Does Bankruptcy Reduce Foreclosure?

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Abstract

In the paper, we examine whether filing for bankruptcy delays or prevents foreclosure, using new household-level panel datasets that combine large samples of prime and subprime mortgages with information on homeowners' non-mortgage debt. Bankruptcy is predicted to delay foreclosure both because legal actions against debtors are stayed for several months during the bankruptcy process and because homeowners gain financially from discharge of unsecured debt in bankruptcy and may use their gains to save their homes. Our main result is that bankruptcy is negatively related to the probability of both foreclosure starting and foreclosure ending with sale of the house, and the relationships are strongly statistically significant. However the number of foreclosures delayed by bankruptcy is small, probably because the 2005 bankruptcy reform made filing much more difficult and costly for debtors.

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Introduction

Mortgage default by homeowners generally results in lenders initiating foreclosure. But homeowners can prevent or delay foreclosure by filing for bankruptcy. There are several reasons why bankruptcy delays foreclosure and why homeowners may gain from the delay. First, bankruptcy filings trigger an "automatic stay" on all legal actions against filers—including foreclosure. To proceed with foreclosure, lenders must petition the bankruptcy court to lift the stay, which causes delay. Bankruptcy particularly delays foreclosure in states that do not require a judicial proceeding (a judge's order) for foreclosure, since the process is much quicker in these states. Second, filing for bankruptcy improves homeowners' financial positions by discharging some unsecured debt and ending wage garnishment. If homeowners wish to keep their homes, they may use the additional funds to repay their mortgage arrears. They may also be able to renegotiate their mortgages or obtain discharge of second mortgages in bankruptcy. Filing for bankruptcy also benefits homeowners because they can live in their homes rent-free during the foreclosure process, which is often lengthened by the bankruptcy filing. Third, lenders respond to mortgage defaults in various ways: they may proceed quickly or slowly to start foreclosure and they may attempt to conclude the foreclosure quickly or delay in order to renegotiate the mortgage terms. This variation in lenders' response means that filing for bankruptcy may delay foreclosure more for some homeowners than others and that filing for bankruptcy may benefit some homeowners more than others.

This paper explores the extent to which bankruptcy delays both the start of the foreclosure process and the end of the process—which is sale of the property at a foreclosure auction. To test the bankruptcy-foreclosure relationship, we construct innovative new datasets that combine large samples of prime and subprime mortgages with information on homeowners' mortgage and non-mortgage debts. Our main result is that bankruptcy is negatively related to the probability of both whether foreclosure starts and whether it ends with sale of the house, and the relationships are strongly statistically significant. However the number of foreclosures that are delayed by bankruptcy is small, probably because the 2005 bankruptcy reform made filing much more difficult and costly for debtors. Additionally, we find that bankruptcy filing helps delay more foreclosure start and liquidation sale for homeowners with positive home equity at the time of the filing. The delay effects are also stronger for the pre-crisis period. Finally, …

Section II of the paper discusses U.S. bankruptcy and foreclosure law and our hypotheses concerning how bankruptcy affects mortgage default and foreclosure. Section III discusses our data and section IV gives results. Section V concludes and discusses policy implications.

Foreclosure and Bankruptcy Law

In this section, we discuss the mortgage foreclosure process in the U.S. and how bankruptcy affects homeowners' incentives to default on their mortgages and lenders' incentives to foreclose. We also consider how the financial crisis that began in 2008 changed homeowners' incentives.

Foreclosure. Lenders have the right to foreclose when homeowners default on their mortgage payments. The foreclosure process is governed by state laws, which determine how long and formal it is. In some states, mortgage lenders must get a court order to foreclose, while in others, they can proceed without court involvement. If homeowners do not repay their mortgage arrears or the mortgage is not renegotiated, the property is eventually sold at a foreclosure auction. In most foreclosures, the sale price of the house is insufficient to repay the mortgage(s)—otherwise homeowners would have sold the house themselves. Some states allow mortgage lenders to pursue "deficiency judgments" against former homeowners, which are unsecured claims for the difference between the amount owed on the mortgage(s) and the foreclosure sale price.[1] Most states also allow homeowners to reclaim the property for a period after foreclosure by repaying the mortgage in full. These periods can last up to a year.

Once they default, homeowners can remain in their homes rent-free for varying periods. Some states force them to leave before the foreclosure sale, while others allow them to stay through the process. In the latter case, they become tenants and the new owner must go through an eviction procedure to force them to leave. The period from default to eviction ranges from a few months to more than a year—and homeowners can extend it by filing for bankruptcy.

Consider homeowners' default decisions. Homeowners may default because they experience economic stress that reduces their ability-to-pay or they may default because doing so makes them better off. Homeowners gain financially from defaulting if the present value of the

[1] To prevent mortgage lenders from selling foreclosed homes for less than market value, some states allow lenders to claim deficiency judgments only if the foreclosure sale has received court approval. See Elias (2008) for discussion of foreclosure law.

future cost of owning (*PVCO*) exceeds the present value of the future cost of renting alternative housing (*PVCR*), or if *PVCO* > *PVCR*. This condition is more likely to hold if home equity is negative, if homeowners expect housing values to fall in the future, or if the terms of the mortgage contract are unfavorable to the homeowner—such as a high interest rate or a "teaser" rate that is about to increase sharply.

Homeowners that default on their mortgages may also default on non-mortgage debt. This causes lenders to pursue collection techniques such as calling debtors at home and at work to demand payment, garnishing debtors' wages if they are employed, and seizing money in their bank accounts if these accounts can be located. Debtors' wages are protected by Federal and state laws that exempt at least 75% or more wages from garnishment and their assets are protected by state asset exemptions, which apply regardless of whether debtors have filed for bankruptcy.

Bankruptcy. How does filing for bankruptcy affect homeowners' gain from defaulting on their mortgages and on their non-mortgage debts?[2] Filing for bankruptcy stops creditors' collection efforts, ends wage garnishment, and stops foreclosure for at least a few months. Many types of unsecured debt—including credit card debts, installment loans, medical bills, and unpaid rent—are discharged.[3] There are two separate personal bankruptcy procedures in the U.S., called Chapters 7 and 13, and most homeowners are allowed to choose between them.

Chapter 7. The most commonly-used bankruptcy procedure is Chapter 7. Most unsecured debts are quickly discharged in Chapter 7, but mortgage contracts cannot be changed.[4] Debtors are obliged to use assets above the exemption levels in their states to repay unsecured debt, but they are not obliged to use of their future earnings to repay. States have separate exemptions for different types of assets, but the exemption for home equity—the "homestead" exemption—is nearly always the largest. Debtors with high incomes are not allowed to file under Chapter 7, but the restriction is generally only binding on debtors whose incomes are above the 90th percentile

[2] For discussion of bankruptcy law and its effect on homeowners, see White (2009), White and Zhu (2010), Morgan et al (2010), Li, White and Zhu (2010), Berkowitz and Hynes (1999) and Lin and White (2001).

[3] Unsecured debts not discharged in bankruptcy include child support obligations, tax obligations, debts incurred by fraud, student loans, and the costs of bankruptcy itself.

[4] The prohibition on changing mortgage terms in bankruptcy is based on the Supreme Court's decision in Nobleman v. American Savings Bank, 508 US 324 (1993) and on 11 U.S.C. § 1322(b)(2), which prevents bankruptcy judges from discharging mortgage debt that is secured only by a primary residence, even if the value of the house is below the mortgage principle. See Levitin and Goodman (2008) for discussion. Note that bankruptcy law in the U.S. is Federal law, so that it is uniform all over the country. But U.S. bankruptcy law allows states to set their own exemptions for home equity and other assets. The state asset exemptions also apply outside of bankruptcy.

of the income distribution.[5] Thus in states with high homestead exemptions, even debtors with high incomes and high assets can use bankruptcy to avoid repaying their unsecured debt.

Homeowners' gain from filing under Chapter 7 can be expressed as:

$$GainCh7 = U_7 + H_7 + \Delta Q_7 - A_7 - C_7$$

U_7 is the value of unsecured debt discharged in Chapter 7. Homeowners benefit from debt discharge regardless of whether they keep their homes. H_7 is the reduction in the present value of future housing costs when homeowners file under Chapter 7. $H_7 = 0$ if homeowners save their homes in Chapter 7, but it equals $(PVCO_7 - PVCR_7)$ if homeowners give up their homes and become renters. Because filing for bankruptcy delays foreclosure, H_7 is larger for homeowners who file for bankruptcy, since they are allowed to live in their homes rent-free for longer. ΔQ_7 denotes the change in the value of home equity when homeowners file for bankruptcy. For homeowners that have negative home equity, give up their homes, and live in states that allow lenders to pursue deficiency judgments, ΔQ_7 equals the increase in the value of home equity due to discharge of deficiency judgments in bankruptcy. Now suppose home equity is positive, but less than the homestead exemption. Outside of bankruptcy, homeowners generally lose their home equity when they default on their mortgages, because homes sold in foreclosure auctions generally sell for the amount of the mortgage. But because bankruptcy delays foreclosure, these homeowners are often able to keep their home equity, either by selling their homes outside of foreclosure or by repaying their mortgage arrears in full—homeowners' ability to repay mortgage arrears increases in bankruptcy since unsecured debt is discharged. However if home equity exceeds the homestead exemption, then homeowners are forced to give up their homes even in bankruptcy, so that filing for bankruptcy does not change their home equity. A_7 is the value of non-exempt assets other than home equity that homeowners must use to repay unsecured debt in bankruptcy. In practice, this term is nearly always zero, since most homeowners can convert their non-exempt assets into exempt home equity or some other exempt asset before filing. C_7 is homeowners' cost of filing for bankruptcy under Chapter 7.

Chapter 13. Chapter 13 is an alternate bankruptcy procedure that is mainly used by homeowners trying to save their homes.[6] In order to file under Chapter 13, homeowners must

[5] The means test for Chapter 7 was adopted as part of the bankruptcy reform of 2005. See White () for discussion.

have regular earnings and must propose a plan to repay their mortgage arrears over 3 to 5 years. Lenders cannot foreclose during the plan period if homeowners are making regular payments and, if homeowners repay all of their mortgage arrears and make all of their regular mortgage payments during the plan period, then the original mortgage contract is reinstated.[7] Filing under Chapter 13 thus benefits homeowners who have large mortgage arrears but wish to save their homes, since it allows them to repay the arrears over several years. The terms of first mortgages cannot otherwise be changed in Chapter 13. But second mortgages and home equity loans can be partially or fully discharged in Chapter 13 if they are underwater and sometimes bankruptcy trustees also challenge fees and penalties that lenders add to mortgages following default.[8]

Filing under Chapter 13 also benefits homeowners who plan to give up their homes, since it delays foreclosure and allows them to live in their homes rent-free for longer. These homeowners often propose repayment plans, but quickly default on the payments. Lenders then must wait until the bankruptcy judge lifts the automatic stay before they can foreclose.

Homeowners' gain from filing under Chapter 13 can be expressed as:

$$GainCh13 = U_{13} + H_{13} + \Delta Q_{13} - \max[E_{13}, A_{13}] - C_{13}.$$

Here U_{13}, the value of unsecured debt discharged in bankruptcy, is the same under both Chapters. H_{13}, the reduction in the cost of housing when homeowners file under Chapter 13, is larger than H_7 for homeowners who shift to rental housing, because Chapter 13 delays foreclosure for longer than Chapter 7. ΔQ_{13}, the increase in the value of home equity when homeowners file under Chapter 13, exceeds ΔQ_7 for homeowners who have positive home equity and large mortgage arrears, since these homeowners would not be able to save their homes in Chapter 7, but may be able to save them in Chapter 13 because of the long repayment period. E_{13} is the value of future earnings that homeowners must use to repay unsecured debt in Chapter 13. This amount equals the difference between homeowners' future earnings and a formula-determined earnings exemption that varies across homeowners. For most homeowners, E_{13} equals zero because the earning exemption is quite high and because mortgages and car

[6] See Carroll and Li (2008), Zhu (2010) and White and Zhu (2010) for discussion of Chapter 13, how it is used by homeowners, and whether they are likely to succeed in saving their homes.
[7] 11 U.S.C. § 1322(c)(1) allows debtors to cure defaults on their mortgages in Chapter 13.
[8] See Porter (2009) and Elias (2009) for discussion.

loans are paid before unsecured debts. A_{13} is the value of non-exempt assets that homeowners must use to repay unsecured debt; this amount is the same as A_7. Homeowners that have both non-exempt future earnings and non-exempt assets are required to repay the maximum of the two in Chapter 13, not the sum. Finally, C_{13} is the cost of filing for bankruptcy under Chapter 13; it is higher than the cost C_7 of filing under Chapter 7. Because of the higher costs of Chapter 13, this chapter only attracts homeowners if their financial gain from filing is higher.

Overall, filing for bankruptcy benefits two separate groups of homeowners: those who plan to save their homes because they have positive home equity, but are in arrears on their mortgage payments, and those who wish to give up their homes, but gain from delay. Homeowners in both situations can increase their gain by filing for bankruptcy.

The housing bubble and the financial crisis. During the housing bubble, most homeowners had positive home equity because house prices were rising. This suggests that many homeowners filed for bankruptcy in order to save their homes. But the mortgage crisis and the subsequent financial crisis and recession caused house prices to fall and wiped out many homeowners' home equity. This suggests that after the crisis, most homeowners filed for bankruptcy in order to increase their financial gain from giving up their homes. In our empirical work, we examine whether bankruptcy was more effective in delaying foreclosure before versus after the financial crisis.

Strategic behavior and the delay effect of bankruptcy. Suppose there are two types of homeowners: strategic versus non-strategic. Non-strategic homeowners are assumed to default on their mortgages only when their ability-to-pay falls; while strategic homeowners default if they gain financially from giving up their homes. Does bankruptcy have a different effect on foreclosure depending on whether homeowners behave strategically or non-strategically?

Following mortgage default, lenders must choose between foreclosing quickly versus delaying foreclosure and, if they delay, they must decide whether to renegotiate the terms of the mortgage contract. Suppose first that lenders never renegotiate (this was common following the financial crisis). Also suppose lenders can identify individual homeowners' types. Then we assume that lenders prefer to delay foreclosure in response to default by non-strategic homeowners, because these homeowners will repay their mortgage arrears in full ("self-cure" in industry parlance) if their ability-to-pay increases. But lenders prefer to foreclose quickly when

strategic homeowners default, because these homeowners will not self-cure unless house values rise. In this situation, strategic homeowners file for bankruptcy following mortgage default, since filing is their only means of delaying foreclosure. In contrast, non-strategic homeowners do not file to delay foreclosure; their filing decisions are made for other reasons and their filings have little effect on the timing of foreclosure. Under these assumptions, bankruptcy is predicted to delay foreclosure by longer for strategic than for non-strategic homeowners. An empirical finding of this type would therefore suggest both that lenders can identify individual homeowners' types and that lenders do not renegotiate mortgages following default.

An alternative possibility is that lenders renegotiate mortgage contracts for strategic homeowners only. This is because strategic homeowners will resume making mortgage payments only if their contracts are changed to make keeping the house financially worthwhile. In contrast, non-strategic homeowners are likely to re-default even if their mortgage payments are reduced, so that renegotiation is not worthwhile and lenders prefer to foreclose quickly. Under this assumption, non-strategic homeowners are likely to file for bankruptcy following default because bankruptcy is their only method of delaying foreclosure, but strategic homeowners do not file because their mortgage contracts are renegotiated. Therefore bankruptcy is predicted to delay foreclosure by longer for homeowners who behave non-strategically. An empirical finding that bankruptcy delays foreclosure by more for non-strategic homeowners thus would suggest both that lenders can identify individual homeowners' types and that they renegotiate only the mortgage contracts of strategic homeowners. [9]

A third possibility is that lenders cannot identify individual homeowners' types and they therefore respond in the same way to defaults by both types. Information concerning homeowners' types is likely to be asymmetric, since mortgage lenders do not receive updated information concerning homeowners' incomes and therefore do not learn whether homeowners have suffered job loss or health problems since the mortgage originated. For homeowners with subprime mortgages, lenders' information is even worse since the initial income information supplied on the mortgage application was often fraudulent. In this situation, lenders' best strategy following default is to play mixed by sometimes delaying foreclosure, sometimes

[9] A recent *New York Times* article suggests that Bank of America forecloses quickly on non-strategic homeowners, while renegotiating mortgage terms with strategic homeowners. See Schwartz (2011). Recent evidence suggests that this strategy makes sense because homeowners often quickly default again when their mortgages are regotiated (Agarwal et al, 2011). Gerardi et al (2007) present evidence concerning homeowners' self-cure rates following mortgage default.

renegotiating, and sometimes foreclosing quickly. In this situation, bankruptcy is predicted to have the same delay effect on foreclosure for both types of homeowners. Thus if we find that bankruptcy delays foreclosure by the same amount for both types of homeowners, the result will provide evidence that lenders cannot identify individual homeowners' types.

Data and summary statistics

We construct separate datasets of prime and subprime mortgages, each combining several sources of information.[10] For our prime mortgage dataset, we start with a large sample of prime mortgages that originated in 2004, 2005 or 2006, from LPS Applied Analytics. Only first mortgages are included. LPS provides information from homeowners' mortgage applications concerning their financial situation, characteristics of the property, terms of the mortgage contract, and information about securitization, plus updates on whether homeowners paid in full or defaulted, whether they filed for bankruptcy, whether lenders started foreclosure and whether the home was sold in foreclosure. We also use information from the FRB Consumer Credit Panel Data, which is a 5% random sample of all individuals in the U.S. that have credit bureau files. It provides information on credit card loans, installment loans, car loans, student loans, and second mortgages/home equity loans. For each loan, updates are provided concerning the current loan principle, credit limits where applicable, and whether default or bankruptcy occurred. [11] Because the FRB data are quarterly and the LPS data are monthly, we convert all data to quarterly. We also merge our data with data from the Home Mortgage Disclosure Act (HMDA), which covers all mortgage originations in the U.S. HMDA provides information on homeowners' race, sex, age, and income at the time of the mortgage application, plus whether the mortgage was co-signed. For our subprime mortgage dataset, we start with a large sample of

[10] Most of the related literature models mortgage default rather than foreclosure and uses only subprime mortgage data. See, for example, Jiang et al (2010), Demyanyk and van Hemet (2011), Mayer et al (2009), and Keys et al (2010). For comparison of prime versus subprime mortgage default behavior, see Li et al (2010). Foote et al (2008), Gerardi et al (2007) and Morgan et al (2010) examine foreclosure.

[11] Our bankruptcy variable equals one if either the FRB or the mortgage data indicate that a homeowner filed for bankruptcy during the relevant quarter. The bankruptcy indicators from the two datasets mostly coincide, but variable reporting lags mean that filing dates sometimes differ by one quarter.

subprime first mortgages from CoreLogic, Inc., that originated during the same period.[12] We then merge our sample of subprime mortgages with the same additional datasets.[13] [14]

The resulting samples of prime and subprime first mortgages are followed quarterly from the date of origination or the first quarter of 2006, whichever occurs later, until the date of mortgage termination or the last quarter of 2010, whichever occurs earlier. We start our sample period in 2006 so that all observations are after the 2005 bankruptcy reform. Mortgage terminations may occur because the home is sold, refinanced, transferred to a different servicer, or because foreclosure occurred. It should be noted that mortgages in our sample originated near the peak of the housing bubble. [15]

Our prime and subprime samples contain 226,000 and 176,000 separate mortgages, respectively, for which we have about 2.7 and 2.4 million quarterly observations, respectively. In our prime sample, 4.2% of homeowners file for bankruptcy at some point during the 2006-2010 sample period, 8.5% of prime mortgages start foreclosure, and 3.5% of properties are liquidated in foreclosure. In our subprime sample, 6% of homeowners file for bankruptcy during the sample period, 24% of mortgages start foreclosure and 11% of homes are sold in foreclosure.[16] (See table 1.) Comparing the probability of foreclosure for homeowners who file versus do not file for bankruptcy, foreclosure starts for 46% of homeowners with prime mortgages who file for bankruptcy, compared to only 6.7% of homeowners with prime

[12] We use subprime mortgages from CoreLogic, because it has better coverage than LPS of subprime mortgages. CoreLogic covers nearly all mortgages that were in non-agency subprime mortgage securitizations. Around 72% of all subprime mortgages issued during our period were included in non-agency securitizations, making our sample fairly representative of all subprime mortgages. (See Ashcraft and Schuermann, 2008, table 1.)

[13] We first merge the HMDA data with LPS/CoreLogic and merge the FRBNY Consumer Credit Panel with LPS/CoreLogic. Then we merge the two datasets with each other. The match between HMDA and LPS/CoreLogic is done by linking mortgages based on the zipcode of the house, the date of origination of the mortgage (within 5 days), the origination amount (within $500), the purpose of the loan (purchase, refinance or other), the type of mortgage (conventional, VA guaranteed, FHA guaranteed or other), occupancy type (owner-occupied or non-owner-occupied), and lien status (first lien or other). The match between FRBNY Consumer Credit Panel with LPS/CoreLogic is done by linking mortgages based on the zipcode of the house, the date of origination of the mortgage, and the origination amount. The match rates between LPS/Corelogic are between 40 and 50 percent. The match rates between LPS/CoreLogic and the FRB Consumer Credit Panel are 3-4%, depending on year. Note that the match rate cannot be greater than 5%, because the FRB Panel covers only 5% of consumers with credit bureau files. We delete observations with missing information on the age of the borrower, age of the loan, or appraisal amount, or if the mortgage principle was less than $2,000 at origination.

[14] The only other paper that uses matched data on mortgage and non-mortgage debt is Elul et al (2010). Their paper focuses on explaining mortgage default.

[15] We also delete mortgages from counties that were affected by Hurricanes Katrina and Rita, which occurred in August and September 2005. This is because many homeowners in these counties delayed making mortgage payments after the hurricanes and their delinquencies were treated as defaults by mortgage lenders.

mortgages who do not file. For our subprime mortgage sample, these figures are 73% and 21%, respectively. Similarly, if homeowners file for bankruptcy, foreclosure ends with sale of the house for 20% of prime mortgages and 33% of subprime mortgages, while if homeowners do not file for bankruptcy, these figures are 2.7% and 9.4%, respectively. The raw data therefore suggest that bankruptcy filings and foreclosures are positively rather than negatively related.

Table 2 shows the timing of bankruptcy filings for those mortgages in which both foreclosure and bankruptcy occurred. The majority of bankruptcy filings—75% for prime mortgages and 53% for subprime mortgages—occur before foreclosure starts, suggesting that homeowners use bankruptcy to prevent foreclosure. Nearly all of the remainder of filings occur during the foreclosure process and are presumably intended to delay foreclosure liquidation. Only 2% of bankruptcy filings occur after foreclosure liquidation—these homeowners probably file in order to have deficiency judgments discharged. Note also that the filings are substantially lower in 2006 for both prime and subprime mortgage owners largely due to the implementation of the consumer bankruptcy reform act in October 2005 which caused households to rush to file for bankruptcy.

Specification

Now turn to our empirical specification. Suppose F_{it} denotes a foreclosure event for mortgage *i* in quarter *t*, where the event can be either the start of foreclosure or the sale of the property in foreclosure. Also suppose B_{it} equals 1 if homeowner *i* files for bankruptcy in quarter *t*. We estimate the following model:

$$F_{it} = a - bB_{it} - cX_{it} + dT_t + fS_i + \mu_{it} \qquad (1)$$

Here X_{it} denotes a vector of control variables (some of which may be lagged), T_t denotes quarter fixed effects, and S_i denotes state fixed effects. We drop mortgages in the quarter following a foreclosure event or a bankruptcy filing. The hypothesis being tested is therefore that the foreclosure event F_{it} is less likely to occur in quarter *t* if homeowners file for bankruptcy in that quarter. (Below, we also test whether bankruptcy filings affect foreclosure events in later quarters.)

Because bankruptcy and foreclosure are likely to be jointly determined, we also estimate a model of bankruptcy filings:

$$B_{it} = gZ_{it} + jT_t + kS_i + \nu_{it} \qquad (2)$$

Here the vector of control variables Z_{it} includes all of the variables in X_{it}, plus three additional variables that affect whether homeowners file for bankruptcy but not whether foreclosure occurs: the aggregate bankruptcy filing rate in the homeowner's bankruptcy court district lagged one quarter, the homestead exemption level in the homeowner's state of residence, and an interaction of the homestead exemption with a dummy variable for whether the homeowner's income at the time of mortgage origination exceeded the state median income level. The lagged aggregate bankruptcy filing rate in the district is related to district-level economic conditions, to the level of bankruptcy stigma in the district, and to variations in local bankruptcy court practices that make bankruptcy more or less pro-debtor. (Individual states have between one and four bankruptcy court districts.) The homestead exemption is the amount of home equity that is exempt in bankruptcy in the homeowner's state of residence; it is related to the financial attractiveness of bankruptcy since homeowners can keep more valuable homes in states with higher exemption levels. In states with high exemptions, homeowners can also keep other financial assets in bankruptcy, by converting them into home equity before filing. However many homeowners' assets are less than the relevant homestead exemption, which means that the exemption affects mainly well-off homeowners. We therefore also include an interaction between the exemption level and a dummy variable for whether homeowners' income at the time of mortgage origination exceeds the state median income level. Previous research has shown that both the lagged district-level bankruptcy filing rate and the interaction of the homestead exemption and the income dummy are related to individual-level bankruptcy decisions (see Fay, Hurst and White, 2002, and Miller, 2011). [17]

Because both foreclosure events and bankruptcy filings are both qualitative variables, we need a non-linear estimation procedure. We also need a simultaneous equations estimation technique that takes account of the joint determination of foreclosure and bankruptcy. Green

[17] Data concerning bankruptcy exemptions is taken from Elias (2008b), various editions. In states that have unlimited homestead exemptions, we set the value of the exemption at one million dollars. There are 94 bankruptcy districts in total. We are grateful to Ted Eisenberg for providing us with a program that assigns counties to bankruptcy districts.

(2003) shows that models of this type can be estimated using bivariate probit, which assumes that the disturbance terms in (1) and (2) have a bivariate normal distribution.[18]

Table 3 gives summary statistics for both prime and subprime mortgages, using our base case samples which drop mortgages in the quarter after the start of foreclosure. Note that the bankruptcy and foreclosure start rates are much lower than in table 1, because the values in table 2 are averages per quarter. Control variables include the age and age squared of the mortgage,[19] a dummy variable for whether home equity was negative in the previous quarter, a dummy for whether income exceeds the state median household income level lagged one quarter,[20] a dummy for whether homeowners are liquidity-constrained which equals one if they used more than 100% of their available revolving credit in the previous quarter, an interaction between the negative home equity and liquidity constraint dummies, homeowners' total revolving debt balance lagged one quarter, homeowners' risk score at the time of the mortgage application, a set of mortgage and property characteristics taken from the mortgage application, a dummy variable for whether the mortgage was originated by an independent mortgage broker (the omitted category is mortgages originated directly by the lender), and a few demographic characteristics: homeowners' age, age squared, sex, race and whether the mortgage has a co-signer (usually interpreted as a dummy for married). We also include a measure of homeowners' gain from refinancing at the current interest rate each quarter.[21] The unemployment rate in the metropolitan area lagged one quarter is used to capture regional economic conditions. Variables that are updated each quarter are marked with asterisks in Table 3.

The main differences between the samples are that homeowners with subprime mortgages have lower risk scores, lower incomes at origination, lower revolving debt balances, are more likely to have negative home equity, are more likely to be liquidity-constrained, and their mortgages are less likely to be fixed rate. Reflecting the pattern of frequent churning of

[18] Green (2003 and 1998) shows that bivariate probit estimation can be used for this type of model regardless of whether the model is recursive or not. Also see Maddala (1983, pp. 122-123).

[19] See Demyanyk and van Hemert (2011) and Jiang et al (2010) for discussion of how mortgage age affects default decisions.

[20] Home equity is recalculated each quarter by updating the value of the house at the time of mortgage origination using the average increase in housing values in the metropolitan area since the mortgage originated. Then the mortgage principle in the current quarter is subtracted. For mortgages not in metropolitan areas, we use the housing price index for the state. Homeowners' income is updated each quarter using the average rate of growth of income in the relevant state since the mortgage originated.

[21] The measure is $\{r_0[1-(1+r_t)^{t-M}]\}/\{ r_t[1-(1+r_0)^{t-M}]\}$, where r_0 is the interest rate on the homeowner's existing mortgage, r_t is the interest rate currently available on new mortgages, and M is the remaining term of the mortgage. See Richard and Roll (1989). When this measure is higher, the gain from refinancing is greater.

subprime mortgages, these mortgages have lower average ages and are more likely to have been for refinance rather than purchase.

Results

Table 4A shows the results of estimating eqs. (1) and (2) with bivariate probit, using the full samples. The foreclosure event being explained is foreclosure start. State and quarter fixed effects are included and errors are clustered by mortgage. The figures shown are marginal effects, with *p*-values in parentheses. Results shown in the top panel are for prime mortgages and those in the bottom panel are for subprime mortgages. The correlation between the two structural disturbances, ρ, is .47 for the prime mortgage sample and .44 for the subprime mortgage sample. Both are statistically significant ($p < 0.001$) and Wald tests for whether ρ equals zero were also significantly different from zero. These results imply that unobserved factors that make homeowners more likely to file for bankruptcy also make lenders more likely to start foreclosure. The fact that ρ is significantly different from zero confirms the need for an estimation method that takes account of the interdependence between the two decisions.

Examining the bankruptcy equations, the lagged district-level bankruptcy filing rate is always positive and strongly statistically significant, the homestead exemption by itself is insignificant in both samples, and the interaction of the homestead exemption and the high-income dummy is positive and statistically significant in the prime mortgage sample.[22] Homeowners with both types of mortgages are also more likely to file for bankruptcy if they have higher revolving debt, negative home equity and lower risk scores, if they are liquidity-constrained, and if they are more than 90 days delinquent on their mortgages.[23] These individual-level financial variables are also highly significant in predicting the start of foreclosure. The fact that these variables are significant predictors of lenders' decisions to start foreclosure suggests that lenders vary their foreclosure strategy in response to homeowners' individual financial characteristics, presumably because they expect that different strategies work best for different types of homeowners.

Table 4B shows the results when we repeat the estimation, but the foreclosure variable is foreclosure liquidation rather than foreclosure start. Again the top panel is for prime mortgages and the bottom for subprime mortgages. The results are similar to those shown in table 4A, with

[22] This result suggests that income figures given on subprime mortgage applications were often fraudulent.
[23] However in the subprime sample, homeowners with high income are more rather than less likely to file for bankruptcy and lenders are more likely to start foreclosure—the opposite sign as the results in the prime sample.

$\rho = .30$ for the prime mortgage sample and .33 for the subprime mortgage sample ($p < 0.001$ for both). Although fewer individual homeowner financial characteristics are significant, some of these variables are again significant in explaining both bankruptcy and foreclosure liquidation, suggesting that lenders take some homeowner financial characteristics into account even in deciding when to complete the foreclosure process.

Table 5 shows the marginal effects of filing for bankruptcy on whether lenders start foreclosure or whether foreclosure liquidation occurs in the same quarter.[24] The results are shown both as marginal effects and as semi-elasticities, where the latter equals the change in the probability of foreclosure start or liquidation occurring when homeowners file for bankruptcy in the same quarter. All of these relationships are strongly statistically significant ($p < 0.001$). The semi-elasticities for foreclosure start are -1.06 for prime mortgages and -1.09 for subprime mortgages, while those for foreclosure liquidation are -1.12 for prime mortgages and -2.45 for subprime mortgages. Thus when homeowners file for bankruptcy, there is a large decrease in the probability of foreclosure occurring.

However because few homeowners in our samples actually file for bankruptcy, our results suggest that bankruptcy does not delay or prevent a large number of foreclosures. Using all mortgages that originated in 2004, 2005 and 2006 as a base, our estimate of the number of foreclosure starts that would be delayed by bankruptcy if the bankruptcy filing rates doubled is 32,000,000((.81)(.0069)(.042) + (.19)(.017)(.06) = 14,142 per year. Here 32,000,000 is the number of mortgages that originated in the three years, .81 and .19 are the breakdown of mortgages into prime versus subprime, and .042 and .06 are the increases in the probability of bankruptcy if the filing rates for prime and subprime mortgage-holders doubled.[25] The fact that few foreclosures are prevented is because relatively few homeowners in our samples file for bankruptcy—probably because the 2005 bankruptcy reform took effect just before our sample period and it made filing for bankruptcy much more difficult and expensive for debtors.

Because bankruptcy filings may affect foreclosure both in the current quarter and later, we rerun our base case model except that the foreclosure events are redefined to be whether foreclosure starts and whether foreclosure liquidation occurs in either the same quarter or the next quarter. The results are shown in table 6. Comparing the results in tables 5 and 6, we find

[24] The marginal effects are calculated using the procedures discussed in Greene (1998).
[25] The breakdown of mortgages between prime and subprime is based on figures in Mayer and Pence (2008). We use an average of their high and low figures.

that the marginal effects for prime mortgages increase by around 5 percent for foreclosure start and 36 percent for liquidation sale, implying that bankruptcy filings reduces foreclosure in both the quarter when they occur and the subsequent quarter. For subprime mortgages, however, the effects become smaller for both foreclosure start and liquidation sale.

We also examined whether filing for bankruptcy is more likely to delay foreclosure when homeowners' mortgages are above-water and they wish to save their homes versus when homeowners' mortgages are under-water and they may wish to give up their homes. To do so, we reran the models in table 4A and 4B, except that we separate observations in which mortgages are underwater versus above-water. The results for the bankruptcy coefficients are shown in table 7. They suggest that bankruptcy is more effective in delaying the start of foreclosure and liquidation for prime and subprime mortgages that are above-water. These results could suggest that bankruptcy trustees provide more help to homeowners if homeowners are trying to save their homes, i.e., they have positive home equity in the house.

August 2008 marks the beginning of the mortgage crisis. Since then, many government policies have been put into effect to delay foreclosure start and foreclosure sale. To test the robustness our results, we re-conduct our baseline analysis separating the observations into pre-crisis period (2006Q1 to 2008Q2) and post-crisis period (2008Q3 to 2010Q4). The results are reported in table 8. They suggest that the bankruptcy is more effective for the pre-crisis period. After the crisis, while filing for bankruptcy still helps delay foreclosure start, it no longer helps delay liquidation sale.

Conclusion

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Table 1:
Probability of Bankruptcy, Foreclosure Start, and Foreclosure Sale Occurring At Any Time During the Sample Period, 2006Q1 to 2010Q4

	Full sample		If homeowner files for bankruptcy		If no bankruptcy filing	
Probability of:	Prime	Subprime	Prime	Subprime	Prime	Subprime
Bankruptcy	0.042	0.060	1.000	1.000	0.000	0.000
30-day delinquency	0.245	0.483	0.731	0.901	0.223	0.457
Foreclosure start	0.084	0.242	0.463	0.723	0.068	0.211
Foreclosure liq.	0.035	0.109	0.205	0.333	0.027	0.094

Notes: Mortgages are coded as one if the event occurred at any time during the period and the figures given are averages over all mortgages.

Table 2:
Timing of Bankruptcy Filings Relative to Foreclosure

	Prime	Subprime
Fraction of bankruptcy filings:		
Before foreclosure start	.75	.53
During the foreclosure process	.23	.45
After foreclosure sale	.02	.02
In 2006	7.16	14.02
In 2007	15.14	23.94
In 2008	23.04	23.87
In 2009	28.78	18.51
In 2010	25.87	15.00

Note: Figures give the timing of bankruptcy for mortgages in which both foreclosure and bankruptcy occurred.

Table 3: Summary Statistics

	Prime Mortgages	Subprime Mortgages
Foreclosure start rate	0.00653 (0.0806)	0.0150 (0.125)
Bankruptcy filing rate	0.00245 (0.0495)	0.00240 (0.0490)
District bankruptcy filing rate (%), lagged	0.000709 (0.00084)	0.00114 (0.000712)
Homestead exemption ($000)	217 (353)	226 (364)
If home equity is negative, lagged	0.153 (0.359)	0.201 (0.400)
If income > state median at origination, lagged	0.651 (0.477)	0.548 (0.498)
Interaction of negative home equity and liquidity constraint, lagged	0.0211 (0.144)	0.0470 (.212)
Revolving debt balance, lagged ($000)*	24.4 (65.0)	12.3 (36.4)
If liquidity-constrained, lagged*	0.0944 (0.292)	0.196 (0.397)
Homeowner's age (years)	47.0 (12.9)	46.7 (12.2)
Mortgage age (quarters)	7.69 (6.12)	12.2 (6.39)
If mortgage co-signed	0.540 (0.498)	0.380 (0.485)
Income at origination ($000)	96.6 (116)	73.9 (74.2)
Risk score at origination	718 (74.0)	645 (85.2)
If mortgage had full documentation	0.345 (0.475)	0.679 (0.467)
If primary residence	0.907 (0.291)	0.952 (0.213)
If property is single family	0.792 (0.405)	0.796 (0.403)
If mortgage was acquired wholesale	0.183 (0.387)	0.104 (0.306)
If fixed rate mortgage	0.755 (0.430)	0.227 (0.419)
If mortgage was for refinance (versus purchase)	0.485 (0.500)	0.646 (0.478)
Homeowner's gain from refinancing	0.981 (0.106)	0.819 (0.125)
Metropolitan unemployment rate (%), lagged	5.62 (2.44)	6.58 (2.68)

Notes: The samples used here drops mortgages in the quarter after foreclosure starts or a bankruptcy filing occurs. Figures are averages over all mortgage-quarter observations. Standard deviations are given in parentheses. All lags are one quarter, except for the divorce rate which is lagged one year. Asterisks indicate variables that are updated each quarter. Variable definitions are given in the text. We set the homestead exemptions to be $1 million for states that have unlimited homestead exemptions. Our agreements with data vendors require that we not report mean values or regression coefficients for homeowners' gender or race.

Table 4A: Bivariate Probit Results Explaining Foreclosure Start and Bankruptcy

Prime Mortgages	Foreclosure Start	Bankruptcy
If file for bankruptcy	-0.00565 (0.000)	
District bankruptcy filing rate lagged (%)		0.447 (0.000)
Homestead exemption ($000)		2.13e-6 (0.352)
Homestead exemption *(If income > state median)		5.44e-07 (0.014)
If mortgage is more than 90 days delinquent, lagged	0.0198 (0.000)	0.00385 (0.000)
If home equity is negative, lagged	0.00247 (0.000)	0.00105 (0.000)
If income > state median at origination, lagged	-0.000235 (0.051)	-0.000287 (0.001)
Revolving debt balance, lagged (thousands $)	1.57e-6 (0.000)	1.39e-6 (0.000)
If liquidity-constrained, lagged	0.00253 (0.000)	0.00244 (0.000)
Interaction of negative home equity and liquidity constraint, lagged	-0.000943 (0.002)	-0.000292 (0.137)
Homeowner's age (years)	-0.000138 (0.000)	4.8e-5 (0.006)
Homeowner's age squared (years)	1.23e-6 (0.000)	-4.10e-7 (0.019)
Mortgage age (quarters)	5.83e-5 (0.171)	0.000193 (0.000)
Mortgage age squared (quarters)	-2.39e-6 (0.213)	-7.98e-6 (0.000)
If mortgage co-signed	-0.00153 (0.000)	0.000206 (0.014)
Risk score at origination	-2.06e-5 (0.000)	-1.26e-5 (0.000)
If mortgage had full documentation	-0.00101 (0.000)	-0.000227 (0.004)
If primary residence	0.000423 (0.018)	7.85e-5 (0.544)
If property is single family	0.0366 (0.006)	3.16e-5 (0.748)
If mortgage acquired wholesale	-9.72e-5 (0.498)	9.98e-5 (0.291)
If fixed rate mortgage	-0.00279 (0.000)	-0.000499 (0.000)
If mortgage was for refinance (versus purchase)	-0.000627 (0.000)	0.000547 (0.000)
Homeowner's gain from refinancing	-0.0198 (0.000)	-0.00214 (0.000)
Metropolitan area unemployment rate (%), lagged	0.000202 (0.000)	9.35e-5 (0.000)
State dummies?	Y	Y
Quarter dummies?	Y	Y
Rho	.465 (0.000)	
Chi-squared test	498 (0.000)	

Subprime Mortgages	Foreclosure Start	Bankruptcy
If file for bankruptcy	-0.0131 (0.000)	
District bankruptcy filing rate lagged (%)		0.942 (0.000)
Homestead exemption ($000)		1.89e-6 (0.434)
Homestead exemption *(If income > state median)		1.88e-07 (0.360)
If mortgage is more than 90 days delinquent, lagged	0.0536 (0.000)	0.00562 (0.000)
If home equity is negative, lagged	0.00111 (0.000)	0.000281 (0.006)
If income > state median at origination, lagged	0.000613 (0.000)	0.000245 (0.001)
Revolving debt balance, lagged (thousands $)	6.66e-6 (0.001)	1.86e-6 (0.006)
If liquidity-constrained, lagged	0.00235 (0.000)	0.00127 (0.000)
Interaction of negative home equity and liquidity constraint, lagged	-0.000487 (0.271)	5.43e-5 (0.756)
Homeowner's age (years)	-0.000228 (0.000)	-1.12e05 (0.355)
Homeowner's age squared (years)	1.87e-6 (0.000)	8.88e-8 (0.460)
Mortgage age (quarters)	-0.0014 (0.000)	-3.02e-5 (0.150)
Mortgage age squared (quarters)	-6.28e-6 (0.040)	-3.48e-6 (0.000)
Mortgage co-signed	-0.00214 (0.000)	0.000271 (0.000)
Risk score at origination	-8.83e-6 (0.000)	-1.26e-6 (0.000)
If mortgage had full documentation	-0.00176 (0.000)	-0.000276 (0.000)
If primary residence	-0.00200 (0.000)	8.05e-5 (0.502)
If property is single family	-0.000407 (0.046)	6.66e-5 (0.318)
If mortgage acquired wholesale	-0.000227 (0.417)	2.91e-5 (0.730)
If fixed rate mortgage	-0.00170 (0.000)	0.000356 (0.000)
If mortgage was for refinance (versus purchase)	-0.00323 (0.000)	0.000112 (0.043)
Homeowner's gain from refinancing	-0.0302 (0.000)	0.00163 (0.000)
Unemployment rate, lagged	0.00117 (0.000)	3.37e-5 (0.512)
State dummies?	Y	Y
Quarter dummies?	Y	Y
Rho	.442 (0.000)	
Chi-squared test	489 (0.000)	

Note: The sample used here drops mortgages in the quarter after foreclosure starts or a bankruptcy filing occurs. Figures given are marginal effects with *p*-values in parentheses.

Table 4B:
Bivariate Probit Results Explaining Foreclosure Liquidation and Bankruptcy

Prime Mortgages	Foreclosure Liq.	Bankruptcy
If file for bankruptcy	-.000157 (0.000)	
District bankruptcy filing rate lagged (%)		0.297 (0.000)
Homestead exemption ($000)		1.48e-6 (0.335)
Homestead exemption *(If income > state median)		7.27e-7 (0.004)
If mortgage is more than 90 days delinquent, lagged	0.000408 (0.000)	0.00372 (0.000)
If home equity is negative, lagged	-2.55e-5 (0.000)	0.000718 (0.000)
If income > state median at origination, lagged	-3.85e-6 (0.261)	-0.000210 (0.000)
Revolving debt balance, lagged (thousands $)	-2.09e-8 (0.398)	1.04e-6 (0.000)
If liquidity-constrained, lagged	-5.51e-6 (0.160)	0.00159 (0.000)
Interaction of negative home equity and liquidity constraint, lagged	-2.65e-6 (0.743)	-0.000309 (0.024)
Homeowner's age (years)	-2.85e-6 (0.000)	3.64e-5 (0.002)
Homeowner's age squared (years)	2.60e-8 (0.000)	-3.06e-7 (0.009)
Mortgage age (quarters)	1.40e-6 (0.000)	0.000119 (0.000)
Mortgage age squared (quarters)	-6.69e-8 (0.000)	-4.75e-6 (0.000)
Mortgage co-signed	-6.57e-6 (0.032)	0.000142 (0.012)
Risk score at origination	7.22e-8 (0.000)	-7.67e-6 (0.000)
If mortgage had full documentation	-1.5e-5 (0.000)	-0.000198 (0.000)
If primary residence	-1.96e-5 (0.060)	6.58e-5 (0.461)
If property is single family	-7.96e-6 (0.024)	4.52e-5 (0.499)
If mortgage acquired wholesale	-1.29e-6 (0.732)	6.94e-5 (0.282)
If fixed rate mortgage	-2.37e-5 (0.000)	-0.000329 (0.000)
If mortgage was for refinance (versus purchase)	-2.90e-5 (0.000)	0.000351 (0.000)
Homeowner's gain from refinancing	-0.000125 (0.000)	-0.00118 (0.000)
Unemployment rate, lagged	1.20e-6 (0.186)	3.94e-5 (0.019)
State dummies?	Y	Y
Quarter dummies?	Y	Y
Rho	.299 (0.000)	
Chi-squared test	39.1 (0.000)	

Subprime Mortgages	Foreclosure Liq.	Bankruptcy
If file for bankruptcy	-0.00636 (0.000)	
District bankruptcy filing rate lagged (%)		1.26 (0.000)
Homestead exemption ($000)		2.13e-6 (0.439)
Homestead exemption *(If income > state median)		1.81e-7 (0.477)
If mortgage is more than 90 days delinquent, lagged	0.0263 (0.000)	0.0109 (0.000)
If home equity is negative, lagged	-0.00109 (0.000)	0.000145 (0.265)
If income > state median at origination, lagged	-0.000407 (0.000)	0.000500 (0.000)
Revolving debt balance, lagged (thousands $)	2.14e-6 (0.149)	1.93e-6 (0.049)
If liquidity-constrained, lagged	-0.000226 (0.093)	0.00160 (0.000)
Interaction of negative home equity and liquidity constraint, lagged	-0.000477 (0.105)	8.71e-5 (0.708)
Homeowner's age (years)	-0.000147 (0.000)	5.09e-6 (0.014)
Homeowner's age squared (years)	1.35e-6 (0.000)	-9.40e-8 (0.663)
Mortgage age (quarters)	3.25e-5 (0.512)	-4.27e-5 (0.143)
Mortgage age squared (quarters)	-4.16e-6 (0.034)	-3.38e-6 (0.015)
Mortgage co-signed	-0.000603 (0.000)	.000514 (0.000)
Risk score at origination	4.00e-6 (0.000)	-2.69e-6 (0.000)
If mortgage had full documentation	-0.000716 (0.000)	-0.000365 (0.000)
If primary residence	-0.00257 (0.000)	0.000131 (0.526)
If property is single family	-0.000309 (0.011)	9.00e-5 (0.426)
If mortgage acquired wholesale	-0.000445 (0.011)	0.000221 (0.122)
If fixed rate mortgage	-0.000602 (0.000)	0.000529 (0.005)
If mortgage was for refinance (versus purchase)	-0.00164 (0.000)	0.000267 (0.005)
Homeowner's gain from refinancing	-0.00912 (0.000)	0.00167 (0.000)
Unemployment rate, lagged	0.000195 (0.005)	1.12e-5 (0.863)
State dummies?	Y	Y
Quarter dummies?	Y	Y
Rho	0.326 (0.000)	
Chi-squared test	40.8 (0.000)	

Note: The sample used here drops mortgages in the quarter after foreclosure starts or a bankruptcy filing occurs. Figures given are marginal effects with *p*-values in parentheses.

Table 5:

Bivariate Probit Results Explaining the Effect of Bankruptcy on Foreclosure Start and Foreclosure Liquidation

Full Sample

	Prime Mortgages	Subprime Mortgages
Foreclosure start		
Marginal effect (*p*-value)	-0.0069 (0.000)	-0.0174 (0.000)
Semi-elasticity	-1.062	-1.088
Foreclosure liquidation		
Marginal effect (*p*-value)	-0.0028 (0.000)	-0.0147 (0.000)
Semi-elasticity	-1.120	-2.450

Table 6:

Bivariate Probit Results Explaining the Effect of Bankruptcy on Foreclosure Start and Foreclosure Liquidation in the Current and Next Quarter

Full Sample

	Prime Mortgages	Subprime Mortgages
Foreclosure start		
Marginal effect (*p*-value)	-0.0073 (0.000)	-0.0101 (0.000)
Semi-elasticity	-1.1231	-0.6273
Foreclosure liquidation		
Marginal effect (*p*-value)	-0.0038 (0.000)	-0.0106 (0.000)
Semi-elasticity	-1.4615	-1.7377

Table 7:

Bivariate Probit Results Explaining the Effect of Bankruptcy on Foreclosure Start and Foreclosure Liquidation: Underwater versus Above-water Mortgages

Underwater Mortgages

	Prime Mortgages	Subprime Mortgages
Foreclosure start		
Marginal effect (*p*-value)	-0.008 (0.000)	-0.0074 (0.000)
Semi-elasticity	-0.80	-0.513
Foreclosure liquidation		
Marginal effect (*p*-value)	0.0560 (0.024)	-0.0107 (0.000)
Semi-elasticity	24.35	-2.377

Above-water Mortgages

	Prime Mortgages	Subprime Mortgages
Foreclosure start		
Marginal effect (*p*-value)	-0.0067 (0.000)	-0.019 (0.000)
Semi-elasticity	-1.136	-1.166
Foreclosure liquidation		
Marginal effect (*p*-value)	-0.0033 (0.000)	-0.017 (0.000)
Semi-elasticity	-1.330	-3.122

Table 8:

Bivariate Probit Results Explaining the Effect of Bankruptcy on Foreclosure Start and Foreclosure Liquidation: Before versus After the Financial Crisis

Before Period

	Prime Mortgages	Subprime Mortgages
Foreclosure start		
Marginal effect (*p*-value)	-0.0042 (0.000)	-0.0135 (0.00)
Semi-elasticity	-1.000	-0.750
Foreclosure liquidation		
Marginal effect (*p*-value)	-0.0023 (0.000)	-0.0163 (0.000)
Semi-elasticity	-1.643	-2.629

After Period

	Prime Mortgages	Subprime Mortgages
Foreclosure start		
Marginal effect (*p*-value)	-0.0094 (0.000)	-0.014 (0.000)
Semi-elasticity	-0.979	-0.87
Foreclosure liquidation		
Marginal effect (*p*-value)	0.0364 (0.000)	0.003 (0.781)
Semi-elasticity	9.333	0.526