Credit Regulation and the Availability of Subprime Mortgage Credit*

Jevgenijs Steinbuks†, Gregory Elliehausen‡, and Michael Staten§

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Abstract

This study investigates the effects of state predatory mortgage lending laws on the availability of subprime mortgage credit. Using the Rothschild-Stiglitz approach to model credit markets under asymmetric information, restrictions on prepayment penalties are shown to reduce the use and attractiveness of mortgage credit. Consistent with model predictions, empirical results indicate that originations of high-cost mortgages subject to tighter restrictions were generally significantly less than predicted in states with more restrictive laws but that this difference of predicted and actual was not significant in states with less restrictive laws. These differences were not found for originations of non-high-cost loans. Thus credit regulation was differentially associated with reduction in originations of high-cost mortgages and non-high-cost lending did not expand in areas where high-cost mortgages were restricted. JEL Classifications: D82, G14, G18, G21

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†Department of Economics, Miami University (Ohio)

‡Financial Services Research Program, George Washington University. Corresponding author. Email: elliehau@gwu.edu.

§University of Arizona

I. INTRODUCTION

Growth of the subprime mortgage market during the 1990s expanded the availability of mortgage credit to borrowers who did not qualify for a mortgage in the prime market. Subprime loans have a higher market share than prime loans among low and moderate income households, and in minority neighborhoods (Calem, Gillen and Wachter 2004; Pennington-Cross 2002; Canner, Passmore and Landerman 1999). The higher pricing and relatively high market share in low-income and large minority share neighborhoods have elevated concerns among consumer activist groups and regulators about the possibility of abusive lending tactics. Concerns over the prevalence of these tactics have led to federal, state, and local legislation that is supposed to curb abusive lending. In 1994, Congress enacted the Home Ownership and Equity Protection Act (HOEPA), which imposed additional Truth in Lending disclosures and certain restrictions on contract terms for "high-cost" mortgages[1]. The regulatory approach taken by HOEPA, and adopted by many states, and some cities and counties since, deems high-cost loans as more likely to be associated with abusive tactics and contract features, and so deserving of tighter restrictions than prime or lower-priced subprime loans.

Statistical evidence on the effects of state and local HOEPA-style predatory lending laws is limited. Most evidence concerns North Carolina's 1999 law, which was the first law to impose tougher standards than HOEPA. The evidence indicates that the volume of subprime mortgage lending in North Carolina declined relative to neighboring states after North Carolina's law became effective. Evidence for other states or localities has only recently begun to appear. A limitation of existing studies is that they do not distinguish between effects on regulated high-cost loans and on unregulated non-high-cost loans.

This study investigates the effect of state predatory mortgage lending laws on the availability of subprime mortgage credit from 1999 (when the first state predatory lending law became effective) to 2004[2]. Following a brief review of existing literature, we develop a theoretical model to investigate the effects of prepayment restrictions on mortgage originations. Then, using data on about five million subprime mortgages from eight

[1] For detailed legal analysis of HOEPA provisions, see Keyfetz (2005).

[2] During 2007, rising default losses, accusations of fraud by borrowers and underwriters and regulatory actions appeared to combine to produce a market environment in which the secondary market for subprime loans collapsed. Lenders were unable to sell subprime products in secondary markets at prices that produced positive yield spreads, leading to losses and the failure of a number of firms. Substantial losses also appeared in mortgage pools and were said to be responsible for the collapse of the secondary market. This paper is concerned with the initial effects of subprime regulation rather than its collapse. Sorting out the relative effect of subprime regulation as opposed to other events causing the collapse of yield spread premiums, the secondary market and substantial numbers of both subprime lenders and secondary market investors is beyond the scope of this analysis.

subprime mortgage lenders, we adopt an "event-study" framework to compare actual originations of high-cost and non-high-cost subprime mortgages with predicted originations in the absence of predatory mortgage lending laws for each state with a predatory lending law. The event study framework is particularly attractive because it allows the data to reveal the effect for each state without arbitrary assumptions about provisions of the different state predatory lending laws. We find that originations of high-cost mortgages, which which are subject to tighter restrictions than lower cost mortgages, were generally significantly less than predicted in states with more restrictive laws. Originations of lower cost loans in more restrictive states were generally not significantly less than predicted in states with more restrictive laws. These findings are consistent with expectations based on our theoretical model that restrictive state predatory mortgage lending laws reduced reduced availability of subprime mortgage credit primarily in the high-risk segment of the market. They further suggest that lower cost lending did not expand when high cost lending was restricted. This study is the only one to distinguish effects of the laws on regulated high-cost and unregulated lower cost loans.

II. LITERATURE REVIEW

A. North Carolina's Predatory Mortgage Lending Law

Five studies using three separate databases have investigated the effect of North Carolina's law. All found significant contraction of credit availability but differ sharply in their interpretation of the decline. Harvey and Nigro (2004) estimated a multivariate model using Home Mortgage Disclosure Act (HMDA) data to investigate originations by subprime lenders from 1998 through 2000 in North Carolina and four comparison states (South Carolina, Georgia, Tennessee, and Virginia[3] The authors found that the North Carolina law reduced the overall level of mortgage originations of subprime lenders in that state. The authors found that the decline in originations was due to a large decline in applications rather than an increase in denial rates, and concluded that subprime lenders may have been less aggressive in marketing loans during the post-enactment period. Burnett, Finkel, and Kaul (2004) examined HMDA data on lending in North Carolina and the same four comparison group states before and after the law but used a longer post-law observation period (2000-2002). They found similar results to Harvey and Nigro for the longer time period.

[3] Until 2004, the HMDA database did not include information on loan prices, which could be used to identify subprime loans. Researchers relied on a list of subprime lenders complied by The US Department of Housing and Urban Development (HUD). HUD classified certain lenders as subprime if the majority of their originations are subprime loans.

The authors of both of these studies were careful to point out that they could not distinguish between predatory and legitimate loans and were therefore unable to separate intended reductions in predatory lending from unintended reductions in access to credit. In contrast, Ernst, Farris and Stein (2002) interpreted observed post-law declines in both total originations and originations per capita at subprime lenders in North Carolina relative to comparison states, which they derived from HMDA data, as declines in "predatory" lending. This interpretation is based on an assertion that the law's restrictions on refinancings, single-premium credit insurance, and prepayment penalties reduced fees paid by borrowers on such transactions and produced no additional costs or losses of benefits.

Elliehausen and Staten (2004) investigated the North Carolina law using a unique database containing all mortgage originations in the portfolios of subprime subsidiaries of nine large financial institutions. They estimated a multivariate model to analyze loans made from 1997 through June 30, 2000 in North Carolina and three adjacent comparison states. They found that first mortgage loan originations per county in North Carolina fell 14% following passage of the state's predatory lending law, relative to county-level originations in the surrounding states. Significant declines occurred only in North Carolina and only among lower income borrowers. Neither higher income borrowers in North Carolina nor borrowers in the comparison states experienced significant declines.

Another study of the North Carolina law conducted by Quercia, Stegman, and Davis (2004) used Loan Performance System's (LPS) database on securitized subprime[4] They found that securitized subprime originations declined more in 1999-2000 in North Carolina than in surrounding states. The declines only occurred in refinance loans. After 2000, refinance loans grew nationally and in some surrounding states, but not in North Carolina.

Quercia, Stegman, and Davis (2004) noted that the reduction in originations is consistent with the findings of prior studies, but they claimed that the decline consisted of subprime refinance originations with abusive or predatory terms. As supporting evidence they pointed to sharp declines in refinance loans with

[4]The LPS database is not a random sample of originations. A loan must satisfy certain criteria to be rated and eligible for securitization, and lenders choose to securitize rather than hold the loans in their portfolios. Evidence suggests that securitized loans are not representative of all originations. Phillips-Patrick, Hirschhorn, Jones, and LaRocca (2000) concluded that the LPS database did not include much of the higher risk segment of the subprime market, and Litan (2003) presents statistics showing different growth rates for originations and securitizations.

characteristics that were explicitly limited by the statute[5] Certainly, a decline in the incidence of a proscribed term is not surprising. But Quercia, Stegman, and Davis's insistence that a decline in loans with proscribed terms amounts to a decline in abusive loans is merely definitional. They define loans with these terms as abusive and then note how abusive loans decline when these terms become illegal[6].

B. Other State Predatory Mortgage Lending Laws

DeMong (2004) surveyed mortgage lenders and brokers in New Jersey and Pennsylvania about lending activity before and after implementation of New Jersey's predatory lending law. New Jersey mortgage lenders and brokers reported a 67 percent decline in the dollar amount of cash-out refinance loans and a 75 percent decline in the dollar amount of home improvement loans in the first two months following implementation of the law compared to the two months before its implementation. These declines were much larger than the 10 percent and 2 percent declines in cash-out refinance and home improvement loans in Pennsylvania. Such large differences suggest that New Jersey's predatory lending law substantially reduced availability of subprime mortgage credit in that state.

Ho and Pennington-Cross (2005, 2006) and Bostic et al. (2008) examine the effects of 28 state and local predatory laws. The authors use HMDA data to estimate the likelihood of loan applications, originations, and rejections in states with and without predatory lending laws. To measure the effects of laws, they devise indices of coverage and severity of restrictions and also enforcement in Bostic et al. The indices reflect differences in state and local laws, which vary widely in terms of trigger thresholds for coverage and the package of extra restrictions imposed on lenders. The construction of indices involves judgements whether specific provisions of different state laws are similar and in aggregating that the restriction of one term has an equal effect as a restriction of another term.

The basic method and findings of the Ho and Pennington-Cross (2005,2006) and Bostic et al. (2008) studies are similar[7]. They consider three separate dependent variables that could demonstrate the effects of

[5] For example, the North Carolina statute prohibited prepayment penalties on all loans up to $150,000, and prohibited balloon payments on any loan designated as " high-cost" under the statute. Quercia, Stegman, and Davis.found declines in North Carolina but increases in surrounding states in loans with prepayment penalties three or more years after origination. They found declines in North Carolina in loans with balloon payments, although Tennessee and South Carolina experienced declines of similar magnitude.

[6] Yezer (2004) argues that the loans most likely to involve deceptive practices are probably those made by small, local lenders that do not securitize or report data under HMDA. Thus, observed declines in lending would reflect primarily declines in availability rather than declines in predatory lending.

[7] Ho and Pennington Cross (2005) considers loans originated by lenders identified as subprime on the HUD list as subprime.

local predatory lending laws–the probability of applying for a subprime loan, the probability of originating a subprime loan, and the probability of being rejected on a subprime application. The authors found that the presence of a predatory lending law alone (without regard to strength) had little effect on loan originations, but applications and rejection rates generally decline, particularly in areas with stronger laws. Limited or moderate laws appeared to change the composition of subprime lenders' portfolios but produce little change in the number of subprime originations. Laws with more severe provisions produce a decline in originations by subprime lenders. These changes appear to occur because of changes in marketing. These results are consistent with subprime lenders' avoiding higher risk borrowers that are covered under state predatory mortgage lending laws.

III. A MODEL OF LENDING WITH PREPAYMENT PENALTIES

In contrast to the previous empirical literature, the first step in this analysis is formulation of a theoretical model capable of predicting the effects of restrictions on prepayment penalties, one of the most common regulatory steps taken by states and localities in regulating subprime mortgages. Prepayment penalties are common in the subprime market but rare in the prime market[8]. Prepayment penalties are a reaction to the high level of prepayment risk associated with subprime mortgages. Because of relatively large jumps in interest rates between risk grades, subprime borrowers have a strong incentive to refinance into lower risk loans if they can qualify. This incentive causes relatively high rates of prepayment for subprime mortgages.

The two-period model used here adapts the Rothschild and Stiglitz (1976) framework to model mortgage-market equilibrium when borrower prepayment costs are private information[9]. Borrowers' ability to improve their risk profiles are largely their private information. A lender cannot sort borrowers according to their prepayment risks and assign corresponding profit-maximizing contracts. This information asymmetry influences the contract choices available. The model developed here shows that prepayment penalties produce a separating equilibrium between high and low prepayment risk borrowers that is consistent with welfare en-

Bostic et al. (2008) considers HMDA-reportable high-cost loans as subprime. Ho and Pennington Cross (2006) and Bostic et al. (2008) limit observations to metropolitan areas that cover include different states. These studies also consider effects of state laws on interest rates using a different database.

[8]Subprime loans are more than three times as likely as prime loans to have prepayment penalty terms in their mortgage contract, and the refinance lock-outs are usually in effect for two to five years. Prepayment penalties are usually binding for borrowers that have them (Cutts and van Order 2005).

[9]This framework was also applied in mortgage market models by Yezer et al. (1994), and Brueckner (2000).

hancing optimal contracts[10] Laws prohibiting prepayment penalties deny the low prepayment risk borrowers an optimal contract, and make them seek credit elsewhere, not borrow, or accept the less attractive contract. These laws may thus have a negative effect on welfare.

Although the model only considers the effect of restrictions on prepayment penalties, it has broader applicability. Other provisions of subprime laws such as negative amortization, balloon payments, and hybrid teaser rates may also reflect lender reactions to adverse selection based on the borrowers' private information (e.g. about tenure in house or ability to prepay). Therefore the model's predictions may generalize to other features of state predatory lending laws, which tend to restrict these provisions.

A. Model Setup

We assume that a separate subprime market has arisen due to information asymmetry regarding credit risk and significant underwriting cost (see Cutts and Van Order 2005). The model describes the behavior of a representative subprime borrower seeking a mortgage from a representative subprime lender. The borrower's and lender's decisions are sequential. At the start of period 0 the borrower and the lender agree on the contract provisions, which include the fixed contract interest rate i_0 and the loan amount L, which is assumed to be less than the value of the collateral. The value of the collateral the subprime borrower can offer is predetermined and normalized to 1 for simplicity[11] The mortgage is a two-period contract scheduled to be paid in full at the end of period 1 . The balance due at the end of period 1 is B_1 includes the principal and interest:

$$B_1 = L * (1 + i_0) \tag{1}$$

The possibility of prepayment arises because the subprime borrower may change perceived creditworthiness at the end of period 0. If the borrower remedies her financial problems, she can qualify for refinancing at the prime rate, which is lower than i_0 . The density of this future prime rate distribution is denoted by $f()$, and the support is given by $i \in \left[\underline{i}, \overline{i}\right]$. Borrowers and lenders have identical knowledge of $f()$ in that

[10] Asymmetric information models have been applied to the analysis of contract features restricting prepayment (Dunn and Spatt 1985, Chari and Jagannathan 1989, Yang 1992, Brueckner 1994, LeRoy 1996, and Stanton and Wallace 1998). However, these models focused on aspects such as borrowers' mobility and interest rate reductions affecting prepayment in the prime market.

[11] Loan to value ratio thus equals to the normalized size of the loan.

they know the distribution which is identical for all borrowers but they do not know the future realization of i. The stochastic balance due at the qualifying interest rate at the end of period 1 is thus:

$$B = L * (1 + i) \tag{2}$$

The critical magnitude of B below which prepayment is optimal, depends on the magnitude of prepayment costs. These costs, represented by C, may include those associated with improving credit history (e.g. costs of remedying financial emergency such as unexpected job loss by retraining or finding a new job), transaction costs of refinancing (which may include prepayment penalties), the opportunity costs of the foregone default option[12] as well as the costs associated with exogenous conditions affecting prepayment, such as unexpected change in income or moving out of the house[13].

The borrower thus will choose to prepay if the value of the balance due at the realized interest rate in the beginning of period 1 satisfies the condition

$$B_1 - B > C \tag{3}$$

The term $B_1 - B$ in (3) is the marginal gain the borrower gets from prepayment. Rearranging, (3) shows that prepayment is optimal when

$$B < \widetilde{B} \equiv B_1 - C \tag{4}$$

$\widetilde{B}$ represents the critical value at which prepayment occurs[14] If the value of the balance due at the realized interest rate in period 1 is higher than $\widetilde{B}$, the borrower pays the mortgage in full by selling the house and recovering the amount $1 - B > 0$ [15] The model thus implicitly assumes that the borrower never exercises the default option[16].

[12] It will be seen later in the text that the default option is never exercised in this model.
[13] See Kau and Keenan (1995) for details.
[14] See Steinbuks (2008) to verify that prepayment condition (4) is optimal.
[15] The borrower is thus left with positive equity and the loan is repaid. If the value of collateral is predetermined this can be a plausible outcome. Given the relatively poor credit history of the borrowers, the loan to value ratio in the subprime market is typically lower than on prime market. For details, see Calomiris and Mason (1998).
[16] This assumption is necessary to ensure that the model is analytically solvable and empirically tractable without the use of complicated option pricing techniques. The main results of the model will not be changed if this assumption is relaxed and

Assuming risk neutrality, the borrower's utility equals the expected discounted value of financial wealth, which can be written as

$$U(L, B_1) = Y - (1 - L) + \delta \int_{\underline{B}}^{\widetilde{B}} (1 - B - C) f(B) dB + \delta \int_{\widetilde{B}}^{\overline{B}} (1 - B_1) f(B) dB \tag{5}$$

The discount factor is denoted by $\delta < 1$, and Y denotes the exogenous component of financial wealth, which equals initial assets plus the discounted value of income in all periods of life[17] According to (5) the borrower's financial wealth is reduced in the first period by the downpayment on the house, which equals $1 - L$, and increased in the second period by $1 - B - C$ over the range of realized balances $[\underline{B}, \widetilde{B}]$ where prepayment occurs, and by $1 - B_1$ over the range of house values $[\widetilde{B}, \overline{B}]$ where the mortgage is paid in full.

A representative risk-neutral lender maximizes the expected discounted value of profits from the subprime mortgage loan. Given the lender's discount factor η , the profit function can be written as

$$\pi(L, B) \equiv -L - F + \eta \int_{\underline{B}}^{B_1 - C} (B - D) f(B) dB + \eta \int_{B_1 - C}^{\overline{B}} (B_1) f(B) dB \tag{6}$$

According to (6) at loan's origination the lender transfers L to the borrower and incurs sunk origination cost F. In period 1, the lender receives the loan balance B_1 from the borrower over the range of house values $[\widetilde{B}, \overline{B}]$ where prepayment does not occur. The lender refinances the loan, over the range of values $[\underline{B}, \widetilde{B}]$ where the borrower chooses to prepay, receiving loan balance B and incurring additional administrative cost of refinancing the loan (e.g. the cost of underwriting another loan at the same interest rate), which is denoted by D [18] The closing costs of the loan are for simplicity normalized to zero and are not included[19].

The model focuses on the values of B , which satisfy condition

$$\underline{B} < B_1 - C < \overline{B} \tag{7}$$

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the housing prices are allowed to fall. Deng, Quigley, and van Order (2000) have found empirically that competing risks of prepayment and default in mortgage market are correlated. Thus, the borrowers with lower prepayment costs will be more likely to end up with negative equity and default if the housing prices are falling. The resulting equilibria in this scenario are similar to those discussed below, as illustrated in Brueckner's (2000) model.

[17] Y may also capture utility the household gets from consuming the housing services.

[18] This cost is smaller if the loan is subject to prepayment penalty. However, as it will become clear later, loans carrying prepayment penalties are never prepaid in this model.

[19] These costs are the same for the lender regardless if prepayment occurs or not, so they have no effect on subsequent results.

Condition (7) eliminates two trivial cases. In the first case, $B_1 - C > \overline{B}$ holds, implying that prepayment always occurs. In the second case $B_1 - C < \underline{B}$ holds, in which case the borrower never prepays.

To derive market equilibrium it is important to understand the properties of the borrower's indifference curves, and the lender's isoprofit curves given by (5) and (6). These curves describe the trade-off between the contract characteristics L and B_1 from the point of view of the borrower and lender.

Implicit differentiation of (5) and (6), and application of Leibniz rule shows that indifference curves are upward sloping, convex, and "horizontal parallel" having the same slope at a given B_1 [20] Lower curves correspond to higher utility levels. The indifference curves also become flatter as the borrower's prepayment costs C and discount factor δ increase. The isoprofit curves are also upward sloping, convex, and "horizontal parallel" having the same slope at a given L under assumption that $f' \geq 0$ [21] Lower curves correspond to lower profit levels. It also worth noting that firm's profit increases as borrower's cost of prepayment rises.

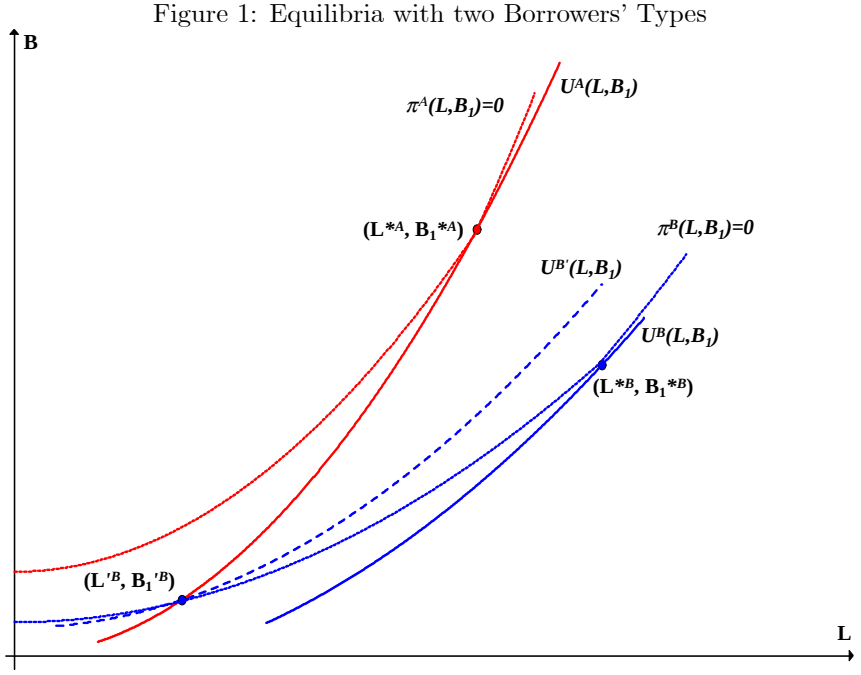
B. Equilibrium

Identical Borrowers. To understand the mechanics of the model, let us first concentrate on subprime mortgage market equilibrium with identical borrowers. In a competitive equilibrium, the subprime lender earns zero profit, so the equilibrium contract should lie on the zero-profit curve, defined by $\pi(L, B_1) = 0$. Because a borrower's utility is higher on lower indifference curves, the equilibrium contract will be located at the point where the lowest borrower's indifference curve touches the lender's zero-profit curve. For a well-behaved optimum, this should be a point of tangency between the curves. But recalling that both indifference and zero-profit curves are convex, a tangency will be optimal only if the zero-profit curve is "more convex" than the indifference curves, e.g. $\left|\frac{\partial^2 U}{\partial B_1^2}\right| < \left|\frac{\partial^2 \pi}{\partial B_1^2}\right|$.

Two borrower types. A setting with two borrower types allows us to illustrate the effect of asymmetric information on the optimal subprime mortgage contract. In this setting, borrowers differ in their ability to improve their credit histories and subsequently refinance their loan at lower interest rate. Because improving credit history is costly, borrowers who are more likely to improve their credit histories can also be thought as borrowers with lower prepayment costs. For simplicity, it is assumed that there are two types of borrowers who are indistinguishable to lenders. Type A borrowers are likely to improve their credit histories and hence

[20] See Steinbuks (2008) for a formal proof.
[21] This assumption is necessary for model to be well behaved.

Figure 1: Equilibria with two Borrowers' Types



have low prepayment costs. These borrowers are considered a high prepayment risk for the lender because their propensity to prepay is high. Type B borrowers are unlikely to improve their credit histories, have high prepayment costs, and are considered low prepayment risk for the lender. Prepayment costs are denoted C^A and $C^B > C^A$ for type A and type B borrowers, respectively.[22]

Substituting these costs in (5) yields two different utility functions, denoted $U^A(L, B_1)$ and $U^B(L, B_1)$. Because the indifference curves become flatter as the borrower's prepayment costs C increases, the indifference curves of these functions have different slopes. In particular, a type B borrower's indifference curve passing through a given (L, B_1) point is flatter than a type A borrower's curve through that point. The prepayment-cost difference, if it can be detected by lenders, also leads to different profit functions, denoted $\pi^A(L, B_1)$ and $\pi^B(L, B_1)$, and different zero-profit curves.

The difference in the heights of these curves is found by setting (6) equal to zero and differentiating, which yields $\frac{\partial B_1}{\partial C} = -\frac{\pi_{B_1}}{\pi_C}$. If the model is well-behaved, this derivative is negative when the zero-profit curves are upward sloping. Thus, a type A borrower's zero-profit curve is higher than a type B borrower's

[22] The inequality $C^B > C^A$ represents the differences between type A and type B borrowers in cost of improving their credit history and ability to qualify for low cost refinancing.

curve. The reason is that a type A borrower has a greater likelihood of prepayment for any given B_1 , which means that he must repay a larger amount in the absence of prepayment to match the profit from a type B borrower.

First - best contracts. The first-best contracts are those that would be chosen by an omniscient planner. The planner's goal is to maximize utility for each borrower type while ensuring non-negative lender profit. This goal is achieved by assigning each borrower type the utility-maximizing contract on its own zero-profit curve, as seen in figure 1. Figure 1 shows that the balance due on first best optimal contract B_1^* is larger, and the optimal size of the loan L^* is lower for the type A borrower. The type A borrower will thus always prefer the type B borrower's first-best contract $\left(L^{*B}, B_1^{*B}\right)$ to his own first-best contract $\left(L^{*A}, B_1^{*A}\right)$.

Second-Best Contracts. The problem with the first-best contracts arises because prepayment costs are private information. The lender cannot identify different borrower types and assign different contracts to them. If the lender were to offer the two first-best contracts shown in figure 1, both borrower types would select the contract intended for type B borrowers. Because the lender operates in a competitive market and cannot unilaterally set interest rates to ensure positive profits, it must tolerate free choice by the borrowers among the set of offered contracts, which generates a loss. While loans extended to type B borrowers would generate zero profit, those made to type A borrowers would yield a loss, a consequence of the fact that the chosen contract $\left(L^{*B}, B^{*B}\right)$ lies below the type A zero-profit curve. Because the lender's overall profits would then be negative, this outcome is inconsistent with equilibrium.

The optimal mortgage contracts in the presence of the asymmetric information are based on the solution proposed by Stiglitz and Rothschild (1976). The equilibrium set of mortgage contracts and an assignment of contracts to borrower types should be such that (i) lenders earn zero profit and (ii) no contract outside the given set attracts borrowers while generating a non-negative profit.

Non-existence of a Pooling Equilibrium. In a pooling equilibrium, the same contract is chosen by both borrower types. To generate zero profit, a pooling contract must lie between the type A and the type B zero-profit curves, with losses on the type A borrowers exactly offset by profits on the type B borrowers. A

pooling contract (L^p, B_1^p) must satisfy

$$\alpha\pi^A\left(L^p, B_1^p\right) + (1-\alpha)\,\pi^B\left(L^p, B_1^p\right) = 0 \tag{8}$$

where α is population share of type A borrowers. The contract (L^p, B_1^p) cannot represent an equilibrium because condition (ii) above is violated. For example, consider a contract $\left(L^G, B_1^G\right)$, located to the southwest of (L^p, B_1^p), which lies above the type A indifference curve, and below the type B indifference curve, passing through (L^p, B_1^p). This contract will attract only type B borrowers, and because it lies above the type B zero-profit curve, it will earn a profit. Such contracts always exist because of the flatter slope of the type B indifference curves.

Separating equilibrium. The equilibrium contracts must differ across borrower types, and each must lie on the relevant zero-profit curve to satisfy condition (i) above. The equilibrium contracts must satisfy the conditions

$$\pi^A(L^A, B_1^A) = 0; \pi^B(L^B, B_1^B) = 0 \tag{9}$$

$$u^A(L^A, B_1^A) \geq u^A(L^B, B_1^B) \tag{10}$$

$$u^B(L^B, B_1^B) \geq u^B(L^A, B_1^A) \tag{11}$$

along with condition (ii) above. Condition (9) is the lender's participation constraint. Under the optimal contract, the lender will never have a negative profit on either type of borrower[23] Conditions (10) and (11) are the borrower's incentive compatibility constraints, which indicate that the mortgage contract intended for a given borrower type is chosen by that type. Note that, while the lenders cannot observe borrower type, they offer mortgage contracts anticipating how they will be selected. Only one of the incentive-compatibility constraints can bind. It is easily seen that this must be (11), the constraint corresponding to a type A

[23] The lender will not make positive profits because the subprime mortgage market is assumed to be perfectly competitive.

borrower. Because (12) then holds as a strict inequality, indicating that type B borrowers strictly prefer their own contracts, alternate contracts near type A contract can be offered without attracting type B borrowers.

To ensure that such contracts are not profitable, the type A contract must correspond to the tangency point $\left(L^{*A}, B_1^{*A}\right)$ on the zero-profit curve, as shown in figure 2. If the contract were not at this tangency, there would exist alternate contracts lying above the zero-profit curve (thus earning a profit) that would attract a type A borrower, violating (ii). With the equilibrium contract for the type A borrower determined, (10) and (11) can be used to locate a type B borrower's equilibrium contract. It is located where the type A indifference curve passing through $\left(L^{*A}, B_1^{*A}\right)$ cuts the type B zero-profit curve. This contract, denoted $\left(L^{'B}, B_1^{'B}\right)$, is shown in figure 1. Because contracts $\left(L^{*A}, B_1^{*A}\right)$ and $\left(L^{'B}, B_1^{'B}\right)$ satisfy the incentive compatibility constraints, each is selected by the intended borrower.

C. Prepayment Penalties as Market Separation Device

Prepayment is optimal when the marginal gain the borrower gets from prepayment is higher than her prepayment costs. By offering a contract with a prepayment penalty, which has lower contract interest rate, the lender can thus insure itself against the prepayment risk. As noted, the interest rate is defined by $1+i_0 = \frac{B_1}{L}$ and in figure 2 reflects the slope of the line segment connecting the origin to a given (B_1, L) point. Noting the relevant slopes in figure 1, it follows that the interest rate on the type A contract $\left(L^{*A}, B_1^{*A}\right)$ is distinctly higher than the rate on the type B contract $\left(L^{'B}, B_1^{'B}\right)$.

From this perspective, interest rate differentials can be viewed as the means for achieving borrower separation. A large loan such as L^{*A} carries a high interest rate, which deters a type B borrower from selecting it. Instead, the borrower opts for the smaller loan $L^{'B}$, which carries a lower rate. A type A borrower, on the other hand, finds the large and small loans equally attractive, despite the higher interest rate on the former, but opts for the larger loan. The reason for a type A borrower's indifference is that greater likelihood of prepayment means that the chance of actually paying the high rate is lower.

The interest-rate differential in figure 1 could correspond to the use of prepayment penalties for smaller loans. Viewed in this way, the model predicts that type A borrowers, who find the extra costs intolerable given their higher chance of prepayment will never choose prepayment penalties. Type B borrowers, on the

other hand, will opt for smaller loans that contain prepayment penalties.

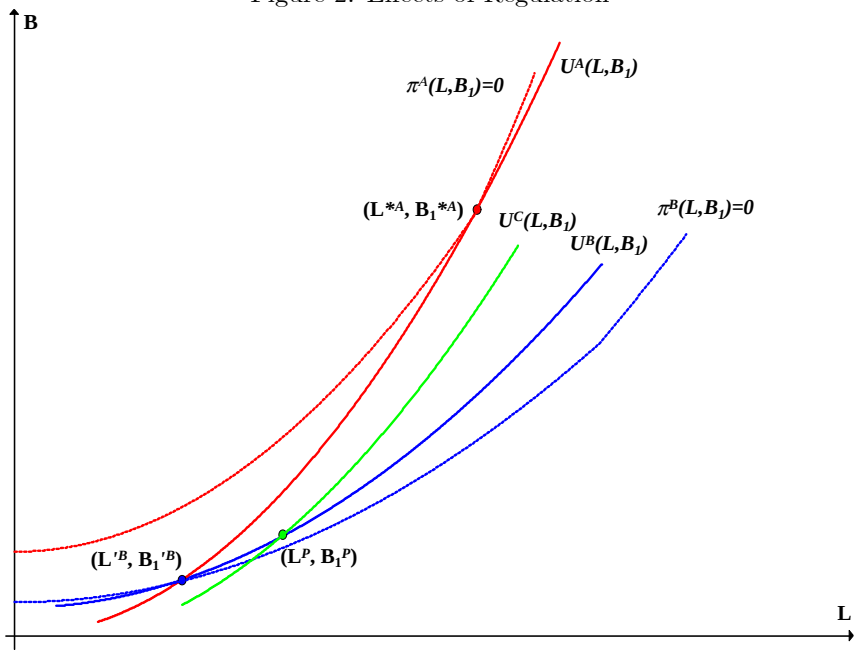
The mortgage-market equilibrium shown in figure 2 is similar to other models in the Rothschild-Stiglitz tradition. Type A borrowers are unaffected by asymmetric information, with their mortgage corresponding to the first-best contract. Type B borrowers end up with a mortgage inferior to the one the planner would assign them, however. The mortgage is inferior because the contract $\left(L^{'B}, B_1^{'B}\right)$ lies on a higher indifference curve than $\left(L^{*B}, B_1^{*B}\right)$. To understand the reason for this outcome, recall first that a pooling equilibrium cannot exist because the lender can always offer a contract, which will attract only profitable type B borrowers and ration type A borrowers out of subprime market. In a separating equilibrium, borrowers must be induced to choose different zero-profit contracts. Although the lender has an option to lend on more favorable terms to the type B borrower (e.g. by not offering prepayment penalties), it must avoid attracting type A individuals to ensure borrower separation. Thus, a type B borrower cannot fully benefit from her favorable position, receiving instead a contract that is distorted to make it unattractive to the type A borrowers.

Although this logic is familiar, the nature of the equilibrium under asymmetric information in the mortgage context is noteworthy. The information asymmetry prevents type B borrowers from achieving their first best contracts because they cannot demonstrate their type. Rather than securing a loan of size L^{*B} , the type B borrower must settle for a smaller loan of size $L^{'B}$. Type A borrowers, by contrast, receive a mortgage of size L^{*A} that fully satisfies their demand for debt, given the lender's greater cost of serving them. Thus, as in Stiglitz and Weiss (1981), asymmetric information leads to a form of credit rationing in the market for loans.

D. Effects of Regulation

Because prepayment penalties can be used to separate borrowers in the subprime market, a law that prohibits prepayment penalties can reduce welfare. With prepayment penalties made illegal, the lenders can still use other devices to achieve separating equilibrium. For example, they can charge upfront points and fees to type B borrowers in return for the lower interest rate. Type A borrowers will never choose to pay points and fees because they have a higher chance of refinancing the loan. Charging upfront points and fees, however, is less effective separation device, which may result in credit rationing and reduction in welfare. To illustrate this point, let us assume that the subprime market comprises three types of borrowers. Type A

Figure 2: Effects of Regulation



and type B borrowers are the same as those considered above. Type C borrowers have the same likelihood of improving their credit histories as the type B borrowers. In the absence of regulation they choose the same contract (with prepayment penalties) as type B borrowers. Type C borrowers, however, are more averse to pay upfront points and fees, because financing points raises both the required monthly payment and the loan-to-value ratio. Either of these effects could raise default risk and make the loan unattractive for the subprime lender. In the context of the model, introduction of points lowers the type C borrowers' discount rate δ relative to the type B borrowers.

Figure 2 illustrates the equilibrium under regulation with three borrower types. Because the lender cannot distinguish between the borrower types, it offers contracts with and without points and fees to achieve separating equilibrium. As explained earlier, in separating equilibrium type A and type B borrowers respectively choose contracts $\left(L^{*A}, B_1^{*A}\right)$ and $\left(L^{'B}, B_1^{'B}\right)$, which satisfy their incentive compatibility constraints. Type C borrowers have a lower chance of improving their credit histories, and therefore flatter indifference curves than type A borrowers. Type C borrowers will thus find contract $\left(L^{*A}, B_1^{*A}\right)$ unattractive. We also know that they have steeper indifference curves than type B borrowers. Type C borrowers thus will not be able to pool with type B borrowers by choosing contract $\left(L^p, B_1^p\right)$, because the lender offers contract

$\left(L'^{B}, B_1'^{B}\right)$ to type B borrowers, which makes type C borrowers worse off. Because no optimal contract can be offered to type C borrowers, they will either be rationed out from subprime market or accept a suboptimal contract.

Prohibition of prepayment penalties thus has important welfare implications. It results in a fall of subprime originations and makes type C borrowers worse-off[24] Because the optimal contracts of type A and type B borrowers are not changed as a result of regulation, prohibition of prepayment penalties results in Pareto inferior allocation and a reduction in welfare.

IV. SPECIFICATION AND ESTIMATION OF REDUCED-FORM MORTGAGE ORIGINATION EQUATIONS

If provisions of state predatory lending laws make subprime mortgage lending more costly, especially for loans extended to high-risk borrowers, the supply of loans to such borrowers would decrease, resulting in a reduction in the number of loans extended. Regulation that makes high-cost loans unattractive or riskier may cause lenders to shift lending to less risky market segments (see Blitz and Long 1965). In the following sections, we estimate an aggregate a reduced form model to test statistically for changes in high-cost and non-high-cost subprime mortgage loan originations after effective dates of state predatory lending laws.

A. Supply of and Demand for Subprime Mortgages

The volume of originations is determined variables affecting supply or demand for subprime credit . The variables consist of

* Personal income per capita (Bureau of Economic Analysis and Census Bureau). Greater income suggests greater ability to service debt, which is associated with greater demand for and supply of credit.

* State unemployment rate (Bureau of Labor Statistics). Higher unemployment is associated with greater interruptions in income which makes households vulnerable to financial distress. Higher unemployment is expected to reduce both demand for credit (because consumers tend to borrow when their income expectations are favorable) and supply of credit.

* State tax burden (The Tax Foundation): State tax burden, measured as the percentage of income that taxpayers in each state pay in state and local taxes, is included to account for differences across states in

[24] To the extent that type C borrowers are lower income and in greater distress, it is curious that advocates of restrictions on prepayment penalties often claim that they are motivated by a desire to aid the most distressed borrowers.

discretionary income.

* Consumer debt per borrower (TransUnion LLC): [25] High levels of consumer debt reduce discretionary income available for repaying mortgages and make consumers more vulnerable to financial distress when faced with unexpected expenses and interruptions in income. Demand for subprime mortgages is likely greater for consumers who have relatively high debt burdens, because they will be less likely to qualify for prime credit. Because high debt burdens make lending riskier and therefore more costly, supply would be inversely related to debt burden.

* Conventional mortgage home price index (Freddie Mac): The home price index indicates the level of home values. House value is a determinant of borrower's Home equity. Greater equity may reduce demand because the loss of equity at default may be higher or increase demand because greater equity may allow more mortgage borrowing, possibly at lower interest rates. Higher house value should be positively related to supply because greater equity reduces the risk of default.

* Percent of borrowers 30+ days past due on any account in the previous four years (Trans Union, LLC): Previous delinquencies affect the demand for subprime mortgages because previous delinquencies may limit access to prime credit and increase the price of subprime credit. Past debt payment problems suggest greater credit risk and are therefore inversely related to supply.

* Age distribution of the population (Census Bureau): High demand for credit is associated with household formation and family growth, which typically occurs at young or middle ages. Populations with greater percentages of such persons are likely to have greater demand for credit.

* Population and percentage of households that are homeowners (Census Bureau): Greater population and homeownership percentage should be positively related to loan origination volume.

* Three-month commercial paper rate (Federal Reserve Bank of St. Louis): The commercial paper rate for financial firms is included to measure the cost of funding mortgages, which is expected to be inversely related to supply

* Dummy variables for month of origination are included to capture seasonal influences on loan volume.

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

Descriptive statistics for these variables are found in Table 1[26].

B. Effects of State Laws

This study uses an "event study" method to assess the effects of state predatory lending laws on subprime mortgage originations[27] We develop a model using pre-law observations to predict the number of subprime originations for the post-law period. Specifically, we use reduced form stochastic specification to estimate the number of subprime originations as a function of variables affecting supply or demand (x_{it}) and seasonal dummy variables (s_t):

$$y_{it} = \alpha_i + \beta x_{it} \ + \delta s_t + \varepsilon_{it} \tag{12}$$

The effect of the law is estimated based on the difference between the predicted and actual number of originations. The event study approach is less restrictive than using the Ho and Pennington-Cross/Bostic et al. indices to differentiate state laws. There is an element of arbitrariness in assigning values for the degree of restrictiveness and in summing the assigned values to construct an index. The event study methodology allows the data to indicate the restrictiveness of the law.

The state laws considered for this study became effective at different times over a five-year period from 1999 to 2004. During this period, economic conditions varied across states and over time. The differences in implementation dates and variations in economic conditions allow the effects of the predatory mortgage lending laws to be distinguished from effects caused by changes in supply or demand.

C. The Subprime Mortgage Origination Database

The data for come from the Financial Services Research Program's (FSRP) third quarter 2004 subprime mortgage database, containing loan-level data on mortgage originations in portfolios of subprime subsidiaries of 8 large financial institutions. The information on loans includes the loan amount, annual percentage rate, contract rate, the amount of points and fees, FICO risk score, borrower income, appraised value of the property, ZIP code, loan quality, and loan performance. The availability of the annual percentage rate and the amount of points and fees permits identification of high-cost loans under HOEPA and various state and

[26] See Harvey and Nigro (2004), Elliehausen and Staten (2004), Calem, Gillen, and Wachter (2004), and Ho and Pennington-Cross (2006a) for further discussion of explanatory variables.

[27] For discussion of event study methodology, see MacKinlay (1997).

local predatory lending laws, which is not possible with other databases used to investigate state predatory lending laws.

The subprime mortgage origination database covers a large part of the higher risk, higher priced subprime mortgage market. Specifically, the database accounted for nearly a quarter of the higher-priced home purchase and refinance loans that were required to report risk premiums under the HMDA (see footnote 78). The database reflects the lending activity of the large subprime lenders that contribute the data, which comprises a significant share of the higher risk segment of the subprime mortgage market targeted by the state HOEPA-like laws target.

This study uses state-level originations from first quarter 1997 through the third quarter of 2004. Twenty-two states that had at least six months of post-law observations were included in the analysis. The effects of state laws are measured by the number of originations overall, originations of high-cost loans, and originations of lower cost loans. High-cost loans are defined according to the relevant statute in each state. As mentioned, high-cost loans are the loans most likely to be affected by state predatory lending laws because these laws impose tighter restrictions on high-cost loans.

V. RESULTS

We estimated a fixed-effects model of equation (12) for total originations, high-cost originations, and non-high-cost originations using data for each state from January 1997 to six months before a predatory lending law was effective.[28] Each of the three estimated equations are statistically significant and explain considerable proportions of the variation in pre-law originations[29]

The estimated equations were then used to predict originations during the post-law period using data on demand and supply conditions for that period. The prediction error, which is the difference between the actual and predicted logarithm of originations, is an estimate of the change in volume of lending that would have occurred in the absence of a law. Overall, 15 states have statistically significant prediction errors (table 2). The prediction error (actual minus predicted) was negative for seven of the 15 states. In these states the model over-predicted the post-law originations. Using Ho and Pennington-Cross's indices as an independent

[28] Because the errors for high-cost and non-high-cost originations are likely to be correlated, we also estimated seemingly unrelated regression (SUR) representation of (12). The results from SUR were not statistically different from those reported here.

[29] Estimated equations explained 55 percent of variation in all originations, 20 percent of variation in high-cost originations, and 60 percent of variation in non-high-cost originations.

assessment of the restrictiveness of the laws, the states having negative prediction errors are about average (KY, MD, and SC) or above average (CA, GA, NC, and NM) in restrictiveness. Kentucky' law is above average in severity, and Maryland's law is above average in coverage.

Of the states having statistically significant positive prediction errors (i.e., model under-predicted the post-law originations), four were below average in severity and coverage, and one (NY) has high coverage but is below average in severity. Three of the states having significant positive prediction errors (CO, CT, and MA) have high coverage and severity.

Considering only the high-cost loan originations, twenty states have statistically significant prediction errors. Nine of the 20 states have significant negative errors (over-prediction) for high-cost loans (AK, CA, CO, GA, NC, NJ, NM, NY, and SC). All but South Carolina have laws that are above average in restrictiveness. South Carolina's law is about average in restrictiveness. Colorado and New York also had significant positive prediction errors in total originations. The results suggest that lenders in Colorado and New York may have shifted lending from covered high-cost loans to uncovered loans in response to these states' predatory lending laws. Most states with significant positive prediction errors for high-cost loans have laws with below average restrictiveness. Connecticut, Illinois, and Massachusetts are the exceptions. Lenders in these states made more high-cost loans in the post-law period than was predicted based on demand and supply conditions alone.

Lastly, considering the prediction errors for non-high cost loans, 10 states had statistically significant prediction errors for these loans. Prediction errors for Colorado and New York, which experienced increases in total originations, were positive, consistent with the hypothesis that lenders in these states increased overall lending by shifting from covered high-cost loans to uncovered loans in response to these states' predatory lending laws. In five of the ten states (MD, NC, OH, OK, and PA) prediction errors were negative. North Carolina's predatory lending law, which was above average in restrictiveness, also has specific restrictions that affect lower cost loans. The four other states' laws were below average in restrictiveness. Three of these four states (OH, OK, and PA) had positive prediction errors for high-cost loans and insignificant prediction errors for total loans.

The pattern of prediction errors is generally consistent with the hypothesis that the volume of covered

high-cost originations declined in states with more restrictive state predatory mortgage lending laws after implementation of the laws. In many states with more restrictive laws, the total volume of subprime originations also declined. The decline in total loans included high-cost loans, but the decline may also have included other loans because some state laws have provisions regulating loans that are not defined as high cost. In several states with more restrictive laws, total originations did not decline significantly, a finding that suggests that lenders in these states may have shifted lending from covered high-cost loans to uncovered loans.

For states where the decline in post-law subprime originations (relative to predicted levels) was statistically significant, we calculated the cumulative decline in the number of high-cost and all subprime originations from predatory mortgage lending legislation. The cumulative decline is simply the sum of prediction errors (actual minus forecasted loans) over the all the months in which the law was in effect. The results suggest that restrictive laws had a dramatic negative effect on credit availability in the subprime loan market. For example, in North Carolina through the third quarter of 2004, 61,675 subprime mortgages were originated after the state's predatory mortgage lending law became effective in July of 2000 (table 3). The number of loans actually originated was 21 percent lower than the 78,086 loans predicted on the basis of demand and supply conditions in North Carolina. The estimated cumulative decline in high-cost loans in North Carolina (8,675 actual vs. 11,692 predicted) was 26 percent.

Declines in total subprime originations (relative to the forecast) ranged from 11 percent in Kentucky and South Carolina to 36 percent in Georgia. Declines in covered high-cost loans were much larger on a percentage basis. Declines (relative to the forecast) in high-cost loan originations ranged from 26 percent in North Carolina to 94 percent in New Mexico.

VI. CONCLUSIONS

This study investigates the effects of HOEPA-like state predatory mortgage lending laws on the availability of subprime mortgage credit. Our theoretical model considers the effect of state predatory lending legislation by examining restriction of prepayment penalties, a common feature of these laws. Because prepayment penalties can be used as an effective instrument that separates borrowers with different prepayment risk in the subprime market, a law that prohibits prepayment penalties can reduce welfare by reducing

lending to borrowers that are unable to refinance into lower cost loans.

We investigate empirically the effect of state laws on availability using a large database of loan originations from eight subprime lenders. The database allows us to effect of the laws on loans defined as high-cost under each state law, which other studies have not been able to do. We estimate a model using pre-law data to predict subprime originations in a state. The model is used to predict originations in the post-law period. Comparison of predicted originations with actual originations in the post-law period provides an estimate of the effect of a law. The pattern of prediction errors is consistent with the hypothesis that the volume of regulated high-cost originations declined in states with more restrictive state predatory lending laws. Prediction errors were not statistically significant or positive in states with less restrictive laws, however, suggesting that the less restrictive laws did not dampen high-cost loan originations. Since restriction of prepayment penalties and perhaps other terms may prevent separating equilibria, restrictive state predatory lending laws may reduce welfare, particularly for borrowers who may not be able to refinance into less risky loans.

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Table 1

Descriptive Statistics

Variable	Mean	Standard deviation	Minimum	Maximum
Number of loans originated per month	1,180	1,336	6	11,278
Number of high-cost loans originated per month	470	623	0	5,698
Number of non-high-cost loans originated per month	595	427	9	2,742
Three-month commercial paper rate (percent)	3.85	2.03	1.02	6.59
Conventional mortgage home price index	174	36	104	350
Debt per borrower (dollars)	15,772	2,784	10,484	43,880
Borrowers having delinquencies of 30 or more days in last 4 years (percent)	4	1	2	7
Homeownership rate (percent)	69	6	53	77
Population (in thousands)	8,764	7,881	1,259	35,900
Percent of population under 20 years	28	2	24	37
Percent of population 20-44 years	37	2	33	40
Percent of population 45-59 years	20	2	14	24
Percent of population 60 or older	15	3	9	22
Personal income per capita (dollars)	30,069	5,413	20,107	45,390
State tax burden (percent)	31	3	26	38
Unemployment (percent)	5	1	2	10

Table 2

Prediction errors for total and high-cost subprime originations, by state

Error = actual value minus predicted value

A. Total subprime originations

State	Months since law was effective	Mean (logarithm)	Standard error	95% confidence interval	
Arkansas	15	0.08	0.12	-0.19	0.35
California	27	-0.19*	0.06	-0.32	-0.06
Colorado	21	0.29*	0.05	0.19	0.39
Connecticut	36	0.38*	0.05	0.28	0.48
Florida	24	0.37*	0.08	0.22	0.53
Georgia	5	-0.45*	0.06	-0.61	-0.30
Illinois	9	0.28	0.13	-0.02	0.58
Kentucky	16	-0.13*	0.04	-0.21	-0.04
Massachusetts	43	0.23*	0.04	0.16	0.31
Maryland	28	-0.43*	0.05	-0.53	-0.33
Maine	13	0.44*	0.08	0.27	0.61
North Carolina	60	-0.25*	0.02	-0.29	-0.20
New Jersey	11	-0.17	0.11	-0.42	0.09
New Mexico	9	-0.43*	0.07	-0.59	-0.27
Nevada	12	0.25*	0.10	0.03	0.46
New York	18	0.22*	0.09	0.03	0.41
Ohio	29	-0.03	0.04	-0.11	0.04
Oklahoma	9	0.00	0.07	-0.15	0.15
Pennsylvania	28	-0.09	0.04	-0.18	0.00
South Carolina	9	-0.14*	0.05	-0.25	-0.03
Texas	16	0.38*	0.07	0.23	0.53
Utah	9	0.12	0.11	-0.14	0.38

B. High- cost originations

State	Months since law was effective	Mean (logarithm)	Standard error	95% confidence interval	
Arkansas	10	-1.00*	0.24	-1.53	-0.46
California	27	-1.49*	0.10	-1.70	-1.29
Colorado	21	-1.42*	0.12	-1.68	-1.16
Connecticut	36	0.97*	0.09	0.79	1.14
Florida	24	1.18*	0.11	0.97	1.40
Georgia	5	-0.90*	0.12	-1.25	-0.55
Illinois	9	0.77*	0.19	0.33	1.21
Kentucky	16	0.19*	0.04	0.10	0.28
Massachusetts	43	0.75*	0.09	0.56	0.94
Maryland	28	-0.03	0.07	-0.17	0.12
Maine	13	1.26*	0.09	1.07	1.45
North Carolina	60	-0.40*	0.05	-0.51	-0.29
New Jersey	11	-2.11*	0.45	-3.12	-1.11
New Mexico	8	-2.73*	0.17	-3.14	-2.32
Nevada	12	0.68*	0.12	0.41	0.96
New York	18	-1.52*	0.12	-1.77	-1.27
Ohio	29	0.54*	0.07	0.40	0.68
Oklahoma	9	0.27*	0.09	0.06	0.48
Pennsylvania	28	0.57*	0.09	0.39	0.76

C. Non-high-cost loans

State	Months since law was effective	Mean (logarithm)	Standard error	95% confidence interval	
Arkansas	15	0.03	0.12	-0.23	0.30
California	27	0.19*	0.06	0.07	0.31
Colorado	21	0.34*	0.05	0.25	0.44
Connecticut	36	0.21*	0.04	0.13	0.28
Florida	24	-0.04	0.05	-0.13	0.06
Georgia	5	0.01	0.09	-0.23	0.26
Illinois	9	0.18	0.08	-0.01	0.37
Kentucky	16	-0.08	0.05	-0.19	0.02
Massachusetts	43	0.00	0.03	-0.05	0.05
Maryland	28	-0.56*	0.05	-0.66	-0.45
Maine	13	0.09	0.06	-0.05	0.24
North Carolina	60	-0.23*	0.02	-0.28	-0.18
New Jersey	10	-0.06	0.09	-0.27	0.15
New Mexico	9	-0.06	0.07	-0.23	0.11
Nevada	12	0.06	0.07	-0.09	0.20
New York	18	0.63*	0.09	0.44	0.81
Ohio	29	-0.20*	0.03	-0.25	-0.14
Oklahoma	9	-0.15*	0.05	-0.26	-0.04
Pennsylvania	28	-0.34*	0.03	-0.40	-0.28
South Carolina	9	0.10	0.05	-0.01	0.22
Texas	16	0.30*	0.08	0.12	0.47
Utah	9	0.12	0.08	-0.06	0.30

Table 3

Cumulative Actual and Predicted Originations in Post-Law Period in States with Statistically Significant Negative Prediction Errors

A. All subprime originations

State	Months since law was effective	Cumulative actual loans	Cumulative predicted loans	Estimated decline
California	27	209,584	246,977	-15%
Georgia	5	4,569	7,167	-36%
Kentucky	16	11,073	12,431	-11%
Maryland	28	41,661	62,363	-33%
North Carolina	60	61,673	78,068	-21%
New Mexico	9	2,379	3,525	-33%
Pennsylvania	28	51,823	55,378	-6%
South Carolina	9	6,595	7,451	-11%

B. High-cost originations

State	Months since law was effective	Cumulative actual loans	Cumulative predicted loans	Estimated decline
Arkansas	15	32	101	-68%
California	27	6785	27604	-75%
Colorado	21	244	909	-73%
Georgia	5	1409	3452	-59%
North Carolina	60	8675	11692	-26%
New Jersey	11	39	425	-91%
New Mexico	9	39	616	-94%
New York	18	778	3162	-75%
South Carolina	9	164	1063	-85%

C. Non-high-cost originations

State	Months since law was effective	Cumulative actual loans	Cumulative predicted loans	Estimated decline
Maryland	28	17398	29568	-41%
North Carolina	60	52998	65298	-19%
Ohio	29	24010	28884	-17%
Oklahoma	9	1613	1849	-13%
Pennsylvania	28	19375	26803	-28%