

Did Bankruptcy Reform Contribute to the Mortgage Crisis?¹

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Abstract:

Before 2005 bankruptcy reform, homeowners in financial distress could use bankruptcy to help save their homes. Homeowners could have their unsecured debts discharged in Chapter 7, thus freeing up funds to make their mortgage payments. Homeowners who were in default on their mortgages could stop foreclosure by filing under Chapter 13 and could use Chapter 13 repayment plans to repay their mortgage arrears over several years. Most homeowners who filed for bankruptcy were not obliged to repay anything to their unsecured creditors.

But the 2005 bankruptcy reform made filing for bankruptcy less useful as a save-your-home procedure. Debtors' cost of filing increased sharply after the reform. Also the homestead exemption in bankruptcy was capped at \$125,000, thus making it impossible for homeowners with high home equity to keep their homes in bankruptcy. A new "means test" increased higher-income debtors' obligation to repay their unsecured debt in bankruptcy.

Because these changes reduced homeowners' gain from filing for bankruptcy, they reduce default rates on unsecured debt. And because homeowners' ability-to-pay is fixed in the short-run, these changes are predicted to increase default rates on mortgages. In the paper, we test whether adoption of the 2005 bankruptcy reform led to higher rates of mortgage default. We use the McDash data--a large dataset of prime and subprime mortgages.

Our main result is that bankruptcy reform caused mortgage default rates to rise. Comparing default rates three months before versus after bankruptcy reform, the increase was 36% for prime mortgages and 11% for subprime mortgages. Using a longer period of one year before versus after the reform, the increase was 50% for prime mortgages and 7% for subprime mortgages. Homeowners subject to the cap on the homestead exemption were 50% more likely to default after the reform, regardless of whether their mortgages were prime or subprime. Homeowners with subprime mortgages were 13% more likely to default if they were subject to the new means test, but default rates of those with prime mortgages did not change.

Introduction

Prior to 2005, debtors in financial distress could file for bankruptcy and have their credit card debts and other unsecured debts discharged. This made it easier for financially distressed homeowners to avoid defaulting on their mortgages, since the money that they saved on paying credit card bills could be used to make their mortgage payments. The availability of debt relief in bankruptcy was widely known, the costs of filing were low, and there was little stigma attached to filing for bankruptcy. Even high-income debtors could take advantage of bankruptcy. But the 2005 bankruptcy reform changed this situation by raising the cost of filing and by making some higher-income and higher-asset debtors ineligible. Did bankruptcy reform therefore contribute to the foreclosure crisis by closing off a procedure that previously helped distressed homeowners save their homes?

In this paper, we examine the connection between bankruptcy reform and mortgage default. We use a large dataset of mortgages originated in 2004-2005 to examine whether the 2005 bankruptcy reform caused default rates on mortgages to rise and whether the rise in default rates was more than temporary. Our main result is that bankruptcy reform caused default rates for both prime and subprime mortgages to rise during the period before the beginning of the mortgage crisis. We also find that default rates rose in response to two specific provisions of bankruptcy reform that made filing for bankruptcy less attractive: the \$125,000 cap on the homestead exemption and the new means test in bankruptcy.

Bernstein (2008) and Morgan, Iverson and Botsch (2008) were the first to suggest that bankruptcy reform caused mortgage rates to rise by shifting risk from unsecured lenders to mortgage lenders. Bernstein's paper does not contain any empirical tests. Morgan et al argued that bankruptcy reform caused mortgage default rates to rise by more in states with high homestead exemption levels, because debtors previously gained the most from filing for bankruptcy in these states. They tested this relationship by examining whether default rates rose by more in states with higher exemption levels. But 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. 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 mortgage crisis. We therefore re-examine the relationship between bankruptcy reform and mortgage default, using more detailed data.

The paper proceeds as follows. We start by briefly describing U.S. bankruptcy law and how the 2005 bankruptcy reform affected homeowners' incentives to default on their mortgages. We then describe our dataset, our empirical specification, and the results.

U.S. Bankruptcy Law and the 2005 Bankruptcy Reform

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, debtors were allowed to choose between them. Under Chapter 7, debtors' unsecured debts are discharged. They are obliged to use only their assets above an asset exemption level to repay; future earnings are entirely exempt. States set the asset exemption levels and have different exemptions for different types of assets. But in nearly all the states, the homestead exemption for equity in an owner-occupied home is the largest. Under Chapter 13, debtors are obliged to have regular earnings and they must follow a court-supervised repayment plan that devotes part of their earnings to repaying unsecured debt over a period of 3 to 5 years. They may also be obliged to use some of their assets to repay unsecured debt.

Homeowners in financial distress benefit indirectly from filing under Chapter 7, because reductions in their unsecured debt payments increase their ability to pay their mortgages. They are allowed to keep their homes in bankruptcy as long as their home equity is less than the state's homestead exemption. But Chapter 7 provides little help to homeowners who have already defaulted on their mortgage payments, because it does not stop lenders from foreclosing more than temporarily. Also, mortgage payments on a debtor's principle residence cannot be lowered in Chapter 7.

Homeowners in financial distress benefit more directly from filing under Chapter 13, since a Chapter 13 filing stops lenders from foreclosing during the repayment plan, as long as homeowners are making payments on the plan. Homeowners who file under

Chapter 13 must repay their mortgage arrears in full, plus interest, as part of their repayment plans. If they succeed in repaying the arrears and also make all of their normal mortgage payments, then the original mortgage contract is reinstated. Prior to 2005, debtors proposed their own Chapter 13 plans and were allowed to choose the length of the repayment period and the amount they repaid unsecured creditors, subject to the approval of the bankruptcy judge. Most bankruptcy judges allowed debtors to propose plans that repaid mortgage arrears in full but repaid only a token amount—10% or less—to unsecured creditors. Filing under Chapter 13 also benefits homeowners because they can challenge fees and penalties that mortgage lenders have added to the mortgage and because they can have second mortgages converted from secured to unsecured debts if the first mortgage exceeds the value of the home.²

As an example, suppose homeowner A has mortgage payments of \$1,500 per month and owes arrears of \$10,000, including past due payments, penalties, and late fees. She also has \$30,000 in unsecured debt. Suppose the debtor's home equity and other assets are entirely exempt. In Chapter 7, the unsecured debt is discharged, but the debtor must repay the mortgage arrears in full or else the lender can foreclose. But in Chapter 13, the debtor can spread repayment of the mortgage arrears, plus interest, over three to five years. If the interest rate is 6% and the plan period is five years, then the debtor repays \$193.00 per month. In addition, she must also make her normal mortgage payments of \$1,500 per month during the plan period. The debtor is not required to repay more than a token amount to unsecured creditors.

But bankruptcy law provides less help to homeowners if their home equity exceeds the homestead exemption. Suppose homeowner B's home is worth \$260,000, her mortgage is \$200,000, her mortgage arrears are \$10,000, her unsecured debt is \$70,000, and her state's homestead exemption is \$40,000. If homeowner B files under Chapter 7, she is obliged to sell her home because her home equity exceeds the homestead exemption. After the mortgage and the mortgage arrears are repaid, she receives the homestead exemption of \$40,000 and the remaining \$10,000 goes to unsecured creditors.

² However the terms of first mortgages cannot be changed in bankruptcy. See Elias (2006), Eggum, Porter and Twomey (2008), Carroll and Li (2008), and White and Zhu (2010) for discussion of how debtors save their homes in Chapter 13. Porter (2008) discusses how mortgage lenders often add excessive fees to mortgages in default.

If she instead files under Chapter 13, she can keep her home, but she must repay the arrears in full plus interest, make her normal mortgage payments, and pay \$10,000 to unsecured creditors as part of her repayment plan.³

A third alternative is for homeowners to default on their mortgages and/or their unsecured debts, but remain outside of bankruptcy—this is referred to as informal bankruptcy.⁴ Unsecured lenders—particularly credit card lenders—respond to default by pursuing collection techniques, including calling the debtor, sending threatening letters, initiating wage garnishment if they can determine where the debtor works and seizing money in the debtor’s bank account if they can find it.⁵ Debtors often file for bankruptcy when lenders aggressively pursue collection or initiate wage garnishment, since bankruptcy ends both. Mortgage lenders do not generally use the same aggressive collection techniques in response to default, but they initiate foreclosure. Mann (2007) has argued that credit card lenders and credit collectors often persuade debtors in default to make payments on their credit card debt, even if debtors could file for bankruptcy and have the debt discharged. This suggests that debtors are more likely to default on their mortgages if they choose informal rather than formal bankruptcy.

Homeowners who do not intend to save their homes can also gain from filing for bankruptcy. Because filing for bankruptcy stops foreclosure, it allows owners to occupy their homes at no cost for a period of three months to a year or more, or until the bankruptcy judge allows lenders to foreclose. Filing under Chapter 13 generally delays foreclosure by longer than filing under Chapter 7. Thus while bankruptcy reduces default by helping homeowners in financial distress to save their homes, it may also increase default by allowing homeowners to occupy their homes cost-free (Elias, 2008).

Now turn to the bankruptcy reform of 2005, which made several important changes. First and most important, the reform raised debtors’ cost of filing for bankruptcy.

³ 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.

⁴ See White (1998) for a model of the role of wage garnishment in determining whether debtors choose informal or formal bankruptcy and Dawsey and Ausubel (2002) for an empirical study of debtors’ choice between informal or formal bankruptcy.

⁵ See Lawless et al (2007) for evidence that credit collectors often make false claims to debtors, such as telling them that they don’t qualify for bankruptcy.

According to a study by the Government Accountability Office (2008), debtors' median filing costs rose from \$700 to \$1,100 in Chapter 7 and from \$2,000 to \$3,000 in Chapter 13. The cost figures for Chapter 13 do not include trustees' fees, which also rose. In addition, bankruptcy reform raised debtors' non-monetary costs of filing by imposing 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 their tax returns even if they never filed a tax return. Second, the reform restricted debtors' right to choose between Chapters 7 and 13 by imposing a new "means test" that they must pass in order to file under Chapter 7. Under the means test, debtors first compare their incomes to the median family income level in their states, 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 debtor's income is below the state median level, then they are allowed to file under Chapter 7. If their income is above the median, then they must compute an individual income exemption by adding pre-determined allowances for housing costs, transport costs, and personal expenses.⁶ Then they add in all of their secured debt expenses (including regular monthly debt payments, penalty fees and interest), their tax payments, mandatory payroll deductions, costs of insurance, costs of care for dependent relatives, some education expenses for their children, telecommunications costs, and various other allowed expenses. The total is their income exemption. Debtors' disposable income equals their family income minus the income exemption. If their disposable income is less than \$2,000 per year, they are allowed to file under Chapter 7. If their disposable income exceeds \$2,000 per year, then they must file under Chapter 13 if they file for bankruptcy at all and they must use all of their disposable income for five years to repay debt. Secured debt such as mortgages and car loans are paid first and whatever is left must be used to repay unsecured debt.⁷ Third, if debtors have lived in their homes for less than 3½ years, then the homestead exemption is

⁶ These are taken from IRS procedures for collecting from delinquent taxpayers. They vary by locality, by family size, by how many automobiles the debtor owns (up to two), and, for personal expenses, by income. Give website.

⁷ For purposes of the means test, income equals debtors' average monthly income during the six months prior to filing, converted to a yearly figure. See White (2007) for discussion of the means test and its economic effects on debtors.

capped at \$125,000. This provision discourages some homeowners with high assets from filing for bankruptcy.⁸

Now consider how the 2005 bankruptcy reform changed homeowners' incentives to default on their mortgages. Suppose first that homeowners' home equity and income are both entirely exempt. Bankruptcy reform affected these homeowners only by raising their costs of filing. Homeowners in this situation are likely to delay or avoid filing for bankruptcy because of budget constraints. Even if they only delay filing, the delay allows credit card lenders more time to pursue collection, which means that debtors have less money to pay their mortgages. Thus the 2005 bankruptcy reform is predicted to cause an increase in mortgage default rates.

Now suppose homeowners have non-exempt home equity, but their income is still entirely exempt. Bankruptcy reform did not change most debtors' gain from filing for bankruptcy in this situation—they were and still are required to use all of their non-exempt home equity to repay unsecured debt, regardless of whether they file under Chapter 7 or Chapter 13. But the cap on the homestead exemption did reduce some homeowners' gain from filing. Homeowners are affected if their home equity exceeds \$125,000, they live in one of the states with homestead exemptions greater than \$125,000, and they moved to their homes within the previous 3½ years. These homeowners are predicted to default on their mortgages more often.⁹ As an example, suppose homeowner C has home equity of \$250,000 and lives in a state with a homestead exemption of \$200,000 and moved to her house in 2004. Prior to bankruptcy reform, she would have been obliged to repay up to \$50,000 in unsecured debt. But after 2005, \$75,000 of her home equity becomes non-exempt, so that her obligation to repay unsecured debt in bankruptcy increases to \$125,000. Homeowners in this situation gain less from filing for bankruptcy after the reform and are therefore more likely to default.

⁸ The states that have homestead exemptions exceeding \$125,000 are those Arkansas, Florida, Iowa, Kansas, Oklahoma, Texas, and the District of Columbia: unlimited homestead exemptions, Arizona: homestead exemption of \$150,000, Massachusetts: \$500,000, Minnesota: \$200,000 in 2005, raised to \$300,000 in 2007, and Nevada: \$200,000 in 2005, raised to \$350,000 in 2006 and to \$550,000 in 2007. See Elias (2007) and earlier editions.

⁹ See Elias (2007) for additional details concerning when the \$125,000 cap on the homestead exemption applies.

Now consider homeowners who have non-exempt income but no non-exempt home equity. As an example, suppose homeowner D has mortgage arrears of \$10,000, normal mortgage payments of \$10,000 per year, unsecured debt of \$80,000, and non-exempt (disposable) income of \$15,000 per year. Prior to bankruptcy reform, he would not have been obliged to repay more than a token amount to unsecured creditors in bankruptcy. But if he files under Chapter 13 after the 2005 bankruptcy reform, he is obliged to pay \$15,000 per year or \$75,000 over five years to unsecured creditors. Thus for debtors who have non-exempt income above \$2,000 per year, the adoption of the means test in 2005 made filing for bankruptcy less attractive and is predicted to increase mortgage default.¹⁰

Finally, consider homeowners that have both non-exempt income and non-exempt home equity. To illustrate, suppose homeowner E has non-exempt home equity of \$20,000 and non-exempt (disposable) income of \$60,000 over five years. Prior to 2005, she would have been obliged to repay \$20,000 to unsecured creditors. But under the 2005 bankruptcy reform, she is obliged to repay the maximum of her non-exempt income and her non-exempt home equity to unsecured creditors, or \$60,000. Thus the 2005 bankruptcy reform reduced homeowners' gain from filing for bankruptcy when their non-exempt income exceeds their non-exempt home equity. Homeowners living in states with high homestead exemptions are more likely to be in this situation, since high homestead exemptions reduce their non-exempt home equity. But if the example were reversed and homeowner E had non-exempt home equity of \$60,000 and non-exempt income of \$20,000 over five years, then her gain from filing for bankruptcy would be unchanged by bankruptcy reform.

Our predictions are therefore as follows: (1) The 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 \$125,000 homestead exemption cap is predicted to rise after bankruptcy reform, since the cap reduced their gains from filing. (3) The default rate of homeowners who have non-exempt income but no non-exempt home equity is predicted to rise after bankruptcy reform, since the means

¹⁰ However because the formula for the income exemption is quite debtor-friendly, many debtors can pass the means test even if their incomes are as high as the 90th percentile of the income distribution. See White

test reduced their gain from filing for bankruptcy. (4) The default rate of homeowners who have non-exempt income in excess of their non-exempt home equity is predicted to rise as a result of bankruptcy reform, since they also gain less from filing.

In the next section, we use a micro-level panel dataset of mortgages that follows the evolution of loan payments over time to test these predictions.

Data and summary statistics

We use individual mortgage-level data from LPS Applied Analytics, Inc., which gives characteristics of mortgages at the time of origination and additional information each month on whether debtors made their mortgage payments or defaulted and whether they filed for bankruptcy. Because the LPS dataset gives little demographic information on borrowers, we merge it with Home Mortgage Disclosure Act data (HMDA).¹¹ This gives us individual information on homeowners' sex, race, marital status, and income at the time of mortgage origination. We also added other local area characteristics, including monthly MSA-level unemployment rates, annual state-level per capita real income growth data, and indices of MSA-level housing prices.¹² Finally we added state-level bankruptcy information, including the homestead exemption and the state median family income level, plus measures of states' rules concerning foreclosure and wage garnishment.

Our sample consists of first lien mortgages used for home purchase or refinance. All originated in 2004 or 2005 and are 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 end of the sample period. We define default to occur when mortgage payments are six months or more delinquent and we drop mortgages from the dataset after the default date. In order to

(2007) for discussion.

¹¹ The HMDA data covers 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), 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 find no statistical differences between the mean of the variables. In other words, the matched sample is a random sample of the original LPS sample.

¹² Unemployment rates come from the Bureau of Labor Statistics, income data from the Bureau of Economic Analysis, housing price data from the Federal Housing Finance Agency, and bankruptcy data from the U.S. Trustee Program at the Department of Justice.

focus on the effect of the 2005 bankruptcy reform on default rates, we examine default during a three-month period before versus after bankruptcy reform went into effect, or from July 2005 to February 2006. During this short period, other aspects of the economic environment remained fairly constant and the mortgage crisis had not yet begun. We examine separate samples of prime and subprime mortgages. Our prime mortgage sample contains 379,174 mortgages, 10 percent of all LPS prime mortgages originated in 2004 or 2005 that were active in July 2005. Our subprime mortgage sample contains 322,694 subprime mortgages, all LPS subprime mortgages originated in 2004 or 2005 that were active in July 2005. As a robustness check, we also rerun our model for a one-year period before and after bankruptcy reform, or from October 2004 to October 2006.

Figure 1 presents some raw data concerning the effect of bankruptcy reform on mortgage default rates. The top panel shows prime and subprime mortgage default rates three months before to three months after bankruptcy reform. Both default rates rose sharply when bankruptcy reform went into effect, although the effect diminished over time. The bottom panel shows interest rates on prime and subprime mortgages during the same period. Interest rates did not change over the period, suggesting that they do not explain the rise in mortgage default. Thus the raw data suggest that bankruptcy reform is associated with an increase in both prime and subprime mortgage default.

Specification and Data Description

The equation we estimate takes the following form:

$$D_{it} = \beta_0 + \beta_1 B_t + \beta_2 HC_{it} + \beta_3 MT1_{it} + \beta_4 MT2_{it} + \beta_5 B_t HC_{it} + \beta_6 B_t MT1_{it} + \beta_7 B_t MT2_{it} + \beta_8 Z_{it} + \varepsilon_{it}$$

Here the i subscript denotes individual homeowners and t denotes time in months. D_{it} equals one when homeowners default on their mortgages. B_t is a dummy variable for months starting October 2005, when the 2005 bankruptcy reform went into effect.

HC_{it} , $MT1_{it}$, and $MT2_{it}$ are dummy variables indicating separate features of bankruptcy reform that are predicted to affect default. The coefficients that are most of interest are

β_1 , which measures the effect on mortgage default of the increase in bankruptcy costs, and the difference-in-difference terms β_5, β_6 , and β_7 , which capture the effect of particular features of bankruptcy reform on the default rate.

HC_{it} equals one if homeowner i 's exempt home equity is limited by the \$125,000 homestead exemption cap. Specifically, $HC_{it} = 1$ if homeowner i 's mortgage was for purchase rather than refinance (which means that homeowners have owned their homes for less than 3½ years), if homeowner i lives in a state with a homestead exemption greater than \$125,000, and if homeowner i 's home equity exceeds \$125,000. Home equity is recomputed each month by multiplying the value of the home at the time of purchase by the change in housing values in the debtor's metropolitan area and subtracting the current value of the mortgage principle.¹³ β_5 is predicted to be positive because homeowners subject to the cap gain less from filing for bankruptcy after the reform and are therefore more likely to default.

$MT1_{it}$ and $MT2_{it}$ both measure the effects of the new means test. $MT1_{it}$ measures the effect of the means test on homeowners who have non-exempt income but no non-exempt home equity. Homeowners' income is measured at the time of mortgage origination; it does not change over time. Because non-exempt income is complicated to compute and we lack the necessary data, we use whether homeowners have income in excess of the state median level as a proxy for whether they have non-exempt income. The coefficient β_6 is predicted to be positive, since the new means test forces these homeowners to repay some of their unsecured debt in bankruptcy and therefore makes them more likely to default on their mortgages.

$MT2_{it}$ measures the effect of the means test on homeowners who have non-exempt income and non-exempt home equity, and for whom non-exempt income exceeds non-exempt home equity.¹⁴ Prior to bankruptcy reform, these homeowners were already obliged to repay some of their unsecured debt in bankruptcy, but the 2005 bankruptcy

¹³ If the debtor does not live in a metropolitan area, we use the average change in housing values in the non-metropolitan of the state he resides. Note that our estimate of non-exempt home equity is biased upward since we have no information on second mortgages and therefore assume that debtors do not have them.

¹⁴ Note that many more homeowners have non-exempt home equity than are subject to the cap on the homestead exemption.

reform forces them to repay more. As noted above, the level of the homestead exemption affects the number of homeowners in this category, since fewer homeowners have non-exempt home equity when homestead exemptions are higher. The coefficient β_7 is predicted to be positive because homeowners in this situation gain less from filing for bankruptcy after the reform and are therefore more likely to default on their mortgages.¹⁵

Table 1 gives summary statistics, shown separately for prime versus subprime mortgages. The average default rates are .0022 per month for prime mortgages and 0.0135 per month for subprime mortgages. The fraction of homeowners subject to the homestead exemption cap is small—3.7% for prime and 1.4% for subprime mortgage-holders. A larger fraction of homeowners is subject to the means test in bankruptcy—21% of prime mortgage-holders and 27% of subprime mortgage-holders. 15% of prime mortgage-holders and 11% of subprime mortgage-holders have non-exempt income in excess of their non-exempt home equity.

Results

Table 1 gives the results of a difference-in-difference analysis that tests each of the variables just discussed, using the raw data. The top panel is for prime mortgages and the bottom panel for subprime mortgages. For both samples, the mortgage default rate following bankruptcy reform—the increase is around .03 percentage points, or 15%, for prime mortgages and .11 percentage points, or 8%, for subprime mortgages. The difference-in-difference for the homestead exemption cap is positive and large for both samples, suggesting that the adoption of the cap caused default rates to rise substantially for affected homeowners. But the two difference-in-differences variables for the means test, *MT1* and *MT2*, are small and sometimes have the wrong sign.

Turn now to the regressions, where we examine how these results change if we introduce control variables. In all regressions, the control variables are whether the debtor is married, is African-American, or is female, a series of dummy variables for the

¹⁵ Considering both means test variables, the omitted category consists of homeowners who have no non-exempt income or home equity and homeowners who have non-exempt home equity that exceeds their non-exempt income. The obligation to repay of both of these groups of homeowners to repay is unaffected by the 2005 bankruptcy reform.

homeowner's FICO score,¹⁶ the homeowner's debt-to-income ratio (including other debt), whether the property is single-family, whether the loan is a jumbo, whether the loan is for purchase rather than re-finance, whether the loan has a fixed or adjustable interest rate, and whether full documentation of income and assets was provided at origination. We also include dummy variables for whether the state allows deficiency judgments, whether the state allows non-judicial foreclosures, and whether the state exempts more than 75 percent of wages from wage garnishment.¹⁷ All of these variables remain constant over time. Variables that change each month include the loan-to-value ratio, whether the loan was part of a private securitization, and whether the loan was kept in the lender's portfolio (the omitted category is loans that were securitized by one of the U.S. government agencies), the age of the loan in months, age squared, a measure of the debtor's benefit from refinancing (which depends on the current interest rate relative to the mortgage interest rate),¹⁸ the lagged income growth rate in the area, the lagged unemployment rate in the area, and the lagged cumulative default rate in the debtor's zipcode. Table 2 gives summary statistics. Note that we do not include time dummies in the regressions, because they are collinear with the bankruptcy reform dummy; nor do we include state dummies since they are collinear with the variables measuring state foreclosure and garnishment laws. Standard errors are clustered by debtor.

Regression results for the period three months before to three months after bankruptcy reform are given in table 3. The top panel is for prime mortgages and the bottom panel is for subprime mortgages. All regressions include the controls discussed above; but only the results for the bankruptcy variables are shown. (See Appendix Table 1 for results of a regression including the control variables.) For simplicity, all

¹⁶ We put FICO scores into four bins, [450,550], [550,650], [650,750], and [750,850]. The omitted category is [350-450].

¹⁷ States that allow deficiency judgments allow lenders after foreclosure to sue the mortgage-holder for the difference between amount of the mortgage and the sale price of the house. States that allow non-judicial foreclosure permit lenders to foreclose without obtaining a court order. Federal law protects 75% of wages from garnishment, but some states protect more than 75% of wages.

¹⁸ Following the literature, we use the Principal/Value as a measure of the incentive to refinance (Richard and Roll, 1989). The Principal/Value (PV_t) measures the ratio of the present value of the payments on mortgage principal outstanding at time t using the existing mortgage rate to that using the current rate available on refinance: $PV_t = \{r_t[1-(1+r_0)^{-t-M}]\} / \{r_0[1-(1+r_t)^{-t-M}]\}$, where r_t and r_0 are the current and existing rates on the mortgage, and M is the maturity in number of months. We use the 5-year constant maturity Treasury rate as the current rate on the mortgage.

regressions use ordinary least squares, but we also report the results using a Cox proportional hazard model below.

Column (1) shows the results when we enter only the bankruptcy reform dummy and controls. This regression tests our hypothesis that bankruptcy reform increased the mortgage default rate by making it more expensive for all homeowners to use bankruptcy to save their homes. The bankruptcy reform dummy is positive and strongly statistically significant ($p < .0001$) in both samples. The model implies that the prime mortgage default rate rose by $.08/.22 = 36\%$ and the subprime mortgage default rate rose by $.16/1.35 = 12\%$ when bankruptcy reform went into effect.

Columns (2) – (4) show the results when each of the three bankruptcy variables and interactions with B_t are introduced separately, while column (5) shows the results when all three variables and interactions are introduced simultaneously. The coefficient of B_t remains essentially unchanged. The interaction of the exemption cap HC_{it} and B_t is positive and significant in both samples. The default rates of prime and subprime mortgage-holders who are affected by the cap increase by 45% and 54%, respectively, after bankruptcy reform. The interaction of $MT1_{it}$ with B_t is also positive in both samples, but it is only significant in the subprime sample. These results suggest that subprime mortgage-holders who were subject to the new means test defaulted 13% more frequently after bankruptcy reform. Finally the interaction of $MT2_{it}$ with B_t is negative in both samples, rather than positive as predicted. This implies that homeowners who previously were forced to repay some of their unsecured debt in bankruptcy and now must repay more did not default more often after bankruptcy reform.

These results suggest that the 2005 bankruptcy reform increased default rates, mainly because of the rise in the cost of filing. Prime mortgage default rates rose by 36% and subprime mortgage default rates rose by 12%. Default rates of homeowners who were subject to the new cap on the homestead exemption rose even more. But the adoption of the new means test in bankruptcy had only small and mixed effects on default rates.

We also ran a version of Morgan et al's (2009) model, using our data and our controls. Morgan et al explain mortgage default rates as a function of the bankruptcy reform dummy B_t interacted with the homestead exemption level in the homeowner's

state and also interacted with a dummy for states that have unlimited homestead exemptions, plus some controls.¹⁹ They argue that homeowners in states with high or unlimited homestead exemptions were harmed the most by bankruptcy reform, since homeowners in these states previously gained the most from filing for bankruptcy. They found that the coefficient of B_t *(homestead exemption) was positive and statistically significant for prime mortgages, but not for subprime mortgages, while B_t *(unlimited homestead exemption dummy) was never statistically significant.

However we argued that this interpretation of the new bankruptcy law overstates the role of the homestead exemption, since the reform did not change the treatment of homestead exemptions in bankruptcy except for homeowners who are affected by the cap on the homestead exemption (captured by our HC_{it} variable) and homeowners whose non-exempt income exceeds their non-exempt home equity (captured by our $MT2_{it}$ variable). Another problem with the Morgan et al approach is that they claim to be estimating difference-in-differences, but their interaction terms cannot be interpreted as difference-in-differences unless B_t and the homestead exemption variables are also entered separately.

Table 4 shows the results when we run Morgan et al's specification, using our dataset and our control variables. Columns (3) and (4) give the results when we add the additional variables necessary to interpret their results as difference-in-differences. Here the interaction of B_t and the homestead exemption is either insignificant or has the wrong sign in both samples, but the interaction of B_t and the unlimited homestead exemption dummy is positive and significant in both samples. These results presumably occur because the unlimited homestead exemption variable in their model is capturing the combined effect of the $HC_{it} * B_t$ and $MT2_{it} * B_t$ interactions in our model. They suggest that bankruptcy reform was associated with a 36% rise in prime mortgage defaults by homeowners in states with unlimited homestead exemption states and a 51% rise in subprime mortgage defaults by homeowners in these states—similar to our results

¹⁹ 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.

for the homestead exemption cap. Overall, our result using Morgan et al's specification confirm that the 2005 bankruptcy reform increased mortgage default rates.

In order to determine whether the effect of bankruptcy reform on default was temporary, we also reran our estimations using a period of one year before to one year after bankruptcy reform, October 2004 – October 2006. We chose this period because it is longer, but it still ends before the beginning of the mortgage crisis. The results are shown in table 5. Comparing the results in tables 3 and 5, most of the coefficients become smaller and less statistically significant. The interaction of the homestead exemption cap variable with the bankruptcy reform dummy particularly falls in value. But surprisingly, the coefficient of the bankruptcy reform dummy itself becomes larger in the prime mortgage sample—the rise in the default rate is 50% over the longer period, compared to 36% in the shorter period. For subprime mortgages, the rise in the default rate is 7% over the longer period, compared to 11% over the shorter period. These results suggest that bankruptcy reform caused default rates to rise more than just temporarily.

As another robustness check, we re-ran our estimations using a Cox proportional hazard model and the results are shown in Tables 6-8. The direction of the effects and the pattern of statistical significance are the same as the OLS results.

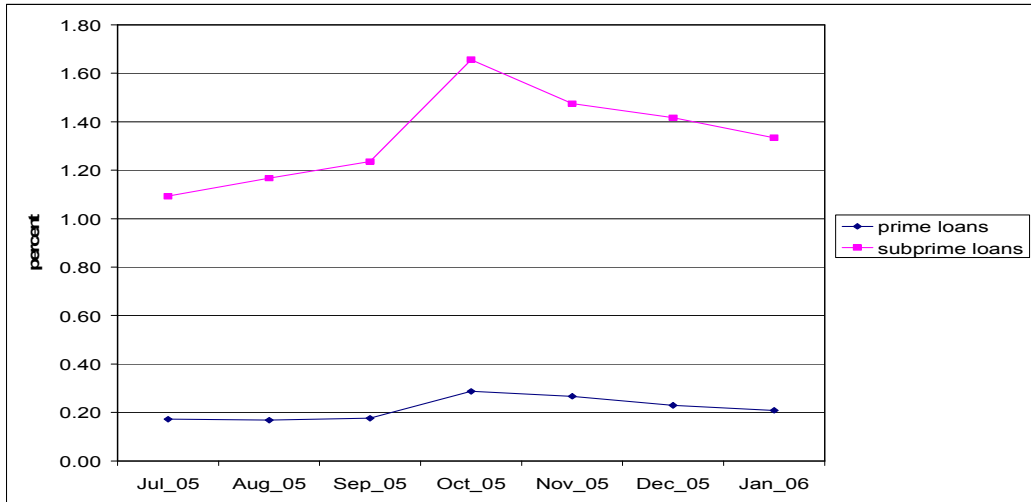
Conclusion

Our main result is that the 2005 bankruptcy reform caused mortgage default rates to rise and the increase was more than just temporary. Comparing three months before versus after bankruptcy reform, prime mortgage default rates rose by 36% and subprime mortgage default rates by 11%. Comparing one year before versus after bankruptcy reform, prime mortgage default rates rose by 50% and subprime mortgage default rates by 7%. Second, default rates of homeowners subject to the cap on the homestead exemption rose by even more—the increase during the three-month period was 45% for prime mortgage-holders and 54% for subprime mortgage-holders. The means test, in contrast, had little effect on default rates. We also found support for Morgan et al's (2009) argument that default rates rose more in states with unlimited homestead

exemptions. But this result occurs at least in part because debtors living in states with unlimited homestead exemptions are likely to be affected by the homestead exemption cap.

**Figure 1:
Monthly Mortgage Default Rates and Mortgage Interest Rates
Around the Time of Bankruptcy Reform**

Default rates



Mortgage interest rates

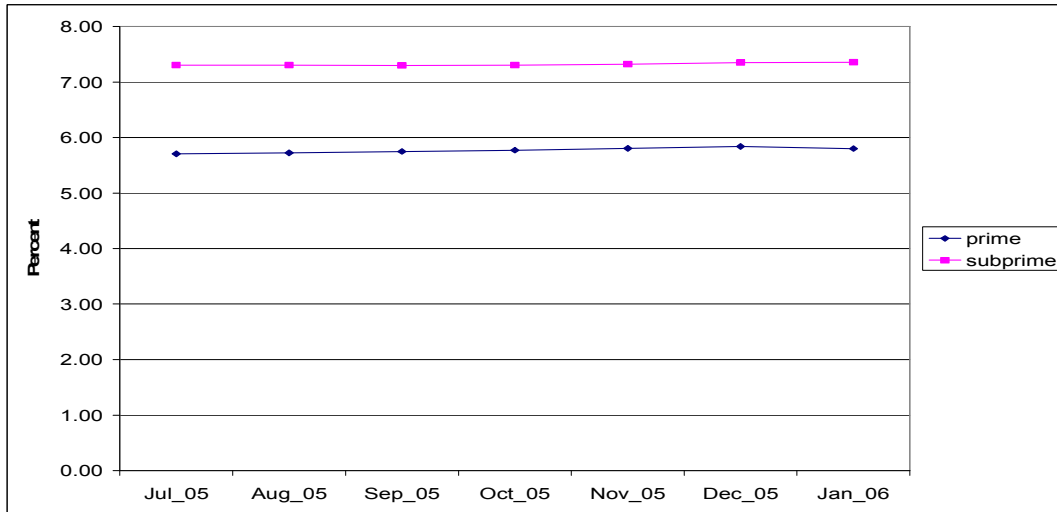


Table 1: Difference-in-difference Analysis of the Effects of Bankruptcy Reform
(Three Months Before to Three Months After Bankruptcy Reform: July 2005 - January 2006)

Prime Mortgages

	Before bankruptcy reform	After bankruptcy reform	Difference
Default Rate (average, %)	0.20	0.23	0.03
Default rate of homeowners subject to the homestead exemption cap ($HC_{it} = 1$) (%)	0.08	0.15	0.07
Default rate of homeowners not subject to the homestead exemption cap ($HC_{it} = 1$) (%)	0.21	0.24	0.04
Difference-in-difference (%)			0.03
Default rate of homeowners subject to the means test ($MT1_{it} = 1$) (%)	0.30	0.32	0.02
Default rate of homeowners not subject to the means test ($MT1_{it} = 0$) (%)	0.17	0.21	0.03
Difference-in-difference (%)			-0.01
Default rate of homeowners subject to the means test ($MT2_{it} = 1$) (%)	0.19	0.19	0
Default rate of homeowners not subject to the means test ($MT2_{it} = 0$) (%)	0.20	0.19	-0.01
Difference-in-difference (%)			0.01

Subprime Mortgages

	Before bankruptcy reform	After bankruptcy reform	Difference
Default Rate (average, %)	1.30	1.41	0.11
Default rate of homeowners subject to the homestead exemption cap ($HC_{it} = 1$) (%)	0.89	1.33	0.44
Default rate of homeowners not subject to the homestead exemption cap ($HC_{it} = 1$) (%)	1.30	1.41	0.11
Difference-in-difference (%)			0.33
Default rate of homeowners subject to the means test ($MT1_{it} = 1$) (%)	1.25	1.33	0.08
Default rate of homeowners not subject to the means test ($MT1_{it} = 0$) (%)	1.32	1.39	0.07
Difference-in-difference (%)			0.01
Default rate of homeowners subject to the means test ($MT2_{it} = 1$) (%)	1.51	1.36	-0.15
Default rate of homeowners not subject to the means test ($MT2_{it} = 0$) (%)	1.28	1.42	0.14
Difference-in-difference (%)			-0.29

Table 2: Summary Statistics
Three Months Before to Three Months After Bankruptcy Reform: July 2005 - January 2006

	Prime Mortgages	Subprime Mortgages
<i>Information available only at origin:</i>		
Married (%)	49.69	36.90
African-American (%)	7.10	16.56
Female (%)	27.59	35.04
FICO score	714	615
Income (current dollars)	\$107,168	\$77,724
Mortgage rate (%)	5.77	7.37
Loan-to-value ratio (%)	68.40	79.90
Debt-to-income ratio (includes all debt, %)	22.58	39.71
If full documentation (%)	35.77	64.15
If single-family house (%)	74.68	80.32
If fixed rate mortgage (%)	61.48	24.66
If jumbo loan (%)	14.71	9.71
If loan was for purchase (%)	55.64	44.21
<i>Information updated monthly:</i>		
Default rate per month (%)	0.22	1.35
If homestead exemption cap is binding ($HC_{it} = 1$) (%)	3.70	1.28
First means test variable ($MT1_{it} = 1$) (%)	21.21	27.05
Second means test variable ($MT2_{it} = 1$) (%)	14.71	11.12
Interest rate (%)	5.78	7.32
Loan-to-value ratio (%)	66.43	71.00
If loan was privately securitized (%)	24.59	83.00
Cumulative delinquency rate (zipcode) (%)	2.08	9.79
Local unemployment rate (MSA) (%)	4.66	4.87
Local real income growth rate (state) (%)	6.08	5.75

1. The prime sample consists of 10% of first-lien mortgages originated in 2004 and 2005 and matched with HMDA (see footnote 12 in the text). The sample size is 379,174. The dynamic information is the average value from July 2005 and January 2006 or else the average for all months with data. In total there are 2,365,961 observations.
2. The subprime sample includes all the first-lien subprime mortgages originated in 2004 and 2005 and matched with HMDA. The sample size is 322,694. The dynamic information is the average value from July 2005 and January 2006 or else the average for all months with data. In total there are 1,798,097 observations.

Table 3:
Estimated Linear Default Regression
(Three Months Before and Three Months After Bankruptcy Reform: July 2005 - January 2006)

Prime Mortgages

	(1)	(2)	(3)	(4)	(5)
B_t	0.0008***	0.0008***	0.0007***	0.0009***	0.0008***
HC_{it}		0.0003**			-0.0002
$B_t HC_{it}$		0.0002			0.0010***
$MT1_{it}$			0.0001		0.0001
$B_t MT1_{it}$			0.0004***		0.0003*
$MT2_{it}$				0.0006***	0.0007***
$B_t MT2_{it}$				-0.0008***	-0.0009***

Subprime Mortgages

	(1)	(2)	(3)	(4)	(5)
B_t	0.0018***	0.0018***	0.0012***	0.0021***	0.0015***
HC_{it}		-0.0021***			-0.0054***
$B_t HC_{it}$		0.0036**			0.0073***
$MT1_{it}$			-0.0015***		-0.0012**
$B_t MT1_{it}$			0.0021***		0.0018***
$MT2_{it}$				0.0033***	0.0037***
$B_t MT2_{it}$				-0.0035***	-0.0039***

Notes: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.
 All equations include the set of control variables shown in Appendix table 1.

Table 4:
OLS Regressions Explaining Default Rates
(Three Months Before and Three Months After Bankruptcy Reform: July 2005 - January 2006)

Morgan et al's Specification

	Prime Mortgages (1)	Subprime Mortgages (2)	Prime Mortgages (3)	Subprime Mortgages (4)
B_t *Homestead exemption	0.0009***	-0.0016***	0.0003	-0.0021***
B_t *Unlimited homestead dummy	0.0006***	0.0054***	0.0008***	0.0069***
B_t			0.0006***	0.0017***
Homestead exemption			0.0002	-0.0005
Unlimited homestead dummy			-0.0002	-0.0017***

Notes: The control variables are the same as in Table 3 and are entered in all regressions.
 *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Table 5:
Estimated Linear Default Regression
(One Year Before and One Year After Bankruptcy Reform: October 2004 - October 2006)

Prime Mortgages

	(1)	(2)	(3)	(4)	(5)
B_t	0.0011***	0.0011***	0.0010***	0.0012***	0.0012***
HC_{it}		0.0004***			0.0002
$B_t HC_{it}$		-0.0007*			0.0002*
$MT1_{it}$			-0.0003***		-0.0002***
$B_t MT1_{it}$			0.0001		-0.0000
$MT2_{it}$				0.0004***	0.0003***
$B_t MT2_{it}$				-0.0007***	-0.0007***

Subprime Mortgages

	(1)	(2)	(3)	(4)	(5)
B_t	0.0012***	0.0012***	0.0007***	0.0014***	0.0010***
HC_{it}		-0.0001			-0.0026***
$B_t HC_{it}$		-0.0006			0.0021**
$MT1_{it}$			-0.0018***		-0.0017***
$B_t MT1_{it}$.0.0011***		.0.0009***
$MT2_{it}$				0.0027***	0.0026***
$B_t MT2_{it}$				-0.0032***	-0.0046***

Notes: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels. All equations include the set of control variables shown in Appendix table 1.

Table 6:
Regressions Explaining Default Rates
(One Year Before and One Year After Bankruptcy Reform: October 2004 - October 2006)

Morgan et al's Specification

	Prime Mortgages (1)	Subprime Mortgages (2)	Prime Mortgages (3)	Subprime Mortgages (4)
B_t *Homestead exemption	0.0010***	-0.0010***	0.0003***	0.0002
B_t *Unlimited homestead dummy	-0.0000	.0010	0.0010	0.0011***
B_t			0.0010***	0.0010***
Homestead exemption			0.0001	-0.0020***
Unlimited homestead dummy			-0.0001	-0.0001
Controls?	Yes	Yes	Yes	Yes

Notes: All regressions include the same control variables as in Table 3. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Table 7:
Cox Proportional Hazard Rate Regressions Explaining Default Hazard Ratios
(Three Months Before and Three Months After Bankruptcy Reform: July 2005 - January 2006)

Prime Mortgages

	(1)	(2)	(3)	(4)	(5)
B_t	1.3475***	1.3313***	1.3083***	1.4302***	1.4153***
HC_{it}		0.9461			0.6633
$B_t HC_{it}$		1.8209**			3.1797***
$MT1_{it}$			0.9886		1.0361
$B_t MT1_{it}$			1.1269*		1.0440
$MT2_{it}$				1.5167***	1.6414***
$B_t MT2_{it}$				0.5784***	0.5094***

Subprime Mortgages

	(1)	(2)	(3)	(4)	(5)
B_t	1.0950***	1.0913***	1.0520***	1.1212***	1.0810***
HC_{it}		.8888			0.6736***
$B_t HC_{it}$		1.3832**			1.8930***
$MT1_{it}$			0.9082***		0.9309**
$B_t MT1_{it}$			1.1557***		1.1263***
$MT2_{it}$				1.3313***	1.3631***
$B_t MT2_{it}$				0.7371***	0.7174***

Notes: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.
 All equations include the set of control variables shown in Appendix table 1.

Table 8:
Cox Proportional Hazard Rate Regressions Explaining Default Hazard Ratios
(One Year Before and One Year After Bankruptcy Reform: October 2004 - October 2006)

Prime Mortgages

	(1)	(2)	(3)	(4)	(5)
B_t	1.4772***	1.4760***	1.5041***	1.5508***	1.6266***
HC_{it}		1.1549			0.9032
$B_t HC_{it}$		1.0803			1.6030***
$MT1_{it}$			0.9952		1.0215
$B_t MT1_{it}$			0.9261*		0.8600***
$MT2_{it}$				1.3182***	1.3638***
$B_t MT2_{it}$				0.6507***	0.5861***

Subprime Mortgages

	(1)	(2)	(3)	(4)	(5)
B_t	1.1905***	1.1902***	1.1638***	1.2105***	1.1923**
HC_{it}		1.0080			0.7332***
$B_t HC_{it}$		1.0330			1.4381***
$MT1_{it}$			0.9231***		0.9311***
$B_t MT1_{it}$			1.0572***		1.0333*
$MT2_{it}$				1.3794***	1.4173***
$B_t MT2_{it}$				0.7242***	0.6950***

Notes: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels. All equations include the set of control variables shown in Appendix table 1.

Appendix Table 1: Results of OLS Regressions Explaining Default

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

	Prime Mortgages	Subprime Mortgages
B_t	0.0008***	0.0018***
Married	-0.0004***	-0.0033***
African-American	0.00017***	0.0040***
Female	0.0002**	-0.0003*
If missing debt-to-income ratio	0.0008***	0.0046***
Debt-to-income ratio	7.6e-06***	9.4e-05***
If FICO 450-550	0.0114	0.0663***
If FICO 550-650	0.0204***	0.0196***
If FICO 650-750	.00051***	0.0084***
If FICO 750-850	0.0006***	0.0007**
If single-family house	0.0002***	0.0018***
If jumbo loan	-0.0003***	0.0013***
If loan was for purchase	0.0002***	0.0028***
If fixed rate mortgage	-0.0005***	-0.0030***
If full documentation	-0.0004***	0.0005***
If missing document	-0.0009***	-0.0035***
If private investor (securitized)	0.0005***	0.0019***
If non-judicial foreclosure allowed	-0.0009***	-0.0033***
Wage garnishment ≤ 25% of wage	-0.0007***	-0.0020***
If state allows deficiency judgments	0.0009***	0.0022***
Current loan-to-value ratio	0.0034***	0.0139***
Local unemployment rate (MSA)	0.0002***	0.0003**
Local real income growth rate (state)	-0.0094***	-0.0175***
Cumulative delinquency rate (zipcode)	0.0116***	0.0368***
Cost of payments on a refinanced mortgage at the current interest rate relative to the cost of payments on the original mortgage	-0.0070***	-0.0341***
Age of loan (in months)	0.0002***	0.0014**
Age of loan squared	-4.2e-06***	-4.2e-05***
Constant	0.0101***	0.0156***

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