



**REGULATION OF SUBPRIME MORTGAGE PRODUCTS:
AN ANALYSIS OF NORTH CAROLINA'S PREDATORY
LENDING LAW**

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The Credit Research Center was founded in 1974 by Robert W. Johnson, Professor of Finance at Purdue University's Krannert Graduate School of Management. The Center's founding was an outgrowth of Dr. Johnson's services as presidential appointee to the National Commission on Consumer Finance in 1969. During its 3-year term, the Commission coordinated a massive research program to study the operation of consumer credit markets in the United States. Delivered to Congress in 1972, the Commission's multi-volume report established the value of academic research for guiding public policy toward markets for financial services. With a combination of foundation and corporate grants, Dr. Johnson established the Credit Research Center at Purdue University to provide an ongoing means of directing academic research expertise toward practical problems in consumer and mortgage credit markets.

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Introduction

The development of the subprime mortgage market in the 1990s expanded availability of mortgage credit to low-income and high-risk consumers, many of whom would previously have had difficulty qualifying for mortgage credit. For these consumers, subprime mortgage credit has provided access to home ownership and the opportunity to borrow against accumulated home equity. However, lending abuses have also occurred. For example, the imposition of high fees on subprime loans, sometimes in conjunction with repeated refinancings (loan “flipping”) of a loan within a short period of time have led to charges of “equity stripping,” as well as an increased risk of foreclosure. Because subprime loans may be used relatively more often by certain groups of borrowers considered “vulnerable” (e.g., lower-income and minority borrowers), the aggressive marketing of subprime loans to these groups has sparked proposals for increased regulation to curb “predatory lending.”

The federal Home Ownership and Equity Protection Act (HOEPA) typifies the prevailing regulatory approach to curbing predatory lending. Since its passage in 1994, HOEPA has classified mortgage loans with relatively high interest rates and fees as potentially predatory and imposed upon them a package of additional consumer protections, including disclosure requirements and limits on certain contractual features. However, in recent years many state and local governments have enacted or proposed their own regulations that impose even more restrictive regulation than does HOEPA.

The first statute below the federal level for regulating high-cost mortgage loans was enacted in North Carolina in July, 1999. North Carolina Senate Bill 1149 utilizes a definition for high-cost loans that covers more loans than the federal law, and its restrictions on such loans are more severe. All such regulations increase to some degree a lender’s cost of making high-cost mortgage loans to consumers. Economic analysis indicates that lenders would respond to higher costs by reducing the supply of mortgage credit.

The following sections test these implications by analyzing the impact of the North Carolina statute on the originations of subprime mortgage loans to North Carolina consumers. The results indicate that after accounting for a variety of factors that influence supply and demand, creditors appear to have sharply restricted lending to higher-risk customers in North Carolina—but not to customers in neighboring states or to lower risk customers in North Carolina—after passage of the law. The findings support the hypothesis that creditors rationed the highest risk customers in response to the higher costs imposed by the North Carolina anti-predatory lending statute.

These results are important because, as mentioned, many states and local governments have proposed laws containing provisions similar to and even more restrictive than those in the North Carolina law. The observed decline in North Carolina in response to the law suggests that adoption of this regulatory approach in other localities may take back some of the benefits of increased availability of mortgage credit that low-income and high-risk consumers obtained during the 1990s. The regulatory remedy to predatory lending may unintentionally harm many of its potential beneficiaries.

Background

A. HOEPA and the Cost of Subprime Lending Responding to reports that lending abuses were on the rise in the subprime mortgage market, in December 2000 the Federal Reserve Board (FRB) proposed revisions to Regulation Z that would expand the number of loans covered under HOEPA and introduce new restrictions on covered loans. At various times through the subsequent public comment period, the Board indicated that its proposal was intended to strike a balance between curbing a variety of abuses that have been termed “predatory lending” and impeding the general growth of the legitimate subprime mortgage market. In this regard, the federal regulators signaled an awareness that an overly-protective anti-predatory lending statute runs the risk of impeding the flow of subprime mortgage credit, thereby harming more people than it helps.

Recent events provide reasons to worry that broad expansion of HOEPA-style regulations could reduce the flow of credit to subprime borrowers. In response to state and local initiatives that impose HOEPA-like tests and restrictions on mortgage loans, several major lenders have announced a reduction or exit from the affected markets.¹ In the spring of 2000, Freddie Mac announced that it would not purchase any mortgage loan that triggers HOEPA disclosures and protections.² Fannie Mae has adopted a similar policy. Both actions sharply reduce the liquidity of HOEPA loans by truncating demand for such loans in the secondary market.³ This raises the cost to a lending institution of making such loans and would likely reduce a lender’s appetite for extending higher cost loans to higher-risk borrowers.

An FRB staff memorandum explicitly voiced the concern that further extension of HOEPA coverage “could have a chilling effect and raise regulatory costs in a segment of the subprime mortgage market. This might deter interest of some predatory lenders in the market. It seems unlikely this effect would be restricted to predatory lenders alone,

¹For example, see Erick Bergquist, “Industry Hits Back on Lending Abuse Laws,” *American Banker*, January 26, 2001, pp. 1,9; Helen Egger, Testimony on behalf of Equicredit Corporation before the Federal Reserve Board, July 27, 2000; Erick Bergquist, “Georgia Predator Law Drives Out Some Lenders,” *American Banker*, October 1, 2002 pp 1,12.

²See editorial by David A. Andrukonis, Chief Credit Officer, Freddie Mac, “Freddie Mac Defends Purchase of Subprime Mortgages,” *American Banker*, April 6, 2000, also available at www.freddiemac.com/news/analysis/ambankerlet.html.

³ Freddie Mac has taken a similar stance with respect to loans designated as “high-cost” loans under some state laws (e.g., Georgia), regardless of whether they are already classified as HOEPA loans. See Bergquist (2002), p 12.

however, and it could cause some potential legitimate competitors to forego entry into this market where competition currently is alleged to be low.”⁴

Regulations imposed by the HOEPA-style statutes typically prohibit certain contract terms (e.g., balloon payments, prepayment penalties, single premium credit insurance), mandate lending procedures (e.g., require that borrowers complete credit counseling), and impose documentation requirements (e.g., demonstrate that a refinancing provides a “net tangible benefit” to the borrower; document that the borrower has sufficient ability to repay the loan) on mortgage loans that have annual percentage rates or fees that exceed various threshold amounts. Such measures may or may not inhibit the abusive and deceptive marketing tactics that are frequently cited by victims of “predatory lending”, but they certainly raise the lender’s cost of making such loans. In particular, some of the documentation requirements may impose unacceptable risks of legal liability for some creditors (predatory and legitimate) who offer high-cost mortgage loans.⁵ Thus these measures risk restricting credit beyond those loans offered by predatory lenders. The impact on the supply of such mortgages depends on two components of the regulation, the pricing threshold values (expressed in terms of loan APR and fees) that determine how many loans will be designated “high-cost” loans and subject to coverage, and the stringency of the package of additional consumer protections triggered when the loan pricing exceeds the designated thresholds.⁶

B. North Carolina’s High-Cost Mortgage Law

In July 1999 the North Carolina General Assembly passed a law that was intended to reduce predatory lending by banning certain practices on all mortgage loans and creating a new category of high-cost mortgages subject to additional restrictions. The statute was enacted in phases. Some features became effective for loans originated on or after October 1, 1999.⁷ The rest of the anti-predatory features became effective on July 1, 2000.

The anti-predatory features included a HOEPA-like trigger mechanism for classifying closed-end mortgage loans as “high-cost” loans.⁸ Limits on the features of high-cost loans include the following:

⁴Durkin and Canner (2000), pp. 3-4.

⁵ For example, the Georgia predatory lending law which took effect on October 1, 2002 requires lenders to document that a refinancing of a loan less than five years old provides a “net tangible benefit” to the borrower. The *American Banker* reported that this provision convinced Ameriquest Mortgage Co. (Orange, CA), the nation’s seventh-largest subprime originator, to stop making all subprime loans in Georgia. Adam Bass, a senior vice president with Ameriquest commented on the net-tangible-benefit clause, “Nobody has explained that to me and I haven’t seen anything from the Georgia department of banking that defines what that is and how you comply.” See Bergquist (2002), p 12.

⁶ Because the more stringent anti-predatory lending laws could choke off mortgage credit at prices above the trigger thresholds, these laws have been described as “stealth” usury laws. See Calomiris (2001).

⁷ These features included a ban on prepayment fees on first mortgages less than \$150,000.

⁸ The “high-cost” loan triggers are exceeded if a loan meets any of the following criteria: 1) APR would qualify the loan for HOEPA protections, 2) points and fees exceed 5 percent of the loan amount for loans greater than or equal to \$20,000 or the lesser of \$1,000 or 8 percent of the loan amount for loans less than \$20,000, or 3) the loan allows for the assessment of a prepayment fee more than 30 months after closing.

- Lender must confirm that a borrower received home-ownership counseling prior to closing the loan
- Lender must document borrower’s ability to repay
- Limits on loan features include
 - No call provision
 - No balloon payment
 - No negative amortization
 - No increased interest rate as a consequence of default
 - No modification or deferral fees
- No financing of fees or charges if the borrower refinances a loan from the same lender.

In addition, for all mortgage loans (regardless of whether they are classified as high-cost) originated on or after July 1, 2000 the statute bans the financing of premiums on credit insurance (i.e., bans the sale of single-premium credit insurance) and also prohibits the refinancing of mortgage loans without demonstrating a reasonable, tangible benefit to the borrower.

These requirements impose more stringent restrictions on mortgage lenders than prevailed under the federal HOEPA rules at the time of passage. In essence, the “package” of restrictions imposed on high-cost mortgage loans in North Carolina raised lenders’ cost of servicing the higher-risk segment of the market by (1) limiting or prohibiting certain contractual features that could be used to mitigate or compensate for higher credit or prepayment risk, (2) imposing new disclosure or procedural requirements, and (3) expanding lender legal and reputational liability.

C. Prior Studies of the Impact of the North Carolina Anti-Predatory Lending Statute

To our knowledge, only two studies have been released that attempt to document the impact of the North Carolina statute on subprime originations. One is a study prepared by a North Carolina-based nonprofit advocacy group, the Center for Responsible Lending (CRL). That study claims to show that North Carolina’s 1999 anti-predatory lending law saved consumers \$100 million on home mortgages originated during the year 2000.⁹ The authors evaluated data reported under the Home Mortgage Disclosure Act (HMDA) from 1998- 2000 and concluded that subprime mortgage lending continued to “thrive” in North Carolina after passage of the statute and low-income borrowers continued “to have access to a wide range of choices when selecting a home loan.”

A careful review of the CRL report reveals a different story. The evidence presented does not support, and often contradicts, the report’s conclusions. All of CRL’s

Note that the statute protections triggered by designation as a “high-cost” loan apply only to closed-end mortgage loans, and do not apply to open-end, home equity loans.

⁹ Keith Ernst, John Farris, and Eric Stein, “North Carolina’s Subprime Home Loan Market After Predatory Lending Reform,” Center for Responsible Lending, Durham, NC, August 13, 2002.

conclusions regarding the volume and composition of subprime mortgage lending in North Carolina are based on simple tabulations of HMDA reports filed for 1998-2000. Notwithstanding the fact that HMDA data have serious weaknesses when used to analyze changes in the volume of *subprime* lending, the data actually show that the HMDA measure of subprime originations per capita declined in 2000, both for the U.S. in general and for North Carolina in particular. Indeed, the decline in North Carolina was larger than the decline in the U.S. average, hardly proof of a “thriving” subprime market.

Even more problematic is the fact that the HMDA data do not contain information on borrower risk characteristics. Consequently, the data cannot be used to detect shifts in underwriting guidelines that might have been triggered by the 1999 statute. As noted above, an economic model of a lender’s reaction to higher costs of servicing higher-risk borrowers (consequent to passage of the 1999 North Carolina statute) predicts that lenders would reduce the supply of loans to higher-risk borrowers. A lender could remain active in the subprime market, but set higher acceptance standards, so that borrowers judged to be higher-risk would be denied loans, even though borrowers with the same risk profile were accepted prior to the 1999 statute. Again, because it focuses on the number of originations, as opposed to the characteristics of borrowers, the HMDA database can’t be used to confirm or refute this prediction.¹⁰

In the other prior study on North Carolina (Staten and Elliehausen 2001) we compared year-to-year changes in the subprime mortgage originations of nine large finance companies between Q1 1998 and Q2 2000 in North Carolina and two neighboring states

¹⁰ Since the CRL report relies exclusively on HMDA data in drawing its conclusions, it is helpful to review the limitations of the data. First, HMDA data do not identify a particular mortgage loan as subprime. The Department of Housing and Urban Development (HUD) annually produces a list of lenders believed to be *predominately* subprime lenders. Researchers using the HMDA data must assume that all loans made by lenders on the HUD subprime list are subprime (although some of these lenders are known to make prime loans) and that no other lenders make subprime loans (although many lenders who are not considered *predominately* subprime lenders nevertheless make large numbers of subprime loans). Thus, analysis that relies on the HUD subprime lender list omits some subprime loans from other lenders and includes prime loans from listed lenders.

There are many institutions that are not required to report under HMDA, and their lending activity is not reflected in the HMDA data at all. During the period covered by the CRL study (1998-2000), a non-depository institution was required to report under HMDA only if its annual lending for home purchase and refinancing equals 10% or more of the dollar value of its loan originations (mortgage and nonmortgage). Many non-depository institutions (e.g., consumer finance companies) have long specialized in making loans of all kinds to “subprime” borrowers. Subprime mortgage loan originations from many of these companies are also missing from the HMDA database. As a consequence, use of the HUD subprime list in conjunction with the HMDA data produces, at best, a very rough approximation of subprime mortgage lending.

More importantly, the HMDA data do not include any information on loan pricing or borrower risk characteristics (other than income). Consequently, the HUD/HMDA subprime data cannot be used to identify the impact of changes in underwriting standards, e.g., tightening of credit to higher-risk borrowers. Of course, such changes are precisely the adjustments that subprime lenders would likely make when confronted with a new statute that imposes restrictions on high-cost loans.

that had not passed any legislation to curb predatory lending. The results suggested that something was affecting the volume and type of originations in North Carolina, relative to other states, following passage of the anti-predatory statute. For borrowers with incomes less than \$25,000, first mortgage originations fell precipitously in the fourth quarter of 1999 relative to the same quarter one year earlier, and the year-over-year decline continued through the end of the second quarter, 2000. Originations in South Carolina and Virginia did not display the dramatic decline in activity for these lower-income borrowers (*see* Chart 1). A similar pattern is evident for borrowers with incomes between \$25,000 and \$50,000. However, originations for the group of borrowers with incomes of \$50,000 - \$74,999 (Chart 2) and also for the group with incomes of \$75,000 and higher do not display markedly different patterns across the three states. These findings suggested that lenders may have scaled back their promotion of closed-end subprime mortgage loans in North Carolina simultaneous with the phased-in enactment of the law.

In the following sections we investigate more rigorously the effects of the North Carolina law. We develop and test an empirical model of the supply and demand for subprime loan originations, and apply multivariate statistical techniques to control for other factors that may have been influencing loan volumes. We utilize a large and unique database of closed-end subprime loans that contains sufficient borrower characteristics to test the hypothesis that closed-end mortgage credit was reduced for higher-risk borrowers.

The Model

We specify aggregate county-level supply and demand functions to test statistically for a decline in the volume of subprime mortgage loan originations in North Carolina following passage of the 1999 statute. We use a before-after comparison group design for the analysis. Comparison groups are counties in adjacent states (South Carolina, Tennessee, and Virginia). The comparison group counties permit stronger conclusions about the possible effects of the law (Phillips and Calder 1979, 1980). An observed decline in North Carolina originations can reasonably be attributed to North Carolina's high-cost mortgage law if declines are observed in North Carolina counties but not in the comparison group counties following passage of the law.

Demand and supply for subprime mortgage credit

The demand for subprime mortgage credit Q_{it}^D in county i in period t is a function of price, P_{it} ; income, Y_{it} ; existing debt, D_{it} ; house values, V_{it} ; percent of borrowers with flawed credit histories, H_{it} ; life-cycle characteristics of the population, L_{it} ; and market size (population) S_{it} . That is,

$$Q_{it}^D = f^D(P_{it}, Y_{it}, D_{it}, V_{it}, H_{it}, L_{it}, S_{it}) + e_{it}, \quad (1)$$

where e_{it} is a random error term.

Generally, we expect mortgage loan demand to increase with county-level average income. However, increases in demand for *subprime* credit likely become smaller at successively higher levels of income. Higher income borrowers typically accumulate larger amounts of savings and assets and become less vulnerable to financial distress. Consequently, with the resulting improvement in their risk profile they would become eligible for *prime* mortgage loans.

Subprime borrowers typically have high existing levels of debt, provide little equity, or have a history of repayment problems. We expect demand for subprime loans to increase with the level of existing debt. House value should be inversely related to demand for subprime mortgages because the pledge of collateral coupled with a higher probability of default makes the expected cost of default higher for the subprime borrower (Barro, 1976; Benjamin, 1978). And we expect greater numbers of borrowers with flawed credit histories to be associated with greater demand for subprime mortgages.

Consumers in early stages of the family life cycle tend to have strong demand for debt. Such consumers are generally relatively young and have children. They typically expect income to increase, as they have not yet reached peak earning years. For many such consumers the rate of return on household durables is relatively high, justifying the use of high-cost credit. Consequently, some early life-cycle borrowers may demand greater amounts of credit than allowed by mainstream creditors. Such borrowers may turn to subprime creditors. Thus, life-cycle borrowing should be positively related to demand for subprime loans.

The supply of subprime credit Q_{it}^S is a function of price; income; existing debt; house values; factor input prices, F_{it} ; regulatory structure, R_{it} ; and market size. That is,

$$Q_{it}^S = f^S(P_{it}, Y_{it}, D_{it}, V_{it}, F_{it}, R_{it}, S_{it}) + u_{it}, \quad (2)$$

where u_{it} is a random error term. Supply should be positively related to income and inversely related to the level of other debts because subprime creditors rely on periodic payments from current income to repay the debt. We expect supply to be positively related to the house value, as collateral can be sold to repay the loan. We expect supply to be inversely related to factor prices.

The regulatory structure proscribes or restricts mortgage terms and lending procedures for mortgage loans, and consequently influences the cost of extending credit. State laws dictate a large part of this regulatory structure and differ across state borders. In particular, North Carolina's high-cost mortgage primarily affects loans in the subprime market (i.e., those with APR and fees above the trigger thresholds). As this law imposes new restrictions on subprime lending and thereby raises costs, we expect that the law would reduce the number of subprime mortgages originated in North Carolina.

Because many lenders offer subprime mortgages we treat the subprime market as a competitive market, making Q_{it} and P_{it} endogenous. Solving equations (1) and (2) for Q_{it} produces the reduced-form equation

$$Q_{it} = f^*(Y_{it}, D_{it}, V_{it}, H_{it}, L_{it}, F_{it}, R_{it}, S_{it}) + v_{it} \quad (3)$$

for estimation.

Data, Hypotheses, and Estimation

Data

The data on the number of subprime mortgages are from a large and unique database collected for the American Financial Services Association (AFSA). In the summer of 2000, AFSA commissioned PriceWaterhouseCoopers (PWC) to collect loan-level data on subprime mortgages from nine AFSA member companies. All of the loans in the resulting data set are closed-end loans secured by residential real estate (either first or second lien). More specifically, the data set includes *all* such loans *originated* by the subprime divisions of the participating companies in the U.S. between July 1, 1995 and June 30, 2000; a total of 1,410,643 loans. Table 1 displays the number and average dollar size of these originated loans by year and type of lien. The originated loans in the data set include an aggregate loan volume of \$48.1 billion in first mortgages and \$15 billion in second mortgages.

How representative are these data of the subprime mortgage market? Statistics on the magnitude of the subprime market are limited. However, using data reported under HMDA, a joint study issued by the U.S. Departments of the Treasury and Housing and Urban Development reported that 790,000 refinancing loans were originated by subprime lenders in 1998.¹¹ By comparison, the AFSA database contains approximately 306,000 subprime loans originated in 1998. Since not all AFSA member companies are required to report under current HMDA rules, we do not know the extent to which the AFSA loans are counted in the loans reported under HMDA. Regardless, it is clear that the volume of subprime lending activity captured in the AFSA database is a substantial component of all subprime lending.¹²

The data include information on the loan terms, the location of the property, the characteristics of the borrower, and payment performance. Because the AFSA data set contains information on the Zip Code of the property securing the loan, it can be used to test for changes in the volume and characteristics of loans originated in North Carolina over time and relative to surrounding states.

¹¹U.S. Department of Housing and Urban Development and U.S. Department of Treasury, *Curbing Predatory Home Mortgage Lending: A Joint Report*, June 2000.

¹²Origination volume in the database for 1998 was equivalent to approximately 39% of the volume originated that same year by subprime lenders required to report under HMDA.

The analysis database for this paper includes all subprime mortgage loans in the AFSA database that were originated in four states (North Carolina, Virginia, South Carolina, and Tennessee) between the first quarter of 1997 and the second quarter of 2000, a total of 83,567 first mortgages and 60,944 second mortgages. Chart 3 shows the distribution of loans across states.

The data used for estimation of the empirical model form a cross-section, time-series panel. The dependent variable is the number of subprime mortgages originated in a county in a given quarter. The individual loans were aggregated to quarterly, county level data. We utilize observations from the first quarter of 1997 to the second quarter of 2000 in 366 counties for first mortgages and 363 counties for second mortgages. Variables were created for the total number of loans originated, the number of loans originated for borrowers with incomes below \$50,000, and the number of loans originated for borrowers with incomes of \$50,000 or more. There were 4,811 county-quarter observations for first mortgages and 4,553 county-quarter observations for second mortgages. Table 2 provides the mean and standard deviation of the quarterly county number of originations.

Table 3 provides the definition, sources, and descriptive statistics for the explanatory variables. Income is measured by county-level personal income per adult and the square of personal income per adult. Existing debt is measured by county-level nonmortgage debt per borrower. This variable was calculated using quarterly county-level aggregate data for nonmortgage debt from Trans Union, LLC's TrenData database.¹³ Average house value is estimated from county-level Census data for 1990 and Freddie Mac's quarterly state-level conventional home mortgage price index.

The model contains three credit history variables: the percentage of borrowers whose worst delinquency during the last 4 years was 30 to 59 days, the percentage of borrowers whose worst delinquency during the last 4 years was 60 to 89 days, and the percentage of borrowers whose worst delinquency during the last 4 years was 90 or more days. These data are quarterly county-level data from the TrenData database.

We include three variables reflecting life-cycle characteristics of the population. The relative number of consumers in early life-cycle stages is measured by the percentage of the population between 25 and 44 years of age. The prevalence of children is measured by the percentage of the population that is less than 16 years of age. Family size is measured by the average number of persons in the household. Factor price variables are average compensation for employees in financial firms and the three-month commercial paper rate paid for financial firms.

¹³ TrenData is a product of Trans Union, one of the three major U.S. credit bureaus. The database is based on a series of random large random samples of U.S. consumer credit histories drawn quarterly since 1992. Each quarterly sample contains approximately 30 million depersonalized credit reports. From this underlying sample, variables are built describing various borrowing and payment attributes of consumers aggregated to the county level.

As mentioned, the regulatory structure consists in large part of state regulations. These regulations affect credit costs, causing creditors' supply functions to differ systematically across the states. Accordingly, we model regulatory structure with state-specific dummy variables. The effect of North Carolina's high-cost mortgage law is modeled as a mean shift after passage of the law. Similar post-law variables were created for comparison-group states.

Hypothesis

We hypothesize that the provisions of the 1999 North Carolina anti-predatory lending statute made subprime mortgage lending more costly, especially for loans extended to high-risk borrowers. This would shift the supply curve for loans to such borrowers to the left, resulting in a reduction in the number of loans extended. We further hypothesize that, because the statute was phased in over 12 months, the effects of the regulation would be seen on originations before the final implementation date (July 1, 2000). Consequently, we expect the coefficient for the post-law dummy variable for North Carolina counties to be negative. We would not expect coefficients for post-law dummy variables for South Carolina, Tennessee, and Virginia counties to be negative or significant.

Admittedly, the window for detecting changes in lending patterns following passage of the North Carolina statute is narrow because the AFSA database contains loans originated through the end of June 2000, but not beyond. However, parts of the statute (most notably, the ban on prepayment penalties) became effective as early as October 1, 1999 and all of the new regulations were known as of July 1999. It seems reasonable to expect that creditors would not wait for the law to be effective to adjust their operations. Marketing expenditures affect revenues in both current and future periods. If the law makes high-cost mortgages more expensive and hence less profitable, the net present value of marketing expenses would decline, leading to a reduction in marketing efforts. Lower marketing expenditures would reduce current originations. Furthermore, an expected reduction in current and future originations would likely make some currently marginal offices unprofitable. All of this suggests that creditors would begin consolidating operations as soon as the information affecting expected future revenues becomes available. They would not wait for the effective date of the law.

Estimation by income groups permits additional tests of hypotheses about the impact of the North Carolina law. A law regulating high-cost mortgages would be expected to have a greater effect on the highest risk borrowers than on less risky subprime borrowers. Consequent adjustments should be observed for North Carolina counties but not in comparison-group counties.

Estimation

We estimate a population-averaged panel model using the general estimating equation extension of the generalized linear model (Liang and Zeger 1986; Zeger, Liang, and Albert 1988). The population-averaged model describes how the average response across

counties changes with the explanatory variables. The population-averaged model provides a response for a given explanatory variable that is directly estimated from the data without specific assumptions about the heterogeneity across individual counties in the population.

Let q_{it} be the number of originations and \mathbf{x}_{it} be a $p \times 1$ vector of fixed explanatory variables at time $t = 1, \dots, n$ for county $i = 1, \dots, m$. The model focuses on the marginal expectation

$$\mu_{it} = E(q_{it})$$

for the number of subprime originations. The model assumes that

$$h(\mu_{it}) = \mathbf{x}_{it}\boldsymbol{\beta} \text{ and } \text{var}(q_{it}) = g(\mu_{it}) \boldsymbol{\Omega},$$

where h is a link function, $\boldsymbol{\beta}$ is a vector of coefficients, and g is a variance function. A parameter $\boldsymbol{\beta}$ is the population-averaged response for a given explanatory variable value x_{it} .

To estimate regression coefficients, let $\mu_{it} = E(q_{it}) = [h^{-1}(\mathbf{x}_{i1}\boldsymbol{\beta}), \dots, h^{-1}(\mathbf{x}_{in}\boldsymbol{\beta})]$ and $\mathbf{A}_i = \text{diag}[g(\mu_{i1}), \dots, g(\mu_{in})]$. For independent observations, $\text{cov}(\mathbf{Y}_i) = \mathbf{A}_i \boldsymbol{\Omega}$. Since repeated observations for a county are correlated, let $\mathbf{R}_i(\boldsymbol{\alpha})$ be a “working” correlation matrix depending on an $s \times 1$ vector of unknown parameters. $\boldsymbol{\beta}$ is estimated by solving the generalized estimating equation

$$\mathbf{U}(\boldsymbol{\beta}) = \sum_i (\mathbf{M}_i \boldsymbol{\Omega}_i^{-1} \mathbf{V}_i^{-1}(\boldsymbol{\alpha})) (\mathbf{Y}_i - \boldsymbol{\mu}_i) = \mathbf{0},$$

where $\mathbf{V}_i(\boldsymbol{\alpha}) = \mathbf{A}_i^{1/2} \mathbf{R}_i(\boldsymbol{\alpha}) \mathbf{A}_i^{1/2}$ (see Liang and Zeger 1986).

Because the number of mortgage originations is a count (that is, a non-negative integer), we assume that the dependent variable has a negative binomial distribution, an extension of the basic Poisson distribution.¹⁴ Because observations are correlated over time, we also assume a first-order autoregressive structure for loan originations within a county. Except for the dummy variables, logarithms of the values of the explanatory variables were used for estimation.

We estimated this model using the total number of subprime mortgages as the dependent variable. We also estimated the model separately for first and second lien mortgages. In addition, we grouped each lien category into loans for borrowers with incomes less than

¹⁴ Negative binomial models for panel data were used by: Hausman, Hall, and Griliches (1984) for investigating the effect of research and development expenditures determinants of the number of patents filed by firms; and by Cameron, Trivedi, Milne, and Piggott (1988) for investigating the influence of health insurance choice on the use of specific medical services. The negative binomial model is less restrictive than the basic Poisson model, which assumes independence of events over time and equality of the conditional mean and variance of the dependent variable.

\$50,000 and loans to borrowers with incomes of \$50,000 or higher. Any rationing associated with North Carolina's high cost mortgage law should affect the lower income groups more than the higher income groups.

Results

A total of seven regression models were estimated. Table 4 contains estimates for three equations, one each for all mortgages, first mortgages, and second mortgages. Estimated equations for four additional equations (originated first and second mortgages to lower and higher income groups) are presented in Table 5. All estimated regressions are statistically significant.

To evaluate the "goodness of fit" of these models, we predicted values of each observation using the estimated coefficients of each regression model. The predicted values were then regressed on the actual values. The R-squared values provide an indication of the "goodness of fit" between the two sets of values. Over all subprime mortgages, the model accounted for 90.1% of the variation in the dependent variable. The predictions for first mortgages were somewhat better than those for second mortgages, 83.1% and 79.5%, respectively. The model explained between 76.2% and 81.2% of the variation in the number of subprime mortgages grouped by type of lien and income of borrower.

Supply and Demand Variables

Interpretation of estimated coefficients in reduced form models is not always clear because some variables are used in both supply and demand equations. Nevertheless, a few observations are possible. These observations support our hypotheses.

The coefficients for income and income squared are both significant. Income is positive, and income squared is negative. Thus, the number of subprime mortgages originated per period increases with income, but at a decreasing rate.

Nonmortgage debt per borrower has positive coefficients, but the coefficients are small and sometimes not statistically different from zero. The sign of the debt coefficients is consistent with the demand hypothesis. That is, borrowers with high demand for debt would be expected to turn to the subprime market when they desire leverage beyond that allowed by mainstream creditors.

Coefficients for delinquency are positive. The variables capturing the percentages of borrowers in a county with less serious delinquencies (delinquencies of 30-59 days and 60-89 days), are small and not statistically significant. In contrast, the variables representing the percentage of borrowers with serious delinquencies (90 days or more) are both large and significant. These results suggest that the subprime market is indeed dominated by lending to credit-impaired consumers who would have difficulty obtaining mortgage loans from mainstream, prime lenders. The proportion of consumers with less

serious delinquencies, who might obtain credit from mainstream sources, does not have a significant effect on the aggregate number of subprime loans in a county.

Of the three variables reflecting characteristics associated with heavy life-cycle borrowing, the percentage of the population 25 to 44 years of age and the percentage of the population less than 16 years of age have negative signs, contrary to our expectations. The percentage of the population is generally not significant, however. In contrast, the average size of households is positive and significant. These findings suggest that it is large family size rather than the relative frequency of consumers in the early life-cycle group that stimulates the demand for subprime credit. Large family size is likely correlated with the rate of return on household durables, making use of high-cost credit by such families more likely to be economical.

Of supply variables, employee compensation is positive, but not generally significantly different from zero. The commercial paper rate is generally negative, consistent with our expectations, and significant.

Regulatory Structure and North Carolina's High-Cost Mortgage Law

Across the entire observation period, the results for the state dummy variables indicate that the number of subprime mortgages originated in counties in South Carolina, Tennessee, and Virginia were either lower or not significantly different from that in counties in North Carolina. Differences may result from differences in regulatory structure or perhaps other factors not accounted for by the supply and demand variables not included in the model.

The state dummy variables for loans originated in the fourth quarter of 1999 and later indicate that the subprime originations in North Carolina were significantly lower, relative to the other states. The size of the coefficient indicates that originations in North Carolina were 14% lower in the Q4 1999 to Q2 2000 period than the earlier period.¹⁵ Originations of both first and second mortgages were lower. First mortgages originated by the lender were 27 % lower, and second mortgages were 5% lower than the earlier period. This is consistent with the hypothesis that North Carolina's high cost mortgage law increased the cost of originating subprime mortgages.

The likelihood that the effect observed in North Carolina was the result of the law as opposed to some other factor is suggested by the coefficients for the other states in the fourth quarter or later. Dummies for originations in the fourth quarter of 1999 and beyond in South Carolina, Tennessee, and Virginia are either positive or not significant.

The likelihood that the results for North Carolina are attributable to the law and not some other, unidentified factor is further supported by the regressions for lower and higher income groups. The coefficient for NC1 is negative and significant for first mortgages and negative but not significant for second mortgages to lower income borrowers. The

¹⁵ The percentage change in the dependent variable due to a dummy variable equaling one rather than zero is $\exp(\beta) - 1$, where β is the coefficient of the dummy variable (see Cameron *et al.* 1988).

size of estimated coefficients indicates declines of 27% and 5%, respectively, from the Q1 1997 to Q3 1999 period. In contrast, the coefficients for NC1 are positive and significant for both first and second mortgages to higher income borrowers. These results are consistent with the hypothesis that the higher costs of North Carolina's high-cost mortgage law make the highest risk loans unprofitable and cause creditors to ration high-risk consumers. That this effect is attributable to the law is again supported by the coefficients for the other states in the fourth quarter or later. SC1, TN1, and VA1 are positive or not significant for first and second mortgages in both lower and higher income groups.

Further evidence supporting the hypothesis that the decline in originations impacted higher-risk borrowers is displayed in Charts 4 and 5. Chart 4 shows the risk score distribution of subprime loans in the AFSA database that were originated in North Carolina during two periods. One period spans the first quarter of 1997 through the third quarter of 1999, immediately prior to the implementation date of the first set of new regulations under the North Carolina anti-predatory statute. The second period includes originations during the fourth quarter 1999 through the second quarter 2000. In this database the risk score is a statistical index calculated by Fair, Isaac and Co (FICO score), the largest risk scorecard supplier in the U.S. A low FICO score signals a higher-risk borrower. The risk distribution of originated loans shifts notably toward lower risk (higher-score) borrowers in the period after the North Carolina law began to be implemented. This shift is statistically significant. In contrast, Chart 5 reveals a much smaller shift away from higher-risk borrowers in the comparison states over the same period.

Additional data suggest that the pricing of these loans reflects the underlying risk. This should not be surprising to economists, but has often been challenged by activists who allege that one of the symptoms of predatory lending in a locale is the lack of correlation between price and borrower risk. They argue that vulnerable and inexperienced borrowers are steered by predatory lenders into loans that are overpriced relative to the borrower's risk profile. Presumably, a law that succeeded in driving out predatory behavior would alter the underlying pricing structure, restoring a positive relationship between risk and the risk premium. One observable implication of their hypothesis would be a shift in the pricing structure of subprime loans following the North Carolina statute to yield a stronger correlation between price and underlying borrower risk.

However, we observe in the database that the average risk premium, defined as the difference between the annual percentage rate and the interest rate for a Treasury security with a comparable term to maturity, declines as the FICO score increases both before and after the North Carolina statute (Chart 6). A positive relationship between risk and risk premiums is evident in both the Q1 1997-Q3 1999 and the Q4 1999-Q2 2000 periods in North Carolina, as well as in the comparison group states. The level of average risk premium in North Carolina and the comparison group states, for loans with scores in the same FICO risk category, differs by no more than about 50 basis points during either period. Consequently, these data do not suggest that the fundamental pricing structure of subprime loans in North Carolina was altered, relative to surrounding states, as a

consequence of the statute's attempt to drive out predatory lending, at least among the nine large lenders represented in the database. This casts further doubt on activist claims that the decline in lending observed in North Carolina following the passage of the anti-predatory lending statute resulted entirely from squeezing out predatory lending.

Conclusions

The decline in the number of closed-end mortgages originated by nine major national lenders in North Carolina following passage of its anti-predatory lending law was significant and large. Overall, the number of subprime mortgage originations declined about 14%. The magnitude of the decline in the number of first mortgages to lower-income borrowers was equal to 27% of quarterly county originations before the law. The magnitude of the decline in the number of second mortgages to lower-income borrowers was equal to 5% of quarterly county originations before the law. Significant declines occurred only in North Carolina and only among the lower-income borrowers. Neither the higher-income borrowers in North Carolina nor borrowers in the other states experienced significant declines. These observations are consistent with the model's prediction that a law raising the cost and risk of making "high-cost" loans would reduce the availability of credit, particularly among the least creditworthy consumers.

One question that remains open for further research is whether lenders in North Carolina adjusted to the new law by shifting higher-risk closed-end applicants to open-end loans. Open-end mortgage loans were not covered by the 1999 statute. Normally, an open-end loan product (essentially, a line of credit) is reserved for lower-risk customers. However, it is possible that lenders could devise an open-end product that remained exempt from the statute but also had sufficient price and risk-mitigation features to make it a feasible alternative for higher-risk borrowers who would formerly have received closed-end loans. We intend to address this question in the future, provided that we can obtain additional data on open-end lending activity.

Given that the declines in closed-end subprime mortgage lending in North Carolina counties (relative to other states) were found only in the higher-risk segment of the market, it appears unlikely that they result solely from declines in abusive or predatory lending. Moreover, the annual percentage rates on loans in the database before and after passage of the North Carolina statute broadly reflected the loans' risk, as they do in surrounding states. Borrowers with higher incomes and higher FICO scores generally had lower annual percentage rates. Consequently, we conclude that the North Carolina statute did impede the flow of mortgage credit to higher-risk borrowers, and any reductions in predatory lending were achieved at the expense of many legitimate loans.¹⁶

¹⁶ Some observers may adopt a paternalistic view that high-cost mortgage lending is harmful *per se* and that high-risk borrowers should not be allowed to obtain mortgage credit in the market. An anti-predatory lending statute like North Carolina's could be intended to prevent higher-risk borrowers from incurring risky debts no matter how large the potential benefits might be (although it would also make it more difficult for borrowers who have had financial problems in the past to improve their credit histories). Proponents of this view might consider the decline in originations to higher-risk borrowers in North Carolina a positive development.

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Chart 1
Year-over-Year Change in Originated Loans
First Liens: Borrower Income < \$25,000

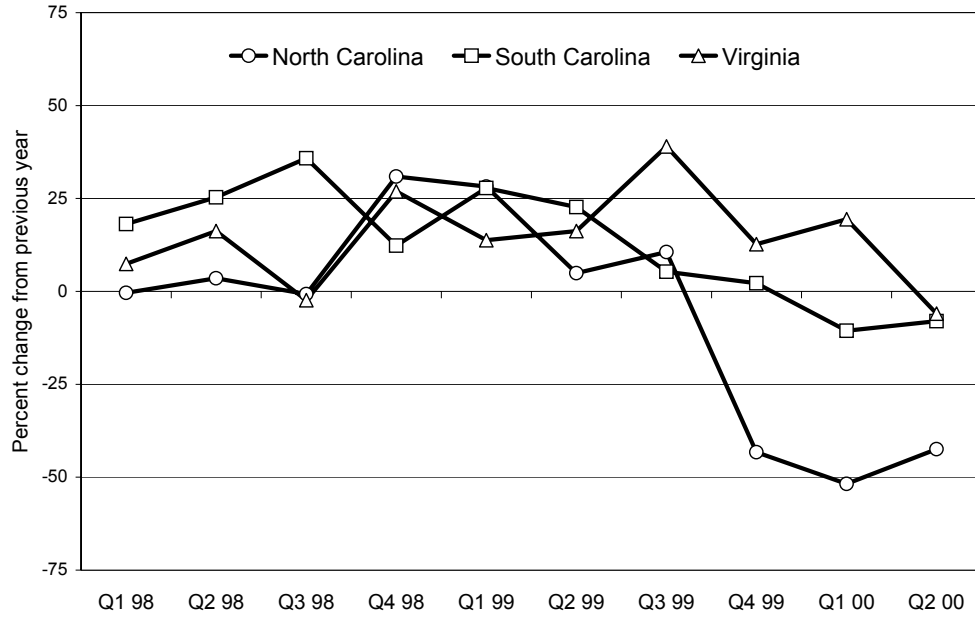


Chart 2
Year-over-Year Change in Originated Loans
First Liens: Borrower Income \$50,000-\$74,999

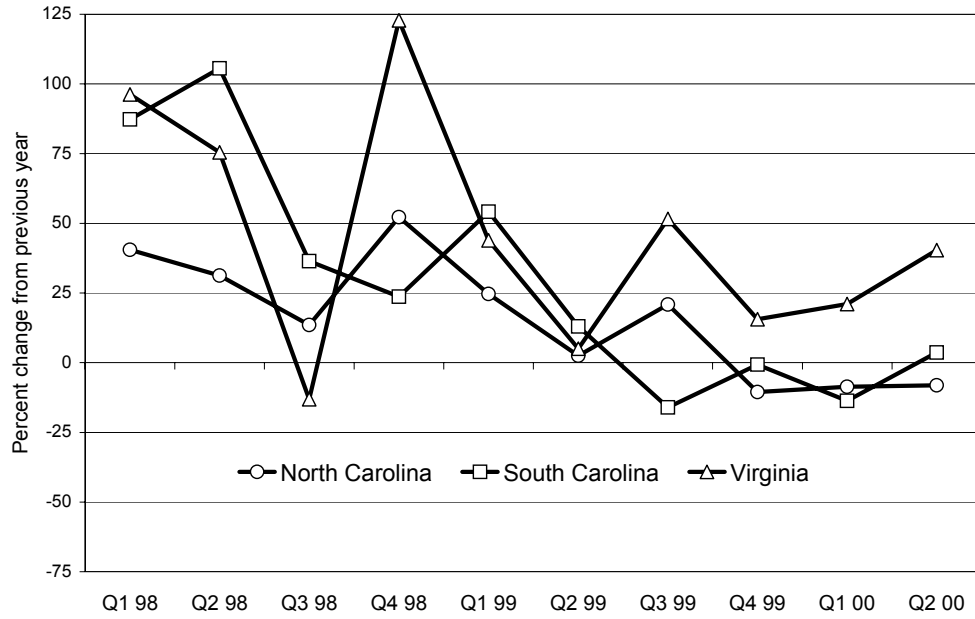


Chart 3
Number of Mortgages Originated,
by State and Lien Type

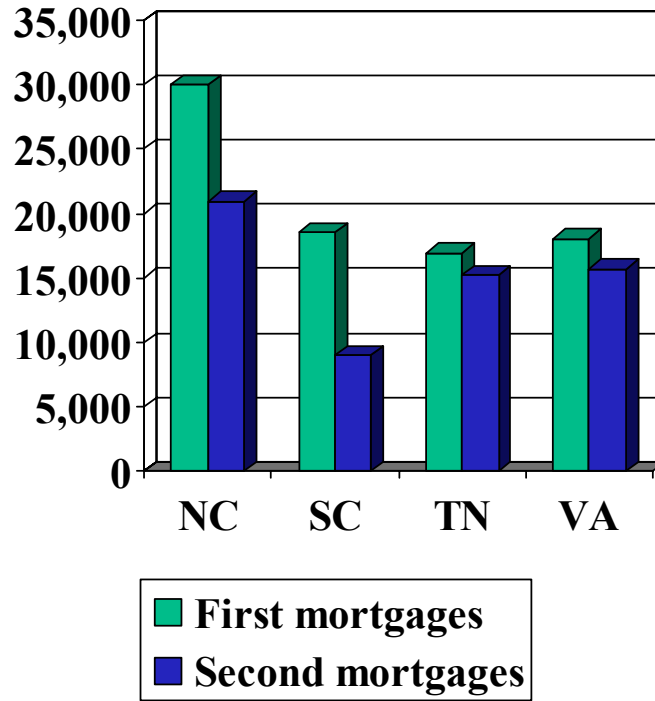


Chart 4
Distribution of First Mortgage Originations
in North Carolina, by FICO score

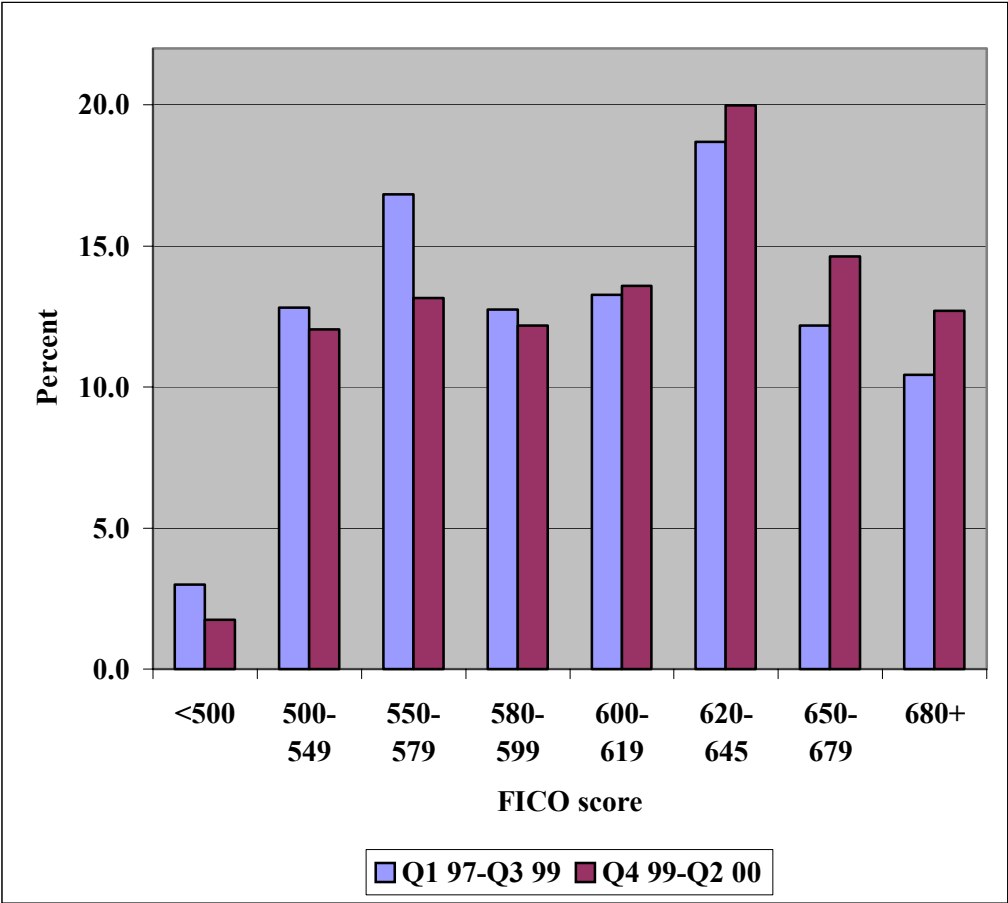


Chart 5 Shift in Distribution of First Mortgage Originations In North Carolina vs. Comparison Group States

(Change in percent of loans in each FICO score category after October 1, 1999)

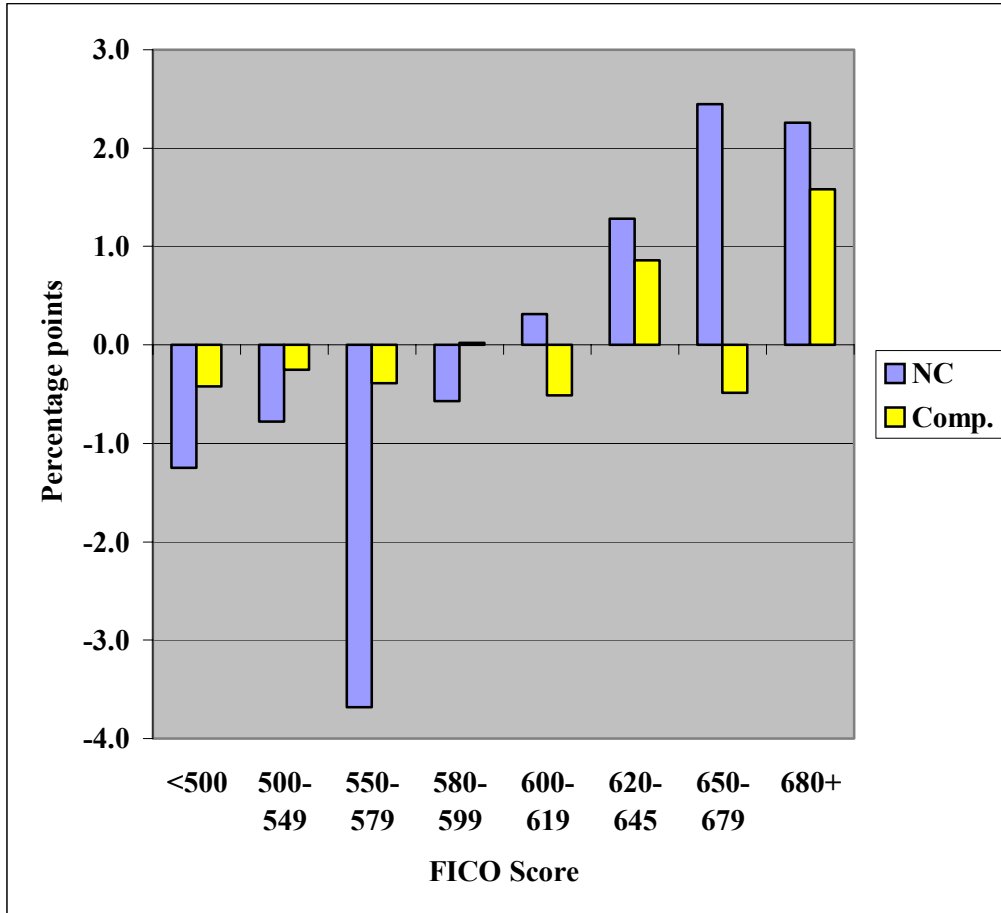


Chart 6
Mean Risk Premiums in North Carolina
and Comparison Group States,
by FICO score

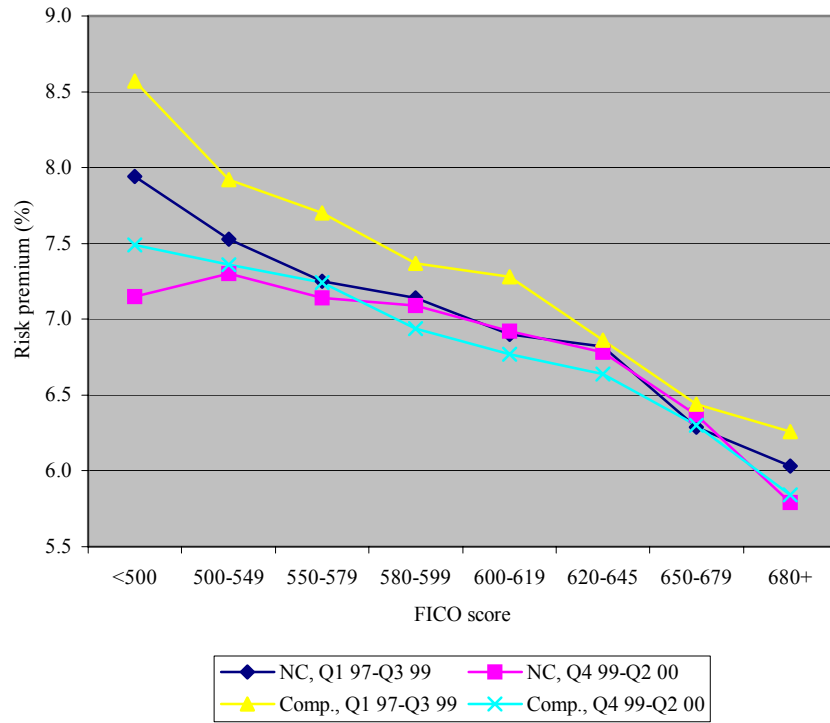


Table 1: Number and Average Dollar Size of Originated Loans, by Type of Lien

Year	First Mortgages		Second Mortgages	
	Number	Average Loan Size (dollars)	Number	Average Loan Size (dollars)
1995 (Q3 and Q4)	26,339	\$45,445	49,023	\$18,858
1996	90,275	52,462	100,865	19,426
1997	134,256	58,859	119,200	21,056
1998	168,282	68,184	138,187	23,561
1999	204,542	72,335	172,981	22,354
2000 (Q1 and Q2)	104,566	74,085	102,127	24,313
All Years: (July 1, 1995-June 30, 2000)	728,879	65,962	681,764	22,023

Table 2: Descriptive Statistics for Dependent Variables
(Number of loans)

	<u>Mean</u>	<u>Standard deviation</u>
All	50.265	78.709
Originated		
First lien	17.096	23.508
Second lien	13.160	20.052
First lien		
Lower income	13.998	18.747
Higher income	2.605	4.749
Second lien		
Lower income	9.624	14.227
Higher income	3.035	6.418

Table 3: Descriptive Statistics for Explanatory Variables

		<u>Mean</u>	<u>Standard deviation</u>
<i>Demand and supply variables</i>			
PI	Personal income per adult, \$000 (BEA and Census)	28.246	6.414
NMD	Consumer debt per borrower, \$000 (TrenData, BEA, and Census)	15.999	3.150
HV	Average house value, \$000 (Census and Freddie Mac)	91.248	35.459
L30	Borrowers ever 30-59 days past due in last 4 years, % (TrenData)	14.453	1.457
L60	Borrowers ever 60-89 days past due in last 4 years, % (TrenData)	6.504	.859
L90	Borrowers ever 90 or more days past due in last 4 years, % (TrenData)	29.914	6.234
P<45	Population 25-44 years of age, % (Census)	29.431	2.903
P<16	Population under 16 years, % (Census)	21.541	2.482
NHH	Average household size (Census)	2.496	.144
W	Average compensation per employee in financial firms, \$000 (BLS)	33.411	9.281
R	3-month commercial paper rate for financial firms, % (FRB of St Louis)	5.483	.410
POP	Total population, 000 (Census)	68.741	106.561
<i>State and regulatory change dummy variables</i>			
NC	North Carolina	.280	.449
SC	South Carolina	.133	.340
TN	Tennessee	.246	.431
VA	Virginia	.340	.474
NC1	North Carolina, Q4 99 or later	.059	.235
SC1	South Carolina, Q4 99 or later	.028	.166
TN1	Tennessee, Q4 99 or later	.054	.226
VA1	Virginia, Q4 99 or later	.074	.261

Table 4: Regression Results

	<u>All loans</u>	<u>First lien</u>	<u>Second lien</u>
PI	6.409** (1.170)	10.859** (2.052)	9.650** (2.797)
PI ²	-.805** (.250)	-1.557** (.306)	-1.341** (.426)
NMD	.057 (.031)	.074 † (.044)	.019 (.053)
HV	-.031** (.098)	-.550** (.121)	-.156 (.129)
L30	.170 (.109)	.103 (.125)	-.075 (.146)
L60	.089 (.071)	.040 (.075)	-.101 (.093)
L90	.674** (.120)	.615** (.125)	.419** (.146)
P<45	-.348 (.279)	-1.002** (.301)	-.565 (.355)
P<16	-1.188** (.339)	-.961** (.340)	-.719 † (.422)
NHH	2.118** (.586)	.777 (.662)	2.138** (.789)
W	.014 (.318)	.008* (.043)	.049 (.049)
R	-.408** (.121)	-.789** (.145)	.473** (.171)
POP	2.118** (.586)	.899** (.050)	.996** (.061)
SC	-.171** (.061)	-.074 (.065)	-.339** (.074)
TN	-.293** (.051)	-.557** (.063)	-.135 † (.070)
VA	-.122** (.067)	-.264** (.065)	-.094 (.072)
NC1	-.146** (.034)	-.270** (.049)	-.093 † (.049)
SC1	.026 (.036)	.097* (.046)	-.050 (.055)
TN1	.110** (.041)	.190** (.043)	-.047 (.046)
VA1	.027 (.047)	.186** (.044)	.136** (.052)
Constant	-15.494** (3.163)	-22.827** (3.572)	-20.587** (5.033)
P ²	4,741	3,358	3,086
R ² (%)	91	84	79

** / * / † Significant at the 1% / 5% / 10% level. Standard errors are in parentheses.

Table 5. Regression Results, by Borrower Income Groups

	Lower income, <u>first lien</u>	Lower income, <u>second lien</u>	Higher income, <u>first lien</u>	Higher income, <u>second lien</u>
PI	11.565** (2.586)	12.043** (3.756)	19.407** (2.732)	12.973** (3.254)
PI ²	-1.687** (.390)	-1.722** (.578)	-2.698** (.395)	-1.812** (.485)
NMD	.089 † (.053)	.004 (.064)	.173 † (.103)	.144 (.119)
HV	-.675** (.133)	-.388** (.147)	-.071 (.280)	.638** (.168)
L30	.170 (.142)	-.301 (.177)	.369 (.280)	.168 (.307)
L60	.032 (.084)	-.130 (.112)	-.259 (.188)	-.410* (.196)
L90	.565** (.139)	.319* (.158)	1.271** (.217)	.853** (.213)
P<45	-1.148** (.345)	-.483 (.409)	-.244 (.406)	-.601 (.460)
P<16	-.871* (.384)	-.629 (.445)	-1.283** (.473)	-.871 (.546)
NHH	.164 (.716)	1.285 (.818)	2.915** (.798)	3.886** (.981)
W	.063 (.045)	.043 (.053)	.160† (.093)	.129 (.095)
R	-.772** (.154)	.239 (.185)	-1.665** (.294)	-1.147 (.339)
POP	.886** (.058)	.981** (.072)	.815 (.106)	.839** (.129)
SC	-.049 (.068)	-.223** (.075)	-.184 † (.100)	-.434 (.091)
TN	-.563** (.067)	-.036 (.714)	-.490** (.085)	-.102 (.088)
VA	-.296** (.070)	-.081 (.076)	-.107 (.084)	.047 (.098)
NC1	-.318** (.051)	-.048 (.056)	.226** (.088)	.598** (.076)
SC1	.106* (.050)	.001 (.057)	.301** (.085)	.339** (.109)
TN1	.172** (.046)	-.014 (.052)	.552** (.083)	.240** (.082)
VA1	.194** (.050)	.162** (.061)	.507** (.083)	.673** (.085)
Constant	-22.752** (4.406)	-23.283 (6.698)	-47.535** (5.063)	-39.468** (6.109)
P ²	2,727	2,312	3,143	3,399
R ² (%)	82	76	76	78