

Pathways After Default: What Happens to Distressed Mortgage Borrowers and Their Homes?

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**Sewin Chan^a, Claudia Sharygin^b,
Vicki Been^c and Andrew Haughwout^d**

NYU Wagner School and
Furman Center for Real Estate & Urban Policy

Abstract: We use a detailed dataset of seriously delinquent mortgages to examine the dynamic process of mortgage default – from initial delinquency and default to final resolution of the loan and disposition of the property. We estimate a two-stage competing risk hazard model to assess the factors associated with whether a borrower behind on mortgage payments receives a legal notice of foreclosure, and with what ultimately happens to the borrower and property. In particular, we focus on a borrower's ability to avoid a foreclosure auction by getting a modification, by refinancing the loan, or by selling the property. We find that the outcomes of the foreclosure process are significantly related to: the terms of the loan; the borrower's credit history; current loan-to-value and the presence of a junior lien; the borrower's post-default payment behavior; the borrower's participation in foreclosure counseling; neighborhood characteristics such as foreclosure rates, recent house price depreciation and median income; and the borrower's race and ethnicity.

Key words: mortgage, default, modification, foreclosure, REO

^a Corresponding author. Robert F. Wagner School of Public Service, New York University, 295 Lafayette Street, New York NY 10012, USA. Tel: +1.212.998.7495. Email: sewin.chan@nyu.edu

^b Furman Center for Real Estate and Urban Policy, New York University.

^c New York University School of Law.

^d Federal Reserve Bank of New York. The views represented here are those of the authors and do not necessarily reflect those of the Federal Reserve Bank of New York or the Federal Reserve System.

1. Introduction

During the recent mortgage crisis, discussions of the impact of mortgage default and foreclosures on homeowners, neighborhoods and the housing market have often assumed that the process is relatively deterministic – if borrowers do not make mortgage payments, their properties are foreclosed, vacated and repossessed by lenders. However, mortgage default and foreclosure are less a single event than a process with uncertain duration and an eventual resolution that can vary widely across lenders, borrowers and neighborhoods. In this paper, we use a dataset of loans in New York City to examine how the post-default outcomes of non-prime mortgages vary with borrower, loan and neighborhood characteristics. The richness of our data both provides a more accurate and comprehensive set of controls than previous research and allows us to paint a clearer picture of what happens to distressed borrowers and their homes.

The complete process of mortgage default – from initial delinquency to final resolution of the loan and disposition of the property – is relatively unexplored in the literature, primarily because researchers have been unable to follow individual borrowers from loan origination to default to the beginning of the foreclosure process and through to specific resolutions such as a modification, the borrower refinancing the mortgage or selling the property, or the lender demanding an auction sale of the property. Moreover, few post-default studies use data spanning the recent foreclosure crisis in the United States, which saw markedly different types of borrowers and loan products than in previous years. By contrast, the dataset we have assembled contains detailed recent information that allows us to examine the entire dynamic process. We explore a wide range of factors that are associated with a loan’s path after default, examining both the factors relating to a foreclosure notice, and those relating to the ultimate resolution of any foreclosure. We are particularly interested in factors that relate to a household’s ability to avoid foreclosure by getting a

modification, refinancing the loan, or selling the property.

Our findings are important because despite the effort devoted over the last few years to developing interventions to help keep borrowers in their homes, there has been widespread dissatisfaction with the success of those measures. A better understanding of the factors associated with the various outcomes of defaults should help lenders, servicers, non-profit organizations and policymakers assess the efficacy of possible interventions and better structure and target foreclosure prevention efforts. It also should help researchers and policymakers better evaluate whether the harms resulting from mortgage default differ depending on how the default is resolved, and therefore more accurately assess the costs and benefits of different interventions.

To analyze the pathways from mortgage distress to ultimate resolution, we have combined data from a variety of sources, including: loan application and underwriting information such as borrowers' credit scores and loan-to-value ratios (LTV); dynamic mortgage servicing records that include detailed loan terms, payment and termination information, including modifications; legal documents for the property, including mortgage documents, foreclosure notices (*lis pendens*), and deed records spanning origination to termination of the loan and resale of the property; and a variety of property-specific and very local neighborhood characteristics. In addition, we calculate current LTV and negative equity using repeat sale house price indices for 56 different community districts (political jurisdictions within New York City), which average just over four square miles each. Although our data is limited to New York City, we believe the results are generalizable to many other areas. While Manhattan is a fairly unique housing market, the other boroughs we study – Brooklyn, the Bronx and Queens – are like many other large cities in the U.S. in terms of the nature and quality of the housing stock, density, and neighborhood demographics. Most foreclosures in New York City have taken place in neighborhoods in these other boroughs.

Importantly, the data allow us to examine the entire complex sequence of decisions

distressed borrowers and their mortgage lenders face.¹ There are many possible courses of events once a borrower is delinquent, even before a legal foreclosure notice is received. Some delinquent borrowers are able to catch up on payments or obtain a loan modification that allows them to become current. Others may be able to repay by refinancing. Some borrowers may choose to sell the property, which forces them to move, but avoids foreclosure and the lowered credit rating and higher future borrowing costs that it entails. Borrowers might also ask to turn the property over to the lender before foreclosure proceedings are initiated (referred to as “deed in lieu” transfers). Finally, the lender may choose to forbear on the enforcement of its rights, and allow the borrower to stay in the house without immediately pressing for repayment of the delinquent amounts. These possible post-default but pre-foreclosure outcomes are illustrated in Figure 1 as the first stage of the foreclosure process.

Borrowers who receive a *lis pendens*, a legal notice of foreclosure, then face multiple possible outcomes. The borrower may still have the option to refinance the loan or to sell the property and repay the lender. The borrower and lender may still agree to modify the mortgage, or the lender may agree to accept a deed in lieu of foreclosure. The lender may choose to force the property to be offered at a foreclosure auction, and if the property does not sell at auction for more than the lender’s reserve price (which may be equal to or less than the outstanding mortgage balance), the lender may take back the property so that the property becomes real estate owned (REO). Finally, the property may essentially stay in limbo for some time, with the lender taking no action to bring the property to auction. Figure 1 illustrates these outcomes in the second stage of the foreclosure process. Each outcome may have different consequences for the borrower, the lender, and the neighboring properties.

We analyze the path to ultimate outcomes using dynamic competing risk models that allow

¹ Throughout this paper we will often refer to the lender, though we recognize that in most cases, it is the lender’s servicer that will be making and implementing foreclosure related decisions.

us to examine factors that may change along the path from mortgage distress to resolution (for example, LTV may change as housing prices evolve over time.) We implement a two-stage approach, first estimating the likelihood of a *lis pendens* relative to no *lis pendens* and pre-foreclosure resolutions such as a modification, refinance or sale, then estimating the likelihood of competing post-*lis pendens* outcomes, including foreclosure auction. Such a model allows us to distinguish between factors associated with outcomes that occur before a foreclosure notice is served, and those associated with outcomes that occur afterwards.

Our empirical results show that the outcomes of the foreclosure process are associated with a mix of many factors. Here, we briefly outline some of the most important findings. First, we find that loan terms are significantly correlated with outcomes: lenders are more likely to file *lis pendens* against riskier loans.

Second, we find that borrower risk variables matter a great deal, but in ways that may at first seem counter-intuitive. After controlling for loan terms, borrowers with worse credit scores at origination are less likely to receive *lis pendens* and go to auction, and more likely to receive modifications or refinance the loan on their own. This seemingly surprising result may signal that after controlling for loan terms, non-prime borrowers with higher credit scores are adversely selected in ways that are unobservable to the researcher, but are observable to servicers and underwriters so that lenders avoid giving these borrowers modifications, and the borrowers find it difficult to obtain a new refinance loan elsewhere. The result may also be due to mean-reversion in that borrowers with especially high FICO scores at origination subsequently get lower FICO scores and thus less favorable outcomes.

Third, current LTV has an important relationship to post-default outcomes. Underwater borrowers face a discontinuous hurdle in refinancing or selling because they have to either provide additional cash at the time of transfer or persuade the lender to accept less than the balance due.

Consistent with this, we find that borrowers with higher current LTVs are much less likely to avoid foreclosure by refinancing their mortgage or selling their homes, but are more likely to receive a modification. This likely reflects both the lower likelihood that the lender will be able to recoup losses by going through the foreclosure process when LTV is high, as well as the probability that lower LTV borrowers who cannot refinance are adversely selected and would not be able to repay, even with a modification. Having a junior lien is correlated both with a lower likelihood of modification, and increased likelihoods that the borrower will receive a *lis pendens* and that the property will go to auction.

Fourth, several borrower behaviors are associated with whether a defaulted loan is modified. Borrowers who make some payments post-default are more likely to get a modification, but the effect is non-monotonic: the chance of a modification declines as the fraction of payments exceeds one half, presumably because these borrowers have demonstrated an increased ability to cure the loan on their own. Loans that are older by the time they default are more likely to be modified, perhaps because the borrower has demonstrated a longer period of prompt repayment. We also find that borrowers who received foreclosure counseling are more likely to receive a modification, although we are not able to discern what part of this effect is due to selection.

Fifth, our dataset allows us to include neighborhood characteristics at the census tract level, a level of geographic detail few studies provide. We find that high rates of foreclosure in the surrounding census tract during the recent past are associated with an increased likelihood of a *lis pendens* and of a foreclosure auction, and a reduced likelihood of modification. We also find a positive association between the likelihood of modification and whether the community district in which the property securing the loan is located has suffered recent house price depreciation. Foreclosure rates may be acting as leading indicators for further house price depreciation or may reflect greater depreciation than is captured in the community district level house price indices. If

that is the case, while modifications are more likely in depreciating areas, lenders may be reluctant to modify loans in neighborhoods with high rates of foreclosure for fear that prices in those neighborhoods may be especially likely to decline further. For those neighborhoods, lenders may rather move through the foreclosure process quickly before prices fall further. Additional census tract level characteristics that are significantly associated with post-default outcomes include the share of non-prime mortgages originated in the two years before the loan's origination, median income, and the tracts' composition of residents by race, ethnicity and immigrant status.

Lastly, in terms of borrower race and ethnicity, we find that Hispanic and Asian borrowers are much more likely to end up at a foreclosure auction, possibly reflecting language barriers faced by these borrowers. Both black and Hispanic borrowers have a greater likelihood of modification.

Our results are largely descriptive. It is important to keep in mind that each of the post-default outcomes is the result of the interaction between the lender, the servicer of the loan and the borrower. As such, the interaction is likely complex, with servicers potentially having incentives unknown to the borrower (and possibly at odds with the interests of the lender). This may lead to involved game theoretic interactions that are beyond the scope of this paper. Further, borrowers typically are faced with mortgage distress on only a single or a very small number of occasions in their lifetimes, and therefore may have limited knowledge as to the best possible course of action. We have not attempted to model this interaction², but rather have documented the relevant facts about the outcomes that should be useful immediately to borrowers, lenders, servicers, non-profit organizations and policymakers and may serve to motivate more theoretical modeling of post-default processes in the future.

² For promising advances in modeling the modification decision, see, for example, Haughwout, Okah and Tracy (2009).

2. Previous Literature

There is a great deal of research about the factors that determine whether and when a borrower defaults. Our focus, however, is on the determinants of post-default outcomes. Early, pre-housing crisis research on the factors associated with post-default outcomes focused primarily on describing the characteristics of households whose homes were foreclosed. Lauria, Baxter and Bourdelon (2004), for example, surveyed borrowers who suffered between 1985 and 1990, and found that neither the borrowers' race nor the racial composition of their neighborhoods affected the length of time between initial delinquency and foreclosure. Ambrose and Capone (1996), on the other hand, found that lenders tended to offer non-white borrowers more time to work out their situation before initiating foreclosure, but that the eventual foreclosure rates of white and nonwhite borrowers were virtually equal. Other early work also focused on the characteristics of the mortgages that determined post-delinquency outcomes. Ambrose and Capone (1998), for example, analyzed a sample defaulted FHA loans and found that LTV is a major predictor of whether the delinquent loan is reinstated, sold, assigned to HUD, or foreclosed. Capozza and Thomson (2006) analyzed a sample of defaulted subprime mortgages issued by a single lender and found that loans with a higher interest rate premium were less likely to enter REO, and that lenders are more likely to foreclose on loans with fixed interest rates, standard documentation and high LTVs.

The current economic crisis has spawned a larger literature exploring the characteristics associated with different post-default outcomes. Gerardi, Shapiro and Willen (2007) used property-level information (mortgage documents and transaction deeds) to compare the likelihood of sale and foreclosure auction for subprime and prime mortgages. They found that subprime borrowers are five to six times more likely to lose their homes to foreclosure auction than prime borrowers, and that high initial LTVs coupled with declines in city-level housing values are significantly associated

with foreclosure auction. In a 2009 update, Gerardi and Willen (2009) matched mortgage documents with Home Mortgage Disclosure Act (HMDA) data, and found, focusing on multi-family (2-4 unit) properties, that black and Hispanic borrowers' properties are more likely to go to auction. Subprime borrowers and non-owner occupiers also were more likely to sell their homes. The authors could not distinguish, however, between forced sales resulting from mortgage default or the initiation of foreclosure proceedings and voluntary sales that may have netted the owner substantial profits.

Another approach to analyzing the determinants of post-default outcomes uses information from loan servicers on the actions taken by borrowers and lenders in each month over the life of the loan. Danis and Pennington-Cross (2005), for example, used a sample of FRMs originated between 1996 and 2003 from LoanPerformance and found that higher credit scores and longer periods of delinquency are associated with higher probabilities of prepayment than of foreclosure, while negative equity is associated with a greater probability of entering foreclosure than prepayment. Using a larger sample over the same time period, Danis and Pennington-Cross (2008) found that delinquent borrowers with higher credit scores are less likely to enter foreclosure, but (contrary to their earlier paper) also are less likely to prepay. They also found that local house price depreciation and volatility are important predictors of entering foreclosure, but that unemployment rates are not. Pennington-Cross and Ho (2010) found that the factors associated with the initiation of foreclosure or becoming REO for adjustable rate mortgages (ARMs) are similar to those for fixed rate mortgages, but differ in magnitude, and that the size of payment shocks when ARMs adjust, not surprisingly, is significantly associated with foreclosure, REO and prepayment.

More recently, researchers have explored a fuller range of outcomes that may occur once a borrower becomes seriously delinquent. Pennington-Cross (2010) used a sample of subprime FRMs originated between 2001 and 2005 to estimate the competing probabilities that the loans in

foreclosure would be paid off, become current, improve from “foreclosed” to delinquent status, remain in foreclosure, or enter REO. He found that loans with a higher fraction of months in delinquency prior to foreclosure, and fewer months spent in foreclosure, are relatively more likely to become REO than to prepay. Voicu, Jacob, Rengert and Fang (2011) merged LoanPerformance with HMDA data to analyze the factors associated with a variety of pre- and post-foreclosure resolutions of loans in default, including prepayment, cure, partial cure and REO. They found that non-Hispanic black borrowers in default are less likely to enter foreclosure than are non-Hispanic whites, and Asian borrowers are less likely to cure and more likely to have their properties become REO. Among other things, they found that default outcomes are associated with a variety of loan characteristics, local legal, economic and housing market conditions, as well as the equity in the home.

Another set of papers have focused on the factors associated with loan modification. Some of these papers are limited by the lack of a direct indicator from the servicer data about whether a mortgage has been modified.³ Using LoanPerformance, which does have this information, Haughwout, Okah and Tracy (2009) analyze how the characteristics of borrowers, loans, and modifications are associated with the probability that a borrower receiving a modification redefaults. Their descriptive statistics suggest that pre-HAMP mortgage modifications were more likely (without controlling for other variables) to go to borrowers with lower credit scores and higher origination LTVs and DTIs, and to those holding adjustable rate mortgages. Collins and Reid (2010) merged HMDA data with that from a servicer that includes modification information, and found that loans with high relative interest rates at origination and African American borrowers are associated with a greater likelihood of modification, while borrowers with ARMs and higher debt-to-income ratios are associated with a lower likelihood. Been, Weselcouch, Voicu and Murff (2011)

³ For example, Piskorski, Seru, and Vig (2009); Foote, Gerardi, Goette and Willen (2009); Adelino, Gerardi and Willen (2009a, 2009b, 2010).

analyzed a New York City subsample of the OCC-OTS Mortgage Metrics database (which also provides direct information from servicers on modifications) merged with HMDA data on borrower characteristics and detailed property-level and neighborhood information. Among many results, they found that loans with higher current LTVs are associated with a greater likelihood of modification, while loans with junior liens and borrowers with higher current credit scores are associated with a lower likelihood. Agarwal, Amromin, Ben-David, Chomsisengphet and Evanoff (2011) used the national OCC-OTS database to study the determinants of liquidation versus “renegotiation” (which they define as modification, repayment plans, and refinancing), and found that seriously delinquent securitized loans are significantly less likely to be renegotiated than similar bank-held loans.

Finally, researchers also have begun to examine the efficacy of efforts many non-profit organizations and local governments are making to provide counseling to borrowers at risk of foreclosure. That research generally finds that counseling is associated with improved outcomes, but it is difficult to distinguish between the effects of counseling and the effects of self-selection into counseling in these results. Collins and O’Rourke (2011) summarize the literature well; in addition to the studies in that review, Been, Weselcouch, Voicu and Murff (2011) found that counseling is associated with a greater likelihood that a borrower will modify the loan and avoid liquidation.

In sum, the evidence about post-default outcomes has some consistent themes, but is often hard to harmonize and reconcile because of different definitions of the various post-default outcomes, differences and limitations in the data and methodologies used, and differences between the types of loans studied. While recent studies that have detailed information on borrowers’ and lenders’ decisions in every month over the life of the loan improve upon studies that only observe these choices at origination and at the eventual outcome, even those more recent studies are limited by the lack of information recorded by the servicer on the actual property. For example, existing

studies often cannot distinguish between loans that were refinanced and properties that were sold, and cannot control for property- or neighborhood-level characteristics that may be important. Our analysis advances the study of post-default outcomes by merging dynamic loan level information with extensive data about the borrowers, the properties, and the neighborhoods in which the properties are located.

3. Data Description

3.1 Mortgage data from New York City

The starting point for our analysis is the mortgage dataset first described in Chan, Gedal, Been and Haughwout (2010). The dataset consists of all first lien subprime and alt-A securitized mortgages originated between 2003 and 2008 in New York City that are in CoreLogic's LoanPerformance, a commercial database that covered about 90 percent of all non-prime securitized mortgages in the United States during the time period we study. LoanPerformance provides information on borrower characteristics at origination (including credit scores and debt-to-income ratios), loan terms (such as loan type, loan-to-value and interest rates), monthly repayments and balances, and loan modifications⁴. These LoanPerformance records were matched to land parcels with a high level of precision using real property deeds from the New York City Department of Finance (DOF)'s Automated City Register Information System (ACRIS).⁵ That match gave a unique geographic identifier for each mortgaged property that allowed additional data from other sources to be merged on, including: (i) additional borrower characteristics (such as race and ethnicity) using

⁴ LoanPerformance flags modified loans when the servicer alerts them of the loan modification or when they conclude, based on changes in the loan terms, that there has been a loan modification. Using the complete LoanPerformance modifications database, Haughwout, Okah, and Tracy (2009) find that 92 percent of modified loans were reported by the servicer and 8 percent were inferred by LoanPerformance.

⁵ The hierarchical matching algorithm used is described in more detail in Chan, Gedal, Been, and Haughwout (2010). Of the loans in the LoanPerformance database, 93 percent were matched back to the deed records. The deeds data do not include Staten Island, which therefore was dropped from the analyses.

data collected under the Home Mortgage Disclosure Act (HMDA), (ii) ACRIS information on whether the borrower took on additional mortgage debt following loan origination, (iii) property characteristics from the New York City DOF's Real Property Assessment Database (RPAD), (iv) data from the Center for New York City Neighborhoods on whether the borrower received free foreclosure prevention counseling,⁶ (v) repeat sales house price indices from the Furman Center for Real Estate and Urban Policy that track appreciation in 56 different community districts of New York City, (vi) the rates of both mortgage foreclosures and properties owned by lenders (REOs) among all 1 to 4 family properties in the census tract, and (vii) a variety of census tract level variables from the 2000 Census and HMDA.

In our analysis, we define borrower default as being at least 90 days past due on payments. After dropping loans that did not match to ACRIS property identifiers, a few loans with missing values of key variables, and loans that were already in default by the time they appeared in the LoanPerformance database,⁷ the resulting dataset has 140,033 mortgages and a wealth of information on the loan terms, the borrowers, the properties and their neighborhoods.

We then supplement the data further to provide additional information about the post-delinquency process. First, to determine whether and when the property entered foreclosure, we merged on property-specific *lis pendens* (legal notifications of foreclosure proceedings) that allow us to tell whether any refinance, sale to a third party or transfer to the lender occurred before or after the initiation of foreclosure proceedings. Second, we use the merged ACRIS deed records to classify all post-default property transfers as arms-length transactions to a third party, deed transfers to the

⁶ The Center for New York City Neighborhoods (CNYCN) is a non-profit organization that coordinates foreclosure counseling from a variety of non-profit providers to homeowners at risk of losing their home to foreclosure. Distressed mortgage borrowers who call 311 (New York City's widely known phone number for government information and non-emergency services) are directed to CNYCN. It is likely that the counseling reported by CNYCN represents the vast majority of foreclosure counseling taking place in New York City. Note that one of the authors, Vicki Been, serves on the board of directors for CNYCN.

⁷ Some months may elapse between origination and the mortgage's entry into LoanPerformance upon securitization.

lender in lieu of foreclosure proceedings, auction sales to a third party, or REO.⁸ Third, we use ACRIS mortgage records to distinguish loan terminations in the LoanPerformance data associated with a refinance of the loan from those associated with a sale of the property.

By combining these three merges, we are able to track each of the post-default outcomes displayed in Figure 1. By the end of the observation period in October 2010, about a third of all borrowers had been 60 days or more delinquent on payments at some point in our study period, and the majority of these (86 percent) had fallen even further behind and entered 90-day delinquency. In our estimation sample of loan records over time, loans are followed from their first 90 day delinquency to foreclosure resolution, or until October 2010. This gives us 40,218 loans and a total of 632,345 loan-months. A subsample of these (30,258 loans) also matched to HMDA data.

3.2 Distribution of post-default outcomes

Table 1 summarizes the distribution of post-default outcomes. Of the 40,218 loans in our estimation sample that were ever 90-days delinquent (hereinafter “defaulted”), just over half receive a *lis pendens* by October 2010. About one fifth of the loans were modified; the majority of these were modified before receiving a *lis pendens*. One fifth of the defaulted loans prepay through refinances and sales; the majority does so by sale of the property, with over two thirds of these selling after receiving a *lis pendens*. The smaller number of refinances that occur, in contrast, do so mostly before receiving a *lis pendens*.

Of the properties that received a *lis pendens*, 14 percent went to auction. The majority of these (86 percent) failed to sell and reverted to bank ownership. Because so few of the foreclosure auction properties actually sell, in our analyses below, we combine the auction sale and REO

⁸ The deed records are categorized by the Department of Finance as standard transactions, deeds-in-lieu, debt free gifts or divorce settlements, estate sales, other judgments, and referee sales (or auction sales). We identify auctioned properties that became REO by flagging deeds that transfer to the lender.

outcomes into one foreclosure auction outcome. A negligible share of properties was recorded with a deed in lieu transfer, so we drop the *pre-lis pendens* deed in lieu observations and group the *post-lis pendens* observations with the REO properties in our analysis.

The “unresolved” category in Table 1 includes loans that were not matched to an outcome using recorded documents from ACRIS. This includes loans that defaulted late in the observation period, and so not much time has elapsed since default, as well as a very small number of loans that are right censored in the LoanPerformance data before the end of the observation period. It also includes defaults that may have been resolved by the borrower or the lender in a way not recorded in our loan records. In particular, we are unable to observe forbearance or other workouts that allow the borrower to catch up on missed payments. To briefly delve into this category of loans, we classify loans as “cured”, meaning the borrower becomes current on the loan after default and remains current through the end of the observation period in October 2010 (3 percent of all loans); “remained delinquent”, meaning the borrower never became current again after first entering default (44 percent); and “cycled”, meaning the borrower became current after initial default, but subsequently returned to 90 day delinquency (6 percent). While other analyses treat cure, or partial cure, as a terminal outcome, we are reluctant to call “cured” a final outcome because of the large number of loans that temporarily cure but end up delinquent or in default again, even in our limited sample timeframe. These “cured” loans will likely end up in one of the other categories given time.⁹

⁹ Our findings can be roughly compared with several other studies: Agarwal, Amromin, Ben-David, Chomsisengphet and Evanoff (2011) observed that one year after a loan becomes seriously delinquent, about half of borrowers in a national sample of the OCC-OTS Mortgage Metrics database are in liquidation, and about one quarter each were renegotiated or had no further action. Been, Weselcouch, Voicu and Murff (2011) followed loans in a New York City subsample of the OCC-OTS database and found that 9 percent received a modification, 8 percent other workouts, about 15 percent were cured, 5 percent experienced liquidation, and almost two thirds remained in serious delinquency during the study period. Capozza and Thomson (2006) observed 6,000 mortgages from a single servicer, and found that of the mortgages that were delinquent but not in bankruptcy at the beginning of the study period, after eight months 38 percent remained in default but did not fall further behind on payments, 21 percent remained in default with worsening delinquency, 6 percent had cured, 11 percent had entered bankruptcy proceedings and 24 percent had become REO.

3.3 Descriptive statistics

Table 2 displays summary statistics for all loans in our estimation sample, categorized by the two stages of the foreclosure process – that is, outcomes leading up to the receipt of a *lis pendens*, and outcomes conditional on having received a *lis pendens*. Table 3 reports a similar set of summary statistics by the loan’s unconditional outcome: first, between loans that received *lis pendens* and those that did not; and second, on the unconditional outcome of the loan – modification, refinance, sale, auction, and unresolved. Unless otherwise noted, the table records the fraction of loans within the column outcome that have the row characteristic.

Loan and borrower characteristics

Loans with different eventual outcomes vary along many dimensions at origination. More of the eventually refinanced loans (85 percent) are non-interest only fixed-rate and adjustable-rate mortgages than is the case for the entire sample (59 percent), and a much smaller number (8 percent) are interest-only mortgages (compared with 23 percent for the entire sample). The relative interest rate at origination for FRMs is calculated as the loan’s interest rate minus the Freddie Mac average rate for prime 30-year fixed rate mortgages during the month of origination, while for ARMs, it is the loan’s initial interest rate minus the six-month London Interbank Offered Rate (LIBOR) at origination. For both FRMs and ARMs, loans that eventually refinance have the highest relative rate at origination. While loans in the sample are roughly equally divided between home purchase loans and refinance loans, a smaller share of loans that receive a *lis pendens* are refinance loans (43 percent), as are an even smaller share of loans that reach a foreclosure auction (24 percent).

Borrowers' average FICO scores¹⁰, debt-to-income ratios, and the share of borrowers who provided full documentation at origination all vary across the outcomes. In particular, borrowers who eventually modify have lower FICO scores at origination than the sample average.¹¹ Borrowers who are able to refinance had lower FICO scores at origination but were more likely to have provided full documentation, while the reverse is true for borrowers whose properties are foreclosed and sold at auction.

We rely on the HMDA subsample for some additional borrower characteristics. Loans that escaped foreclosure by modifying or refinancing were more likely to have co-borrowers. Turning to race and ethnicity, 38 percent of the borrowers in default are black, 19 percent are Hispanic, and 9 percent are Asian. The borrowers' race and ethnicity do not vary much by receipt of *lis pendens*, though more refinancings are for Hispanics, more modifications are worked out with blacks, and more auctions affect Asians than their respective shares in the sample would suggest.

As the loans first enter default, differences in loan characteristics between eventual outcomes become even more apparent. Loans that eventually refinance have an average balance at default that is more than \$100,000 lower than loans that go to a foreclosure auction or remain unresolved through the end of the observation period.

In terms of current loan-to-value (LTV) at the time of default, loans that eventually refinance have the lowest average LTV of 66 percent, while loans that eventually modify have an average LTV of 94.¹² Loans that end up at a foreclosure auction have an average LTV of 89 percent at default, and loans that are not resolved have the highest average LTV, 98 percent. We should emphasize

¹⁰ The Fair Isaac Corporation (FICO) credit score is the most widely used credit score model in the United States. It depends on credit and payment history, credit use and recent searches for credit.

¹¹ Our descriptive statistics are consistent with Haughwout, Okah and Tracy (2009) who observed, based upon a national sample, that borrowers who eventually modify had lower credit scores at origination.

¹² The numerator of the current LTV measure combines the loan amounts for the first lien mortgage (the focus of our analysis) as well as any other liens in existence at the time of origination. Any new liens taken out afterwards will not be reflected in this measure. While we have information on the size of these additional liens, some of them are home equity lines of credit, so it would be misleading to including in our measure of LTV.

that these current LTVs are measured at the first 90-day delinquency, and that they become substantially higher by the time of the foreclosure auction, or by the end of our observation window. Borrowers with additional liens at the time of origination or after are less likely to modify, refinance or sell, and more likely to receive a *lis pendens* or go to auction.

Borrower behaviors

On average, borrowers make a payment in 42 percent of the months after initially entering default. However, borrowers who are able to subsequently refinance their mortgage made monthly payments on the original mortgage 61 percent of the time, suggesting that their financial situation may not have been as bad as other borrowers.

Just 2.5 percent of all borrowers received foreclosure counseling. This fraction is much higher for borrowers who eventually receive a modification (3.6 percent). Only a tiny portion of those who refinance or sell had received counseling.

Neighborhood characteristics

We measure house price depreciation during the preceding year for each month in our later analyses, but in the tables, report these values for the initial default month only. Although house prices declined by 8 percent on average in the year preceding initial default, they fell by 12 percent on average for loans that eventually modify. Among loans that eventually refinance, housing values actually increased by 7 percent in the year preceding default, and were also slightly appreciating in neighborhoods where borrowers were able to sell their homes. In contrast, borrowers whose defaults remained unresolved experienced price declines of 10 percent on average.

The neighborhood foreclosure rate in each month of our analyses is measured as the number of foreclosure notices issued on 1-4 family buildings in a census tract during the preceding

six-months, divided by that tract’s stock of 1-4 family buildings. While the majority of loans are in census tracts that experienced a foreclosure rate of less than two percent in the six months prior to initial default, about one in three loans were in neighborhoods where the foreclosure rate was 2 percent or more.

Our neighborhood race and income variables are taken from the 2000 U.S. Census. About half of the loans were originated in census tracts where the median household income was less than \$40,000. A considerable 48 percent of loans are in tracts that were at least 60 percent black in 2000. This may be surprising considering that blacks made up just one quarter of New York City residents; but it likely reflects both the higher proportion of blacks in our sample of non-prime loans in default, and the relatively high levels of residential racial segregation in New York City.

4. Exploring the Factors Affecting Post-Default Outcomes

4.1 Empirical strategy

Our empirical strategy employs a discrete time proportional hazard framework with competing risks to explore the factors associated with post-default outcomes. In each stage of our analyses, the probability that mortgage i will transition to outcome j at time t , conditional on not having previously transitioned to any outcome is given by the following hazard H:

$$\begin{aligned}
 H_{it}(\text{outcome}=j) = & \text{MNL} (\theta_j \text{ months since default} \\
 & + \beta_j \text{ loan and borrower characteristics}_{it} + \gamma_j \text{ borrower behaviors}_{it} \\
 & + \delta_j \text{ neighborhood characteristics}_{it} + \alpha_j \text{ calendar and origination year fixed effects})
 \end{aligned}$$

where MNL is the standard multinomial logit functional form, and α_j , β_j , γ_j , δ_j and θ_j represent vectors of coefficient estimates for each outcome j .

We include time since default among the covariates to allow the hazard rate to be time-

dependent. To control for city-, state-, or nation-wide macroeconomic factors such as unemployment rates and city-wide house price movements, we include calendar year fixed effects. The origination year fixed effects are intended to pick up any city-wide systematic changes in mortgage characteristics over time, including average borrower risk and underwriting standards. To control for unobserved heterogeneity and possible dependence among observations for the same loan, we use a robust variance estimator that allows for clustering by loan.

We start by estimating a two stage model, as summarized in Figure 1. The first stage corresponds to the time up to the filing of a legal foreclosure notice (*lis pendens*) by the lender. Five outcomes are possible: (i) the loan is modified, (ii) the loan is refinanced, (iii) the property is sold in an arms-length transaction, (iv) a *lis pendens* is filed, and (v) no resolution (none of the above outcomes). The second stage is conditional on receipt of a *lis pendens*. The five possible outcomes are: (i) the loan is modified, (ii) the loan is refinanced, (iii) the property is sold in an arms-length transaction, (iv) the lender sells the property at auction, or retains as REO, and (v) no resolution (none of the above outcomes). Because the effects of many variables do not change between the first and second stage, we also estimate a reduced form collapsed model whereby the five unconditional outcomes correspond to those in the second stage above.

4.2 Results

Table 4 presents our results. The first set of columns gives estimates for the first stage transitions. In the second set of columns are the estimates for the second stage, which is conditional on having received a *lis pendens*. Relative risk ratios (and p-values) are reported, relative to the no resolution outcome.¹³ The third set of columns contains analogous estimates for the reduced form collapsed model. In Table 5, we present results of the same set of models, but include the HMDA

¹³ The relative risk ratio is the exponentiated value of the multinomial logit coefficient.

variables. Although this is a smaller sample (as not all our loans matched to HMDA), the coefficients on the non-HMDA variables are very similar to those in Table 4. Throughout this section, we will describe a variable as associated with a greater likelihood of a particular outcome (or as “more likely”) when the estimated relative risk ratio for the variable is greater than one.¹⁴ Our results here are descriptive and it is important to note that while post-default outcomes will depend on both observable and unobservable factors, we can only incorporate those that are observable in this analysis.

Loan characteristics

The first set of rows in Table 4 shows the association between the various outcomes and the loan type interacted with the relative initial interest rate on the loan (as defined earlier in 3.3). There are important variations in the likelihood a *lis pendens* will be filed among different types of loans: FRMs and ARMs with relatively lower interest rates at origination, as well as interest only mortgages, are less likely to receive a *lis pendens* than are non-standard mortgages (the reference group) and loans with relatively higher interest rates at origination. These results may reflect a belief on the part of lenders that borrowers who have chosen or qualified for less exotic and less expensive mortgages may be more likely to cure or refinance, which could lead lenders to delay filing a *lis pendens* even when faced with serious delinquency. We see qualitatively similar results when we consider foreclosure auctions. In particular, the lowest interest rate FRMs and ARMs are significantly and

¹⁴ A relative risk ratio greater than one in the MNL framework implies a greater probability of that particular outcome as compared to the reference outcome. It does not necessarily imply a greater absolute probability of that particular outcome, because the absolute probability will also depend on the baseline probabilities of the other outcomes.

substantially less likely to end up at a foreclosure auction.¹⁵

The association between loan type and the probability of modification is mixed. Interest only loans and fixed rate mortgages are more likely to be modified compared to other product types. Among FRMs, higher interest rates (relative to other FRMs at the loan's origination) are associated with a greater likelihood of modifying, particularly after receiving a *lis pendens*. But there was no overall effect of relative interest rate for ARMs.

Fixed rate mortgages with lower relative interest rates are associated with a lower likelihood that the loan will be refinanced. This likely reflects a selection effect whereby these borrowers are better risks in ways that are otherwise unmeasured in our data, were originally able to get more competitive rates and are thus able to find another lender to refinance their loan following default.¹⁶

Loans with larger current balances are more likely than those with smaller balances to experience one of the estimated outcomes rather than remain in delinquency. Those in the highest quintile have a 50 percent greater relative risk of receiving a *lis pendens* and a twice as large relative risk of auction than loans in the lowest quintile.¹⁷ The smallest loans may be associated with a lower chance of arriving at auction because of fixed costs faced by a lender in the foreclosure process, and higher balance loans also may be perceived by lenders as being less likely to become profitable because borrowers would have a harder time making the larger payments.

The association between the current loan balance and modification is also monotonically

¹⁵ Our results are contrary to Capozza and Thomson (2006) who find that loans with high interest rate premia are less likely to be foreclosed, and that FRMs, loans with standard documentation and high LTVs are more likely to be foreclosed. The difference may reflect the different time periods studied (2001-2002 originations for Capozza and Thomson versus 2003-2008 here), the different populations studied (6,000 subprime loans from one lender, versus most non-prime loans originated in New York City here), or the fact that we look at the full range of post-default outcomes that may occur (rather than the more restricted outcomes they study), during a time when the federal, state and local governments were incentivizing modifications.

¹⁶ We also tried specifications that included the current rate premium (the current rate on the loan minus the Freddie Mac average rate on 30 year FRMs), because it is usually an important predictor of prepayment behavior. However, the current rate premium was not significant in explaining refinances and sales, probably because it is highly correlated with the relative rates at origination, and because we also have calendar year dummies in our model.

¹⁷ This finding is in contrast to Pennington-Cross (2010), who found that the relative risk of REO decreases as the unpaid balance increases.

increasing: loans with balances in the highest quintile have a relative risk of modification that is over one third higher than those in the lowest quintile. This could reflect a greater incentive for these borrowers to seek a modification, as well as the substantial fixed costs associated with modification making larger loans more worthwhile for lenders to modify. A large outstanding loan balance is one of the strongest predictors of refinance and sale, especially before receiving a *lis pendens*, which may reflect that borrowers who originally qualified for a large mortgage have a greater ability to pursue other options, as well as a greater incentive to do so.

Compared to home purchase loans, refinances are less likely to receive a *lis pendens*, less likely to go to auction, and more likely to be modified or to refinance. Purchasers, which includes all first-time homebuyers, are likely to have shorter homeownership and mortgage borrowing experience than refinancers and thus may be more likely to end up at auction. Sales are less likely among refinance loans, possibly reflecting a longer housing tenure and attachment among those who were originally refinance borrowers.

Owner occupiers are associated with a lower likelihood of a *lis pendens* and a higher likelihood of modification than investors (consistent with other literature). Owner occupants also are associated with a lower likelihood of sale, again, possibly reflecting attachment or possibly because non-occupants were not included in any programs to help borrowers avoid foreclosure.

Taken together, these findings show that riskier loans are more likely to proceed through the foreclosure process.

Borrower risk characteristics

We find a generally monotonic relationship between borrower FICO score and the likelihood of receiving a *lis pendens* and going to auction, with better (higher) credit scores associated with a *higher* likelihood of a *lis pendens* or auction. While we cannot observe contemporaneous FICO

scores, the Fair Isaac Corporation has shown that borrowers with higher original scores suffer a larger decline in scores following delinquency, default and foreclosure (Christie, 2010). Thus, our result likely implies that borrowers who have suffered a larger decline in FICO score since origination are more likely to receive a *lis pendens* or go to auction. It is important to note that we have already controlled for loan type and some loan terms, which will have been driven in large part by the borrower's risk characteristics at origination, so this FICO score result (and analogously, those that follow) should be interpreted as conditional on these loan characteristics.

One possibility is that lenders may think that higher credit score borrowers who are 90 days delinquent may be having trouble repaying as a result of some fundamental change like divorce, job loss or poor health, because they have a history of regular repayment compared with lower credit score borrowers, who have a more erratic payment history. It is also likely that conditional on loan type and terms, the higher FICO score borrowers in our sample of non-prime loans are adversely selected in ways that are known to lenders, but that are unobserved in our data. This would also explain the otherwise puzzling result of lower FICO score borrowers being more likely to refinance.¹⁸

Modifications are much more likely among borrowers with lower FICO scores at origination. Overall, borrowers with scores below 590 have a relative risk of modification that is twice that of borrowers with scores above 720 (the reference group). This might suggest that lenders are reluctant to modify loans for borrowers who have a fundamental problem (as above) or who have strategically defaulted, that is, chosen to miss payments despite having the ability to pay.¹⁹

Loans with higher LTVs show a lower relative risk of receiving a *lis pendens* and going to

¹⁸ The adverse selection of higher FICO score borrowers in default is also consistent with Brevoort and Cooper (2010) who find that post-foreclosure borrowers with originally higher FICO scores take longer to recover their scores than those with originally lower scores.

¹⁹ Been, Weselcouch, Voicu and Murff (2010), who are able to observe contemporaneous FICO scores, find that borrowers experiencing greater declines in FICO since origination are less likely to receive modifications. As noted above, since FICO scores tend to fall following default, our results are also consistent with their findings.

auction. For these higher LTV loans, lenders may believe that the net present value of the mortgage if the borrower continues to try to make payments is higher than the lender's expected return from selling the property, or they may be concerned with potential liability issues for maintenance, taxes and injuries while the property is vacant.²⁰ For the lower LTV loans, the failure of the borrower to sell the property and repay the mortgage is seemingly irrational, and lenders may interpret this inaction as a problematic signal and proceed quickly with the foreclosure process.

The loan's current LTV has a strong and monotonically increasing association with the likelihood of modification, with loans greater than 120 percent LTV having twice the relative risk of modification compared to loans with less than 80 percent LTV. This is consistent with other research and likely reflects a greater willingness of lenders to modify loans for which repossession would result in the greatest losses.

Loans with higher current LTV are associated with a lower likelihood of a refinance or sale, reflecting the difficulty of either course of action when equity is negative or nearly so. The estimates suggest that the relative risk of refinancing or selling the property when the loan is underwater is less than half that for those at 80 percent LTV or lower. Having an additional lien is associated with an increased probability of a *lis pendens* and auction. Conditional on combined LTV, a loan with a junior lien at origination will have a lower first-lien-only LTV, and thus an auction sale is more likely to cover the balance owed. A junior lien also makes it less likely a borrower will get a modification, which is not surprising given the difficulty of negotiating a modification when more than one lender is involved.

Full documentation loans are associated with a higher likelihood of modification relative to loans with no or low documentation. Among these full-documentation loans, those with DTIs over 45 are even more likely to modify. Full documentation borrowers who had lower debt-to-income

²⁰ Some have argued that some banks have delayed foreclosure sales to avoid realizing loan losses. Banks might equally well delay even beginning the foreclosure process on underwater properties for the same reasons.

ratios at origination were more likely to be able to avoid foreclosure by refinancing.

Borrower behaviors

Modifications are more likely, and *lis pendens* and auctions less likely, the greater the number of months between origination and the initial default date. This could reflect a greater willingness of lenders to work with borrowers that have a longer track record of payment. The length of time between origination and default also reduces the likelihood of refinancing or sale, the latter perhaps reflecting greater borrower attachment to the home.

We control for the fraction of monthly payments made by the borrower since their initial default, and find that those who have made more than half of these payments are less likely to receive a *lis pendens* than those who have made no payments – unsurprisingly, lenders are less likely to foreclose on borrowers who continue to repay. Borrowers who have made some payments are also more likely to modify, although this effect is non-monotonic. Borrowers who have made fewer than half of the monthly payments since defaulting have a relative risk of modification that is over two and a half times greater than those making no payments (the reference group), while those making more than half the payments have relative risks that are less than two times greater. Lenders may be more likely to modify those who can show some ability to continue making payments, while not wanting to modify (as much) those who seem able to catch up on their own. This latter group of borrowers may also be less likely to seek a modification.

For ARMs, modifications pre-*lis pendens* are more likely shortly after the initial rate adjustment, and this effect decreases over time. Defaults that occur within this window are more likely due to the borrower being unable to deal with the higher mortgage payments than are defaults outside of this window, which may be more likely due to other financial distress, such as job loss. Increases in payment shocks are associated with a lower relative probability of modification,

however, with loans whose payments are at least 25 percent higher since origination having a relative risk of modification that is approximately half that of borrowers whose payments increased by less than 25 percent. ARMs with monthly payments that are at least 50 percent larger than they were at origination are also much more likely to receive a *lis pendens*.

The indicator variable for foreclosure counseling is equal to one in the months after a borrower receives the counseling. We find that the receipt of counseling is significantly associated with an increased relative risk of modification, and that the effect is more pronounced after the receipt of a *lis pendens*. This result suggests that counseling may help borrowers better negotiate modifications with lenders, although some part of this effect could be due to selection. Other studies of foreclosure counseling (see the review in Collins and O'Rourke, 2011) tend to find that counseling helps borrowers avoid foreclosure, even though there is always evidence of selection bias when that counseling is voluntary.

Neighborhood characteristics

Conditional on current LTV, properties in community districts with house price depreciation greater than 10 percent in the past year are associated with a lower probability of receiving a *lis pendens*. But once a *lis pendens* is filed, higher depreciation rates are associated with a greater likelihood of ending up at auction, even after controlling for current LTV. Loans that are in community districts with any housing price depreciation in the past year are more likely to be modified, again, after controlling for current LTV. Lenders might target declining house price areas for modification because borrowers in appreciating areas will have more options in terms of selling or refinancing the property to avoid repossession. Borrowers in declining house price areas with positive equity or with high psychological or other costs of moving might be more likely to seek a modification to help them ride out the decline. We find that borrowers in neighborhoods with

house price growth in the past year are more likely to refinance their loans, but these coefficients are not statistically significant.

We find a positive and monotonically increasing association between the rate of foreclosure notices in the neighborhood within the prior 6 months and the probability of receiving a *lis pendens* and of going to auction. A foreclosure rate of over 4 percent in the surrounding census tract increases the relative risk of a *lis pendens* by one third, compared with mortgages in neighborhoods where the foreclosure rate is less than 1 percent (the reference group). These neighborhood foreclosure rates are plausibly exogenous to each borrower, and they may serve as a proxy for reduced stigma associated with going through the foreclosure process when one's neighbors also are doing so (see Haughwout, Okah and Tracy, 2009). To some extent, the foreclosure rates may also proxy for very local neighborhood economic conditions, such as unemployment, that affect the borrower's ability to repay loans. Further, neighborhood foreclosure rates may reflect expectations about future house price depreciation that are not already captured in price indices based on recent sales transactions. We already control for house price depreciation in the past year and found that foreclosure proceedings are less likely to be initiated in areas where prices have already declined. If high foreclosure rates signal further house price declines, lenders may want to move loans in those neighborhoods through foreclosure more rapidly in order to avoid further erosion of their collateral.

On the other hand, the likelihood of modification falls monotonically with recent foreclosure rates in the property's census tract. Because the foreclosure rates are measured at the census tract level, while the house price indices are at the larger community district level, greater house price depreciation in higher foreclosure tracts compared with the community district average would lead to systematically overestimated housing values and underestimated current LTVs for

loans in high foreclosure neighborhoods.²¹ Thus, higher recent foreclosure activity in the neighborhood could be acting as a proxy for the extent of very localized depreciation. Taken together, the effect on recent house price depreciation and foreclosure rates may mean that while modifications are more likely in generally depreciating areas, lenders avoid modifying loans in the neighborhoods with the very worst house price performance.

The rate of foreclosures in the surrounding census tract has a generally negative effect on the probability of a refinance. The possibility that foreclosure notices are a forward-looking indicator of falling house prices may make it more difficult for borrowers to secure new loans in these neighborhoods or borrowers may simply not demand refinances in these circumstances and rather, just give up.

We also included in the specification the non-prime share of mortgages originated in the census tract during the two years prior to the loan's origination. The non-prime share is positively associated with receiving a *lis pendens* and arriving at auction. Loans in tracts where this non-prime share was more than 20 percent have a relative risk of receiving a *lis pendens* that is 17 percent higher, and a relative risk of auction that is 39 percent higher, than loans where the non-prime share was less than 10 percent (the reference group). The non-prime share of mortgages at origination also increases the likelihood of modification before *lis pendens*. There are several possible explanations for these results. It may be the case that non-prime shares at origination are a leading indicator of high foreclosure rates and lower housing values, prompting lenders to push loans into foreclosure before even more value is lost. It may also be that particular lenders are concentrated in these areas and that the model is picking up different behavior by those particular lenders. Another possibility is that areas with high non-prime shares were "targeted" by aggressive mortgage lenders for loans

²¹ Foreclosures could be causing diminished house price appreciation by increasing the housing supply on the market and driving down prices. And, they may generate negative externalities such as the visible deterioration of properties that lead to lower property values in high foreclosure tracts relative to others in the same community district.

that were inappropriate in ways unobserved in our data. Servicers now dealing with these distressed loans may see the pattern, decide that there is little chance that such loans will ever be profitable in their current form, and therefore offer a modification, or alternatively, proceed through the foreclosure process as quickly as possible. If this is true, then the share of non-prime originations in a neighborhood is acting as a proxy for poor underwriting standards or other inappropriate practices at origination that are unobserved by the researcher, but are observed by the servicer.

For neighborhood income and racial and ethnic composition, we find that loans in poorer neighborhoods are associated with a lower likelihood of a *lis pendens* or auction. This is possibly due to these being more modest properties that do not justify the lender's fixed costs of foreclosure proceedings. Conditional on neighborhood income and all the other factors above, loans in census tracts with higher shares of black residents are associated with a higher likelihood of a *lis pendens* than loans in tracts with lower shares of black residents. In contrast, black residential composition has no clear association with auctions. Loans in tracts with higher shares of Hispanic residents are more likely both to receive a *lis pendens* and go to auction, while those in neighborhoods with relatively more immigrants are no less likely to receive *lis pendens*, but are much less likely to go to auction.

Loans in tracts with median annual income less than \$30,000 are less likely to receive modifications than those in neighborhoods with median income over \$40,000 (the reference group). However, conditional on this, larger shares of black residents are associated with a greater likelihood of modification. Overall, loans in tracts that are over 60 percent black have a relative risk of modification that is at least one quarter higher than loans in tracts that are less than 20 percent black. This magnitude is slightly lower when we control for the borrower's own race, as Table 5 shows, but the effect is still statistically significant. Modifications are also more likely for loans in neighborhoods that are more than 40 percent Hispanic. We did not find any effect of the share of

Asian or immigrant residents on the relative risk of modification.

Borrower characteristics from HMDA

Table 5 shows that overall, Hispanic and Asian borrowers have a relative risk of ending up at a foreclosure auction that is 19 and 42 percent higher respectively, compared with other borrowers. Black and Hispanic borrowers are 16 and 18 percent more likely than other borrowers to have their loans modified. However, the likelihood that a borrower will sell or refinance is independent of her race and ethnicity.

Loans with a co-borrower are less likely to receive a *lis pendens* and go to auction, and more likely to be modified than those without co-borrowers. Co-borrower loans are more likely to refinance, possibly reflecting a smaller variance in income when there are two borrowers, and thus a higher likelihood of obtaining new credit. On the other hand, loans with co-borrowers are less likely to sell, perhaps reflecting generally lower mobility rates among couples.

5. Conclusion

Using a rich data set, we have shown how post-default outcomes (including the foreclosure notice, modification, refinance, sale, and foreclosure auction) are associated with the type of loan and its terms, borrower characteristics and behavior, and the characteristics of the neighborhood. As noted at the outset, our results are descriptive and we have not tried to model either the complex set of incentives the lender, servicer and borrower face, or the interactions among the parties. Nevertheless, we have made an important contribution by documenting, with very detailed data, associations that researchers, policymakers and practitioners should consider in trying to craft better solutions to the still-unfolding foreclosure crisis.

The outcomes of borrower defaults and foreclosures have implications not just for the

lender and the household's financial well-being, but also for the health of the surrounding neighborhood. Homes in financial distress may depress local house prices through deterioration of the property, and foreclosed properties may become vacant and lead to more crime, vermin, or other negative effects. Properties that sell at auction or become REO may also lower house prices in the surrounding area by increasing market supply and by lowering nearby appraisals. For these reasons, the various outcomes of distressed mortgage borrowers have far-reaching consequences for lenders, households and neighborhoods. Understanding the factors associated with more favorable outcomes will facilitate more targeted and effective interventions by lenders, policymakers and non-profit groups.

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References

- Adelino, Manuel, Kristopher Gerardi and Paul S. Willen. 2009a. "Renegotiating Home Mortgages: Evidence from the Subprime Crisis." Manuscript.
- Adelino, Manuel, Kristopher Gerardi and Paul S. Willen. 2009b. "Why Don't Lenders Renegotiate More Home Mortgages? Redefaults, Self-cures, and Securitization." Federal Reserve Bank of Boston Public Policy Discussion Papers, No. 09-4.
- Adelino, Manuel, Kristopher Gerardi and Paul S. Willen. 2010. "What Explains Differences In Foreclosure Rates? A Response to Piskorski, Seru, and Vig." Federal Reserve Bank of Boston Working Paper 2010-8, March 2010.
- Agarwal, Sumit, Gene Amromin, Itzhak Ben-David, Souphala Chomsisengphet and Douglas D. Evanoff. 2011. "The Role of Securitization in Mortgage Renegotiation." Federal Reserve Bank of Chicago Working Paper WP2011-02, January 2011.
- Ambrose, Brent W. and Charles A. Capone, Jr. 1996. "Do Lenders Discriminate in Processing Defaults?" *Cityscape: A Journal of Policy Development and Research*, 2(1):89-98.
- Ambrose, Brent W. and Charles A. Capone, Jr. 1998. "Modeling the Conditional Probability of Foreclosure in the Context of Single-Family Mortgage Default Resolutions". *Real Estate*

Economics 26(3):391-429.

Ambrose, Brent W. and Charles A. Capone, Jr. 2000. "The Hazard Rates of First and Second Default." *The Journal of Real Estate Finance and Economics* 20(3):275-293.

Been, Vicki, Mary Weselcouch, Ioan Voicu and Scott Murff. 2011. "Determinants of the Incidence of Loan Modifications." Manuscript.

Brevoort, Kenneth P. and Cheryl R. Cooper. 2010. "Foreclosure's Wake: The Credit Experiences of Individuals Following Foreclosure." Board of Governors of the Federal Reserve System Finance and Economics Discussion Series, No. 2010-59.

Capozza, D. and T. Thomson. 2005. "Optimal Stopping and Losses on Subprime Mortgages." *Journal of Real Estate Finance and Economics*, 30(2): 115–131.

Capozza, D. and T. Thomson. 2006. "Subprime Transitions: Lingering or Malingering in Default?" *The Journal of Real Estate Finance and Economics* **33**(3) 241–258.

Chan, Sewin, Michael Gedal, Vicki Been and Andrew Haughwout. 2010. "The Role of Neighborhood Characteristics in Mortgage Default Risk: Evidence from New York City." Available at: <http://ssrn.com/abstract=1631944>

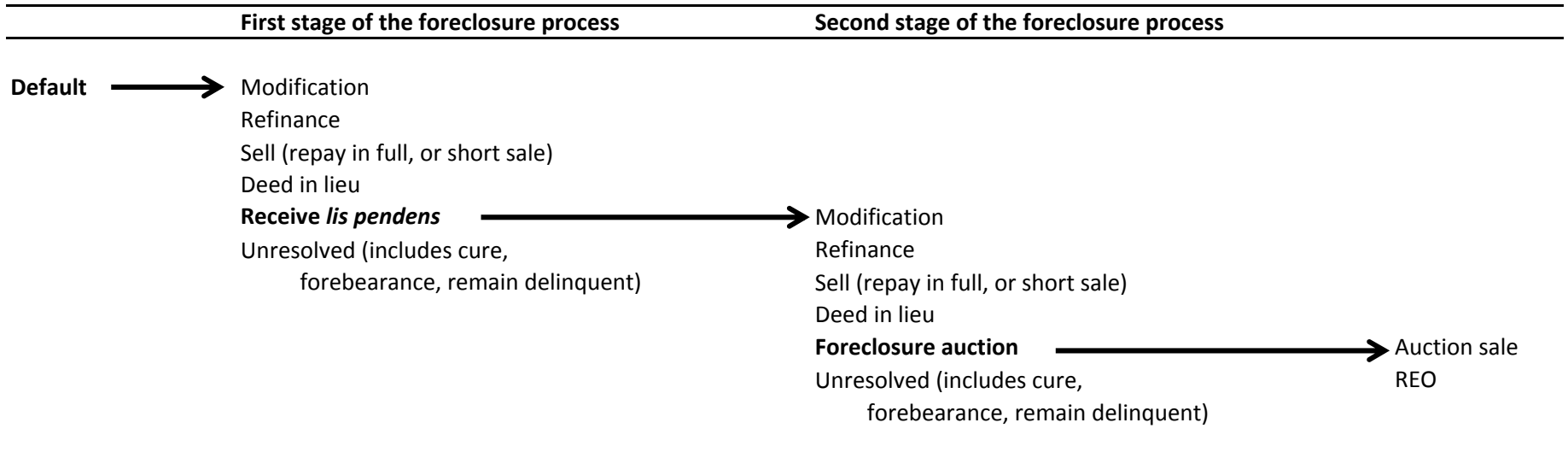
Christie, Les, 2010. "How Foreclosure Impacts Your Credit Score," CNNMoney.com, April 10. Available at: http://money.cnn.com/2010/04/22/real_estate/foreclosure_credit_score/index.htm

Collins, J. Michael and Collin O'Rourke, 2011. "Homeownership Education and Counseling: Do We Know What Works?" Research Institute for Housing America Special Report, Mortgage Bankers Association, April 2011. Available at: http://www.housingamerica.org/RIHA/RIHA/Publications/76378_10554_Research_RIHA_Collins_Report.pdf

Danis, Michelle A. and Anthony Pennington-Cross. 2005. "A dynamic look at subprime loan performance." *Journal of Fixed Income*, 15(1) 28-39, 2005.

- Danis, Michelle A. and Anthony N. Pennington-Cross. 2008. "The Delinquency of Subprime Mortgages." *Journal of Economics and Business* 60(1-2):67–90.
- Foote, Christopher L., Kristopher Gerardi, Lorenz Goette and Paul Willen. 2009. "Reducing Foreclosures: No Easy Answers." NBER Working Paper No. 15063.
- Gerardi, Kristopher S., Adam H. Shapiro and Paul Willen. 2007. "Subprime Outcomes: Risky Mortgages, Homeownership Experiences, and Foreclosures." Federal Reserve Bank of Boston Working Paper 2007-15.
- Gerardi, Kristopher and Paul Willen. 2009. "Subprime Mortgages, Foreclosures, and Urban Neighborhoods." *The B.E. Journal of Economic Analysis & Policy* 9(3), Article 12.
- Haughwout, Andrew, Ebiere Okah and Joseph Tracy. 2009. "Second Chances: Subprime Mortgage Modification and Re-Default." Federal Reserve Bank of New York Staff Report No. 417.
- Lauria, Mickey, Vern Baxter and Bridget Bordelon. 2004. "An Investigation of the Time between Mortgage Default and Foreclosure." *Housing Studies* 19(4):581-600.
- Pennington-Cross, A. 2010. "The Duration of Foreclosures in the Subprime Mortgage Market: A Competing Risks Model with Mixing." *The Journal of Real Estate Finance and Economics* 40(2): 109-129.
- Pennington-Cross, Anthony and Giang Ho. 2010. "The Termination of Subprime Hybrid and Fixed-Rate Mortgages." *Real Estate Economics* 38(3): 399-426.
- Piskorski, Tomasz, Amit Seru and Vikrant Vig. 2010. "Securitization and Distressed Loan Renegotiation: Evidence from the Subprime Mortgage Crisis." *Journal of Financial Economics* 97(3), 369-397.
- Voicu, Ioan, Marilyn Jacob, Kristopher Rengert and Irene Fang. 2011. "Subprime Loan Default Resolutions: Do They Vary across Mortgage Products and Borrower Demographic Groups?" *The Journal of Real Estate Finance and Economics*, forthcoming.

Figure 1: The Foreclosure Process and Possible Post-Default Outcomes



Note that in Tables 2-5, deed in lieu loans are dropped in the first stage, and aggregated with the REOs in the second stage.

Table 1: Distribution of Post-Default Outcomes

	All loans in default		Received <i>lis pendens</i>			
			No		Yes	
Post-default outcome:						
Modified	8,650	21.5%	5,697	30.5%	2,953	13.7%
Refinance	2,038	5.1%	1,490	8.0%	548	2.5%
Arms-length sale	6,061	15.1%	1,771	9.5%	4,290	19.9%
Deed-in-lieu	8	0.0%	1	0.0%	7	0.0%
Foreclosure auction:	2,950	7.3%			2,950	13.7%
Auction sale	424	1.1%			424	2.0%
REO	2,526	6.3%			2,526	11.7%
Other outcome:	20,511	51.0%	9,710	52.0%	10,801	50.1%
Cured	1,019	2.5%	768	4.1%	251	1.2%
Cycled	2,197	5.5%	1,042	5.6%	1,155	5.4%
Remained delinquent	17,295	43.0%	7,900	42.3%	9,395	43.6%
Total number of loans	40,218	100%	18,669	100%	21,549	100%

Sample: LoanPerformance first lien non-prime securitized mortgages originated 2003-2008 in New York City that are ever 90 days delinquent by October 2010.

Table 2: Descriptive Statistics by Stage of Foreclosure and Post-Default Outcome

	All loans in default	First stage of the foreclosure process					Second stage of the foreclosure process (conditional on <i>lis pendens</i>)				
		Modification	Refinance	Sale	<i>Lis pendens</i>	Unresolved	Modification	Refinance	Sale	Auction	Unresolved
At origination:											
Loan type:											
FRM (not interest only)	0.24	0.29	0.30	0.24	0.19	0.32	0.25	0.26	0.19	0.11	0.19
ARM (not interest only)	0.35	0.25	0.51	0.48	0.38	0.28	0.32	0.56	0.50	0.44	0.32
Interest only	0.23	0.22	0.11	0.17	0.24	0.24	0.20	0.07	0.17	0.24	0.28
Other loan type	0.18	0.22	0.07	0.11	0.19	0.14	0.23	0.09	0.13	0.21	0.21
Relative interest rate - fixed rate loans	0.30	0.34	0.48	0.37	0.27	0.32	0.37	0.46	0.33	0.20	0.23
Relative interest rate - adjustable rate loans	1.09	0.62	2.45	1.99	1.30	0.52	0.99	3.08	2.22	1.62	0.85
Purchase loan	0.48	0.33	0.36	0.50	0.57	0.40	0.38	0.22	0.61	0.76	0.56
Owner-occupier	0.92	0.95	0.93	0.89	0.92	0.91	0.94	0.95	0.92	0.94	0.90
Average FICO score	652	640	620	641	653	661	634	592	644	663	663
Average debt to income	42	43	41	42	43	41	43	41	43	44	42
Full documentation	0.29	0.37	0.39	0.32	0.26	0.29	0.35	0.48	0.28	0.21	0.24
From HMDA:											
Female	0.41	0.42	0.41	0.38	0.42	0.40	0.46	0.49	0.43	0.40	0.42
Has co-borrower	0.21	0.27	0.38	0.24	0.16	0.26	0.21	0.31	0.19	0.10	0.14
Hispanic	0.19	0.18	0.11	0.16	0.19	0.19	0.18	0.09	0.19	0.21	0.20
Black	0.38	0.39	0.37	0.34	0.39	0.33	0.43	0.42	0.40	0.37	0.39
Asian	0.09	0.08	0.08	0.10	0.08	0.10	0.06	0.04	0.08	0.12	0.08
Average share of non-prime loans in tract	0.22	0.23	0.20	0.21	0.23	0.22	0.24	0.21	0.22	0.24	0.23
In the default month:											
Average months between default and origination	26	31	18	20	21	36	23	17	16	13	25
Average loan balance \$	421,750	418,940	327,118	394,758	432,269	419,498	418,991	309,833	401,251	434,081	453,922
Average LTV %	92	97	70	80	92	96	88	64	81	89	100
Has junior lien	0.35	0.28	0.21	0.28	0.41	0.31	0.31	0.12	0.36	0.55	0.44
Average growth in ARM payments since origination											
25-50%	0.03	0.05	0.02	0.03	0.03	0.03	0.04	0.04	0.02	0.02	0.03
50%	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.01
Average past 6 months foreclosure rate in tract %	0.020	0.020	0.014	0.016	0.020	0.020	0.021	0.015	0.017	0.020	0.022
In the last observation month:											
Average months since default	11	8	8	6	10	15	17	13	11	18	6
Average share of payments made since default	0.44	0.38	0.60	0.49	0.47	0.37	0.49	0.72	0.63	0.57	0.35
Average past year local house price growth	-0.07	-0.12	0.06	0.03	-0.06	-0.10	-0.12	0.03	0.01	-0.07	-0.07
Average LTV %	102	109	70	81	101	109	114	66	86	101	105
Census tract averages from 2000:											
Share of black residents	0.48	0.50	0.50	0.46	0.49	0.43	0.53	0.53	0.50	0.52	0.47
Share of Hispanic residents	0.23	0.21	0.19	0.23	0.23	0.23	0.22	0.20	0.24	0.23	0.24
Share of Asian residents	0.06	0.06	0.06	0.07	0.06	0.07	0.06	0.05	0.06	0.06	0.06
Share of foreign born	0.37	0.38	0.35	0.36	0.37	0.37	0.37	0.34	0.37	0.35	0.37
Median income	40,434	42,088	41,527	41,172	39,322	41,631	41,089	40,299	39,458	39,805	38,603
Number of loans	40,218	5,697	1,490	1,771	21,549	9,710	2,953	548	4,290	2,950	10,801

Sample: LoanPerformance first lien non-prime securitized mortgages originated 2003-2008 in New York City that are ever 90 days delinquent by October 2010.

The table indicates the fraction of loans within the column outcome that have the row characteristic, unless otherwise noted.

Table 3: Descriptive Statistics by *Lis Pendens* and Post-Default Outcome

	All loans in default	Received <i>lis pendens</i> :		Modification	Refinance	Post-default outcome:		
		No	Yes			Sale	Auction	Unresolved
At origination:								
Loan type:								
FRM (not interest only)	0.24	0.30	0.19	0.28	0.29	0.20	0.11	0.25
ARM (not interest only)	0.35	0.31	0.38	0.27	0.53	0.49	0.44	0.30
Interest only	0.23	0.22	0.24	0.21	0.10	0.17	0.24	0.26
Other loan type	0.18	0.16	0.19	0.22	0.07	0.13	0.21	0.17
Relative interest rate - FRMs	0.30	0.34	0.27	0.35	0.48	0.34	0.20	0.27
Relative interest rate - ARMs	1.09	0.84	1.30	0.75	2.62	2.15	1.62	0.69
Purchase loan	0.48	0.38	0.57	0.35	0.33	0.58	0.76	0.48
Owner-occupier	0.92	0.92	0.92	0.95	0.94	0.91	0.94	0.91
Average FICO score	652	649	653	638	613	643	663	662
Average debt to income	42	42	43	43	41	42	44	42
Full documentation	0.29	0.33	0.26	0.37	0.41	0.29	0.21	0.26
From HMDA:								
Female	0.41	0.40	0.42	0.43	0.43	0.42	0.40	0.41
Has co-borrower	0.21	0.27	0.16	0.25	0.36	0.20	0.10	0.20
Hispanic	0.19	0.18	0.19	0.18	0.10	0.18	0.21	0.19
Black	0.38	0.35	0.39	0.40	0.39	0.38	0.37	0.36
Asian	0.09	0.09	0.08	0.07	0.07	0.08	0.12	0.09
Average share of non-prime loans in tract	0.22	0.22	0.23	0.23	0.20	0.22	0.24	0.22
In the default month:								
Average months between default and origination	26	32	21	28	17	17	13	30
Average loan balance \$	421,750	409,608	432,269	418,957	322,470	399,354	434,081	437,630
Average LTV %	92	93	92	94	68	81	89	98
Has junior lien	0.35	0.29	0.41	0.29	0.18	0.33	0.55	0.38
Average growth in ARM payments since origination								
25-50%	0.03	0.03	0.03	0.05	0.03	0.03	0.02	0.03
50%	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02
Average past 6 months foreclosure rate in tract %	0.020	0.019	0.020	0.020	0.014	0.017	0.020	0.021
In the last observation month:								
Average months since default	11	12	10	11	9	10	18	10
Average share of payments made since default	0.44	0.40	0.47	0.42	0.63	0.59	0.57	0.36
Average past year local house price growth	-0.07	-0.08	-0.06	-0.12	0.05	0.02	-0.07	-0.09
Average LTV %	102	103	101	110	69	84	101	107
Census tract averages from 2000:								
Share of black residents	0.48	0.46	0.49	0.51	0.51	0.48	0.52	0.45
Share of Hispanic residents	0.23	0.22	0.23	0.21	0.20	0.23	0.23	0.23
Share of Asian residents	0.06	0.07	0.06	0.06	0.06	0.07	0.06	0.07
Share of foreign born	0.37	0.37	0.37	0.37	0.35	0.36	0.35	0.37
Median income	40,434	41,719	39,322	41,747	41,197	39,959	39,805	40,036
Number of loans	40,218	18,669	21,549	8,650	2,038	6,061	2,950	20,511

Sample: LoanPerformance first lien non-prime securitized mortgages originated 2003-2008 in New York City that are ever 90 days delinquent by October 2010
The table indicates the fraction of loans within the column outcome that have the row characteristic, unless otherwise noted

Table 4: Foreclosure Models - Full Sample

		First stage of the foreclosure process				Second stage of the foreclosure process (conditional on <i>lis pendens</i>)				Collapsed model			
		Modification	Refinance	Sale	<i>Lis pendens</i>	Modification	Refinance	Sale	Auction	Modification	Refinance	Sale	Auction
Loan characteristics:													
Interest only loan		1.3683** (0.073)	1.0340 (0.151)	0.8227+ (0.088)	0.8084** (0.022)	1.9272** (0.156)	0.7228 (0.178)	1.0007 (0.067)	0.8206* (0.063)	1.4404** (0.065)	0.9231 (0.115)	0.8619** (0.049)	0.8307* (0.063)
FRM relative rate at origination:	<1%	1.0954+ (0.058)	1.4581* (0.214)	0.8802 (0.107)	0.7737** (0.028)	1.6336** (0.135)	1.5001+ (0.350)	0.8972 (0.081)	0.6393** (0.090)	1.2016** (0.054)	1.5132** (0.187)	0.8162** (0.058)	0.5505** (0.077)
	1-2 %	1.1166+ (0.065)	1.3728* (0.207)	1.0069 (0.125)	0.8912** (0.034)	1.4610** (0.127)	1.4049 (0.328)	0.8725 (0.077)	1.0004 (0.109)	1.2316** (0.059)	1.3960** (0.177)	0.8744+ (0.063)	0.9884 (0.111)
	2-3 %	1.1634+ (0.100)	1.2951 (0.210)	1.0312 (0.151)	0.8813* (0.047)	1.7184** (0.182)	1.3876 (0.352)	0.9885 (0.094)	1.2795+ (0.164)	1.3098** (0.089)	1.2809+ (0.177)	0.9512 (0.077)	1.1391 (0.152)
	>3 %	1.3471* (0.163)	1.1355 (0.238)	0.9410 (0.187)	0.9012 (0.070)	2.0259** (0.306)	0.6255 (0.223)	0.9265 (0.125)	0.8998 (0.222)	1.5364** (0.145)	0.9260 (0.170)	0.8890 (0.099)	0.7547 (0.198)
ARM relative rate at origination:	<1%	0.7725** (0.067)	1.0576 (0.231)	0.7987 (0.132)	0.5986** (0.030)	1.5002** (0.210)	0.2858 (0.219)	0.9434 (0.126)	0.8266 (0.139)	0.8353* (0.062)	0.8210 (0.170)	0.6767** (0.069)	0.6015** (0.097)
	1-2 %	0.9091 (0.055)	1.0171 (0.165)	0.8111 (0.103)	0.8915** (0.029)	1.1880* (0.098)	1.0571 (0.276)	1.0329 (0.077)	0.9404 (0.076)	0.9720 (0.048)	1.0636 (0.145)	0.9058 (0.059)	0.8647+ (0.070)
	2-3 %	0.8579* (0.054)	1.2840+ (0.172)	1.0020 (0.106)	1.0057 (0.032)	1.1738* (0.092)	1.0297 (0.219)	0.9913 (0.065)	1.0866 (0.078)	0.9606 (0.046)	1.1765 (0.133)	0.9645 (0.054)	1.0802 (0.080)
	>3 %	0.8644 (0.099)	1.2356 (0.178)	1.1239 (0.136)	1.0577 (0.048)	1.0402 (0.130)	1.4643+ (0.328)	1.0552 (0.082)	1.2239+ (0.129)	0.9645 (0.077)	1.2743* (0.154)	1.0465 (0.069)	1.1928 (0.128)
Current loan balance:	2nd quintile	1.0953+ (0.060)	1.0175 (0.091)	1.2130* (0.101)	1.0491 (0.032)	1.1547 (0.103)	0.7114** (0.094)	1.1973** (0.067)	1.2816** (0.105)	1.1262* (0.053)	0.9031 (0.067)	1.2050** (0.056)	1.2543** (0.103)
	3rd quintile	1.0995 (0.064)	1.0577 (0.116)	1.4359** (0.135)	1.1448** (0.036)	1.2609* (0.117)	0.6559** (0.106)	1.2419** (0.079)	1.4051** (0.123)	1.1606** (0.057)	0.8973 (0.082)	1.3117** (0.069)	1.4475** (0.127)
	4th quintile	1.2147** (0.074)	1.0868 (0.141)	1.4148** (0.150)	1.3037** (0.044)	1.4806** (0.146)	0.5461** (0.112)	1.2953** (0.091)	1.5472** (0.147)	1.3283** (0.069)	0.8786 (0.096)	1.3851** (0.081)	1.6431** (0.155)
	top quintile	1.3430** (0.085)	6.1689** (0.687)	3.7325** (0.393)	1.5197** (0.053)	2.2960** (0.227)	1.8554** (0.372)	2.9636** (0.234)	2.4067** (0.252)	1.6536** (0.088)	4.7023** (0.470)	3.3825** (0.209)	2.8108** (0.284)
Prepayment penalty in effect		0.8082** (0.066)	0.8169* (0.078)	0.8618+ (0.075)	1.0457+ (0.028)	1.0490 (0.132)	0.8315 (0.156)	0.9308 (0.060)	0.8382+ (0.078)	0.8693* (0.060)	0.8326* (0.073)	0.8926* (0.046)	0.8093* (0.073)
Purchase loan		0.7877** (0.030)	0.7548** (0.054)	1.1785** (0.074)	1.2621** (0.026)	0.6077** (0.032)	0.4429** (0.057)	1.1695** (0.051)	1.3469** (0.078)	0.7205** (0.022)	0.6322** (0.039)	1.2262** (0.045)	1.4664** (0.084)
Owner-occupier		1.3720** (0.091)	1.0891 (0.122)	0.6850** (0.057)	0.8800** (0.028)	1.1375 (0.089)	1.3082 (0.280)	0.8340** (0.053)	0.9701 (0.083)	1.2692** (0.065)	1.0850 (0.107)	0.7676** (0.039)	1.0055 (0.093)
Single family home		1.1383** (0.040)	1.4730** (0.104)	1.3215** (0.082)	1.1679** (0.024)	1.1682** (0.063)	0.9359 (0.102)	1.1480** (0.049)	1.3568** (0.073)	1.1690** (0.034)	1.2580** (0.075)	1.2598** (0.044)	1.5267** (0.083)
Building age:	11-50 years	1.0638 (0.066)	1.3349* (0.178)	1.1633 (0.138)	1.0952* (0.043)	1.0022 (0.091)	2.2420** (0.670)	1.2396* (0.111)	0.7822* (0.082)	1.0561 (0.055)	1.3453* (0.161)	1.2566** (0.091)	0.8302+ (0.092)
	>50 years	0.9646 (0.050)	1.2016 (0.136)	1.3052** (0.121)	1.2729** (0.038)	0.8927 (0.063)	2.4339** (0.676)	1.3815** (0.098)	0.9487 (0.068)	0.9583 (0.040)	1.2527* (0.128)	1.4650** (0.084)	1.1590+ (0.090)

continued

		First stage of the foreclosure process				Second stage of the foreclosure process (conditional on <i>lis pendens</i>)				Collapsed model			
		Modification	Refinance	Sale	<i>Lis pendens</i>	Modification	Refinance	Sale	Auction	Modification	Refinance	Sale	Auction
Borrower risk characteristics:													
FICO at origination:	680-720	1.0650 (0.058)	0.8017+ (0.102)	1.0506 (0.096)	0.9806 (0.027)	1.2080* (0.103)	1.1162 (0.323)	0.9270 (0.055)	0.9899 (0.064)	1.0998* (0.051)	0.8839 (0.103)	0.9678 (0.050)	1.0032 (0.069)
	650-680	1.2467** (0.067)	1.1067 (0.132)	0.8967 (0.086)	0.9558 (0.027)	1.5665** (0.130)	1.2274 (0.342)	1.0273 (0.060)	0.8748* (0.058)	1.3324** (0.061)	1.1505 (0.126)	1.0093 (0.052)	0.9570 (0.067)
	620-650	1.3606** (0.075)	1.1339 (0.135)	0.9879 (0.096)	0.9509+ (0.028)	1.7406** (0.147)	1.8746* (0.494)	0.9664 (0.059)	0.9191 (0.063)	1.4628** (0.068)	1.3078* (0.141)	0.9846 (0.052)	0.9675 (0.070)
	590-620	1.5584** (0.099)	1.0503 (0.141)	1.0249 (0.115)	0.8472** (0.031)	2.2434** (0.212)	1.8309* (0.521)	1.0885 (0.081)	0.6470** (0.059)	1.7341** (0.091)	1.3029* (0.157)	1.0476 (0.066)	0.6870** (0.065)
	560-590	1.9367** (0.138)	1.2252 (0.172)	1.0224 (0.126)	0.8681** (0.037)	2.7121** (0.291)	3.2607** (0.918)	1.1717+ (0.096)	0.5743** (0.070)	2.1346** (0.127)	1.6998** (0.207)	1.1079 (0.077)	0.6104** (0.074)
	530-560	1.9728** (0.157)	1.4337* (0.209)	1.0432 (0.138)	0.7634** (0.037)	2.9583** (0.348)	3.5796** (1.048)	1.1972* (0.108)	0.4343** (0.065)	2.1831** (0.145)	1.9836** (0.254)	1.1346+ (0.085)	0.4325** (0.066)
	<530	2.1042** (0.198)	1.5630** (0.239)	1.0227 (0.152)	0.7590** (0.043)	3.4656** (0.484)	4.3844** (1.291)	1.2985** (0.130)	0.6459** (0.107)	2.4115** (0.188)	2.3356** (0.306)	1.1727+ (0.099)	0.5230** (0.099)
Current LTV:	80-90%	1.0969 (0.066)	0.7703** (0.071)	0.7188** (0.059)	0.9489+ (0.027)	1.2810** (0.118)	0.5306** (0.105)	0.6491** (0.039)	0.8423* (0.069)	1.1324* (0.057)	0.7242** (0.062)	0.6555** (0.031)	0.8070** (0.064)
	90-100%	1.2597** (0.077)	0.5672** (0.072)	0.4693** (0.053)	0.9222** (0.029)	1.6911** (0.157)	0.3532** (0.100)	0.4954** (0.040)	0.8910 (0.083)	1.3509** (0.069)	0.5420** (0.063)	0.4740** (0.030)	0.8234* (0.072)
	100-110%	1.3021** (0.084)	0.3765** (0.065)	0.4220** (0.057)	0.8625** (0.031)	1.5939** (0.163)	0.4483** (0.138)	0.4411** (0.041)	0.7730* (0.083)	1.3611** (0.074)	0.3862** (0.060)	0.4345** (0.033)	0.7426** (0.075)
	110-120%	1.5347** (0.106)	0.3604** (0.073)	0.3548** (0.057)	0.8395** (0.036)	1.8841** (0.209)	0.5228+ (0.177)	0.4946** (0.051)	0.7932+ (0.094)	1.6128** (0.095)	0.3968** (0.070)	0.4578** (0.038)	0.7841* (0.087)
	>120%	1.7893** (0.127)	0.2112** (0.041)	0.4003** (0.059)	0.7707** (0.034)	3.2608** (0.371)	0.8661 (0.244)	0.6216** (0.063)	0.7749* (0.100)	2.1827** (0.132)	0.3479** (0.055)	0.5896** (0.047)	0.8039+ (0.094)
Has junior lien		0.8073** (0.034)	1.2353* (0.102)	1.1867* (0.088)	1.1302** (0.026)	0.7403** (0.042)	0.8779 (0.142)	1.1478** (0.054)	1.2597** (0.071)	0.7718** (0.026)	1.1087 (0.083)	1.1859** (0.047)	1.2534** (0.070)
Full documentation & DTI < =45%		1.2415** (0.067)	1.2876* (0.132)	1.2296* (0.116)	0.9873 (0.032)	1.0588 (0.085)	1.0552 (0.169)	0.8748* (0.058)	1.0908 (0.095)	1.2202** (0.055)	1.2730** (0.111)	0.9985 (0.054)	1.0629 (0.098)
Full documentation & DTI > 45%		1.3737** (0.070)	0.9297 (0.101)	1.1609 (0.112)	0.9778 (0.031)	1.0084 (0.077)	0.8455 (0.142)	0.9637 (0.061)	0.9646 (0.080)	1.2868** (0.055)	0.9970 (0.092)	1.0355 (0.056)	0.9080 (0.079)

continued

		First stage of the foreclosure process				Second stage of the foreclosure process (conditional on <i>lis pendens</i>)				Collapsed model			
		Modification	Refinance	Sale	<i>Lis pendens</i>	Modification	Refinance	Sale	Auction	Modification	Refinance	Sale	Auction
Borrower payment behavior:													
no. of months before default		1.0150** (0.002)	0.9680** (0.003)	0.9788** (0.003)	0.9728** (0.001)	1.0616** (0.003)	1.0147** (0.006)	1.0116** (0.002)	0.9725** (0.004)	1.0241** (0.002)	0.9816** (0.003)	0.9819** (0.002)	0.9438** (0.004)
Payments since default:	>0 but <half	2.8468** (0.135)	0.9832 (0.140)	0.9082 (0.107)	1.0077 (0.038)	3.1423** (0.234)	1.0933 (0.210)	1.0511 (0.071)	0.9318 (0.079)	2.6870** (0.108)	1.0049 (0.113)	1.0108 (0.059)	1.0339 (0.086)
	>half	1.6738** (0.069)	0.9463 (0.069)	0.8296** (0.052)	0.6951** (0.015)	2.4121** (0.175)	0.6217** (0.087)	1.1161* (0.054)	0.7714** (0.050)	1.6937** (0.062)	0.7953** (0.053)	0.9521 (0.037)	0.8238** (0.052)
1-3 months after ARM rate adjustment		1.1463 (0.154)	1.1958 (0.173)	1.3305+ (0.197)	0.8636* (0.056)	0.8851 (0.150)	1.1515 (0.236)	0.9855 (0.088)	1.2141+ (0.135)	1.0176 (0.107)	1.1225 (0.132)	1.0690 (0.082)	1.2435* (0.138)
4-6 months after ARM rate adjustment		1.4018** (0.160)	0.9702 (0.170)	1.2407 (0.207)	1.0287 (0.066)	1.1970 (0.168)	1.1600 (0.249)	0.9483 (0.097)	1.1537 (0.134)	1.2990** (0.115)	1.0118 (0.138)	1.0099 (0.087)	1.2041 (0.137)
7-12 months after ARM rate adjustment		1.2976** (0.112)	1.0224 (0.165)	0.9957 (0.164)	1.1516** (0.060)	1.0120 (0.107)	1.3213 (0.229)	1.0741 (0.089)	1.1167 (0.102)	1.1704* (0.078)	1.1060 (0.130)	1.0796 (0.080)	1.1552 (0.106)
Change in ARM payments:	25-50%	0.5716** (0.059)	1.0659 (0.148)	1.1601 (0.151)	1.0333 (0.048)	0.5491** (0.067)	1.2473 (0.203)	1.0212 (0.076)	1.0260 (0.088)	0.5546** (0.043)	1.1364 (0.118)	1.0735 (0.070)	1.1164 (0.097)
	> 50%	0.4216** (0.068)	0.8785 (0.214)	1.3590 (0.256)	1.2537** (0.078)	0.5213** (0.104)	1.5022 (0.569)	1.2047 (0.140)	0.9980 (0.174)	0.5082** (0.061)	0.9748 (0.207)	1.3181** (0.135)	1.1624 (0.196)
Neighborhood characteristics:													
Recent house price depreciation:	0-10%	1.2122* (0.102)	0.7644* (0.082)	0.9606 (0.106)	1.0163 (0.031)	1.0542 (0.113)	0.7511+ (0.124)	0.9505 (0.067)	1.2644** (0.110)	1.1733* (0.077)	0.7555** (0.068)	0.9766 (0.058)	1.2768** (0.109)
	>10%	1.2200* (0.103)	0.8401 (0.114)	1.1809 (0.145)	0.8935** (0.032)	0.9698 (0.105)	0.8289 (0.185)	1.0707 (0.087)	1.4055** (0.137)	1.1240+ (0.075)	0.8387 (0.097)	1.0929 (0.074)	1.3733** (0.130)
Recent foreclosure rate:	1-2%	0.9224* (0.037)	1.0718 (0.076)	1.0357 (0.068)	1.0681** (0.024)	0.8732* (0.053)	0.8075+ (0.099)	1.0542 (0.048)	1.0936 (0.071)	0.9148** (0.031)	0.9146 (0.056)	1.1287** (0.042)	1.2204** (0.079)
	2-3%	0.8083** (0.037)	0.9394 (0.090)	1.1248 (0.091)	1.1541** (0.031)	0.7163** (0.048)	0.8701 (0.124)	1.0353 (0.056)	1.1211 (0.080)	0.7935** (0.030)	0.8275* (0.065)	1.1870** (0.054)	1.3546** (0.096)
	3-4%	0.6904** (0.039)	0.8896 (0.116)	0.9304 (0.105)	1.1727** (0.038)	0.6476** (0.050)	0.8763 (0.160)	0.9861 (0.067)	1.1388 (0.094)	0.6919** (0.031)	0.8099* (0.084)	1.1043+ (0.064)	1.4303** (0.118)
	>4%	0.5881** (0.038)	0.9267 (0.131)	0.8116+ (0.103)	1.3334** (0.045)	0.5643** (0.047)	0.7120+ (0.142)	1.0691 (0.076)	1.3348** (0.109)	0.5862** (0.030)	0.7296** (0.083)	1.1495* (0.071)	1.7016** (0.140)
Share of non-prime loans:	10-20%	1.1773* (0.087)	0.9682 (0.116)	1.0402 (0.105)	1.1209** (0.047)	0.9672 (0.102)	1.1669 (0.241)	1.2456** (0.106)	1.1115 (0.131)	1.1454* (0.070)	1.0067 (0.103)	1.1643* (0.078)	1.1562 (0.145)
	>20%	1.2149* (0.092)	1.0437 (0.132)	1.0019 (0.107)	1.1848** (0.051)	0.9457 (0.102)	1.0976 (0.236)	1.2514* (0.110)	1.4166** (0.170)	1.1638* (0.073)	1.0835 (0.117)	1.1579* (0.080)	1.4651** (0.185)
Median income:	<\$30,000	0.9388 (0.043)	0.9915 (0.085)	0.9236 (0.071)	0.9864 (0.025)	1.0508 (0.066)	1.0816 (0.147)	0.9069+ (0.046)	0.6965** (0.044)	0.9641 (0.036)	1.0113 (0.074)	0.8692** (0.038)	0.5933** (0.039)
	\$30-40,000	1.0191 (0.038)	1.0216 (0.077)	0.9963 (0.065)	1.0461* (0.022)	0.9781 (0.051)	0.9313 (0.109)	0.9174* (0.040)	0.7984** (0.042)	1.0137 (0.031)	0.9780 (0.062)	0.9468 (0.035)	0.8019** (0.043)

continued

		First stage of the foreclosure process				Second stage of the foreclosure process (conditional on <i>lis pendens</i>)				Collapsed model			
		Modification	Refinance	Sale	<i>Lis pendens</i>	Modification	Refinance	Sale	Auction	Modification	Refinance	Sale	Auction
Share of Black residents:	20-40%	1.1406*	1.1377	0.8410+	1.0266	1.1877*	0.9720	0.9700	0.8641+	1.1390**	1.0897	0.9284	0.8594+
		(0.061)	(0.131)	(0.084)	(0.032)	(0.094)	(0.166)	(0.063)	(0.071)	(0.051)	(0.104)	(0.051)	(0.070)
	40-60%	1.0638	1.2612*	1.0273	1.0830*	1.4759**	0.9738	1.0604	0.9031	1.1852**	1.1998+	1.0394	0.9095
		(0.064)	(0.144)	(0.104)	(0.037)	(0.129)	(0.181)	(0.070)	(0.081)	(0.059)	(0.118)	(0.058)	(0.083)
	60-80%	1.2376**	1.1256	1.0652	1.0851*	1.5912**	0.9098	0.9663	0.8921	1.3420**	1.1039	0.9812	0.8868
		(0.072)	(0.131)	(0.108)	(0.038)	(0.137)	(0.165)	(0.068)	(0.079)	(0.065)	(0.108)	(0.058)	(0.081)
	>80%	1.1918**	1.2144+	1.0093	1.0880*	1.4133**	1.0751	0.9490	1.0118	1.2562**	1.2155*	0.9627	1.0954
		(0.068)	(0.134)	(0.098)	(0.037)	(0.123)	(0.189)	(0.066)	(0.092)	(0.060)	(0.114)	(0.055)	(0.101)
Share of Hispanic residents:	20-40%	0.9899	1.0576	1.1139	1.1580**	0.9590	0.9739	0.9611	1.1785*	0.9925	0.9860	1.0436	1.3385**
		(0.046)	(0.098)	(0.085)	(0.031)	(0.064)	(0.146)	(0.052)	(0.080)	(0.038)	(0.078)	(0.047)	(0.095)
	>40%	1.0673	0.9389	1.1620	1.1786**	1.1804*	0.8515	1.0096	1.2732**	1.1221*	0.9012	1.1037+	1.4718**
		(0.062)	(0.109)	(0.113)	(0.039)	(0.100)	(0.154)	(0.066)	(0.111)	(0.054)	(0.088)	(0.062)	(0.133)
Share of Asian residents:	20-40%	0.9637	0.8604	1.0036	0.9734	0.9628	1.0982	1.0434	1.1769+	0.9790	0.9384	1.0245	1.1567
		(0.057)	(0.114)	(0.104)	(0.034)	(0.086)	(0.219)	(0.071)	(0.111)	(0.048)	(0.100)	(0.061)	(0.107)
	>40%	1.0111	0.7087	1.6988**	0.8943	1.0152	0.5315	1.0553	1.3159	1.0253	0.6964	1.2743+	0.9303
		(0.139)	(0.208)	(0.321)	(0.072)	(0.193)	(0.328)	(0.162)	(0.267)	(0.117)	(0.188)	(0.162)	(0.250)
Share of foreign born:	40-60%	0.9829	0.9626	0.9062+	0.9903	1.1063*	0.9330	1.0815*	0.7369**	1.0084	0.9513	1.0189	0.7277**
		(0.032)	(0.063)	(0.053)	(0.019)	(0.052)	(0.094)	(0.042)	(0.037)	(0.027)	(0.052)	(0.033)	(0.037)
	>60%	0.9596	0.8653	0.8906	1.0176	0.8715	0.7566	1.0210	0.6658**	0.9031+	0.8004+	0.9815	0.6976**
		(0.062)	(0.124)	(0.104)	(0.037)	(0.082)	(0.193)	(0.075)	(0.066)	(0.049)	(0.100)	(0.061)	(0.068)
Number of Loans													
Number of loan-months		285,295	285,295	285,295	285,295	161,502	161,502	161,502	161,502	427,972	427,972	427,972	427,972

Competing risk models with relative risk ratios reported. Standard errors are in (). Statistical significance is indicated by: +10%, *5%, and **1%.

Sample: LoanPerformance first lien non-prime securitized mortgages originated 2003-2008 in New York City that are ever 90 days delinquent by October 2010.

All models also include: number of months since default; indicators for no or low documentation interacted with DTI, local house price appreciation > 5%, received foreclosure counselling, other race; indicators for missing values of FICO, DTI, prepayment penalty, race, and gender; fixed effects for calendar year and origination year.

Table 5: Foreclosure Models - HMDA Matched Sample

		First stage of the foreclosure process				Second stage of the foreclosure process (conditional on <i>lis pendens</i>)				Collapsed model			
		Modification	Refinance	Sale	<i>Lis pendens</i>	Modification	Refinance	Sale	Auction	Modification	Refinance	Sale	Auction
Loan characteristics:													
Interest only loan		1.3922** (0.082)	0.9751 (0.156)	0.8106+ (0.098)	0.7985** (0.025)	1.9329** (0.174)	0.6948 (0.189)	1.0251 (0.077)	0.8234* (0.071)	1.4504** (0.072)	0.8856 (0.121)	0.8613* (0.055)	0.8288* (0.072)
FRM relative rate at origination:	<1%	1.0709 (0.062)	1.3014 (0.213)	0.8553 (0.116)	0.7828** (0.031)	1.4947** (0.137)	1.5820+ (0.402)	0.8896 (0.091)	0.6552** (0.096)	1.1675** (0.058)	1.4016* (0.192)	0.8139** (0.065)	0.6139** (0.087)
	1-2 %	1.1313+ (0.072)	1.3416+ (0.223)	0.9615 (0.135)	0.8878** (0.039)	1.4420** (0.141)	1.3470 (0.345)	0.9466 (0.094)	0.9651 (0.122)	1.2436** (0.065)	1.3879* (0.194)	0.9045 (0.074)	0.9139 (0.123)
	2-3 %	1.1684+ (0.110)	1.1663 (0.218)	0.9750 (0.167)	0.8799* (0.053)	1.5376** (0.180)	1.4257 (0.388)	1.0164 (0.112)	1.2787+ (0.189)	1.2717** (0.094)	1.2457 (0.193)	0.9444 (0.090)	1.1755 (0.173)
	>3 %	1.3944** (0.176)	0.9425 (0.233)	0.7779 (0.188)	0.8982 (0.077)	2.0665** (0.326)	0.7182 (0.272)	1.1049 (0.170)	0.8666 (0.264)	1.5862** (0.154)	0.8690 (0.180)	0.9127 (0.121)	0.6877 (0.210)
ARM relative rate at origination:	<1%	0.7455** (0.071)	1.0581 (0.254)	0.8112 (0.148)	0.5882** (0.032)	1.4140* (0.220)	0.3063 (0.240)	0.9613 (0.142)	0.7623 (0.139)	0.8096* (0.067)	0.8116 (0.183)	0.6976** (0.078)	0.5851** (0.103)
	1-2 %	0.9098 (0.060)	0.8937 (0.160)	0.8192 (0.115)	0.8948** (0.032)	1.1857+ (0.107)	1.1244 (0.308)	1.0654 (0.089)	0.9164 (0.081)	0.9721 (0.052)	0.9871 (0.148)	0.9365 (0.067)	0.8816 (0.078)
	2-3 %	0.8868+ (0.060)	1.1762 (0.174)	1.0049 (0.119)	0.9690 (0.033)	1.1443 (0.098)	1.0005 (0.226)	1.0358 (0.076)	1.0873 (0.085)	0.9680 (0.050)	1.1094 (0.136)	0.9798 (0.061)	1.1022 (0.089)
	>3 %	0.8199 (0.105)	1.0979 (0.177)	1.0984 (0.150)	1.0513 (0.053)	1.0621 (0.137)	1.2765 (0.307)	1.0891 (0.094)	1.2238+ (0.141)	0.9479 (0.083)	1.1324 (0.151)	1.0476 (0.077)	1.2153 (0.146)
Current loan balance:	2nd quintile	1.0780 (0.065)	1.0683 (0.108)	1.1634 (0.109)	1.0038 (0.033)	1.2560* (0.120)	0.6651** (0.098)	1.2391** (0.076)	1.2494* (0.111)	1.1306* (0.058)	0.9163 (0.075)	1.1925** (0.062)	1.1588 (0.105)
	3rd quintile	1.0919 (0.069)	1.1026 (0.135)	1.4718** (0.154)	1.1265** (0.039)	1.3464** (0.136)	0.6993* (0.120)	1.2680** (0.089)	1.3303** (0.126)	1.1624** (0.063)	0.9238 (0.093)	1.3203** (0.078)	1.3875** (0.131)
	4th quintile	1.2029** (0.081)	1.1194 (0.167)	1.3832** (0.165)	1.2944** (0.048)	1.6060** (0.175)	0.5179** (0.118)	1.3448** (0.104)	1.4404** (0.148)	1.3360** (0.077)	0.8389 (0.105)	1.3969** (0.091)	1.5579** (0.158)
	top quintile	1.3132** (0.092)	5.9799** (0.772)	3.5784** (0.428)	1.4626** (0.057)	2.5825** (0.282)	2.0489** (0.444)	3.1700** (0.277)	2.2145** (0.252)	1.6831** (0.099)	4.4980** (0.511)	3.4113** (0.236)	2.5733** (0.285)
Prepayment penalty in effect		0.8066* (0.070)	0.7444** (0.082)	0.9026 (0.085)	1.0609* (0.031)	1.0097 (0.132)	0.8493 (0.170)	0.9219 (0.063)	0.8022* (0.081)	0.8579* (0.062)	0.7742** (0.076)	0.9078+ (0.050)	0.8173* (0.079)
Purchase loan		0.7570** (0.032)	0.7430** (0.060)	1.1814* (0.084)	1.2492** (0.029)	0.5756** (0.033)	0.4448** (0.064)	1.1356** (0.056)	1.3230** (0.085)	0.6936** (0.024)	0.6160** (0.043)	1.2120** (0.049)	1.4623** (0.093)
Owner-occupier		1.3643** (0.101)	1.0674 (0.139)	0.6780** (0.063)	0.8833** (0.031)	1.0911 (0.091)	1.3478 (0.317)	0.8323* (0.060)	0.9972 (0.095)	1.2328** (0.069)	1.0657 (0.122)	0.7603** (0.044)	1.0006 (0.100)
Single family home		1.1300** (0.044)	1.5078** (0.121)	1.3347** (0.093)	1.1833** (0.027)	1.2199** (0.072)	0.8854 (0.108)	1.1635** (0.055)	1.3114** (0.078)	1.1846** (0.038)	1.2313** (0.083)	1.2769** (0.051)	1.5129** (0.091)
Building age:	11-50 years	1.0393 (0.072)	1.4790* (0.235)	1.1627 (0.157)	1.0611 (0.047)	0.9934 (0.098)	1.7048+ (0.531)	1.1728 (0.117)	0.7898* (0.092)	1.0172 (0.058)	1.4135* (0.198)	1.1990* (0.097)	0.8316 (0.099)
	>50 years	0.9510 (0.054)	1.2837+ (0.176)	1.3197** (0.142)	1.2326** (0.042)	0.8919 (0.071)	1.9752* (0.564)	1.3071** (0.104)	0.9310 (0.077)	0.9355 (0.044)	1.3155* (0.160)	1.4072** (0.091)	1.1378 (0.097)

continued

		First stage of the foreclosure process				Second stage of the foreclosure process (conditional on <i>lis pendens</i>)				Collapsed model			
		Modification	Refinance	Sale	<i>Lis pendens</i>	Modification	Refinance	Sale	Auction	Modification	Refinance	Sale	Auction
Borrower risk characteristics:													
FICO at origination:	680-720	1.0637 (0.064)	0.8607 (0.123)	1.0449 (0.106)	0.9938 (0.030)	1.1409 (0.105)	1.1576 (0.385)	0.8592* (0.056)	0.9953 (0.071)	1.0849 (0.055)	0.9087 (0.119)	0.9177 (0.052)	1.0276 (0.079)
	650-680	1.2289** (0.074)	1.1936 (0.160)	0.8675 (0.093)	0.9604 (0.030)	1.5032** (0.136)	1.4479 (0.462)	0.9753 (0.063)	0.8987 (0.067)	1.2949** (0.065)	1.2492+ (0.154)	0.9508 (0.054)	0.9597 (0.076)
	620-650	1.3781** (0.084)	1.1418 (0.152)	0.9478 (0.102)	0.9596 (0.031)	1.6376** (0.151)	2.1062* (0.640)	0.9274 (0.061)	0.9304 (0.071)	1.4604** (0.074)	1.3269* (0.162)	0.9533 (0.055)	1.0025 (0.082)
	590-620	1.5701** (0.110)	1.0383 (0.156)	1.0078 (0.126)	0.8291** (0.034)	2.0174** (0.207)	2.2045* (0.721)	1.0226 (0.083)	0.6626** (0.068)	1.6976** (0.098)	1.3463* (0.183)	1.0016 (0.070)	0.7102** (0.076)
	560-590	1.8457** (0.146)	1.2065 (0.186)	1.0045 (0.137)	0.8605** (0.040)	2.5724** (0.303)	3.9544** (1.281)	1.1588+ (0.104)	0.6077** (0.081)	2.0416** (0.134)	1.7264** (0.236)	1.0889 (0.083)	0.6486** (0.088)
	530-560	1.9242** (0.169)	1.3726+ (0.224)	1.0292 (0.151)	0.7428** (0.040)	2.6964** (0.346)	4.4066** (1.471)	1.1015 (0.109)	0.4668** (0.075)	2.0949** (0.151)	2.0128** (0.288)	1.0711 (0.088)	0.4441** (0.075)
	<530	2.2030** (0.227)	1.5484* (0.266)	0.9748 (0.164)	0.7729** (0.048)	3.2059** (0.471)	5.1137** (1.738)	1.2600* (0.139)	0.6718* (0.122)	2.4495** (0.206)	2.3484** (0.350)	1.1436 (0.106)	0.6136* (0.116)
Current LTV:	80-90%	1.0795 (0.071)	0.7178** (0.073)	0.7675** (0.068)	0.9642 (0.029)	1.3007** (0.127)	0.5146** (0.110)	0.6515** (0.042)	0.8521+ (0.075)	1.1293* (0.062)	0.6696** (0.063)	0.6718** (0.035)	0.7994** (0.069)
	90-100%	1.2584** (0.083)	0.5400** (0.075)	0.4719** (0.058)	0.9105** (0.031)	1.7085** (0.170)	0.3603** (0.111)	0.5018** (0.044)	0.9029 (0.090)	1.3634** (0.075)	0.5240** (0.067)	0.4781** (0.033)	0.8103* (0.078)
	100-110%	1.2991** (0.091)	0.2676** (0.056)	0.4421** (0.066)	0.8754** (0.035)	1.5736** (0.175)	0.4918* (0.160)	0.4500** (0.046)	0.8254+ (0.096)	1.3648** (0.081)	0.3101** (0.056)	0.4476** (0.037)	0.7780* (0.086)
	110-120%	1.5569** (0.117)	0.3558** (0.077)	0.3777** (0.067)	0.8394** (0.039)	1.8945** (0.229)	0.4675* (0.176)	0.5256** (0.059)	0.8035+ (0.105)	1.6532** (0.106)	0.3866** (0.074)	0.4904** (0.045)	0.7726* (0.095)
	>120%	1.7394** (0.137)	0.2075** (0.044)	0.4248** (0.069)	0.7844** (0.038)	3.2604** (0.408)	0.9694 (0.288)	0.6347** (0.071)	0.8579 (0.120)	2.1782** (0.144)	0.3719** (0.063)	0.6020** (0.053)	0.8309 (0.108)
Has junior lien		0.8265** (0.038)	1.2736** (0.117)	1.1273 (0.092)	1.0997** (0.028)	0.7871** (0.050)	0.9161 (0.161)	1.1427* (0.060)	1.2451** (0.077)	0.7879** (0.029)	1.1379 (0.094)	1.1414** (0.050)	1.2131** (0.074)
Full documentation & DTI < =45%		1.2130** (0.073)	1.3302* (0.152)	1.2413* (0.128)	1.0678+ (0.038)	1.0038 (0.089)	1.0910 (0.203)	0.8350* (0.063)	1.2770** (0.119)	1.1987** (0.060)	1.2635* (0.125)	0.9956 (0.061)	1.2143+ (0.128)
Full documentation & DTI > 45%		1.3547** (0.077)	0.8491 (0.104)	1.1282 (0.121)	1.0533 (0.038)	0.9800 (0.082)	1.0366 (0.192)	0.9537 (0.067)	1.0320 (0.095)	1.2741** (0.060)	0.9723 (0.099)	1.0320 (0.062)	0.9529 (0.091)

continued

		First stage of the foreclosure process				Second stage of the foreclosure process (conditional on <i>lis pendens</i>)				Collapsed model			
		Modification	Refinance	Sale	<i>Lis pendens</i>	Modification	Refinance	Sale	Auction	Modification	Refinance	Sale	Auction
Borrower payment behavior:													
no. of months before default		1.0120**	0.9682**	0.9828**	0.9723**	1.0613**	1.0132*	1.0112**	0.9741**	1.0218**	0.9815**	0.9841**	0.9451**
		(0.002)	(0.004)	(0.003)	(0.001)	(0.004)	(0.007)	(0.003)	(0.005)	(0.002)	(0.003)	(0.002)	(0.005)
Payments since default:	>0 but <half	2.8120**	0.9344	0.8840	1.0069	3.0550**	1.2147	0.9781	0.9295	2.6166**	1.0292	0.9456	1.0024
		(0.147)	(0.156)	(0.117)	(0.042)	(0.251)	(0.247)	(0.074)	(0.088)	(0.115)	(0.128)	(0.063)	(0.096)
	>half	1.6214**	0.9134	0.8200**	0.7024**	2.3109**	0.5775**	1.1160*	0.7550**	1.6331**	0.7634**	0.9430	0.8148**
		(0.074)	(0.076)	(0.058)	(0.016)	(0.182)	(0.090)	(0.060)	(0.054)	(0.065)	(0.057)	(0.040)	(0.057)
1-3 months after ARM rate adjustment		1.1455	1.2101	1.3171+	0.8610*	0.9240	1.1071	0.9766	1.1403	1.0387	1.1254	1.0616	1.1469
		(0.165)	(0.196)	(0.217)	(0.060)	(0.164)	(0.256)	(0.096)	(0.140)	(0.116)	(0.149)	(0.089)	(0.140)
4-6 months after ARM rate adjustment		1.4648**	0.8893	1.1454	0.9858	1.2080	1.0940	0.9341	1.2166	1.3422**	0.9471	0.9812	1.2438+
		(0.176)	(0.186)	(0.220)	(0.070)	(0.180)	(0.265)	(0.105)	(0.148)	(0.125)	(0.150)	(0.095)	(0.149)
7-12 months after ARM rate adjustment		1.3258**	0.9362	0.9941	1.1097+	1.0010	1.3231	1.0146	1.1187	1.1842*	1.0682	1.0279	1.1361
		(0.121)	(0.180)	(0.180)	(0.063)	(0.113)	(0.256)	(0.094)	(0.109)	(0.084)	(0.143)	(0.084)	(0.111)
Change in ARM payments:	25-50%	0.5228**	0.9925	1.1032	1.0329	0.5077**	1.2123	0.9841	0.9378	0.5098**	1.0706	1.0320	1.0350
		(0.058)	(0.158)	(0.157)	(0.051)	(0.066)	(0.219)	(0.079)	(0.086)	(0.043)	(0.125)	(0.073)	(0.096)
	> 50%	0.4543**	0.9050	1.1007	1.2733**	0.5131**	1.4546	1.1146	1.0588	0.5418**	1.0020	1.1929	1.2793
		(0.080)	(0.235)	(0.246)	(0.086)	(0.116)	(0.670)	(0.147)	(0.193)	(0.072)	(0.230)	(0.139)	(0.230)
Neighborhood characteristics:													
Recent house price depreciation:	0-10%	1.1947+	0.8576	1.0117	1.0275	1.0505	0.7789	0.9480	1.2680*	1.1672*	0.8212+	0.9936	1.2972**
		(0.111)	(0.104)	(0.122)	(0.034)	(0.122)	(0.141)	(0.073)	(0.119)	(0.084)	(0.083)	(0.064)	(0.120)
	>10%	1.2341*	0.9705	1.1790	0.8943**	1.0044	0.8637	1.0822	1.3715**	1.1482+	0.9324	1.1042	1.3595**
		(0.114)	(0.147)	(0.161)	(0.036)	(0.118)	(0.211)	(0.096)	(0.145)	(0.083)	(0.120)	(0.082)	(0.141)
Recent foreclosure rate:	1-2%	0.9155*	1.0602	0.9969	1.0562*	0.8870+	0.7537*	1.0798	1.0768	0.9115*	0.8989	1.1232**	1.1694*
		(0.040)	(0.086)	(0.073)	(0.027)	(0.059)	(0.103)	(0.054)	(0.076)	(0.034)	(0.062)	(0.047)	(0.082)
	2-3%	0.8118**	0.8890	1.0909	1.1447**	0.7458**	0.8137	1.0265	1.1114	0.8009**	0.7859**	1.1534**	1.3067**
		(0.041)	(0.098)	(0.099)	(0.034)	(0.054)	(0.129)	(0.062)	(0.087)	(0.033)	(0.070)	(0.058)	(0.101)
	3-4%	0.6975**	0.9155	0.9280	1.1549**	0.6719**	0.9014	0.9967	1.1241	0.6960**	0.8411	1.0884	1.3540**
		(0.043)	(0.133)	(0.116)	(0.042)	(0.057)	(0.177)	(0.075)	(0.102)	(0.035)	(0.096)	(0.070)	(0.122)
	>4%	0.6048**	0.9869	0.7676+	1.2910**	0.5993**	0.6690+	1.0670	1.3196**	0.6053**	0.7556*	1.1243+	1.6281**
		(0.042)	(0.153)	(0.109)	(0.048)	(0.053)	(0.144)	(0.084)	(0.117)	(0.033)	(0.094)	(0.077)	(0.145)
Share of non-prime loans:	10-20%	1.1406	0.9490	1.0304	1.1217*	0.9865	1.2043	1.2334*	1.1549	1.1207+	0.9951	1.1424+	1.1692
		(0.092)	(0.127)	(0.113)	(0.051)	(0.113)	(0.261)	(0.111)	(0.151)	(0.074)	(0.112)	(0.081)	(0.154)
	>20%	1.1806*	1.0087	0.9740	1.1598**	0.9674	1.1022	1.2840**	1.4460**	1.1427*	1.0464	1.1436+	1.3855*
		(0.098)	(0.142)	(0.112)	(0.054)	(0.112)	(0.249)	(0.120)	(0.192)	(0.078)	(0.124)	(0.084)	(0.185)
Median income:	<\$30,000	0.9756	0.9620	0.9181	0.9971	1.0586	1.0778	0.9553	0.6971**	0.9952	0.9855	0.9058*	0.6180**
		(0.049)	(0.097)	(0.080)	(0.028)	(0.071)	(0.163)	(0.053)	(0.048)	(0.040)	(0.083)	(0.043)	(0.045)
	\$30-40,000	1.0661	1.0748	1.0625	1.0387	0.9986	0.9716	0.9440	0.7828**	1.0537	1.0284	0.9801	0.7831**
		(0.043)	(0.090)	(0.077)	(0.024)	(0.056)	(0.122)	(0.045)	(0.046)	(0.035)	(0.071)	(0.040)	(0.047)

continued

		First stage of the foreclosure process				Second stage of the foreclosure process (conditional on <i>lis pendens</i>)				Collapsed model			
		Modification	Refinance	Sale	<i>Lis pendens</i>	Modification	Refinance	Sale	Auction	Modification	Refinance	Sale	Auction
Share of Black residents:	20-40%	1.1250*	1.1076	0.8508	1.0243	1.1487	0.9539	0.9730	0.9416	1.1113*	1.0855	0.9287	0.8935
		(0.067)	(0.149)	(0.095)	(0.036)	(0.103)	(0.182)	(0.072)	(0.085)	(0.056)	(0.119)	(0.057)	(0.082)
	40-60%	0.9903	1.3995*	1.0725	1.0895*	1.3558**	0.9279	1.0019	0.9636	1.1015+	1.2562*	1.0170	1.0125
		(0.067)	(0.190)	(0.125)	(0.041)	(0.131)	(0.202)	(0.075)	(0.095)	(0.061)	(0.145)	(0.065)	(0.099)
	60-80%	1.1860*	1.2081	1.0385	1.0861*	1.4464**	0.9395	0.9532	0.9563	1.2510**	1.1572	0.9545	0.9330
		(0.080)	(0.167)	(0.124)	(0.043)	(0.139)	(0.197)	(0.076)	(0.094)	(0.069)	(0.133)	(0.064)	(0.096)
	>80%	1.1390+	1.3375*	0.9645	1.0866*	1.2558*	1.1993	0.9119	1.1289	1.1607**	1.3420**	0.9150	1.1914+
		(0.077)	(0.178)	(0.112)	(0.043)	(0.123)	(0.252)	(0.073)	(0.115)	(0.064)	(0.151)	(0.062)	(0.126)
Share of Hispanic residents:	20-40%	0.9596	1.1129	0.9842	1.1455**	0.9620	1.0683	0.9390	1.2103*	0.9646	1.0740	0.9769	1.3156**
		(0.050)	(0.116)	(0.087)	(0.034)	(0.070)	(0.183)	(0.057)	(0.091)	(0.041)	(0.095)	(0.050)	(0.102)
	>40%	1.0149	0.9705	1.0909	1.1803**	1.1804+	1.0767	0.9890	1.2720*	1.0798	0.9916	1.0491	1.4326**
		(0.068)	(0.133)	(0.123)	(0.044)	(0.112)	(0.223)	(0.074)	(0.126)	(0.059)	(0.112)	(0.067)	(0.146)
Share of Asian residents:	20-40%	0.9414	0.8731	0.9904	0.9991	1.1374	1.2389	1.1063	1.1852	1.0024	0.9680	1.0377	1.1200
		(0.063)	(0.130)	(0.118)	(0.040)	(0.115)	(0.278)	(0.087)	(0.134)	(0.056)	(0.116)	(0.071)	(0.122)
	>40%	0.9825	0.5621	1.5401+	0.8803	1.0524	0.4349	1.1994	1.3767	1.0003	0.6017	1.2992+	0.8858
		(0.156)	(0.202)	(0.346)	(0.084)	(0.251)	(0.326)	(0.194)	(0.295)	(0.134)	(0.188)	(0.186)	(0.286)
Share of foreign born:	40-60%	0.9755	0.9561	0.9083	0.9925	1.1323*	0.9357	1.0697	0.7502**	1.0101	0.9561	1.0115	0.7243**
		(0.034)	(0.070)	(0.059)	(0.021)	(0.058)	(0.106)	(0.046)	(0.041)	(0.029)	(0.059)	(0.037)	(0.040)
	>60%	0.9321	0.9113	0.8070	1.0198	0.9474	0.9727	0.9933	0.6881**	0.9047+	0.9088	0.9228	0.7092**
		(0.068)	(0.146)	(0.109)	(0.042)	(0.099)	(0.259)	(0.082)	(0.079)	(0.055)	(0.122)	(0.066)	(0.080)
Borrower characteristics from HMDA:													
Hispanic		1.1699**	0.9187	0.9969	1.0085	1.0452	0.6206*	1.0144	1.0572	1.1720**	0.8206+	1.0548	1.2059*
		(0.067)	(0.112)	(0.099)	(0.032)	(0.087)	(0.128)	(0.064)	(0.085)	(0.055)	(0.086)	(0.058)	(0.100)
Black		1.1040+	0.9898	0.9732	0.9919	1.2646**	0.8912	1.0099	0.8653*	1.1718**	0.9581	1.0110	0.9475
		(0.058)	(0.096)	(0.084)	(0.029)	(0.094)	(0.125)	(0.056)	(0.062)	(0.050)	(0.075)	(0.048)	(0.072)
Asian		1.1060	1.1138	1.0875	0.9517	0.8212+	0.8731	0.9572	1.2435*	1.0142	1.0513	0.9911	1.3345**
		(0.076)	(0.150)	(0.122)	(0.037)	(0.088)	(0.213)	(0.075)	(0.115)	(0.059)	(0.122)	(0.066)	(0.131)
Female		0.9994	0.9742	0.8984+	1.0145	1.1229*	1.2738*	1.0455	0.8898*	1.0499+	1.0821	1.0015	0.9347
		(0.033)	(0.063)	(0.052)	(0.019)	(0.052)	(0.129)	(0.039)	(0.041)	(0.028)	(0.059)	(0.032)	(0.044)
Has co-borrower		1.1500**	1.2949**	0.8015**	0.6580**	1.1777**	1.1359	1.0575	0.7363**	1.1372**	1.4245**	0.8272**	0.5126**
		(0.042)	(0.103)	(0.061)	(0.018)	(0.069)	(0.166)	(0.064)	(0.062)	(0.035)	(0.101)	(0.039)	(0.043)
Number of Loans													
Number of loan-months		230,335	230,335	230,335	230,335	134,817	134,817	134,817	134,817	349,532	349,532	349,532	349,532

Competing risk models with relative risk ratios reported. Standard errors are in (). Statistical significance is indicated by: +10%, *5%, and **1%.

Sample: LoanPerformance first lien non-prime securitized mortgages originated 2003-2008 in New York City that are ever 90 days delinquent by October 2010.

All models also include: number of months since default; indicators for no or low documentation