Effects of Bankruptcy Asset Exemptions and Foreclosure Laws on Mortgage Default and Foreclosure Rates[*]

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Abstract

This paper investigates the effects of bankruptcy asset exemptions and foreclosure laws on mortgage default and foreclosure rates across different segments of the mortgage market using state-level data. The empirical model improves on previous models by addressing the bias from omitted debt portfolio variable, and recognizing that credit term variables included in existing models are not econometrically exogenous in explaining default and possible foreclosure. We find that high bankruptcy homestead exemptions, judicial foreclosure, and prohibition of deficiency judgments are associated with greater default and foreclosure rates and have a small negative effect on the fraction of serious delinquencies that lead to foreclosure. Higher personal property exemptions are generally inversely related to serious delinquencies and foreclosures. And for prime mortgages higher personal property exemptions are associated with lower share of foreclosure starts as a fraction of serious delinquencies. These results suggest that lenders in default friendly states may seek to resolve default outside of foreclosure and avoid pushing borrowers to seek relief by filing for bankruptcy.

Keywords: home equity exemptions, foreclosure laws, mortgage defaults, mortgage foreclosures, personal bankruptcy, personal property exemptions, portfolio choice, unsecured debt.

JEL Classifications: D14, G21, K35

I. INTRODUCTION

Although legally a loan is in default when a scheduled monthly payment is unpaid for 30 days, in practice industry views default as occurring when an a loan is 90 days past due (three missed payments and a fourth payment is due). Foreclosure is the legal process that a mortgage lender initiates to take possession of the property of a defaulting borrower. Foreclosure is not the only course of action a lender may take in the event of default, and many mortgages in default eventually become current regardless of whether or not a foreclosure has been initiated (US Department of Housing and Urban Development 1996).

The economic literature has convincingly demonstrated that legal framework has an important influence on the payment behavior of borrowers and lenders in credit markets.[1] Much of the legal framework governing credit in the United States is provided by the states, and federal laws often overlie state laws. This situation exists for laws governing default and foreclosure in mortgage markets. State foreclosure laws influence decisions to default on mortgage loans and resolve defaults by foreclosure. Each state has a unique set of foreclosure laws. Federal bankruptcy law supersedes state law provisions regarding lenders' rights to foreclose. Filing for bankruptcy invokes an automatic stay on lender efforts to collect on debts, thereby delaying or stopping a mortgage lender's acquisition of the property of a defaulting borrower. A lender may request a release from a stay, and the court may honour the request. However, a borrower's decision to file for bankruptcy introduces uncertainty, creates delays, and causes additional costs in the foreclosure process. Bankruptcy homestead and personal property exemptions preserve a part of the borrower's home equity and other assets after bankruptcy, thereby influencing the borrower's incentive to file for bankruptcy. The exemption levels are set by the states and vary widely; but federal exemption levels also exist, and a borrower may choose federal exemption levels, unless the state in which the borrower resides has opted out of the federal system.

Studies investigating determinants of mortgage default and foreclosure have considered effects of state foreclosure laws but not borrowers' incentives to file for bankruptcy to delay foreclosure. Evidence is available on the effects of bankruptcy asset exemptions on availability of secured credit. This evidence is inconsistent and only partially accounts for differences in foreclosure laws. No evidence exists on bankruptcy asset

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[1] For example, see Barth, Cordes, and Yezer (1986), Clauretie and Herzog, (1990), Gropp, Scholz, and White (1997), White (2005), and references therein.

exemptions' effects on mortgage default and foreclosure rates.

This paper contributes to the literature, by examining the effects of both foreclosure laws and bankruptcy asset exemptions on defaults and foreclosures. The paper brings several improvements relative to previous studies. First, it recognizes that the effects may differ in different market segments, and therefore considers separately fixed and adjustable-rate mortgages in prime and subprime markets. Adjustable-rate mortgages are more attractive to higher risk credit constrained borrowers because monthly payments are initially lower than those for fixed-rate mortgages (Coulibaly and Li 2007). Credit constrained borrowers using adjustable-rate mortgages are vulnerable to increases in interest rates and events that reduce their discretionary income. As a consequence, serious delinquencies tend to be greater for adjustable-rate mortgages than fixed-rate mortgages (chart 1). The effects of bankruptcy exemptions may differ in prime and subprime market segments, as subprime borrowers had on average lower levels of home equity to protect through bankruptcy (Gorton 2008).

Second, it points to the importance of relative holdings of mortgage and non-mortgage debt (debt portfolio) in explaining mortgage default. Theoretical model developed in that paper predicts that there is a non-linear relationship between bankruptcy asset exemptions, debt portfolio, and the mortgage defaults. A marginal increase in bankruptcy asset exemptions changes borrower's optimal debt portfolio, which, in turn affects her decision to default on mortgage debt. The empirical model used for this paper addresses the bias from omitted debt portfolio, and our results support the prediction of the theoretical model.

Third, the empirical model also improves on previous models by recognizing that borrowers consider the risk of default in choosing credit terms. When borrowers choose to finance a larger percentage of house value at a higher interest rate, they are aware that the higher debt service burden and smaller equity stake in the house affects their ability and willingness to repay the mortgage. Thus, the loan-to-value ratio and interest rate are not econometrically exogenous in explaining default and possible foreclosure. More complete specification and the improvement in econometric methods therefore provides more reliable evidence on the effects of foreclosure laws and bankruptcy asset exemptions in mortgage markets.

Our preliminary findings indicate that judicial foreclosure, prohibition of deficiency judgments, and high bankruptcy homestead exemptions are associated with greater default and foreclosure rates and have a

small negative effect on the fraction of serious delinquencies that lead to foreclosure. These results suggest that lenders in default friendly states may seek to resolve default outside of foreclosure in order to avoid pushing borrowers seek relief by filing for bankruptcy. Higher personal property exemptions are generally inversely related to serious delinquencies and foreclosures. And for prime mortgages higher personal property exemptions are associated with lower share of foreclosure starts as a fraction of serious delinquencies. The last finding tends to support Berkowitz and Hynes' (1999) hypothesis that by discharging non-mortgage debts, personal property exemptions may help borrowers make payments on secured debts and avoid foreclosure, at least in the prime mortgage market.

II. STATE FORECLOSURE AND BANKRUPTCY LAWS' EFFECTS IN MORTGAGE MARKETS

Legal rules may affect default risk by creating transaction costs, which may influence borrowers' and lenders incentives' to default. Mulherin and Muller (1987) examined incentives to default in mortgages in which the lender purchases default insurance from an insurer. This practice is typical in risky mortgage transactions involving high loan amounts relative to home value.[2] Their theoretical model showed that default insurance causes incentives of borrowers, lenders, and mortgage insurers to diverge. Specifically, they demonstrated that if the contract rate for the mortgage is less than the current market rate, the lender is better off when the borrower defaults rather than makes the payment. That insurers do not cover the entire principal reduces the lender's gain from default. Transaction costs may further reduce the lender benefits to default and provide borrowers an incentive to pay. However, under certain circumstances—below-market financing arrangements or rising interest rates combined with falling house prices, for example—insurance may stimulate lender induced defaults and foreclosures.[3] Among the transaction costs that may influence borrowers' and lenders' incentives to default are state laws governing foreclosures and the amount of borrowers' housing and personal assets that are protected in bankruptcy.

A few empirical studies have examined effects of state foreclosure laws on mortgage default (Clauretie 1987 ; Aalberts and Clauretie 1988; Clauretie and Herzog 1990; Pennington-Cross 2008; Cutts and Merill 2008). These studies did not consider bankruptcy asset exemptions, however. Studies of effects of bankruptcy asset

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[2] According to industry estimates, about 75 percent of new mortgages carry either public or private mortgage insurance (US Mortgage Insurers See Jump in New Business in January, Dow Jones Newswires, 27 February 2009).

[3] The popularity of discounted initial interest rates on hybrid mortgages in the mid-2000s and subsequent period of rising interest rates and falling home prices is a recent example of conditions favorable to lender induced default and foreclosure.

exemptions have focused on mortgage denials and loan amount rather than foreclosure rates and generally have not considered state foreclosure laws (Berkowitz and Hynes 1999, Lin and White 2001; Chomsisengphet and Elul 2006). Evidence from these studies is contradictory. Pence (2003, 2006) considered effects of both state laws governing foreclosure and bankruptcy asset exemptions on mortgage loan amount for groups of contiguous metropolitan counties that touch state lines. Reductions in availability may eliminate more risky borrowers from the market thereby reducing defaults, but more lenient bankruptcy asset exemptions may make lead to greater defaults because default is less costly. The issue of bankruptcy asset exemptions' effects on foreclosure rates remains unresolved (White 2005). The remainder of this section discusses these studies in greater detail.

A. Foreclosure Laws

Two types of foreclosure procedures are used in the US: judicial and non-judicial foreclosures. In a judicial foreclosure, a court orders the foreclosure and supervises the sale and disbursement of the proceeds of the sale of the collateral. In a non-judicial foreclosure, the lender notifies the borrower of its intent to foreclose and appoints an independent party (attorney, foreclosure service, or trustee) to arrange the sale.[4] Judicial foreclosures are available in all states, but some states allow only judicial foreclosures.

Because of their greater complexity, judicial foreclosures are generally more costly and time consuming than non-judicial foreclosures. Crew-Cutts and Merrill (2008) reported that in Freddie Mac's experience the average time from the time a mortgage is sent to an attorney to begin the process of foreclosure to finalized foreclosure sale and possession is 272 days in states that require judicial foreclosure and 149 days in states that allow non-judicial foreclosures. They also reported that foreclosure costs are greater the in states that require judicial foreclosures than states that allow non-judicial foreclosures.

Statutory right of redemption and deficiency judgement are other significant provisions of foreclosure laws in some states. A statutory right of redemption allows a borrower to purchase the foreclosed property at the foreclosure sale price plus accrued interest during a specified period of time after the foreclosure sale. This right may lower bids at foreclosure sales as it delays the buyer from obtaining a clear title. A

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[4]In a small number of states, a state official must hear evidence and approve foreclosure before a non-judicial foreclosure can occur. For further discussion the foreclosure process, see US Department of Housing and Urban Development (1996) or Crew-Cutts and Merrill (2008).

deficiency judgement allows a lender to recover against the borrower's personal assets if the proceeds from the foreclosure sale are not sufficient to repay the loan.

As mentioned, a few empirical studies of state foreclosure laws are available. Noting then recent mortgage default studies investigating borrowers' default option, Clauretie (1987) and Aalberts and Clauretie (1988) pointed out that default and foreclosure is not the only option available a borrower and the lender when a mortgage becomes seriously delinquent. They may renegotiate the loan, or the borrower may refinance or sell the house and perhaps salvage any equity that remains.[5] Whether or not a foreclosure occurs depends on borrowers and lenders costs and benefits of foreclosure relative to these other options.

The costs and benefits of foreclosure depend on loan to value, the contract interest rate relative to the current market rate (as shown by Mulherin and Muller 1987), property price appreciation, and available legal remedies to default. In their empirical analyses of foreclosure rates based on this model, Clauretie (1987) and Aalberts and Clauretie (1988) considered state laws allowing power-of-sale foreclosure (that is, not requiring judicial foreclosure) and deficiency judgements; length of any statutory redemption period; and the average length of the foreclosure period.[6] Data on foreclosure rates were from the Mortgage Bankers Association (both studies) and the Federal Home Loan Bank System (Clauretie 1987). They used ordinary least squares for estimation. The model included the change in unemployment (lagged two periods) and change in divorce rate (lagged one period) as factors that may trigger defaults. They used changes in unemployment and divorce rates, arguing that variability had a greater effect on defaults than levels, and lagged values of changes because it takes time for changes to work through to default. As borrowers likely are aware that the higher debt service burden associated with the contract interest rate and the smaller equity stake in the house affects their ability and willingness to repay the mortgage, the contract interest rate and loan to value are endogenous, making ordinary least squares estimates of these parameters biased.

Results of estimation were similar in both studies and indicated that legal remedies significantly affected foreclosure rates.[7] For conventional mortgages, availability of power-of-sale foreclosures was associated with higher rates of foreclosure, and average length of foreclosure period and length of statutory redemption

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[5] Also see US Department of Housing and Urban Development (1996) or Wallace (2007). Wallace noted further that some borrowers take such actions to cure defaults after the lender has filed for foreclosure and the foreclosure is pending.

[6] See Jones (1993) for an analysis of deficiency judgements and mortgage default.

[7] Coefficients are considered statistically significant in this review if their level of significance is 10 percent or less.

period were associated with lower foreclosure rates. They obtained the opposite effects for FHA and VA mortgages. That is, power-of-sale foreclosures was associated with lower rates of foreclosure, and average length of foreclosure period and length of statutory redemption period were associated with higher foreclosure rates. They attributed the finding that foreclosures of government-insured loans were higher in states with larger foreclosure costs to adverse selection. In high-foreclosure cost states, lenders channel risky borrowers to government–insured mortgages, which limit or compensate for those costs. Availability of deficiency judgement was positively related to the foreclosure rate for both conventional and government-insured loans but was not statistically significant.[8] Clauretie and Herzog (1990) examined insurance default loss rate for private and government-insured mortgages using a model similar to that in Clauretie (1987). For both types of loans, insurance loss rates were significantly lower in states where power-of-sale foreclosures were available and higher in states with a statutory right of redemption. Availability of deficiency judgement was associated with statistically significantly lower loss rates for privately insured mortgage but not for government-insured mortgages. These findings support the hypothesis that state laws affect foreclosure costs and thereby influence default loss rates. That power-of sale (statutory right of redemption) is associated with lower (greater) foreclosure rates but higher default loss rates for government-insured mortgages is consistent with Clauretie's suggestion that lenders channel high-risk mortgages to government-insured programs in states with high foreclosure costs.

Pennington-Cross (2008) examined the effects of required judicial foreclosure and statutory right of redemption on the duration of subprime mortgage foreclosures (that is, the time from foreclosure start to exit through cure, partial cure, transfer of property to the lender, or pay off). Explanatory variables included loan to value, FICO score, savings if the mortgage were refinanced at current market rate, the unemployment rate, length of pre-foreclosure delinquencies, outstanding mortgage balance, and required judicial foreclosure, and statutory right of redemption. Results of estimation indicated that loans in states that states that do not require judicial foreclosure exited foreclosure significantly earlier through all options (cure, partial cure, transfer of property to the lender, or pay off) earlier than loans in states that require judicial foreclosure. A

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[8] The current mortgage rate relative to the rate five years earlier, which reflects the difference between contract and current mortgage rates, was statistically significant and positive for both conventional and government-insured loans, consistent with Mulherin and Muller's (1987) prediction that lenders' have an incentive to foreclose when the current market rate is greater than the contract rate. Increases in house prices were significantly negatively related to foreclosure rates. For both types of loans, changes in unemployment and divorce rates had positive coefficients but were not statistically significant.

statutory right of redemption was not significantly related to the duration of foreclosures, however.

B. Bankruptcy Asset Exemptions

Gropp, Scholz, and White (1997) found that larger bankruptcy asset exemptions reduce availability of credit generally. This finding stimulated further research investigating whether or not bankruptcy asset exemptions have similar effects on secured and unsecured credit. Mortgages, like other forms of secured credit, differ from unsecured credit in bankruptcy. If the borrower defaults on a mortgage, the lender has the right to foreclose on the house. The proceeds of selling the house go first to repay the mortgage. After repaying the mortgage, the borrower retains any surplus up to the amount of the homestead exemption. Because the secured lender must be repaid in full before the borrower benefits from the exemption, the amount of the exemption provides the borrower no incentive to default on the mortgage (Berkowitz and Hynes 1999).

The amount of the exemption does influence the decision to file for bankruptcy, however. Filing for bankruptcy is more attractive in when homestead and personal property exemptions are higher, and filing for bankruptcy likely affects foreclosure. Defaulting mortgage borrowers typically file for Chapter 13 bankruptcy (US Department of Housing and Urban Development 1996). The bankruptcy filing temporarily stops foreclosure proceedings. The lender may request a release from the stay on processing the foreclosure. Such requests are usually granted when the value of the house is less than the amount of mortgage debt. Even when the lender's request is granted, the bankruptcy filing delays foreclosure and causes the lender to incur additional legal costs. Thus, higher asset exemptions may induce more borrowers seeking to delay foreclosure to file for bankruptcy (Lin and White 2001).[9] And the delay and additional legal costs may make lenders less willing to make higher risk loans. Whether the delay and additional legal costs would cause lenders to start foreclosure proceedings earlier or make them more willing to pursue solutions to serious delinquency outside of foreclosure when asset exemptions are higher is unclear.[10] Bankruptcy asset exemptions may

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[9] For evidence that higher exemption levels are associated with higher bankruptcy filing rates, see Agarwal, Liu, and Mielnicki (2003).

[10] Crew-Cutts and Merrill (2008) noted that lenders foreclosure costs are higher the longer the length of the foreclosure period. This consideration suggests that lenders ought to initial foreclosure promptly to avoid higher costs of delay. However, limited evidence suggests that the prospect of delay and higher cost might initially cause lenders to attempt non-foreclosure solutions to default. Examining data on foreclosed conventional and VA mortgages, Springer and Waller (1993) found that mortgages owed by borrowers who filed for bankruptcy remained delinquent for a longer period of time prior to starting foreclosure than mortgages where bankruptcy was not involved.

affect secured lenders in other ways as well. When the sale of the house is insufficient to repay mortgage fully, the mortgage lender has an unsecured claim for the unpaid portion of the loan. The amount of the personal property exemption adversely affects the value of this claim. Thus, relatively high loan-to-value mortgages would be riskier in states with higher personal property exemption levels. In other cases, higher asset exemption values may make secured lending less risky. Berkowitz and Hynes (1999) suggested that while higher amounts of asset exemptions may induce borrowers to file for bankruptcy, higher asset exemptions leave them with more wealth after bankruptcy, which may in turn help them continue to repay secured debts after bankruptcy.

Existing evidence on effects of bankruptcy asset exemptions concerns mortgage denials and loan amount and is based largely on Home Mortgage Disclosure Act (HMDA) data. Berkowitz and Hynes (1999) found a small though statistically significant negative effect for the amount of the homestead exemption on the probability of denial. This finding, they argued, supports the prediction of their theoretical model that a small wealth effect from a higher exemption helps borrowers repay their mortgages and thereby reduces the risk of mortgage lending.

The amount of the personal property exemption was not statistically significantly related to the probability of denial. In addition, regressions using state-level data from the Federal Housing Finance Board indicated that neither the amount of the homestead exemption nor the amount of the personal property exemption had a statistically significant effect on the average mortgage interest rate or the average loan-to-value ratio. Berkowitz and Hynes interpreted these results consistent with their hypotheses that the amount of bankruptcy asset exemptions should not affect the supply of secured credit.

Lin and White's (2001) model predicted that a higher homestead or higher personal property exemption would increase the likelihood of mortgage default if delay costs in bankruptcy are positive, which is usually the case. This prediction holds even when bankruptcy discharges the unsecured debt and borrower uses the entire increase in wealth to pay the mortgage. Lin and White (2001) estimated separate models for denials of home purchase and home improvement loans. Home improvement loans are of interest because they rank below first mortgages in priority or are unsecured. Home improvement lenders therefore rely more heavily

on borrowers' non-housing wealth for repayment of the loan. [11] Bankruptcy asset exemptions likely would have a greater effect on home improvement loans than home purchase loans.

Results of estimation indicated that higher asset exemptions were generally associated with greater probability of loan denial. For home purchase loans, an unlimited homestead exemption and amount of personal property exemptions were statistically significant and positive. For home improvement loans, $30,000-400,000 and unlimited homestead exemptions were statistically significant and positive. The amount of the personal property exemption was positive, but not statistically significant.[12] Consistent with expectations, the effect of the homestead exemption was greater for home improvement loans than home purchase loans. Applicants for home improvement loans were five percentage points more likely to be turned down in states with an unlimited homestead exemption. Applicants for home purchase loans were two percentage points more likely to be turned down. Lin and White also found that availability of deficiency judgement was associated with lower probability of denial, although the coefficient was small and not significant for home improvement loans.

Identifying a likely cause for differences in findings of Berkowitz and Hynes (1999) and Lin and White (2001) is difficult. Chomsisengphet and Elul (2006) argued that Lin and White's observation of a positive relationship between default and bankruptcy asset exemptions can be explained by a failure to account for borrowers' creditworthiness. They argued that creditworthiness, as measured by a credit bureau risk score, is correlated with levels of bankruptcy asset exemptions. Higher exemption levels are associated with higher default rates and therefore lower credit scores. They found that exemptions were not statistically significantly related to mortgage denials or loan size when average credit risk score was included in the model. It is not obvious that this evidence supports a conclusion that bankruptcy asset exemptions have no effect on default risk for secured loans. Credit bureau risk scores are a prediction of bankruptcy, serious delinquency, or other derogatory event, and higher asset exemptions might well influence borrowers' decisions to file for bankruptcy, which in turn.

Pence (2003, 2006) suggested that because both real estate markets and state foreclosure and bankruptcy

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[11] Berkowitz and Hynes (1999) did not include home improvement loans in their analyses.

[12] The difference in findings of Lin and White and those of Berkowitz and Hynes is not due to the difference in specification of the homestead exemption. Lin and White found that the amount of the homestead exemption was also significant and positive when specified as a continuous variable.

laws exhibit strong regional patterns, a regional shock to the housing market could be misinterpreted as an effect of the law. Pence's solution to this problem was to compare approved home mortgage applications in census tracts that are geographically near each other but are located in different states. Her empirical model considered the effects of both state foreclosure and bankruptcy laws on loan size. The estimated effect of judicial foreclosure was statistically significant and negative. States with a judicial foreclosure requirement had a 4 to 6 percent lower loan size than states allowing non-judicial foreclosures. Statutory right of redemption not significant, although, Pence (2003, 2006) noted, this result was based on a small sample of boarder areas with differences in this provision. The effect of deficiency judgement was sensitive to the estimation technique and was probably not reliable, again, because of a small sample of border areas with differences in the provision. Bankruptcy asset exemptions were statistically significant. Estimated effects were negative for homestead exemptions but positive for personal property exemptions. Neither effect was very large, however.

In 2005, the Bankruptcy Abuse Prevention and Consumer Protection Act imposed changes to discourage bankruptcy filings. The act raised filing costs, required debtors to receive credit counselling, and increased income and asset documentation. The act also restricted access to Chapter 7 for higher income debtors and imposed a \$125,000 limit on the homestead exemption for debtors who lived in their homes for less than $3\frac{1}{2}$ years. These reforms increased the costs of filing for bankruptcy and thereby reduced the desirability of filing for bankruptcy to protect home equity. Thus, foreclosures would be expected to rise, especially in states with high homestead exemptions and among debtors with relatively high incomes, following implementation of bankruptcy reform (Morgan, Iverson, and Botsch 2008, Li, White, and Zhu 2009). Empirical analyses by Morgan, Iverson, and Botsch (2008) and Li, White, and Zhu (2009) supported these hypotheses.

In sum, previous studies find that state foreclosure laws have significant effects on default and foreclosure rates for secured credit. These studies do not consider bankruptcy asset exemptions' possible incentive to default, however. Higher bankruptcy asset exemptions make default more attractive to the borrower and raise lenders' costs. As higher exemptions also leave borrowers with greater wealth after bankruptcy, they improve borrowers' ability to repay secured debts. Thus, the net effect of bankruptcy asset exemptions is unclear. There is evidence on the effects of bankruptcy asset exemptions on availability of secured credit.

This evidence is inconsistent and only partially accounts for differences in foreclosure laws, however. No evidence exists on bankruptcy asset exemptions' effects on mortgage default and foreclosure rates. And there no currently available evidence on how bankruptcy asset exemptions or creditor remedies to default affects payment performance of less risky and riskier segments of the mortgage market.

A MODEL OF BORROWING WITH BANKRUPTCY ASSET EXEMPTIONS *(preliminary and incomplete)*

This section presents a simple model that simultaneously considers consumers' decisions to default on their mortgages and to file for personal bankruptcy. The model stems from the cost-benefit analysis of Lin and White (2001). However, in our model borrowers are assumed to be risk-averse, and their decisions are driven by their preferences to hold mortgage and non-mortgage debt.[13] The key prediction of the model is that there is a non-linear relationship between bankruptcy asset exemptions, optimal holdings of mortgage and non-mortgage debt (debt portfolio), and the mortgage defaults. The empirical models which do not include debt portfolio (measured e.g. by the ratio of mortgage-debt to total consumer debt) in mortgage default equations are therefore misspecified.

A. Basic Framework

The economy is represented by a consumer and a lender, which live two periods. The consumer is risk-averse and maximizes expected lifetime utility. The lender is risk-neutral and maximizes expected lifetime profit. In period 1, the consumer is endowed with exogenously determined non-housing wealth y_1, which includes earned and inherited income. In the second period, the consumer earns income y_2, which can take values of y_H if her productivity improves (for example through learning-by-doing) and y_L otherwise. The consumer's productivity in period 2 is exogenously determined, with the probability of improvement equal to π. The consumer's expected income in period 2 is thus given by

$$y_2 = \pi y_H + (1 - \pi) y_L, y_H > y_L. \tag{1}$$

In period 1, the consumer buys a house of value H_1, financed by a mortgage of amount b_M which is

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[13]Lin and White (2001) assume that borrowers are risk-neutral, and their decisions are "ruthless" in that the value of defaulting or filing for bankruptcy depends only on the value of particular assets or liabilities and the transaction costs.

secured by the house. The consumer also takes an amount b_C of unsecured personal loan. Following Lin and White (2001), we assume that the consumer has only one unsecured loan.[14] For simplicity, we assume that the consumer does not save in period 1.[15] The lender chooses the interest rates on the mortgage and the personal loans, equal to r_M and r_C respectively. The lender can also choose not to lend at all. In period 2, both loans come due, so that the consumer owes $b_M (1 + r_M)$ on the mortgage loan and $b_C (1 + r_C)$ on the personal loan. The value of borrower's house in the second period, H_2, can take values of H_H if the economy is booming and H_L if the economy is in recession. The state of the economy is exogenously determined, with probability of boom equal to p. We assume that p and π are independent.[16] The value of borrower's house in period 2 is thus given by

$$H_2 = pH_H + (1 - p) H_L. \tag{2}$$

In the second period, the consumer can default on the personal loan and file for bankruptcy, default on the mortgage, or default on both loans. If the consumer chooses to file for bankruptcy, she is allowed to keep an exogenous amount of assets, determined by the state personal property exemption x_C. Personal debt is totally or partially discharged depending on the level of gross income held in the second period. If total second period income is larger than x_C, then the individual must pay the difference to the creditors. Also, the consumer must give up her house in bankruptcy if the home equity exceeds the state homestead exemption x_M. Otherwise, she consumes all her assets and repays nothing. We assume that when filing for bankruptcy the consumer incurs up-front transaction costs (e.g. fees paid to bankruptcy lawyers) equal to D. The mortgage debt is not discharged if the consumer files for bankruptcy.

If the consumer chooses to default on the mortgage, the lender will foreclose on the house. After foreclosure, the mortgage lender sells the house for an amount H_2 to repay the mortgage loan. The remainder is used to repay personal debt, and the amount up to the homestead exemption x_M is returned to the borrower. We assume that when defaulting on mortgage the consumer incurs transaction costs R of filing for mortgage

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[14]See Bizer and De Marzo (1992) for discussion of how creditors' incentives are affected by whether debtors have prior loans.

[15]It can be shown that this assumption does not affect key predictions of the model.

[16]Lin and White (2001) argue that this correlation is rather low (about 0.27).The model's predictions will still hold if probabilities are not independent.

foreclosure, which may include the legal fees and the rental costs of relocating to a new residence. Following Lin and White (2001) we assume that the lender does not have the right to collect deficiency judgments from the borrower, so he loses whatever portion of the mortgage not covered by the proceeds of foreclosure.

When the consumer defaults on both mortgage and personal loans, she is assumed to incur transaction costs Z. We assume that $D < R < Z < D + R$, because the consumer can exploit economies of scale in paying off the legal costs of default on both loans.

We assume that lender's transaction costs are small if foreclosure and / or bankruptcy is initiated (e.g. because lender handles large number of legal disputes and exploits the economies of scale), and are normalized to zero for simplicity.[17]

B. The Consumer's Utility Maximization Problem

We assume that the consumer's utility is additively separable across time, and is also separable within a time period for consumption and leisure, and satisfies regularity conditions. Under these assumptions the consumer's utility function can be written as

$$U(C_1, C_2) = U(C_1) + \rho E U(C_2), \ U'(C) > 0, \ U''(C) < 0, \tag{3}$$

where C_1 and C_2 are consumption levels in periods 1 and 2 respectively, ρ is the consumer's discount rate, and E is the expectations operator. In period 1 there is no uncertainty, and the value of consumption is equal to the amount of consumer's wealth and borrowed funds less the value of the house. The consumption in period 1 is thus given by

$$C_1 = y_1 - H_1 + b_C + b_M. \tag{4}$$

In period 2, the consumption is determined by the borrower's decision to default on the personal loan and / or the mortgage loan. When deciding whether to default, the consumer compares her consumption possibilities once second period income and housing price are realized. Four different cases need to be

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[17]In further research we plan to consider positive lender's transaction costs if the consumer defaults on both mortgage and consumer loans. This may be the case if foreclosure in the context of bankruptcy requires approval of the bankruptcy trustee and is therefore likely to be delayed. Our empirical results below show that these delay costs are likely to be important, and cause lender to resolve dispute out of foreclosure.

considered.

Case 1. The consumer chooses not to default on either the personal loan or the mortgage loan. Then, the second period consumption is

$$C_2^1 = y_2 + H_2 - b_M \left(1 + r_M\right) - b_C \left(1 + r_C\right). \tag{5}$$

Case 2. The consumer chooses to default on the mortgage loan but not on the personal loan. The lender forecloses on the house. If there is a positive balance left $(H_2 - b_M \left(1 + r_M\right) > 0)$, it can be used to repay consumer debt. If there is a negative balance left $(H_2 - b_M \left(1 + r_M\right) < 0)$ the mortgage debt is discharged. To make things interesting, we assume that

$$H_L - b_M \left(1 + r_M\right) < 0, \tag{6}$$

and

$$H_H - b_M \left(1 + r_M\right) > x_M. \tag{7}$$

Then the second period consumption is given by

$$C_2^2 = y_2 + p\left(H_H - b_M \left(1 + r_M\right)\right) - b_C \left(1 + r_C\right) - R. \tag{8}$$

Case 3. The consumer chooses to default on consumer debt, and repay the mortgage. She files for bankruptcy, and her personal debt is discharged, but the mortgage debt is not. The amount of debt repaid in bankruptcy is determined by the homestead and personal property exemptions in the consumer's state of residence. The lender garnishes the borrower's income less the amount of state personal property exemption. If the borrower has positive equity in the house, the lender also forecloses on the house, returns the amount up to state homestead exemption to the borrower, and uses the remainder of the balance to repay borrower's personal debt. The amount paid to the lender is thus given by

$$F = y_2 - x_C + \max\left(0, H_2 - b_M \left(1 + r_M\right) - x_M\right). \tag{9}$$

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Using equations (6) and (7) in the equation (9) gives

$$F = y_2 - x_C + p\left(H_H - b_M\left(1 + r_M\right) - x_M\right). \tag{10}$$

The borrower thus gives up the portion of her second period income that exceeds state personal property exemption, and collects the amount up to state homestead exemption if she has positive equity left after the house is foreclosed by the lender. The borrower also incurs the transaction costs of filing for bankruptcy, and pays off the mortgage debt if house equity is less or equal to zero. The second period consumption is then given by

$$\begin{aligned} C_2^3 &= x_C - y_2 - D - p\left(H_H - b_M\left(1 + r_M\right) - x_M\right) \\ &\quad + (1 - p)\left(H_L - b_M\left(1 + r_M\right)\right). \end{aligned} \tag{11}$$

Case 4. The consumer chooses to default on both the personal debt and the mortgage. It is assumed that lender first forecloses on the house. If there is a positive balance left $\left(H_2 - b_M\left(1 + r_M\right) > 0\right)$, lender returns the amount up to homestead exemption to the borrower, and collects the rest to repay the consumer debt. As before, if there is a negative balance left $\left(H_2 - b_M\left(1 + r_M\right) < 0\right)$ the lender cannot obtain a deficiency judgement and the mortgage debt is discharged. In addition, the borrower keeps the amount up to personal property exemption and pays the transaction costs of defaulting on both loans. The second period consumption in this case is given by

$$C_2^4 = x_C - y_2 - Z - p\left(H_H - b_M\left(1 + r_M\right) - x_M\right). \tag{12}$$

The comparison of the second period consumption possibilities given by the equations (5), (8), (11), and (12) yields a set of inequalities that determine which of the four cases will happen. These inequalities are presented in Appendix I, part A. Careful analysis of these inequalities shows that some cases are mutually exclusive. Regardless of the distributions of y and H it is never optimal to have Case I and Case II, or Case

III and Case IV.[18] Given that the majority of the consumers rarely default on either debt, it is interesting to consider choices between Case I and Case III, or Case I and Case IV. Below we focus on the choice between Case I and Case IV (default on neither debts or default on both debts), which is also discussed most carefully in Lin and White (2001). Specifically, we consider the case when the borrower chooses not to default on either debt if $y_2 = y_H$, and chooses to default on both debts if $y_2 = y_L$. The assumptions necessary to make this case valid are discussed in the Appendix I, part B. In this case the consumer's utility maximization problem becomes:

$$\max_{b_C, b_M} U\left(y_1 - H_1 + b_C + b_M\right) \tag{13}$$

$$+\rho[\pi U\left(y_H + pH_H + (1-p)H_L - b_M\left(1 + r_M\right) - b_C\left(1 + r_C\right)\right) +$$

$$+ (1 - \pi) U\left(x_C - p\left(H_H - b_M\left(1 + r_M\right) - x_M\right) - y_L - Z\right)].$$

C. The Lender's Profit Maximization Problem

To close the model we need the lender's participation constraint which determines market equilibrium. Lender decides what interest rate to charge on the loans, and whether to lend at all, given possibility of default. Because lender is risk-neutral, he maximizes expected profits given by

$$\pi = -b_M^* - b_C^* + \pi\left((1 + r_M)b_M^* + (1 + r_C)b_C^*\right) + (1 - \pi)\left(y_L - x_C + p\left(H_H - x_M\right)\right) \tag{14}$$

where b_M^* and b_C^* satisfy the consumer's utility maximization problem (13). The lender will not issue credit if $\pi < 0$. Lender's constraint should be taken into account if the model is solved numerically. *(Note for a discussant: the authors are currently working on numerical results!)*

D. The Effect of a Marginal Increase in the Bankruptcy Asset Exemptions

This section considers the effect of a marginal increase in bankruptcy asset exemptions: homestead exemption x_M, and / or personal property exemption x_C. Using the implicit function theorem, we can

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[18]Lin and White (2001) make a similar point.

determine the slopes of optimal mortgage loan with respect to optimal consumer loan and vice versa (see Appendix I, part C for a proof):
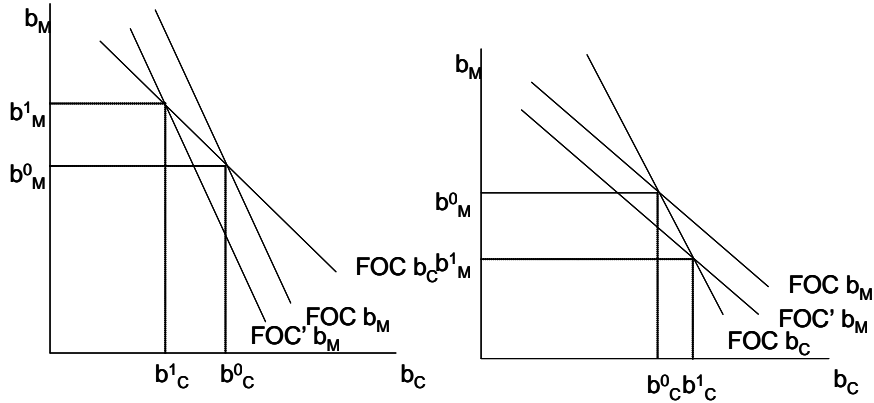
$$\frac{db_C}{db_M}\bigg|_{FOCb_C} < 0; \quad \frac{db_C}{db_M}\bigg|_{FOCb_M} < 0. \tag{15}$$

The result (15) indicates that consumer and mortgage loans are the substitutes. In equilibrium, an exogenous shock leading to decline in the amount of consumer debt will result in an increase in mortgage debt and vice versa.

Now consider the effect of a marginal increase in x_M (the result is similar for x_C). Again, using the implicit function theorem yields (see Appendix I, part C for a proof):

$$\frac{db_C}{dx_M}\bigg|_{FOCb_C} = \frac{db_M}{dx_M}\bigg|_{FOCb_C} = 0; \frac{db_C}{dx_M}\bigg|_{FOCb_M} = \frac{db_M}{dx_M}\bigg|_{FOCb_M} < 0. \tag{16}$$

The result (16) indicates that an increase in x_M does not have an effect on choice between the amounts of mortgage and personal loans along the optimality condition for consumer loans, and the equilibrium holdings of both mortgage and personal debt decline along the optimality condition for mortgage loans. The equilibrium condition for mortgage loans thus shifts inwards in $b_C : b_M$ space (see figure below.)

The effect of x_M on the choice between the mortgage and personal debt depends on the slopes of the optimality conditions for consumer and mortgage loans. What we observe in the data is likely the case of the optimality condition for consumer loans being steeper than the optimality condition for mortgage loans (see chart on the right of the figure 1). In this case, an increase in x_M lowers the optimal mortgage loan amount,

and raises optimal consumer loan amount. This, in turn, changes the consumer's decision to default on her mortgage debt.

This conclusion illustrates the key result of the model. There is a non-linear relationship between bankruptcy asset exemptions, optimal holdings of mortgage and non-mortgage debt (debt portfolio), and the mortgage defaults. The empirical models which do not include debt portfolio (measured e.g. by the ratio of mortgage-debt to total consumer debt) in mortgage default equations are therefore misspecified.

IV. SPECIFICATION AND ESTIMATION OF MORTGAGE DEFAULT AND FORECLOSURE EQUATIONS

As discussed above, the economic literature identifies effects of bankruptcy asset exemptions and foreclosure laws on both borrowers' and lenders' decisions. For borrowers, bankruptcy asset exemptions and state foreclosure laws affect the benefits from defaulting on their mortgage and filing for bankruptcy. For lenders, these legal provisions influence their willingness to lend and their willingness to initiate foreclosure procedures when borrowers default.

A. Model and Data

We estimate an empirical model to test statistically for the effect of bankruptcy asset exemptions and foreclosure laws on mortgage delinquencies and foreclosures. The stochastic model specifies default or foreclosure as a function of variables affecting the value of the prepayment and default options, borrower and loan characteristics, and macroeconomic conditions, x_{it}; legal environment z_{it}[19], and state-specific fixed effects α_i:

$$d_{it} = \alpha_i + \beta x_{it} + \delta z_{it} + \varepsilon_{it} \tag{17}$$

where ε_{it} is an error term.

We consider three measures of mortgage defaults: (1) seriously delinquent loans, (2) foreclosure starts, and (3) the ratio of foreclosure starts to serious delinquencies. Serious delinquencies are loans which are delinquent for 90 days or more. As mentioned, serious delinquency is viewed as default according to industry practice. Foreclosure starts are loans in which the foreclosure process has been started but not completed or REO. Foreclosure starts do not always end up as completed, with the lender taking possession of the

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[19]some legal environment variables are time-invariant.

property. A non-trivial number of foreclosure starts cure and become current (Wallace 2007; Crew-Cutts and Merrill 2008). The ratio of foreclosure starts to seriously delinquent loans indicates that fewer lenders and borrowers resort to out-of-foreclosure resolution of mortgage defaults. [20] These variables are from the Mortgage Bankers Association's National Delinquency Survey. [21] For our analysis, we use state-level delinquencies from first quarter of 1998 through the fourth quarter of 2006.

The choice of explanatory variables is based on the theoretical framework established in the literature on mortgage terminations (Clapp, Deng, and An 2006; Ho and Pennington-Cross 2006; Deng, Quigley, and van Order 1996, 2000) and foreclosure (Clauretie 1980; Clauretie and Herzog 1990).

State Foreclosure Laws and Bankruptcy Asset Exemptions.

- Judicial foreclosure required (Cutts and Merrill 2008): The duration of foreclosure process is longer in states that require judicial foreclosure than in states that allow power-of-sale foreclosures. Judicial foreclosure introduces uncertainty, causes delays, and gives rise to additional costs. The delay in evicting the borrower makes judicial foreclosure attractive from borrowers' perspective.

- Deficiency judgement prohibited (American College of Mortgage Attorneys, Inc., National Mortgage Law Summary, 2007-2008, 6the Ed.): A deficiency judgement is a court order authorizing a lender to collect part of any unsatisfied debt after foreclosure and sale of the property. Prohibition of deficiency judgements may increase lenders' foreclosures losses and makes foreclosure less costly for borrowers.

- Statutory right of redemption permitted (United States Foreclosure Law website www.foreclosurelaw.org and Pence 2003): Statutory redemption rights allow the borrower who have defaulted on the mortgage loan to redeem the property if he/she can repurchase the property at its sale price after it has been sold to some third-party in the foreclosure process. The borrowers are given some time period to redeem the property and this time period depends on the state in which the property is located. Statutory re-

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[20] Foreclosure inventory depends not only on borrowers' and lenders' decisions to resolve defaults through pursue foreclosure but also on the speed of the foreclosure process. See Wallace (2007) for discussion.

[21] The National Delinquency Survey (NDS) provides data on delinquency and foreclosures of residential mortgages based on a sample of more than 44 million mortgage loans serviced by mortgage companies, commercial banks, thrifts, credit unions, and others. The NDS provides quarterly delinquency and foreclosure statistics at the national, regional and state levels. Delinquency and foreclosure measures are broken out into loan type (prime, subprime, VA and FHA) and fixed and adjustable rate products. At each geographic classification, there are 7 measures: total delinquencies, delinquency by past due category (30-59 days, 60-89 days and 90 days and over), new foreclosures, foreclosure inventory, and seriously delinquent. The total number of loans serviced each quarter, as compiled through the survey, is also included in the data. For more on the NDS data, see Mortgage Bankers Association website: http://www.mbaa.org/.

demption rights thus make foreclosure filing very attractive to the borrowers facing temporary liquidity constraints.

- Wage garnishment limit (Agarwal, Liu, and Mielnicki 2003): High limits on wage garnishment (court ordered deductions from salary for the payment of unsecured debt) lower lenders' ability to collect the debt and increase incentive to seek relief from creditors by filing for personal bankruptcy. It is thus expected that higher limits on wage garnishment result in lower foreclosures as consumers become more likely to file for bankruptcy in order to have their unsecured debt discharged and then use the wealth gain to repay their mortgages (Berkowitz and Hynes 1999).

- Values of homestead and personal property exemptions (Agarwal, Liu, and Mielnicki 2003): Larger amounts of homestead protection for real estate and other property exemptions protect borrowers' assets from creditors in a forced sale to satisfy unpaid unsecured debt. Foreclosure rates are expected to be lower in states with high personal property exemptions because borrowers have greater incentives to file for bankruptcy, obtain discharge of their non-mortgage debts, and use the funds that would otherwise go to non-mortgage creditors to repay their mortgages and thereby keep their homes (Berkowitz and Hynes 1999). The effect of homestead exemptions on mortgage foreclosures is more complex, and depends on borrowers' non-housing wealth, net housing equity and the amount of unsecured debt (Lin and White 2001). For example, if the borrower has relatively high housing equity, low non-housing wealth, and large unsecured debts (perhaps because he or she owns an unincorporated business) in a state with high homestead exemptions, she finds it optimal to default on mortgage loan and file for bankruptcy. Thus, contrary to Berkowitz and Hynes' (1999) hypothesis, foreclosure rates may be higher in the states with high homestead exemptions. We convert the values of homestead and personal property exemptions in real terms, by normalizing their values by average house price and income per capita, respectively. Because the effect of such exemptions is possibly non-linear, following Lin and White (2001) we construct dummy variables corresponding to quintile distributions of normalized home exemptions. The first (second) dummy variable takes on a value of one if the normalized value of homestead exemption is between 0.1 and 0.3 (above 0.3). Based on the prediction of theoretical model, we also add the interaction term between the high homestead exemptions dummy and the

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share of consumer debt in total debt to capture the composite effect of bankruptcy asset exemptions and unsecured debt on mortgage default.

- Post-bankruptcy reform indicators: We include a dummy variable indicating quarters in which the Bankruptcy Abuse Prevention and Consumer Protection Act was in effect and a dummy variable indicating that the act was in effect and the state had a homestead exemption greater than $125,000. The act limited the homestead exemption to $125,000 for consumers who live in their home less than $3\frac{1}{2}$ years. Because the act made bankruptcy more costly and provided less debt relief for most filers, we expect fewer bankruptcy filings to protect home equity and consequently higher mortgage defaults after the act became effective, especially in state with relatively high homestead exemptions.

Borrower Risk and Macroeconomic Conditions

We measure borrower risk by the distribution of credit bureau scores and consumer (non-mortgage) debt to total debt.

- Distribution of credit bureau scores (TransUnion LLC): Credit bureau scores predict the risk of serious delinquency, bankruptcy, or other serious derogatory event using data on past debt payment behavior and credit use. As shown in previous studies (Bennett, Peach and Peristiani 2001, for example), mortgage default is lower in the states in which a higher share of borrowers have high credit scores.[22] We define credit bureau score intervals that based on quartiles of the distribution of credit bureau risk scores nationally. For the prime mortgages, we constructed dummy variables indicating whether the percentage of borrowers in a state in the lowest three credit risk (highest three credit bureau score) intervals is 60 to 65 percent, 66 to 70 percent, or above 70 percent. For subprime mortgages, the dummy variables indicate whether the percentage of borrowers in the highest credit risk interval is 25 to 30 percent, 31 to 35 percent, or above 35 percent.

- Non-mortgage debt as a fraction of total debt (TransUnion LLC): According to the theoretical model borrower's debt portfolio (here measured by non-mortgage debt as a fraction of total debt) is among the determinants of the mortgage default. Another reason for including this variable is that borrowers

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[22]We truncate credit score distributions upwards for prime mortgages, and downwards for subprime mortgages, because it is unlikely that many borrowers with good credit histories will apply for subprime credit, and vice versa.

with high shares of consumer (non-mortgage) debt tend to have relatively high debt service burdens because of the short term to maturity for most consumer loans. Such borrowers are likely to be credit and liquidity constrained (Paxson 1990). Credit constrained borrowers are more vulnerable than other borrowers to financial distress caused by unexpected expenses and interruptions in income. They are less likely to be able to refinance mortgages and more likely to file for bankruptcy and default on their mortgage debt when they experience distress (Archer, Ling, and McGill 1996).

Variables reflecting macroeconomic conditions include current mortgage interest rates, mortgage debt to home value, and unemployment.

- Mortgage interest rates (Federal Housing Finance Board's Monthly Survey of Rates and Terms on Conventional Single-Family Non-Farm Mortgage Loans[23]): Higher interest rates lower value of mortgage refinance option. They also increase the costs of servicing mortgage debt, thus increasing the likelihood of mortgage default (Deng, Quigley, and van Order 1996, 2000).

- Current loan-to-value ratio (TransUnion LLC[24], Office of Federal Housing Enterprise Oversight, OFHEO): Higher loan-to-value ratio (LTV) corresponds to lower value of prepayment option and higher value of default option, making mortgage default more attractive (Deng, Quigley, and van Order 1996, 2000). We compute LTV as the ratio of mortgage debt per borrower from TransUnion LLC to average home price, which we obtain by deflating Coldwell Banker's Home Price Comparison Index by the OFHEO House Price Index.

- State unemployment rate (Bureau of Labour Statistics): Higher unemployment is associated with greater interruptions in income which makes households vulnerable to financial distress. Higher unemployment was found to increase the likelihood of mortgage default (Deng, Quigley, and van Order 1996, 2000).

Tables 1 and 2 provide descriptive statistics for the dependent and explanatory variables.

B. Estimation

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[23]We also considered Freddie Mac PMMS interest rates, and the results were not economically and statistically different.

[24]Trans Union's TrenData database provides quarterly county-level data on credit use and payment performance, based on information from a series of large random samples of U.S. consumer credit histories.

The focus of this paper is to assess the effects of state foreclosure laws and asset bankruptcy exemptions on mortgage defaults and foreclosure in different market segments. Therefore, we estimate the effects separately for estimated for prime fixed-rate, prime adjustable-rate, subprime fixed-rate, and subprime adjustable-rate loans.

Two important econometric issues for estimating this model are the endogeneity of loan terms affecting prepayment and default options and identification of time-invariant state legal environment in fixed effects panel data setting.

Endogeneity of Loan Terms

Mortgage default decisions and the mortgage interest rates, which affect the value of the call (refinance) option, can be simultaneously determined. An exogenous increase in mortgage defaults forces lenders to compensate for losses on foreclosed assets by raising mortgage interest rates for non-defaulting borrowers. The rise in the interest rate, in turn, causes an additional increase in mortgage defaults.[25] Similarly, mortgage default decisions and current loan to value ratio, which affects the value of put (default) option, can be simultaneously determined. Borrowers consider the risk of default in choosing credit terms. When borrowers choose to finance a larger percentage of house value at a higher interest rate, they are aware that the higher debt service burden and smaller equity stake in the house affects their ability and willingness to repay the mortgage.[26] Thus, the loan-to-value ratio and interest rate are not econometrically exogenous in explaining default and possible foreclosure.

Identification of Time-Invariant Variables

Second, econometric identification of time-invariant variables in panel data model with unobserved state random effects is difficult. If unobserved state random effects are correlated with some explanatory variables, random-effects model will produce inconsistent estimates, and the fixed-effects model eliminates time-invariant variables (Wooldridge, 2002).

Implementation

We address the econometric complications by estimating our model in two steps. In the first step, we regress mortgage interest rates or loan to value ratio on a set of instruments that shift credit demand or

[25] For additional discussion, see Lin and White (2001), p. 146.
[26] See Yezer, Phillips, and Trost (1994).

supply and are uncorrelated with ex-ante mortgage default decisions. We use the following set of instruments:

- Lagged values of mortgage interest rates or loan to value ratio.

- Prime rate (St. Louis Fed FRED database): The prime rate reflects the opportunity cost of production of mortgage loans.

- Borrowers' age distribution dummy variables (Census Bureau): Family life-cycle considerations suggest that age influences demand for credit. Older households are likely to seek larger loan amounts relative to home value. Older households also tend to be wealthier and choose higher valued homes.

- Net tightening of mortgage credit standards for mortgage loans (Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices): Tighter credit standards are associated with higher contract rates and greater loan-to-home value requirements.

- State income per capita (Bureau of Economic Analysis): Income reflects wealth and therefore influences home values and loan amount relative to home values.

For the mortgage interest rate, we use the lagged value of mortgage interest rate, prime rate, age distribution dummies, and net tightening as instruments. For loan to value, we use the lagged value of loan to value, prime rate, age distribution dummies, net tightening, and state income per capita as instruments.

In the second stage, we use the predicted values of mortgage interest rates and loan-to-value ratios as explanatory variables and estimate equation (1) using Hausman and Taylor's (1981) estimator. This method yields consistent estimates for time-invariant variables if either (1) time-invariant variables are not correlated with state-level random effects, or (2) there are exogenous time-varying variables, which are not correlated with state-level random effects, and can be used to instrument for time-invariant variables (Wooldridge, 2002). We believe that the former assumption is satisfied. State foreclosure laws and exemption levels were set well before our estimation time frame. Very few changes were made, and the few changes in exemptions were small changes (Lin and White, 2001).

V. RESULTS

Tables 3 to 8 report the results of estimating the fixed-effects regression model explaining the effects of bankruptcy asset exemptions state and foreclosure laws on serious delinquencies, foreclosures, and the

ratio of foreclosure starts to serious delinquencies. All estimated models are statistically significant and have reasonable goodness of fit. Joint tests that the coefficients of foreclosure law and bankruptcy asset exemption coefficients are equal to zero are rejected for each model.

Effects of Borrower Risk and Macroeconomic Conditions

The estimated effects of borrower risk and macroeconomic conditions on default and foreclosure are generally statistically significant at conventional levels and consistent with theory and findings of previous studies. Results are similar for serious delinquency and foreclosure starts, except that the size of the coefficients for serious delinquency is much larger in absolute value than the size of coefficients for foreclosures. The signs of coefficients for these variables are the same for each type of interest rate in both prime and subprime markets. The coefficients for the dummy variables reflecting credit bureau score distributions increase in size as the percentage of higher risk borrowers increases, which indicates that higher risk populations have significantly higher rates of serious delinquency and foreclosure. Consistent with the prediction of theoretical model, higher levels of non-mortgage debt to total debt in are generally positively and significantly related to default and foreclosure. And both serious delinquencies and foreclosures are higher in states with higher unemployment rates.

The estimated effects of the current mortgage interest rate and loan-to-value ratio are consistent with expectations. As mentioned earlier in this paper, higher interest rates lower the value of mortgage refinance option, making default less costly to borrowers. Higher interest rates also may make default on high-risk mortgages more attractive to lenders when the current interest rate is greater than the contract rate. We find that higher interest rates are significantly positively related to serious delinquencies and foreclosures in all but one model. Higher current loan-to-value ratios are associated with significantly greater serious delinquencies and foreclosures in all models.

For prime FRM and ARM loans, the ratio of foreclosure starts to seriously delinquent loans is higher in states with greater percentages of risky borrowers. For subprime loans, the ratio of foreclosure starts is largely not related to the percentage of risky borrowers. Foreclosure starts to serious delinquencies are not generally significantly related to the ratio of non-mortgage debt to total debt. However, for the riskiest category of mortgages, subprime ARMs, relatively high levels of non-mortgage debt is inversely related to

the ratio of foreclosures to serious delinquencies. The unemployment rate is inversely related to the share of foreclosure start-ups as a fraction of seriously delinquent loans in all models.

The interest rate is negatively related to the ratio of foreclosures to serious delinquencies for fixed-rate prime mortgages. For adjustable rate-prime and both types of subprime mortgages, however, the interest rate is positively related to foreclosures to serious delinquencies. The ratio of foreclosures to seriously delinquent mortgages is lower in the states where average current loan-to-value ratio is higher.

State Foreclosure Laws

Foreclosures and serious delinquencies are higher in states that require judicial foreclosure than in states that allow non-judicial foreclosures. This result is consistent with the hypothesis that the delay associated with judicial foreclosure provides borrowers with an incentive to force lenders to initiate foreclosure proceedings as a remedy to default. Despite the higher incidence of foreclosures, the ratio of foreclosures to serious delinquencies is smaller in states that require judicial foreclosure than in states that allow non-judicial foreclosures. This result may reflect lenders' incentive to resolve defaults outside of foreclosure when judicial foreclosures are required.

Prohibition of deficiency judgement is positively related to serious delinquency and foreclosure. However, the standard errors of the estimated coefficients for this variable are relatively large, perhaps in part because the provisions of the laws regarding deficiency judgements are quite heterogeneous. Consequently, the positive coefficients are not statistically significant at conventional levels. Prohibition of deficiency judgement is associated with fewer foreclosures relative to serious delinquencies, although the relationship is generally small and not statistically significant.

States that provide a statutory right of redemption generally had fewer serious delinquencies and foreclosures, but the effect of these provisions is small (in absolute value) and not statistically significant. A statutory right of redemption is inversely related to the fraction of foreclosures to serious delinquencies. Again, the effect is small and not significant.

Bankruptcy Asset Exemptions

Both personal property and homestead exemptions are statistically significant in most of the estimated specifications. Estimated coefficients for normalized personal property exemptions are negative and sig-

nificant in the regressions for prime and subprime serious delinquencies and subprime foreclosures. The coefficient for prime fixed-rate mortgage foreclosure starts is positive but not statistically significantly different from zero. Estimated coefficients for normalized property exemptions are statistically significant and negative in the regressions for the ratio of foreclosure starts to seriously delinquent loans subprime but not prime mortgages. These findings provide strong support for Berkowitz and Hynes' (1999) hypothesis that by discharging non-mortgage debts, personal property exemptions may help borrowers make payments on secured debts and avoid default and foreclosure.

The estimated effects of homestead exemptions on mortgage foreclosures are non-linear, differ in different market segments, and are sometimes influenced by non-mortgage indebtedness. Homestead exemptions greater than 30 percent of the average home price are associated with higher subprime foreclosures than the benchmark case of low exemptions (less than 10 percent of average home price). High homestead exemptions are associated with lower prime foreclosures, however; but when high exemptions interacted with the ratio of non-mortgage to total debt, we find that high exemptions and relatively higher non-mortgage debt are associated with significantly higher foreclosure starts for prime mortgages. This result is consistent with the theoretical model, and provides some support for Lin and White's (2001) hypothesis that borrowers with high housing equity are more likely to file for bankruptcy in the states with high homestead exemptions than borrowers in other states. In the case of prime borrowers, this effect is observed when borrowers owe relatively large amounts of unsecured debt. Greater exemption levels increase borrowers' wealth under bankruptcy and therefore increases the likelihood of filing for bankruptcy. Empirical evidence indicates that higher asset exemptions are indeed positively related to probability of filing for bankruptcy (Agarwal, Liu, and Mielnicki 2003).

The effects of homestead exemptions between 10 to 30 percent of average home price on foreclosures are positive for prime mortgages although not statistically significant for prime FRMs. In contrast, the estimated effects of homestead exemptions between 10 to 30 percent of average home price on foreclosures of for subprime mortgages are statistically significant and negative.

The effect of homestead exemptions on the fraction of foreclosures to serious delinquencies is small in absolute value and not generally statistically significant.

Bankruptcy Reform

Serious delinquencies and foreclosure starts for prime loans were significantly higher following the effective date of bankruptcy reform in October 2005. Foreclosure starts for subprime ARM loans were also significantly higher after bankruptcy reform. And the ratio of foreclosures to serious delinquencies was significantly higher for each type of interest rates in both prime and subprime markets. The finding of greater foreclosures after bankruptcy reform is consistent with findings of Morgan, Iverson, and Botsch (2008) and Li, White, and Zhu's (2009).

Contrary to expectations, serious delinquencies and foreclosures of subprime FRM loans were lower after bankruptcy reform. An explanation for this result is not obvious, but it is worth noting that the subprime market is not homogeneous. Subprime FRM borrowers tend to have higher FICO risk scores, lower valued properties, and lower incomes than subprime ARM borrowers (Elliehausen, Hwang, and Park 2008). As a goal of bankruptcy reform was to reduce the availability of bankruptcy relief for higher income and higher asset debtors, the act may have affected subprime FRM borrowers in a more limited way.

We did not find strong evidence that foreclosure starts increased more in states with homestead exemptions greater than the bankruptcy reform act's $125,000 limit than in states with lower limits. Foreclosure starts for both prime and subprime ARM foreclosures were greater in high-exemption states than is lower exemption states. That the effect of the $125,000 limit is significant in the ARM but not FRM segment may be a consequence of ARMs greater risk.

VI. CONCLUSIONS

This paper investigates the effects of foreclosure laws and bankruptcy asset exemptions on mortgage default and foreclosure rates. Theoretical considerations suggest that bankruptcy asset exemptions should matter, but predicted effects could either increase or reduce foreclosures. Higher exemption levels leave borrower with greater wealth after bankruptcy to pay secured debts and therefore make bankruptcy less costly for the borrower. Although a mortgage must be paid in full before a before the borrower benefits from the bankruptcy homestead exemption, filing for bankruptcy invokes an automatic stay on lender efforts to collect the debt, which increases the time between delinquency and foreclosure. The delay resulting from a bankruptcy filing may make foreclosure attractive to a borrower and induce them to force lenders to foreclose

to resolve delinquency. Lenders, on the other hand, may be more receptive to resolving a default outside of foreclosure.

These laws are important because they may affect whether or not some consumers are able to obtain mortgages. They also may affect whether or not borrowers who experience payment problems ultimately are able to remain in the house. Cutts and Merrill (2008) found that very short and very long foreclosure processes are associated with relatively high home loss rates, for example. Thus, laws that greatly delay resolution of defaults or induce borrowers to take actions that greatly delay resolution may harm borrowers that the laws seek to protect.

We find evidence that foreclosure laws that raise the cost of foreclosure result in greater foreclosures. Foreclosures are higher in states that require judicial foreclosure and prohibit deficiency judgements, although prohibition of deficiency judgements is not statistically significant at conventional levels. These findings suggest that costly foreclosure laws induce borrowers to force lenders to foreclose to resolve default. However, we also find that costly foreclosure results in lower foreclosures to serious delinquency, which suggests that lenders attempt to resolve default outside default. The effects of foreclosure laws are similar in both prime and subprime markets.

Effects of bankruptcy asset exemptions differ in prime and subprime markets. We find that higher personal property exemptions reduce foreclosures for subprime but not prime mortgages. This negative effect is consistent with Berkowitz and Hynes' (1999) prediction that greater wealth after completion of bankruptcy may help borrowers repay secured debts. Thus, subprime borrowers, who are likely to be liquidity constrained, use wealth increase to repay secured lenders rather than delay foreclosure to stay in house.

High homestead exemptions are associated with greater foreclosures for prime and subprime ARMs, (consistent with Lin and White) using delay in foreclosure to stay in the house. High homestead exemptions are associated with fewer foreclosures for subprime FRMs, (consistent with Berkowitz and Hynes) using increase in wealth to repay secured creditors. We find that high exemptions and relatively higher non-mortgage debt are associated with significantly higher foreclosure starts for prime mortgages, which confirms our hypothesis that debt portfolio matters in explaining the effect of bankruptcy asset exemptions on mortgage default and

foreclosure rates. It also seems that the effect of homestead exemptions depends on the circumstances of the borrower. ARM borrowers use ARM to afford larger mortgage and appear to use bankruptcy to prolong staying in the house. In contrast, subprime FRM borrowers typically have impaired credit histories and often refinance mortgages to consolidate debts and reduce debt servicing costs.

Finally, bankruptcy reform increased foreclosures for subprime ARM and prime borrowers, consistent with higher bankruptcy costs discouraging filing for bankruptcy to delay foreclosure to stay in the house. Again, we find different effects in different market segments. Subprime FRM borrowers' lower incomes and house values suggests that they were less likely than subprime ARM or prime borrowers to be affected by bankruptcy reform law's exemption or income limits.

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APPENDIX I: A MODEL OF BORROWING WITH BANKRUPTCY ASSET EXEMPTIONS - ADDITIONAL RESULTS

A. Cost - Benefit Analysis

The consumer's decision whether to default on either or both of the loans is determined by the second period consumption possibilities given by the equations (5), (8), (11), and (12).

Case 1. It is optimal not to default on either debts when $C_2^1 > C_2^2$; $C_2^1 > C_2^3$; and $C_2^1 > C_2^4$. This result holds if

$$(1 - p)(H_L - b_M(1 + r_M)) + R > 0, \tag{18}$$

$$y_2 + pH_H > \frac{1}{2}(x_C + px_M + b_C(1 + r_C) - D) + pb_M(1 + r_M), \text{ and} \tag{19}$$

$$y_2 + pH_H > \frac{1}{2}(x_C + px_M + b_C(1 + r_C) - Z - (1 - p)(H_L - b_M(1 + r_M))). \tag{20}$$

Case 2. It is optimal to default on the mortgage debt when $C_2^2 > C_2^1$; $C_2^2 > C_2^3$; and $C_2^2 > C_2^4$. This result holds if

$$(1 - p)(H_L - b_M(1 + r_M)) + R < 0, \tag{21}$$

$$y_2 + pH_H > pb_M(1 + r_M) + \tag{22}$$

$$+\frac{1}{2}(x_C + px_M + b_C(1 + r_C) - D + R + (1 - p)(H_L - b_M(1 + r_M))), \text{ and}$$

$$y_2 + pH_H > \frac{1}{2}(x_C + px_M + b_C(1 + r_C) - Z + R) + pb_M(1 + r_M). \tag{23}$$

Case 3. It is optimal to default on the personal debt when $C_2^3 > C_2^1$; $C_2^3 > C_2^2$; and $C_2^3 > C_2^4$. This result

holds if

$$(1-p)(H_L - b_M(1+r_M)) + Z - D > 0, \tag{24}$$

$$y_2 + pH_H < \frac{1}{2}(x_C + px_M + b_C(1+r_C) - D) + pb_M(1+r_M), \text{ and} \tag{25}$$

$$y_2 + pH_H < pb_M(1+r_M) + \tag{26}$$

$$+ \frac{1}{2}(x_C + px_M + b_C(1+r_C) - D + R + (1-p)(H_L - b_M(1+r_M))).$$

Case 4. It is optimal to default on both debts when $C_2^3 > C_2^1$; $C_2^3 > C_2^2$; and $C_2^3 > C_2^4$. This result holds

if

$$(1-p)(H_L - b_M(1+r_M)) + Z - D < 0, \tag{27}$$

$$y_2 + pH_H < \frac{1}{2}(x_C + px_M + b_C(1+r_C) - Z + R) + pb_M(1+r_M), \text{ and} \tag{28}$$

$$y_2 + pH_H < \frac{1}{2}(x_C + px_M + b_C(1+r_C) - Z - (1-p)(H_L - b_M(1+r_M))). \tag{29}$$

B. Default Decisions under Income Uncertainty

Proposition 1 *The borrower chooses not to default on either debts when $y_2 = y_H$, and to default on both*

debts when $y_2 = y_L$ if the following inequalities are satisfied:

$$(1-p)(H_L - b_M(1+r_M)) + R > 0 \tag{30}$$

$$(1 - p)(H_L - b_M(1 + r_M)) + Z - D < 0 \tag{31}$$

$$y_H + pH_H > \frac{1}{2}(x_C + px_M + b_C(1 + r_C) - D) + pb_M(1 + r_M) \tag{32}$$

$$y_L + pH_H < \frac{1}{2}(x_C + px_M + b_C(1 + r_C) - Z - (1 - p)(H_L - b_M(1 + r_M))) \tag{33}$$

$$pb_M(1 + r_M) + (1 - p)(H_L - b_M(1 + r_M)) + Z - D > 0 \tag{34}$$

Proof. To prove the proposition we need to show that cases 2 and 3 do not hold, and the inequalities (19) and (20) are satisfied if $y_2 = y_H$, and the inequalities (28) and (29) are satisfied if $y_2 = y_L$. The inequalities (30) and (31) are identical to inequalities (18) and (27), so we do not need to prove that these inequalities hold. Cases 2 and 3 never hold because inequalities (30) and (21), and inequalities (31) and (24) are mutually exclusive. If $y_2 = y_H$ then the inequality (32) becomes the inequality (19). Subtracting (20) from (19) gives: $pb_M(1 + r_M) + (1 - p)(H_L - b_M(1 + r_M)) + Z - D > 0$ (by inequality (34)). So inequality (20) holds when inequality (19) holds. This eliminates case 4 (inequalities (20) and (29) are mutually exclusive). So, if $y_2 = y_H$ then only case 1 is feasible. If $y_2 = y_L$ then the inequality (33) becomes the inequality (29), so case 1 does not hold (inequalities (20) and (29) are mutually exclusive). Subtracting (28) from (29) gives: $-(pb_M(1 + r_M) + (1 - p)(H_L - b_M(1 + r_M)) + R) < 0$ (by (34), and because $R > Z - D$). So inequality (28) holds when inequality (29) holds. ∎

C. Derivation of the Effect of a Marginal Increase in the Bankruptcy Asset Exemptions

The first order conditions for the consumer's maximization problem (13) are:

$$U_C'(y_1 - H_1 + b_C + b_M) \tag{35}$$

$$-\rho(1 + r_C)\pi U_C'(y_H + pH_H + (1 - p)H_L - b_M(1 + r_M) - b_C(1 + r_C)) = 0$$

and

$$U'_M (y_1 - H_1 + b_C + b_M) \tag{36}$$

$$-\rho (1 + r_M) \pi U'_M (y_H + pH_H + (1 - p) H_L - b_M (1 + r_M) - b_C (1 + r_C)) +$$

$$+\rho (1 - \pi) p (1 + r_M) U'_M (x_C - p (H_H - b_M (1 + r_M) - x_M) - y_L - Z)$$

$$= 0.$$

Using the implicit function theorem, we could determine the slopes of optimal mortgage loan with respect to optimal consumer loan and vice versa:

$$\left. \frac{db_C}{db_M} \right|_{FOCb_C} = -\frac{U''_{CM} (\bullet) + \rho (1 + r_C) (1 + r_M) U''_{CM} (\bullet)}{U''_{CC} (\bullet) + \rho (1 + r_C)^2 \pi U''_{CM} (\bullet)} < 0 \tag{37}$$

$$\left. \frac{db_C}{db_M} \right|_{FOCb_M} = -\frac{U''_{MM} (\bullet) + \rho (1 + r_M)^2 \pi U''_{MM} (\bullet) + \rho (1 - \pi) p^2 (1 + r_M)^2 U''_{MM} (\bullet)}{U''_{MC} (\bullet) + \rho (1 + r_M) (1 + r_C) \pi U''_{MC} (\bullet)} < 0 \tag{38}$$

Now consider the effect of a marginal increase in x_M (x_C). Again, using the implicit function theorem yields:

$$\left. \frac{db_C}{dx_M} \right|_{FOCb_C} = \left. \frac{db_M}{dx_M} \right|_{FOCb_C} = -\frac{0}{U''_{CC} (\bullet) + \rho (1 + r_C)^2 \pi U''_{CM} (\bullet)} = 0 \tag{39}$$

$$\left. \frac{db_C}{dx_M} \right|_{FOCb_M} = \left. \frac{db_M}{dx_M} \right|_{FOCb_M} = -\frac{(1 - \pi) p^2 (1 + r_M) U''_M (\bullet)}{U''_{MC} (\bullet) + \rho (1 + r_M) (1 + r_C) \pi U''_{MC} (\bullet)} < 0 \tag{40}$$

APPENDIX II: EMPIRICAL RESULTS

Table 1

Descriptive Statistics of Dependent Variables Seriously Delinquent Loans and Foreclosure Start-ups as a Fraction of Total Originations, and Foreclosure Start-ups as a Fraction of Total Originations, First Quarter 1998 – Fourth Quarter 2006

	Fixed Rate Mortgage		Adjustable-Rate Mortgages	
	mean	standard deviation	mean	standard deviation
Seriously Delinquent Prime Mortgages as a % of Total Prime Originations	0.59	0.47	1.43	1.04
Seriously Delinquent Subprime Mortgages as a % of Total Subprime Originations	7.58	4.57	8.44	4.25
Prime Foreclosures Started as a % of Total Prime Originations	0.12	0.08	0.34	0.22
Subprime Foreclosures Started as a % of Total Subprime Originations	1.48	0.93	2.02	0.94
Prime Foreclosures Started as a % of Total Seriously Delinquent Prime Mortgages	22.23	7.61	25.68	7.95
Sub Prime Foreclosures Started as a % of Total Seriously Delinquent Sub Prime Mortgages	21.25	10.05	26.07	9.51

Table 2

Loan Terms, Borrower Characteristics, Macroeconomic Conditions, and State Law and Bankruptcy Asset Exemptions, First Quarter 1998 – Fourth Quarter 2006.

Description	mean	standard dev.	min	max
State Law and Bankruptcy Asset Exemptions				
Judicial foreclosure required	0.43	0.50	0	1
Deficiency judgment prohibited	0.12	0.32	0	1
Statutory right of redemption	0.20	0.40	0	1
% of garnishment	20.18	8.46	0	25.00
Normalized value of homestead exemption between 0.1 and 0.3	0.19	0.39	0	1
Normalized value of homestead exemption above 0.3**	0.26	0.44	0	1
Property Exemption / Income Per Capita	0.30	0.19	0.05	1.47
Actual average time from DDLPI to foreclosure sale relative to the US average, days	353.18	86.46	213	598
Actual Average Cost from DDLPI to foreclosure sale relative to US Average, percent	96.69	33.23	44	224
Loan Terms				
FHFB Transaction Mortgage Fixed Rate	6.83	0.77	5.72	8.47
FHFB Transaction Mortgage Adjustable Rate	6.01	0.67	4.70	7.22
Current Loan to Value ratio	0.12	0.03	0.05	0.21
Borrower Characteristics				
Share of lower risk borrowers 60% - 65%	0.16	0.37	0	1
Share of lower risk borrowers 65% - 70%	0.30	0.46	0	1
Share of lower risk borrowers greater than 70%	0.40	0.49	0	1
Share of lower risk borrowers greater than 35%	0.30	0.46	0	1
Share of high-risk borrowers 30% - 35%*	0.30	0.46	0	1
Share of high-risk borrowers 25% - 30%*	0.32	0.47	0	1
Share of Non-mortgage Debt in Total Debt	0.40	0.1	0.18	0.69
Macroeconomic Conditions				
% Unemployment	0.05	0.02	0.02	0.13

Note: DDLPI - Due Date of Last Paid Installment, FHFB- Federal Housing Finance Board.

Table 3: Regression analysis for Seriously Delinquent Loans (SDLs) - Prime Loans

	FRM		ARM	
	coef	se	coef	se
Intercept	3.123***	0.262	4.933***	0.597
State Law and Bankruptcy Asset Exemptions				
Judicial Foreclosure	0.399***	0.133	0.729***	0.282
Deficiency Judgment	0.223	0.206	0.628	0.437
Statutory Redemption rights	-0.046	0.166	-0.127	0.351
% of garnishment	-0.014*	0.008	-0.017	0.017
Normalized Homestead exemption 0.1 - 0.3	0.128***	0.044	0.185*	0.109
Normalized Homestead exemption above 0.3	-0.153	0.157	-0.036	0.396
Property Exemption / Income Per Capita	-0.893***	0.242	-1.682***	0.616
Norm. Home. > 0.3 x Non-mortgage/Total debt	1.034***	0.391	1.148	0.981
Loan Terms				
FHFB Transaction Mortgage Fixed Rate	0.043***	0.015		
Average of monthly 1 year FHFB ARM rate			0.120***	0.036
Current Loan to Value ratio	1.324***	0.102	3.068***	0.247
Borrower Characteristics				
Proportion of borrowers with Credit Score ≥ 595 is between 60% and 64.99 %	-0.070	0.045	-0.258**	0.112
Proportion of borrowers with Credit Score ≥ 595 is between 65% and 69.99%	-0.183***	0.067	-0.314*	0.167
Proportion of borrowers with Credit Score ≥ 595 is above 70%	-0.209***	0.080	-0.357*	0.198
Non-mortgage Debt to Total Debt	-0.017	0.429	4.609***	1.013
Macroeconomic Conditions				
% Unemployment	8.863***	0.907	23.391***	2.298
Bankruptcy law 2006				
1: time >= 2005q4, 0 else	0.115***	0.032	0.208**	0.083
Homestead exemption > 125,000 X time >= 2005q4	-0.122**	0.055	-0.010	0.139
Number of observations	1,785		1,779	
Pseudo - R2	28.76%		24.62%	
Joint Hypothesis Test: Chi - square (χ^2)	35.53		18.93	
P – value	0.000		0.008	

Note: ***, **, and * denote the significance at the 1%, 5%, and 10% levels, respectively.

Table 4: Regression analysis for Seriously Delinquent Loans (SDLs) - Sub Prime Loans

	FRM		ARM	
	coef	se	coef	se
Intercept	22.986***	2.877	26.542***	2.993
State Law and Bankruptcy Asset Exemptions				
Judicial Foreclosure	3.435**	1.470	2.410	1.547
Deficiency Judgment	3.379	2.270	1.470	2.389
Statutory Redemption rights	0.562	1.833	-0.701	1.929
% of garnishment	-0.104	0.088	-0.103	0.092
Normalized Homestead exemption 0.1 - 0.3	-1.230***	0.397	0.159	0.418
Normalized Homestead exemption above 0.3	-1.275	1.435	3.920***	1.519
Property Exemption / Income Per Capita	-18.921***	2.194	-14.165***	2.358
Norm. Home. > 0.3 x Non-mortgage/Total debt	0.736	3.577	-1.127	3.778
Loan Terms				
FHFB Transaction Mortgage Fixed Rate	0.413***	0.132		
Average of monthly 1 year FHFB ARM rate			0.246*	0.135
Current Loan to Value ratio	15.185***	0.933	16.564***	0.973
Borrower Characteristics				
Proportion of borrowers with Credit Score < 595 above 35 %	4.710***	0.880	1.736*	0.932
Proportion of borrowers with Credit Score < 595 between 30% and 34.99%	2.829***	0.749	1.010	0.793
Proportion of borrowers with Credit Score < 595 between 25% and 29.99%	2.320***	0.636	1.070	0.675
Non-mortgage Debt to Total Debt	41.760***	3.915	43.958***	4.001
Macroeconomic Conditions				
% Unemployment	39.986***	8.216	45.699***	8.761
Bankruptcy law 2006				
1: time >= 2005q4, 0 else	-1.924***	0.292	0.149	0.319
Homestead exemption > 125,000 X time >= 2005q4	-0.273	0.501	0.915*	0.529
Number of observations	1,785		1,779	
Pseudo - R2	38.82%		26.52%	
Joint Hypothesis Test: Chi - square (χ^2)	100.00		50.61	
P - value	0.000		0.000	

Note: ***, **, and * denote the significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Regression analysis for Foreclosure Start-ups - Prime Loans

	FRM		ARM	
	coef	se	coef	se
Intercept	0.657***	0.039	0.713***	0.128
State Law and Bankruptcy Asset Exemptions				
Judicial Foreclosure	0.062***	0.021	0.091	0.058
Deficiency Judgment	0.017	0.033	0.077	0.089
Statutory Redemption rights	-0.016	0.026	-0.051	0.072
% of garnishment	-0.002	0.001	-0.002	0.003
Normalized Homestead exemption 0.1 - 0.3	0.010	0.006	0.041*	0.024
Normalized Homestead exemption above 0.3	-0.092***	0.022	-0.056	0.089
Property Exemption / Income Per Capita	0.026	0.034	-0.066	0.138
Norm. Home. > 0.3 x Non-mortgage/Total debt	0.311***	0.055	0.515**	0.220
Loan Terms				
FHFB Transaction Mortgage Fixed Rate	-0.001	0.002		
Average of monthly 1 year FHFB ARM rate			0.057***	0.008
Current Loan to Value ratio	0.274***	0.014	0.586***	0.055
Borrower Characteristics				
Proportion of borrowers with Credit Score ≥ 595 is between 60% and 64.99 %	-0.020***	0.006	-0.064**	0.025
Proportion of borrowers with Credit Score ≥ 595 is between 65% and 69.99%	-0.045***	0.009	-0.107***	0.037
Proportion of borrowers with Credit Score ≥ 595 is above 70%	-0.055***	0.011	-0.097**	0.044
Non-mortgage Debt to Total Debt	0.078	0.060	1.066***	0.225
Macroeconomic Conditions				
% Unemployment	1.236***	0.127	3.369***	0.515
Bankruptcy law 2006				
1: time >= 2005q4, 0 else	0.008*	0.004	0.048***	0.019
Homestead exemption > 125,000 X time >= 2005q4	0.010	0.008	0.070**	0.031
Number of observations	1,785		1,779	
Pseudo - R2	41.31%		26.79%	
Joint Hypothesis Test: Chi - square (χ^2)	39.83		7.81	
P - value	0.000		0.349	

Note: ***, **, and * denote the significance at the 1%, 5%, and 10% levels, respectively.

Table 6: Regression analysis for Foreclosure Start-ups - Sub Prime Loans

	FRM		ARM	
	coef	se	coef	se
Intercept	1.967***	0.593	3.625***	0.620
State Law and Bankruptcy Asset Exemptions				
Judicial Foreclosure	0.340	0.238	0.445*	0.248
Deficiency Judgment	0.149	0.371	0.446	0.387
Statutory Redemption rights	-0.053	0.298	0.028	0.310
% of garnishment	-0.005	0.014	-0.010	0.015
Normalized Homestead exemption 0.1 - 0.3	-0.341***	0.097	-0.206**	0.104
Normalized Homestead exemption above 0.3	0.511	0.354	1.064***	0.383
Property Exemption / Income Per Capita	-1.855***	0.538	-1.267**	0.592
Norm. Home. > 0.3 x Non-mortgage/Total debt	-1.531*	0.881	-1.449	0.952
Loan Terms				
FHFB Transaction Mortgage Fixed Rate	0.230***	0.032		
Average of monthly 1 year FHFB ARM rate			0.331***	0.034
Current Loan to Value ratio	2.342***	0.226	2.925***	0.237
Borrower Characteristics				
Proportion of borrowers with Credit Score < 595 above 35 %	0.636***	0.216	0.635***	0.233
Proportion of borrowers with Credit Score < 595 between 30% and 34.99%	0.542***	0.184	0.457**	0.200
Proportion of borrowers with Credit Score < 595 between 25% and 29.99%	0.380**	0.157	0.511***	0.170
Non-mortgage Debt to Total Debt	8.548***	0.958	5.599***	0.969
Macroeconomic Conditions				
% Unemployment	-1.906	2.024	6.082***	2.206
Bankruptcy law 2006				
1: time >= 2005q4, 0 else	-0.277***	0.072	0.229***	0.080
Homestead exemption > 125,000 X time >= 2005q4	-0.050	0.123	0.193	0.133
Number of observations	1,785		1,779	
Pseudo - R2	33.84%		28.56%	
Joint Hypothesis Test: Chi - square (χ^2)	38.55		26.92	
P - value	0.000		0.000	

Note: ***, **, and * denote the significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Regression analysis for Share of Foreclosure start-ups in Seriously Delinquent Loans - Prime Loans

	FRM		ARM	
	coef	se	coef	se
Intercept	0.238***	0.041	-0.054	0.040
State Law and Bankruptcy Asset Exemptions				
Judicial Foreclosure	-0.046***	0.011	-0.054***	0.012
Deficiency Judgment	-0.017	0.017	-0.012	0.019
Statutory Redemption rights	-0.008	0.013	-0.000	0.015
% of garnishment	0.000	0.001	0.000	0.001
Normalized Homestead exemption 0.1 - 0.3	0.008	0.009	0.012	0.009
Normalized Homestead exemption above 0.3	-0.019	0.035	-0.032	0.034
Property Exemption / Income Per Capita	-0.031	0.051	-0.071	0.052
Norm. Home. > 0.3 x Non-mortgage/Total debt	0.064	0.085	0.119	0.083
Loan Terms				
FHFB Transaction Mortgage Fixed Rate	-0.016***	0.003		
Average of monthly 1 year FHFB ARM rate			0.030***	0.003
Current Loan to Value ratio	-0.034*	0.019	-0.084***	0.018
Borrower Characteristics				
Proportion of borrowers with Credit Score ≥ 595 is between 60% and 64.99 %	0.015	0.010	0.011	0.009
Proportion of borrowers with Credit Score ≥ 595 is between 65% and 69.99%	0.029**	0.014	0.013	0.013
Proportion of borrowers with Credit Score ≥ 595 is above 70%	0.039**	0.016	0.040**	0.016
Non-mortgage Debt to Total Debt	0.085	0.085	-0.106	0.074
Macroeconomic Conditions				
% Unemployment	-0.424**	0.196	-0.117	0.193
Bankruptcy law 2006				
1: time >= 2005q4, 0 else	0.027***	0.007	0.024***	0.007
Homestead exemption > 125,000 X time >= 2005q4	-0.001	0.012	0.007	0.012
Number of observations	1,784		1,779	
Pseudo - R2	20.00%		39.03%	
Joint Hypothesis Test: Chi - square (χ^2)	19.96		26.76	
P - value	0.006		0.000	

Note: ***, **, and * denote the significance at the 1%, 5%, and 10% levels, respectively.

Table 8: Regression analysis for Share of Foreclosure start-ups in Seriously Delinquent Loans - Sub Prime Loans

	FRM		ARM	
	coef	se	coef	se
Intercept	-0.142**	0.062	-0.085	0.062
State Law and Bankruptcy Asset Exemptions				
Judicial Foreclosure	-0.055***	0.017	-0.035	0.023
Deficiency Judgment	-0.071***	0.027	0.012	0.036
Statutory Redemption rights	-0.034	0.021	0.010	0.029
% of garnishment	0.002**	0.001	0.002	0.001
Normalized Homestead exemption 0.1 - 0.3	-0.002	0.012	-0.017	0.011
Normalized Homestead exemption above 0.3	0.081*	0.045	-0.044	0.041
Property Exemption / Income Per Capita	0.226***	0.063	0.119*	0.062
Norm. Home. > 0.3 x Non-mortgage/Total debt	-0.172	0.109	-0.005	0.101
Loan Terms				
FHFB Transaction Mortgage Fixed Rate	0.018***	0.004		
Average of monthly 1 year FHFB ARM rate			0.026***	0.004
Current Loan to Value ratio	-0.088***	0.027	-0.167***	0.025
Borrower Characteristics				
Proportion of borrowers with Credit Score < 595 above 35 %	-0.057**	0.027	-0.002	0.025
Proportion of borrowers with Credit Score < 595 between 30% and 34.99%	-0.002	0.024	0.020	0.021
Proportion of borrowers with Credit Score < 595 between 25% and 29.99%	0.003	0.021	0.029	0.018
Non-mortgage Debt to Total Debt	0.117	0.119	-0.521***	0.102
Macroeconomic Conditions				
% Unemployment	-1.220***	0.261	-0.671***	0.235
Bankruptcy law 2006				
1: time >= 2005q4, 0 else	0.032***	0.009	0.040***	0.008
Homestead exemption > 125,000 X time >= 2005q4	-0.025	0.016	-0.013	0.014
Number of observations	1,765		1,772	
Pseudo - R2	27.94%		26.68%	
Joint Hypothesis Test: Chi - square (χ^2)	35.13		11.46	
P – value	0.000		0.120	

Note: ***, **, and * denote the significance at the 1%, 5%, and 10% levels, respectively.

Appendix III

Chart 1
Seriously delinquent mortgages