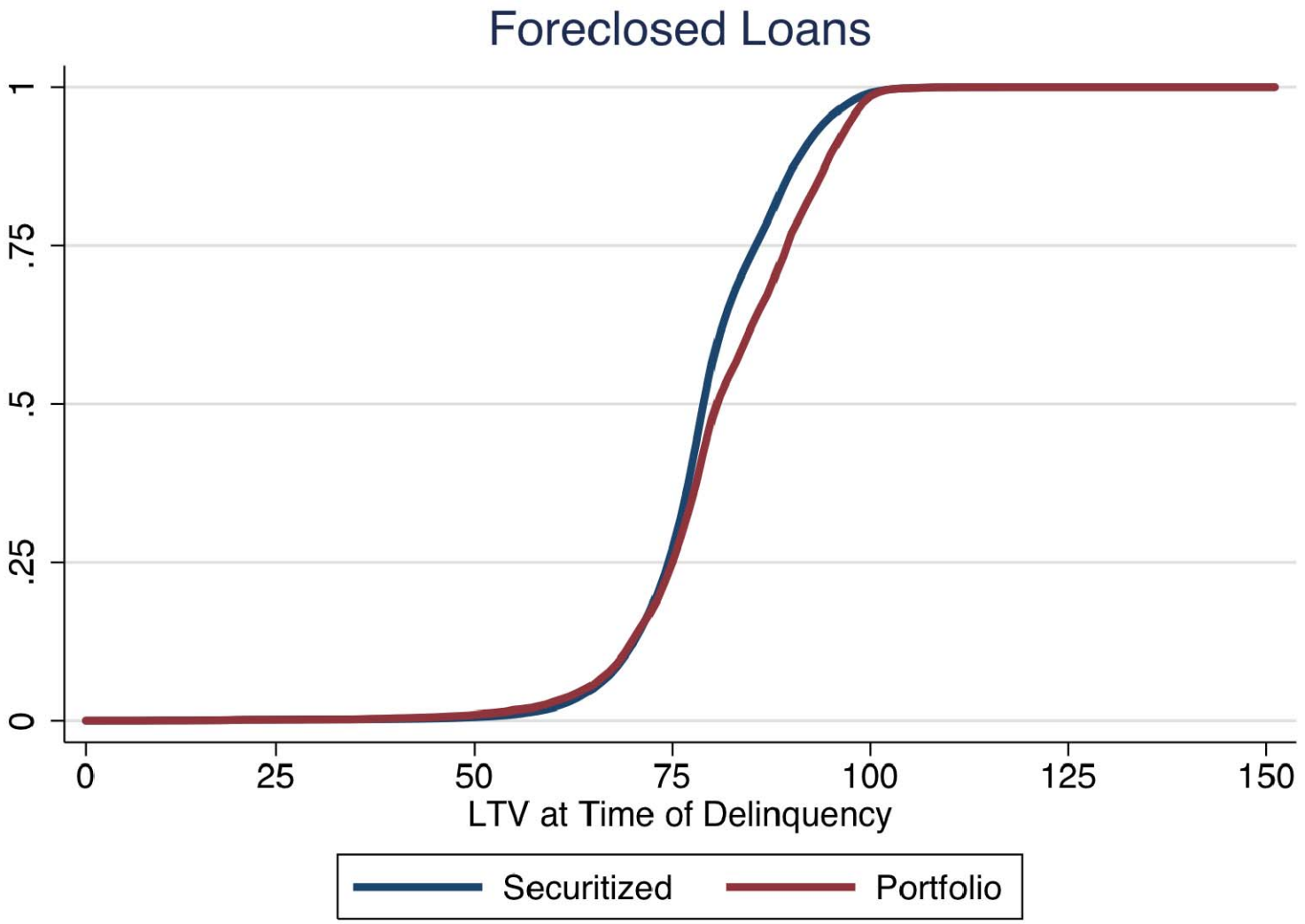
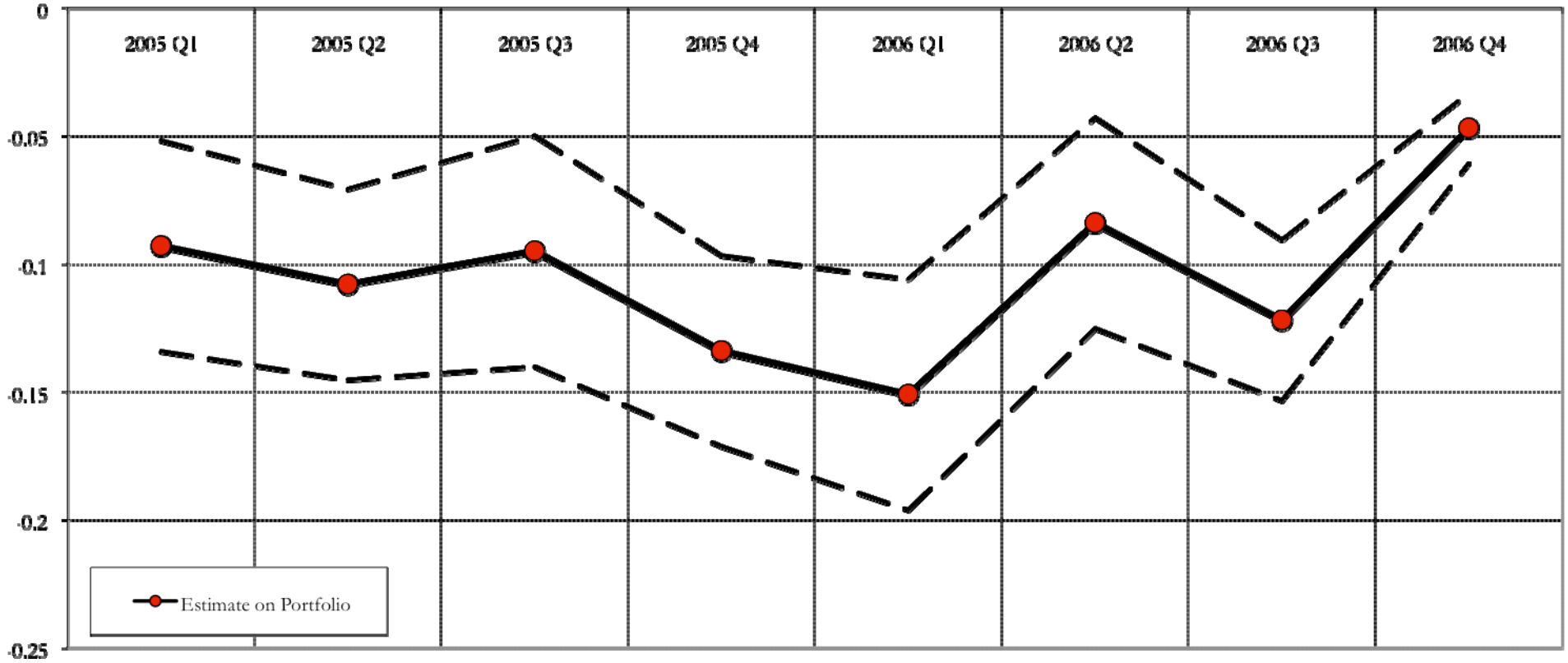


Figure 5: Estimates on Portfolio from Logit Regression using Credit Scores and LTV *At* Time of Delinquency

This figure reports the estimate (marginals) on Portfolio dummy using a specification similar to Table 3. We use FICO scores and LTV *at the time* of delinquency instead of using credit scores and LTV at the time of origination as in Table 3. Also plotted in the graph are the 95% confidence interval bands around the estimate. The estimate is significant in all the specifications at 1% level.



Appendix A: Description of Variables

Variable	Description
Portfolio	Investor status at the time of delinquency. Portfolio = 1 if status is held on portfolio. Portfolio = 0 if status is privately securitized.
FICO	Credit score at origination.
LTV	Loan-to-Value ratio at origination.
LTV Squared	Square of loan-to-value squared.
Origination Amount	Origination amount in thousands of dollars.
Origination Amount Squared	Square of origination amount in thousands of dollars.
Original Interest Rate	Monthly interest rate at origination in percent.
FIX	A variable whose value is 1 if mortgage is fixed-rate mortgage; otherwise value is 0.
15 Year Term	A variable whose value is 1 if original term length is 15 years; otherwise value is 0.
20 Year Term	A variable whose value is 1 if original term length is 20 years; otherwise value is 0.
No Insurance	A variable whose value is 1 if borrower does not have mortgage insurance; otherwise value is 0.
Insurance	A variable whose value is 1 if borrower has mortgage insurance; otherwise value is 0.
Age at Delinquency	Number of months since origination when loan first becomes 60+ days delinquent.
HPI Change from Origination to Delinquency	Percentage change in the OFHEO House Price Index (HPI) from origination to time of 60+ days delinquency at MSA level.
Delinquency	A variable whose value is 1 if the borrower becomes 60+ days delinquent; otherwise value is 0.
Default / Foreclosure	A variable whose value is 1 if the borrower enters foreclosure complete, foreclosure postsale or REO; otherwise value is 0.
Current	A variable whose value is 1 if a 60+ delinquent loan's payment history improves in delinquency status at the end of a pre-specified window; otherwise value is 0.

Appendix Table A.I: Additional Robustness Tests

This table reports the estimates (marginals) on Portfolio dummy using a specification similar to Table 3. The dependent variable is Foreclosure. The regression includes all the controls that were used in Table 3. Time and MSA (or zip) fixed effects are included in all specifications. Coefficients on discrete variables represent the effect of moving from 0 to 1. Standard errors are clustered at MSA level and resulting t-statistics are reported in parentheses. ***, ** and * represents significance at 1%, 5% and 10% respectively.

	Zipcode FE		**Alternative Foreclosure Definition**		**LTV = 80 Dummy**	
	All Loans	High Quality	All Loans	High Quality	All Loans	High Quality
	(1)	(2)	(3)	(4)	(5)	(6)
Mean Securitized	0.2324	0.2289	0.5554	0.5398	0.2324	0.2289
Portfolio	-0.057	-0.063	-0.101	-0.124	-0.051	-0.057
	(24.73)	(4.03)	(19.69)	(9.96)	(15.04)	(6.57)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Clustering Unit	MSA	MSA	MSA	MSA	MSA	MSA
Other Fixed Effects	Zip	Zip	MSA	MSA	MSA	MSA
N	327438	16491	327372	16272	327401	16106

Appendix Table A.II: Robustness with Transfer Loans

This table reports the estimates (marginals) on Portfolio dummy using a specification similar to Table 3. The dependent variable is a is a dummy variable that indicates whether or not a 60+ delinquent loan's payment history becomes better than 60+ at the end of a pre-specified window. We choose four different windows to track the payment history of a 60+ delinquent loan (reported on the X axis): (a) one month after the loan becomes 60+ delinquent; (b) three months after the loan becomes 60+ delinquent; (c) six months after the loan becomes 60+ delinquent and (b) twelve months after the loan becomes 60+ delinquent. The regression includes all the controls that were used in Table 3. Time and MSA (or zip) fixed effects are included in all specifications. Coefficients on discrete variables represent the effect of moving from 0 to 1. Standard errors are clustered at MSA level and resulting t-statistics are reported in parentheses. ***, ** and * represents significance at 1%, 5% and 10% respectively. Transfer loans are those loans whose servicing rights are transferred to servicers who do not report payment history of loans to LPS subsequent to the transfer.

Panel A1: Summary Statistics of Transferred Loans (All Loans Sample)

	All Transferred Loans							
	1 month		3 months		6 months		12 months	
	Securitized	Bank-held (Portfolio)	Securitized	Bank-held (Portfolio)	Securitized	Bank-held (Portfolio)	Securitized	Bank-held (Portfolio)
Mean	629	611	626	610	628	607	638	597
Median	627	607	626	607	628	602	643	587
N	5614	4193	4646	3580	2003	1292	328	242

Panel A2: Regression Results of All Loans Sample

	All Loans							
	1 month		3 months		6 months		12 months	
	Original Sample	Original + Transferred	Original Sample	Original + Transferred	Original Sample	Original + Transferred	Original Sample	Original + Transferred
Mean Securitized	0.29	0.29	0.33	0.33	0.37	0.37	0.38	0.38
Mean Portfolio	0.37	0.35	0.43	0.40	0.48	0.46	0.50	0.50
Portfolio	0.045***	0.026***	0.054***	0.028***	0.064***	0.047***	0.079***	0.070***
	(11.52)	(7.24)	(11.14)	(7.02)	(11.38)	(9.37)	(12.36)	(11.46)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering Unit	MSA	MSA	MSA	MSA	MSA	MSA	MSA	MSA
Other Fixed Effects	MSA	MSA	MSA	MSA	MSA	MSA	MSA	MSA
N	287188	296636	269723	277651	222743	225900	165558	166078

Panel B1: Summary Statistics of Transferred Loans (High Quality Sample)

	High Quality Loans Transferred Loans							
	1 month		3 months		6 months		12 months	
	Securitized	Bank-held (Portfolio)	Securitized	Bank-held (Portfolio)	Securitized	Bank-held (Portfolio)	Securitized	Bank-held (Portfolio)
Mean	721	727	720	724	716	721	732	714
Median	711	716	710	714	709	718	732	725
N	142	129	103	84	48	23	11	3

Panel B2: Regression Results of High Quality Sample

	High Quality Loans							
	1 month		3 months		6 months		12 months	
	Original Sample	Original + Transferred	Original Sample	Original + Transferred	Original Sample	Original + Transferred	Original Sample	Original + Transferred
Mean Securitized	0.27	0.27	0.33	0.33	0.38	0.38	0.39	0.39
Mean Portfolio	0.36	0.35	0.44	0.43	0.52	0.52	0.57	0.57
Portfolio	0.058***	0.043***	0.083***	0.068***	0.106***	0.100***	0.141***	0.140***
	(4.91)	(3.84)	(7.35)	(6.19)	(6.33)	(6.11)	(6.82)	(6.70)
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering Unit	MSA	MSA	MSA	MSA	MSA	MSA	MSA	MSA
Other Fixed Effects	MSA	MSA	MSA	MSA	MSA	MSA	MSA	MSA
N	13393	13656	12290	12474	9484	9579	6813	6824

Discussion of Findings:

As explained in Section II, payment history for loans that are transferred to servicers who do not report to LPS is not available subsequent to the transfer. In this part, we examine the robustness of our results to inclusion of payment history that we observe till the transfer date of loans that are transferred out of our sample. More precisely, we re-estimate the current regressions (Section V.B) that allow comparison between the rate at which delinquent

bank-held loans resume making payments as compared to securitized loans at different horizons. At each different horizon we include all the transfer loans that leave the database *after a given horizon* so that their payment history is available.

Panel A1 presents average FICO scores for all the securitized and portfolio loans that are transferred as a function of the month of their transfer measured from their first instance of serious delinquency (60+ delinquent). As can be observed, in general, transferred loans tend to be of worse credit quality as measured by their credit score at the time of origination. Moreover, bank-held loans tend to have lower FICO scores than securitized loans and a higher proportion of delinquent bank-held loans is transferred (there are about 8 delinquent securitized loans for every delinquent bank loan in our sample). To examine how the inclusion of these loans affects our results, we estimate the logit regressions similar to Table 9 and report the results in Panel A2 of the table. The dependent variable indicates whether or not a 60+ delinquent loan's payment history becomes better than 60+ at the end of a pre-specified window. We choose four different windows to track the payment history of a 60+ delinquent loan (reported on the X axis): (a) one month after the loan becomes 60+ delinquent, (b) three months after the loan becomes 60+ delinquent (c) six months after the loan becomes 60+ delinquent (d) twelve months after the loan becomes 60+ delinquent.

As we observe from *Panel A2*, after inclusion of transfer loans we still find that portfolio loans become current at a significantly higher rate compared to securitized loans. However, we also find that inclusion of data on transfer loans makes the difference in current rates smaller, especially at one and third month horizon. To understand these results recall that, as discussed in Section IV.C & Section V.C, we find much smaller differences in servicing of portfolio and securitized loans in the group of loans of lower credit quality (as measured by FICO score) -- with virtually *no difference* in current rates for loans with FICO credit score less than 620. As we had argued, these results are consistent with lower intensity of renegotiation on loans of lower credit quality, which is in line with a number of economic arguments (see Section V.C).

Note that transfer loans have on average a low FICO credit score, and portfolio transfer loans have lower credit score compared to securitized transfer loans (Panel A1). In fact more than half the portfolio loans that are transferred have a FICO less than 620. Therefore, in light of results in Table 10, it is not surprising that including a large number of transfer loans with FICO scores less than 620 makes the difference in servicing between portfolio and securitized loans (as measured by current rate) smaller since we are effectively adding more loans of lower credit quality to our sample. This effect is the strongest at shorter horizons as, by construction, over shorter horizons

there is a substantial number of loans that are eventually transferred but whose payment history is available subsequent to the transfer (i.e., these loans transfer after the short horizons).

To confirm that our intuition is correct, we also re-estimate our regressions only for high quality loans. The notion is that addition of transfer loans to this sample should have limited affect on our results. This follows from Section V.C where we argue that there are a number of economic arguments that suggest that renegotiation would be taken with a higher intensity for these loans. In other words, since loans that are transferred to the high quality sample have high FICO scores (at least greater than FICO of 700 on average; see *Panel B1*), results from Table 10 in the paper tell us that these loans would be renegotiated with a higher intensity. Consistent with this observation, in *Panel B2*, we find that inclusion of transfer loans into the high quality sample has virtually no effect on the estimates of differences in current rates between bank-held and securitized loans in this simple. Overall we find that our results are robust to inclusion of payment history that we observe till the transfer date of these loans.