

**BILATERAL IMPLICIT TAXES AND  
ANTI-COMPETITIVE BANKING REGULATION**

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## **Abstract**

This paper examines how banks impound implicit taxes into loan interest rates. Economic theory predicts that the most flexible party bears the least tax cost. We hypothesize that mortgagors, being geographically fixed, are less flexible than banks and bear greater implicit tax costs, and that this effect diminishes when, after the 1994 Riegle-Neal Interstate and Branching Efficiency Act, banks competed across state lines. Using data from 1977 to 2004 on banks' and mortgagors' state and federal taxes and detailed loan-specific data on mortgage originations, we investigate how interest rates vary separately with banks' and mortgagors' taxes. We find that mortgage rates vary positively with both banks' tax costs and the value of mortgagors' interest tax deductions. These findings are consistent with banks both passing on their tax costs to borrowers and capturing portions of borrowers' tax benefits. The estimated annual magnitude of this tax shift is \$23 billion, which we find declined after 1993 by approximately 40 percent.

# **BILATERAL IMPLICIT TAXES AND ANTI-COMPETITIVE BANKING REGULATION**

## **1. Introduction**

This paper uses detailed data on home mortgage loan originations and banks' and households' state and federal taxes to examine how implicit taxes are bilaterally impounded into home mortgage interest rates and how this tax shifting varies with anti-competitive banking regulation (i.e., the 1994 Riegle-Neal Interstate and Branching Efficiency Act). We use the term implicit taxes to mean the variations in the prices of goods and services resulting from the taxes on a transaction being levied on one or another party to that transaction. This is consistent with several papers, such as Maydew (2001, p. 396), who states, broadly, "... 'implicit taxes' was popularized by Scholes and Wolfson to describe the phenomenon where tax favored assets bear lower pretax returns than tax disfavored assets."

Banks' taxes vary across time and state, which banks shift onto borrowers to the extent possible by increasing interest rates on tax-disfavored investments. Households enjoy a tax benefit, i.e., principal residence mortgage interest deductibility, that varies across time and state, a tax-favored asset, the benefit of which banks also capture to the extent possible. Prior to the 1994 Riegle-Neal Interstate and Branching Efficiency Act, interstate banking was restricted or disallowed by a patchwork of state laws, possibly creating state-specific bank oligopolies by artificially restricting the quantity of mortgage lenders. If so, then this regulatory system increased banks' power both to shift tax costs to parties with whom they contracted and to capture their tax benefits. If permitting banks to compete across state lines

reduced the degree of state-specific oligopoly, then it increased banking industry competitiveness, reduced banks' contracting power,<sup>1</sup> and mitigated such tax shifting.

Examining data from 1977 to 2004, we find considerable support for the proposition that banks both shift their tax costs onto mortgagors and take significant portions of the value of their mortgage interest benefit. This finding is consistent with our conjecture that the inherently local nature of the home mortgage market and banks' regulatory environment provide them with greater contracting power than mortgagors, as described below. This hypothesis is further supported by the reduction in tax shifting we find after anti-competitive banking regulation is reduced. Specifically, our primary tests find home mortgage interest rates increasing with banks' tax rates, consistent with banks shifting these costs to mortgagors, and also find these interest rates increasing with the value of mortgage interest deductions, consistent with banks capturing a portion of mortgagors' tax benefits.

Our tests also find after Congress changed the law to permit interstate branch banking that banks appear to shift less of their taxes and mortgagors appear to keep more of the value of their interest deductions, consistent with the allowance of interstate branch banking leading to a more competitive banking industry. There have been conflicting arguments on the potential impacts of deregulation on competition in the banking industry. Proponents of restrictions on interstate banking have raised concerns about excessive concentration once entry barriers are lifted and small banks are acquired by large banks. For example, Pilloff (2004) directly associates competition levels with the number of competitors, and argues that lifting restrictions on interstate banking results in acquisitions, which, in turn, reduce the

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<sup>1</sup> We use the term "contracting power" to stand for the factors that make it possible for one contracting party to influence price more strongly than another, such as relative elasticity of demand and supply, informational advantages, and oligopolistic market structure.

number of providers of financial services available to consumers, thus eliminating competition. Proponents of deregulation, on the other hand, argue that elimination of interstate banking restrictions would increase competition. In his comments submitted to the Board of Governors of the Federal Reserve System, Assistant Attorney General to the Department of Justice Antitrust Division, R. Hewitt Pate, argues that the repeal of prohibitions on interstate banking has tended to erode banks' monopoly power in traditional products, and many local markets are more competitive with the growth of interstate banking after legislatively imposed barriers to entry decreased. Consistent with this view, in his testimony to the Committee on Banking, Housing and Urban Affairs of the U.S. Senate, Vice Chair of Washington Mutual also argues that interstate banking has improved competition by easing access to financial products in otherwise underserved markets, which provides consumers with financial products at more competitive prices. Our study provides evidence on this debate by examining how tax shifting changes with banking deregulation. Our finding of decreased tax shifting is consistent with deregulation increasing the banking industry's competitiveness, and, also, shows a decrease in consumers' mortgage interest rates as a result.

We estimate the typical annual amount of change in mortgagors' interest rates from implicit taxation to be about 21 basis points. This amount is split between banks capturing mortgagors' interest deduction benefits, approximately 10 basis points, and banks shifting their tax costs onto consumers, 11 basis points. This estimate is small relative to the interest on a typical individual loan. For example, if a 30-year, \$100,000 mortgage bore interest of 6 percent absent implicit taxes, then with implicit taxes the rate would be 6.21 percent. This is likely less than the amount most consumers would notice (and, perhaps, is one reason it takes place). The resulting additional payment would only be about \$13 more per month, with

additional interest of about \$200 in the first year, \$852 in the first five years, and \$4,651 over the life of the loan. However, the home mortgage market is quite large, around \$11 trillion. Projecting the 21 basis point estimate onto the value of the mortgage market suggests that the magnitude of this tax shifting is approximately \$23 billion per year. To provide some scale for this value, consider that as the aggregate value of mortgagors' federal mortgage interest deduction is estimated to be \$72 billion (Jackson 2005) banks' tax shifting can reduce it by more than 30 percent. Removing anti-competitive restrictions from the banking industry is estimated to have reduced this shifting by approximately 8 basis points, or about 40 percent. However, substantial shifting appears to remain.

In the spirit of Scholes and Wolfson (1992), our tests consider both of the parties to the mortgage loan transaction, both parties' state and local income taxes arising from the loan, and the non-tax factors used in prior research examining the determinants of mortgage interest rates. Our analyses are intended to contribute to the understanding of the effects of taxes on business transactions in several ways. First, we address the question of how loan interest rates implicitly reflect the contracting parties' taxes and to what extent. This issue lies in the implicit tax research area, which examines how taxes are impounded in the prices of assets with tax favored (or disfavored) returns. One advantage of our study is that we examine a contracting setting where differential contracting power is predicted, and is predicted to change over time. This allows us to develop specific hypotheses about how tax costs are shared and about how this sharing changes with changes in markets' competitiveness.

Second, we consider the bilateral, or joint, effects of the contracting parties' differing tax situations. Prices are set in transactions between two or more parties, and considering all parties to the transaction can yield more accurate and convincing evidence as well as a more

complete understanding of the process. For example, if our study had ignored mortgagors' tax benefits and only considered banks' tax costs, then, to the extent mortgagors' and banks' state and federal tax rates are correlated, we would have miscalculated the extent of their tax shifting. Also, ignoring mortgagors' taxes would mean that we failed to incorporate and test the interesting theory that not only can parties pass on their own tax costs, but, given sufficient contracting power, they can also capture others' tax benefits.

Third, we examine how well-intended government regulation can have unintended consequences by restricting competitive markets. Though our study does not consider the numerous benefits suggested for limiting banking competition to the state or local level, and is unable to investigate its net benefit, we are able to comment on one of its costs; how the resultant oligopolistic contracting power enables banks to favorably shift taxes between themselves and the parties they contract with. Although we document the effects of this anti-competitive regulation only for the mortgage market, we expect that a similar effect is pervasive in all contracts to the extent that they are inherently local.

Fourth, we incorporate both state and federal taxes in our analyses. This refinement greatly increases the strength of our study, as state taxes vary substantially over time and across geographic area for both banks and mortgagors. Fifth, we improve our understanding of the workings of the banking industry and the process by which home mortgage interest rates are set. Sixth, we provide estimates of the magnitudes of the implicit tax costs of one of the largest and most important financial markets in the world. Finally, we shed light on the extent to which a costly government subsidy, home mortgage interest deductibility, which is intended to promote housing, is going to the intended parties, and how other state and federal regulation interacts in the market to facilitate or thwart that intent.

Our sample consists of several elements. First, we have Federal Housing Financing Board (FHFB) proprietary, individual, loan-specific mortgage data consisting of dates, interest rates, geographic locations, and the factors commonly used in setting interest rates for such loans. Second, we have National Bureau of Economic Research (NBER) state-year specific estimates of the average (and maximum) marginal values of mortgage interest deductions for state and federal tax purposes based on actual tax returns. Finally, we have banks' publicly-available statements of financial condition which report, among other things, their state and federal income taxes. We match these data sets on a state-year basis and combine them with publicly available data on T-bill rates and state-year-specific economic indicators, GDP and unemployment rates, to investigate the determinants of mortgage interest rates. Prior papers have examined banks and their taxes, the distribution and value of the mortgage interest deduction and their effects on the housing market, and the determinants of mortgage interest rates. We draw on this work to design controls for the non-tax factors in our models. However, none of the prior literature of which we are aware examines how the contracting parties' taxes implicitly affect these interest rates or uses measures of such shifting to evaluate the competitiveness of the banking industry and how government regulation may have affected it.

The balance of the paper is structured as follows: Section 2 describes related research and our contribution to the literature, Section 3 describes the institutional background, Section 4 formally develops the hypotheses, Section 5 describes the empirical tests, Section 6 describes the sample and data, Section 7 sets out the results, Section 8 discusses robustness tests, and Section 9 concludes.

## 2. Related Research

As discussed in Shackelford and Shevlin (2001) implicit taxes are an important issue in the area of tax and accounting and are examined by accounting researchers in a variety of settings. Though the major focus of much of this work is on how the tax costs of the parties to a transaction affect asset returns and prices, the question of whether and to what extent taxes are impounded into the costs and benefits of market-determined transactions is not well resolved.

Guenther (1994) examines how T-bill spreads change during times of tax law changes and Erickson and Maydew (1998) and Atwood (2002) similarly examine how preferred stock prices react to tax law changes. Dhaliwal et al. (2004) examine how the prices paid to acquire hospitals vary between purchases of taxable and non-taxable entities, and find that higher prices are paid for taxable entities, consistent with buyers having to compensate sellers for some portion of their taxes arising on account of the purchase. Ayers et al. (2004) examine how the structure of mergers and acquisitions vary with shareholder taxes, and find that as tax rates increase, the probability of a tax-free form increases. They also find that corporations “time” the completion of acquisitions to coincide with the timing of tax law changes. Atwood (2003) examines the implicit tax effects evident in municipal bonds and is able to create more refined tests by also considering a hybrid instrument, what she denominates the AMT (Alternative Minimum Tax) bond, which is free from regular income taxation, but subject to AMT taxation, to triangulate her tax estimates.

Erickson and Wang (1999) is unusual in that they have micro-level data for their study of how tax benefits in a stock repurchase were shared between Seagram and DuPont Corporations. They were able to generate good approximations of these values because of the

detailed financial statement notes about the transaction. Though they find substantial tax sharing, because it is a single, jointly coordinated, transaction between two related companies, they cannot generalize this result to the broader setting of implicit taxes in markets.

Shackelford (1991) examines a setting where banks lending to Employee Stock Ownership Plans (ESOPs) could enjoy a tax exclusion of one-half their interest income from the ESOP loan. He finds that banks set interest rates on such loans so that they retained between 21 percent and 33 percent of the value of the interest exclusion, which, consistent with the formation of tax clienteles, was concentrated in high-tax-rate banks that derived the most financial benefit from the income exclusion.

Hayn (1989) examines pre-Tax Reform Act (TRA) 1986 acquisitions and finds that target and bidders' returns vary with the tax attributes of the target firm. Henning and Shaw (2000), examining the affect of allowing a deduction for goodwill, finds increased purchase prices in transactions producing greater amounts of goodwill.

The results of papers in this area are often inconsistent. For example, Engel et al. (1999) find little tax effect in examining Trust Preferred Securities (TRUPS), even though there appears to be material tax dollars available. Guenther (1994) finds a very small effect to sometimes-substantial tax changes.

Our paper contributes to this literature in several ways. Most importantly, because we examine the correlation between widely varying tax rates and mortgage interest rates, we can reliably attribute our observed effects to tax shifting as opposed to other, unknown, transaction costs. By examining the taxation of all the parties to the contract we avoid possibly spurious estimates and provide more reliable evidence about the implicit tax effects. We study a market where we can draw on economic theory to hypothesize that differential

contracting power exists and to predict how it varies between the parties and over time. These variations strengthen our tests' inferences and provide interesting, detailed insights into the mechanisms forming and supporting the existence of implicit taxes.

Examining mortgage loans provides three benefits. First, the existence of an extensive literature on mortgage interest rates' determinants means that the factors used to price mortgage loans are well known. This permits us to control for the many relevant non-tax factors so as to better isolate the tax effects and provide more reliable and more accurate estimates.

Second, we have an extensive set of observations with which to work. Our sample contains approximately five million loans and thousands of bank-years' data. Though our primary tests conservatively use only the state-year changes in the median (maximum) loan and the median banks' tax rates, (1,377 observations) the substantial numbers of observations with which the medians (maximums) are determined make them precise and robust estimates.

Finally, the public policy implications of our paper are substantial in that mortgage loans are held by millions of people, are issued by thousands of business enterprises, and represent trillions of dollars of transactions. For example, the value of U.S. home mortgages stands at about \$11 trillion; the interest on this balance is estimated at \$1 trillion, and the value of just the federal tax benefit to home mortgage interest is estimated at around \$600 billion over the twenty-year sample period (Ling and McGill 1992) and the effect we document is approximately 30 percent of this value. Though we examine how banks price home mortgages, because this data is available, the inferences we draw are equally applicable to all forms of contracts, to the extent that natural and legislative barriers to entry restrict competition.

### **3. Institutional Background**

#### 3.1 BANKING REGULATION, TAXATION AND COMPETITION

As discussed in Beatty and Harris (2001a), under the 1994 Riegle-Neal Interstate and Branching Efficiency Act, interstate banking can be undertaken with branches or subsidiaries. Prior to this act, state law restricted interstate banking, virtually prohibiting all interstate banking with subsidiaries until 1985 and all interstate branching until 1993. During the late 1980s many states allowed bank multistate holding companies to operate across state lines, though each bank they held was restricted to operations in a single state. For example, as of January 1991, 32 states allowed national interstate banking and 16 others allowed some regional banking. Thus, before 1994 interstate banking was restricted in many states and allowed in a few. Making the issue more complex is the fact that the allowances were sometimes cross-linked, for example, some states allowed foreign banks only from certain other states. However convoluted the regulation of interstate banking was before 1994, the ability of banks to compete across states lines became both generally more extensive and more uniform after the passage of the law.

Banks, like other business entities, pay both federal and state income taxes, and a major element of banks' taxable income is their interest income. While federal income tax regulations and rates are uniformly applied across states and, therefore, only vary across time, state income taxes vary widely from state to state as well as across time. This greater variation should make our statistical tests more powerful than if only federal income taxes were considered.

The number of bank and thrift organizations has been declining since the removal of restrictions on geographical expansion.<sup>2</sup> A large majority of merger transactions that took place between 1994 and 2004 involved a target that operated in a single state, resulting in an increase in interstate banking and concentration in the banking industry at the national level (Federal Reserve Board Staff Study 2004). Whether this structural transition would improve or reduce competition at the local level has been at the centre of a lingering debate.

One view is that deregulation and interstate banking would erode banks' monopoly power in traditional products, improve competition and provide consumers with financial products at more competitive prices. Increased concentration at the national level does not necessarily increase concentration at the local level because bank mergers after deregulation mostly occurred across states, not within states. Concentration in local markets has actually declined since the mid-1990s in both urban and rural local markets. Thus, competition in banking is “fought on the battlefield of the local market”.<sup>3</sup> As a result of deregulation, local banks face competition from large banks in a larger number of local markets, and many nonbank enterprises (credit unions, securities firms, and loan production offices from out-of-market lenders) are allowed to provide loans and other services that were once mainly offered by traditional banks. Consequently, in their ex post assessments of the effects of deregulation and interstate banking, proponents argue that interstate banking resulted in lower loan rates, higher deposit rates, and easier access to banking and related services.<sup>4,5</sup> Increased

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<sup>2</sup> An examination of data from the Federal Reserve Board and Federal Deposit Insurance Corporation reveals that the number of bank and thrift organizations was slightly over 10,000 in 1994, and dropped below 8,000 by 2005. Further analysis shows that the number of multistate organizations more than doubled from 1990 to 2005.

<sup>3</sup> From the remarks by former Chairman Alan Greenspan before the Independent Community Bankers of America Convention, San Diego, California (March 17, 2004).

<sup>4</sup> For further examples of excerpts from regulators that support interstate banking, see comments of R. Hewitt Pate, the Assistant Attorney General to the Department of Justice Antitrust Division, submitted to the Board of

competition is also expected to lead to efficiency gains in banking, and result in financial products and services at more competitive prices. This expectation has been phrased along the lines of the efficient-structure hypothesis (Demsetz 1973). Increased competition through deregulation should drive value-maximizing managers to seek greater efficiencies through consolidation if there are economies of scale or scope to be gained. Thus, allowing interstate banking would allow better performing (more efficient) banks to expand at the expense of poorer performers<sup>6</sup>, and the transition from a suboptimal scale to an optimal scale reduces costs.<sup>7</sup> The Branching Efficiency Act would also allow banks to convert their subsidiaries into branches, eliminating overhead costs. (Laderman and Pozdena 1991). These efficiency gains would, in turn, be passed on to consumers, resulting in lower loan rates. While few prior studies document evidence supporting increased efficiency after deregulation, there is no direct evidence of banks passing these gains on to customers.<sup>8</sup> Jayaratne and Strahan (1997) estimate that the ratio of noninterest expenses to assets would have fallen from 3.5% to 3.3% during their sample period (1978-1992) if branching had been permitted, which, in turn, would have reduced loan rates from 11.5% to 11.1%.

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Governors of the Federal Reserve System in 2003, and the testimony of the Vice Chair of Washington Mutual to the Committee on Banking, Housing and Urban Affairs of the U.S. Senate in 2004.

<sup>5</sup> See the statement of John P. LaWare, a member of the Board of Governors of the Federal Reserve System, before the Subcommittee on Financial Institutions Supervision, Regulation and Deposit Insurance of the Committee on Banking, Finance and Urban Affairs, U.S. House of Representatives, in 1993.

<sup>6</sup> Consistent with this expectation, Jayaratne and Strahan (1997) report that the market share of high profit banks increased from 51.3% to 59.8% after branching deregulation.

<sup>7</sup> Randall Kroszner, a member of the Board of Governors of the U.S. Federal Reserve System, states (2006): "After the removal of barriers to the geographic expansion of banks, the United States experienced substantial gains in terms of banking efficiency....Regulatory changes appear to have led to meaningful improvements in the efficiency of banks, reductions in costs....These cost reductions led, in turn, to lower prices on loans, although deposit interest rates changed little....Before regulatory reform, well-run banks faced binding constraints on the markets in which they could operate. When these constraints were lifted, however, assets were reallocated toward more-profitable banks as they gained the opportunity to increase market share, largely by acquiring less-profitable banks".

<sup>8</sup> Jayaratne and Strahan (1997) and Black and Strahan (2001) show that banks' noninterest costs, wages, and loan losses all declined in the aftermath of branching reform.

A second view on the competition effects of deregulation and interstate banking is that once entry barriers are lifted, bank consolidations would result in excessive concentration through acquisitions. This excessive concentration would limit the range of choices available to consumers, make the banking industry less competitive, which, in turn, would lead to higher loan rates. Policymakers and regulators have often expressed such concerns.<sup>9,10</sup> These ex-ante evaluations of interstate banking were consistent with the structure-conduct-performance hypothesis, which states that concentration would lead to increases in market power and reductions in competition (Mason 1939; Bain 1956). Empirical findings of a number of studies provide support for the concerns about lifting the geographical restrictions in the banking industry. For example, Kahn et al. (2005) report an increase in personal loan rates of between 11.9 and 14.5 basis points with a 100 point increase in the Herfindahl-Hirschman Index.<sup>11</sup>

Prior studies establish a link between competition levels and loan rates, but they do not provide direct evidence of the impact of deregulation on loan rates. Our study first identifies banks' tax costs and consumers' tax benefits as determinants of loan rates, and then directly examines how deregulation has affected the association between these tax variables and loan rates. More specifically, we show how this legislation has affected the extent to which banks pass their tax costs onto loan customers and capture customers' tax benefits, and measure the effect of this legislation on the magnitude of implicit taxes embedded in loan prices.

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<sup>9</sup> Bernard Sanders, Vermont Congressman and a member of the U.S. House's Banking, Finance, and Urban Affairs Committee at the time when the Committee was reviewing the Riegle-Neal Act of Interstate Banking and Branching Efficiency Act, states: "The legislation favors the likes of Citibank, the Chase Manhattan interests, and other mega-billion dollar banking interests over the consumers who will be forced to pay usurious interest rates".

<sup>10</sup> In a written statement submitted to the Federal Deposit Insurance Corporation in 2005, the National Association of Realtors also argues that acquisition of in-state banks by out-of-state banks reduces the number of providers of financial services that are available to consumers and eliminate competition.

### 3.2 HOMEOWNERS' STATE AND FEDERAL TAXATION

Federal tax law permits the deduction of principal residence mortgage interest, as do some states. The amount of this deduction for federal and state purposes varies across time as well as across states. Some states allow a full deduction and some allow no deduction. Obviously, mortgagors in states without an income tax have no state benefit. Also, the value of this deduction varies in detailed ways across taxpayers within a state, and is a complex function of household composition, federal tax itemizing versus taking a standard deduction and myriad other factors. The best data in this area would incorporate all of these features.

Individuals' tax return data is proprietary information. However, the NBER has access to individuals' actual, as-filed state and federal tax return data, which reflect reported combinations of income, deductions, etc., and the state, year, and federal variations in tax rules and regulations. While detailed data is not released to the public, it is publicly provided as summarized tax data files. This study utilizes the panel of state and federal tax data that contains, among other things, annual state-specific average (maximum) marginal<sup>12</sup> values of state and federal mortgage interest tax deductions, based on panels of actual tax returns from 1979 to 2004, and projected figures for 1977 and 1978.

## 4. Hypotheses Development

Basic economic theory predicts that changes in taxes will be borne most heavily by the least flexible party to the transaction (Harberger 1962). This theory is well-received and has become the standard model for investigating how tax changes are shared between contracting

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<sup>11</sup> Berger and Hannan (1997) and Hannan (1997) also show that small business and consumer loan rates increase with market concentration, measured with the Herfindahl-Hirschman Index.

<sup>12</sup> This is the value of a tax deduction from one additional dollar of mortgage interest.

parties. See, for example, Ke, et al. (2000) where the authors state that tax effects are expected to vary with the parties' elasticity. Consistent with this, partial equilibrium analyses generally find that the party bearing the implicit tax cost is the one who is least able to change his behavior (Zodrow 1999). We hypothesize that banks are considerably more flexible than mortgagors for several reasons. First, mortgagors' borrowing is undertaken for the purchase of principal residences. Presumably, this choice is inflexible as to geographic location. Second, the banking market is localized, potentially limiting the supply of lenders. As discussed above, for a considerable time banking was restricted to state and local markets by law, and we hypothesize that the relaxation of these restrictions made the banking industry more competitive and reduced banks' ability to shift taxes to borrowers.

However, even if banking were not restricted by law, lenders may have greater contracting power than mortgagors. This follows for two reasons. First, banks may have greater flexibility in how they raise and allocate their capital. On the input side, banks have flexibility as to their capitalization in that they can choose, within capital-constraint limits, the level of borrowing they undertake. Thus, they may minimize their excess capital, allowing them greater flexibility about the amounts they want to invest. On the output side, banks also have flexibility in that they may choose any of a variety of investments to undertake. As seen in Beatty and Harris (2001b), banks may invest in a wide variety of securities as well as commercial loans instead of home mortgages.

Second, features of the banking market may make it inherently local, naturally limiting the supply of lenders. For example, Harris and Sansing (1998) show that local informational advantages can affect firms' capital structures. This reasoning suggests that local informational advantages may also inherently limit competition in the mortgage market to

firms with a physical presence in the geographic area of the property securing the mortgage. This can arise because of the need to evaluate property-specific (as opposed to borrower-specific) information that is difficult to acquire without a long-term local physical presence such as knowledge of: pricing of comparable properties, local costs of construction and renovation, neighborhoods, planned development, state and local property and mortgage default enforcement laws and regulations, locations of adverse and beneficial commercial enterprises, qualities of school districts, crime patterns, zoning laws, the quality of mortgage appraisers, etc. If the costs of reliable local agents are too high, due to any of a number of agency problems, then such local informational advantages may raise the cost of market entry sufficiently so as to restrict the supply of lenders, even in the absence of statutory restrictions. Finally, the remaining, substantial, state and federal banking regulation may continue to impede banking industry competitiveness. These considerations suggest that even after the relaxation of artificial regulatory restrictions on the supply of mortgage lenders, banks will still bear less of their own tax costs and capture some portion mortgagors' tax benefits, but to a lesser extent than before the regulatory change.

The issue of how taxes are shared between firms and consumers in non-competitive markets has been examined by a number of analytical and empirical papers. Several review papers digest these studies and provide overviews of their key findings. Zodrow (1999) notes that these studies support the proposition that in non-competitive industries firms pass greater amounts of their taxes onto consumers. A similar conclusion is voiced in a Congressional Budget Office study and literature review (1996) of tax incidence. Most recently, Auerbach (2006) describes the economic theory behind the conclusion that in perfectly competitive markets firms pass no taxes onto consumers and that as markets become non-competitive that

firms pass taxes onto consumers, possibly even exceeding the amount of the taxes paid by the firms.

Thus, we form following hypotheses:

HYPOTHESIS 1. *Mortgagors bear implicit tax costs from banks' taxes.*

HYPOTHESIS 2. *Mortgagors bear implicit tax costs from their mortgage interest tax deductions.*

HYPOTHESIS 3. *Relaxing state regulation of interstate banking increases banking industry competitiveness.*

HYPOTHESIS 4. *Mortgagors' implicit tax costs decline with banking industry competitiveness.*

## 5. Empirical Tests

We test our first two hypotheses with the following model:

$$\begin{aligned} \Delta RATE_{it} = & \alpha_0 + \alpha_1 \Delta FEES_{it} + \alpha_2 \Delta SIZE_{it} + \alpha_3 \Delta TERM_{it} + \alpha_4 \Delta LPR_{it} + \alpha_5 \Delta UNEMP_{it} + \alpha_6 \Delta GDP_{it} \\ & + \alpha_7 \Delta TBOND_{it} + \alpha_8 \Delta BTAX_{it} + \alpha_9 \Delta ITAX_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

where  $\Delta$  denotes change from year t-1 to year t. For the median (maximum) loan in state i in year t:  $RATE_{it}$  is loan contract interest rate;  $FEES_{it}$  is initial fees and charges as a percentage of loan amount;  $SIZE_{it}$  is natural logarithm of loan size;  $TERM_{it}$  is natural logarithm of loan maturity in years;  $LPR_{it}$  is loan-to-price ratio. For state i in year t:  $UNEMP_{it}$  is the value of the average unemployment rate;  $GDP_{it}$  is natural logarithm of gross domestic product per capita;  $TBOND_{it}$  is yield on a treasury bond with the same maturity as the median loan. For commercial banks in state i in year t:  $BTAX_{it}$  is the median ratio of the sum of federal, state

and local taxes to income before taxes. For individuals in state  $i$  in year  $t$ :  $ITAX_{it}$  is average (maximum) marginal combined state and federal mortgage interest tax deduction.

We also estimate equation (1) and equation (2) (below) with data associated with each state-year's maximum loan. This is matched with each state-year's state and federal tax return data from its maximum-income tax return. This design is intended to provide additional assurance about our findings. Also, it is intended to address a potential mismatch in the median data. That is, we associate loan information from the median loan with tax return data from the average tax return. This could create a mismatch in that the population of income-tax-return filers is not identical with the population of home buyers. Specifically, tax return data is likely filed by many persons who are not homeowners, perhaps, downward biasing the tax numbers in comparison to the loan numbers. In contrast, the maximum-size home loan is likely taken out by a person at, or near, the top of the income distribution. Finding similar results with both specifications provides assurance both as to the robustness of analyses and their generalizability.

We include the annual changes in control variables broadly consistent with prior work in the area of mortgage loan interest rates (Sandor and Sosin 1975; Furstenberg 1969; Herzog and Earley 1970). For each state-year median (maximum) loan we include fees and initial charges, FEES, to reflect the possibility that greater amounts of fees and charges may be paid to offset the interest rate for a given loan, suggesting a negative relation with interest rate. However, when considered across time and across many loans, it is also possible that FEES will be positively correlated with interest if they tend to rise and fall together, along with the overall cost of borrowing.

The natural logarithm of loan amount, SIZE, is included to control for the possibility that larger loans may impose greater risk on lenders, suggesting a positive relation with interest rate. On the other hand, wealthier persons who have a lower default risk may purchase higher price homes. Lenders may require higher credit standards for larger loans and higher prices may suggest better quality loans. Similarly, property value reflects the neighborhood quality, and the better neighborhood quality reduces the risk of losses due to default by maintaining property value (Sandor and Sosin 1975).

We also include loan maturity, TERM, to control for the effect of interest rate risk on the mortgage rate. While longer maturity loans should bear a higher interest rate due to increased risk and the greater sensitivity of longer delayed payments to interest rate fluctuations, it may also be negatively associated with mortgage rates because longer-term loans result in lower monthly payments reducing the probability of default (Hendershott and Shilling 1989; Sandor and Sosin 1975).

Loan-to-price ratio, LPR, controls for credit risk arising from the degree of security provided by the mortgaged property. This measure is the amount of home mortgage relative to the purchase price of the home. There are alternative views and findings on the association between mortgage interest rate and the loan-to-price ratio. Herzog and Earley (1970), and Furstenberg (1969) find a positive relation, suggesting that higher loan-to-price ratios may suggest that borrowers have fewer savings. These borrowers may lack the necessary cushion to keep up mortgage payments during a time of financial crisis, thus increasing the likelihood of foreclosure. In contrast, findings of a recent study conducted by Pennsylvania Department of Banking (2004) suggest that states with lower loan-to-price ratios tend to have higher foreclosure rates. Loans with high loan-to-price ratios are likely to be more difficult to qualify

for. Thus, this finding is consistent with the view that borrowers with higher monthly income, thus lower default probability, can qualify for loans with higher loan-to-price ratios.

Additionally, for each state-year, we include state unemployment rate, UNEMP, and state gross domestic product per capita, GDP, to control for regional default risk and economic health. We expect GDP to be negatively related to interest rate and unemployment rates to be positively so. For each state-year, we include the T-bill rate, TBOND, for a loan of a maturity equal to the maturity of the median interest rate mortgage in that state, which we take as the risk-free rate. We expect this to be positively correlated with a state's mortgage rates.

The above control variables are included in the model to account for the effects of various non-tax factors found in prior work to explain variations in home mortgage interest rates. We include annual, state-specific median banks' state and federal combined tax rates, BTAX, to determine whether banks increase mortgagors' interest rates in order to shift their tax costs onto borrowers. If banks shift their tax costs onto borrowers, then banks' tax rates will be positively related to mortgagors' interest rates. We include the annual, state-specific combined value of the median (maximum) state and federal mortgage interest deduction, ITAX, to determine the extent to which banks raise mortgage interest rates to capture mortgagors' tax benefits. If banks raise mortgage rates relative to mortgagors' tax benefits, then this variable will be positively related to interest rates.

To test our last two hypotheses we estimate the following regression:

$$\begin{aligned} \Delta RATE_{it} = & \theta_0 + \theta_1 D + \theta_2 \Delta FEES_{it} + \theta_3 \Delta SIZE_{it} + \theta_4 \Delta TERM_{it} + \theta_5 \Delta LPR_{it} + \theta_6 \Delta UNEMP_{it} + \theta_7 \Delta GDP_{it} \\ & + \theta_8 \Delta TBOND_{it} + \theta_9 \Delta BTAX_{it} + \theta_{10} D * \Delta BTAX_{it} + \theta_{11} \Delta ITAX_{it} + \theta_{12} D * \Delta ITAX_{it} + \varepsilon_{it} \end{aligned} \quad (2)$$

where the variables are as defined above, and D equals 1 if the observation belongs to year 1994 or after, and 0 otherwise. Equation (2) tests for the effects of reducing anti-competitive banking regulation by estimating how tax shifting changed after the interstate banking law's passage. If banks reduced their shifting behavior as hypothesized, then all of the interacted coefficients will be negative.

Interest rates and other variables used in this analysis have been shown to be nonstationary in prior work (Todd 2001; Lehnert et al. 2005; Naranjo and Toevs 2002). However, these same studies have uniformly found these variables to be stationary in the first-differences. Ordinary least squares (OLS) estimates of nonstationary relations are inconsistent and potentially biased. Correspondingly, our primary analyses are estimated with variables transformed by first differencing. Additionally, first differencing the variables should yield estimates free of a variety of other possible econometric difficulties, as widely discussed in the finance and accounting literature, such as fixed effects. (Plosser and Schwert 1978, Schwert 1981, and Christie 1987). Finally, all t-statistics are based on Newey-West's (1987) heteroskedasticity and autocorrelation consistent standard error estimates.<sup>13</sup>

## **6. Sample and Data**

Our sample consists of observations on banks, mortgage loan originations, and taxpayers' federal, state and local taxes from 1977 to 2004 from the fifty states and the District of Columbia. We create observations by matching data from several sources. Regulations require banks to provide financial information, Reports of Condition and Income, with the

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<sup>13</sup> We use the Newey-West fixed bandwidth,  $q$ , in our tests. It is based on the number of observations in the sample, and is computed as:  $q = \text{int} [4(N/100)^{2/9}]$ , where  $\text{int} [ \ ]$  denotes the integer part and  $N$  is the number of observations.

Federal Reserve, but do not require them to separate out branch information. This data contains bank tax expense, locations, dates and considerable capital structure information. As pointed out in Beatty and Harris (2001a), and as discussed by the Advisory Commission on Intergovernmental Relations (1989), most states tax banks based on administrative practice and regulation rather than statutory authority. This makes determining banks' actual state tax rates problematic. Petroni and Shackelford (1999) also note that state statutory rates are problematic due to differing tax-base definitions and credit allowances across the states. Correspondingly, Petroni and Shackelford (1999) and Beatty and Harris (2001a, 2001b) use empirical estimates of tax rates. Following these papers, we use bank regulatory filings to construct banks' annual state-specific effective tax rates. They use the median tax rate from all banks filing regulatory reports. In contrast, we use median tax rates based only on banks operating in a single state in a given year.<sup>14,15</sup> We do so because we consider time periods both before and after the allowance of branch banking. After branch banking, a multistate bank's tax rate need not reflect only the state it is nominally located in, but also reflects the rates of other states where it does branch business. Banks operating in a single state report taxes based solely on that state's rate and should more accurately reflect the tax rate faced both by single-state banks and branches of multistate banks. Additional analyses in Beatty and Harris (2001a) investigate the propriety of using a single median tax rate and show that it is a robust and superior measure.

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<sup>14</sup> We identify the banks that operate in a single state using the Federal Deposit Insurance Corporation (FDIC)'s Institution Directory. The Directory includes demographic and financial information on any bank insured by the FDIC. It also includes information on the locations of all offices (branches) of these banks. We then collect federal, state and local income tax information for these banks from the Call Reports at the Federal Reserve Bank of Chicago.

<sup>15</sup> Alternatively, median tax rates might be based only on banks operating in a single state over the entire sample period. Such a measurement criteria, however, may potentially bias our sample toward smaller banks that manage to survive all the mergers and acquisitions.

Individuals' tax return data is proprietary information. However, the NBER has access to individuals' state and federal tax return data, which contain the actual, reported combinations of income, deductions, etc., and incorporates the annual state and federal variations in tax rules and regulations. Though detailed data is not released to the public, the NBER does publicly provide summarized tax data files. Our study utilizes this panel of state and federal tax data that contains, among other things, annual state-specific average (maximum) marginal values of state and federal mortgage interest tax deductions, based on panels of actual tax returns from 1979 to 2004, and on projected figures for 1977 and 1978.

The Federal Housing Financing Board (FHFB) collects proprietary data on home mortgages. The dataset contains information about geographic location, date, loan amount, loan to price ratio, initial fees and charges, interest rate, etc. It does not contain highly specific information, such as borrower credit scores, income, household composition, spousal income, etc. The FHFB generously gave us access to its dataset of actual mortgage originations from 1976 to 2004, which contains approximately 170,000 loans per year. We utilize the loan-specific mortgage interest rate and control variables from the median-size loan in each state-year.<sup>16</sup> We take the median because it is a robust and reliable estimate of central tendency. Similarly, the maximum-size loan provides a reliable estimate of interest rates, which can be well matched with the tax return data. More importantly, taking a single specific loan for the sample, as opposed to the sample mean, allows us to exactly match loan-specific control data with interest rate data. Using only one loan per year also reduces spurious correlation problems and inflated t-statistics to the extent our model fails to capture all the correlated features of loans within a state-year (Bernard 1987).

The annual gross domestic product (GDP) per capita and unemployment rates for each state are collected from the U. S. Department of Labor Bureau of Labor Statistics. We obtain Treasury bond yield data from the Federal Reserve Board Statistical Release H.15, which includes historical data on interest rates.

## 7. Results

Tables 1 and 2 report the descriptive statistics and the correlations among the variables. Panels A and B of Table 1 report the mean, median, minimum, maximum and standard deviations of the levels of the median and maximum loan data, and Panels C and D report their first-differences. Panel E displays the mean and median values of the tax variables across the sample period. Table 2 reports the Pearson correlations among variables' first differences, above the diagonal are median loan sample correlations and below are maximum loan sample correlations. Generally, the Spearman and Pearson correlations show a high degree of similarity, providing some comfort that the distributions of the variables are well-behaved. However, these values fail to account for the numerous effects of other variables as is done in the multivariate analyses. Interpretations of the univariate correlations between any of the variables and mortgage interest rate are of dubious value, because of the extreme effect of T-bond rates. Correlations between another variable and T-bond in a univariate test may mask relations between that variable and interest rate that would otherwise be evident in a well-specified multivariate analysis. Of more interest is the insignificant relation seen between the combined federal and state banks' and mortgagors' tax variables,

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<sup>16</sup> As discussed below, we also conduct a number of robustness tests, such as using the sample mean, and continue to find similar results.

which suggests that multicollinearity between the variables testing our implicit tax hypothesis should not be a problem.

Table 3 displays the results of estimating equation (1). All of the variables for which we predict a direction display the hypothesized relation and are significant at conventional levels. The model has substantial explanatory power, with an adjusted R-square of 57.3 percent.  $\Delta FEES$  is significantly negatively related to interest rates (p-value = 0.001), suggesting that it is a substitute for interest.  $\Delta SIZE$  is significantly negatively associated with interest rates (p-value = 0.0055), consistent with banks' risk increasing in the size of the loan being less important than the increase in large loan borrowers' creditworthiness.  $\Delta TERM$  is insignificant in this specification with a p-value of 0.2002.  $\Delta LPR$  is significantly positively associated with interest rates (p-value = 0.0037), consistent with loans becoming more risky as the value of the security declines relative to the amount of the loan. Both state economic climate variables,  $\Delta UNEMP$  and  $\Delta GDP$ , are significant as predicted. As unemployment increases, banks increase loan rates, consistent with their perceiving an increasing risk of default. As state productivity climbs and  $\Delta GDP$  increases, banks reduce loan interest rates, consistent with a declining default risk.

Consistent with *Hypothesis 1*,  $\Delta BTAX$  is significantly positively correlated with mortgagors' interest rates, displaying a value of 0.0647 with a p-value of 0.0002, consistent with banks shifting their combined federal and state tax costs on to mortgagors. Consistent with *Hypothesis 2*,  $\Delta ITAX$  is significantly positive, having a value of 0.0805 with a p-value of 0.0001, consistent with banks increasing loan interest rates as the combined value of mortgagors' state and federal interest tax deduction increases.

Table 4 displays the results of estimating equation (2), which jointly tests *Hypothesis 3*, that regulation uniformly allowing interstate banking increased banking industry competitiveness, and, *Hypothesis 4*, that increasing competition reduced banks' ability to shift their taxes and capture mortgagors' benefits. First, note, as in Table 3, that the control variables continue to display coefficients very similar to the prior estimations, though a statistical test suggests that  $\Delta\text{TERM}$  is substantially more positively significant, with a p-value of 0.0638. Also, the tax variables continue to display significance similar to that seen in Table 3. However, both tax variables,  $\Delta\text{BTAX}$  and  $\Delta\text{ITAX}$ , have somewhat larger coefficients, 0.0729 and 0.1006, and somewhat higher levels of significance with p-values of 0.0008 and 0.0012, consistent with an improved fit from separating out the years after the regulatory change. More importantly, the coefficients on the interacted tax variables,  $D*\Delta\text{BTAX}$  (-0.0327) and  $D*\Delta\text{ITAX}$  (-0.0358), are both significantly negative, with p-values of 0.0192 and 0.0109, consistent with banks shifting less taxes because they operated in a more competitive environment after 1993.

We use the coefficients from estimating equation (2) with median data, as shown in Table 4, to generate economic estimates of the magnitudes of the effects we document, as it separates out of the tax and competition effects. The extent of banks shifting their tax costs onto mortgagors is computed as the sum of the products of the coefficients  $\Delta\text{BTAX}$  (0.0729) and  $\Delta\text{ITAX}$  (0.1006), multiplied by their respective mean absolute values, 1.535 and 0.934 (not tabulated) yielding 0.2059, or approximately 21 basis points. Similarly, the reduction in tax shifting from the increasing bank competition is computed as the sum of the interacted coefficients,  $D*\Delta\text{BTAX}$  (-0.0327) and  $D*\Delta\text{ITAX}$  (-0.0358), multiplied by their respective mean absolute values, enumerated directly above, yielding -0.0836 or approximately -8 basis

points. We use mean absolute values as opposed to simple means because the former better captures the annual effect of implicit taxes. For example, if tax rates increased two percent one year and declined two percent the next, the average would be zero. Thus, even given that we observed significant effects for the annual changes in taxes, the estimated average effect would be zero. In contrast, taking the mean absolute value captures the typical annual effect.

Tables 5 and 6 report the results of estimating equations (1) and (2) with maximum size loan interest rates and control variables matched with the marginal value of mortgage interest deductions for taxpayers reporting the highest income in each state-year. The results for the control variables are very similar in terms of signs and significance levels, though  $\Delta\text{TERM}$  is significant at the 0.02 level in both Tables 5 and 6. However, the loan to price ratio,  $\Delta\text{LPR}$ , does flip sign for the maximum loans, suggesting that the riskiness of very large home mortgages is falling in this factor, whereas it is increasing for smaller loans. This switch is consistent with prior work that finds differing effects on this variable. This is also consistent with the notion that for the highest-income taxpayers, mortgage security is more a function of the borrower's income and other assets than the value of the specific property securing the loan. The overall adjusted R-square value is somewhat lower in Tables 5 and 6, 0.3766 and 0.3844, as compared to 0.5729 and 0.5857, for Tables 3 and 4.

Most important, the coefficient estimates are strikingly similar. The coefficients on  $\Delta\text{BTAX}$  and  $\Delta\text{ITAX}$  in Table 5, 0.0478 and 0.0980, are quite close to the values in Table 3, 0.0647 and 0.0805, and also display a high significance level, with p-values of 0.0083 and 0.0007. Similarly, the coefficients of interest shown in Table 6,  $\Delta\text{BTAX}$ ,  $D*\Delta\text{BTAX}$ ,  $\Delta\text{ITAX}$ , and  $D*\Delta\text{ITAX}$ , 0.0793, -0.0373, 0.1039, and -0.0314, are also similar to those shown in the corresponding median regression in Table 4, 0.0729, -0.0327, 0.1006, and -0.0358, and

all are significant at about the 0.05 level or better. This similarity of results, not only with respect to direction and significance, but also with respect to magnitudes, suggests that the results are both robust and generalizable.

## **8. Robustness Tests**

We re-estimate equations (1) and (2) with our full sample of 4,851,655 loans.

Because, we cannot match loans in a meaningful way across years, this regression is estimated with the level data, as opposed to the first-differences data used in our primary analyses. This can lead to a potential bias in the analysis. Also, because we use only each state-year's median bank tax rate and average value of the mortgage interest deduction because we cannot meaningfully associated variations in these values with any specific loans, we expect the fit between the dependent and independent variables to be less than with the median (maximum) data. Nonetheless, this analysis provides substantial additional support for our primary results. Focusing only on the complete regression, which includes the regressors for the effects of bank deregulation, we find an adjusted R-square of 0.8796 and coefficients on BTAX, D\*BTAX, ITAX, and D\*ITAX of 0.0110, -0.0017, 0.0101, and -0.0033, with associated t-statistics of, 108.3, -15.7, 200.8, and -40.9, respectively. Though these coefficient estimates are smaller than those found in the median and maximum first-differenced equations, the mean values of BTAX and ITAX are larger (as one would expect of the levels), and the estimated magnitude of tax shift with this sample is 52 basis points, which is close to the 21 basis point estimate we find with the median values.

We also re-estimate equations (1) and (2) with our median and maximum samples combined, with interactive controls for the maximum loans on the hypothesis variables, and

continue to find similar results as to sign, significance and magnitudes. Also, as individuals' tax data for 1977 and 1978 are based on projections, we re-estimate our models excluding these years and find results consistent with those of our primary tests. As we hypothesize a change in banks' competitive environment after the change in bank regulation, we re-estimate equation (2), allowing for all of the variables to change after 1994, and continue to find similar results on the tax variables.

We also perform a number of additional robustness tests with the median data. First, we test the robustness of our findings to our choice of annual state-specific median interest rate loans by also selecting loans plus and minus three observations away from the median. We find essentially identical results. We also compute annual state-specific average interest rates and then match them with loan-specific control variables for the loan in that state that year which is closest to the average. This allows us to more closely match our control variables to loan interest rates like those actually observed while using a different measure of central tendency for banks' taxes. We continue to observe essentially identical results. We also permit the intercept to vary by year in order to account for period-specific effects that are not captured by the explanatory variables, and our findings still hold. Finally, we control for possible endogeneity between interest rates and house prices by applying a two-stage least squares estimation technique, and continue to find essentially the same results.

An alternative interpretation of our findings could be that, when a lender can charge a higher interest rate, then all else equal the lender is more likely to be profitable and face a higher tax rate. Similarly, higher mortgage interest rates can result in higher tax benefits for mortgagors. In order to rule out such an alternative explanation, we estimate the models after including a profitability measure, change in return on assets ( $\Delta ROA$ ). The coefficients on

$\Delta$ ROA are insignificant in all specifications, and the coefficient estimates are almost identical to the original findings. In addition, we also run a Granger causality analysis to address this potential endogeneity problem. More specifically, we test whether interest rate changes caused changes in banks' tax costs and mortgagors' tax benefits, or whether causality runs in the direction we hypothesize. We set the number of lags included in the regressions to two. The test statistics suggest that banks' tax costs and mortgagors' tax benefits linearly predicts mortgage interest rates at 5% and 10%, respectively. For both tax variables, we reject that causality runs in the opposite direction.

We repeat our tests two more times, but for each test we select at random an alternate 9-year time period, 1977-1987 for one and 1983-1993 for the other, and substitute each for the 1994-2004 time period. With these analyses we investigate whether the tax variables' coefficients vary randomly from the overall sample. If the coefficients of our regressions are unstable then these time periods also might appear different from the others. However, we find no effects for the randomly selected time periods. This suggests that the observed variations we document after 1993 are due to regulatory revisions and not to mere chance.

While all interest on loans originated on or before October 13, 1987 used to be fully deductible, provisions of tax laws have imposed limitations on interest deductions if the acquisition debt is over \$1 million. Our results might be affected if the shifting of taxes is different for these larger amount loans. This change in tax law is not likely to affect  $\Delta$ ITAX in the median loan sample as the maximum loan size is only \$950,000. However, there are 135 loans over \$1 million in the maximum loan sample all of which were originated between 2001 and 2004. In order to check whether pooling loans smaller and larger than \$1 million affect our results, we run the maximum loan sample tests without these 135 loans, run the

tests after putting dummy variables on such excess loans, and estimate the model only with pre-1987 data. Our results still hold for all specifications.

Since the 1970's Ginnie Mae, Fannie Mae, and Freddie Mac, collectively referred to as Government Sponsored Enterprises (GSEs), have greatly altered the market by purchasing, insuring and securitizing home mortgages. In order to control for the potential effects of these developments on loan rates and our results, we re-run our tests after controlling for the rate of securitization. The data on the amount of securitization activity comes from the Federal Reserve Board Statistical Release Z.1 Section L.218 on flow of funds accounts of the United States. We continue to find the same tax results.

Following the assumption of rational expectations, our analyses use tax and non-tax data in the same year. This implicitly assumes that banks predict their tax costs and mortgagors' tax benefits, and accordingly, pass these costs and capture these benefits before they are realized. In order to check the validity of the assumption of rational expectations in our setting, we estimate the models with both the current and lagged tax variables. For the median loan sample, both current and lagged tax variables are significant, but the coefficients on the lagged tax variables have smaller magnitudes and t-stats. The coefficients on lagged  $\Delta BTAX$  and lagged  $\Delta ITAX$  are 0.0189 and 0.0382 with associated t-statistics of 1.68 and 1.87, respectively. For the maximum loan sample, we the coefficients on both lagged tax variables are statistically insignificant.

We also test whether the relation between interest rates and tax variables are driven in both directions. We allow the coefficients to differ when the change is negative. Results suggest that interest rates go up (down) with increases (decreases) in banks' tax costs and mortgagors' tax benefits.

We also estimate the model with a substantially different data set. The data for interest rate and other mortgage terms, including initial fees and charges, purchase price, loan maturity and loan-to-price ratio are obtained from the Federal Housing Finance Board (FHFB)'s public data from its interest rate survey. The data provides annual historical averages (as opposed to the loan-specific data we use in our primary analyses) for loan terms and house prices by state. The survey excludes Federal Housing Administration (FHA)-insured and Veterans Affairs (VA)-guaranteed loans, multifamily loans, mobile home loans and refinancing. The data on annual marginal federal income tax rates is for four-person families at the same relative positions in the income distribution, twice the median income level, and are from the Office of Tax Analysis of the Department of Treasury. We find substantially similar results with this data with regard to our hypotheses, though we cannot separate out state and federal tax effects. However, the average data does not yield consistent results with our control variables, especially the ones relating to the details of the financing, such as loan maturity and loan-to-price ratio. This appears to arise because the averages of the variables are not well matched. This can occur if the distributions are differently skewed between the loan interest rate and the other variables. We address this in the primary analyses presented by using control variables from the same loan as the interest rate. Also, because our analysis is based on single, state-specific medians, such skewness is unlikely to affect our results as it could analyses based on the full sample. We also permit the intercept to vary by year in order to account for period-specific effects that are not captured by the explanatory variables, and our findings still hold.

## 9. Concluding Comments

In this paper we examine whether and to what extent banks shift taxes favorably between themselves and the mortgagors to whom they lend. We also examine whether and to what extent anti-competitive banking regulation limiting banks' activities to a single state increased banks' abilities to shift taxes, and how this changed after banks were allowed to compete across state lines.

We find substantial evidence of banks shifting taxes by implicitly pricing them in mortgage interest rates. They appear to do so both by shifting banks' state and federal tax costs onto mortgagors and by capturing portions of the value of mortgagors' state and federal principal residence interest expense deductions. Additionally, this tax shifting is significantly reduced after anti-competitive banking regulation is reduced. However, substantial shifting appears to remain, consistent with the remaining banking regulation being significantly anti-competitive and with banks operating in a naturally oligopolistic market.

The magnitudes of these implicit taxes are economically substantial. We estimate that banks shifting taxes implicitly changes mortgagors' interest rates by approximately 21 basis points. Though this amount is likely less than the average consumer might notice (and, perhaps, is a reason why it takes place), economy-wide this represents an annual effect of \$23 billion. As the value of the mortgage interest deduction is estimated at around \$72 billion, this is more than 30 percent of that benefit. Removing anti-competitive restrictions from the banking industry is estimated to have reduced this shifting by about 8 basis points, or by approximately 40 percent.

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**TABLE 1**  
**Summary Statistics**

**Panel A: Levels of Variables (Median Loan Sample)**

<b>Variable Name</b>	<b>Mean</b>	<b>Median</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Standard Deviation</b>
RATE (%)	9.052	8.500	5.375	16.000	2.341
FEES (%)	1.522	1.303	0.000	10.500	1.282
SIZE	128,488	99,785	8,000	950,000	95,434
TERM	26.658	30.000	5.000	40.000	5.765
LPR (%)	76.450	79.841	16.000	100.000	14.396
UNEMP (%)	5.983	5.700	2.200	18.000	2.051
GDP	19,537	18,852	5,766	52,101	7,851
TBOND (%)	8.166	7.787	4.014	13.720	2.401
BTAX (%)	28.244	29.310	6.261	47.479	6.336
ITAX (%)	27.125	27.250	19.880	40.570	3.700

<sup>1</sup> The sample represents 1,428 state-year observations from 1977 to 2004 for 50 states and the District of Columbia.

<sup>2</sup> **For the median loan in state i in year t:** RATE<sub>it</sub> = Loan contract interest rate; FEES<sub>it</sub> = Initial fees and charges as a percentage of loan amount; SIZE<sub>it</sub> = Natural logarithm of loan size; TERM<sub>it</sub> = Natural logarithm of loan maturity in years; LPR<sub>it</sub> = Loan-to-price ratio. **For state i in year t:** UNEMP<sub>it</sub> = Average unemployment rate; GDP<sub>it</sub> = Natural logarithm of gross domestic product per capita; TBOND<sub>it</sub> = Yield on a treasury bond with the same maturity as the median loan. **For commercial banks in state i in year t:** BTAX<sub>it</sub> = Median ratio of the sum of federal, state and local taxes to income before taxes. **For state i in year t:** ITAX<sub>it</sub> = Average marginal combined state and federal mortgage interest tax deduction.

**TABLE 1 (continued)**  
**Summary Statistics**

**Panel B: Levels of Variables (Maximum Loan Sample)**

<b>Variable Name</b>	<b>Mean</b>	<b>Median</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Standard Deviation</b>
RATE (%)	8.917	8.250	2.950	18.000	2.789
FEES (%)	1.247	1.000	0.000	9.750	1.155
SIZE	559,514	495,049	74,000	1,246,120	274,236
TERM	26.758	30.000	3.000	40.000	6.480
LPR (%)	56.816	60.000	5.000	100.000	18.578
UNEMP (%)	5.983	5.700	2.200	18.000	2.051
GDP	19,537	18,852	5,766	52,101	7,851
TBOND (%)	8.166	7.787	4.014	13.720	2.401
BTAX (%)	28.244	29.310	6.261	47.479	6.336
ITAX (%)	43.190	42.790	28.000	59.920	7.644

<sup>1</sup> The sample represents 1,428 state-year observations from 1977 to 2004 for 50 states and the District of Columbia.

<sup>2</sup> **For the maximum loan in state i in year t:**  $RATE_{it}$  = Loan contract interest rate;  $FEES_{it}$  = Initial fees and charges as a percentage of loan amount;  $SIZE_{it}$  = Natural logarithm of loan size;  $TERM_{it}$  = Natural logarithm of loan maturity in years;  $LPR_{it}$  = Loan-to-price ratio. **For state i in year t:**  $UNEMP_{it}$  = Average unemployment rate;  $GDP_{it}$  = Natural logarithm of gross domestic product per capita;  $TBOND_{it}$  = Yield on a treasury bond with the same maturity as the median loan. **For commercial banks in state i in year t:**  $BTAX_{it}$  = Median ratio of the sum of federal, state and local taxes to income before taxes. **For state i in year t:**  $ITAX_{it}$  = Marginal combined state and federal mortgage interest tax deduction for high income tax payers.

**TABLE 1 (continued)**  
**Summary Statistics**

**Panel C: First-Differences of Variables (Median Loan Sample)**

<b>Variable Name</b>	<b>Mean</b>	<b>Median</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Standard Deviation</b>
$\Delta$ RATE (%)	-0.116	-0.120	-3.250	3.500	0.969
$\Delta$ FEES (%)	-0.016	0.000	-6.710	9.000	1.464
$\Delta$ SIZE	0.055	0.067	-2.708	2.303	0.669
$\Delta$ TERM	0.004	0.000	-1.792	1.792	0.367
$\Delta$ LPR (%)	0.008	2.000	-70.000	72.043	19.676
$\Delta$ UNEMP (%)	-0.054	-0.100	-4.100	4.600	1.033
$\Delta$ GDP	0.056	0.051	-0.073	0.268	0.031
$\Delta$ TBOND (%)	-0.081	-0.065	-3.220	2.450	1.121
$\Delta$ BTAX (%)	0.330	0.257	-15.227	13.106	2.296
$\Delta$ ITAX (%)	-0.147	0.200	-6.420	4.220	1.328

<sup>1</sup> The sample represents 1,377 state-year observations from 1977 to 2004 for 50 states and the District of Columbia.

<sup>2</sup>  $\Delta$ VARIABLE<sub>it</sub> = VARIABLE<sub>it</sub> - VARIABLE<sub>it-1</sub>. **For the median loan in state i in year t:** RATE<sub>it</sub> = Loan contract interest rate; FEES<sub>it</sub> = Initial fees and charges as a percentage of loan amount; SIZE<sub>it</sub> = Natural logarithm of loan size; TERM<sub>it</sub> = Natural logarithm of loan maturity in years; LPR<sub>it</sub> = Loan-to-price ratio. **For state i in year t:** UNEMP<sub>it</sub> = Average unemployment rate; GDP<sub>it</sub> = Natural logarithm of gross domestic product per capita; TBOND<sub>it</sub> = Yield on a treasury bond with the same maturity as the median loan. **For commercial banks in state i in year t:** BTAX<sub>it</sub> = Median ratio of the sum of federal, state and local taxes to income before taxes. **For state i in year t:** ITAX<sub>it</sub> = Average marginal combined state and federal mortgage interest tax deduction.

**TABLE 1 (continued)**  
**Summary Statistics**

**Panel D: First-Differences of Variables (Maximum Loan Sample)**

<b>Variable Name</b>	<b>Mean</b>	<b>Median</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Standard Deviation</b>
$\Delta$ RATE (%)	-0.148	-0.125	-7.500	6.250	1.761
$\Delta$ FEES (%)	-0.033	-0.500	-8.750	6.750	1.313
$\Delta$ SIZE	0.060	0.040	-0.922	0.960	0.220
$\Delta$ TERM	-0.001	0.000	-2.303	2.120	0.459
$\Delta$ LPR (%)	-0.172	1.500	-72.000	72.000	24.270
$\Delta$ UNEMP (%)	-0.054	-0.100	-4.100	4.600	1.033
$\Delta$ GDP	0.056	0.051	-0.073	0.268	0.031
$\Delta$ TBOND (%)	-0.081	-0.065	-3.220	2.450	1.121
$\Delta$ BTAX (%)	0.330	0.257	-15.227	13.106	2.296
$\Delta$ ITAX (%)	0.545	0.660	-9.180	17.240	3.395

<sup>1</sup> The sample represents 1,377 state-year observations from 1977 to 2004 for 50 states and the District of Columbia.

<sup>2</sup>  $\Delta$ VARIABLE<sub>it</sub> = VARIABLE<sub>it</sub> - VARIABLE<sub>it-1</sub>. **For the median loan in state i in year t:** RATE<sub>it</sub> = Loan contract interest rate; FEES<sub>it</sub> = Initial fees and charges as a percentage of loan amount; SIZE<sub>it</sub> = Natural logarithm of loan size; TERM<sub>it</sub> = Natural logarithm of loan maturity in years; LPR<sub>it</sub> = Loan-to-price ratio. **For state i in year t:** UNEMP<sub>it</sub> = Average unemployment rate; GDP<sub>it</sub> = Natural logarithm of gross domestic product per capita; TBOND<sub>it</sub> = Yield on a treasury bond with the same maturity as the median loan. **For commercial banks in state i in year t:** BTAX<sub>it</sub> = Median ratio of the sum of federal, state and local taxes to income before taxes. **For state i in year t:** ITAX<sub>it</sub> = Marginal combined state and federal mortgage interest tax deduction for high income tax payers.

**TABLE 1 (continued)**  
**Summary Statistics**

**Panel E: Tax Variables across the Sample Period**

Year	BTAX		ITAX (Median )		ITAX (Maximum)	
	Mean	Median	Mean	Median	Mean	Median
1977	22.276	22.303	30.085	30.030	52.277	52.100
1978	22.388	21.874	30.370	29.810	52.245	51.970
1979	22.137	21.622	30.550	30.340	52.210	51.940
1980	22.573	23.309	32.158	31.960	52.221	51.930
1981	21.258	21.571	33.407	33.360	52.191	51.920
1982	20.790	20.493	31.310	31.415	52.232	51.970
1983	22.669	21.614	29.674	29.815	52.370	52.230
1984	22.773	22.106	29.774	29.800	52.305	52.080
1985	24.247	23.621	29.695	29.900	52.242	52.080
1986	26.013	25.465	29.905	30.160	52.163	52.080
1987	26.917	27.061	26.040	26.810	41.070	41.430
1988	26.323	25.391	24.616	25.160	30.890	31.420
1989	28.428	28.358	24.897	25.720	30.895	31.430
1990	29.371	28.790	24.625	25.350	30.934	31.430
1991	30.075	29.679	23.925	24.750	33.857	34.270
1992	31.816	30.949	23.909	24.860	33.933	34.450
1993	32.192	31.448	24.526	25.580	42.169	42.680
1994	32.380	32.172	24.737	25.780	42.158	42.770
1995	32.842	32.896	25.139	26.270	42.135	42.680
1996	33.179	32.541	25.697	26.740	42.106	42.690
1997	33.016	32.378	26.010	26.980	42.095	42.620
1998	32.486	32.403	26.777	27.570	42.082	42.570
1999	31.991	32.447	27.196	28.000	42.053	42.540
2000	31.983	32.445	27.642	28.430	42.003	42.530
2001	31.660	31.997	26.608	27.430	41.512	42.150
2002	31.625	31.509	25.865	26.770	41.039	41.670
2003	30.993	31.012	23.618	24.580	37.556	38.250
2004	30.306	31.518	23.849	24.950	37.546	38.250

<sup>1</sup> The sample represents state-year observations from 1977 to 2004 for 50 states and the District of Columbia.

<sup>2</sup> BTAX = Each sample year's median (mean) state median ratio of the sum of federal, state and local taxes to income before taxes. ITAX = Each sample year's median (mean) marginal combined state and federal mortgage interest tax deduction for average and high income tax payers.

**TABLE 2**  
**Correlations among Regression Variables for Median and Maximum Loan Samples**

	$\Delta$ RATE	$\Delta$ FEES	$\Delta$ SIZE	$\Delta$ TERM	$\Delta$ LPR	$\Delta$ UNEMP	$\Delta$ GDP	$\Delta$ TBOND	$\Delta$ BTAX	$\Delta$ ITAX
$\Delta$ RATE		0.058 0.033	0.058 0.032	0.074 0.006	0.050 0.062	0.077 0.004	0.456 <.001	0.639 <.001	0.003 0.912	0.231 <.001
$\Delta$ FEES	0.017 0.532		-0.062 0.021	0.019 0.470	-0.066 0.015	0.049 0.068	0.056 0.040	0.078 0.004	0.000 0.993	0.001 0.974
$\Delta$ SIZE	-0.099 <.001	-0.098 <.001		0.086 0.001	-0.262 <.001	0.023 0.385	-0.003 0.911	0.008 0.763	-0.043 0.109	0.015 0.588
$\Delta$ TERM	0.032 0.236	0.063 0.019	-0.121 <.001		0.316 <.001	-0.056 0.039	0.016 0.549	0.167 <.001	-0.064 0.018	0.018 0.514
$\Delta$ LPR	0.075 0.005	-0.060 0.027	-0.145 <.001	0.126 <.001		-0.034 0.212	0.034 0.209	0.035 0.195	0.003 0.902	-0.009 0.747
$\Delta$ UNEMP	0.038 0.164	0.010 0.712	-0.027 0.313	0.034 0.203	-0.044 0.107		-0.204 <.001	-0.065 0.016	-0.089 0.001	-0.120 <.001
$\Delta$ GDP	0.282 <.001	0.078 0.004	0.051 0.058	0.016 0.548	0.020 0.468	-0.204 <.001		0.444 <.001	0.041 0.130	0.349 <.001
$\Delta$ TBOND	0.474 <.001	0.062 0.022	-0.035 0.195	0.046 0.089	0.026 0.338	-0.065 0.016	0.444 <.001		-0.187 <.001	0.189 <.001
$\Delta$ BTAX	-0.001 0.970	0.006 0.826	0.049 0.069	-0.004 0.887	0.021 0.427	-0.089 0.001	0.041 0.130	-0.187 <.001		-0.016 0.545
$\Delta$ ITAX	0.010 0.711	0.000 0.989	-0.010 0.725	0.035 0.196	0.036 0.185	-0.133 <.001	0.049 0.067	0.255 <.001	-0.039 0.147	

<sup>1</sup> Pearson correlations for median (maximum) loan samples are presented above (below) the diagonal.

<sup>2</sup> Significance levels presented are based on two-tailed tests.

<sup>3</sup>  $\Delta$ VARIABLE<sub>it</sub> = VARIABLE<sub>it</sub> - VARIABLE<sub>it-1</sub>. **Above (below) the diagonal, for the median (maximum) loan in state i in year t:** RATE<sub>it</sub> = Loan contract interest rate; FEES<sub>it</sub> = Initial fees and charges as a percentage of loan amount; SIZE<sub>it</sub> = Natural logarithm of loan size; TERM<sub>it</sub> = Natural logarithm of loan maturity in years; LPR<sub>it</sub> = Loan-to-price ratio **For state i in year t:** UNEMP<sub>it</sub> = Average unemployment rate; GDP<sub>it</sub> = Natural logarithm of gross domestic product per capita; TBOND<sub>it</sub> = Yield on a treasury bond with the same maturity as the median loan. **For commercial banks in state i in year t:** BTAX<sub>it</sub> = Median ratio of the sum of federal, state and local taxes to income before taxes. **For state i in year t:** ITAX<sub>it</sub> = Average marginal combined state and federal mortgage interest tax deduction for the median loan sample; = Marginal combined state and federal mortgage interest tax deduction for high income tax payers for the maximum loan sample.

**TABLE 3**  
**Loan Rates and Aggregated Taxes: Median Loans**

$$\Delta RATE_{it} = \alpha_0 + \alpha_1 \Delta FEES_{it} + \alpha_2 \Delta SIZE_{it} + \alpha_3 \Delta TERM_{it} + \alpha_4 \Delta LPR_{it} + \alpha_5 \Delta UNEMP_{it} + \alpha_6 \Delta GDP_{it} + \alpha_7 \Delta TBOND_{it} + \alpha_8 \Delta BTAX_{it} + \alpha_9 \Delta ITAX_{it} + \varepsilon_{it}$$

Variable	Predicted Sign	Coefficient Estimate	t-statistic	p-value
Intercept	-/+	-0.2951	-6.9919	<0.0001
$\Delta FEES$	-/+	-0.2500	-8.6207	<0.0001
$\Delta SIZE$	-/+	-0.0395	-2.7837	0.0055
$\Delta TERM$	-/+	0.0652	1.2817	0.2002
$\Delta LPR$	-/+	0.0029	2.6822	0.0074
$\Delta UNEMP$	+	0.1639	8.2337	<0.0001
$\Delta GDP$	-	-4.7612	-6.2099	<0.0001
$\Delta TBOND$	+	0.4434	25.4806	<0.0001
$\Delta BTAX$	+	0.0647	3.5185	0.0002
$\Delta ITAX$	+	0.0805	5.7908	0.0001
<b>Adjusted R<sup>2</sup></b>		<b>0.5729</b>		
<b>No. of Obs.</b>		<b>1,377</b>		

<sup>1</sup> The sample represents 1,377 state-year observations from 1977 to 2004 for 50 states and the District of Columbia.

<sup>2</sup>  $\Delta VARIABLE_{it} = VARIABLE_{it} - VARIABLE_{it-1}$ . **For the median loan in state i in year t:**  $RATE_{it}$  = Loan contract interest rate;  $FEES_{it}$  = Initial fees and charges as a percentage of loan amount;  $SIZE_{it}$  = Natural logarithm of loan size;  $TERM_{it}$  = Natural logarithm of loan maturity in years;  $LPR_{it}$  = Loan-to-price ratio. **For state i in year t:**  $UNEMP_{it}$  = Average unemployment rate;  $GDP_{it}$  = Natural logarithm of gross domestic product per capita;  $TBOND_{it}$  = Yield on a treasury bond with the same maturity as the median loan. **For commercial banks in state i in year t:**  $BTAX_{it}$  = Median ratio of the sum of federal, state and local taxes to income before taxes. **For state i in year t:**  $ITAX_{it}$  = Average marginal combined state and federal mortgage interest tax deduction.

<sup>3</sup> All t-statistics are based on Newey-West's (1987) heteroskedasticity and autocorrelation consistent standard error estimates.

<sup>4</sup> All p-values are based on one-tailed t-tests when the coefficient sign is predicted, and based on two-tailed t-tests otherwise.

**TABLE 4**  
**Loan Rates, Aggregated Taxes and Regulatory Change: Median Loans**

$$\Delta RATE_{it} = \theta_0 + \theta_1 D + \theta_2 \Delta FEES_{it} + \theta_3 \Delta SIZE_{it} + \theta_4 \Delta TERM_{it} + \theta_5 \Delta LPR_{it} + \theta_6 \Delta UNEMP_{it} + \theta_7 \Delta GDP_{it} + \theta_8 \Delta TBOND_{it} + \theta_9 \Delta BTAX_{it} + \theta_{10} D * \Delta BTAX_{it} + \theta_{11} \Delta ITAX_{it} + \theta_{12} D * \Delta ITAX_{it} + \varepsilon_{it}$$

Variable	Predicted Sign	Coefficient Estimate	t-statistic	p-value
Intercept	-/+	-0.3712	-5.6591	<0.0001
D	-/+	0.1006	2.6536	0.0081
$\Delta FEES$	-/+	-0.2130	-7.3958	<0.0001
$\Delta SIZE$	-/+	-0.0440	-3.1548	0.0016
$\Delta TERM$	-/+	0.0933	1.8553	0.0638
$\Delta LPR$	-/+	0.0029	2.7075	0.0068
$\Delta UNEMP$	+	0.1817	9.1328	<0.0001
$\Delta GDP$	-	-5.5032	-5.9513	<0.0001
$\Delta TBOND$	+	0.4402	23.2897	<0.0001
$\Delta BTAX$	+	0.0729	3.1603	0.0008
$D * \Delta BTAX$	-	-0.0327	-2.0723	0.0192
$\Delta ITAX$	+	0.1006	3.0525	0.0012
$D * \Delta ITAX$	-	-0.0358	-2.2956	0.0109
<b>Adjusted R<sup>2</sup></b>		<b>0.5857</b>		
<b>No. of Obs.</b>		<b>1,377</b>		

<sup>1</sup> The sample represents 1,377 state-year observations from 1977 to 2004 for 50 states and the District of Columbia.

<sup>2</sup>  $\Delta VARIABLE_{it} = VARIABLE_{it} - VARIABLE_{it-1}$ , and  $D = 1$  if the observation belongs to 1994 or after, and 0 otherwise. **For the median loan in state i in year t:**  $RATE_{it}$  = Loan contract interest rate;  $FEES_{it}$  = Initial fees and charges as a percentage of loan amount;  $SIZE_{it}$  = Natural logarithm of loan size;  $TERM_{it}$  = Natural logarithm of loan maturity in years;  $LPR_{it}$  = Loan-to-price ratio. **For state i in year t:**  $UNEMP_{it}$  = Average unemployment rate;  $GDP_{it}$  = Natural logarithm of gross domestic product per capita;  $TBOND_{it}$  = Yield on a treasury bond with the same maturity as the median loan. **For commercial banks in state i in year t:**  $BTAX_{it}$  = Median ratio of the sum of federal, state and local taxes to income before taxes. **For state i in year t:**  $ITAX_{it}$  = Average marginal combined state and federal mortgage interest tax deduction.

<sup>3</sup> All t-statistics are based on Newey-West's (1987) heteroskedasticity and autocorrelation consistent standard error estimates.

<sup>4</sup> All p-values are based on one-tailed t-tests when the coefficient sign is predicted, and based on two-tailed t-tests otherwise.

**TABLE 5**  
**Loan Rates and Aggregated Taxes: Maximum Loans**

$$\Delta RATE_{it} = \alpha_0 + \alpha_1 \Delta FEES_{it} + \alpha_2 \Delta SIZE_{it} + \alpha_3 \Delta TERM_{it} + \alpha_4 \Delta LPR_{it} + \alpha_5 \Delta UNEMP_{it} + \alpha_6 \Delta GDP_{it} + \alpha_7 \Delta TBOND_{it} + \alpha_8 \Delta BTAX_{it} + \alpha_9 \Delta ITAX_{it} + \varepsilon_{it}$$

Variable	Predicted Sign	Coefficient Estimate	t-statistic	p-value
Intercept	-/+	-0.5565	-6.2317	<0.0001
$\Delta FEES$	-/+	-0.0407	-3.2116	0.0014
$\Delta SIZE$	-/+	-0.9242	-4.4538	<0.0001
$\Delta TERM$	-/+	0.1909	2.1943	0.0284
$\Delta LPR$	-/+	-0.0067	-3.6022	0.0004
$\Delta UNEMP$	+	0.1270	2.5808	0.0050
$\Delta GDP$	-	-9.7097	-6.3030	<0.0001
$\Delta TBOND$	+	0.4990	10.1227	<0.0001
$\Delta BTAX$	+	0.0478	2.4000	0.0083
$\Delta ITAX$	+	0.0980	3.1862	0.0007
<b>Adjusted R<sup>2</sup></b>		<b>0.3766</b>		
<b>No. of Obs.</b>		<b>1,377</b>		

<sup>1</sup> The sample represents 1,377 state-year observations from 1977 to 2004 for 50 states and the District of Columbia.

<sup>2</sup>  $\Delta VARIABLE_{it} = VARIABLE_{it} - VARIABLE_{it-1}$ . **For the maximum loan in state i in year t:**  $RATE_{it}$  = Loan contract interest rate;  $FEES_{it}$  = Initial fees and charges as a percentage of loan amount;  $SIZE_{it}$  = Natural logarithm of loan size;  $TERM_{it}$  = Natural logarithm of loan maturity in years;  $LPR_{it}$  = Loan-to-price ratio. **For state i in year t:**  $UNEMP_{it}$  = Average unemployment rate;  $GDP_{it}$  = Natural logarithm of gross domestic product per capita;  $TBOND_{it}$  = Yield on a treasury bond with the same maturity as the median loan. **For commercial banks in state i in year t:**  $BTAX_{it}$  = Median ratio of the sum of federal, state and local taxes to income before taxes. **For state i in year t:**  $ITAX_{it}$  = Marginal combined state and federal mortgage interest tax deduction for high income taxpayers.

<sup>3</sup> All t-statistics are based on Newey-West's (1987) heteroskedasticity and autocorrelation consistent standard error estimates.

<sup>4</sup> All p-values are based on one-tailed t-tests when the coefficient sign is predicted, and based on two-tailed t-tests otherwise.

**TABLE 6**  
**Loan Rates, Aggregated Taxes and Regulatory Change: Maximum Loans**

$$\Delta RATE_{it} = \beta_0 + \beta_1 D + \beta_2 \Delta FEES_{it} + \beta_3 \Delta SIZE_{it} + \beta_4 \Delta TERM_{it} + \beta_5 \Delta LPR_{it} + \beta_6 \Delta UNEMP_{it} + \beta_7 \Delta GDP_{it} + \beta_8 \Delta TBOND_{it} + \beta_9 \Delta BTAX_{it} + \beta_{10} D * \Delta BTAX_{it} + \beta_{11} \Delta ITAX_{it} + \beta_{12} D * \Delta ITAX_{it} + \varepsilon_{it}$$

Variable	Predicted Sign	Coefficient Estimate	t-statistic	p-value
Intercept	-/+	-0.7442	-5.8002	<0.0001
D	-/+	0.2698	3.0040	0.0027
$\Delta FEES$	-/+	-0.0421	-3.3205	0.0009
$\Delta SIZE$	-/+	-0.9235	-4.4292	<0.0001
$\Delta TERM$	-/+	0.2024	2.3158	0.0207
$\Delta LPR$	-/+	-0.0068	-3.6505	0.0002
$\Delta UNEMP$	+	0.1517	3.0094	0.0013
$\Delta GDP$	-	-11.4536	-6.4314	<0.0001
$\Delta TBOND$	+	0.4675	9.1849	<0.0001
$\Delta BTAX$	+	0.0793	1.8229	0.0343
$D * \Delta BTAX$	-	-0.0373	-1.6427	0.0503
$\Delta ITAX$	+	0.1039	2.3298	0.0100
$D * \Delta ITAX$	-	-0.0314	-2.4326	0.0076
<b>Adjusted R<sup>2</sup></b>		<b>0.3844</b>		
<b>No. of Obs.</b>		<b>1,377</b>		

<sup>1</sup> The sample represents 1,377 state-year observations from 1977 to 2004 for 50 states and the District of Columbia.

<sup>2</sup>  $\Delta VARIABLE_{it} = VARIABLE_{it} - VARIABLE_{it-1}$ , and  $D = 1$  if the observation belongs to 1994 or after, and 0 otherwise. **For the maximum loan in state i in year t:**  $RATE_{it}$  = Loan contract interest rate;  $FEES_{it}$  = Initial fees and charges as a percentage of loan amount;  $SIZE_{it}$  = Natural logarithm of loan size;  $TERM_{it}$  = Natural logarithm of loan maturity in years;  $LPR_{it}$  = Loan-to-price ratio. **For state i in year t:**  $UNEMP_{it}$  = Average unemployment rate;  $GDP_{it}$  = Natural logarithm of gross domestic product per capita;  $TBOND_{it}$  = Yield on a treasury bond with the same maturity as the median loan. **For commercial banks in state i in year t:**  $BTAX_{it}$  = Median ratio of the sum of federal, state and local taxes to income before taxes. **For state i in year t:**  $ITAX_{it}$  = Marginal combined state and federal mortgage interest tax deduction for high income taxpayers.

<sup>3</sup> All t-statistics are based on Newey-West's (1987) heteroskedasticity and autocorrelation consistent standard error estimates.

<sup>4</sup> All p-values are based on one-tailed t-tests when the coefficient sign is predicted, and based on two-tailed t-tests otherwise.