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The Journal of Law & Economics

February, 2014

The Journal of Law & Economics

57 J. Law & Econ. 225

LENGTH: 10061 words**ARTICLE:** **State Foreclosure Laws and the Incidence of Mortgage Default****NAME:** Cem Demiroglu , Evan Dudley and Christopher M. James

BIO: We thank seminar participants at the University of Florida and Université Laval for helpful comments.
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LEXISNEXIS SUMMARY:

... Our finding that default rates are higher in judicial review states is consistent with a longer time to foreclosure reducing the expected costs of default for borrowers in judicial review states. ... The coefficient estimates can be interpreted as follows: when equity is less than or equal to 0, the effect of a change in equity is given by the coefficient on Equity; for values of equity greater than 0 percent but less than 25 percent, the effect of changes in equity on default rates is equal to the sum of the coefficient on Equity and the first interactive variable ([#x2016] (Equity >= 0) x Equity). ... For example, subprime borrowers in non-judicial-review states are 17 percent (6.8 percent versus 5.8 percent) more likely to file for bankruptcy after a default than are subprime borrowers in states with judicial review (the difference is statistically significant at the 1 percent level). ... Relative default hazards with state laws, January 2005-June 2010: prime loans Table 13 Hazard Estimates of the Effect of **State Foreclosure Laws** through June 2010 Explanatory Variable Subprime Alt-A Prime Loans Loans Loan and local characteristics at origination: FICO Score -.006** -.008** -.010** Cash-Out Refinance -.084** .064** .294** Full-Documentation Loan -.332** -.633** -.507** Prepayment Penalty -.002 .119** .239** Original Loan Rate (%) .083** .042** .399** Adjustable Rate .350** .279** .348** Negative Amortization .623* .437** 1.940** Original Loan Balance (\$ 1,000s) .001** .001** .000** Per Capita Income, Zip Code -.004** -.005** -.005** (\$ 1,000s) Time-varying local economic conditions: Change in Unemployment, County .004** -.013** .026** (%) Change in Per Capita Income, .511** -.726** -5.547** State Intercept effect of state laws: Emergency Relief -.052** -.086** -.041** Judicial Review .008 .150** .230** Deficiency Judgment -.191** -.091** -.134** Baseline effect of equity in non-judicial-review and non-deficiency-judgment states: Equity (%) -1.993** -2.305** -2.874** Equity (%) x (Equity > 0%) -.467** -2.007** -2.125** Equity (%) - 25% x (Equity > 1.575** 3.535** 5.195** %) Incremental effect of judicial review: Equity (%) -.380** -.221** .618** Equity (%) x (Equity > 0%) .700** .652** -.963** Equity (%) - 25% x (Equity > -.116** -.451** .111 %) Incremental effect of deficiency judgments: Equity (%) .171** .351** .841** Equity (%) x (Equity > 0%) .165* .110 .299 Equity (%) - 25% x (Equity > -.165** -.336** -1.421** %) Note These programs do not affect the ability of lenders to seize defaulting borrowers' other assets and to garnish these borrowers' wages in states where deficiency judgments are permitted. ... Our results show that judicial review and deficiency judgments have a significant effect on the likelihood of default on residential mortgages, conditional on having negative equity. ... Variation in default rates across states with different foreclosure laws cannot be explained by differences in borrowers'

liquidity or income shocks, unless changes in unemployment and income not captured by the controls are correlated with state laws.

HIGHLIGHT: Abstract

This paper examines how differences in **state foreclosure laws** influence the incidence of default in the residential mortgage market. In particular, we examine how judicial review requirements, lenders' recourse rights (deficiency judgments), and state assistance programs for distressed borrowers affected the likelihood of default during the recent U.S. housing crisis. We argue that **state foreclosure laws** should have little effect on the likelihood of liquidity events (for example, shocks to borrowers' ability to make payments) and thus provide a good instrument for identifying borrowers' costs of default. We find that borrowers with negative home equity are significantly more likely to default in states with borrower-friendly foreclosure laws. Finally, we examine how recent state and federal loan foreclosure prevention programs affected the likelihood of default. Overall, we find a significant decline in the effect of judicial review requirements but not deficiency judgments on default after 2008.

TEXT:

[*225] 1. Introduction

The dramatic decline in housing prices across the United States in recent years has left many households with homes worth significantly less than their mortgage loans, or negative equity. While negative equity is a potentially important factor influencing the decision to default, that decision also depends on the cost of default as well as the borrower's liquidity and expectations concerning the future [*226] changes in housing prices. ⁿ¹ Understanding the importance of negative equity in the default decision and how the foreclosure process influences the propensity to default has important implications for public policies aimed at assisting distressed borrowers as well as the incentive that lenders and servicers have to modify or restructure mortgages. The concern is that policies designed to assist distressed borrowers or create a more borrower-friendly foreclosure process may induce nondistressed borrowers to default on their loans. For example, some programs, such as the Home Affordable Modification Program (HAMP), require lenders to evaluate loan modification options or engage in mediation before proceeding with a foreclosure. The concern is that these policies may increase the attractiveness of default by lengthening the foreclosure process and the time borrowers in default can live rent free in their homes. These policies may also induce nondistressed borrowers with negative home equity or borrowers who must reduce current consumption to continue making their mortgage payments to default. Critics contend that, given the negative externalities associated with foreclosures (Campbell, Giglio, and Pathak 2011), there are potentially large social costs associated with foreclosure mitigation programs that increase the incidence of default (see Zingales 2010).

In this paper, we examine how the foreclosure process influences a borrower's decision to default and whether the importance of the foreclosure process varies with the degree of negative equity. We also examine whether state and federal foreclosure prevention programs initiated after late 2008 have reduced or eliminated potential differences across states with borrower-versus creditor-friendly foreclosure laws.

Mortgage defaults may be driven by both strategic and liquidity considerations. Strategic considerations include a borrower's willingness to pay, which involves a comparison of the cost of continuing to make mortgage payments and the costs of default. Liquidity factors include cash flow and wealth shocks that affect a borrower's ability to pay. Lack of detailed information on the borrower's income and assets at the time of default makes it difficult to identify the importance of negative equity versus liquidity factors in the default decision. ⁿ² While a finding [*227] that defaults are more frequent when borrowers have negative equity suggests that the presence of strategic factors is important, there are several reasons to expect liquidity-driven defaults to also increase when a borrower has negative equity. First, since a borrower who experiences an income shock but has substantial home equity may be able to avoid default through selling or refinancing a home, liquidity-driven defaults are more likely to occur when the borrower has negative equity. Obviously, the severity of the income shock, the borrower's non-real-estate-related wealth, and the speed with which the

house can be sold will determine the extent to which the borrower can avoid default given an income shock. Second, negative home equity may be correlated with ability to pay; thus, without good controls for the borrower's income and wealth, making inferences about whether the default is liquidity driven is difficult.

Recent studies attempt to evaluate the importance of negative equity in the default decision (see, for example, Bhutta, Dokko, and Shan 2010; Foote, Gerardi, and Willen 2008). For example, Foote, Gerardi, and Willen (2008) study the relationship between negative equity and mortgage foreclosures during the 1990-91 recession in Massachusetts. They use data collected from the Registry of Deeds for mortgages originated after January 1987 to track each borrower's home equity (calculated using home value at purchase, original mortgage amount, and town-level housing price changes) and default and foreclosure history. Overall, they find relatively low rates of foreclosure among home owners with negative equity: only 6.4 percent of the borrowers with negative equity at the end of 1991 entered foreclosure in the next 3 years. One explanation for the relatively low rate of defaults among borrowers with negative equity is that the decision to default depends not just on the borrower's current equity in the home but also on his expectation about future home price changes. Another explanation is that there are significant borrower-borne costs (including social stigma) associated with default.

There are several reasons to suspect that negative equity may be a more important determinant of default during the recent financial crisis. First, the average decline in housing prices has been much larger during the current crisis, at least in some parts of the United States, including California, Florida, Nevada, and Arizona. Second, as Guiso, Sapienza, and Zingales (2013) point out, the relationship between the likelihood of default and negative equity is likely to be nonlinear, with small declines in housing prices not having much of an effect on default. Third, the growth of subprime and alternative A-paper (alt-A) mortgage products with adjustable rates, high cumulative loan-to-value (CLTV) ratios, and negative amortization features may increase the incidence of negative equity for a given decline in housing prices. Fourth, the growth of subprime and limited-documentation loans may have led to the extension of credit to borrowers with greater susceptibility to income shocks and to borrowers more dependent on [*228] refinancing. During the recent crisis, many of these borrowers may have been subject to so-called double-trigger events in which negative equity coincides with a life event such as a job loss or an inability to access liquidity (see Foote, Gerardi, and Willen [2008] and Riddiough [1991] for a discussion of trigger events). Finally, the social stigma associated with default may decrease as the incidence of default increases. Moreover, the social stigma of default may be much lower among subprime borrowers with checkered credit histories at the time of loan origination.

A potentially important component of the decision to default involves evaluating the costs (and benefits) associated with exercising the default option. The costs and benefits of default, in turn, depend in part on **state foreclosure laws** that govern the process that the lender must follow when foreclosing on a loan.ⁿ³ Until recently, changes in **state foreclosure laws** have been infrequent, with most **state foreclosure laws** dating back to the 1930s.ⁿ⁴ As a result, **state foreclosure laws** are unlikely to be related to economic conditions at the time of default and thus provide a good instrument for identifying the costs and benefits of default. As discussed below, we consider the reasonableness of this assumption by examining the relationship between **state foreclosure laws** and the likelihood of personal bankruptcies.

Foreclosure laws differ across states in two important dimensions. The first is the presence of judicial review. In states with judicial review, lenders have the burden of demonstrating to the court that they have the right to foreclose. In contrast, in states without judicial review, the burden shifts to the borrower to demonstrate that the lender does not have the right to proceed with a foreclosure sale (for example, by demonstrating errors in how the loan was serviced). Foreclosure is likely to be a more time-consuming and costly process in judicial review states. For example, data from Citibank indicate that the average time from delinquency to liquidation in judicial review states is 20 months, compared with 15.7 months in non-judicial-review states (see Hayre and Saraf 2008). Gerardi, Lambie-Hanson, and Willen (2013) also find that the time from default to liquidation is longer in judicial review states. These results suggest that the borrower may gain from judicial review by living rent free for a longer period of time.ⁿ⁵ In addition, according to Citibank data, foreclosure costs average \$ 3,112 in judicial review states versus \$ 2,269 in states without judicial review. Higher [*229] costs of foreclosure may induce lenders to provide greater concessions in a loan modification.

A second important aspect of the foreclosure process is whether the lender can seek a deficiency judgment and attach a claim on other non-mortgage-related assets or garnish future wages. Even borrowers who are deep underwater might choose to continue making mortgage payments because of the threat of deficiency judgment, especially if the borrower has valuable assets or earnings that the lender could pursue. Even if lenders rarely seek deficiency judgments, some borrowers (particularly those with high net worth or high expected future income) may perceive recourse as a credible threat.¹⁶ Foreclosure laws are likely to matter for the borrower's default decision primarily when the borrower has very little or negative equity in the home. For example, judicial review is unlikely to increase the bargaining power of borrowers with sufficiently high positive home equity since the lender can foreclose and cover the foreclosure expenses out of the borrower's equity. Also, lenders will not seek deficiency judgment if the price obtained in the foreclosure sale exceeds the claim on the borrower.

Table 1 indicates whether states and the District of Columbia have judicial review and deficiency judgment. Overall, we posit that foreclosure laws are more borrower friendly and thus costs of defaulting are lower in states with judicial review and states that prohibit deficiency judgments. As a result, we expect to observe a higher incidence of default, conditional on negative home equity, in states that require judicial review before foreclosure and states that prohibit deficiency judgments.

Our analysis is based on a sample of more than 2 million subprime and alt-A residential mortgages originated between 2005 and 2007 and subsequently securitized by private-label conduits. For some of our analyses we also use a sample of over 400,000 nonconforming (jumbo) prime mortgages that were placed into private mortgage-backed securities. Our source of loan data is Lew-tan's ABSNet Loan database.

We construct a hazard model of the decision to default as a function of borrowers' characteristics at origination and changes in county-level unemployment, state-level income, and housing prices at the metropolitan statistical area (MSA) level since origination. Theoretical models of default predict a nonlinear relationship between default and home equity (see, for example, Campbell and Cocco 2011). The idea is that an increase in equity is expected to have a different effect on the default likelihood for a home owner with positive home equity than one with negative home equity. To address this issue, we follow an approach similar to Foote, Gerardi, and Willen (2008) by modeling the effect of equity using a linear spline specification. The hazard model allows us to estimate differences in the default likelihood of mortgages in states with strong versus weak borrower protection for various levels of home equity. We estimate the hazard model using data from January 2005 to December 2008.

[*230] Table 1

Foreclosure Laws and Emergency Relief Funds

State	Judicial Review	Deficiency Judgment	Emergency Relief Fund
Alabama	0	1	0
Alaska	0	0	.5
Arizona	0	0	0
Arkansas	0	1	0
California	0	0/1	0
Colorado	0	1	0
Connecticut	.5	1	1
Delaware	.5	1	.5
District of Columbia	0	1	0
Florida	1	1	0

Georgia	0	1	0
Hawaii	.5	1	0
Idaho	0	1	0
Illinois	1	1	0
Indiana	1	1	0
Iowa	1	1	0
Kansas	1	1	0
Kentucky	1	1	0
Louisiana	.5	1	0
Maine	1	1	.5
Maryland	1	1	1
Massachusetts	0	0	0
Michigan	0	1	.5
Minnesota	0	1	1
Mississippi	0	1	0
Missouri	0	0	0
Montana	0	0	0
Nebraska	0	1	0
Nevada	0	1	0
New Hampshire	0	1	0
New Jersey	1	1	1
New Mexico	1	.5	0
New York	1	1	0
North Carolina	1	1	1
North Dakota	1	0	0
Ohio	1	1	0
Oklahoma	0	1	0
Oregon	0	1	0
Pennsylvania	1	1	1
Rhode Island	.5	1	0
South Carolina	1	1	0
South Dakota	0	1	0
Tennessee	0	1	0
Texas	0	1	0
Utah	0	1	0
Vermont	1	1	.5
Virginia	0	1	0
Washington	0	1	1

West Virginia	0	0	0
Wisconsin	1	.5	0
Wyoming	0	1	0

Note. A value of 0 indicates the lack of that type of law in the state; a value of .5 indicates that the law is applicable under certain conditions only; a value of 1 indicates the unambiguous presence of that law in that state.

[*231] Our default analysis yields several interesting findings. First, consistent with the importance of **state foreclosure laws**, we find that judicial review is associated with significantly higher and deficiency judgment is associated with significantly lower likelihood of default, but only when equity is negative. Moreover, the impact of **state foreclosure laws** increases with the amount of negative equity. In the period through December 2008, these differences are both economically and statistically significant. For example, to match the default hazard of an alt-A borrower with -10 percent equity in a state with judicial review, a similar borrower in a non-judicial-review state would need to have equity of -18 percent. Given that the median home purchase price is about \$ 380,000 in the alt-A sample, this suggests that the cost of default is about \$ 30,400 less for borrowers in judicial review states.

Second, we find evidence that during the current crisis, defaults occur at relatively low levels of negative equity. For example, in states with judicial review, a decrease in equity from 0 percent to -10 percent increases the likelihood of default of a subprime borrower by 9 percent. One reason for this may be the extraordinary tightening of mortgage lending standards during the current crisis, which makes it extremely difficult for subprime borrowers to refinance their mortgages. ⁿ⁷

We also examine the likelihood, conditional on default, of personal bankruptcy filings. We expect bankruptcy filings to be more frequent in states without judicial review because a filing for bankruptcy stops the foreclosure process while the stay is in place and provides a judicial mechanism to challenge a foreclosure. ⁿ⁸ In other words, the stay of bankruptcy provides an alternative to judicial review as a way of lengthening the foreclosure process. We also expect bankruptcy to be more frequent in deficiency judgment states because bankruptcy protects (up to exemption limits) the borrower's other assets from deficiency judgments.

Controlling for borrowers' characteristics, we find that borrowers who are [*232] underwater and more than 60 days delinquent are significantly more likely to file for bankruptcy in non-judicial-review states and in states that permit deficiency judgments. These findings suggest that in states with creditor-friendly foreclosure laws, borrowers are more likely to use alternative protective mechanisms such as personal bankruptcy to shield their homes and other personal assets from possible seizure by the lenders.

The finding that foreclosure laws that are positively correlated with default are also negatively correlated with bankruptcy supports the view that foreclosure laws are instruments for the cost of the foreclosure process and not merely proxies for income or liquidity shocks (or other omitted default triggers) in the default regressions. In particular, if judicial review were correlated with the severity of negative income shocks to borrowers, then delinquent borrowers in states with judicial review would be more likely to file for personal bankruptcy protection, which is the opposite of what we find.

We focus our analysis on the pre-2009 period because state and federal foreclosure prevention programs and the so-called robo-signing scandal are likely to have affected the determinants of default and the foreclosure process in the post-2008 period. ⁿ⁹ For example, HAMP was enacted in early 2009 and was intended to provide incentives for lenders to modify the mortgages of distressed borrowers. In addition, in November 2008, Fannie Mae and Freddie Mac along with large servicers of non-government-sponsored-enterprise loans placed a temporary nationwide moratorium on foreclosure proceedings to provide time to implement loan modification programs (see Freddie Mac 2008; Sidel 2008). Also, beginning in late 2008, states such as California and Florida either enacted or implemented foreclosure prevention programs that required lenders to engage in mediation before initiating a foreclosure process. These are likely to blur the

distinction between judicial review and non-judicial-review foreclosures. For example, a nationwide foreclosure moratorium is likely to reduce the differences in expected time in foreclosure between judicial review and non-judicial-review states and thus reduce any differences in expected costs of default arising from differences in **state foreclosure laws**.

We investigate whether determinants of default changed in the post-2008 period by examining the defaults during the January 2009-June 2010 period. For this extended period, we estimate the hazard model with a set of interactive dummies for the post-2008 period. While we continue to find an effect of **state foreclosure laws**, we find that the effect of judicial review is smaller in the post-2008 period. Moreover, we find that the difference between judicial review and non-judicial-review states in terms of the time from default to foreclosure declines significantly after 2008. Overall, the evidence suggests that foreclosure [*233] mitigation programs reduced the importance of state judicial review requirements after 2008.

We next attempt to isolate the impact of foreclosure prevention programs by examining changes in default hazards around a change in state foreclosure proceedings. In particular, California's enactment of an automatic mediation program in September 2008 provides a natural experiment to test the impact of these programs on the probability of default (California is the state with the largest number of loans in our sample). We estimate a difference-in-differences model to compare California (a non-judicial-review state) to Arizona (the only contiguous non-judicial-review state that did not implement a mandatory mediation program) before and after California changed its foreclosure process. Consistent with the hypothesis that borrower-friendly foreclosure laws increase the incidence of defaults, we find that, conditional on negative equity, there is a significant incremental effect on default between Arizona and California only after September 2008.

Our paper adds to the literature on the importance of the foreclosure process in the decision to default. Our findings are similar to those of Jones (1993) and more recently Ghent and Kudlyak (2011), who find that recourse laws have a significant impact on the likelihood of default only when the borrower has negative equity.ⁿ¹⁰ A contemporaneous paper by Gerardi, Lambie-Hanson, and Willen (2013) examines the relationship between judicial review and how defaults are resolved. They find that, conditional on default, the likelihood of a foreclosure is similar in judicial review and non-judicial-review states, but the foreclosure process is much longer in judicial review states. For reasons discussed later, we focus on how the foreclosure process affects the likelihood of default and not on how defaults are resolved. Our finding that default rates are higher in judicial review states is consistent with a longer time to foreclosure reducing the expected costs of default for borrowers in judicial review states.

To the best of our knowledge, ours is the first study to use loan-level data to examine how judicial review and deficiency judgments together impact the likelihood of default. More important, we provide evidence that foreclosure mitigation programs have a significant effect on the likelihood of default. Finally, we provide evidence that the bankruptcy process mitigates the effect of creditor-friendly laws. Our findings suggest that during the current crisis, defaults are quite sensitive to the borrower's equity position and the expected costs of the foreclosure process.

2. Foreclosure Laws and Their Effect on Mortgage Defaults

The intuition for the hypothesis that **state foreclosure laws** affect the likelihood of default rests in a simple bargaining game between the borrower and the lender. [*234] A borrower's decision to default will depend on his liquidity and the equity that he has in the home. A borrower may decide to default because the outstanding loan balance exceeds the value of the house that it was used to finance; that is, the loan is underwater. More generally, when considering whether to exercise the option to default, the borrower compares net benefits of exercising the default option to the costs of default and defaults when the benefits exceed the costs.ⁿ¹¹ The cost of default is in part a function of the home owner's equity, defined as the difference between the home price and the outstanding loan amount. The cost of default is also a function of whether the lender can go after the defaulting borrower's other assets in the event that the value of the underlying real estate collateral is less than the principal amount of the mortgage plus lender-born foreclosure costs.

The default decision may also be a function of the loan modification that the borrower expects to obtain from the lender. The willingness of the lender to modify the loan will in turn depend on the expected sale price of the house in foreclosure, the length of the foreclosure process, and the costs associated with foreclosure relative to loan modification. The foreclosure price net of foreclosure costs equals the lender's reservation price in the bargaining game between the borrower and the lender. Both parties bargain over the surplus the lender derives from loan continuation relative to foreclosure. The amount of surplus that the borrower can extract from the lender will be a function of the anticipated foreclosure price and costs associated with the foreclosure process. ⁿ¹²

Cutts and Merrill (2008) provide a detailed review of the foreclosure process. A foreclosure is initiated by the loan servicer, who acts as an agent for the investor institution that provided funding for the loan. Foreclosure starts with the filing of a notice of default or substitution of trustee in the county in which the property is located. The foreclosure process and thus the costs of foreclosure are governed by state law (for a summary of the relevant state foreclosure statutes, see Rao and Walsh [2009] and Elias [2009]). Thus, differences in **state foreclosure laws** provide a way to identify variations in the costs of default.

2.1. Judicial Review Foreclosure

A judicial review foreclosure requires a judge or court official to preside over the case, while a statutory or power-of-sale foreclosure allows the loan servicer to proceed without a court official. As discussed in the Introduction, judicial review foreclosures have, on average, longer time lines and are more expensive to investors than the statutory process. We therefore expect that borrowers with [*235] negative equity are more likely to default in states with judicial review foreclosure laws.

2.2. Deficiency Judgments

A mortgage creditor also has the right to recover a substantial amount of its principal after the foreclosure sale by undertaking a deficiency judgment. This type of lawsuit is described in Rao and Walsh (2009, p. 37) as an effort "to recover the difference between the price the house sold for at the foreclosure sale and the total debt that was due under the mortgage and note at the time of foreclosure." Deficiency judgments allow the lender to recover more money than the proceeds from the foreclosure sale. In terms of the bargaining game described above, as Ghent and Kudlyak (2011) explain, deficiency judgments increase the reservation price of a foreclosure sale and therefore reduce the surplus that a defaulter may expect to extract in the loan modification process. Therefore, borrowers with negative equity are less likely to default in states with deficiency judgments.

2.3. Classification of States by Foreclosure Laws

Table 1 reports the classification of each state's (and the District of Columbia's) foreclosure laws with respect to judicial review and deficiency judgments. The values in the table are taken from Rao and Walsh (2009), Foreclosure.com, RealtyTrac, National Consumers League, and Hayre and Saraf (2008). ⁿ¹³ For example, in California deficiency judgments are not applicable to mortgages used to purchase the property (purchase money mortgages). Deficiency judgments are permitted in the case of cash-out refinancings, but the plaintiff must then go through a judicial review. We set the dummy variable for deficiency judgments equal to 0 for purchase property loans and 1 for cash-out refinancings. This specification leaves the effect of judicial review unchanged (Judicial Review = 0 for all California loans). A plaintiff must go through the judicial review process if he decides to seek a deficiency judgment for a cash-out mortgage in California, however. Judicial review is not required otherwise.

As shown in Table 1, there is more variation across states in terms of judicial review than deficiency judgment. More important, among states that require judicial review, there is considerable variation in deficiency judgment. This variation allows us to investigate the separate effects of deficiency judgments and judicial review. Finally, the two states with the largest number of loans in our sample have very different foreclosure laws. California does not have judicial review and limits deficiency judgments. Florida, the state with the second-largest number of loans, is a judicial review

state that permits deficiency judgments. [*236] Both states experienced significant declines in housing prices after 2006. As we discuss later, to address concerns that our findings may be driven by different economic conditions or expectations about future housing price changes in Florida and California rather than differences in foreclosure laws, we also examine the determinants of default, excluding loans from Florida and California.

Table 1 also reports the value of a dummy variable for the existence of state emergency relief funds (for a description of state emergency relief programs, see Rao and Walsh [2009]). The purpose of these funds is to temporarily help distressed borrowers with their mortgage payments by making them short-term loans or deferring mortgage payments. Eligibility for these relief programs depends on providing evidence of financial hardship. Thus, the relief funds offer temporary respite to borrowers without extinguishing their mortgage debt. All else the same, we would expect the presence of an emergency relief fund to reduce the likelihood of default.

3. Data

Our data consist of subprime, alt-A, and nonconforming prime loans from Lewtan's ABSNet Loan database. This database contains private-label securitized mortgages originated since 2001. We restrict our sample to loans originated between 2005 and 2007, as the data coverage prior to this period is thin. We also exclude loans made for investment purposes because foreclosure laws are different for those loans. Subprime borrowers typically have poor credit histories and little savings for down payments on the loans. Alt-A borrowers have minor credit quality issues or are unable or unwilling to provide full documentation of assets or income (see Mayer, Pence, and Sherlund 2009). We focus on subprime and alt-A loans because these loans have on average higher loan-to-value (LTV) ratios, and thus they are more likely to result in negative equity when housing prices decline. As we discuss later, we also examine the determinants of default for a sample of nonconforming prime loans during the same period.

The database provides information on a broad set of borrowers' credit characteristics and on the type of loan in terms of reset features, prepayment fees, and amortization. Our primary measure of a borrower's credit quality is the borrower's FICO score at loan origination. This score provides a ranking of borrowers based on the probability of having a negative credit event in the next 2 years. ABSNet Loan also contains data on LTV and CLTV ratios at the time the mortgage is originated. The CLTV ratio accounts for any secondary loans with liens on the property. A higher CLTV ratio implies that the borrower used more leverage to finance the house. We combine the CLTV ratio with MSA-level housing prices at loan origination to estimate the price at which the home was purchased. According to ABSNet Loan, the CLTV ratio includes a second mortgage in place at the time the first mortgage was originated but may not reflect a second mortgage taken out after the first mortgage was originated. Thus, our [*237] CLTV measure may understate the aggregate loan amount. Since, as discussed below, we use the CLTV ratio to measure a borrower's equity, we may overstate the amount of equity in the home. We address the sensitivity of our results to potential measurement error in Section 4.

Loans are classified in ABSNet Loan as subprime and alt-A according to the loan's credit quality and the level of documentation that the borrower provides to the loan originator. In terms of documentation, ABSNet Loan classifies loans as full documentation, limited documentation, or no documentation. Information on the type of loan is also provided. We differentiate between three main categories of loan: fixed-rate loans, adjustable-rate mortgages, and negative-amortization mortgages. Negative-amortization mortgages are mainly in the alt-A sample of loans.

We restrict our sample to loans with nonmissing original FICO score, interest rate, loan balance, LTV ratio (required for estimating home equity), loan type, MSA, and zip code. The MSA field is required to match each loan with quarterly MSA-level housing prices. The zip code field is required to match each loan with monthly county-level unemployment rates. After filtering the data as described above, we are left with 1,314,015 subprime, 1,213,921 alt-A, and 450,409 prime mortgage loans. Table 2 provides definitions for the key variables that we use in our empirical analysis.

3.1. Time-Varying Variables

Data on home prices were obtained from the Federal Housing Finance Agency (formerly known as the Office of Federal Housing Enterprise Oversight) and consist of a quarterly home price index by MSA, not seasonally adjusted. This index is based on over 41 million repeat transactions using data provided from Fannie Mae and Freddie Mac for mortgages originated over the past 35 years (Calhoun 1996; Federal Housing Finance Agency 2010). We obtain a monthly series for each MSA by linearly interpolating the quarterly home price indexes. We measure home equity in terms of the percentage of the original loan balance:

$$\text{Equity}[t] = \text{Home Price} \times \text{HPA}[t] - \text{Cumulative Loan Balance/Cumulative Loan Balance}, (1)$$

where

$$\text{Home Price} = \text{Original Loan Balance/LTV Ratio},$$

$$\text{HPA}[t] = \text{Home Price Index}/\text{Home Price Index at Origination},$$

and [*238]

Table 2
Variable Definitions

Variable	Expected Sign	Definition
FICO Score	-	FICO credit score at origination
CLTV Ratio	+	Cumulative loan-to-value ratio; combined value of all liens divided by the value of the house at origination
Cash-Out Refinance	-	Equals one if the mortgage loan is a cash-out refinancing loan and zero otherwise
Full-Documentation Loan	-	Equals one if full documentation on the loan is provided and zero otherwise
Prepayment Penalty	+	Equals one if there is a prepayment penalty and zero otherwise
Original Loan Rate (%)	+	Initial rate as of the first payment date
Adjustable Rate	+	Equals one if the mortgage loan has an adjustable rate and zero otherwise
Negative Amortization	+	Equals one if the mortgage

		loan has a negative amortization and zero otherwise
Original Loan Balance (\$1,000s)	+/-	Value of the mortgage loan at origination
Per Capita Income, Zip Code (\$1,000s)	-	Zip-code-level median income in 1999 from the 2000 U.S. census
Change in Unemployment Rate, County	+	Change in county-level unemployment rate since origination<a>
Change in Personal Income, State	-	Ratio of change in personal income per capita since origination to personal income per capita at origination
Emergency Relief Program	-	Equals 1 if the state has an emergency relief program for troubled mortgage loans, 0 if not, and .5 if intermediate case<c>
Judicial Review	+	Equals 1 if the state has a judicial review process, 0 if not, and .5 if intermediate case
Deficiency Judgment	-	Equals 1 if the state allows deficiency judgments, 0 if not, and .5 if intermediate case
Equity	-	Difference between current home price and cumulative loan balance divided by cumulative loan balance

<a> Bureau of Labor Statistics, Local Area Unemployment Statistics (<http://www.bls.gov/lau>).

 Bureau of Economic Analysis, Regional Data: GDP and Personal Income (http://www.bea.gov/iTable/index_regional.cfm).

<c> Rao and Walsh (2009). [*239] Cumulative Loan Balance = Original Loan Balance x CLTV Ratio/LTV Ratio.

Our measure of equity is a crude one because it does not use the current mortgage balance. This will bias the equity amount upward for negative amortization loans, which are prevalent in the alt-A sample. This measure also ignores whether any home equity has been withdrawn from the house by way of a home equity line of credit. This effect will also bias our measure of home equity upward. Note, however, that since housing prices declined on average during the 2006-9 period and the subprime and alt-A loans had initially high LTV ratios (averages of 85 percent and 81 percent, respectively), it is unlikely that our sample consists of a large number of borrowers who were able to withdraw a significant amount of equity. Finally, as discussed earlier, since equity is based on cumulative loan balances and ABSNet Loan may not capture some second mortgages, we may overstate the amount of equity that borrowers have in their homes.

We also control for changes in personal income and employment. These variables are important because we wish to distinguish between the cost of default and the effect of reduced income or loss of employment on borrowers' decisions to default. Quarterly state-level information on total personal income is available from the Bureau of Economic Analysis. We divide these numbers by 2000 U.S. census state population estimates to obtain per capita income. The advantage of this time series is that it varies quarterly and is available until the second half of 2010. We obtained monthly county-level unemployment rates from the Bureau of Labor Statistics. Our empirical estimates measure the change in per capita income and the change in unemployment since loan origination.

3.2. Default and the Resolution of Default

Our empirical analysis focuses on the determinants of default. As in Demyanyk and Van Hemert (2011) and Mian, Sufi, and Trebbi (2011), a loan is classified as in default when it first becomes more than 60 days delinquent. Loans that are more than 60 days past due are considered to be seriously delinquent by bank regulators. A loan is more than 60 days delinquent if the borrower is behind on two mortgage payments according to the Mortgage Bankers Association's (MBA) definition. This definition states that a mortgage is more than 60 days delinquent if the monthly payment is not received by the end of the day immediately preceding the loan's next due date. Our results are robust to using more than 90 days' delinquency according to the MBA definition. See Table B1 in the online appendix.

ABSNet Loan provides information on delinquencies and some information on the resolution of default. In particular, we can determine for delinquent loans whether there was a self-cure or whether the loan was modified, was sold in foreclosure, became real estate owned (REO), or was ultimately liquidated. However, for many of the delinquent loans in our sample, the distress resolution [*240] process had not been completed as of the end of our sample period. Moreover, we do not have information on the terms of any loan modification or on how loans came into REO or were liquidated. For example, we do not have information on short sales or whether the lender took a deed in lieu of foreclosure.

We focus on the determinants of default as opposed to how defaults are resolved for several reasons. First, in many cases we do not have information on how the default was resolved. Second, for many loans, particularly those for which the default occurred in 2007 or later, it is too early to determine how the default process will be resolved. Third, the relationship between default rates and **state foreclosure laws** provides the clearest identification of differences in the costs of defaulting. In particular, the resolution of defaults involves a complex bargaining game between the borrower and the lender. As a result, it is unclear what relationship exists, if any, between how defaults are resolved and the importance of default costs. For example, when considering a loan modification, the lender must weigh not only the cost of modifying a particular loan against the costs of foreclosure but also the impact of loan modification on other borrowers' decisions to default. Thus, a lender in a borrower-friendly state might decide not to modify loans because of concerns over increasing the pool of potential defaulters. Lenders in states that are less borrower friendly may have fewer concerns about the pool of potential defaulters but still decide not to modify because the costs of modifying an individual loan are greater than the costs of foreclosing on the loan.

3.3. Empirical Methods

The borrower's decision to default will depend on loan and borrowers' characteristics at origination and changes in the borrower's income, employment status, and home equity after origination. Because of the presence of time-varying variables in the decision to default on the loan, we employ a hazard model of default. This approach lends itself naturally to loan survival rates when time variation in employment, income, and home prices affect borrowers' decisions to default on their mortgages. Duration models have been applied to mortgage defaults and prepayment decisions in Gerardi, Lambie-Hanson, and Willen (2013), Foote, Gerardi, and Willen (2008), and Demyanyk and Van Hemert (2011). We model the discrete-time analogue to the proportional hazard model. The advantage of this specification is that it permits derivation of relative default hazards, which we discuss below.

Our data set is a panel data set of monthly observations in which each cross-sectional observation is a vector of binary responses, along with covariates, some of which are time varying. We employ a piecewise-constant proportional hazard model in which for loan i at time t , the default hazard $[\lambda_{im}](t; x[m])$ is

$$\lambda(t; x_m) = \exp(x_m \beta) \lambda_m, \quad m - 1 \leq t < m, \quad (2)$$

where m is the monthly period, $x[m]$ is a vector of time-varying covariates, and $[\beta]$ is a vector of parameters to be estimated. Wooldridge (2010) shows that

[*241]

$$\log[-\log(1 - P_{im})] = \log(\lambda_m) + x_m \beta, \quad (3)$$

where $P[im]$ equals the probability that an event occurs to individual i in interval m , given that the individual did not have events in any of the earlier intervals. The transformation on the left is a complimentary log-log function, and this specification of the Cox proportional hazard model can be easily and quickly estimated using PROC LOGISTIC in SAS (see Allison 2010).

3.3. Marginal Effects

We define the marginal effect (ME) of a binary variable j as the relative hazard ratio associated with increasing this variable from zero to one:

$$ME = \frac{\exp(x_m \beta + \beta_j) \lambda_m}{\exp(x_m \beta) \lambda_m} = \exp(\beta_j), \quad \text{for all } m.$$

Thus, for example, we find that the marginal effect of moving from a statutory review to a judicial review state can be interpreted as the percentage change in the default hazard for a borrower, holding all covariates constant. The expression in equation (4) is also a hazard ratio. Following Demyanyk and Van Hemert (2011), we measure the economic significance of continuous explanatory variables by a marginal statistic (MS) defined as the log-proportional odds ratio associated with a 1-standard-deviation increase in the variable. The marginal statistic is defined as

$$MS_j = \beta_j \sigma_j = \log \left[\frac{\exp(x_m \beta + \beta_j \sigma_j) \lambda_m}{\exp(x_m \beta) \lambda_m} \right]. \quad (5)$$

The effect of equity on the home owner's default decision is likely to be nonlinear. In particular, the effect of an increase in equity when the equity is negative will be different from when the equity is positive. For this reason, we model equity as a piecewise continuous function as in Foote, Gerardi, and Willen (2008). Because we include the interaction of equity with foreclosure law variables, we restrict the number of break points to two: one at 25 percent equity and another at 0 percent equity. We choose 25 percent equity, as Foote, Gerardi, and Willen (2008) find a significant kink at that point. We also choose 0 percent, as home owners are more likely to default when equity is negative than when it is positive. In particular, this piecewise continuous function $f[0]$ in a state with statutory review and no deficiency judgments is

$$f_0(\text{Equity}) = \beta_0 + \beta_1 \times \text{Equity} + \beta_2 \times \mathbb{I}(\text{Equity} \geq 0) \times (\text{Equity}) \\ + \beta_3 \times \mathbb{I}(\text{Equity} \geq .25) \times (\text{Equity} - .25). \quad (6)$$

Here

$\mathbb{I}(\omega)$ is an indicator function equal to one if ω is true and zero otherwise. We estimate a similar function for each of the two state laws as well. Let $f[1]$ and $f[2]$ denote similar functions when there is judicial review and deficiency judgment, respectively. Then Equity will appear in the hazard model as

[*242]

$$f(\text{Equity}) = f_0(\text{Equity}) + D_{\text{Judicial}} \times f_1(\text{Equity}) \\ + D_{\text{Deficiency}} \times f_2(\text{Equity}) \quad (7)$$

where $D[\text{Judicial}]$ and $D[\text{Deficiency}]$ are variables that take on values of 0, .5, or 1 as indicated in Table 1. To address potential concerns with mismeasurement of the value of equity, we also estimate the hazard model using 15 percent and -5 percent as break points. We estimate the model with break points at lower values of home equity because of the possibility that the value of equity is overstated because of limited information on second mortgages obtained after the first mortgage was originated.

3.4. Relative Default Hazard

We also measure the effect of home equity on default relative to a borrower who has 25 percent equity in his home. The relative hazard of default is defined as the ratio of the default hazard for a given level of home equity to the default hazard for the same borrower with 25 percent home equity. This level of home equity corresponds to an 80 percent CLTV ratio:

$$\text{Relative Default Hazard} = \frac{\exp[z_m \gamma + f(\text{Equity})] \lambda_m}{\exp[z_m \gamma + f(.25)] \lambda_m} \quad (8) \\ = \exp[f(\text{Equity}) - f(.25)].$$

We find that the relative default hazard measures the effect of a change in home equity, holding state laws constant. The advantage of equation (6) is that it lends itself naturally to a graphical analysis, thereby providing a visual interpretation of the effect of **state foreclosure laws** on the incidence of default by comparing relative default hazards between states with different foreclosure laws.

3.5. Equity Contribution Amounts

We also measure how much less (or more) equity borrowers in non-judicial-review (non-deficiency-judgment) states would need to have the same default hazard as a borrower in a judicial review (deficiency judgment) state, all else held equal. This equity contribution amount is obtained by solving the following equation for Equity at different levels of equity (for example, -.10) in the nonjudicial-review or non-deficiency-judgment states:

$$1 = \exp[f_0(-.10) - f_0(\text{Equity}) + f_k(-.10)]^{(9)}$$

where

$$f_k(\text{Equity}) = \beta_{0k} + \beta_{1k} \times \text{Equity} + \beta_{2k} \times \mathbb{I}(\text{Equity} \geq 0) \times (\text{Equity}) \\ + \beta_{3k} \times \mathbb{I}(\text{Equity} \geq .25) \times (\text{Equity} - .25), \quad k = 1, 2$$

and

[*243]

$$k = \begin{cases} 1 & \text{if judicial review state} \\ 2 & \text{if deficiency judgment state} \end{cases}$$

4. Descriptive Statistics and Empirical Tests

We present cumulative default rates by vintage for subprime and alt-A loans in Figures 1-12. As shown, the shape of the vintage curves for subprime and alt-A loans are very similar. Given that housing prices continued to increase until mid-2006, the default rates are much lower for the 2005 vintage than for the 2006 and 2007 vintages. For all vintages, cumulative default rates are similar in both judicial review and non-judicial-review states, while cumulative default rates for the 2006 and 2007 vintage loans are higher in states that do not permit deficiency judgments.

Table 3 provides summary statistics for subprime and alt-A loans based on whether the loan was originated in states requiring judicial review and states where deficiency judgments are permitted. There is no obvious pattern suggesting that loan characteristics vary systematically with foreclosure laws. For example, average FICO scores are higher for both subprime and alt-A loans originated in non-judicial-review (creditor-friendly) states. However, average FICO scores are lower for both types of loans in states that permit deficiency judgments. The only notable difference is the higher percentage of cash-out refinancing loans where deficiency judgments are permitted. However, this relationship is mechanical since in California deficiency judgments are permitted only for cash-out loans. When we exclude California, we find a similar proportion of cash-out loans in deficiency judgment and non-deficiency-judgment states.

Since our primary focus is on the relationship between default rates, borrowers' equity, and foreclosure laws, in Table 4 we show how owners' equity and default rates vary over time on the basis of **state foreclosure laws**. The values in the table are computed using loans that had not experienced any delinquencies between origination and 3 months

prior to the calculation date. As shown, on average, borrowers' equity is significantly lower in non-judicial-review states than in judicial review states. Moreover, average equity declines more over time in non-judicial-review states than in judicial review states. For example, for alt-A loans, the average owner's equity in non-judicial-review states declines from 37.3 percent at the end of the first quarter of 2007 to 4.5 percent at the end of the first quarter of 2010, while in judicial review states average equity declines from 38 percent to 11 percent. In contrast, average equity is higher and falls by less over time in states that permit deficiency judgments. Thus, one explanation for the higher default rates in non-judicial-review and non-deficiency-judgment states may be that housing prices declined by more in these states than in judicial review and deficiency judgment states. These summary statistics highlight the importance of controlling for owners' equity when examining the relationship between default rates and **state foreclosure laws**.

[*244] Figure 1. Cumulative default rates for subprime loans: judicial review versus no judicial review, 2005.

Figure 2. Cumulative default rates for subprime loans: deficiency judgment versus no deficiency judgment, 2005.

[*245] Figure 3. Cumulative default rates for subprime loans: judicial review versus no judicial review, 2006.

Figure 4. Cumulative default rates for subprime loans: deficiency judgment versus no deficiency judgment, 2006.

[*246] Figure 5. Cumulative default rates for subprime loans: judicial review versus no judicial review, 2007.

Figure 6. Cumulative default rates for subprime loans: deficiency judgment versus no deficiency judgment, 2007.

[*247] Figure 7. Cumulative default rates for alt-A loans: judicial review versus no judicial review, 2005.

Figure 8. Cumulative default rates for alt-A loans: deficiency judgment versus no deficiency judgment, 2005.

[*248] Figure 9. Cumulative default rates for alt-A loans: judicial review versus no judicial review, 2006.

Figure 10. Cumulative default rates for alt-A loans: deficiency judgment versus no deficiency judgment, 2006.

[*249] Figure 11. Cumulative default rates for alt-A loans: judicial review versus no judicial review, 2007.

Figure 12. Cumulative default rates for alt-A loans: deficiency judgment versus no deficiency judgment, 2007.

[*250] Table 3

Summary Statistics

Variable	Subprime Loans			
	Judicial Review		Deficiency Judgment	
	No	Yes	No	Yes
FICO Score	625	617**	643	617**
CLTV Ratio (%)	85.2	84.6**	87.6	84.4**
Original Loan Rate (%)	8.2	8.5**	8.1	8.4**
Original Loan Balance (\$ 1,000s)	212.5	186.9**	253.2	191.8**
Full-Documentation Loan (%)	59.3	59.4	48.8	61.5**
Cash-Out Refinance (%)	44.5	49.2**	22.0	51.6**
Prepayment Penalty (%)	76.7	54.1**	76.5	67.2**
Adjustable Rate (%)	70.1	67.5**	74.8	67.7**
Negative Amortization (%)	.002	.001+	.004	.001*

Unemployment Rate, County (%)	5.1	4.5**	5.1	4.8**
Per Capita Income, State (\$ 1,000s)	37.2	38.3**	38.5	37.7**
Per Capita Income, Zip Code (\$ 1,000s)	47.4	45.9**	45.8	47.0**
Loans	772,780	505,668	229,562	1,065,958

Alt-A Loans

Variable	Judicial Review		Deficiency Judgment	
	No	Yes	No	Yes
FICO Score	709	705**	713	706**
CLTV Ratio (%)	81.0	81.8**	83.4	80.4**
Original Loan Rate (%)	5.3	5.8**	5.3	5.5**
Original Loan Balance (\$ 1,000s)	348.8	287.6**	405.6	303.1**
Full-Documentation Loan (%)	17.4	17.8**	13.1	19.2**
Cash-Out Refinance (%)	36.7	33.6**	9.8	45.6**
Prepayment Penalty (%)	40.4	30.5**	41.6	36.1**
Adjustable Rate (%)	35.7	31.6**	43.4	31.0**
Negative Amortization (%)	29.0	21.7**	29.9	25.7**
Unemployment Rate, County (%)	4.8	4.3**	4.9	4.6**
Per Capita Income, State (\$ 1,000s)	38.5	38.7**	39.4	38.5**
Per Capita Income, Zip Code (\$ 1,000s)	54.4	51.8**	53.8	53.6**
Loans	840,008	355,390	327,159	877,235

Note. The sample consists of non-investor-owned residential mortgages originated between 2005 and 2007 and subsequently securitized in a private-label securitization transaction. Loans from states with judicial review (or deficiency judgment) scores equal to .5 are excluded. Information on borrower FICO scores at the time of the loan and original loan characteristics is from from ABSNet Loan. The county-level monthly unemployment rate is from the Bureau of Labor Statistics. State-level per capital income is calculated by dividing aggregate quarterly state income from the Bureau of Economic Analysis by the estimated prior year's end state population provided by the U.S. census. Zip code level per capita income is from the year 2000 U.S. census. Tests are conducted for whether the difference in means (yes versus no) is significantly different from zero. Alt-A p alternative A-paper.

+ Significant at the 10 percent level.

* Significant at the 5 percent level.

** Significant at the 1 percent level.

[*251] Table 4

Average Delinquency Rates and Home Equity

	Delinquency Rate (%)				Owner's Equity (%)			
	Judicial		Deficiency		Judicial		Deficiency	
	Review		Judgment		Review		Judgment	
	No	Yes	No	Yes	No	Yes	No	Yes
Subprime loans:								
March 2007	4.5	4.5	4.7	4.4**	28.7	29.8**	25.1	30.1**
September 2007	7.8	7.7	9.7	7.4**	26.3	28.2**	20.7	28.4**
March 2008	10.0	9.4**	14.7	8.7**	23.5	26.5**	15.2	26.5**
September 2008	11.0	10.7**	17.2	9.8**	16.4	20.3**	4.5	20.4**
March 2009	10.3	10.5	14.9	9.7**	12.6	14.8**	-1.2	15.8**
September 2009	10.7	11.1**	14.0	10.4**	11.5	12.5**	-3.2	14.1**
March 2010	6.9	7.4*	8.2	7.0**	11.2	11.1	-1.9	13.0**
Alt-A loans:								
March 2007	1.2	1.3**	1.4	1.2**	37.3	38.0**	32.4	39.4**
September 2007	2.4	2.5**	3.0	2.2**	33.8	35.6**	27.3	36.9**
March 2008	4.2	4.1*	5.8	3.6**	28.4	32.8**	20.4	33.1**
September 2008	5.5	5.1**	7.6	4.6**	17.2	25.4**	7.4	24.1**
March 2009	6.7	6.1**	8.9	5.7**	9.3	17.7**	-1.8	16.7**
September 2009	7.9	7.1**	9.8	7.0**	4.8	12.9**	-6.7	11.9**
March 2010	5.2	5.1	6.0	4.9**	4.5	11.0**	-5.9	10.8**

	Loans with Negative Owner's Equity (%)			
	Judicial		Deficiency	
	Review		Judgment	
	No	Yes	No	Yes
Subprime loans:				
March 2007	5.1	2.0**	10.5	2.5**
September 2007	11.5	6.8**	23.8	6.7**
March 2008	16.3	10.1**	34.1	10.0**
September 2008	27.7	21.7**	51.4	20.8**
March 2009	32.3	31.8*	62.4	27.8**
September 2009	36.0	35.8	65.0	32.0**
March 2010	37.1	39.8**	63.0	34.8**
Alt-A loans:				
March 2007	4.2	1.4**	8.5	1.6**
September 2007	10.7	6.0**	18.6	6.0**

March 2008	17.8	9.9**	31.1	9.9**
September 2008	34.1	22.2**	52.1	23.0**
March 2009	46.3	34.5**	68.4	33.9**
September 2009	54.1	42.2**	75.2	42.3**
March 2010	55.7	45.9**	74.3	45.3**

Note. Results are reported for every 6 months from March 2007 to June 2010 for loans that had no history of default between origination and 3 months prior to calculation. Loans from states with judicial review (or deficiency judgment) scores equal to .5 are excluded. We report the results for six-month intervals beginning in March 2007. Tests are conducted for whether the difference in rates (yes versus no) is significantly different from zero. Alt-A p alternative A-paper.

* Significant at the 5 percent level.

** Significant at the 1 percent level.

[*252] We also compute but do not tabulate the number of months from default to either liquidation or REO (in the case of REO, the foreclosed property is not sold but rather is held by the lender). In judicial review states, the median time from the date of default to REO is 12 months, compared with 6 months for non-judicial-review states. The median time from default to liquidation is 17 months in judicial review states, compared with only 12 months in non-judicial-review states. Rank-sum tests imply that the distribution of times to REO and liquidation are significantly different at the 1 percent level for judicial review and non-judicial-review states. These results are consistent with the findings of precrisis studies that find longer foreclosure times in states with judicial review (see Hayre and Saraf 2008).

4.1. Hazard Model Estimates of Default

We begin by estimating our hazard model without the state law variables. We estimate the model separately for subprime, alt-A, and prime loans. The hazard estimates using data from January 2005 to December 2008 are presented in Table 5. These estimates are based on maximum-likelihood estimates of equation (2). The explanatory variables that we use are similar to the variables used by De-myanyk and Van Hemert (2011) in their analysis of the defaults of subprime loans. The hazard estimates indicate the effect of each variable on the default hazard. A positive sign indicates that an increase in a given variable increases the probability of default. We also report marginal statistics of the covariates as defined by equation (5).

The estimated effects of borrowers' and loan characteristics on default are generally consistent with our expectations. In particular, we find that default rates are inversely related to FICO scores, the level of documentation, and per capita income in the zip code where the home is located. We also find that default rates are higher for adjustable-rate loans and loans that permit negative amortization. Moreover, while we find that changes in unemployment and personal income have the expected signs, their marginal contribution to default likelihood is small.

We model the effect of owners' equity using a linear spline function because we expect that owners' equity will affect the default decision differently depending on whether it is positive or negative. As described above, we initially set the break points for the linear spline at 0 percent and 25 percent. The coefficient estimates can be interpreted as follows: when equity is less than or equal to 0, the effect of a change in equity is given by the coefficient on Equity; for values of equity greater than 0 percent but less than 25 percent, the effect of changes in equity on default rates is equal to the sum of the coefficient on Equity and the first interactive variable ($(\text{Equity} \geq 0) \times \text{Equity}$). Finally, when equity is greater than 25 percent, the effect of equity is equal to the sum of all three coefficients on Equity.

[*253] Table 5

Default Hazard Estimates without State Law Effects

Explanatory Variable	Subprime Loans	
	Coefficient	Marginal Contribution
Loan and local characteristics at origination:		
FICO Score	-.007**	-.424
Cash-Out Refinance	-.170**	-.085
Full-Documentation Loan	-.358**	-.176
Prepayment Penalty	-.062**	-.029
Original Loan Rate (%)	.094**	.177
Adjustable Rate	.261**	.121
Negative Amortization	.573<+>	.002
Original Loan Balance (\$ 1,000s)	.001**	.163
Per Capita Income, Zip Code (\$ 1,000s)	-.005**	-.070
Time-varying local economic conditions:		
Change in Unemployment, County (%)	.053**	.100
Change in Per Capita Income, State	-2.061**	-.088
Time-varying home equity:		
Equity (%)	-2.879**	-.930
Equity (%) x (Equity > 0%)	1.043**	.337
[Equity (%) - 25%] x (Equity > 25%)	1.296**	.419

Explanatory Variable	Alt-A Loans	
	Coefficient	Marginal Contribution
Loan and local characteristics at origination:		
FICO Score	-.009**	-.445
Cash-Out Refinance	-.018**	-.009
Full-Documentation Loan	-.616**	-.235
Prepayment Penalty	.099**	.048
Original Loan Rate (%)	.060**	.138
Adjustable Rate	.228**	.108
Negative Amortization	.365**	.161
Original Loan Balance (\$ 1,000s)	.001**	.162
Per Capita Income, Zip Code (\$ 1,000s)	-.005**	-.098
Time-varying local economic conditions:		
Change in Unemployment, County (%)	.011**	.024
Change in Per Capita Income, State	-4.016**	-.182
Time-varying home equity:		

Equity (%)	-3.018**	-1.301
Equity (%) x (Equity > 0%)	-.894**	-.386
[Equity (%) - 25%] x (Equity > 25%)	3.580**	1.544
Prime Loans		
Explanatory Variable	Coefficient	Marginal Contribution
Loan and local characteristics at origination:		
FICO Score	-.010**	-.443
Cash-Out Refinance	.182**	.074
Full-Documentation Loan	-.463**	-.225
Prepayment Penalty	.304**	.064
Original Loan Rate (%)	.397**	.311
Adjustable Rate	.276**	.137
Negative Amortization	1.880**	.200
Original Loan Balance (\$ 1,000s)	.0001*	.011
Per Capita Income, Zip Code (\$ 1,000s)	-.006**	-.146
Time-varying local economic conditions:		
Change in Unemployment, County (%)	.020**	.045
Change in Per Capita Income, State	-2.176**	-.111
Time-varying home equity:		
Equity (%)	-4.049**	-1.811
Equity (%) x (Equity > 0%)	-.836**	-.374
[Equity (%) - 25%] x (Equity > 25%)	4.941**	2.210

Note. Values are hazard estimates from a discrete-time version of the Cox proportional hazard model defined in equation (2) for January 2005 to December 2008.

The effect of home owner's equity is modeled using a linear spline with break points at 0 percent and 25 percent.

Marginal contributions are calculated using equation (5) and show the effect of a 1-standard-deviation change in the explanatory variable on the hazard rate. Alt-A p alternative A-paper.

+ Significant at the 10 percent level.

** Significant at the 1 percent level.

[*254] Figure 13 illustrates the effect on default rates of changes in owners' equity. ⁿ¹⁴ In particular, in Figure 13 we plot the relative default hazard curves (defined in equation [8]) for subprime, alt-A, and prime loans. Recall that the relative hazard is the ratio of the estimated hazard for a given level of equity to the hazard for a borrower in the same state with 25 percent equity. Not surprisingly, relative hazards increase as equity declines for all three types of loans. As shown, borrowers with no equity are on average 2.5 times more likely to default than borrowers with 25 percent equity. Subprime and alt-A borrowers with -25 percent equity are 3.3 and 5.7 (respectively) times more likely to default than borrowers in these loan groups with 25 percent equity. Prime borrowers with -25 percent equity are nine times more likely to default than borrowers with 25 percent equity. ⁿ¹⁵ The finding that relative hazards increase as owners' equity declines is perhaps not surprising. As Foote, Gerardi, and Willen (2008) and Bhutta, Dokko, and Shan (2010) point out,

liquidity-constrained borrowers are more likely to default when they have negative equity in their homes because they are unable to avoid default by selling their homes or refinancing their loans.

4.2. *Effect of Judicial Review and Deficiency Judgments on Loan Delinquency*

To investigate the importance of default costs, we estimate hazard models including a set of **state foreclosure law** dummy variables. Since default costs are expected to be a more important consideration when borrowers have negative equity, we interact the foreclosure law variables with our equity spline variables. The baseline hazard is defined as the hazard rate when no judicial review and no deficiency judgment are permitted. Given this baseline, we can compute the marginal effect associated with judicial review and deficiency judgments for various levels of equity. If borrower-friendly foreclosure laws reduce the costs of default, we expect the marginal effect of judicial review to be larger and the marginal effect of deficiency judgment to be lower (hazard ratio to decline) when owners' equity is negative. Another way to show the effect of **state foreclosure laws** is to plot the relative hazards for judicial review and deficiency judgment states and the baseline. If default costs are an important determinant of defaults, we expect the relative hazards for judicial review and deficiency judgment states to depart from the baseline hazard when equity is negative.

Figures 14-16 show that this is indeed the case: for all three types of loans, the relative default hazard in judicial review states lies above the relative default hazard in the baseline case of non-judicial-review and non-deficiency-judgment states. The effect of judicial review is greater for subprime and alt-A borrowers than it is for prime borrowers. Moreover, the relative default hazard in deficiency judgment states lies below the baseline relative hazard curve for all three types of loans. Not surprisingly, the effect of deficiency judgment is greatest for prime borrowers, who are more likely to have substantial assets that may be subject to deficiency rulings. It is also important to note that the effect of judicial review and deficiency judgment on the relative default hazard is present only when equity is negative, which is consistent with the importance of default costs.

[*255] Figure 13. Relative default hazards without state laws, January 2005-December 2008

We further investigate the economic significance of our results by estimating the marginal effect of state laws on default. The marginal effect measures the percentage increase in the hazard rate, holding equity constant, of a borrower who moves across states with different foreclosure laws. Whether the marginal effect of **state foreclosure laws** increases with the size of the equity shortfall is an empirical question. In the online appendix, we present a simple model of default with foreclosure costs that vary with state laws. This model demonstrates that whether the effect of state laws on the probability of default increases with the equity shortfall depends on the borrower's equity and the distribution of the random individual-specific component of the costs of defaulting. The model shows that, for realistic values of the equity shortfall, the probability of default varies with equity and **state foreclosure laws** in a manner that is similar to what we document empirically in Figures 14-19.

Table 6 reports hazard estimates with state law effects. Corresponding estimates of the marginal effects of state laws for different levels of equity are reported in Table 7. As shown, for subprime and alt-A loans, the marginal effect of judicial review is generally greater than 1 and increases steadily as equity becomes more negative. For example, on the basis of marginal effects, we find that subprime borrowers with -10 percent equity are on average 9 percent more likely to default if located in a judicial review state. The marginal effect of judicial review increases to 25 percent from 9 percent for subprime borrowers when equity decreases to -25 percent from -10 percent. The increase in the marginal effect of judicial review is even more pronounced for alt-A loans. However, for prime loans, judicial review does not appear to be related to default. With respect to deficiency judgment, we find that borrowers are less likely to default for a given level of equity in a deficiency judgment state and that the impact of deficiency judgment on borrowers' default behavior increases as equity becomes more negative. Overall, these results are consistent with the evidence presented in Figures 14-16.

[*256] Figure 14. Relative default hazards with state laws, January 2005-December 2008: subprime loans.

[*256] Figure 15. Relative default hazards with state laws, January 2005-December 2008: alt-A loans

[*257] Figure 16. Relative default hazards with state laws, January 2005-December 2008: prime loans

To investigate whether our findings are sensitive to the equity break points, we also estimate the hazard model using break points at -5 percent and 15 percent and use the estimates from the model to compute marginal effects of judicial review and deficiency judgments (not reported). The results are similar to those reported in Table 7. For example, using the lower break points, we find that the marginal effect of judicial review increases to 23.2 percent from 5.3 percent as subprime borrowers' equity decreases to -25 percent from -10 percent. As before, the increase in the marginal effect of judicial review is more pronounced for alt-A loans (increasing from 23 percent to 57 percent as equity declines from -10 percent to -25 percent). Overall, our findings concerning the effects of **state foreclosure laws** are robust to the break points used. Finally, as shown in Table 6, we find that state emergency relief programs (programs designed to provide short-term financial assistance to avoid default) are associated with significantly lower default rates.

[*258] Table 6

Default Hazard Estimates with State Law Effects

Variable	Subprime Loans	
Intercept effect of state laws:		
Emergency Relief Program	-.029**	
Judicial Review	-.004	
Deficiency Judgment	-.059**	
Baseline effect of equity in non-judicial-review and non-deficiency-judgment states:		
Equity (%)	-2.915**	
Equity (%) x (Equity > 0%)	.924**	
[Equity (%) - 25%] x (Equity > 25%)	1.284**	
Incremental effect of judicial review:		
Equity (%)	-.894**	
Equity (%) x (Equity > 0%)	1.119**	
[Equity (%) - 25%] x (Equity > 25%)	-.033	
Incremental effect of deficiency judgments:		
Equity (%)	.614**	
Equity (%) x (Equity > 0%)	-.541**	
[Equity (%) - 25%] x (Equity > 25%)	.006	
Variable	Alt-A Loans	Prime Loans
Intercept effect of state laws:		
Emergency Relief Program	-.078**	-.147**
Judicial Review	.123**	.399**
Deficiency Judgment	-.006	-.218**

Baseline effect of equity in non-judicial-review
and non-deficiency-judgment states:

Equity (%)	-3.201**	-4.130**
Equity (%) x (Equity > 0%)	-1.211**	-1.476**
[Equity (%) - 25%] x (Equity > 25%)	4.020**	5.876**

Incremental effect of judicial review:

Equity (%)	-1.463**	.274
Equity (%) x (Equity > 0%)	2.221**	-1.308**
[Equity (%) - 25%] x (Equity > 25%)	-.913 **	.820**

Incremental effect of deficiency judgments:

Equity (%)	.858**	.434<+>
Equity (%) x (Equity > 0%)	-.653**	1.038**
[Equity (%) - 25%] x (Equity > 25%)	-.071	-1.715**

Note. Values are hazard estimates from a discrete-time version of the Cox proportional hazard model defined in equation (2). Loan and local characteristics at origination, time-varying local economic conditions, and **state foreclosure laws** for January 2005-December 2008 are included. Alt-A = alternative A-paper.

+ Significant at the 10 percent level.

** Significant at the 1 percent level.

One way to measure the economic significance of **state foreclosure laws** on default is to calculate, holding everything else constant, what amount of equity would lead to the same default hazard for borrowers in non-judicial-review (non-deficiency-judgment) states relative to borrowers in judicial review (deficiency judgment) states. We report the differences computed using equation (9) in Table 8. As expected, a considerably larger amount (in absolute value) of negative equity is required in non-judicial-review states to obtain the same hazard rate as in judicial review states. For example, to obtain the same hazard rate as an alt-A borrower with -10 percent equity in a judicial review state, all else equal, -18 percent equity is needed in a non-judicial-review state. For subprime loans the difference is less (3 percent), while for prime loans the difference is 9 percent. Given that the median home purchase price for the subprime sample is about \$ 190,000, a 3 percent difference in negative equity implies a cost of default that is \$ 5,700 lower in judicial review states.

A potential concern with our interpretation of the results is that our sample of mortgages consists of a large number of loans in Florida and California, and these two states differ in terms of the judicial review process and the lender's rights to recourse (recall that Florida is a judicial review state that permits deficiency judgments, while California is a non-judicial-review state with limited rights by lenders to recourse). For example, borrowers in California may have higher expectations concerning future housing price changes than borrowers in Florida. If our results are driven by loans from California and Florida, then we may incorrectly attribute differences in default rates to differences in **state foreclosure laws** rather than differences in (omitted) economic conditions in the two states. To investigate the sensitivity of our findings to the inclusion of these two states, we estimate the hazard model using a sample of loans that excludes those from California and Florida. Our results are reported in Tables 9 and 10. For subprime and alt-A loans the marginal effects of judicial review are even greater when Florida and California are excluded from the sample. For example, for a subprime borrower with -10 percent equity, the marginal effect of judicial review is 49 percent. Overall, the results reported in Table 10 suggest that our findings concerning the importance of the foreclosure process on

default rates are not driven by loans in Florida and California.

[*259] Table 7

Marginal Effect of State Foreclosure Laws

Owner's Equity	Subprim Loans		Alt-A Loans
	Judicial Review	Deficiency Judgment	Judicial Review
25%	1.054	.960	1.367
10%	1.019	.950	1.220
0%	.996	.943	1.131
-5%	1.041	.914	1.217
-10%	1.089	.887	1.309
-15%	1.139	.860	1.409
-20%	1.191	.834	1.515
-25%	1.245	.809	1.630
-50%	1.557	.693	2.350

Owner's Equity	Subprime loans		Prime Loans
	Deficiency Judgment	Judicial Review	Deficiency Judgment
25%	1.047	1.151	1.162
10%	1.015	1.344	.932
0%	.994	1.491	.804
-5%	.953	1.471	.787
-10%	.913	1.451	.770
-15%	.874	1.431	.753
-20%	.838	1.411	.737
-25%	.802	1.392	.722
-50%	.647	1.300	.647

Note. Marginal effects are calculated from hazard estimates reported from a discrete-time version of the Cox proportional hazard model defined in equation (2). The marginal effect is defined as $ME = \exp[\beta_0 + \beta_1 \text{Equity} + \beta_2 \text{Equity} \geq 0 + \beta_3 \text{Equity} \geq 0.25 + \beta_4 \text{Equity} - 0.25]$, where $k = 1$ for judicial review states and $k = 2$ for deficiency judgment states. Loan and local characteristics at origination, time-varying local economic conditions, and **state foreclosure laws** for January 2005-December 2008 are included. Alt-A = alternative A-paper.

[*260] Table 8

Equity Contribution Amounts

	Non-Judicial- Review State	Non-Deficiency- Judgment State
Owner's Equity		
Subprime loans:		

.00	.00	.03
-.10	-.03	.04
-.25	-.08	.07
Alt-A loans:		
.00	-.04	.00
-.10	-.08	.03
-.25	-.15	.07
Prime loans:		
.00	-.10	.04
-.10	-.09	.06
-.25	-.08	.08

Note. Amounts are based on hazard estimates reported from a discrete-time version of the Cox proportional hazard model defined in equation (2). We report the amount of equity required in non-judicial states and non-deficiency states to match the default hazard in judicial and deficiency states. The equity contribution amount is obtained by solving equation (9).

An additional potential concern with our interpretation of the results is that there exists a positive correlation between the incidence of judicial review and the geographical location of judicial review states. Judicial review states tend to be located in the Northeast and Midwest (see Mian, Sufi, and Trebbi 2011, figure 2). It is therefore possible that judicial review is correlated with regional determinants of default that are not related to the legal aspects of the foreclosure process. The fact that our results are robust to the inclusion of regional controls for income and employment rates as well as the exclusion of Florida and California from the sample partially addresses this concern. We further address this concern in Section 5 by examining the effect of **state foreclosure laws** on the likelihood of personal bankruptcy. We also undertake a natural experiment based on California's enactment of a mandatory loan mediation program in Section 6. It may ultimately be impossible, however, to entirely rule out the alternative explanation that differences in default rates between judicial review and non-judicial-review states are attributable to differences in economic shocks across geographical regions in the United States.

[*261] Table 9

Default Hazard Estimates with State Law Effects Estimated Excluding California and Florida

Subprime Loans	
Intercept effect of state laws:	
Emergency Relief Program	-.013*
Judicial Review	-.036**
Deficiency Judgment	-.007
Baseline effect of equity in non-judicial-review and non-deficiency-judgment states:	
Equity (%)	-4.677**
Equity (%) x (Equity > 0%)	2.960**
[Equity (%) - 25%] x (Equity 1 25%)	1.183**
Incremental effect of judicial review:	

Equity (%)	-4.355**	
Equity (%) x (Equity > 0%)	4.601**	
[Equity (%) - 25%] x (Equity > 25%)	-.127*	
Incremental effect of deficiency judgments:		
Equity (%)	2.241**	
Equity (%) x (Equity > 0%)	-2.221**	
[Equity (%) - 25%] x (Equity 1 25%)	.045	
	Alt-A Loans	Prime Loans
Intercept effect of state laws:		
Emergency Relief Program	-.061**	-.097**
Judicial Review	-.030*	.165**
Deficiency Judgment	-.056**	-.095
Baseline effect of equity in non-judicial-review and non-deficiency-judgment states:		
Equity (%)	-3.360**	-5.247**
Equity (%) x (Equity > 0%)	-.350	1.397<+>
[Equity (%) - 25%] x (Equity 1 25%)	3.226**	3.596**
Incremental effect of judicial review:		
Equity (%)	-3.600**	-.773
Equity (%) x (Equity > 0%)	3.962**	-.012
[Equity (%) - 25%] x (Equity > 25%)	-.357**	.832**
Incremental effect of deficiency judgments:		
Equity (%)	.953 **	2.151**
Equity (%) x (Equity > 0%)	-.717*	-1.772<+>
[Equity (%) - 25%] x (Equity 1 25%)	-.111	-.257

Note. Hazard estimates reported from a discrete-time version of the Cox proportional hazard model defined in equation (2) are examined for robustness to excluding loans originated in Florida and California. Alt-A = alternative A-paper.

+ Significant at the 10 percent level.

* Significant at the 5 percent level.

** Significant at the 1 percent level.

5. Likelihood of Personal Bankruptcy

In Section 4, we showed that the likelihood of default on an underwater mortgage is significantly higher in judicial review states and states that do not permit deficiency judgments. One interpretation of this finding is that **state foreclosure laws** that better protect borrowers in default also induce underwater borrowers to default on their mortgages. An alternative explanation, however, is that **state foreclosure laws** simply proxy for some unobserved factor that is correlated with the likelihood of default (an omitted-variables problem). While it is hard to think of such a factor, other than differences in the expected costs of default, we provide some empirical evidence that we believe rules out the omitted-variables problem as an explanation for our results.

There are two procedures for filing a personal bankruptcy: Chapter 13 and Chapter 7.ⁿ¹⁶ A Chapter 13 filing is similar to a Chapter 11 corporate bankruptcy in that it involves a court-supervised restructuring of an individual's unsecured debt claims. In a Chapter 13 procedure, a portion of an individual's unsecured debt can be discharged through a repayment plan that involves the borrower committing a portion of his disposable income to repay unsecured debt. At the end of the repayment period (typically 3-5 years), the remainder of the unsecured debt will be discharged. While first-lien mortgages are generally not discharged under Chapter 13, the filing provides for a stay that stops the foreclosure process and allows for mortgage arrears to be paid over the life of a court-approved repayment plan. Chapter 13 also allows second-and third-mortgage liens to be stripped off and treated as unsecured debt. Chapter 7 filings involve a court-supervised liquidation of nonexempt property and like Chapter 13 provides for a stay during the bankruptcy procedure. Home equity is exempt up to a limit that varies by state up to a federal limit of \$ 125,000 (effective after 2005).

[*262] Table 9

Default Hazard Estimates with State Law Effects Estimated Excluding California and Florida

Owner's Equity	Subprime Loan		Alt-A Loans	
	Judicial Review	Deficiency Judgment	Judicial Review	
25%	1.026	.998	1.063	
10%	.989	.995	1.006	
0%	.965	.993	.971	
-5%	1.199	.888	1.162	
-10%	1.491	.794	1.391	
-15%	1.854	.709	1.665	
-20%	2.305	.634	1.994	
-25%	2.866	.567	2.387	
-50%	8.513	.324	5.871	

Owner's Equity	Alt-A Loans		Prime Loan	
	Deficiency Judgment	Judicial Review	Deficiency Judgment	
25%	1.003	.969	1.000	
10%	.969	1.091	.945	
0%	.946	1.180	.909	
-5%	.902	1.226	.817	
-10%	.860	1.274	.733	
-15%	.820	1.325	.659	
-20%	.782	1.377	.591	
-25%	.745	1.431	.531	
-50%	.587	1.736	.310	

Note. Marginal effects are calculated from hazard estimates reported from a discrete-time version of the Cox proportional hazard model defined in equation (2). The marginal effect (ME) is defined as $ME = \exp[\beta_k] \times \exp[\beta_k] \times (Equity \geq 0) \times Equity \times \exp[\beta_k] \times (Equity \geq 0.25) \times (Equity - 0.25)$, where $k = 1$ for judicial review

states and $k = 2$ for deficiency judgment states. Loan and local characteristics at origination, time-varying local economic conditions, and **state foreclosure laws** for January 2005-December 2008 are included. Alt-A p alternative A-paper.

[*263] We investigate whether the **state foreclosure laws** are related to the likelihood of personal bankruptcy conditional on default by a borrower with an underwater mortgage. If foreclosure laws indeed measure the level of borrower protection in default, then borrowers in stronger protection states should be less likely to use an alternative protection mechanism, namely, personal bankruptcy.

Consider for example the case of judicial review. Since bankruptcy provides for an automatic stay and a mechanism for challenging a foreclosure, we would expect, conditional on default, bankruptcies to be more frequent in non-judicial-review states. Moreover, as discussed in the Introduction, bankruptcy provides a mechanism to protect borrowers' non-real-estate-related assets from judgment.

As a result, if default costs are driving the differences in default rates, we should also find a negative (positive) relation between the likelihood of bankruptcy and judicial review (deficiency judgment). On the other hand, if judicial review is, for some exogenous reason, positively related to the severity of income and employment shocks and we underestimate these shocks at the individual loan level by using county- and state-level data, then we would expect a positive relation between the likelihood of bankruptcy and judicial review. A similar argument implies that bankruptcy is less likely in states that permit deficiency judgments.

We put these two competing hypotheses to the test in Tables 11 and 12. Because nationwide mortgage modification programs that were launched after December 2008 could affect how defaults are resolved, we focus our attention on loans that were in default in December 2008 or before.

Table 11 provides results of a univariate analysis of bankruptcy rates by **state foreclosure laws**. We find that, conditional on default, bankruptcy is more likely in states with deficiency judgments and lacking judicial review requirements. For example, subprime borrowers in non-judicial-review states are 17 percent (6.8 percent versus 5.8 percent) more likely to file for bankruptcy after a default than are subprime borrowers in states with judicial review (the difference is statistically significant at the 1 percent level).

In Table 12, we present results of logit regressions that examine the determinants of personal bankruptcy conditional on default for borrowers with negative home equity at the time of default. We find that, conditional on default and controlling for loan and borrowers' characteristics, the likelihood of bankruptcy is significantly higher in deficiency judgment states and significantly lower in states with judicial review. These results are consistent with the existence of differences in default costs in that they suggest that borrowers in default use bankruptcy as a substitute for judicial review and/or nonrecourse to extend the foreclosure process or to shield assets.

[*264] Table 11

Univariate Results of State Foreclosure Laws and the Likelihood of Personal Bankruptcy

Foreclosure Law Group	Subprime Loans	Alt-A Loans	Prime Loans
All	6.56	8.98	9.14
Judicial review states	5.84	8.19	9.17
Non-judicial-review states	6.83	9.17	9.14
p-Value for difference in proportions	.000	.000	.974
Deficiency judgment states	7.15	9.96	11.63
Non-deficiency-judgment states	5.50	8.00	7.72

p-Value for difference in proportions .000 .000 .000

Note. Except for *p*-values, data are percentages. Borrowers were more than 60 days' delinquent on their mortgages. Alt-A = alternative A-paper.

6. Foreclosure Mitigation and Mediation Programs and Loan Delinquency after 2008

In response to the increase in mortgage defaults and foreclosures, a number of federal and state foreclosure prevention programs were introduced to incentivize mortgage servicers to pursue mortgage modifications in lieu of foreclosures.ⁿ¹⁷ Beginning in late 2008, several policies and court settlements occurred that might have significantly affected the incidence of default and the effect of **state foreclosure laws** on the incidence of default. First, as discussed in Mayer et al. (2011), in several states, attorneys general brought suits against Countrywide and other subprime and alt-A lenders alleging deceptive mortgage-lending practices. In response to these suits, Countrywide entered into a multistate settlement effective December 2008 in which it agreed to modify subprime mortgages that it serviced and were at risk of default. Mayer et al. (2011, p. 13) argue that the settlement provided borrowers with incentives to strategically default since "by abruptly stopping payment, home owners could make themselves eligible for the benefits of the Settlement." Second, in October 2008, JP Morgan, Citibank,

[*265] and other large mortgage servicers announced streamlined loan modification programs for borrowers in danger of default and programs to evaluate loan modifications before beginning the foreclosure process.ⁿ¹⁸ In addition, JP Morgan, Bank of America, Citibank, Wachovia, and other large servicers announced plans to temporarily suspend foreclosure proceedings while they implemented their streamlined loan modification programs (see Sidel 2008; Congressional Research Service 2009). Third, in February 2009, the Obama administration announced the Making Home Affordable (MHA) program, designed to increase loan modifications under HAMP. One important feature of this program is that it requires recipients of Troubled Asset Relief Program funds to implement loan modifications for HAMP-eligible loans. More important, the MHA prohibits a servicer from referring loans to foreclosure or conducting a foreclosure sale unless certain conditions are met, including whether the borrower qualifies for a loan modification under HAMP (see U.S. Departments of the Treasury and Housing and Urban Development 2010). **Table 12**

Logit Regressions of **State Foreclosure Laws** and the Likelihood of Personal Bankruptcy

Explanatory Variable	Subprime Loans	Alt-A Loans	Prime Loans
Judicial Review	-.0107**	-.0160**	-.0166
Deficiency Judgment	.0196**	.0199**	.0387**
FICO Score	.0001**	-.0001**	-.0003**
Cash-Out Refinance	.0102**	.0096**	.0114
Full-Documentation Loan	.0064**	-.0095**	-.0099
Prepayment Penalty	-.0166	-.0166	-.0166
Original Interest Rate (%)	-.0027**	-.0019**	-.0238**
Adjustable Rate	-.0095**	-.0016	.0059
Negative Amortization		-.0061*	-.0554**
Original Loan Balance (\$ 1,000s)	.0000**	.0000**	.0000
Home Equity	.0679**	.0723**	.0228
Change in Unemployment Rate, County (%)	-.0108**	-.0096**	-.0124**
Change in Per Capita Income, State (%)	-.0032**	-.0024**	.0001

Per Capita Income, Zip Code (\$ 1,000s)	.0001*	.0002**	.0004*
Loans	126,331	114,242	7,717
Pseudo-R ²	3.2	1.5	2.9

Note. Borrowers were more than 60 days' delinquent on their mortgages. The sample is restricted to defaults that occurred on or before December 2008. Values are marginal effects of the coefficient estimates; significance levels are calculated on the basis of robust standard errors clustered at the zip code level. The regressions include an intercept dummy and vintage dummies (not reported). Alt-A = alternative A-paper.

* Significant at the 5 percent level.

** Significant at the 1 percent level.

The final change affecting the foreclosure process in late 2008 was enactment (or state judiciary requirement) of laws requiring lenders to engage in mediation [*266] with the borrower and to explore loan modification alternatives prior to proceeding with a foreclosure (see Cohen and Jakabovics 2010). For example, California (the state with the most subprime and alt-A loans in our sample and a non-judicial-review state) enacted in September 2008 legislation requiring mandatory mediation. Most state mediation programs do not require the lender or servicer to settle. Nevertheless, mediation increases the length of the foreclosure process and potentially blurs the distinction between judicial review and nonjudicial-review foreclosures.

Given the policy initiatives discussed above, we examine whether the relationship between default rates and **state foreclosure laws** changed after December 2008. ⁿ¹⁹ We expect these policy initiatives to reduce differences in default rates between judicial review and non-judicial-review states since they reduce procedural differences. For example, state mediation programs, by requiring a review by a third party, make the process in non-judicial-review states resemble the process in states that require judicial review.

One simple way to examine the effects of these programs is to examine whether differences in the time from default to foreclosure between judicial review and non-judicial-review states changed after fall 2008. For example, by requiring review by a third party, state mediation programs may delay and possibly eliminate the advent of foreclosure. However, one challenge in comparing foreclosure times is that our data end in June 2010, and thus loans that defaulted after fall 2008 have had at most only 20 months in the foreclosure process. Another challenge is that loans that were in default before fall 2008 but were still in the foreclosure process in fall 2008 might be subject to the modified foreclosure process after 2008. To address these challenges, we compare the time from default to the initiation of foreclosure proceedings for two groups of loans: loans that defaulted in October 2007 and loans that defaulted in October 2008 (not reported). For loans that defaulted in October 2007, foreclosure proceedings were initiated for 86 percent of the loans in judicial review states and 89 percent of the loans in non-judicial-review states. The median time from default to the initiation of foreclosure proceedings was 50 percent shorter in non-judicial-review states (1 versus 2 months) than in judicial review states. ⁿ²⁰ In contrast, for the October 2008 cohort, initiation of foreclosure proceedings was more common in judicial review states than in non-judicial-review states (77 percent versus 75 percent of defaulted loans, respectively, with the difference significant at the 1 percent level). In addition, the median time from default to the initiation [*267] of foreclosure proceedings was the same in judicial review and non-judicial-review states (3 months for both groups).

Figure 17. Relative default hazards with state laws, January 2005-June 2010: subprime loans

To formally examine whether the effect of **state foreclosure laws** on default changed after 2008, we estimate the hazard model using loan performance data through June 2010 without interaction terms to distinguish the pre-and post-2008 periods. Our findings are summarized in Figures 17-19. As shown, using data through June 2010, the effect

of judicial review is small compared to the estimates for the sample ending in December 2008 (see Figures 14-16). The relative default hazard in judicial review states lies along the same line as the baseline relative hazard curve for all three types of loans. In contrast, deficiency judgments continue to have a negative effect on the relative default hazard, especially for prime borrowers.

Table 13 reports hazard estimates with state law effects based on the January 2005-June 2010 sample period. Corresponding marginal effects are reported in Table 14. The marginal effects of judicial review are approximately half the reported effect over the shorter sample period. For example, at -10 percent equity, the marginal effect of judicial review for alt-A loans is 19 percent, compared with 31 percent over the shorter sample period. The marginal effect of deficiency judgments remains economically significant through June 2010. For example, at -10 percent equity, the marginal effect of deficiency judgments reported in Table 14 is -12 percent for alt-A loans, compared with -8 percent over the shorter sample period. Moreover, the marginal effect of deficiency judgments increases through June 2010 for very low levels of equity for prime borrowers.

[*268] Figure 18. Relative default hazards with state laws, January 2005-June 2010: alt-A loans

Figure 19. Relative default hazards with state laws, January 2005-June 2010: prime loans

[*269] Table 13

Hazard Estimates of the Effect of State Foreclosure Laws through June 2010			
Explanatory Variable	Subprime Loans	Alt-A Loans	Prime Loans
Loan and local characteristics at origination:			
FICO Score	-.006**	-.008**	-.010**
Cash-Out Refinance	-.084**	.064**	.294**
Full-Documentation Loan	-.332**	-.633**	-.507**
Prepayment Penalty	-.002	.119**	.239**
Original Loan Rate (%)	.083**	.042**	.399**
Adjustable Rate	.350**	.279**	.348**
Negative Amortization	.623*	.437**	1.940**
Original Loan Balance (\$ 1,000s)	.001**	.001**	.000**
Per Capita Income, Zip Code (\$ 1,000s)	-.004**	-.005**	-.005**
Time-varying local economic conditions:			
Change in Unemployment, County (%)	.004**	-.013**	.026**
Change in Per Capita Income, State	.511**	-.726**	-5.547**
Intercept effect of state laws:			
Emergency Relief	-.052**	-.086**	-.041**
Judicial Review	.008	.150**	.230**

Deficiency Judgment	-.191**	-.091**	-.134**
Baseline effect of equity in non-judicial-review and non-deficiency-judgment states:			
Equity (%)	-1.993**	-2.305**	-2.874**
Equity (%) x (Equity > 0%)	-.467**	-2.007**	-2.125**
[Equity (%) - 25%] x (Equity > 25%)	1.575**	3.535**	5.195**
Incremental effect of judicial review:			
Equity (%)	-.380**	-.221**	.618**
Equity (%) x (Equity > 0%)	.700**	.652**	-.963**
[Equity (%) - 25%] x (Equity > 25%)	-.116**	-.451**	.111
Incremental effect of deficiency judgments:			
Equity (%)	.171**	.351**	.841**
Equity (%) x (Equity > 0%)	.165*	.110	.299
[Equity (%) - 25%] x (Equity > 25%)	-.165**	-.336**	-1.421**

Note. Hazard estimates are reported from a discrete-time version of the Cox proportional hazard model defined in equation (2). Vintage year dummies are included in the hazard model but are not reported. Loan and local characteristics at origination, time-varying local economic conditions, and **state foreclosure laws** for January 2005-June 2010 are included. Alt-A = alternative A-paper.

* Significant at the 5 percent level.

** Significant at the 1 percent level.

The fact that marginal effects of deficiency judgments remain strong but those of judicial review weaken significantly after 2008 suggests that loan modification programs and foreclosure moratoriums that affect the foreclosure process weaken the effect of judicial review on borrowers' decision to default. These programs do not affect the ability of lenders to seize defaulting borrowers' other assets and to garnish these borrowers' wages in states where deficiency judgments are permitted.

To further investigate changes in the determinants of default in the post-2008 period, we estimate the hazard model with a set of interactive dummy variables [*271] to capture any change in the determinants of default after 2008. In Table 15, we report coefficient estimates for the state foreclosure variables for the period through December 2008 and the post-2008 period. ⁿ²¹ If state and federal foreclosure mitigation programs reduce differences in the time or cost of foreclosures, we would expect the effect of judicial review to decline after December 2008. In contrast, we would not expect a change in the effect of deficiency judgments on default after December 2008. **Table 14**

Marginal Effects of the Effect of State Foreclosure Laws through June 2010

Equity	Subprime Loans		Alt-A Loans
	Judicial Review	Deficiency Judgment	Judicial Review
.250	1.092	.898	1.294
.100	1.041	.854	1.213
.000	1.008	.826	1.162
-.050	1.027	.819	1.175
-.100	1.047	.812	1.188
-.150	1.067	.805	1.201
-.200	1.088	.798	1.215
-.250	1.108	.791	1.228
-.500	1.219	.758	1.298

Equity	Alt-A Loans	Prime Loans	
	Deficiency Judgment	Judicial Review	Deficiency Judgment
.250	1.025	1.154	1.163
.100	.956	1.216	.980
.000	.913	1.258	.874
-.050	.897	1.220	.838
-.100	.882	1.183	.804
-.150	.866	1.147	.771
-.200	.851	1.112	.739
-.250	.836	1.078	.709
-.500	.766	.924	.574

Note. Marginal effects are calculated from hazard estimates reported from a discrete-time version of the Cox proportional hazard model defined in equation (2). The marginal effect is defined as $ME = \exp[\beta_0 + \beta_1 [1k] \times \text{Equity} + \beta_2 [2k] \times (\text{Equity} \geq 0) \times \text{Equity} + \beta_3 [3k] \times (\text{Equity} \geq .25) \times (\text{Equity} - .25)]$, where $k = 1$ for judicial review states and $k = 2$ for deficiency judgment states. Loan and local characteristics at origination, time-varying local economic conditions, and **state foreclosure laws** for January 2005-June 2010 are included. Alt-A = alternative A-paper.

Consistent with this expectation, we find for both subprime and alt-A loans that the effect of judicial review is lower and statistically different in the post-December 2008 period. For example, the incremental effect of judicial review on default for alt-A loans when equity is negative decreases in absolute value from -1.12 to -.13 after December 2008. The difference between these two coefficients is statistically significant at the 1 percent confidence level. The incremental effect of judicial review on subprime loans declines from -.67 to -.32 and is statistically different after 2008. In contrast, the incremental effect of deficiency judgments when equity is negative is not statistically different across the two sample periods for subprime (.45 versus .21) and prime loans (.43 versus .54). It is smaller and statistically different however for alt-A loans (.77 versus .34).

While the reported results suggest an impact of foreclosure modification programs on hazard rates, we cannot rule

out some other contemporaneous factor that may have affected relative default rates in judicial review and non-judicial-review states. One way to address this concern is to compare hazard rates in two contiguous states around a change in one state's foreclosure process. This allows us to examine, using a difference-in-differences approach, the impact of the foreclosure process on default rates. Moreover, by comparing contiguous states we reduce the likelihood that any difference is due to economic conditions (this approach is similar to the one employed by Pence [2006] in her analysis of the effect of **state foreclosure laws** on the availability of mortgages). ⁿ²²

California's enactment of a mandatory mortgage mediation program provides an opportunity to conduct a quasi-natural experiment. In particular, on September 9, 2008, California (a non-judicial-review state with no deficiency judgments for purchase money loans) enacted a requirement that lenders and borrowers engage in mediation. In contrast, as of the end of our sample period, Arizona (another non-judicial-review and non-deficiency-judgment state) had no mediation requirement. ⁿ²³ Thus, a comparison of the effect of negative equity on defaults in California and Arizona before and after September 2008 provides a way of isolating the impact of foreclosure costs of default. Note that since the change in California occurred in September 2008 and the Hope Alliance was initiated and a foreclosure moratorium began in November 2008, the impact of the California statute may be difficult to detect.

[*272] Table 15

Default Hazard Estimates for January 2005-June 2010 with December 2008 Break Point

Subprime Loans

Explanatory Variable	December 2008 and Before	After December 2008
Loan and local characteristics		
at origination:		
FICO Score	-.006**,a>	-.003*
Cash-Out Refinance	-.139**,a>	.059*
Full-Documentation Loan	-.337**,a>	-.282*
Prepayment Penalty	-.023**	-.022*
Original Loan Rate (%)	.087**,a>	.057*
Adjustable Rate	.348**,a>	.377*
Negative Amortization	.652*	.213
Original Loan Balance (\$ 1,0002)	.001**,a>	.001*
Per Capita Income, Zip Code (\$1,000s)	-.004**	-.003*
Time-varying local economic conditions:		
Change in Unemployment, County (%)	.047**,>	-.012*
Change in Per Capita Income, State	-1.185**,a>	-1.890*
Intercept effect of state laws:		
Emergency Relief Program	-.045**,a>	.015
Judicial Review	-.011<+,a>	.035*
Deficiency Judgment	-.173**,a>	-.105*
Baseline effect of equity in		
non-judicial-review		
and non-deficiency-judgment states:		

Equity (%)	-2.105**,a>	-1.625**
Equity (%) x (Equity > 0%)	-.057<a>	-.749*
[Equity (%) - 25%] x (Equity > 25%)	1.254**,a>	1.842*
Incremental effect of judicial review:		
Equity (%)	-.672**,a>	-.322*
Equity (%) - (Equity > 0%)	.970**,a>	.410*
[Equity (%) - 25%] x (Equity > 25%)	-.088<+>	.045
Incremental effect of deficiency judgments:		
Equity (%)	.450**	.205<+>
Equity (%) x (Equity > 0%)	-.197*	.335
[Equity (%) - 25%] x (Equity > 25%)	-.055<a>	-.668*

Alt-A Loans

Explanatory Variable	December 2008 and Before	After December 2008
Loan and local characteristics		
at origination:		
FICO Score	-.009**,a>	-.007*
Cash-Out Refinance	.020**,a>	.131*
Full-Documentation Loan	-.627**	-.625*
Prepayment Penalty	.130**,a>	.074*
Original Loan Rate (%)	.050**,a>	.027*
Adjustable Rate	.298**,a>	.252*
Negative Amortization	.515**,a>	.309*
Original Loan Balance (\$ 1,0002)	.001**,a>	.000*
Per Capita Income, Zip Code (\$1,000s)	-.005**	-.005*
Time-varying local economic conditions:		
Change in Unemployment, County (%)	.014**,a>	-.034*
Change in Per Capita Income, State	-1.854**,a>	-1.077*
Intercept effect of state laws:		
Emergency Relief Program	-.107**,a>	.017+
Judicial Review	.142**	.108*
Deficiency Judgment	-.063**	-.058*
Baseline effect of equity in non-judicial-review and non-deficiency-judgment states:		
Equity (%)	-2.605**	-2.461*

Equity (%) x (Equity > 0%)	-1.618**,a>	-.701*
[Equity (%) - 25%] x (Equity > 25%)	3.530**,a>	2.0608*
Incremental effect of judicial review:		
Equity (%)	-1.119**,a>	-.127<+>
Equity (%) - (Equity > 0%)	1.658**,a>	.401*
[Equity (%) - 25%] x (Equity > 25%)	-.592**,a>	-.163
Incremental effect of deficiency		
judgments:		
Equity (%)	.772**,a>	.336*
Equity (%) x (Equity > 0%)	-.480**,a>	.092
[Equity (%) - 25%] x (Equity > 25%)	-.138	-.319

Prime Loans

Explanatory Variable	December 2008 and Before	After December 2008
Loan and local characteristics		
at origination:		
FICO Score	-.010**	-.010*
Cash-Out Refinance	.220**,a>	.415*
Full-Documentation Loan	-.458**,a>	-.575*
Prepayment Penalty	.305**,a>	.166*
Original Loan Rate (%)	.396**,a>	.442*
Adjustable Rate	.279**,a>	.444*
Negative Amortization	1.867**	2.149*
Original Loan Balance (\$ 1,0002)	.000<+,a>	.000*
Per Capita Income, Zip Code (\$ 1,000s)	-.006**	-.005*
Time-varying local economic conditions:		
Change in Unemployment, County (%)	.011<+>	-.006
Change in Per Capita Income, State	-2.587**	-3.384*
Intercept effect of state laws:		
Emergency Relief Program	-.147**,a>	.024
Judicial Review	.399**,a>	.094*
Deficiency Judgment	-.218**	-.197*
Baseline effect of equity in non-judicial-review and non-deficiency-judgment states:		
Equity (%)	-4.130**,a>	-2.738*
Equity (%) x (Equity > 0%)	-1.476**	-.869*

[Equity (%) - 25%] x (Equity > 25%)	5.876**,a>	1.885*
Incremental effect of judicial review:		
Equity (%)	.274	.339
Equity (%) - (Equity > 0%)	-1.308**	-.553
[Equity (%) - 25%] x (Equity > 25%)	.820**	.174
Incremental effect of deficiency judgments:		
Equity (%)	.434<+>	.538*
Equity (%) x (Equity > 0%)	1.038**	.697<+>
[Equity (%) - 25%] x (Equity > 25%)	-1.715**	-.584

Note. Hazard estimates are reported from a discrete-time version of the Cox proportional hazard model defined in equation (2). Vintage year dummies are included in the hazard model but are not reported. Loan characteristics and time-varying controls are included in the model but are not reported. Alt-A p alternative A-paper.

<+> Significant at the 10 percent level.

* Significant at the 5 percent level.

** Significant at the 1 percent level.

<a> Change in coefficient after December 2008 is significant at the 1 percent level.

[*274] Table 16

Default Hazard Estimates for California and Arizona

Variable	Subprime Loans	Alt-A Loans
California	.191**	-.037<+>
After September 2008	.315**	.270**
California x After September 2008	-.316**	-.142**
Coefficient of equity for borrowers with negative equity:		
Arizona in or before September 2008	-3.742**	-3.799**
California in or before September 2008	-1.736**,b>	3.019**,b>
Arizona after September 2008	-1.349**,a>	-1.882**,a>
California after September 2008	-1.424**,b>	2.353**,b>
Loans in Arizona	55,272	59,558
Loans in California	264,716	431,230
Loan-month observations	6,366,777	12,309,654
Variable		
California	Prime Loans	-.150<+>
After September 2008		.094
California x After September 2008		.096
Coefficient of equity for borrowers with		

negative equity:	
Arizona in or before September 2008	-3.913**
California in or before September 2008	4.452**
Arizona after September 2008	-2.308**
California after September 2008	2.887**
Loans in Arizona	13,130
Loans in California	183,063
Loan-month observations	6,027,928

Note. Hazard estimates are reported from a discrete-time version of the Cox proportional hazard model defined in equation (2) with a difference-in-differences specification. Loan and local characteristics at origination and time-varying local economic conditions and dummy variables for before and after September 2008, a dummy variable for California, the interaction of the dummy variables, and the interaction of the dummy variables with equity splines are included, but only the coefficients of key variables are reported for brevity. Alt-A p alternative A-paper.

<+> Significant at the 10 percent level.

** Significant at the 1 percent level.

<a> Change in coefficient after September 2008 is significant at the 1 percent level.

 Coefficients for California and Arizona are significantly different at the 1 percent level.

Table 16 provides the results of our difference-in-differences estimates for California and Arizona. Notice that hazard estimates for borrowers with negative equity in Arizona are higher than the hazard estimates for borrowers in California before September 2008. For example, the hazard estimates for alt-A and subprime borrowers with negative equity are -3.799 and -3.742, respectively, for Arizona and -3.019 and -1.736 for California. In contrast, after September 2008, the hazard estimates for borrowers with negative equity are higher in California than in Arizona. The difference in hazard estimates between California and Arizona are statistically significant at the 1 percent confidence level in each sample period for alt-A and subprime borrowers.

Figures 20-25 further illustrate the difference in default rates between these two states. The default hazard for subprime borrowers before September 2008 is lower in California than in Arizona. Both default hazards decline after September 2008, but the default hazard is higher in California than in Arizona during the later sample period. We observe a similar pattern for alt-A borrowers. The default hazards for this type of borrower are virtually identical before September 2008. After September 2008, alt-A borrowers in Arizona are less likely to default than similar borrowers in California. The decline in the default hazards for borrowers in Arizona relative to borrowers in California is therefore consistent with the notion that California's mandatory loan mediation program modified the relative costs of defaulting between California and Arizona. Overall, these results are consistent with the hypothesis that lengthening the foreclosure process increases the incidence of default by reducing the costs of default.

[*275] Figure 20. Relative default hazards for California and Arizona before September 2008: subprime loans.
Figure 21. Relative default hazards for California and Arizona after September 2008: subprime loans.

[*276] Figure 22\$. Relative default hazards for California and Arizona before September 2008: alt-A loans.
Figure 23. Relative default hazards for California and Arizona after September 2008: alt-A loans.

[*277] Figure 24. Relative default hazards for California and Arizona before September 2008: prime loans.
Figure 25. Relative default hazards for California and Arizona after September 2008: prime loans.

[*278] 7. Conclusions

We investigate the effect of **state foreclosure laws** on the likelihood of default for a large sample of mortgages originated between 2005 and 2007. Our results show that judicial review and deficiency judgments have a significant effect on the likelihood of default on residential mortgages, conditional on having negative equity. The evidence suggests that during our sample period, borrowers' expected costs of default in states with judicial review and states without deficiency judgments were significantly lower than in less borrower-friendly states. Variation in default rates across states with different foreclosure laws cannot be explained by differences in borrowers' liquidity or income shocks, unless changes in unemployment and income not captured by the controls are correlated with state laws. However, we find that the incidence of bankruptcy is higher in states without judicial review and in states with deficiency judgments (states where we find that, conditional on having negative equity, default rates are higher). Thus, a spurious correlation between foreclosure laws and ability to pay is unlikely to explain our results. Our findings also suggest that loan modification programs enacted after 2008 greatly reduced the effect of judicial review but not deficiency judgments on the likelihood of mortgage delinquency. Overall, our results suggest that default costs are an important factor affecting whether borrowers will exercise their default option.

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Legal Topics:

For related research and practice materials, see the following legal topics:

Banking Law Consumer Protection Predatory Lending Real Property Law Financing Mortgages & Other Security Instruments Mortgagee's Interests Real Property Law Financing Mortgages & Other Security Instruments Mortgagor's Interests

FOOTNOTES:

n1 Early option-theoretic models of mortgage pricing assume that borrowers default immediately when the value of the property drops below the value of the mortgage (note that the value of the mortgage is not the same as the outstanding balance, since the former includes the value of the default and prepayment option). These types of defaults are often referred to in the literature as ruthless or strategic defaults. For a review of this literature, see Vandell (1995). More recent models of default identify borrowers' liquidity and/or solvency, default costs, expectations concerning future housing price changes, and negative equity as important determinants of default.

n2 Recent nonacademic studies attempt to measure the importance of strategic default. For example, Experian and Oliver Wyman (2010) use information on a borrower's payment performance on non-real-estate loans as a proxy for his capacity to make payments on mortgage debt. However, the study does not consider whether the borrower has negative equity (the mortgage is underwater), although a necessary condition for strategic default is the lack of significant positive home equity. A study by Morgan Stanley classifies defaults as strategic if the borrower is more than 90 days delinquent on his mortgage while being current on other consumer debt of at least \$ 10,000 and estimates that 12 percent of all mortgage defaults in February 2010 were strategic (see Tirupattur, Chang, and Egan 2010). Both studies estimate higher strategic default rates for states with bigger declines in housing prices in recent years.

n3 Jones (1993) makes a similar argument in the context of deficiency judgments. It is important to note that borrowers may anticipate lower default costs and choose strategies that increase the risk of nonstrategic defaults. This argument suggests that default rates might be higher in borrower-friendly states regardless of the level of equity.

n4 See U.S. Government Accountability Office (2010) and Rao and Walsh (2009) for descriptions of the foreclosure process and Pence (2006), Elias (2009), and Rao and Walsh (2009) for descriptions of state foreclosure statutes.

n5 Perhaps the best example of this is the case of Patsy Campbell of Okeechobee County, Florida (a judicial review state), whose foreclosure process has lasted (as of December 2010) 25 years (Whelan 2010).

n6 Ghent and Kudlyak (2011) and Ambrose, Capone, and Deng (2001) model the impact of deficiency judgments on the negotiation process between borrowers and lenders. They argue that for relatively low recovery rates (less than 35 percent), the potential for deficiency judgments has little effect on the likelihood of default but may affect how defaults are resolved in terms of a short sale, deed in lieu of foreclosure, or foreclosure. For high recovery rates, deficiency judgments deter defaults. Their models explain how deficiency judgments might have a strong deterrent effect even though judgments are rare.

n7 According to Federal Reserve Bank, Senior Loan Officer Opinion Survey on Bank Lending Practices (<http://www.federalreserve.gov/boarddocs/snloansurvey>), the net percentage of banks tightening lending standards on subprime mortgage loans increased from 56.3 percent in the second quarter of 2007 (the first-quarter data are unavailable) to 100 percent in the fourth quarter of 2008. During the same period, the net percentage of banks increasing lending standards for prime mortgage loans increased from 15.1 percent to 69.2 percent.

n8 In his popular guide to avoiding foreclosure, Elias (2009, p. 110) explains the advantage of bankruptcy in terms of extending the foreclosure process: "I see nothing wrong with filing under Chapter 13 if you are able to propose a feasible plan and by filing for bankruptcy you are able to stay in your house a while longer. If real estate prices come back up and your income situation improves, you may be able to keep your house after all." In the case of Chapter 7, the guide states, "Whether or not you plan to give up your house, you can buy some time just by filing for bankruptcy" (Elias 2009, p. 119).

n9 The robo-signing scandal refers to the allegation that loan servicers falsely claimed they had verified information as part of the foreclosure process. For a discussion of the robo-signing scandal, see Field (2010).

n10 In contrast, Guiso, Sapienza, and Zingales (2013) find no relationship between recourse and survey participants' intention to default during the current crisis.

n11 Jones (1993), Foote, Gerardi, and Willen (2008), and Adelino, Gerardi, and Willen (2013) provide a detailed analysis of the default decision. Campbell and Cocco (2011) present a general model of the determinants of mortgage default.

n12 See Brown, Ciochetti, and Riddiough (2006) for a discussion of the bargaining game in the context of commercial real estate defaults. For a discussion of the determinants of strategic defaults on residential mortgage loans, see Foote, Gerardi, and Willen (2008) and Vandell (1995).

n13 In a few instances in which these four sources do not all agree, we read the relevant state statute from Foreclosure.com to classify the state's foreclosure process. The primary difference between these sources is how they classify states, such as California, in which judicial review or deficiency judgment is available only in certain circumstances.

n14 We also estimate the model with break points at -5 percent and 15 percent and find that the location of the break points has little impact on the coefficient estimates for the explanatory variables.

n15 This result should not be surprising given the fact that default rates on prime loans with positive equity are very low.

n16 For a discussion of the personal bankruptcy process and how bankruptcy affects the foreclosure process, see Li and White (2009) and Li, White, and Zhu (2011).

n17 Early federal government efforts focused on modifying mortgages for borrowers who, because of rate resets or extenuating circumstance (such as the loss of a job or a medical emergency), could no longer afford their mortgage payments. These early programs targeted potential nonstrategic defaulters and were seen as largely ineffective in reducing the number of foreclosures (see Adelino, Gerardi, and Willen 2013). See Gerardi and Li (2010) for a description of mortgage foreclosure prevention efforts and Congressional Research Service (2009).

n18 JP Morgan's initiative was announced in October 31, 2008 (Congressional Research Service 2009). In November 2008, the Hope Now Alliance (consisting of all large mortgage servicers), Fannie Mae, and Freddie Mac began the Streamlined Modification program for loans

guaranteed by government-sponsored enterprises. This announcement also coincided with the suspension of all foreclosure sales by Fannie Mae and Freddie Mac (see Freddie Mac 2009).

n19 We select December 2008 as the end date because defaults are defined as more than 60 days delinquent, and January 2009 is 60 days after the foreclosure moratorium began. As we discuss later, we find a significant effect of **state foreclosure laws** with data on defaults through June 2010.

n20 This difference and the difference in the frequency of foreclosure proceedings are statistically significant at the 1 percent level. We test for differences in medians with a rank-sum test. We also truncate the time line after October 2007 and October 2008 defaults to 20 months, as this is the length of time between October 2008 and the end of our sample in June 2010.

n21 The coefficients reported in Table 15 for the January 2005–December 2008 sample period are different from those reported in Table 6 because we limit the number of months since origination to 23 for the estimates reported in Table 6. We do so to ensure identification of the baseline hazard parameters $[\lambda]$. To identify these parameters, observations from loans of all three vintage years are required for each parameter. This limits the number of loan months to 23, the maximum number of months since origination until December 2008 for 2007 vintage year loans.

n22 We also estimate the hazard model with state law effects on the Pence (2006) sample of 55 urban areas that cross state borders and obtain results that are consistent with the main analysis with respect to judicial review. The effect of deficiency judgments is not significant in the subprime and alt-A subsamples because of the lack of variation in deficiency judgment laws across the urban areas in the Pence (2006) sample. See Table B2 in the online appendix.

n23 The other states contiguous to California enacted mediation programs in late 2008 or early 2009. Courts in Florida, a judicial review state, required mediation beginning in early 2009.