

Did Bankruptcy Reform Cause Mortgage Defaults to Rise?¹

Wenli Li, Federal Reserve Bank of Philadelphia

Michelle J. White, UC San Diego and NBER

and

Ning Zhu, University of California, Davis

Original draft: September 2009

Current draft: January 2010

¹ We are grateful to Mark Watson at the Kansas Fed for his invaluable support on the LPS mortgage data, to Susheela Patwari for very capable research assistance and to Gordon Dahl, Richard Green, Joseph Doherty, and Ed Morrison for extremely helpful comments. The views expressed here are the authors' and do not represent those of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

Abstract

This paper argues that the U.S. bankruptcy reform of 2005 played an important role in the subprime mortgage crisis and the recession of 2008-09. When debtors file for bankruptcy, credit card debt and other types of unsecured debt are discharged—thus loosening debtors' budget constraints. Filing allows financially distressed homeowners to shift funds from paying their credit card bills to paying their mortgages and thus gives them a way to avoid losing their homes. But a major reform of U.S. bankruptcy law in 2005 raised the cost of filing and reduced the availability of debt discharge in bankruptcy. It therefore caused the number of filings to fall sharply. In this paper we argue that the 2005 bankruptcy reform caused default rates on mortgages to rise.

We use a large dataset of mortgages to examine whether mortgage defaults rose as a result of the 2005 bankruptcy reform. Our major result is that prime mortgage default rates rose by 17% and subprime mortgage default rates by 19% after bankruptcy reform. The default rates of homeowners with high assets and high incomes rose even more. We calculate that the reform caused the number of mortgage defaults to increase by nearly 300,000 per year, thus contributing to the severity of the mortgage crisis when it began.

Introduction

The financial crisis and the recession of 2008-09 were triggered by the bursting of the housing bubble and the subprime mortgage crisis that began in late 2006/early 2007. But U.S. personal bankruptcy law also played an important role. Because credit card debt and other types of unsecured debt are discharged in bankruptcy, filing for bankruptcy loosens homeowners' budget constraints and allows them to shift funds from paying credit card debt to paying their mortgages. Bankruptcy thus gives financially distressed homeowners a way to avoid losing their homes when their debts exceed their ability-to-pay. The availability of debt relief in bankruptcy was widely known, the costs of filing were low, and there was little stigma attached to filing. Even debtors with high income and high assets could take advantage of bankruptcy. But a major reform of U.S. bankruptcy law in 2005 raised the cost of filing and reduced the availability of debt discharge in bankruptcy for debtors with high income or high assets. It therefore caused the number of filings to fall sharply. In this paper we argue that the 2005 bankruptcy reform caused default rates on mortgages to rise by closing off a popular procedure that previously helped many distressed homeowners save their homes. The reform therefore contributed to the severity of the mortgage crisis by raising default rates even before the crisis began.

In this paper, we use a large dataset of mortgages to examine whether mortgage defaults rose as a result of the 2005 bankruptcy reform and whether homeowners with high incomes and high assets were particularly affected. Our major result is that prime mortgage default rates rose by 17% and subprime mortgage default rates by 19% after bankruptcy reform. We also find that the new means test and the new cap on the homestead exemption caused default rates of homeowners with high assets and high incomes to rise even more. Our results suggest that the 2005 bankruptcy reform caused the number of mortgage defaults to increase by nearly 300,000 per year, thus adding greatly to the severity of the mortgage crisis.

Bernstein (2008) and Morgan, Iverson and Botsch (2008) have suggested that the 2005 bankruptcy reform caused the subsequent increase in mortgage defaults. Bernstein's paper does not provide any empirical tests. Morgan et al argued that bankruptcy reform raised mortgage default rates the most in states with high homestead exemptions, because homeowners in these states previously gained the most from filing for bankruptcy. They tested this hypothesis by examining whether default rates rose more in states with higher exemptions. But the 2005 bankruptcy reform did not in fact change the treatment of homestead exemption levels in bankruptcy, except by imposing a cap on the exemption for a small proportion of homeowners. As a result, their test is not very precise and they in fact did not find very strong support for their hypothesis. Also because Morgan et al used aggregate state-year data covering a long time period, they were unable to distinguish between the effects on default rates of bankruptcy reform versus the bursting of the housing bubble. We therefore examine the relationship between bankruptcy reform and mortgage default using a large dataset of individual mortgages and a shorter time period that ends before the mortgage crisis. Our data also allow us to examine how particular provisions of the 2005 bankruptcy reform affected the default rates of homeowners subject to these provisions.

The paper proceeds as follows. We start by describing how U.S. bankruptcy law treats mortgage debt and how the 2005 bankruptcy reform affected homeowners' incentives to default on their mortgages. We then describe our dataset, our empirical model, and the results. In the conclusion, we estimate how many additional mortgage defaults occurred starting in 2006 as a result of bankruptcy reform.

U.S. Bankruptcy Law and the 2005 Bankruptcy Reform²

US bankruptcy law provides two separate personal bankruptcy procedures—Chapter 7 and Chapter 13—and both help financially distressed homeowners keep their homes. Prior to 2005, all debtors were allowed to choose between them. Under Chapter 7, most unsecured debts are discharged. Debtors are only obliged to use assets above an asset exemption level to repay unsecured debt; their future earnings are entirely exempt. States

² See White (2007a) and (2007b) and White and Zhu (2010) for further discussion of bankruptcy law, bankruptcy reform, and their effects on homeowners.

set the asset exemption levels and have different exemptions for different types of assets, but the homestead exemption for equity in an owner-occupied home is the largest in nearly all the states. In states with high homestead exemptions, even debtors with high assets and high income can gain from filing for bankruptcy under Chapter 7. Under Chapter 13, debtors must have regular earnings and must follow a court-supervised repayment plan to repay some of their debt from future earnings over a period of 3 to 5 years. They may also be obliged to use their non-exempt assets to repay.

How does filing for bankruptcy under either chapter help homeowners in financial distress? Consider Chapter 7 first. Homeowners who wish to save their homes benefit from filing under Chapter 7 because discharge of unsecured debt increases their ability to make their mortgage payments.³ Homeowners in Chapter 7 are allowed to keep their homes as long as their home equity is entirely exempt, meaning that it is less than their state's homestead exemption. In addition, filing under Chapter 7 stops mortgage lenders from foreclosing for a few months, which may give homeowners enough time to repay their mortgage arrears if they have fallen behind. But the terms of residential mortgage contracts cannot be changed in Chapter 7. Homeowners who wish to save their homes must therefore repay all of their mortgage arrears quickly, or else lenders can resume foreclosure.

Homeowners also gain from filing under Chapter 7 if they do not plan to save their homes. Since foreclosure is delayed during the bankruptcy proceeding, homeowners get cost-free housing for several months.⁴ Homeowners also gain from delaying foreclosure if they positive home equity, since delay gives them more time to sell their homes privately and obtain the highest price. If foreclosure has already occurred, then mortgage lenders in some states have a claim against the borrower for the difference between the amount due on the mortgage and the sale price of the home—called a “deficiency judgment.” These judgments can be discharged in Chapter 7.

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

³ Berkowitz and Hynes (1999) first suggested that filing for bankruptcy helps homeowners keep their homes by reducing their unsecured debt.

⁴ In some states, homeowners can even stay in their homes through foreclosure, which means that they become tenants and the lender (now the landlord) must go through an eviction procedure to force them to leave (Elias, 2008).

$$Gain_{Chapter7} = U_7 + H_7 - \max[A - X_A, 0] - C_7$$

U_7 is the value of unsecured debt discharged in Chapter 7. Homeowners receive this gain in bankruptcy regardless of whether they keep their homes or not. H_7 is the reduction in the present value of future housing costs when homeowners file under Chapter 7. If homeowners save their homes in Chapter 7, then $H_7 = 0$. But if they give up their homes, then H_7 equals the reduction in housing costs when they shift from owning to renting, or $(PVCO_7 - PVCR_7)$, where $PVCO_7$ and $PVCR_7$ are the present value of the future costs of owning and renting, respectively. H_7 includes homeowners' gain from living in their homes cost-free during bankruptcy, from having deficiency judgments discharged, and from lower housing costs once they give up their homes. The term $\max[A - X_A, 0]$ is the value of homeowners' non-exempt assets, where A denotes the value of homeowners' assets and X_A is the homestead exemption.⁵ Homeowners that have non-exempt assets greater than zero must use these assets to repay unsecured debt in bankruptcy. This generally makes filing for bankruptcy unattractive, since homeowners must give up their homes in bankruptcy. Finally, C_7 is homeowners' cost of filing for bankruptcy under Chapter 7, including both time costs and out-of-pocket costs.

Homeowners in financial distress who wish to save their homes often benefit more by filing for bankruptcy under Chapter 13. While the terms of first mortgages cannot be changed in bankruptcy, homeowners in Chapter 13 are allowed to spread repayment of their mortgage arrears, plus interest, over the period of their repayment plans. They must also make all of their normal mortgage payments during the plan period. Lenders cannot proceed with foreclosure as long as homeowners are making the required payments. If homeowners make all of the payments specified in the plan, then the original mortgage contract is reinstated. Thus Chapter 13 allows homeowners to save their homes even if they have large mortgage arrears, by giving them several years to repay. Prior to 2005, homeowners proposed their own Chapter 13 plans and were allowed to choose the length of the repayment period and the amount of unsecured debt to be repaid. They frequently

⁵ Financial assets other than home equity are not generally exempt in bankruptcy. But homeowners who plan in advance for bankruptcy can keep these assets by using them to pay down their mortgages, assuming that the additional home equity is exempt under the homestead exemption.

proposed plans that repaid their mortgage arrears, but paid only a token amount to unsecured creditors. Bankruptcy judges generally accepted these plans as long as homeowners would not be required to repay any of their unsecured debt in Chapter 7.⁶ Also in Chapter 13, bankruptcy trustees sometimes challenge fees and penalties that mortgage lenders add to the mortgage and second mortgages are sometimes discharged if the amount owed on the first mortgage exceeds the value of the home.⁷

Homeowners also gain from filing under Chapter 13 even if they do not plan to save their homes, or if they decide after filing that they cannot afford to save their homes. The same amount of unsecured debt is discharged in Chapter 13 as in Chapter 7. Car loans also can be partially discharged in Chapter 13, but not in Chapter 7. Also homeowners can delay foreclosure and live cost-free in their homes for longer in Chapter 13 than in Chapter 7, particularly if they propose and withdraw several rounds of repayment plans.

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

$$Gain_{Chapter13} = U_{13} + C_{13} + H_{13} - I_{13} - \max[A - X_A, 0] - C_{13}.$$

Here U_{13} refers to unsecured debt discharged in Chapter 13, where $U_{13} = U_7$ for most filers. C_{13} is the value of car debt that can be discharged in Chapter 13. H_{13} is the reduction in the cost of housing when homeowners file under Chapter 13. If homeowners keep their homes in Chapter 13, then H_{13} equals the reduction in the present value of the cost of owning due to discharge of second mortgages, home equity loans, fees and/or penalties. If homeowners give up their homes and move to rental housing, then H_{13} equals the reduction in the present value of the cost of housing, including homeowners' gain from having cost-free housing during the bankruptcy process. I_{13} denotes the present value of future income that must be used to repay unsecured debt in Chapter 13; prior to 2005 this was generally only a token amount. $\max[A - X_A, 0]$ is again the value of non-exempt assets (if any) that homeowners must use to repay unsecured debt.

⁶ Debtors are obliged to repay unsecured debt from home equity in Chapter 13 because the "best interests of creditors" test, § 1129(a)(7) of the U.S. Bankruptcy Code, requires that unsecured creditors receive no less in Chapter 13 than they would receive in Chapter 7. These payments are made over five years as part of the debtor's repayment plan.

⁷ Having a second mortgage discharged in Chapter 13 requires that a valuation hearing be held, which raises bankruptcy costs. For more detailed discussion of how Chapter 13 affects homeowners, see Elias (2006), Eggum, Porter and Twomey (2008), Carroll and Li (2008), and White and Zhu (2010). Porter (2008) discusses how mortgage lenders often add excessive fees to mortgages in default.

Finally, C_{13} is homeowners' cost of filing for bankruptcy under Chapter 13, which is higher than C_7 .

Thus prior to 2005, the availability of bankruptcy reduced default by helping homeowners in financial distress to save their homes, but it also increased default by reducing homeowners' housing costs if they gave up their homes and filed for bankruptcy.

Now consider how the 2005 bankruptcy reform changed homeowners' gain from filing for bankruptcy. First, the reform raised homeowners' costs of filing. According to a study by the Government Accountability Office (2008), debtors' median filing costs rose from \$700 to \$1,100 under Chapter 7 and from \$2,000 to \$3,000 under Chapter 13. In addition, debtors in Chapter 13 must pay a fee to the Chapter 13 trustee which varies by state but is typically 10% of the amount specified in their repayment plans. Debtors' non-monetary costs of filing also rose because of new requirements that they undergo credit counseling before filing, take a course in debt management during the bankruptcy process, and provide extensive documentation of their income and assets—including copies of past tax returns. Higher costs are predicted to reduce homeowners' probability of filing and, because they gain less from bankruptcy, they are more likely to default on their mortgages.

Second, a new cap on the homestead exemption was adopted, which limits the asset exemption X_A to a maximum of \$125,000 and therefore increases some homeowners' the obligation to repay in bankruptcy. The cap applies to relatively few homeowners, because only ten states have asset exemptions greater than \$125,000 and because homeowners are exempt if they have owned their homes longer than 3½ years.⁸ But for a small number of affected homeowners, the cap makes bankruptcy much less attractive since they must give up their homes. It is therefore predicted to increase mortgage default.

Third, the reform introduced a new "means test" that forces some high-income homeowners to file under Chapter 13 and to use some of their future income to repay

⁸ The states that have unlimited homestead exemptions are Arkansas, Florida, Iowa, Kansas, Oklahoma, Texas, and the District of Columbia. Arizona's exemption is \$150,000; Massachusetts' is \$500,000; Minnesota's was \$200,000 in 2005, raised to \$300,000 in 2007; and Nevada's was \$200,000 in 2005, raised to \$350,000 in 2006 and to \$550,000 in 2007. See Elias (2007) and earlier editions.

debt. Suppose homeowners have no non-exempt assets. Under the means test, they first compare their family income to the median family income in their state, adjusted for family size. State median income levels vary widely, from \$46,000 for a family of three in Mississippi to \$85,000 for the same size family in New Jersey and Connecticut. If income is less than the state median income level, then homeowners “pass” the means test and the reform does not change their gain from filing for bankruptcy. But if homeowners’ income exceeds the state median level, then they must compute an individual income exemption. They first follow a formula to determine their allowed housing costs, transport costs, and personal expenses. Then they add their mortgage and car loan payments in excess of the formula amounts for housing and transportation, including regular monthly debt payments, arrears, penalty fees and interest. Finally they add a list of other allowed expenses.⁹ Their yearly income exemption under the means test, denoted X_I , equals the total. Homeowners then compute their non-exempt income, which equals their actual income I minus the income exemption, or $I - X_I$. If $I - X_I$ exceeds \$2,000 per year, then homeowners “fail” the means test and they must file under Chapter 13 if they file for bankruptcy at all. In Chapter 13, they must use all of their non-exempt income for five years to repay, or $5(I - X_I)$. They repay mortgage debt and other secured debt first, and then use the remainder to repay unsecured debt. Since homeowners’ obligation to repay debt from future income was a token amount prior to bankruptcy reform, the reform made filing for bankruptcy less attractive for homeowners who “fail” the means test. They are predicted to default on their mortgages more often after bankruptcy reform.

Finally, the means test affected homeowners differently if they have non-exempt assets, or $A - X_A > 0$. Prior to the reform, these homeowners were obliged to use their non-exempt assets to repay unsecured debt in bankruptcy and they were also obliged to use a token amount of future income to repay if they filed under Chapter 13. After the

⁹ The formulas are taken from IRS procedures for collecting from delinquent taxpayers. The housing cost allowances vary by locality, the transport cost allowances vary depend on how many automobiles the debtor owns (up to two), and the personal expense allowances vary by income. See www.justice.gov/ust/eo/bapcpa/20090315/meanstesting.htm. The additional expenses that debtors are allowed to add include costs of taking care of elderly or disabled relatives, some children’s education expenses, tax payments, payroll deductions, costs of security, and telecommunication costs.

2005 bankruptcy reform, they are forced to take the means test and their new obligation to repay equals their non-exempt assets or their non-exempt income—whichever is larger. Their repayment obligation therefore increases from $A - X_A$ to $\max[(A - X_A), 5(I - X_I)]$. But because these homeowners already were forced to give up their homes if they filed for bankruptcy, they already found filing for bankruptcy unattractive. As a result, bankruptcy reform probably had little effect on whether they file and therefore is likely to have little effect on their probability of defaulting.

Our predictions are therefore as follows: (1) The mortgage default rate is predicted to rise for all homeowners following the 2005 bankruptcy reform, because the reform made filing more costly. (2) The default rate of homeowners affected by the cap on the homestead exemption is predicted to rise after bankruptcy reform, since the cap forces them to give up their homes in bankruptcy. (3) The default rate of homeowners who fail the means test is predicted to rise after bankruptcy reform, since they must now use future income to repay unsecured debt in bankruptcy and therefore their gain from filing is smaller. (4) The default rate of homeowners who have non-exempt income exceeding their non-exempt assets is unlikely to change after bankruptcy reform. While the reform made filing for bankruptcy less attractive for these homeowners, they were unlikely to file even before the reform and therefore their default rates are unlikely to change significantly after the reform. Table 1 shows the three groups of homeowners—(2) through (4)—that were particularly affected by bankruptcy reform. In the next section, we test the predictions that homeowners in general are more likely to default after bankruptcy reform and that homeowners in groups (2) and (3) are particularly more likely to default after bankruptcy reform.¹⁰

Data and summary statistics

We use individual-level mortgage data from LPS Applied Analytics, Inc., which gives detailed information for a large sample of mortgages at the time of origination and updates each month concerning whether homeowners defaulted and whether they filed for bankruptcy. Our sample consists of first-lien, 30 year mortgages used for home

¹⁰ We neglect other changes made under the 2005 bankruptcy reform, because their effects cannot be tested using our data. For example, the conditions for discharging car loans in Chapter 13 were tightened after bankruptcy reform, but we do not have data on car loans.

purchase or refinance. All mortgages originated in 2004 or 2005 and were still in effect at the beginning of our sample period. We follow them until they are repaid in full, go into default, or until the sample period ends. We define mortgage default to occur when payments become 60 days delinquent.

The 2005 bankruptcy reform went into effect in mid-October 2005. We examine default behavior over a three-month period before versus after bankruptcy reform and test whether default rates rose after bankruptcy reform.¹¹ During this short period, other aspects of the economic environment remained fairly constant and the mortgage crisis had not yet begun. As a robustness check, we also run our model for the six-month period before versus after bankruptcy reform. Both the 3-month and 6-month periods end before the start of the mortgage crisis.

Because the LPS dataset do not give homeowners' income, we merge it with data from the Home Mortgage Disclosure Act (HMDA). This gives us information on homeowners' income, as well as their sex, race, and marital status, as of the time or mortgage origination.¹² We also add other local area macroeconomic characteristics and state-level bankruptcy information.¹³

We construct separate samples of prime and subprime mortgages. Our prime mortgage sample contains 380,784 mortgages and our subprime sample contains 268,840 mortgages. The number of monthly observations in the two samples is approximately 2.2 million and 1.5 million, respectively.¹⁴

¹¹ Because bankruptcy reform went into effect in the middle of October 2005, our sample period covers seven months. We assign October 2005 to the pre-reform period because virtually all mortgage payments are due at the beginning of the month.

¹² HMDA data (www.ffiec.gov/hmda/history.htm) cover nearly all mortgage applications and originations. Mortgages were matched based on the zipcode of the property, the date when the mortgage originated (within 5 days), the origination amount (within \$500), the purpose of the loan (purchase, refinance or other), the type of loan (conventional, VA guaranteed, FHA guaranteed or other), occupancy type (owner occupied or non-owner occupied), and lien status (first lien or other). The match rate was 48%. We calculated summary statistics of all the variables that are included in this study and found no statistically significant differences between the means of the matched observations and the original LPS dataset. This suggests that the matched observations are a random subset of the original LPS dataset.

¹³ Additional variables include unemployment rates by metropolitan area, taken from the Bureau of Labor Statistics; income data by state, taken from the Bureau of Economic Analysis; housing price data by metropolitan area, taken from the Federal Housing Finance Agency; bankruptcy exemption levels by state, taken from Elias (2006 and earlier editions); and median state income levels, taken from the U.S. Trustee Program at the Department of Justice.

¹⁴ We start with a 10% random sample of LPS prime mortgages that originated in 2004 or 2005 and were still in effect in July 2005. With the loss of observations resulting from the HMDA match, we end up with

Figure 1 gives mortgage default rates for prime and subprime mortgages during the period three months before to three months after bankruptcy reform. Neither set of default rates shows a trend before bankruptcy reform and both rose sharply when the reform went into effect.

Now consider the three groups of homeowners discussed above who are particularly affected by bankruptcy reform. *HC* denotes homeowners who are subject to the new cap on the homestead exemption. We calculate each homeowner's home equity every month by updating the value of the house at the time of mortgage origination, using the mean monthly change in housing values in the metropolitan area since the origination date. Home equity then equals the current value of the house minus the current mortgage principle. $HC = 1$ if home equity exceeds the \$125,000 cap.¹⁵

MT1 denotes homeowners who "fail" the means test and are forced to repay from future income after bankruptcy reform, but have no non-exempt assets. We have data on household income at the time the mortgage originated. Because we do not have the information needed to calculate individual homeowners' income exemptions, we use the state median income level as a proxy for the income exemption. *MT1* equals one if homeowner *i*'s income exceeds the income exemption and if homeowner *i* has no non-exempt home equity. We refer to *MT1* as the income-only means test.¹⁶

MT2 denotes homeowners who have both non-exempt income and non-exempt home equity and whose non-exempt income exceeds their non-exempt home equity. These homeowners previously found bankruptcy unattractive, because they were required to repay some unsecured debt in bankruptcy and this obligation probably would force them to give up their homes. Post-reform, their obligation to repay unsecured debt in

approximately a 5% sample. For the subprime mortgages, we start with the full LPS sample, but end up with approximately a 50% sample after the HMDA match.

¹⁵ The homestead exemption cap applies only to homeowners who have lived in their homes for less than 3½ years. We assume that all homeowners whose mortgages were for purchase are subject to the cap, but homeowners whose mortgages were for refinance are not. If the debtor does not live in a metropolitan area, we update the value of the house using the average change in housing values in the non-metropolitan areas of the state. Note that our estimate of *HC* is biased upward, since we have no information on second mortgages and we therefore assume that debtors do not have them.

¹⁶ *MT1* is measured with error both because we do not have updated information on income and because our proxy for homeowners' income exemptions is inexact.

bankruptcy is even higher. We calculate non-exempt income as discussed in connection with $MT1$. To calculate home equity, we calculate homeowner i 's home equity as discussed in connection with HC and then subtract the relevant state homestead exemption level.¹⁷ $MT2$ equals one if homeowner i 's non-exempt income and non-exempt home equity are both positive and if the former exceeds the latter.¹⁸ We refer to $MT2$ as the income/asset test.

BR is a dummy variable for months when the 2005 bankruptcy reform was in effect.

Table 2 gives the results of a difference-in-difference analysis using the raw data. After bankruptcy reform, the default rates of prime and subprime mortgage-holders increased by 15% and 9%, respectively. Now consider the homestead exemption cap, HC . The default rate of homeowners affected by the cap increased by more than the default rate for non-affected homeowners—the difference-in-difference is 19%, for homeowners with prime mortgages and 38% for homeowners with subprime mortgages. Similarly the default rate of homeowners with prime mortgages who fail the means test ($MT1 = 1$) increases by more than the default homeowners with prime mortgages who pass the means test—the difference-in-difference is 14%. But the difference-in-difference is a negative 4% for homeowners with subprime mortgages. Finally the difference-in-difference for the income/asset test ($MT2 = 1$) is positive for both groups of homeowners, but very small. These results suggest that the 2005 bankruptcy reform had strong effects on homeowners in general, on all homeowners who were subject to new cap on the homestead exemption, and on homeowners with prime mortgages who were subject to the new means test.

Specification

Now turn to the regressions. We estimate a logit hazard model, where the regressors include a dummy variable BR for months in which the 2005 bankruptcy reform was in effect, dummy variables HC , $MT1$, and $MT2$ for homeowners affected by the three

¹⁷ Note that many more homeowners have non-exempt home equity than are subject to the cap on the homestead exemption.

¹⁸ $MT2$ is likely to be measured with more error than either $MT1$ or HC , because our computations of both non-exempt assets and non-exempt income contain error and the computation of $MT2$ increases the error by comparing them.

features of bankruptcy reform, interactions between BR and each of these variables, a set of controls, state dummies, year dummies, and dummies for the age of the mortgage in months. The key variables are the coefficients of BR and the coefficients of the three interaction terms.¹⁹

Ai and Norton (2003) pointed out that in non-linear models, the coefficients of interaction terms do not equal difference-in-differences. Instead the true difference-in-difference equals $[E(1,1) - E(1,0)] - [E(0,1) - E(0,0)]$, where $E(1,1)$ denotes the expected value of the logit function conditional on $BR = 1$ and $HC = 1$ and the other terms are analogously defined. We compute the difference-in-difference effects by this procedure.²⁰

Our choice of control variables is determined by data availability and the literature on mortgage default—see, for example, Gerardi et al (2007), Mayer, Pence, and Sherlund (2008), Demyanyk and van Hemert (2008), Keys et al (2008), Rajan, Seru and Vig (2009), Elul (2009), and Jiang et al (2009). Controls include whether the debtor is married, is African-American, or is female, a set of dummy variables for the homeowner's FICO score in bins (the highest category is omitted), a set of dummy variables for the homeowner's debt-to-income ratio in bins (the lowest category is omitted), and a set of dummy variables for the homeowner's loan-to-value ratio in bins (the lowest category is omitted). (The debt-to-income ratio includes all types of debt.) We also include dummy variables for whether the loan is a jumbo, whether it is fixed-rate (versus adjustable rate or hybrid), whether the loan is for refinance (versus purchase), whether the homeowner provided full documentation of income and assets when applying for the mortgage (versus documentation only of assets or no documentation), whether the house is single-family, and whether the property is a vacation home or an investment property (the omitted category is primary residence). Additional dummy variables include whether the loan was originated by the bank that holds it, acquired wholesale from a broker, or acquired from a correspondent, where the omitted category is

¹⁹ We drop mortgages once they go into default. See Kiefer (1988) for discussion of hazard models.

²⁰ We use Stata 11 to do these calculations.

loans originated by independent mortgage brokers.²¹ We also include a dummy variable for loans that were securitized and a variable measuring homeowners' benefit from refinancing their mortgages at the currently-available interest rate relative to keeping their current mortgages (PV_t).²² Finally we include the lagged unemployment rate in the metropolitan area, the lagged real income growth rate in the state, and the lagged cumulative delinquency rate in the homeowner's zipcode, plus state dummies, year dummies, and dummies for age of the mortgage in months.²³ We cluster observations by mortgage. Table 3 gives summary statistics for both samples.

Results

Table 4 gives the results for the three month before-versus-after bankruptcy reform sample in which only the bankruptcy reform dummy and control variables are included. The figures given are marginal effects. The dummy variable for the homestead exemption cap (HC) is insignificant in both samples, which reflects the fact that having home equity above or below the \$125,000 figure did not affect homeowners' default behavior before 2005. The means test variable ($MT1$) is negative and significant in both samples, which makes sense because homeowners with higher-than-median incomes are less likely to default on their mortgages. The income/asset means test variable ($MT2$) is also negative and significant for the prime mortgage sample, but is insignificant for the subprime mortgage sample.

Examining the other variables, homeowners with lower FICO scores, higher debt-to-income ratios and higher loan-to-value ratios are more likely to default. All of the

²¹ Correspondents are mortgage brokers that sell all the mortgages they originate to a single bank; while independent mortgage brokers sell to multiple banks. Correspondents' interests are more closely aligned with the interests of their banks, due to the long-term relationship. See Jiang et al (2009) for discussion.

²² $PV_t = \{r_t[1-(1+r_t)^{-M}]\} / \{r_0[1-(1+r_0)^{-M}]\}$, where r_0 is the actual interest rate specified in the homeowner's mortgage, r_t is the current interest rate available on new mortgages, and M is the number of months to maturity. A higher value of PV_t indicates that homeowners gain more from refinancing. See Richard and Roll (1989).

²³ Most of the control variables are observed only at the time of mortgage origination. Variables that are updated each month include the loan-to-value ratio, PV_t , HC , $MT1$, $MT2$, the macroeconomic variables, and the year and age of the mortgage dummies. We do not include the monthly rate of increase of house prices in the metropolitan area as a control, since this information is used in constructing HC and $MT2$.

variables representing mortgage sources have negative signs, suggesting that mortgages originated by brokers—the omitted category—are most likely to default.²⁴ Prime mortgages that were securitized are more likely to default, but—surprisingly—the result is reversed for subprime mortgages.²⁵ We also find that homeowners are more likely to default if they live in zipcodes with higher lagged default rates, in states with higher lagged real income growth rates, and if they live in metropolitan areas with higher lagged unemployment rates (subprime mortgages only).

Table 5 gives the results for the bankruptcy reform dummy and the three interactions, using the same sample. (All models also include the control variables shown in table 4.) The results shown for *BR* are marginal effects and the results for the interaction terms are difference-in-differences. Asterisks and double asterisks indicate statistical significance at the 5% and 1% levels, respectively. Because *HC*, *MT1* and *MT2* are correlated, we show the results when we enter them both individually and together.

Both samples show that the adoption of bankruptcy reform led to a substantial increase in overall mortgage default rates—in the full specification in column (5), the increases are 19% for the prime mortgage sample and 17% for the subprime mortgage sample. These figures are larger than the diff-in-diff figures in table 3 that we obtained using the raw data. Now turn to the cap on the homestead exemption. Homeowners who are affected by the cap are much more likely to default after bankruptcy reform—the increases are 53% for prime mortgage-holders and 44% for subprime mortgage-holders. These results are strongly statistically significant ($p = .017$ and $p = .003$, respectively). They support our hypothesis that homeowners subject to the cap are less likely to file for bankruptcy after the reform, because they no longer can get the benefit of bankruptcy and still keep their homes. As a result, they are more likely to default. The means test interaction, however, has mixed effects. In the prime mortgage sample, homeowners

²⁴ See Jiang et al (2009) for discussion.

²⁵ One explanation for the negative coefficient on the full documentation variable is that lenders are offer loans to borrowers with lower FICO scores if they provide full documentation. Thus these borrowers with full documentation are not necessarily more credit-worthy. See Keys et al (2008) for discussion of the relationship between documentation levels, FICO scores and default.

who fail the means test are significantly more likely to default after bankruptcy reform—the increase is 14% and it is significant at the 5% level ($p = .044$). However in the subprime mortgage sample, homeowners subject to the means test do not significantly change their default behavior. The latter result probably reflects the fact that many homeowners with subprime mortgages overstated their incomes in applying for their mortgages. Finally, the income/asset means test variable ($MT2$) is insignificant for the prime mortgage sample and has the wrong sign for subprime mortgage-holders. As discussed above, homeowners in this group already found bankruptcy unattractive before the reform and, as a result, the reform had little effect on their default behavior.²⁶

These results generally support our hypothesis that the 2005 bankruptcy reform caused mortgage default to increase. Homeowners in general, homeowners who were affected by the new cap on the homestead exemption, and homeowners with prime mortgages who were affected by the new means test all defaulted significantly more often after bankruptcy reform.

Results for the six-month sample and additional robustness tests: to be added.

In order to determine whether the effect of bankruptcy reform on default was temporary, we reran our model using a period of six months before to six months after bankruptcy reform, or from October 2004 – October 2006. We chose this period because it is longer, but still ends before the mortgage crisis. The results are shown in table 5. Comparing the results in tables 4 and 5, the overall increase in default rates becomes larger -- 36% for homeowners with prime mortgages and 40% for homeowners with subprime mortgages (using the results in column (5) of table 5). The cap on the homestead exemption remains significant, but becomes smaller—the increases for affected homeowners are 24% and 33% for homeowners with prime and subprime mortgages. The income-based means test also becomes smaller, but is statistically significant for both samples—the increases are 13% for homeowners with prime mortgages and 7% for homeowners with subprime mortgages (p values are ? and .003, respectively). Finally the income/asset means test ($MT2$) is now statistically significant for prime mortgage-holders—the default

²⁶ We also reran the models in table 4, clustering the errors by zipcode rather than by mortgage. The results (not shown) were virtually unchanged.

rate rises by 13% for this group after bankruptcy (start) higher default rate and subprime mortgage-holders have a the increase for this group is 13% ($p = .026$). These results suggest that bankruptcy reform caused default rates to rise more than just temporarily.

We also tested Morgan et al's (2008) model of the effect of bankruptcy reform on mortgage default. Morgan et al argue that homeowners in states with high or unlimited homestead exemptions were harmed the most by bankruptcy reform, since these homeowners previously gained the most from filing. Using aggregate state-year data, they estimated a model of mortgage default rates as a function of the bankruptcy reform dummy interacted with both the homestead exemption level in the relevant state and whether the state has an unlimited homestead exemption, plus some controls. They did not find very strong support for their hypothesis, since only one of the four interactions—the interaction of the bankruptcy reform dummy with the homestead exemption variable for prime mortgages—was positive and significant; while the other three interactions were insignificant. They were not able to test whether default rates in general rose after bankruptcy reform for all homeowners.

We argued above that this interpretation of the bankruptcy reform overstates the role of the homestead exemption, since the reform changed the homestead exemption only for homeowners subject to the new cap on the exemption (captured by our HC_{it} variable) and for homeowners subject to the income/asset means test (captured by our $MT2_{it}$ variable).

Table 6 shows the results when we run a version of Morgan et al's model, using our data and our controls.²⁷ We use the 3 month before and after sample period and we estimate the model using the same logit hazard model as used for the other regressions. Surprisingly, the interaction of the bankruptcy reform dummy and the homestead exemption is negative and significant for both prime and subprime mortgage-holders, suggesting that homeowners living in states with higher homestead exemptions were *less* likely to default after bankruptcy reform. But the interaction of bankruptcy reform and

²⁷ The controls do not include age of the mortgage dummies and do not Morgan et al (2009) standardize the homestead exemption using the median housing value in the state. We standardized the state homestead exemption level using the appraised value of the house.

the unlimited homestead exemption dummy is large and positive in both samples, suggesting that default rates of homeowners living in states with unlimited homestead exemptions rose by **72% and 82%** after bankruptcy reform for those with prime and subprime mortgages, respectively. This result presumably occurs because the unlimited homestead exemption variable in their model captures the effect of the cap on the homestead exemption.²⁸ Overall, our results provide stronger confirmation than Morgan et al's for their hypothesis that bankruptcy reform caused mortgage default rates to rise the most for those homeowners who previously gained the most from bankruptcy.

Conclusion

REVISE Our main result is that the 2005 bankruptcy reform caused mortgage default rates to rise. Depending on the length of the period before versus after bankruptcy reform that we use to measure the effect, homeowners with prime mortgages defaulted 27% to 36% more often and homeowner with subprime mortgages defaulted 37 to 40% more often. In addition, homeowners subject to the new cap on the homestead exemption defaulted 25% to 60% more often if they have prime mortgages and 33 to 67% more often if they have subprime mortgages. Homeowners who “fail” the means test and are forced to use some of their future income to repay default between 13 to 21% more often after bankruptcy reform if they have prime mortgages, but they do not change their behavior if they have subprime mortgages.

Overall, our results suggest that bankruptcy reform contributed to the severity of the mortgage crisis by raising default rates even before the mortgage crisis began. We can use our results to predict the increase in mortgage defaults that resulted from bankruptcy reform. Using the effect of the bankruptcy reform dummy from the model in table 4, column (5), and using only mortgages originated in 2004-05, bankruptcy reform is predicted to cause an additional 274,000 mortgage defaults each year.²⁹ In addition, the

²⁸ The correlation of the dummy variable for states that have unlimited homestead exemptions and our HC variable is .11 in both samples.

²⁹ These figures are based on 32,000,000 mortgage originations in 2004-06, of which 82% were prime and 18% were subprime. Using our monthly default rates of .0021 per month for prime mortgages and .014 per month for subprime mortgages and our estimates that bankruptcy reform was associated with increases in the default rate of 19%

adoption of the homestead exemption cap and the new means test are predicted to cause an additional 19,000 defaults per year by homeowners subject to these provisions.³⁰ Thus even before the mortgage crisis began, the 2005 bankruptcy reform was responsible for an increase of nearly 300,000 in the number of mortgage defaults per year.

for prime mortgages and 17% for subprime mortgages, we calculate that $32,000,000 * (.82 * .0021 * .19 * 11.86 + .18 * .014 * .17 * 11.12) = 269,000$ additional defaults occurred each year after bankruptcy reform. The figures 11.86 and 11.12 convert from monthly to yearly default rates, where $11.86 = \sum_{t=0}^{11} (1 - .0021)^t$ and $11.12 = \sum_{t=0}^{11} (1 - .014)^t$. The number of mortgages originated in 2004-06 and the breakdown of mortgage originations between prime and subprime are taken from Mayer and Pence (2008). Note that Mayer and Pence give a range of figures for the breakdown of mortgages between prime versus subprime, based on different definitions of subprime mortgages. We use the average of their high versus low figures.

³⁰ The figure for the number of additional defaults by homeowners subject to the homestead exemption cap is $32,000,000 * (.82 * .048 * .00118 * .535 * 11.86 + (1 - .82) * .010 * .0135 * .439 * 11.12) = 13,000$, where .048 and .010 are the proportions of prime and subprime mortgages with $HC = 1$, .00118 and .0135 are the default rates of prime and subprime mortgages with $HC = 1$, and .535 and .439 are the proportional increases in the default rates of prime and subprime mortgages with $HC = 1$ after bankruptcy reform. The figure for the number of additional defaults by homeowners subject to the income-based means test is $32,000,000 * (.82 * .29 * .00189 * .14 * 10.64 + (1 - .82) * .45 * .012 * (-.05) * 11.12) = 4,000$, where .29 and .45 are the proportions of prime and subprime mortgages with $MT1 = 1$, .00189 and .0125 are the default rates of prime and subprime mortgages with $MT1 = 1$, and .14 and -.05 are the proportional changes in the default rates of prime and subprime mortgages with $MT1 = 1$ after bankruptcy reform. We do not calculate a figure for the number of additional defaults for homeowners with $MT2 = 1$, since the relationship was never significant. See the previous footnote for data sources.

Figure 1:
Mortgage Default Rates Three Months Before and After Bankruptcy Reform

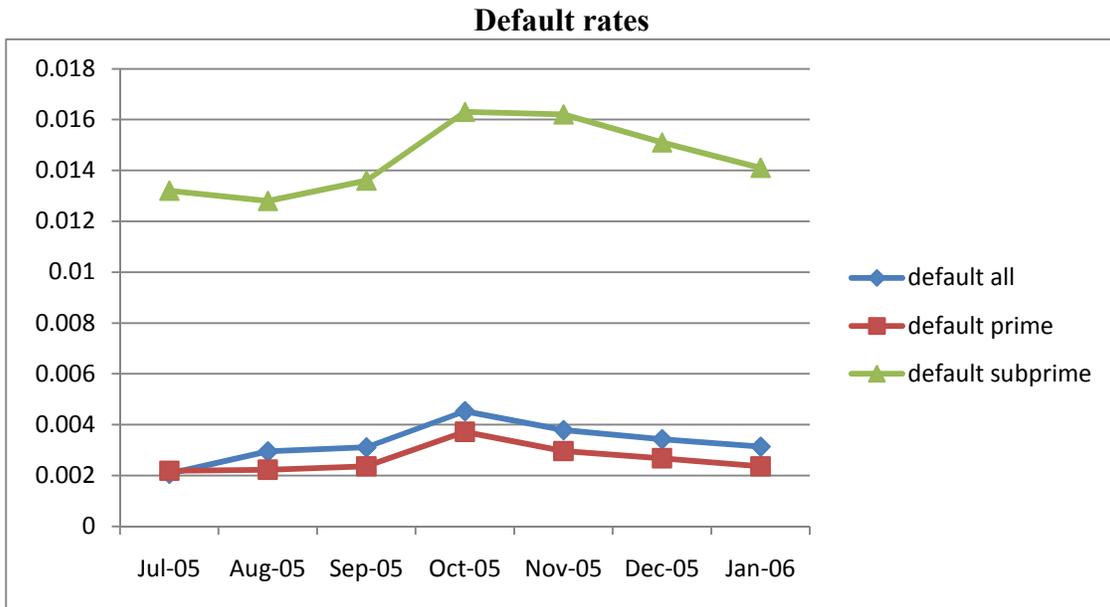


Table 1:
Effect of the 2005 bankruptcy reform on homeowners' obligation to repay

	All home equity exempt	Some home equity non-exempt
All income exempt	Must repay more if homestead exemption cap is binding ($HC = 1$); otherwise no change	Must repay more if homestead exemption cap is binding ($HC = 1$); otherwise no change
Some income non-exempt	Must repay more ($MT1 = 1$)	Must repay more if non-exempt income > non-exempt home equity ($MT2 = 1$); otherwise no change

Table 2:
Difference-in-difference Analysis of the Effects of Bankruptcy Reform
Three Months Before to Three Months After Bankruptcy Reform

	Prime mortgages			Subprime mortgages		
	BR = 0	BR = 1	difference	BR = 0	BR = 1	difference
default rate	0.00196	0.00228	0.00032	0.0133	0.0146	0.0013
			15.2%			9.4%
default rate if <i>HC</i> =1	0.000842	0.00153	0.000688	0.0096	0.0160	0.0064
default rate if <i>HC</i> =0	0.00202	0.00231	0.00029	0.0133	0.0145	0.0012
Diff-in-diff			0.000398			0.0052
Diff-in-diff (%)			18.9%			37.5%
default rate if <i>MT1</i> =1	0.00165	0.00217	0.00052	0.0121	0.0129	0.0008
default rate if <i>MT1</i> =0	0.00209	0.00232	0.00023	0.0143	0.0157	0.0015
Diff-in-diff			0.00029			-0.0006
Diff-in-diff (%)			13.7%			-4.3%
default rate if <i>MT2</i> =1	0.00136	0.00168	0.00032	0.0123	0.0139	0.0016
default rate if <i>MT2</i> =0	0.00222	0.00252	0.00030	0.0134	0.0147	0.0013
Diff-in-diff			0.00002			0.0003
Diff-in-diff (%)			0.9%			2.2%

Table 3: Summary Statistics**Three Months Before to Three Months After Bankruptcy Reform: July 2005 - January 2006**

	Prime Mortgages	Subprime Mortgages
Default rate per month ($D_{it} = 1$)	0.0021 (.046)	0.0138 (.117)
Homestead exemption cap ($HC_{it} = 1$)	0.0475 (.213)	0.0102 (.101)
Income-based means test ($MT1_{it} = 1$)	0.289 (.453)	0.446 (.497)
Income/asset means test ($MT2_{it} = 1$)	0.296 (.457)	0.114 (.317)
Average income*	\$102,000 (91,000)	\$73,000 (59,000)
Median income*		
FICO score (650,750)*	0.521 (.500)	0.231 (.421)
FICO score (550,650)*	0.138 (.345)	0.624 (.484)
FICO score (350,550)*	0.00732 (.085)	0.124 (.330)
Debt payment-to-income ratio > 0.50+*	0.0831 (.276)	0.044 (.205)
Debt payment-to-income ratio (0.4, 0.5)*	0.119 (.324)	0.191 (.394)
Debt payment-to-income ratio missing*	0.344 (.475)	0.526 (.499)
Loan-to-value ratio 100+*	0.0176 (.130)	0.000257 (.016)
Loan-to-value ratio (80,100)*	0.219 (.413)	0.385 (.486)
Loan-to-value missing*	0 (0)	0.075 (.263)
If full documentation *	0.367 (.482)	0.563 (.495)
If documentation information missing*	0.158 (.365)	0.107 (.309)
If single-family house*	0.747 (.434)	0.808 (.393)
If fixed rate mortgage*	0.609 (.488)	0.246 (.431)
If jumbo loan*	0.147 (.354)	0.087 (.281)
If loan was to re-finance*	0.353 (.477)	0.523 (.499)
If loan is securitized	0.242 (.429)	0.822 (.382)
If vacation home*	0.040 (.196)	0.010 (.101)
If investment property*	0.051 (.220)	0.051 (.219)
If occupancy type missing*	0.193 (.395)	0.050 (.219)
If mortgage was securitized	0.242 (.429)	0.822 (.382)
If loan was originated by bank	0.515 (.500)	0.434 (.495)
If loan was acquired wholesale, but not from a mortgage broker	0.194 (.395)	0.172 (.377)
If loan was acquired from a correspondent	0.221 (.415)	0.102 (.303)
Homeowner's benefit from refinancing (PV)*	1.07 (.239)	0.839 (.145)
Lagged cumulative delinquency rate (zipcode)	0.085 (.305)	0.341 (.726)
Lagged unemployment rate (MSA)	0.0461 (.0131)	0.047 (.014)
Lagged real income growth rate (state)	0.00157 (.0232)	0.0013 (.032)

Notes: The variables marked with asterisks are observed only at the time of origination. Summary statistics for these variables are based on values at the time of origination. Other variables are updated each month and summary statistics are averages over all months of data. The prime (subprime) sample includes 10% (50%) of all first-lien mortgages originated in 2004 and 2005. (See footnote 12 in the text.) The prime (subprime) sample includes 380,784 (268,840) separate mortgages and 2,247,078 (1,482,447) mortgage-month observations. Data on debt-to-income ratios is available starting in January 2005.

DELETE! Table 3: Summary Statistics

Three Months Before to Three Months After Bankruptcy Reform: July 2005 - January 2006

	Prime Mortgages +- 3 mo	Prime Mortgages +- 6 mo
Default rate per month ($D_{it} = 1$)	0.00211 (.046)	0.00183 (.043)
Homestead exemption cap ($HC_{it} = 1$)	0.0475 (.213)	0.0485 (.214)
Income-based means test ($MT1_{it} = 1$)	0.289 (.453)	0.292 (.455)
Income/asset means test ($MT2_{it} = 1$)	0.296 (.457)	.292 (.455)
Average income*	\$102,000 (91,000)	\$101,400 (90,350)
Median income*		
FICO score (650,750)*	0.521 (.500)	0.521 (.499)
FICO score (550,650)*	0.138 (.345)	0.139 (.346)
FICO score (350,550)*	0.00732 (.085)	0.00749 (.086)
Debt payment-to-income ratio $> 0.50+^*$	0.0831 (.276)	0.0829 (.2751)
Debt payment-to-income ratio (0.4, 0.5)*	0.119 (.324)	0.118 (.323)
Debt payment-to-income ratio missing*	0.344 (.475)	0.345 (.475)
Loan-to-value ratio $100+^*$	0.0176 (.130)	0.0177 (.131)
Loan-to-value ratio (80,100)*	0.219 (.413)	0.220 (.414)
Loan-to-value missing*	0 (0)	0 (0)
If full documentation *	0.367 (.482)	0.368 (.482)
If documentation information missing*	0.158 (.365)	0.165 (.375)
If single-family house*	0.747 (.434)	0.747 (.434)
If fixed rate mortgage*	0.609 (.488)	0.6088 (.488)
If jumbo loan*	0.147 (.354)	0.147 (.354)
If loan was to re-finance*	0.353 (.477)	0.350 (.477)
If loan is securitized	0.242 (.429)	0.252 (.434)
If vacation home*	0.040 (.196)	0.040 (.195)
If investment property*	0.051 (.220)	0.050 (.218)
If occupancy type missing*	0.193 (.395)	0.205 (.403)
If mortgage was securitized	0.242 (.429)	0.2528 (.433)
If loan was originated by bank	0.515 (.500)	0.513 (.500)
If loan was acquired wholesale, but not from a mortgage broker	0.194 (.395)	0.194 (.395)
If loan was acquired from a correspondent	0.221 (.415)	0.222 (.416)
Homeowner's benefit from refinancing (PV)*	1.07 (.239)	1.07 (.237)
Lagged cumulative delinquency rate (zipcode)	0.085 (.305)	0.079 (.273)
Lagged unemployment rate (MSA)	0.0461 (.0131)	0.047 (.0136)
Lagged real income growth rate (state)	0.00157 (.0232)	0.00194 (.0276)

Notes: The variables marked with asterisks are observed only at the time of origination. Summary statistics for these variables are based on values at the time of origination. Other variables are updated each month and summary statistics are averages over all months of data. The prime (subprime) sample includes 10% (50%) of all first-lien mortgages originated in 2004 and 2005. (See footnote 12 in the text.) The prime (subprime) sample includes 380,784 (268,840) separate mortgages and 2,247,078 (1,482,447) mortgage-month observations. Data on debt-to-income ratios is available starting in January 2005.

**Table 4:
Result of Logit Hazard Models Explaining Mortgage Default**

(Three Months Before-versus-After Bankruptcy Reform: July 2005 - January 2006)

	Prime Mortgages	Subprime Mortgages
<i>HC</i>	.000162 (.000226)	-.00107 (.00107)
<i>MT1</i>	-.000447 (.000082)**	-.00136 (.000249)**
<i>MT2</i>	-.000486 (.000083)**	.000332 (.00041)
FICO (650,750)	.0027 (.00015)**	.00927 (.0017)**
FICO (550,650)	.0054 (.00017)**	.0209 (.0016)**
FICO (350,550)	.0076 (.00023)**	.0285 (.0017)**
Debt-to-income ratio 0.50+	.000030 (.00015)	.0011 (.00055)*
Debt-to-income ratio (40,50)	.00045 (.00011)**	.00238 (.00032)**
Debt-to-income ratio missing	.00027 (.000097)**	-.00257 (.00035)**
Loan-to-value ratio 100+	.00095 (.00020)**	.0235 (.00238)**
Loan-to-value ratio (80,100)	.00140 (.000088)**	-.00080 (.00024)**
Loan-to-value ratio missing	dropped	-.00127 (.00055)*
If single-family house	.000083 (.000087)	.00178 (.00029)**
If jumbo loan	-.000053 (.00015)	.00171 (.00046)**
If loan was for re-finance	-.00018 (.000086)*	-.00281 (.00023)**
If fixed rate mortgage	-.00054 (.000087)**	-.00506 (.00030)**
If full documentation	-.00040 (.000085)**	-.000896 (.00028)**
If documentation information missing	-.00066 (.00012)**	.000134 (.00047)
If vacation home	.00026 (.00016)	.000289 (.0010)
If investment property	-.00012 (.00016)	-.000543 (.00049)
If occupancy type missing	.00053 (.000098)**	.00492 (.00080)**
If mortgage was securitized	.00043 (.00010)**	-.00311 (.00036)**
If loan was originated by bank	-.0011 (.00014)**	-.00687 (.00035)**
If loan was acquired wholesale, but not from a mortgage broker	-.00065 (.00015)**	-.00447 (.00041)**
If loan was acquired from a correspondent bank	-.00074 (.00014)**	-.00634 (.00046)**
Homeowner's benefit from refinancing	-.0025 (.00055)**	-.0263 (.0011)**
Lagged cumulative delinquency rate (zipcode)	.00021 (.000060)**	.00155 (.00011)**
Lagged unemployment rate (MSA)	-.000039 (.000033)	.000651 (.0001)**
Lagged real income growth rate (state)	-.0197 (.00264)**	-.0872 (.0072)**
State dummies?	Yes	Yes
Year dummies?	Yes	Yes
Age of mortgage in month dummies?	Yes	Yes

Notes: The results for *BR* and for the interaction terms are given in table 5, column (5). All figures are marginal effects. * and ** indicate statistical significance at the 5% and 1% levels, respectively. Homeowners' sex, race and marital status are entered as additional controls, but the results are not shown due to restrictions on our use of the LPS data.

Table 5:
Results of Logit Hazard Models Explaining Mortgage Default
Three months before to three months after the 2005 bankruptcy reform

Prime Mortgages

		(2)	(3)	(4)	(5)
BR_t	.00039** (.000088) 18.5%	.00039** (.00089) 18.6%	.000393** (.000089) 18.6%	.00039** (.000089) 18.7%	.00040** (.000089) 18.9%
$BR_t * HC_{it}$.00105* (.00044) 49.8%			.0011** (.00045) 53.5%
$BR_t * MT1_{it}$.00028* (.00014) 13.3%		.00030* (.00015) 14.3%
$BR_t * MT2_{it}$				-.000015 (.000015) -0.73%	.00021 (.0015) 0.98%

Subprime Mortgages

		(2)	(3)	(4)	(5)
BR_t	.00245** (.00026) 17.6%	.00247** (.00027) 17.8%	.00236** (.00027) 17.0%	.00244** (.000270) 17.4%	.00236** (.00027) 16.9%
$BR_t * HC_{it}$.00562** (.00217) 40.6%			.00615** (.000209) 43.9%
$BR_t * MT1_{it}$.000091 (.000438) 0.65%		-0.00074 (.000455) -5.31%
$BR_t * MT2_{it}$				-.00112 (.00072) -8.0%	-.00150* (.000733) -10.7%

Notes: ** and * indicate statistical significance at the 1% and 5% levels, respectively. All equations include the control variables shown in Appendix table 1, plus state dummies, year dummies, and month dummies for age of the loan.

(IN PROGRESS)

Table 6:
Results of Logit Hazard Models Explaining Mortgage Default
Six months before to six months after the 2005 bankruptcy reform

Prime Mortgages

		(2)	(3)	(4)	(5)
BR_t	1.45*** (.053) %	1.44*** (.053)	1.41*** (0.054)	1.42*** (0.055)	1.36*** (0.057)
$BR_t * HC_{it}$		1.26** (0.20) %			1.24 (0.20)
$BR_t * MT1_{it}$			1.08 (0.057) %		1.13** (.063)
$BR_t * MT2_{it}$				1.10* (0.063) %	1.13** (.063)

Subprime Mortgages

		(2)	(3)	(4)	(5)
BR_t	0.00378** (.00022) 31%	?	?	?	?
$BR_t * HC_{it}$.00148 (.00162) 12%			.00193 (.00147) 16%
$BR_t * MT1_{it}$.000448 (.000310) 3.6%		.000375 (.000321) 3.0%
$BR_t * MT2_{it}$				-.00107 (.000557) -8.6%	-.000887 (.000566) -7.2%

Notes: ** and * indicate statistical significance at the 1% and 5% levels, respectively. All equations include the control variables shown in table 4, plus state dummies, year dummies, and month dummies for age of the loan.

Table 6:
Results of Logit Hazard Regressions Explaining Default Rates
Morgan et al's Specification

Three months before to three months after the 2005 bankruptcy reform

	Prime Mortgages 3 months before/after (1)	Subprime Mortgages 3 months before/after (2)
B_t *Homestead exemption	0.81** (0.072)	0.79*** (0.038)
B_t *Unlimited homestead dummy	1.72*** (0.17)	1.82*** (0.089)
Homestead exemption	1.15** (0.081)	0.92** (0.037)
Unlimited homestead dummy	0.72 (0.39)	1.12 (0.32)

Notes: These regressions include the same control variables as used in Table 5 and 6. * and ** indicate statistical significance at the 5% and 1% levels, respectively.

References

- Ai, C. R. and Norton, E. C. (2003), Interaction terms in logit and probit models, *Economics Letters*, 80(1), pp. 123–129.
- Bernstein, David (2008), “Bankruptcy Reform and Foreclosure,” papers.ssrn.com/sol3/papers.cfm?abstract_id=1154635.
- Berkowitz, Jeremy, and Richard Hynes, “Bankruptcy Exemptions and the Market for Mortgage Loans,” *J. of Law & Economics*, 42, 809-830 (1999).
- Carroll, Sarah, and Wenli Li, “The Homeownership Experience of Households in Bankruptcy,” Philadelphia Federal Reserve Bank working paper, June 3, 2008.
- Demyanyk, Yulia, and Otto van Hemert, “Understanding the Subprime Mortgage Crisis,” ssrn.com/abstract=1020396 (2008).
- Eggum, John, Katherine Porter, and Tara Twomey, “Saving Homes in Bankruptcy: Housing Affordability and Loan Modification,” *Utah Law Review*, vol. 2008:3, pp. 1123-1168.
- Elias, Stephen, *The New Bankruptcy: Will it Work for You?* Nolo Press, 2006.
- Elias, Stephen, *The Foreclosure Survival Guide*. Nolo Press, 2008.
- Elul, Ronel, “Securitization and Mortgage Default: Reputation versus Adverse Selection.” Working paper, Research Dept., FRB Philadelphia, 2009.
- Gerardi, Kristopher, Adam Hale Shapiro, and Paul S. Willen (2007), “Subprime outcomes: Risky mortgages, homeownership experiences and foreclosures,” Federal Reserve Bank of Boston Working Paper 0715.
- Government Accountability Office, “Bankruptcy Reform: Dollar Costs Associated with the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005,” U.S. GAO-08-697 (June 2008).
- Jiang, Wei, Ashlyn Aiko Nelson, and Edward Vytlačil, “Liar’s Loan? Effects of Origination Channel and Information Falsification on Mortgage Delinquency,” August 2009.
- Keys, Benjamin J., Tanmoy K Mukherjee, Amit Seru, and Vikrant Vig, “Did Securitization lead to Lax Screening? Evidence from Subprime Loans,” SSRN abstract 1093137 (December 2008).

Kiefer, Nicholas M., "Economic Duration Data and Hazard Functions," *J. of Ec. Lit.*, vol. XXVI, pp. 646-679 (June 1988).

Mayer, Christopher, Karen Pence and Sherlund, "The Rise in Mortgage Defaults," Finance and Economics Discussion Series 2008-59, Federal Reserve Board, 2008.

Morgan, Donald P., Benjamin Iverson, and Matthew Botsch, "Seismic Effects of the Bankruptcy Reform," Staff Report no. 358, Federal Reserve Bank of New York (2008).

Porter, Katherine, "Misbehavior and Mistake in Bankruptcy Mortgage Claims," *Texas Law Review*, vol. 87:1, pp. 121-182 (2008).

Rajan, Uday, Amit Seru, and Vikrant Vig, 2009, "The Failure of Models that Predict Failure: Distance, Incentives, and Defaults," working paper, London School of Business.

Richard, Scott F., and Richard Roll, "Prepayments on Fixed-rate Mortgage-backed Securities," *Journal of Portfolio Management*, vol. 15(3), 73-82 (1989).

White, Michelle J., "Why Don't More Households File for Bankruptcy?" *Journal of Law, Economics, and Organization*, vol. 14:2, pp. 205-231, October 1998.

White, Michelle J., "Bankruptcy Law," in *Handbook of Law and Economics*, edited by A.M. Polinsky and Steven Shavell. Elsevier Press (2007a).

White, Michelle J., "[Bankruptcy Reform and Credit Cards](#)," *J. of Economic Perspectives*, Fall 2007, pp. 175-199 (2007b).

White, Michelle J., and Ning Zhu, "Saving Your Home in Chapter 13 Bankruptcy," *Journal of Legal Studies*, January 2010.