The Economic Effects of Legal Restrictions on High-Cost Mortgages

Jevgenijs Steinbuks*and Gregory Elliehausen†

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Abstract

We analyze the effects of HOEPA-like state predatory mortgage lending laws, which have been a model for recent changes in federal regulation enacted to regulate the mortgage contract terms common in higher-risk mortgage market segments. Using the Rothschild-Stiglitz approach to model credit markets under asymmetric information, legal restrictions are shown to reduce the use and attractiveness of mortgage credit. Consistent with model predictions, empirical results indicate that originations of regulated high-cost mortgages were significantly less than predicted in states with more restrictive laws. The difference of predicted and actual originations of high-cost mortgages in states with less restrictive laws was not significant. These differences were also not significant for non-high-cost originations across all states. Thus credit regulation was differentially associated with reduction in originations of high-cost mortgages, and non-high-cost lending did not consistently expand in areas where high-cost mortgages were restricted.

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*Purdue University. Corresponding author. Email: jsteinbu@purdue.edu
†Federal Reserve Board of Governors. Email: gregory.elluehausen@frb.gov

I. INTRODUCTION

The Dodd–Frank Wall Street Reform and Consumer Protection Act (Dodd–Frank Act) signed into law in 2010 in response to the financial crisis of 2007 – 2010 brought a significant change in the U.S. mortgage lending industry. The act introduced a number of restrictions that affected loan contract terms and provisions, previously widespread in the risky segments of mortgage lending market.[1] Among the most significant provisions were the "ability to repay" rule, the expansion of definition and restrictions of "high-cost" loans, and restraints on prepayment penalties.

The "ability to repay" rule prohibited creditors from making residential mortgage loans unless creditor was able to verify that consumer had reasonable ability to repay loan according to its terms. The Dodd–Frank Act defined "qualified mortgages" – the low-risk loans that met income documentation requirements and underwriting standards consistent with statutory and regulatory requirements. These qualified mortgages were presumed to meet "ability to repay" requirements. The rule has significantly impeded origination of non-qualified mortgage loans, and effectively banned low- and no- income documentation mortgages.

"High-cost" loans are defined and regulated by the Home Ownership and Equity Protection Act (HOEPA) signed into law in 1994. These loans are frequently alleged to be associated with abusive tactics and contract features, and so deserving of tighter restrictions than prime or lower-priced subprime loans (Bostic, Engel, McCoy, Pennington-Cross, & Wachter, 2008). The Dodd–Frank Act expanded coverage of HOEPA and imposed additional Truth in Lending disclosures and restrictions on contract terms for "high-cost" mortgages.

Prepayment penalties inhibit a borrower ability to prepay the loan. Lenders and investors in the mortgage market used this clause to manage the mortgage prepayment risk by charging fees when the mortgage is paid out before the due date in exchange for a lower contract interest rate at origination. Prepayment penalty terms were more common for subprime than for prime loans, and the refinance lock-outs were usually in effect for two to five years (Cutts and van Order, 2005). The Dodd–Frank Act prohibited prepayment penalties for "not qualified" mortgages and significantly restricted application of prepayment penalties to "qualified" loans.

It is well known in the economic literature that regulations imposing limits on loan terms and lending

[1] For a comprehensive analysis of Mortgage Related Provisions of the Dodd-Frank Wall Street Reform and Consumer Protection Act see Mortgage Bankers Association (2010).

practices may limit the ability of borrowers and lenders to make economically efficient lending decisions (Barth, Cordes, and Yezer, 1979, p. 101). This paper focuses on those regulations of Dodd-Frank Act enacted to deal specifically with the mortgage contract terms in high-cost mortgage market segment. Specifically, it shows how state predatory lending legislation, which has been a model for recent changes in federal regulation, affected the originations of subprime mortgages from 1999 (when the first state predatory lending law became effective) to 2004.[2] We develop a theoretical model to investigate the effects of prepayment restrictions on mortgage originations, one of the most significant provisions of Dodd-Frank Act affecting mortgage contract terms. We show that state predatory lending laws regulating prepayment penalties can be welfare-reducing. By limiting access to credit to high-risk subprime borrowers, they impede borrowers' effort to qualify for lower cost credit by improving credit scores. Then, using data on about five million subprime mortgages from eight 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 the need for arbitrary assumptions about provisions of the different state predatory lending laws. Our findings are consistent with expectations based on the theoretical model that restrictive state predatory mortgage lending laws reduced availability of subprime mortgage credit primarily in the high-risk segment of the market targeted by HOEPA-type laws. They further suggest that lower cost lending did not generally expand when high cost lending was restricted.

Our study is relevant to a number of earlier studies aimed at understanding theoretical and empirical effects of state predatory lending legislation. Ho and Pennington-Cross (2006a) argue that tightened underwriting standards and the increased cost of borrowing from state predatory lending laws result in reduction in subprime borrowing. They argue that these laws may reduce the number of fraudulent applications and reduce asymmetric information in subprime mortgage market. Bond, Musto, and Yilmaz (2009) demonstrate that predatory-lending laws restricting loan features such as prepayment penalties can be welfare increasing because they reduce the lenders' informational advantage for the refinancing of mortgages in the subprime

[2] This paper is only concerned with the effects of high-cost mortgage regulation. Sorting out the relative effect of high-cost mortgage regulation as opposed to other events causing the financial crisis of 2007-2010, such as e.g. 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.

market. The welfare effect is determined by the trade-off between reduction in availability of mortgage credit and increased transparency of subprime mortgage market.

Most empirical evidence concerns North Carolina's 1999 law, which was the first law to impose tougher standards than HOEPA (Ernst, Farris and Stein 2002; Burnett, Finkel, and Kaul 2004; Harvey and Nigro 2004; Elliehausen and Staten 2004; Quercia, Stegman, and Davis 2004). 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. More recent studies for other states or localities (DeMong 2004; Ho and Pennington-Cross 2005, 2006a, 2006b; Bostic et al. 2008) concluded 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 declined, particularly in areas with stronger laws. Limited or moderate laws appeared to change the composition of subprime lenders' portfolios but produced little change in the number of subprime originations, but laws with more severe provisions produced a decline in originations by subprime lenders. The changes appear to have occurred 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.

Our study is most closely related to previous studies of Ho and Pennington-Cross (2005, 2006a, 2006b) and Bostic et al. (2008). To measure the effects of laws, they devise indices of coverage and severity of restrictions and also enforcement in Bostic et al.[3] 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. A further limitation of all these studies is that they do not distinguish between effects on regulated high-cost loans and on unregulated non-high-cost loans. This limitation may be a factor contributing to sometimes inconsistent findings in existing studies. This study is the first one to distinguish effects of the laws on regulated high-cost and unregulated lower cost loans.

[3]Ho and Pennington Cross (2005) considers loans originated by lenders identified as subprime on the HUD list as subprime. Bostic et al. (2008) considers HMDA-reportable high-cost loans as subprime. Ho and Pennington Cross (2006a, 2006b) and Bostic et al. (2008) limit observations to metropolitan areas that cover different states. These studies also consider effects of state laws on interest rates using a different database.

The rest of the paper is structured as follows. Section II describes the various types of mortgage contract terms and the types of restrictions imposed by the Dodd-Frank Act. Section III presents a theoretical analysis of the effects of restricting prepayment penalties. Section IV presents the empirical framework for estimating the effects of state predatory lending laws on mortgage originations in high-cost and low-cost segments of subprime market. Section V presents the empirical estimates of these effects. The main conclusions are presented in section VI.

II. TYPES OF MORTGAGE CONTRACT TERMS AND CREDIT RESTRICTIONS

Table 1 lists and describes mortgage loan terms subject to regulation of the Dodd-Frank Act. These provisions can be broadly classified into three categories: (1) those that allow the borrower have lower mortgage payments at loan origination in exchange for higher payments in the future; (2) those that sort out across borrowers' with different credit risk profiles; and (3) those that impose additional charges or costs on borrower in prepayment or default. Examples of the first type are balloon mortgages, interest-only loans, and negative amortization loans. Examples of the second type are high loan-to-value loans, low documentation mortgages, and points and fees. Examples of the third type are late charges and prepayment penalties.

Before introduction of Dodd-Frank Act there were a number of both federal and state statutes that prohibited, limited, or discouraged application of these contract terms.[4] For example, balloon payments on high cost loans were fully prohibited in some states. In other states, balloon payments were restricted for high-cost loans with a short term to maturity. However, many states did not impose any restrictions on underwriting high-cost loans with balloon payments. Until recently, there has been considerable variation among the fifty states in which, if any, these contract terms were regulated and in the stringency of such regulations.[5] This state-to-state variation provides "experimental" data for this paper.[6]

The Dodd-Frank Act has significantly restricted these credit market instruments. The "ability to repay" rule made no- and low- documentation loans illegal. The high loan-to-value loans, interest-only mortgages,

[4] Before Dood-Frank Act become effective, in July 2008 the U.S. Board of Governors of the Federal Reserve System introduced similar restrictions on high-cost loans by amending HOEPA provisions. The amendments required lenders to verify a borrowers' ability to repay a loan, setting more extensive minimal documentation requirements, and banning prepayment penalties on higher-priced loans.

[5] For a comprehensive summary of state predatory lending legislation affecting mortgage loan terms, see Ho & Pennington-Cross, (2005).

[6] Ho & Pennington-Cross, (2006, p.211) argue that introducing predatory lending laws can be interpreted as a "natural experiment with well-defined control and treatment groups, [...] because state boundaries reflect political and not economic regions."

negative amortization mortgages, and almost all balloon mortgages were considered "non-qualified", i.e. not automatically meeting the "ability to repay" rule. This has considerably tightened the underwriting standards for these mortgages. The Dodd-Frank Act has also expanded the definition of "high-cost" mortgages, by lowering points and fees trigger and prohibited balloon payments and prepayment penalties on these mortgages. For qualified mortgages, prepayment penalties were restricted to non-adjustable interest loans, and three-year phase-out of prepayment penalties was required. Pyramiding of late fees was banned and late fees were limited to four percent of payment due on high-cost loans.

III. ECONOMIC EFFECT OF RESTRICTING PREPAYMENT PENALTIES

In this section, we develop a theoretical model to analyze the effects of restricting prepayment penalties, an economically significant component of state HOEPA-type laws, and Dodd-Frank Act. Prepayment penalties are important because substantial credit score migration contributes to high prepayment rates in subprime mortgage lending (Cutts and Van Order 2005). By making scheduled payments on time many borrowers were able to substantially improve their credit scores and qualify for lower cost mortgages. Numerous analyses have shown that prepayment penalties do deter prepayment in subprime market[7], and are an efficient means of sorting borrowers on prepayment risk.[8] Possibility of refinancing into lower cost mortgages was an important characteristic of subprime market.[9]

The two-period model used here is based on the Rothschild and Stiglitz (1976) framework to model mortgage-market equilibrium when borrower prepayment costs are private information,[10] and extends Brueckner's (2000) model of mortgage default under asymmetric information to prepayment case. Borrowers' ability to improve their risk profiles are largely their private information. A lender cannot sort borrowers according

[7] See e.g. Ho and Pennington-Cross (2006c), Danis and Pennington-Cross (2008), and Bhardwajy and Sengupta (2008).

[8] 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.

[9] Before the mortgage crisis, the literature on subprime mortgages emphasized the ability of lower credit-score borrowers to improve their credit scores and refinance into a lower risk loan (Cutts and Van Order 2005, Phillips-Patrick et al. 2000, for example). Adverse selection was a feature of this market: "Unlike prime mortgages, older subprime mortgages can be riskier because, absent other factors rare in the prime market such as prepayment penalties, they would have been prepaid had the borrower's credit improved (Phillips-Patrick et al. 2000, p.12)." As house prices continued rising rapidly through the early-2000s, borrowers with relatively high credit scores became more common in the subprime. These borrowers were subprime (or Alt-A) because they were seeking high LTVs and could only service the debt with an ARM (Corbae and Quintin 2011). Nevertheless, lower credit-score borrowers, FRMs, and loans without prepayment penalties retained a significant albeit smaller share of the subprime market toward the end of the house price boom (Chomsisengphet and Pennington-Cross 2006, Gerardi et al. 2008).

[10] This framework was also applied in mortgage market models by Yezer et al. (1994).

to their prepayment risk 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 enhancing optimal contracts. 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.[11]

A. Model Setup

We assume that a separate subprime market has arisen due to information asymmetry regarding credit and prepayment risks and significant underwriting cost (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.[12] 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.[13] 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 they know the distribution which is identical for all borrowers but they do not know the future realization

[11] 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.

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

[13] Courchane, Surette, and Zorn (2004) provide evidence consistent with our model's hypothesis that many subprime borrowers are subsequently able to qualify for lower risk loans. Using data on mortgage transactions compiled from public records, they found that 40 percent of borrowers whose previous mortgage was subprime (defined as originated by a lender designated as subprime in the HUD subprime lender list) currently had a prime mortgage.

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 value of B below which prepayment is optimal, depends on the level of prepayment costs. These costs, represented by C, include costs of improving credit history (e.g. finding a new job, cutting discretionary spending, or selling assets in response to an emergency), transaction costs of refinancing (prepayment penalties), the opportunity costs of the foregone default option[14], and costs associated with exogenous conditions affecting prepayment, such as unexpected change in income or moving out of the house[15].

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[16]. 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 $1 - B > 0$ [17] The model thus implicitly assumes that the borrower never exercises the default option[18].

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

[14] It will be seen later in the text that the default option is never exercised in this model.

[15] See Kau and Keenan (1995) for details.

[16] See Steinbuks (2008) to verify that prepayment condition (4) is optimal.

[17] 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).

[18] 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 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.

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

The discount factor is $\delta < 1$, and Y is the exogenous component of financial wealth, which equals initial assets plus the discounted value of income in all periods of life[19] 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 [20] The closing costs of the loan are for simplicity normalized to zero and are not included[21].

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

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

Condition (7) eliminates two trivial cases: (1) $B_1 - C > \overline{B}$, when prepayment always occurs, and (2) $B_1 - C < \underline{B}$, when the borrower never prepays.

The borrower's indifference curves and the lender's isoprofit curves given by (5) and (6) describe the trade-off between the contract characteristics L and B_1. Implicit differentiation of (5) and (6), and application of Leibniz rule shows that indifference curves are upward sloping, convex, and "horizontal parallel" having

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

[20] 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.

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

the same slope at a given B_1.[22] Lower curves correspond to higher utility levels. The indifference curves become flatter as the borrower's prepayment costs C and discount factor δ increase. The isoprofit curves are upward sloping, convex, and "horizontal parallel" having the same slope at a given L under assumption that $f^{'} \geq 0$.[23] Lower curves correspond to lower profit levels. It also worth noting that firm's profit increases as borrower's prepayment cost rise.

B. Equilibrium

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.[24]

Two borrower types. 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 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.[25]

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 (figure 1). 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,

[22] See Steinbuks (2008) for a formal proof.

[23] This assumption is necessary for model to be well behaved.

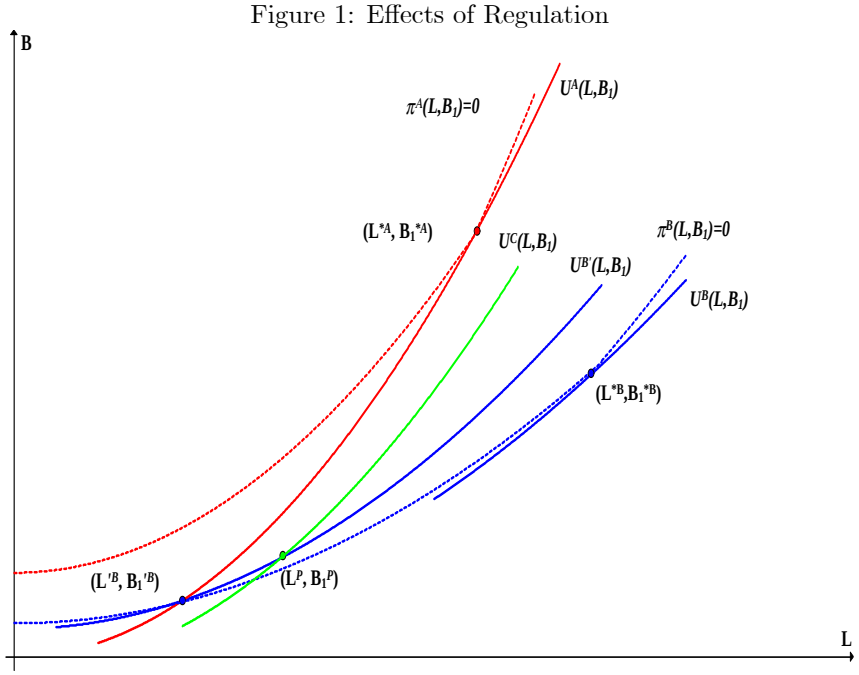
[24] Recalling that both indifference and zero-profit curves are convex, a tangency will be optimal only if the zero-profit curve is "more convex" than the indifference curves, e.g. $\left|\frac{\partial^2 U}{\partial B_1^2}\right| < \left|\frac{\partial^2 \pi}{\partial B_1^2}\right|$.

[25] 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.

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

First - best contracts. First-best contracts 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. 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 $\left(L^{*A}, B_1^{*A}\right)$.

Figure 1: Effects of Regulation



Second-Best Contracts. The problem with the first-best contracts is that 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.

In the presence of the asymmetric information, 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 (Stiglitz and Rothschild 1976).

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) 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. Because it lies above the type B zero-profit curve, it will earn a profit. Such contracts always exist because the type B indifference curves are flatter.

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

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

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

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

along with condition (ii) above. Equation (9) is the lender's participation constraint, which indicates that profit on both contract types is zero. Equations (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. 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 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.

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 1. If the contract were not at this tangency, alternate contracts lying above the zero-profit curve (thus earning a profit) 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 gains borrowers get from prepayment are higher than their prepayment costs. By offering a contract with a prepayment penalty, that has a lower contract interest rate, the lender ensures against the prepayment risk. As noted, the interest rate is defined by $1 + i_0 = \frac{B_1}{L}$ and in figure 1 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 are 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.[26]

The mortgage-market equilibrium shown in figure 1 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 their first-best contract, however. 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, type B borrowers cannot fully benefit from their favorable position, receiving instead a contract that is distorted to make it unattractive to the type A borrowers.

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.[27] 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, because 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 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

[26] Elliehausen, Staten and Steinbuks (2008) found that borrowers' choice of prepayment penalty can be predicted on the basis of variables hypothesized to affect their propensity to prepay.

[27] We tested this hypothesis on loan-level data from FSRP database by running a regression of the amount of points and fees on the dummy variable for loans with prepayment penalty, the dummy variable for states regulating prepayment penalties, the interaction of these two terms, and the time fixed effects. We found that on average, subprime borrowers could achieve 2.5 percent reduction in points by accepting prepayment penalty. We also found that the trade-off between points and prepayment penalties was about 10 times smaller in the states regulating prepayment penalties.

contract (with prepayment penalties) as type B borrowers. Type C borrowers, however, are more averse than type B borrowers 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 1 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. 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. To the extent that type C borrowers have lower incomes and fewer choices, 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.

IV. EMPIRICAL MODEL FOR MORTGAGE ORIGINATIONS

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 (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

Variables affecting supply or demand for subprime credit 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 discretionary income.

* Consumer debt per borrower (TransUnion LLC): [28] 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

[28] 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.

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.

Descriptive statistics for these variables are found in Table 2[29].

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[30] 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. Assigning values for the degree of restrictiveness and summing the assigned values to construct an index is arbitrary.

The state laws considered for this study became effective at different times over a five-year period from

[29] 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.

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

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 this study 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.[31] 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 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. In 2004 it accounted for nearly a quarter of the higher-priced home purchase and refinance loans that were required to report risk premiums under the HMDA (Avery, Canner, and Cook 2005). 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 non high-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. However, non high-cost lending may also be affected because some state laws have provisions that apply to non high-cost loans.

V. RESULTS

[31] For more detailed description of the FSRP dataset see Elliehausen and Staten (2001).

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.[32] Each of the three estimated equations are statistically significant and explain considerable proportions of the variation in pre-law originations[33]

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 3). 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. Estimated effects of the state laws vary substantially from state to state, but generally the states having negative prediction errors are states that have more restrictive laws. Comparing our results with Ho and Pennington-Cross's index we find that these states have about average (KY, MD, and SC) or above average (CA, GA, NC, and NM) index values in restrictiveness according to Ho and Pennington-Cross's index. Kentucky' law is above average in severity, and Maryland's law is above average in coverage according to Ho and Pennington-Cross.

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, suggesting that lenders in Colorado and New York may have shifted lending from covered high-cost loans to uncovered loans in response to these states'

[32] 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.

[33] 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.

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 4). 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 effect of HOEPA-like state predatory mortgage lending laws, which has been a model for recent changes in federal regulation enacted to deal specifically with the mortgage contract terms common in higher-risk mortgage market segments. Specifically, it shows how state predatory lending legislation affected the mortgage originations in high-cost and low-cost segments of subprime market. 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 investigate the 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: Effects of Legal Restrictions on Mortgage Loan Terms

Contract Term	Description	Qualified Mortgages	High-Cost Mortgages
Baloon Payment Mortgage	Mortgage amount is not amortized over the life of the loan, the remaining balance is due as a final repayment to the lender.	Balloon payments cannot be twice as large as average of earlier scheduled payments, except for balloon loans under specified circumstances.	Prohibits balloon payments
Low Documentation Mortgage	A mortgage that requires less stringent documentation of income and assets than full-documentation loans in exchange for a higher interest rate	Prohibited	
Interest-Only Mortgage	A mortgage whose scheduled monthly payment consists of interest only. The option to pay interest only lasts for a specified period, usually 5 to 10 years.	Not Qualified.	
Late Changes	Permit lender to collect charges in addition to normal finance charges if borrower is late in making mortgage payments	Pyramiding of late fees banned.	Limits late fees to four percent of payment due on high-cost loans. Pyramiding of late fees banned.
Negative Amortization Mortgage	A mortgage whose principal amount increases with monthly payments because the payment amount is less than the full amount of the interest.	Not Qualified.	Requires disclosure and counseling for first-time borrowers prior to consummation of loans with negative amortization secured by "dwelling."
Points and Fees	Up-front fees paid to the lender at closing to buy-down or lower your interest rate over the life of the loan.	Total points and fees payable in connection with loan should not exceed 3 percent of total loan amount.	Total points and fees payable in connection with loan exceed 5 percent of total loan amount (8 percent or $1,000 for loans under $20,000).
Prepayment Penalty	A provision in a mortgage contract that requires borrower to pay a penalty if the mortgage is prepaid within a certain time period.	Restricts prepayment penalties to loans that are not adjustable and do not have an APR that exceeds Average Prime Offer Rate (APOR) by 1.5 or more percentage points for first lien loans, 2.5 or more percentage points for jumbo loans, or 3.5 or more percentage points for subordinate lien loans. Also, requires three-year phase-out of prepayment penalties for qualified mortgages and prohibits offering loan with a prepayment penalty without offering loan that does not have prepayment penalty.	Prohibits repayment penalties.

Table 2: 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 3:

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

Note: * indicates statistical significance at 5% level.

Table 4:

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%