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Deposit Competition and Mortgage Securitization

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Abstract

We study how deposit competition affects a bank's decision to securitize mortgages. Exploiting the state-specific removal of deposit market caps across the US as a source of competition, we find a 7.1 percentage point increase in the probability that banks securitize mortgage loans. This result is driven by an 11 basis point increase in deposit costs and corresponding reductions in banks' deposit holdings. Our results are strongest among banks that rely more on deposit funding. These findings highlight a hitherto undocumented and unintended regulatory cause that motivates banks to adopt the originate-to-distribute model.

Keywords: competition, deposits, originate-to-distribute, securitization

JEL classification: G21, G28, K21

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1 INTRODUCTION

We investigate the importance of competition in deposit markets for banks' propensity to securitize mortgage loans. A bank can fund a loan using deposits or, alternatively, through securitization, with funds from capital markets. Although many financial assets have been securitized in recent years, deposits continue to finance between 25% and 70% of loan amounts across consumer lending markets (Gorton and Metrick, 2013). Despite the significance of deposits for funding bank lending, there is little understanding of the role that deposit market competition plays in motivating banks to securitize loans. Prior studies offer numerous explanations for the growth in securitization (Loutskina and Strahan, 2009; Loutskina, 2011; Keys et al., 2010, 2012; Ghent and Valkanov, 2016; McGowan and Nguyen, 2022). We contribute to this literature by showing that deposit market competition plays a significant and hitherto undocumented role for banks' incentives to securitize mortgages.

To illustrate the role of deposit competition for securitization, we isolate a factor that intensifies deposit competition within a market via an exogenous regulatory change in the 1990s and early 2000s: the removal of deposit concentration limits as part of the Interstate Banking and Branching Efficiency Act of 1994 (IBBEA). This law enabled individual states in the United States (US) to relax a cap that prevents interstate bank mergers where the target institution holds at least 30% of statewide deposits. Removing the deposit cap lowers entry barriers for out-of-state (multi-state) banks. This change harms incumbent single-state banks because they must now compete for deposits with multi-state entrants. In contrast, deregulation benefits multi-state banks as they have access to a new deposit source upon entering a new state.

Intensifying deposit market competition may provoke an increase in securitization by single-state banks through two channels. First, as the aggregate quantity of deposits in a market is fixed at a given point in time, when multi-state banks enter a new state, they capture deposit market share from incumbent single-state banks. This reduces incumbents' deposit holdings and limits their ability to finance lending using deposits. Securitization

offers an alternative source of funding that allows incumbents to maintain credit supply (Han et al., 2015; Drechsler et al., 2017). Second, in markets featuring tough deposit competition, the opportunity cost of using deposits to finance lending is high because incumbents must set higher equilibrium deposit rates to prevent a drain of liquidity. Securitization therefore provides a bank with a cheaper funding source because securitized loans do not appear on the bank's balance sheet, and also allows it to avoid issuing relatively expensive equity to comply with capital regulations (Pennacchi, 1988; Gorton and Pennacchi, 1995).

Our results highlight two key issues. First, the removal of limits on deposit market caps triggers statistically and economically significant increases in single-state banks' funding costs and corresponding reductions in deposits. Second, this shortage of deposit funding motivates banks to significantly increase securitization of mortgages. Using bank-level data, we document a 7.1 percentage point (pp) increase in the probability that a bank securitizes mortgage loans after deposit market caps are removed. Tests that exploit mortgage loan-level data provide corroborating evidence that deposit competition significantly raises the odds that a bank securitizes a mortgage loan.

Further analyses reveal heterogeneity in the data. Banks that rely more heavily on deposits to finance lending, and are thus exposed to a greater competitive shock, are significantly more likely to turn to securitization in the face of tougher deposit competition. Moreover, we find that single-state banks experience an 11 basis point increase in average deposit costs and their branches lose 10% of their deposit holdings. In contrast, there is no significant change in multi-state banks' deposit costs, and unlike single-state banks, they exhibit no significant change in the probability of securitizing mortgages. Our findings are also externally valid: we obtain similar results using alternative measures of deposit market competition during the period 2010 to 2019.

We rule out that our results are driven by confounding events and measurement issues. Placebo tests indicate that securitization activities in non-banks that operate in the same lending environment as banks, but do not rely on deposits to finance loans,

do not respond to the removal of deposit market caps. Similarly, there is no change in securitization status among banks in contiguous states that experience no change in deposit competition. Further sensitivity checks confirm that regulatory reforms implemented through the Gramm-Leach-Bliley Act of 1999 (GLBA), Basel II requirements, intrastate branching deregulation, and adjustments in supervisory authorities' regulatory intensity do not affect our inferences. The results are also robust to shocks to monetary policy and deposit market concentration (Drechsler et al., 2017, 2020), borrower quality, house prices, and shifting demand patterns among mortgage-backed securities' investors. A final set of checks demonstrates that the documented contraction in deposit supply does not arise from alternative demand or supply shocks.

Our results are important for three reasons. First, we offer novel evidence of an unintended regulatory factor that motivates banks to move away from the originate-to-hold to the originate-to-distribute (OTD) model. Theories predict that securitization distorts lenders' monitoring incentives because banks have less skin in the game relative to holding loans on their balance sheets (Gorton and Pennacchi, 1995; Parlour and Winton, 2013). At the same time, securitization can provide cheap funding sources for banks when they are in need of liquidity (Loutskina, 2011). To mitigate the adverse effects, and promote the benefits of securitization activities, one has to understand the incentives that motivate banks to opt for the OTD model in the first place.

Second, policymakers and the media have long argued that the origins of the securitization boom and the subsequent financial crisis are rooted in regulatory changes. For example, by repealing restrictions on the separation of retail and investment banking, the GLBA triggered an increase in bank risk taking. Various other statutory changes, including the partial repeal of the Glass-Steagall Act in 1999, the enactment of the Commodity Futures Modernization Act of 2000, and the American Dream Downpayment Act of 2003, created arbitrage conditions in favor of subprime mortgages and potentially encouraged securitization activities by banks and financial companies (Blundell-Wignall et al., 2009).[1] We show that the removal of deposit

market caps as part of the deregulation of state banking markets via the IBBEA increased banks' securitization activities.

Third, unlike prior work that focuses on large multi-state banks (Rice and Strahan, 2010; Favara and Imbs, 2015), we highlight a missing piece of the puzzle on the role of deposit market cap deregulation in affecting small local banks that play a crucial role in funding households and small businesses.

This paper relates to several strands of literature. One area of research examines the rise and fall of securitization around the financial crisis. These studies mainly consider demand-side explanations for the pre-2007 securitization boom. A common theme running through these papers is the view that investors neglected the risk of nationwide house price downturns and the belief that diversified exposures to residential mortgages were almost riskless (Gerardi et al., 2008; Gennaioli et al., 2012; Chernenko et al., 2016). This fueled demand and inflated credit ratings for mortgage-backed securities. Other contributions focus on regulatory arbitrage, and rating bias (Griffin and Tang, 2012). Unlike these studies, our paper offers new insights into supply-side forces. To this extent, we complement the supply-side mechanism documented by Drechsler et al. (2020). They show that monetary tightening between 2003 and 2006 provoked a shift towards non-agency lending by non-bank institutions. In contrast to their work, we find an increase in banks' securitization activity that predates the monetary tightening episode, in line with the upward trend in securitization from the mid-1990s shown in Figure 1 when deposit market competition began to intensify.[2]

[Insert Figure 1]

Another strand of literature documents how advancements in securitization have changed the nature of banking. Loutskina (2011) reports links between credit supply and the liquidity of bank loans. By providing a new source of funds, securitization reduces the sensitivity of banks' willingness to supply credit to the availability of deposits and liquid funds. Further studies by Loutskina and Strahan (2009), Mian and Sufi (2009), Demyanyk and Van Hemert (2011), and Keys et al. (2012) evaluate how securitization affects loan origination decisions.

Our paper differs from this literature by focusing on banks' incentives to securitize loans. Closest to our research are the contributions by Han et al. (2015) and McGowan and Nguyen (2022). The former develop a model showing that deposit competition increases the attractiveness of loan sales and support their predictions with empirical evidence that securitization is more likely in high-tax environments. The latter show that lenders use securitization to mitigate credit risk when constraints prevent pricing credit risk into mortgage contracts. A unique contribution of our work is to shed new light on the question of why mortgage securitization accelerated in the late 1990s by establishing a link between the relaxation of deposit market caps, deposit supply, and an increase in securitization.

Moreover, this paper speaks to the literature on deposit competition. Since deposits account for the majority of US banks' funding, changes in deposit competition directly influence banks' funding models (Pennacchi, 1988; Gorton and Pennacchi, 1995), risk taking (Hellmann et al., 2000; Allen and Gale, 2004; Egan et al., 2017) and credit supply (Arping, 2017). Drechsler et al. (2017) show that deposit competition influences the transmission of monetary policy through bank balance sheets. Li et al. (2019) find that banks operating in more concentrated deposit markets are able to extend longer maturity loans. Our findings complement this literature by showing that the effect of deposit competition goes beyond credit supply, and motivates banks to change their business model by moving from the originate-to-hold to the OTD model.

Our research also offers new insights into the effects of deregulating banking markets. Berger et al. (2020) find that deregulation raises banks' cost of capital. Several studies link deregulation to improvements in bank performance (Jayaratne and Strahan, 1998; Stiroh and Strahan, 2003; Jiang et al., 2016) and stability (Goetz, 2018). Keil and Müller (2020) show that out-of-state banks' deposit market share increases from 2.5% in 1994 to 45.8% in 2011 after the removal of interstate branching restrictions. We extend this literature and shed light on a largely unexplored dimension of deregulation by illustrating how it incentivizes banks to change business models.

Finally, our study informs policymakers about the substitution effect between traditional deposit taking and non-traditional securitization activities beyond the US. For example, the 2020 EU Securitization Regulation applies across 19 EU member states and introduces a framework for simple, transparent, and standardised synthetic securitization activities for EU banks. This raises the possibility that banks may move towards an OTD model when they face competition in deposit markets.

2 CONCEPTUAL FRAMEWORK

The removal of state-level deposit market caps has implications for banks' ability to source deposits, and the cost of funds. The mechanism that operates via banks' funding costs may also have consequences for the likelihood that banks engage in securitization activities and for bank lending.

A key feature of this specific type of deregulation is its differential effect on single-state incumbent banks and out-of-state multi-market banks. Removing deposit market caps provides opportunities for multi-market banks to increase their geographic reach by expanding into new states to enlarge their deposit sources and lending activity. However, this adversely affects single-state banks that traditionally depend on lending and deposit taking in geographically delimited markets. Whereas single-state banks were previously shielded from out-of-state competition, they must now compete for core deposit funding sources to not only sustain current but also future lending activities. Deregulation therefore disadvantages single-state banks and hands a competitive advantage to multi-market entrants.

Evidence shows that following the removal of deposit market caps, the equilibrium number of banks competing in deregulated markets increases as multi-state banks enter and capture deposit market share (Keil and Müller, 2020). This leads to higher demand for inelastically supplied deposits within the state. Faced with a drain of liquidity that could ultimately provoke liquidation of loans and assets, single-state banks set higher equilibrium deposit rates to retain deposits, leading to narrower net interest margins and lower profits.

Against a background of rising deposit costs, contracting profits, and reallocations of deposit market shares that potentially undermine lending, single-state banks have incentives to look for ways to lower the cost of funding. A plausible strategy, documented by Pennacchi (1988), Gorton and Pennacchi (1995), Loutskina and Strahan (2009), and Han et al. (2015), is to fund loans through securitization rather than using deposits. The funds acquired through loan sales do not appear as costly deposits on the balance sheet. A further benefit of securitization is that banks do not need to issue expensive equity to meet capital adequacy requirements or hold interest-bearing liabilities against these funds.

The effect of lifting the deposit market cap on lending is ambiguous. Single-state banks may reduce credit supply if they cannot compensate for the funding shortfall triggered by the erosion of their deposit base either through securitization or obtaining other funding sources to support lending. However, where single-state banks can secure sufficient funding via securitization, they may sustain current lending levels. In this case, a single-state bank continues to supply the same amount of credit but pivots from funding loans through deposits to securitization. Prior work by Jayaratne and Strahan (1996) shows bank branching deregulation did not increase the amount of bank lending, but instead only improved the quality of lending.

3 DATA

We obtain quarterly bank-level data for commercial and savings banks in the US from their consolidated reports on Condition and Income (Call Reports) for the period between 1994Q1 to 2006Q4. The Call Reports provide information on bank balance sheet items, income, and expenses. The Call Reports also provide us with information about bank size (total assets), equity capital ratios, return on assets (ROA), and information we use to calculate the Z-score, an accounting based measure of the distance to default.[3] To ensure that the data set only contains viable commercial and savings banks, we exclude banks with no deposits, no loans, and zero or negative equity capital in the current or previous year. This results in a sample

of 438,212 bank-quarter observations for 14,574 banks. Given that we are interested in how incumbent banks respond to deposit competition, the sample for single-state banks contains 433,809 bank-quarter observations for 13,011 banks.[4]

To classify whether a bank securitizes mortgage loans, we generate an OTD dummy variable that equals 1 if a bank reports that it sells mortgage loans during the quarter or if it receives mortgage servicing fees, 0 otherwise. Table 1 lists the Call Report items we use to establish whether a bank securitizes mortgages. We also complement our OTD measure by merging information on mortgage securitization from the HMDA database. If any of these items from Call Reports have a non-zero value, or if any bank in our sample reports a securitization of their mortgages in HMDA data, the bank sells mortgage loans, and we code the OTD indicator 1.[5]

The IBBEA sets a deposit market cap which prevents interstate mergers where the target holds at least 30% of statewide deposits. However, the law grants states authority to set a higher threshold or remove the cap entirely, thereby reducing entry barriers for multi-state banks and intensifying deposit market. To capture deposit competition, we exploit state-level removal of the 30% deposit cap. We retrieve quarterly information on the statewide deposit cap limit from Rice and Strahan (2010) and generate a dummy variable, DC_{st}, which equals 1 if state s has a deposit cap limit above the 30% ratio, 0 otherwise.

Ratewatch.com provides monthly, bank branch-level information from 1997 on the interest rate paid on each deposit product. Using this data, we follow Drechsler et al. (2017) and construct the quarterly average interest rate paid on 1) all main deposit products (i.e., 12 month certificates of deposit products (CD), money market 25k funds (MM), and interest checking accounts), 2) 12 month CD, and 3) MM 25k funds.[6] We also collect annual branch level deposit data from the FDIC Summary of Deposits (SoD). This source allows us to measure each branch's total deposit holdings, deposit growth rate, and construct the deposit concentration Herfindahl-Hirshman Index at the branch, bank, and county levels.

We complement the bank-level securitization tests using loan-level data between 1994 and 2006 from the Home Mortgage Disclosure Act (HMDA) database. This data set contains approximately 95% of all mortgage loan applications. For each loan, we observe whether the loan is originated, the census tract where the property is located, the lender, various borrower and loan characteristics, whether the loan is eligible for sale to a Government Sponsored Entity (GSE), and whether the loan is securitized or remains on the lender's balance sheet. Using this information, we construct a dummy variable that equals 1 if a loan is securitized, 0 otherwise; a dummy variable that equals 1 if the borrower is female, 0 otherwise; and, to measure risk, the loan-to-income (LTI) ratio.

We restrict the sample to observations of loans originated by banks (deposit-taking institutions). Moreover, to ensure a homogeneous unit of observation, we restrict the sample to observations of first-lien loans originated by single-state banks for home purchases. This provides a sample containing approximately 4.6 million observations.

[Insert Table 1] [Insert Table 2]

Table 1 describes each variable in the data set. Table 2 tabulates summary statistics. Between 1994Q1 and 2006Q4, 28% banks in our sample operate an OTD model and the average bank pays an interest rate of 2.06% on its deposits.

4 INSTITUTIONAL BACKGROUND AND EMPIRICAL STRATEGY

Historically, US banks were prohibited from branching both within and across state lines. These restrictions protected banks from entry on the grounds that allowing banks to expand freely could damage financial stability, and adversely affect economic development. Beginning in the 1970s with developments in communications technology and the invention of automatic teller machines, the geographical boundary between banks and customers weakened as states removed intrastate entry barriers between 1970 and 1994 (Kroszner and Strahan, 1999).

Lawmakers passed the IBBEA of 1994 to allow interstate branching (Kroszner and Strahan, 1999). While the legislation applies to all states, it granted state authorities discretion to restrict mergers on the grounds of excess consolidation of deposit market shares. The IBBEA specifies a deposit cap limit of 30% of statewide deposits. This prevents multi-state banks from acquiring a financial institution with at least 30% of statewide deposits, thereby constraining deposit competition. However, the law grants states authority to set the statewide deposit market cap. Setting a lower cap hinders entry by out-of-state banks, thereby limiting the contestability of markets and preserving within-state deposit competition (Johnson and Rice, 2008). Online Appendix Table A.1 provides information on the timing of the removal of deposit market caps.

4.1 *Identification Strategy*

Our identification strategy exploits exogenous changes in deposit market caps across states and time. We use a difference-in-difference estimator that compares the evolution of mortgage securitization between banks in states that remove the deposit market cap versus similar institutions in other states that do not deregulate. We estimate

$$y_{bst} = \beta DC_{st} + \gamma X_{bst-1} + \delta_b + \delta_t + \varepsilon_{bst}, \tag{1}$$

where y_{bst} is a dependent variable (e.g. OTD status) for bank b in state s in quarter t; DC_{st} is a dummy variable equal to 1 if a state removes the 30% statewide deposit cap in favor of a higher limit, 0 otherwise; X_{bst} is a vector of control variables including the first lags of Bank Size, Capital ratio, ROA, Z-score, and the state house price index HPI; δ_b and δ_t are bank and quarter-year fixed effects, respectively; ε_{bst} is the error term. We cluster the standard errors at the state level. The bank and quarter-year fixed effects purge all bank-specific, time-invariant factors and time-varying shocks common to all banks (e.g. federal law changes, monetary policy, and macroeconomic fundamentals).

We use the same approach in the deposit cost tests with the exception that the dependent variable (interest rates paid on various deposit products) is measured at the bank-branch-state-year level. In these tests, we use branch fixed effects and year fixed effects to rule out that our results are driven by other branch specific time-invariant characteristics or any time varying common economic factors that affect all branches simultaneously.

Difference-in-difference estimates are more meaningful when the treatment and control groups are observationally equivalent ex-ante because similar units are differentially exposed to a shock. To examine the groups' comparability, we use the normalized difference methodology proposed by Imbens and Wooldridge (2009). Normalized level differences of less than 0.25 in a variable during the pre-treatment period indicate the groups are similar along a given dimension. All the absolute normalized difference values in Table 3 show the groups resemble each another.

[Insert Table 3] [Insert Figure 2]

Critical to our identification strategy is the identifying assumption of parallel trends. To examine whether OTD status evolves in tandem within the treatment and control groups prior to the removal of deposit caps, we estimate

$$y_{bst} = \beta_{-8}DC_{st-8} + \beta_{-7}DC_{st-7} + \cdots + \beta_{-1}DC_{st-1} + \beta_0 DC_{st} + \cdots + \beta_n DC_{st+n} + \varepsilon_{bst}, \quad (2)$$

where y_{bst} is a dummy variable equal to 1 if bank b in state s securitizes mortgages during quarter t; DC_{st-k} is the k^{th} quarter lag of the deregulation variable, DC_{st}; DC_{st+n} is the n^{th} quarter lead of the deregulation variable, DC_{st}; ε_{bst} is the error term. Insignificant estimates of β_{-i} [where $i \in (-8, -7, \cdots, -1)$] indicate parallel trends as there are no significant differences in y_{bst} between the treatment and control groups during quarter i before deregulation occurs.

Figure 2 plots the quarterly coefficient estimates and their corresponding 95% confidence intervals. During all pre-treatment quarters the estimates are insignificant, which empirically supports the parallel trends assumption.

The removal of deposit caps is plausibly exogeneous with respect to mortgage securitization for several reasons. First, previous research highlights that the deregulation process was chaotic, suggesting the gradual removal of barriers to entry appeared at random (Goetz et al., 2013; Goetz, 2018). Second, the data show no trends in mortgage securitization before the removal of deposit caps as one would anticipate if conditions within the securitization market motivate enactment. Column 1 in Online Appendix Table A.2 presents the pre-treatment dynamic coefficient estimates depicted in Figure 2. Relative to banks in untreated states, treated banks do not show significantly higher OTD incidences.

A related question is whether securitization or developments within the deposit market motivate the removal of statewide deposit caps. If so, simultaneity bias will be present in equation (1). We estimate a Cox Proportional Hazard model

$$h(t) = h_0(t) \times exp(\beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n), \tag{3}$$

where t represents time until the removal of the deposit cap limit, $h_0(t)$ is the baseline hazard, and $X_1, X_2, \cdots X_n$ denote state-level covariates. We define failure as the quarter in which a state removes the statewide deposit cap.

[Insert Table 4]

Columns 1, 2, and 3 of Table 4 suggest that the average incidence of securitization, deposit rates, and deposit growth rates are insignificant determinants of the removal of deposit market caps. In other words, these factors do not influence the timing of the legislative shock to deposit market competition. This is consistent with exogeneity of the removal of deposit market caps documented elsewhere in the literature.

4.2 *Does The Removal of Deposit Market Caps Increase Deposit Competition?*

A necessary condition for the econometric analysis is that the removal of deposit caps triggers an increase in deposit competition. To establish whether this is the case, we estimate equation (1) using various deposit market Herfindahl-Hirschman indexes (HHI). To do so, we follow Drechsler et al. (2017) and Li et al. (2019) and construct three measures of deposit competition.

The first measure is a branch-HHI variable. Using branch-level data from the FDIC's Summary of Deposits database, we calculate the branch-HHI by summing the squared deposit market shares of all banks that operate branches in county c during year t. We then assign to each bank branch in our data the HHI of the county in which it is located. A lower branch-HHI value indicates less concentration (i.e., more deposit market competition). Since many banks have multiple branches distributed across county lines, the branch-HHI does not fully capture the aggregate deposit competition level that each bank faces. To tackle this issue, we follow Drechsler et al. (2017) and calculate a bank-HHI, defined as the weighted average of branch-HHIs across all of bank b's branches during year t. Weights are defined using the share of deposits a bank raises in a given market. With this set up, two banks operating in one county could have different bank-HHIs because their branching footprints do not fully overlap (Li et al., 2019). Finally, we calculate the county-HHI as the average of the bank-HHIs across all banks operating in a given county. This measure captures the exposure of a given local market to funding conditions across all banks operating within it.

Column 1 in Online Appendix Table A.3 reports estimates using the branch HHI measure as the dependent variable. The results show that following the removal of deposit cap limits, the average branch-HHI declines by 0.012 units, equivalent to a 5.71% increase in deposit competition between branches. We find corroborating evidence in columns 2 and 3 of the table. Using the bank-level indicator, estimates show that deposit competition increases by 2.3% following the removal of deposit caps. The county-level estimates in column 3 show that, at this level, competition intensifies by 3.81%.

5 RESULTS

Table 5 presents estimates of equation (1) using the OTD indicator as the dependent variable. In column 1, the sample contains single- and multi-state banks. Removing the 30% statewide deposit market cap significantly increases the probability that a bank operates an OTD model by 7.1 percentage points. The magnitude of this effect is equivalent to a 25.3% increase considering 28% of banks in the sample operate an OTD model.[7]

[Insert Table 5]

Among the control variables, column 1 shows that increasing size, profitability, and soundness is associated with a sigificantly higher probability that a bank securitizes mortgages. The probability of OTD status is significantly lower among well capitalized banks and those operating in states with faster rates of house price appreciation.

The shock to deposit competition is likely to be greater for a single- relative to a multi-state bank that can source deposits from out-of-state markets where competition is less severe (Gilje et al., 2016; Danisewicz et al., 2017). Consistent with this view, column 2 of Table 5 shows that the deposit competition coefficient estimate is positive and significantly related to OTD status for single-state banks. In contrast, when we constrain the sample to multi-state banks in column 3, deposit competition has no significant effect on OTD status.

To corroborate the bank-level findings, the rest of Table 5 presents estimates of equation (1) using the loan-level HMDA data. In column 4, we estimate that the shock to deposit competition provokes a 13 pp increase in the probability that a single-state bank securitizes a mortgage loan. The coefficient estimate is significant at the 1% level. Given that on average, 71% of mortgage loans get securitized in our sample, the magnitude of the effect is economically significant, and equivalent to a 18% increase. The results in columns 5 and 6 show that this is a general result for the mortgage market. Irrespective of whether we limit the sample to loans eligible for sale to the GSEs (column 5) or non-GSE eligible loans (column 6), increasing deposit competition leads to a significantly higher likelihood that a loan is securitized.[8] The

deposit competition coefficient estimate implies an increase in the probability of securitization of between 13.1 pp and 13.5 pp.

Together, the findings show that increasing deposit competition influences securitization along both the extensive and intensive margin. As deposit competition intensifies, more banks sell mortgage loans. At the same time, banks also securitize a greater share of the mortgages they originate.

5.1 *Deposit Costs*

To understand the mechanism underlying the deposit competition-securitization nexus among single-state banks, we analyze the evolution of deposit costs using the branch-level data set. We first test how deposit competition influences the average cost of deposit funds across all deposit products.

Column 1 of Table 6 shows that deposit competition provokes an 11 basis point increase in the average deposit rate. The coefficient estimate is significant at the 1% level. Given that the average interest rate a bank pays for its deposits is 2.06%, the magnitude of the effect is economically meaningful and equivalent to a 5.34% increase.

[Insert Table 6]

Our next tests examines how deposit competition affects the rate paid on 12 month CDs and MM 25k funds, two of the most important sources of deposit funding. Column 2 in Table 6 shows that the interest rate paid on CDs significantly increases by 13.1 basis points. Greater deposit competition triggers a significant 7.9 basis point increase in the rates paid on MM 25k funds.

The estimates suggest that as deposit competition intensifies, incumbent banks are forced to set higher equilibrium deposit interest rates to prevent a drain of liquidity. To understand whether single-state banks experience a relative contraction in deposit funding, we estimate equation (1) using the level of deposits as the dependent variable. Column 4 of Table 6 shows

that the average single-state bank branch experiences a significant 10% reduction in its deposit holdings.[9]

5.2 *Bank Funding Structure*

So far, the findings suggest that banks turn to securitization to finance loans in the face of tougher deposit competition which erodes their deposit holdings and increases deposit costs. However, the extent of the changes in securitization behavior may vary according to a bank's ex-ante dependence on deposits to fund lending. To examine this conjecture, we estimate

$$y_{bst} = \beta DC_{st} + \gamma X_{bst-1} + \varphi DC_{st} \times Z_{bs} + \delta_b + \delta_t + \varepsilon_{bst}, \tag{4}$$

where all variables are defined as in equation (1) except Z_b which is a pre-treatment average characteristic for bank b. The characteristics we consider are: reliance on deposits (measured using the high deposit share dummy variable), wholesale funding reliance (measured using the high wholesale funding share dummy variable), the loans-to-deposits ratio (measured using the high loans-to-deposits dummy variable), capitalization (measured using the high capital dummy variable), and bank size (measured using the larger bank dummy variable).

[Insert Table 7]

Across all specifications in Table 7 we find that deposit competition provokes a significant increase in mortgage securitization. However, bank characteristics amplify and dampen this response. For example, column 1 of Table 7 shows that following the removal of deposit caps, banks with a deposit-to-asset ratio above the median are 2 pp more likely to operate an OTD model relative to banks below the median. The finding is consistent with this group being exposed to relatively more intense competition, and a larger increase in deposit funding costs, due to their greater reliance on deposits to fund mortgage credit origination.

Banks that use more wholesale funding to finance their activities are potentially insulated from deposit competition after the removal of deposit caps because this funding source is not

directly affected by the removal of deposit caps. Column 2 of Table 7 provides evidence that this is these case. A financial institution with an above median wholesale funding share is 10 pp less likely to securitize mortgages after deregulation.

In column 3, we ask how the loans-to-deposit ratio influences securitization choices. Intuitively, higher values on this metric show banks are more reliant on deposits to fund lending. Consistent with this intuition, banks with loans-to-deposit ratios above the median are approximately 13 pp more likely to securitize following the removal of deposit caps.

The remainder of Table 7 studies how capitalization and size correlate with mortgage securitization after deregulation. We find that better capitalized banks are less likely to offload mortgage loans in column 4 whereas, among single-state banks, relatively larger institutions are no more likely to securitize mortgages compared to smaller banks in column 5.

5.3 *External Validity Tests*

Our empirical analyses focus on 1994Q1 to 2006Q4 because this period contains plausibly exogenous variation in deposit competition that allows us to pin down consistent estimates. However, if the deposit competition-mortgage securitization nexus holds generally, we should obtain similar findings during other periods. Call Reports do not contain OTD status data before 1994. We thus design an external validity test using information between 2010Q1 and 2019Q4. This period does not feature regulatory-driven variation in states' deposit competition. To this end, we follow Drechsler et al. (2017) and Li et al. (2019) and use the branch-, bank-, and county-HHIs as measures for deposit market competition. We merge these HHI variables into the bank-level data and estimate

$$y_{bct} = \beta HHI_{jt} + \delta_b + \delta_t + \varepsilon_{bct}, \tag{5}$$

where y_{bct} is the OTD status of bank b in county c in year t; HHI_{jt}, $(j \in i, b, c)$, is one of the three HHI indexes where higher HHI values indicate lower deposit market competition. δ_b

and δ_t denote bank and year fixed effects, respectively; ε_{bct} is the error term. Standard errors are clustered at the bank level.

Estimates of equation (5) are shown in Table 8. We find that more intense deposit competition significantly increases the probability that a bank operates an OTD model. Column 1 shows that banks with bank-HHI one standard deviation above the mean (i.e. a less competitive market for deposits) is 2 pp less likely to operate an OTD model relative to one with a bank-HHI one standard deviation below the mean.[10] Column 2 provides similar evidence, bank operating in a county with a branch-HHI one standard deviation above the mean is 2.6 pp less likely to operate an OTD model relative to one with a branch-HHI one standard deviation below the mean. Finally, column 3 shows that comparing a bank that is one standard deviation above to a bank one standard deviation below the mean county-HHI results in a 1.8 pp lower probability that it operates an OTD model.

Together, these findings imply that tougher deposit market competition leads to a greater likelihood that banks use securitization to finance loans. Our baseline findings thus hold more generally, and are not an artifact of the sample time period, or the way we measure deposit market competition.

6 ROBUSTNESS TESTS

In this section, we conduct tests to affirm that the findings are not driven by the choice of estimator, or confounding factors.

6.1 *Methodological Sensitivity Checks*

The identification strategy leverages the staggered removal of statewide deposit cap limits across US states using a two-way fixed effects difference-in-difference estimator. This approach rests on the identifying assumption that, conditional on the control variables and fixed effects, changes to deposit competition are exogenous. Recent econometric advances highlight that

the strict exogeneity assumption may fail under the twoway fixed effect design in cases where treatment is staggered across time because the composite error term can correlate with the treatment variable and group fixed effects (Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Sun and Abraham, 2021; Baker et al., 2022).

To address this issue, we use a stacked difference-in-difference estimator to obtain dynamic coefficient estimates in the eight quarters on either side of the normalized change in deposit competition when the statewide deposit market cap limit is removed. Column 1 in Online Appendix Table A.2 reports the results. During the eight pre-treatment quarters, the coefficient estimates are insignificant. However, after the deposit competition shock, the dynamic coefficient estimates are positive and significant, and are also of the same order of magnitude as the baseline results.

In addition, we check the robustness of the findings to estimating equation (1) using a logit estimator. The marginal effect in column 2 of Online Appendix Table A.2 remains similar. We also test the sensitivity of the results to bootstrapping the standard errors using 50 replications rather than state-level clustering. Column 3 shows that our key findings remain unaffected. Overall, methodological issues do not appear to drive the inferences.

6.2 *Placebo Tests*

We use placebo tests to examine whether observable or unobservable confounds bias our results. Deposit competition applies exclusively to financial intermediaries that fund loans using deposits. Securitization within non-deposit taking financial institutions should be unaffected by the removal of statewide deposit caps. If an observable or unobservable omitted variable rather than deposit competition drives our results, we would expect securitization among non-banks to respond to deregulation the same way as is the case for banks.

[Insert Table 9]

Using HMDA data, for each non-bank we calculate the annual securitization rate (the ratio of securitized loans to total loans originated by the institution) of mortgage loans, the

average loan-to-income (LTI) ratio of borrowers, the female loan ratio (the ratio of loans to females to total loans originated by the institution), and the urban ratio (the ratio of loans for properties in metropolitan statistical areas to total loans originated by the institution). We then estimate

$$s_{ist} = \beta DC_{st} + \gamma X_{ist-1} + \delta_i + \delta_t + \varepsilon_{ist}, \tag{6}$$

where s_{ist} is the securitization rate for non-bank i in state s during year t; DC_{st} is the deposit competition indicator; X_{ist-1} is a vector of control variables; δ_i and δ_t are non-bank and year fixed effects, respectively; ε_{ist} is the error term.

We present estimates of equation (6) in Table 9. Column 1 shows that deposit competition has no effect on a non-bank's securitization rate. The deposit competition coefficient estimate is economically close to zero and statistically insignificant. Column 2 of Table 9 demonstrates that this finding remains unaffected by the inclusion of control variables.

Our second approach is to restrict the sample to banks in states that do not remove deposit caps but are contiguous with the treatment group (states that remove restrictions). We randomly allocate 50% of banks within each state to placebo treatment status and estimate

$$OTD_{bst} = \beta Placebo_{st} + \gamma X_{bst-1} + \delta_b + \delta_t + \varepsilon_{bst}, \tag{7}$$

where all variables are defined as in equation (1) except $Placebo_{st}$ equals 1 if a contiguous state has removed the 30% deposit cap during quarter t, 0 otherwise. The placebo coefficient estimate in column 3 of Table 9 is insignificant. Hence, our results are not driven by secular trends in the banking industry. We only detect changes in mortgage securitization among banks that are exposed to actual changes in deposit competition.

In sum, the removal of statewide deposit market caps influences neither non-banks' nor untreated banks' securitization decisions. If an omitted variable drives the baseline findings, the placebo deposit competition coefficient should be statistically significant and comparable in economic magnitude to Table 5. The placebo checks also suggest the effects we observe

are not due to developments in the lending market which both banks and non-banks are subject to. Rather, it is only when deposit-taking banks are subject to tougher deposit competition that the probability of securitization changes. This suggests our findings have a causal interpretation.

6.3 *The Legal Environment*

The IBBEA granted states the authority to remove other impediments to interstate branching. During the sample period states repeal entry barriers by changing regulation surrounding the minimum age of a target institution, allowing de novo interstate branching, and removing restrictions on the acquisition of individual bank branches.[11] These measures may also influence the level of deposit market competition single-state banks face from multi-state entrants. We therefore use the Rice and Strahan (2010) branching expansion (BE) index which aggregates the four interstate branching regulation indices to measure the overall level of deposit competition in a state. Column 1 of Table 10 shows that the probability a bank securitizes mortgages is significantly increasing in the BE index. In essence, when states remove more entry barriers, single-state banks experience tougher deposit competition which triggers mortgage securitization.

[Insert Table 10]

A concern could be that removal of the 30% deposit cap coincides with changes to other interstate branching restrictions. However, Goetz et al. (2013) and Goetz (2018) report deregulation of the four interstate branching restrictions was haphazard and plausibly exogenous. We therefore append equation (1) with controls for whether the state permits de novo branching, sets an age limit for target institutions of less than 5 years, and if it permits interstate branch acquisition. Column 2 in Table 10 reports the estimates. The effect of removing the deposit cap is robust to this change: the deposit competition coefficient estimate remains significant but is also comparable in economic magnitude to the baseline

results. Hence, the key finding is not driven by changes to other aspects of interstate branching regulation.

The results in column 2 show that de novo branching provokes a significant increase in the likelihood that a bank securitizes mortgage loans. This is consistent with this form of deregulation provoking tougher deposit competition as multi-state banks enter by increasing the number of branches operating in the state. In contrast, removing barriers to branch acquisition significantly lowers the odds that a bank operates an OTD model because this form of deregulation leads to consolidation in deposit markets. Removing age limits has an insignificant effect on securitization.

The GLBA is frequently identified as the catalyst for the increase in securitization activity during the lead up to the financial crisis. We therefore remove observations from 1999Q4 onward when the Act was in force. Column 3 in Table 10 shows the deposit competition coefficient remains positive and statistically significant. This test also rules out that our findings are due to subsequent legislation such as the repeal of the Glass-Steagall Act in 1999, the Commodity Futures Modernization Act of 2000, the American Dream Downpayment Act of 2003, and the monetary policy tightening between 2003 and 2006.

The Basel II Accord, published in June 2004, proposed changes to international banking standards, including higher capital ratios (Raz et al., 2022). We therefore exclude observations from 2004Q2 onward and report estimates of equation (1) in column 4 of Table 10. We continue to find the deposit competition coefficient is positive and significantly related to OTD status.

Banks are potentially subject to different levels of regulatory monitoring depending on their charter and regulator (Danisewicz et al., 2018, 2020). We therefore create charter-year and regulator-year fixed effects to capture time-varying differential shocks to regulation and monitoring. The inferences are unaffected by this change in column 5 of Table 10.

Between the early 1970s and 1994 US states removed restrictions on intrastate bank branching. While this deregulation episode was completed prior to the start of our sample, a concern may be that the effects of intrastate deregulation persist through time. We therefore

append equation (1) with a variable that measures the number of quarters since a state liberalized intrastate deregulation. We continue to find statistically significant effects arising from the removal of deposit market caps on OTD status in column 6 of Table 10.

6.4 *Mortgage Market Factors*

Next, we augment equation (1) with mortgage market control variables to capture a diverse set of potential confounds. For example, the secondary market for prime mortgages is thicker than for jumbo loans owing to the GSEs' purchase guarantees. Agarwal et al. (2014) report that during the securitization boom banks were more likely to securitize less risky mortgage loans. Prior research links securitization to insufficient screening (Keys et al., 2010). We capture these forces using the bank-level ratio of jumbo to total mortgage loan applications (secondary market thickness), LTI ratio (borrower riskiness), and loan denial rates (screening intensity). Table 11 shows that these changes do not affect our inferences.

[Insert Table 11] [Insert Table 12]

Alternatively, OTD status may respond to elements of the lending environment. Deposit constrained banks may turn to securitization to fund loans where they accept a greater number of mortgage applications. Column 1 of Table 12 shows the findings are robust to controlling for the mortgage application acceptance rate.

Chernenko et al. (2016) argue that the growth in securitization before the financial crisis reflects an increase in investor demand for MBS and CDOs. Thus, the higher incidence of OTD status across banks may reflect investor demand, rather than supply-side deposit competition effects. Relatedly, the GSEs account for approximately 70% of secondary market mortgage loan purchases. Where the GSEs alter their underwriting criteria to include a wider range of loans, banks have stronger incentives to use securitization to unload credit risk. We approximate overall demand for MBS (including private and GSE purchases) using third party purchases (the state-level ratio of loan sales to third parties to total originated loans). GSE demand is measured using the state level ratio of loan sales to GSEs to total originated loans

(GSE purchases). Similarly, we capture non-GSE demand using the state level ratio of loan sales to private buyers to total originated loans (Private purchases). Our estimates in columns 2 to 4 of Table 12 show that demand-side factors do not confound our inferences.

Banks may securitize mortgages to unload prepayment risk due to refinancing or the credit risk of mortgage default (McGowan and Nguyen, 2022). Columns 5 and 6 of Table 12 present estimates of equation (1) that includes controls for these factors. Deposit competition continues to exert a significantly positive effect on OTD status.

Drechsler et al. (2020) show that between 2003 and 2006, the tightening of monetary policy incentivizes financial institutions, especially non-banks, to increase lending in the private secondary market. They argue that the effects of monetary policy vary depending on deposit concentration across banks. To rule out this concern, we use the Drechsler et al. (2017) bank-HHI variable and interact it with the Fed funds rate. This term captures the differential effect of monetary policy across imperfectly competitive deposit markets.

Column 7 in Table 12 presents estimates of equation (1) with the additional controls for bank-HHI and the bank-HHI-Fed rate interaction. In more concentrated deposit markets, banks have a lower probability of operating an OTD model, consistent with our argument that increasing deposit competition creates securitization incentives. Furthermore, in line with Drechsler et al. (2020), we observe that when the Federal Reserve tightens monetary policy, banks in more concentrated markets are more likely to sell loans in the secondary market. Importantly, while the predictions in Drechsler et al. (2020) hold in our setting, the deposit competition coefficient remains positive and significant, suggesting that the interplay between bank market structure and monetary policy does not confound the effect of deposit competition on OTD status.

The rest of Table 12 presents tests that show loan demand does not confound the inferences. Irrespective of whether we measure demand using the number of mortgage applications (column 8) or the amount of mortgage credit (column 9), the findings are robust.

6.5 *Lending, Risk Taking, Liquidity, and Regulatory Capital*

Do banks reduce lending in the face of tougher deposit market competition? On the one hand, as single-state banks face a contraction in deposit holdings, they may reduce credit supply. Alternatively, the amount of credit they originate may remain unchanged because banks pivot towards securitization to fund loans. Column 1 in Online Appendix Table A.6 shows the shock to deposit competition had no significant effect on the amount of credit treated banks originate. In column 2, we find similar results using loan growth as the dependent variable. Columns 3 and 4 present similar results using the annual mortgage loan amount and mortgage loan growth rate as the dependent variable. Finally, we use the loan-level HMDA to evaluate whether deposit competition affects the probability that a bank accepts a mortgage application. The deposit competition coefficient estimate in column 5 of Table A.6 is again insignificant. Deposit competition therefore had little effect on credit supply.

While securitization offers a cheaper funding source in the face of intensifying deposit competition, banks could alternatively originate riskier mortgages that have wider net interest margins and hold them on balance sheet. We test this conjecture using loan-level data by estimating

$$A_{ilst} = \beta_1 DC_{st} + \beta_2 W_{ilst} + \beta_3 DC_{st} \times W_{ilst} + \gamma X_{ilst-1} + \delta_i + \delta_t + \varepsilon_{ilst}, \tag{8}$$

where A_{ilst} equals 1 if loan application by borrower i located in state s during year t is accepted by lender l, 0 otherwise; W_{ilst} is a loan-level measure of borrower i's riskiness; all other variables are defined as in equation (1).

Column 1 in Online Appendix Table A.7 presents estimates of equation (8) using the LTI ratio measure of riskiness. Loans with higher LTI ratios are significantly less likely to be accepted. However, the LTI-deposit competition coefficient estimate is insignificant. Column 2 shows complementary evidence using applicant income to measure risk. Applications from high income borrowers are significantly more likely to be accepted but the income-deposit

competition interaction coefficient is insignificant. Financial institutions therefore do not lower lending standards by originating riskier loans when deposit competition increases.

Next, we test if our findings are driven by state-level laws on bankruptcy, renegotiation conditions between lenders and borrowers, and state corporate tax. Column 1, 2, and 3 of Online Appendix Table A.8 show that our results remain unchanged with the inclusion of these state-level conditions. Column 4 of the same table shows results from a sample that excludes observations of banks that are involved in mergers and acquisitions during the sample. Much of the 2008 housing crisis was concentrated in California, Florida, and New York. We therefore exclude observations from these states in column 5 of Online Appendix Table A.8 to ensure the results are not driven by housing market fundamentals in these areas. In each case, the findings are robust.

6.6 *Deposit Supply and Loan Demand*

We revisit the idea that reductions in deposit supply rather than deposit competition drive our inferences. To implement these tests, we use variables found to determine deposit supply elsewhere in the literature. For example, Acharya and Mora (2014) and Han et al. (2015) report that deposit supply is greater in regions where seniors make up a larger share of the population. Other factors that may affect deposit supply include the population growth rate, job creation, poverty, unemployment and the rate of relocation (migration) from other parts of the US. Irrespective of the inclusion of these additional variables, we continue to find in Table A.9 that deposit competition significantly affects banks' propensity to engage in securitization.

Finally, Online Appendix Table A.10 shows the shock to deposit competition did not influence mortgage loan demand, either at the bank or market levels.

7 CONCLUSION

We present evidence that deposit competition spurs banks' securitization activity. As banks compete more intensively for deposits, deposit costs increase and banks' deposit holdings contract. This motivates banks to turn to capital markets to fund lending via securitization. Our estimates show deposit competition increases the probability a bank securitizes mortgages by 7.1 percentage points. Mortgage loan-level analyses provide complementary evidence showing securitization increases along the intensive margin as well. A novel insight of our work is the substitutability of deposit and securitization funding models in the face of deposit competition.

It is important to recognize that our findings help explain the timing and intensity of the remarkable securitization boom ahead of the financial crisis. Existing supply-side explanations show the tightening of monetary policy in 2003 helped provoke an increase in securitization by non-bank lenders (Drechsler et al., 2020). Yet, the pace of securitization activity accelerated in the mid-1990s among banks, including small local banks, suggesting other factors also helped ignite the boom. Consistent with this fact, we document that the removal of deposit market caps raised the intensity of deposit market competition and spurred securitization. Quantitatively, this channel matters, accounting for 25.3% of the increase in the number of banks operating OTD platforms during the pre-crisis period. In addition, regulatory-induced deposit competition does not influence securitization incentives among non-banks that do not rely on deposit funding but are subject to the same lending market environment.

The link between deposit competition and securitization does not just hold during the pre-2007 years. Rather, it is present during the years following the financial crisis as well. This is consistent with the continuing importance of deposits, and competition for deposits, in funding loans. Other factors that govern the intensity of competition in deposit markets may produce similar outcomes.

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FOOTNOTES

1 While these deregulation episodes likely contributed to developments within securitization markets, they are federal in nature and therefore do not confound our estimates.

2 Robustness checks show our findings are not driven by the period of monetary tightening from 2003.

3 The Z-score is calculated at an annual frequency using the equation: $Z_{bt} = (ROA_{bt} + ETA_{bt})/ROASD_{bt}$ where ROA_{bt}, ETA_{bt}, and $ROASD_b$ are return on assets, the ratio of equity to total assets, and the standard deviation of returns on assets over the 3 year rolling window for bank b, respectively.

4 Mergers and acquisitions (M&A) are treated in the standard way in the literature. We artificially create a new identification number for the new bank after the M&A that is independent from the two banks that entered the M&A transaction.

5 Call Reports document the total bank-level value of securitization during a quarter. It is not possible to disentangle the value into securitization of loans during the quarter and previously originated loans.

6 We focus on these products because Drechsler et al. (2017) show they account for the majority of deposits held by most banks. They are therefore representative of the average cost of deposits that a bank faces. We use quarterly rather than monthly data to mirror the frequency of the bank-level information.

7 Consistent with the view that deposit competition provokes securitization by eroding incumbents' profitability, Online Appendix Table A.4 shows that single-state banks' net interest income margin narrows by 0.052 percentage points following the removal of the

deposit cap limit. Figure 2 shows the removal of deposit caps leads to an increase in the probability a single-state bank securitizes mortgages, even in the short run. This is consistent with multi-markets banks entering quickly following deregulation. The FDIC Summary of Deposits database shows multi-state banks capture 11.4% deposit market share within a year of the removal of the deposit cap. Five years after deregulation, their market share increased to 45.2%. These patterns suggest single-state banks rapidly experienced erosion of their deposit base which triggered entry into the OTD market for mortgages.

8 The GSEs are key participants in the secondary market for mortgage loans due their mandate to provide liquidity to support lending and home ownership. To achieve this aim, they specify a set of underwriting criteria that a loan must meet to be eligible for GSE purchase. Loans eligible for sale to the GSEs therefore tend to have lower debt-to-income ratios, smaller loan amounts, higher credit scores, and due to less risk, lower interest rates, relative to non-GSE-eligible loans (McGowan and Nguyen, 2022).

9 Online Appendix Table A.5 reports estimates showing the effect of deposit competition on multi-state banks. We find the removal of deposit caps has no significant effect on the probability that a multi-state bank securitizes mortgages (column 1), loan growth (column 2), deposit growth rates (column 3), or deposit interest rates (column 4). The findings are consistent with multi-state banks avoiding deposit competition by sourcing deposits from less competitive markets, and recent evidence that shows 85% of multi-state banks set uniform deposit interest rates across their branches (Granja and Paixao, 2021).

10 The standard deviation of the bank-HHI is 0.11. The effect size is calculated as $2 \times 0.11 \times (-0.091) \times 100 = 2$ pp.

11 The minimum age of the target institution defines how long a bank must have been in

existence prior to its interstate acquisition or merger. This requirement cannot be set to be more than 5 years. Under de novo interstate branching the opening of new out-of-state branches only applies when states 'opt-in' to this provision. States may permit the acquisition of individual branches, rather than all branches belonging to a bank. An interstate merger transaction may involve the acquisition of a branch or branches without the acquisition of the whole bank in the state.

Tables

Table 1: Variable Descriptions

Variable	Description	Source
Financial institution-level data		
OTD	A dummy variable equal to 1 if a bank reports any mortgage securitization in its quarterly Call Report or HMDA data, 0 otherwise. Specifically, if any of the Call Report items RCFD3164, RCFDB705, RCFDB706, RIADB493, RCFD3431, RCFD5500, RCFD5501, RCFD5502, RCFD5503, RCFD5504, RCFD5505, RCFD5371, RCFDB804, RCFDB805, RCFDA590, RCFDA591, RCFDB705, RCFDB706, RCFDB776, RCFDB777, RCFDA590, and RCFDA591 are non-zero, or if the bank reports mortgage loans securitization in the HMDA database.	FFIEC 031 Call Report & HMDA
Loan growth	The quarterly growth rate of total outstanding loans	
Bank size	Natural logarithm of a bank's total assets	FFIEC 031 Call Report
ROA (%)	Ratio of profits to total assets	FFIEC 031 Call Report
Capital ratio (%)	Ratio of bank equity capital to total assets	FFIEC 031 Call Report
Z-score (Ln)	The logarithm of the Z-score	FFIEC 031 Call Report and authors' calculation
High deposit share	A dummy that equals 1 if the ratio of deposits over total assets of a bank before the state removal of deposit caps is above the median, 0 otherwise	FFIEC 031 Call Report
High wholesale share	A dummy that equals 1 if the ratio of wholesale funding over total assets of a bank before the state removal of deposit caps is above the median, 0 otherwise	FFIEC 031 Call Report
High loans-to-deposits	A dummy that equals 1 if the ratio of loans over total deposits of a bank before the state removal of deposit caps is above the median, 0 otherwise	FFIEC 031 Call Report
High capital	A dummy that equals 1 if the equity over total asset ratio of a bank before the state removal of deposit caps is above the median, 0 otherwise	FFIEC 031 Call Report
Larger bank	A dummy that equals 1 if total assets of a bank before the state removal of deposit caps is above the median, 0 otherwise	FFIEC 031 Call Report
Bank-HHI	The weighted average of branch-HHIs across all of its branches	FDIC SoD and Authors' Calculation
Mortgage volume	The natural logarithm of total mortgages that a bank originates in a year	HMDA
Mortgage growth	The annual growth rate of mortgage amount that a bank originates	HMDA
Mortgage applications (Ln)	The natural logarithm of total number of mortgage applications that a bank receives in a year	HMDA
Single state bank	Dummy variable that equals 1 if a bank operates in one state only, 0 otherwise	FFIEC 031 Call Report
NII (%)	Net interest income margin	FFIEC 031 Call Report
Securitization of non-banks	Ratio of securitized mortgages to total originated mortgages by a non-bank	HMDA
Loan-level data		
Securitization	A dummy variable that equals 1 if a mortgage loan is securitized, 0 otherwise	HMDA
Female	A dummy variable that equals 1 if the mortgage applicant is female, 0 otherwise	HMDA
LTI Ratio	The Loan-to-income ratio of a mortgage loan	HMDA
Accept	A dummy variable that equals 1 if the mortgage is accepted, 0 otherwise	HMDA
Mortgage amount (Ln)	The natural logarithm of mortgage amount	HMDA
Year level data		
Fed rates (%)	The annual effective Fed funds rate	NY Fed
Branch-level data		
Average Deposit Rate (%)	Quarterly average interest rate that a branch pays for its depositors for three main savings products including Certificate of Deposits 12 months, Money Markets 25k, and Interest Checking Accounts	RateWatch.com
CD12M Rate (%)	Quarterly average interest rate that a branch pays for its depositors for the savings product Certificate of Deposits 12 months	RateWatch.com
MM25K Rate (%)	Quarterly average interest rate that a branch pays for its depositors for the savings product Money Markets 25K	RateWatch.com
Deposit Growth (%)	The yearly growth rate in deposits of a branch	SoD
Branch HHI	A sum of squared deposit market shares for all bank branches operating in a given county	SoD and Authors' Calculation

Table 1 Cont'd: Variable Descriptions

Variable	Description	Source
State-level data		
DC	Dummy variable that equals 1 if a state relaxes the deposit market cap for interstate mergers to above 30%, 0 otherwise	Rice and Strahan (2010)
BE index	Interstate branching expansion Index	Rice and Strahan (2010)
De novo branching	Dummy variable that equals 1 if the host state allows de novo branching, 0 otherwise	Rice and Strahan (2010)
Branching acquisition	Dummy variable that equals 1 if the host state allows acquisition of an existing local branch, 0 otherwise	Rice and Strahan (2010)
Age limit	Dummy variable that equals 1 if the host state allows the age of a bank prior to its acquisition in an interstate bank merger of less than 5 years, 0 otherwise	Rice and Strahan (2010)
Time since intrastate deregulation	The number of quarters since a state liberalized intrastate deregulation.	Jayaratne and Strahan (1996)
HPI	Average quarterly state-level rate of change in house prices	FHFA
Mortgage applications (ln)	The natural logarithm of the total number of mortgage applications that all banks in a state receive in a year	HMDA
Jumbo share (%)	Ratio of jumbo loans originated to total originated loans	HMDA
LTI ratio	Average loan-to-income ratio of mortgage loans originated	HMDA
Denial (debt-to-income)	Average denial rates of mortgage loans in a state	HMDA
Denial (employment history)	Average denial rates of mortgage loans due to employment reasons in a state	HMDA
Denial (collateral)	Average denial rates of mortgage loans due to collateral in a state	HMDA
Denial (insufficient cash)	Average denial rates of mortgage loans due to insufficient cash in a state	HMDA
Denial (missing information)	Average denial rates of mortgage loans due to missing information in a state	HMDA
Acceptance Rate	Average acceptance rates of mortgage loans in a state	HMDA
Third Party Purchases	The ratio of mortgage loans purchased by a third party in a state over total originated mortgages	HMDA
GSE Purchases	The ratio of mortgage loans purchased by a GSE in a state over total originated mortgages	HMDA
Private Purchases	The ratio of mortgage loans purchased by a non-GSE in a state over total originated mortgages	HMDA
Refinancing	The ratio of mortgage refinancing applications to total applications in a state	HMDA
Homestead exemptions (Ln)	The natural logarithm of the amount of home equity that homeowners in a state are entitled to retain in the bankruptcy proceedings	?
Renegotiation rate (%)	The percentage of mortgages that default and successfully renegotiate terms with the mortgage servicer	Fannie Mae Single Family Loan
State corporate tax (%)	The state corporate income tax rate where the loan is originated	Tax Foundation
County-level data		
Unemployment rate (%)	The unemployment rate in the county where the bank is located	US Census
Poverty rate (%)	The percentage of people who live under the poverty threshold in a county	US Census
Net job creation rate (%)	The net job creation rate in the county where the bank is located	US Census
Population growth (%)	The growth rate of population in a county	US Census
Senior population (%)	The percentage of people who are 65 years old and above in a county	US Census
Relocation rate (%)	The percentage of people who relocate over total population in a county	US Census
Mortgage Default (%)	Average mortgage default rates of mortgage loans in a county	HUD
County-HHI	An average of all bank HHIs operating in the county	SoD and Authors' Calculation

Notes: This table defines each variable in the data set and the data source. FFIEC 031 Call Report denotes the Federal Financial Institutions Examination Council 031 consolidated reports of condition and income database. 'Chicago Fed' denotes the Federal Reserve Bank of Chicago. 'FDIC' denotes the Federal Deposit Insurance Corporation. 'SoD' denotes the Summary of Deposits database. 'HMDA' denotes the Home Mortgage Disclosure Act database. 'HUD' denotes the US Department of Housing and Urban Development. 'FHFA' denotes the Federal Housing Finance Agency. 'NY Fed' denotes the Federal Reserve Bank of New York.

Table 2: Summary statistics

Variable	Mean	Std. dev.	Min.	Max.	Observations
Bank-level data					
OTD	0.28	0.45	0	1	433,809
Loan growth	2.82	5.86	-9.02	26.86	433,809
Bank size	11.39	1.17	9.10	15.33	433,809
ROA (%)	0.66	0.5	-0.92	2.06	433,809
Capital ratio (%)	10.6	3.59	6.02	29.47	433,809
Z-score (Ln)	3.38	0.38	2.58	4.34	433,809
High deposit share	0.56	0.5	0	1	433,809
High wholesale share	0.42	0.49	0	1	433,809
High loans-to-deposits	0.29	0.46	0	1	433,809
High capital	0.53	0.5	0	1	433,809
Larger bank	0.3	0.46	0	1	433,809
Bank-HHI 1994-2006	0.21	0.11	0.03	0.57	433,809
Bank-HHI 2010-2019	0.22	0.11	0.03	0.57	209,919
Mortgage Amount (Ln)	8.15	1.86	3.81	12.49	8,842
Mortgage Growth (%)	27.04	85.61	-73.48	297.78	8,842
Mortgage applications (Ln)	3.98	1.82	0	13.07	10,657
NII (%)	2.5	1.15	0.53	5.61	433,809
Securitization rate of non-banks	0.57	0.44	0	1	21,420
Loan-level data					
Accept	0.62	0.49	0	1	7,507,486
Securitization	0.71	0.45	0	1	4,631,398
Female	0.23	0.42	0	1	4,631,398
LTI Ratio	2	2.36	0	1316.09	4,631,398
Mortgage Amount (Ln)	4.68	0.79	0	11.49	4,631,398
Annual data					
Fed rate	3.91	1.69	1	6	433,809
Branch-level data					
Average Deposit Rate (%)	2.06	1.39	0.1	5.85	269,580
CD12M Rate (%)	3.44	1.49	0.1	5.85	260,566
MM25K Rate (%)	2.09	1.25	0.1	5.85	270,088
Deposit Growth (%)	11.06	22.31	-15.91	79.57	393,592
Branch HHI (1994 to 2006)	0.21	0.11	0.05	1	641,545
Branch HHI (2010 to 2019)	0.22	0.12	0.06	0.77	209,919

Table 2 Cont'd: Summary statistics

Variable	Mean	Std. dev.	Min.	Max.	Observations
State-level data					
DC	0.52	0.5	0	1	433,809
BE index	1.14	1.36	0	4	433,809
De novo branching	0.23	0.42	0	1	433,809
Branching Acquisition	0.18	0.38	0	1	433,809
Age Limit	0.18	0.38	0	1	433,809
Time since intrastate deregulation	13.77	7.04	0	34	428,800
HPI	5.4	0.31	4.77	6.58	433,809
Jumbo shares (%)	0.05	0.05	0	0.45	433,809
LTI ratio	1.89	0.27	1.45	3.2	433,809
Denial (debt-to-income)	0.02	0.01	0.01	0.07	433,809
Denial (employment history)	0	0	0	0.03	433,809
Denial (collateral)	0.01	0	0	0.03	433,809
Denial (insufficient cash)	0	0	0	0.02	433,809
Denial (missing information)	0	0	0	0.01	433,809
Acceptance Rate	0.63	0.09	0.41	0.84	433,809
Third Party Purchases	0.48	0.08	0.17	0.77	433,809
GSE Purchases	0.31	0.08	0.09	0.52	433,809
Private Purchases	29.27	26.72	0	100	433,809
Refinance	0.45	0.15	0.09	0.8	433,809
Homestead exemtptions (Ln)	10.46	0.47	8.15	12.58	433,809
Renegotiation rates (%)	0.03	0.05	0	0.49	433,809
State corporate tax (%)	5.34	3.06	0	11.66	433,809
County-level data					
Unemployment Rate (%)	4.94	1.07	2	9.70	433,809
Poverty Rate (%)	12.29	3.19	4.5	25.7	433,809
Net Job Creation (%)	2.29	1.8	-1.98	6.81	433,809
Population Growth (%)	0.9	5.93	-94.39	1183.03	433,809
Senior Population (%)	14.38	4.08	2.5	37.85	433,809
Reallocation Rate (%)	26.61	3.02	20.63	34.55	433,809
Mortgage default (%)	1.43	0.51	0.2	3.61	433,809
County HHI (1994 to 2006)	0.20	0.09	0.05	1	33,127
County HHI (2010 to 2019)	0.23	0.08	0.1	0.57	209,919

Notes: This table presents descriptive statistics for the variables used in the empirical analysis. In the Bank, Branch, and Loan level data, we report descriptive statistics for only single-state banks given that our main analyses are based on single-state banks. Variable definitions and data sources are shown in Table 1. 'Ln' denotes that a variable is measured in natural logarithms.

Table 3: Ex-ante Comparability of Treatment and Control Groups

	Treatment		Control		
Variable	Mean	σ	Mean	σ	ND
OTD	0.272	0.445	0.251	0.434	0.03
Deposit rate (%)	4.474	0.544	4.393	0.481	0.11
Deposit growth (%)	1.326	6.212	0.853	5.614	0.06
Loan growth (%)	2.554	5.576	2.733	6.088	-0.02
Bank size	11.318	1.240	10.986	1.173	0.19
ROA	0.646	0.500	0.706	0.482	-0.09
Capital ratio (%)	9.873	3.259	9.571	2.961	0.07
Z-score	3.315	0.375	3.251	0.377	0.12

Notes: This table shows the mean pre-treatment value of each variable within the treatment and control group. σ denotes the standard deviation of the mean. ND indicates the normalized difference between the treatment and control groups' mean values. Imbens and Wooldridge (2009) show that an absolute normalized difference smaller than 0.25 indicates that there is no significant difference between mean values.

Table 4: Banking Market Characteristics and Time to Deposit Market Cap Removal

	(1)	(2)	(3)
Dependent variable	Time to deregulation		
OTD	-2.210		
	(2.817)		
Average deposit rate		-0.261	
		(0.160)	
Deposit growth			-0.006
			(1.083)
Bank size	2.045***	0.004	-0.022
	(0.606)	(0.129)	(0.075)
Capital ratio	-0.345	-0.323**	-0.163***
	(0.473)	(0.139)	(0.052)
ROA	-3.224***	1.339*	0.607***
	(0.547)	(0.712)	(0.231)
Z-score	0.285	1.750	-0.085
	(3.513)	(1.759)	(0.463)
Unemployment rate	-0.264	0.224	0.462***
	(0.245)	(0.348)	(0.077)
Poverty rate	-0.026	0.004	0.011
	(0.080)	(0.027)	(0.016)
Net job creation rate	0.050	-0.131	0.097***
	(0.187)	(0.283)	(0.033)
Observations	299	127	148
p-value of chi^2	0.00	0.00	0.00

Notes: This table reports estimates equation (3). Variable definitions are shown in Table 1. Standard errors are shown in parentheses. *, ** and, *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 5: Deposit Competition and Mortgage Securitization

	(1)	(2)	(3)	(4)	(5)	(6)
Level of aggregation	Bank			Loan		
Dependent variable	OTD			Securitization		
Sample	All	Single	Multi	All	GSE	Non-GSE
DC	0.071***	0.072***	-0.056	0.130***	0.131***	0.135***
	(0.021)	(0.021)	(0.059)	(0.023)	(0.023)	(0.032)
$Size_{t-1}$	0.121***	0.120***	-0.002	0.005	0.006	-0.005
	(0.008)	(0.008)	(0.045)	(0.007)	(0.007)	(0.014)
Capital $ratio_{t-1}$	-0.005***	-0.005***	-0.006	-0.001	-0.001	0.003
	(0.002)	(0.002)	(0.007)	(0.003)	(0.003)	(0.004)
ROA_{t-1}	0.009**	0.010***	-0.020	-0.026**	-0.025**	-0.031
	(0.004)	(0.004)	(0.022)	(0.011)	(0.011)	(0.021)
$Z\text{-}Score_{t-1}$	0.015*	0.016*	-0.020	-0.042	-0.049	0.015
	(0.008)	(0.008)	(0.022)	(0.031)	(0.033)	(0.036)
HPI_{t-1}	-0.115**	-0.119**	0.094	0.027	0.019	0.146**
	(0.050)	(0.051)	(0.079)	(0.030)	(0.030)	(0.066)
Female				0.004***	-0.002	0.009***
				(0.001)	(0.002)	(0.001)
LTI				0.003***	0.012***	-0.000**
				(0.001)	(0.002)	(0.000)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter × Year FE	Yes	Yes	Yes	No	No	No
Year FE	No	No	No	Yes	Yes	Yes
Observations	438,212	433,809	4,403	4,631,398	4,238,454	392,944
Adjusted R^2	0.679	0.674	0.812	0.397	0.402	0.433

Notes: This table reports estimates of equation (1). The sample in columns 1 and 3 contain single- and multi-state banks. In columns 2, 4, 5, and 6 the sample contains only single-state banks. For single-state banks, we code DC as equal to 1 if the state they operate in has relaxed the 30% deposit cap, 0 otherwise. For multi-state banks, we code DC as equal to 1 if the state they have headquarter in has relaxed the 30% deposit cap, 0 otherwise. 'GSE' denotes loans that are eligible for sale to the Government Sponsored Enterprises. 'Non-GSE' denotes loans that are ineligible for sale to the Government Sponsored Enterprises. Variable definitions are shown in Table 1. The standard errors are clustered by state and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 6: Deposit Competition and Deposit Interest Rates

Dependent variable	(1) Average deposit rates	(2) Certificates of deposit	(3) Money market 25k	(4) Deposits
DC	0.110***	0.131***	0.079**	-0.105***
	(0.019)	(0.012)	(0.031)	(0.029)
$Size_{t-1}$	0.011	0.015*	-0.017	0.427***
	(0.008)	(0.008)	(0.013)	(0.025)
Capital $ratio_{t-1}$	-0.000	0.000	-0.005*	-0.019***
	(0.002)	(0.002)	(0.003)	(0.005)
ROA_{t-1}	0.014**	0.019***	-0.023**	0.039*
	(0.007)	(0.007)	(0.010)	(0.020)
Z-$score_{t-1}$	-0.010	-0.011	-0.015	0.022
	(0.012)	(0.011)	(0.022)	(0.026)
HPI_{t-1}	0.136**	-0.010	0.458***	0.175*
	(0.065)	(0.093)	(0.115)	(0.095)
Branch $deposits_{t-1}$	0.014	-0.028**	-0.029	
	(0.018)	(0.012)	(0.033)	
Observations	269,580	260,566	270,088	492,572
Branch FE	Yes	Yes	Yes	Yes
Quarter × Year FE	Yes	Yes	Yes	No
Year FE	No	No	No	Yes
Adjusted R^2	0.945	0.952	0.830	0.386

Notes: This table reports estimates of equation (1) for single-state banks. Variable definitions are shown in Table 1. The standard errors are clustered by state and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 7: Heterogenous Treatment Effects

Dependent variable: OTD	(1)	(2)	(3)	(4)	(5)
DC	0.061***	0.089***	0.071***	0.077***	0.071***
	(0.020)	(0.024)	(0.021)	(0.022)	(0.021)
DC × High deposit shares	0.020**				
	(0.008)				
DC × High wholesales share		-0.100***			
		(0.015)			
DC × High loans-to-deposits ratio			0.133**		
			(0.056)		
DC × High capital				-0.011**	
				(0.005)	
DC × Larger bank					0.011
					(0.032)
Size_{t-1}	0.121***	0.122***	0.120***	0.119***	0.120***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
$\text{Capital ratio}_{t-1}$	-0.005***	-0.004***	-0.005***	-0.005***	-0.005***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ROA_{t-1}	0.010***	0.010***	0.010***	0.010***	0.010***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Z-score_{t-1}	0.015*	0.015*	0.016*	0.016*	0.016*
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
HPI_{t-1}	-0.120**	-0.118**	-0.119**	-0.118**	-0.119**
	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)
Observations	433,809	433,809	433,809	433,809	433,809
Bank FE	Yes	Yes	Yes	Yes	Yes
Quarter*Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.674	0.675	0.674	0.674	0.674

Notes: This table reports estimates of equation (4) for single-state banks and estimates the heterogeneous effect across bank characteristics. Variable definitions are shown in Table 1. The standard errors are clustered by state and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 8: External Validity Tests

	(1)	(2)	(3)
Dependent variable: OTD			
Bank-HHI	-0.091*		
	(0.053)		
Branch-HHI		-0.119**	
		(0.048)	
County-HHI			-0.112*
			(0.067)
Control variables	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Quarter × Year FE	Yes	Yes	Yes
Observations	209,919	209,919	209,919
Adjusted R^2	0.860	0.860	0.860

Notes: This table reports estimates of equation (1) for single-state banks. The sample contains observations from 2010Q1 to 2019Q4. We retrieve data from the FDIC Summary of Deposits database and follow Drechsler et al. (2017) and Li et al. (2019) to construct three measures for deposit market competition: Branch-HHI, Bank-HHI, and County-HHI. The vector of unreported control variables contains $\text{Size}_{t\text{-}1}$, $\text{Capital ratio}_{t\text{-}1}$, $\text{ROA}_{t\text{-}1}$, $\text{Z-score}_{t\text{-}1}$, and $\text{HPI}_{t\text{-}1}$. Variable definitions are shown in Table 1. The standard errors are clustered at the bank level and reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 9: Falsification Tests

	(1)	(2)	(3)
Sample	Nonbanks		Banks
Dependent variable	Securitization rate		OTD
DC	-0.005	-0.005	
	(0.009)	(0.009)	
LTI		0.001	
		(0.001)	
Gender		0.037**	
		(0.018)	
Urban		-0.032*	
		(0.017)	
Placebo			0.001
			(0.008)
Size_{t-1}			0.119***
			(0.016)
$\text{Capital Ratio}_{t-1}$			-0.014***
			(0.001)
ROA_{t-1}			0.016***
			(0.005)
Z-score_{t-1}			0.053***
			(0.011)
HPI_{t-1}			-0.429**
			(0.173)
Firm FE	Yes	Yes	No
Year FE	Yes	Yes	No
Bank FE	No	No	Yes
Quarter × Year FE	No	No	Yes
Observations	21,420	21,420	142,151
Adjusted R^2	0.82	0.82	0.64

Notes: This table reports estimates of equation (6) for non-banks in columns 1 and 2, and single-state banks in column 3. The sample includes annual firm-level data on non-banks using data from HMDA. Variable definitions are shown in Table 1. The standard errors are clustered at the state level and reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 10: Banking Regulatory Robustness Tests

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All	All	Exclude	Exclude	All	All
Dependent variable: OTD			GBLA	Basel II		
BE index	0.017***					
	(0.005)					
DC		0.075***	0.071***	0.071***	0.071***	0.072***
		(0.015)	(0.016)	(0.020)	(0.021)	(0.021)
De novo branching		0.064**				
		(0.027)				
Age limit		-0.002				
		(0.023)				
Branching acquisition		-0.033*				
		(0.020)				
Time since intrastate deregulation						-0.008*
						(0.004)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Regulator × Quarter × Year FE	No	No	No	No	Yes	No
Observations	433,809	433,809	213,178	373,901	433,809	428,800
Adjusted R^2	0.678	0.679	0.756	0.691	0.678	0.679

Notes: This table reports estimates of equation (1) for single-state banks. The vector of unreported control variables contains Size_{t-1}, $\text{Capital ratio}_{t-1}$, ROA_{t-1}, Z-score_{t-1}, and HPI_{t-1}. Variable definitions are shown in Table 1. The standard errors are clustered by state and the reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 11: Borrower Credit Quality Tests

Dependent variable: OTD	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DC	0.072***	0.071***	0.072***	0.071***	0.072***	0.074***	0.069***
	(0.021)	(0.021)	(0.022)	(0.021)	(0.021)	(0.020)	(0.021)
Jumbo share	-0.165						
	(0.141)						
LTI ratio		0.049					
		(0.037)					
Denial rate (DTI ratio)			0.939				
			(0.753)				
Denial rate (employment history)				3.455**			
				(1.664)			
Denial rate (collateral)					1.070		
					(1.315)		
Denial rate (insufficient cash)						3.473	
						(2.130)	
Denial rate (missing information)							6.537
							(4.234)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	433,809	433,809	433,809	433,809	433,809	433,809	433,809
Adjusted R^2	0.674	0.674	0.674	0.674	0.674	0.674	0.674

Notes: This table reports estimates of equation (1) for single-state banks. Variable definitions are shown in Table 1. The vector of unreported control variables contains $\text{Size}_{t\text{-}1}$, $\text{Capital ratio}_{t\text{-}1}$, $\text{ROA}_{t\text{-}1}$, $\text{Z-score}_{t\text{-}1}$, and $\text{HPI}_{t\text{-}1}$. Variable definitions are shown in Table 1. The standard errors are clustered by state and are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

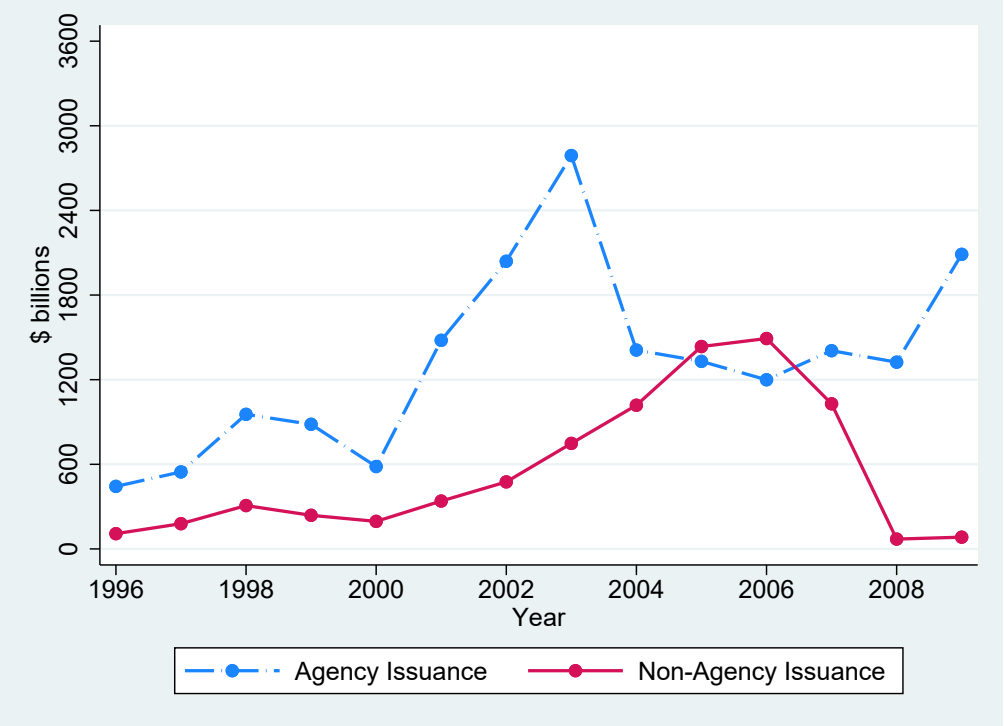
Table 12: Lending Environment

Dependent variable: OTD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DC	0.075***	0.074***	0.073***	0.072***	0.073***	0.071***	0.071***	0.072***	0.072***
	(0.019)	(0.020)	(0.021)	(0.021)	(0.020)	(0.021)	(0.021)	(0.021)	(0.021)
Acceptance rate	-0.241**								
	(0.101)								
Third party purchases		-0.089							
		(0.078)							
GSE purchases			-0.080						
			(0.073)						
Private purchases				0.000					
				(0.000)					
Refinancing					-0.090				
					(0.083)				
Mortgage default						0.022*			
						(0.011)			
Bank-HHI × FED rate							2.464**		
							(1.076)		
Bank-HHI							-0.104*		
							(0.059)		
Number of applications								-0.001	
								(0.026)	
Mortgage amount									-0.003
									(0.027)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	433,809	433,809	433,809	433,809	433,809	433,809	433,809	433,809	433,809
Adjusted R^2	0.674	0.674	0.674	0.674	0.674	0.674	0.674	0.674	0.674

Notes: This table reports estimates of equation (1) for single-state banks. The vector of unreported control variables contains Size_{t-1}, $\text{Capital ratio}_{t-1}$, ROA_{t-1}, Z-score_{t-1}, and HPI_{t-1}. Variable definitions are shown in Table 1. The standard errors are clustered by state and are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

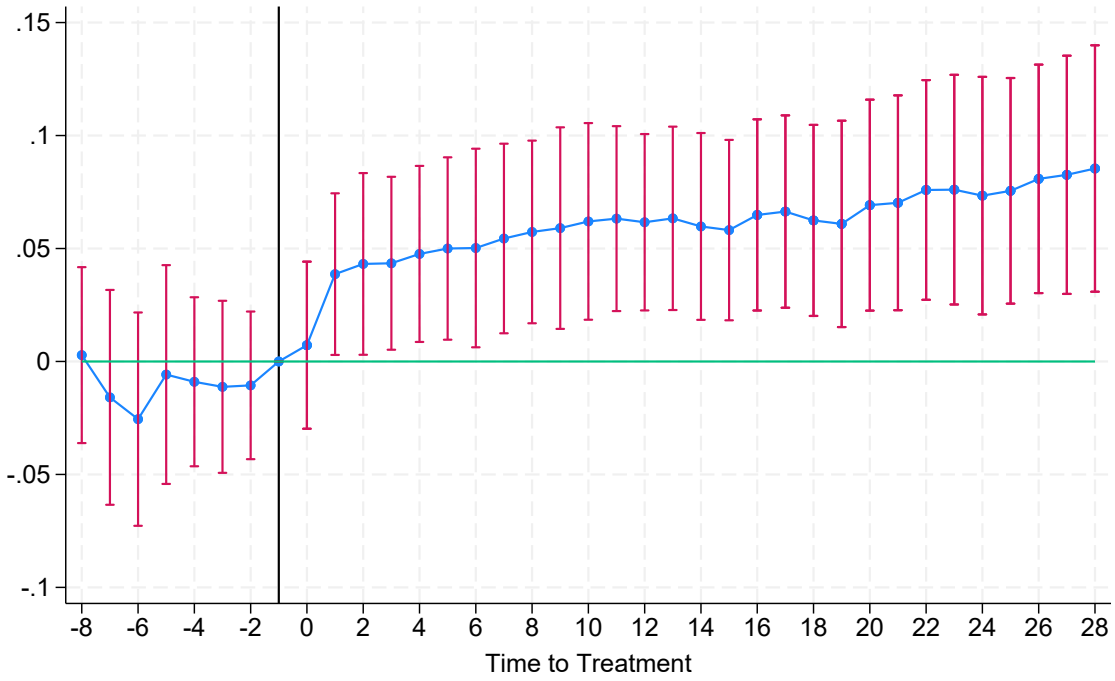
Figures

Figure 1: Quarterly Issuance of Agency and non-Agency Securitizations



Notes: This figure shows the semi-annual issuance of agency and non-agency mortgage related securities between 1996 and 2008. Agency mortgage related securities are issued by Government Sponsored Enterprises (GSEs). Non-Agency mortgage related securities are issued by private entities. The data source is the Securities Industry and Financial Markets Association (SIFMA). The y-axis measures securitization in billions of US$.

Figure 2: Parallel Trends Test



Notes: This figure shows the dynamic treatment effects of removing the deposit cap on banks' OTD status. The dots plots two way fixed effects event-study coefficient estimates for relative-time periods from 8 quarters before to 28 quarters after the date when a state removes the deposit cap limit. The vertical lines indicate 95% confidence intervals.

A ONLINE APPENDIX

Table A.1: Deposit Market Cap Removal Dates

State	Deposit Cap Relaxation Effective Date	Deposit Cap Limit for Interstate Mergers	State	Deposit Cap Relaxation Effective Date	Deposit Cap Limit for Interstate Mergers
Alaska	1994q1	50	Montana	Not Deregulated	22
Alabama	1997q2	30	North Carolina	1995q3	30
Arkansas	Not Deregulated	25	North Dakota	Not Deregulated	25
Arizona	1996q3	30	Nebraska	Not Deregulated	14
California	1995q3	30	New Hampshire	2000q3	30
Colorado	Not Deregulated	25	New Jersey	1996q2	30
Connecticut	1995q2	30	New Mexico	1996q2	40
District of Columbia	1996q1	30	Nevada	1995q3	30
Delaware	1995q3	30	New York	1997q2	30
Florida	1997q2	30	Ohio	1997q2	30
Georgia	1997q2	30	Oklahoma	Not Deregulated	20
Hawaii	1997q2	30	Oregon	Not Deregulated	30
Iowa	Not Deregulated	15	Pennsylvania	1995q3	30
Idaho	1995q3	100	Rhode Island	1995q2	30
Illinois	1997q2	30	South Carolina	1996q3	30
Indiana	1997q2	30	South Dakota	1996q1	30
Kansas	Not Deregulated	15	Tennessee	1997q2	30
Kentucky	Not Deregulated	15	Texas	Not Deregulated	20
Louisiana	1997q2	30	Utah	1995q2	30
Massachusetts	1996q3	30	Virginia	1995q3	30
Maryland	1995q3	30	Vermont	1996q2	30
Maine	1997q1	30	Washington	1996q2	30
Michigan	1995q1	100	Wisconsin	1996q2	30
Minnesota	1997q2	30	West Virginia	Not Deregulated	25
Missouri	Not Deregulated	13	Wyoming	1997q2	30
Mississippi	Not Deregulated	25			

Notes: This table reports a) the effective date when a state relaxes the 30% deposit market concentration limit with respect to interstate mergers, and b) the concentration limitation. The data sources are Johnson and Rice (2008) and Rice and Strahan (2010).

Table A.2: Methodological Sensitivity Checks

Estimator	(1) Stacked-DID	(2) Logit	(3) Bootstrap
Lag 8	0.013		
	(0.030)		
Lag 7	-0.023		
	(0.036)		
Lag 6	-0.037		
	(0.038)		
Lag 5	-0.001		
	(0.034)		
Lag 4	-0.007		
	(0.030)		
Lag 3	-0.011		
	(0.031)		
Lag 2	0.008		
	(0.015)		
Lag 1	0.033		
	(0.025)		
Lead 1	0.060**		
	(0.025)		
Lead 2	0.065**		
	(0.025)		
Lead 3	0.065***		
	(0.025)		
Lead 4	0.066**		
	(0.026)		
Lead 5	0.070***		
	(0.026)		
Lead 6	0.068**		
	(0.026)		
Lead 7	0.069**		
	(0.027)		
Lead 8	0.071**		
	(0.027)		
Deposit competition		1.481***	0.071***
		(0.032)	(0.002)
Observations	1,715,620	433,809	433,809
Control Variables	Yes	Yes	Yes
Bank effects	Yes	Yes	Yes
Quarter * Year effects	Yes	Yes	Yes
$PseudoR^2$ or Adjusted R^2	0.68	0.36	0.19

Notes: This table shows the sensitivity of our findings with regard to the choice of estimators. Column (1) presents estimates from a stacked DID estimator as discussed in Baker et al. (2022). We use full sets of leads and lags for the regression but for brevity only report the coefficients for 8 quarters before and after the Effective Date when a state relaxes the 30% deposit cap. Column (2) estimates equation (1) using a logit estimator. Column 3 reports estimates of equation (1) using 50 bootstrap replications rather than clustering the standard errors at the state level. Variable definitions are shown in Table 1. The standard errors are clustered by state (except in column (3)) and are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.3: Deposit Cap Removal and Deposit Competition

	1	2	3
Level of analysis	Branch	Bank	County
Dependent variable	Branch-HHI	Bank-HHI	County-HHI
DC	-0.012***	-0.006***	-0.008***
	(0.004)	(0.002)	(0.002)
$Size_{t-1}$	-0.016***	0.014***	0.008***
	(0.003)	(0.003)	(0.002)
Capital $ratio_{t-1}$	-0.001*	-0.002***	-0.004***
	(0.001)	(0.000)	(0.001)
ROA_{t-1}	0.005*	-0.003	-0.018***
	(0.003)	(0.002)	(0.006)
Z-$score_{t-1}$	0.011**	0.001	-0.006
	(0.005)	(0.002)	(0.007)
HPI_{t-1}	0.025	-0.065***	-0.016*
	(0.020)	(0.006)	(0.009)
Deposit (Ln) $_{t-1}$	-0.001***	-0.022***	0.008***
	(0.000)	(0.002)	(0.002)
Branch FE	Yes	No	No
Bank FE	No	Yes	No
County FE	No	No	Yes
Year FE	Yes	Yes	Yes
Observations	641,545	72,418	33,127
Adjusted R^2	0.472	0.752	0.713

This table reports how the removal of deposit cap limit affects deposit concentration at the branch, bank, and county level. Variable definitions are shown in Table 1. The standard errors are clustered by bank in Column (1) and (2) and by county in Column (3) and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table A.4: Profitability Effects

	(1)
Dependent variable	NII
DC	-0.052***
	(0.014)
Size_{t-1}	-0.046***
	(0.014)
Capital ratio_{t-1}	0.006***
	(0.002)
ROA_{t-1}	0.274***
	(0.008)
Z-score_{t-1}	-0.093***
	(0.007)
HPI_{t-1}	-0.070
	(0.042)
Bank FE	Yes
Quarter × Year FE	Yes
Observations	433,809
Adjusted R^2	0.917

This table reports estimates of equation (1) for single-state banks using the net interest income margin as the dependent variable. Variable definitions are shown in Table 1. The standard errors are clustered by state and reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table A.5: The Impact of Deposit Competition on Multi-state Banks

Dependent variable	(1) OTD	(2) Loan growth	(3) Deposits	(4) Deposit interest rate	(5) Deposit market shares
DC	-0.056	-1.167	-0.090	0.027	-0.001
	(0.108)	(0.106)	(1.739)	(0.043)	(0.007)
DC × Multi-state bank					0.017**
					(0.008)
Control variables	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	No	No	No
Branch FE	No	No	Yes	Yes	Yes
Quarter × Year FE	Yes	No	Yes	No	No
Year FE	No	No	Yes	Yes	Yes
Observations	4,651	4,651	274,029	26,025	641,545
Adjusted R^2	0.806	0.190	0.896	0.951	0.866

Notes: In this table, columns 1-4 report estimates of equation (1) for multi-state banks. In column 5, we run deposit market share of a branch on the interaction term between DC and a dummy variable for whether the branch belongs to a multi-state bank. In columns 1-2 we use the bank-level data set. As multi-state banks operate across state lines, in these regressions DC is the weighted average of deposit competition index across all states that a bank operates in using the share of deposits a bank has in each state as the weight. In column 3, 4, and 5, because we use branch-level deposits, interest rates, and deposit market shares data, DC is equal to 1 if the branch operates in a state that relaxes the 30% deposit cap limit, 0 otherwise. The unreported control variables are Size_{t-1}, $\text{Capital ratio}_{t-1}$, ROA_{t-1}, Z-score_{t-1}, and HPI_{t-1}. Variable definitions are shown in Table 1. The standard errors are clustered by state and are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.6: Deposit Competition and Bank Lending

Level of aggregation	(1)	(2)	(3) Bank	(4)	(5) Loan
Dependent variable	Loan amount	Loan growth	Mortgage amount	Mortgage growth	Accept
Deposit Competition	0.010	0.118	0.008	-0.021	-0.002
	(0.017)	(0.153)	(0.102)	(4.552)	(0.018)
Control variables	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Quarter*Year FE	Yes	Yes	No	No	No
Year FE	No	No	Yes	Yes	Yes
Observations	433,809	433,809	8,842	8,842	7,507,486
Adjusted R^2	0.983	0.219	0.796	0.008	0.207

Notes: This table reports estimates of (1) for single-state banks. The sample in columns 1 and 2 is the bank-level Call Report data. The sample in columns 3 and 4 is bank-level HMDA data. The sample in column 5 is the HMDA loan-level data. The vector of unreported control variables contains $\text{Size}_{t\text{-}1}$, $\text{Capital ratio}_{t\text{-}1}$, $\text{ROA}_{t\text{-}1}$, $\text{Z-score}_{t\text{-}1}$, and $\text{HPI}_{t\text{-}1}$. In columns 3 and 4, we further control for the bank-level share of female applicants and the mean LTI ratio. Column 5 includes further controls for whether the applicant is female and the LTI ratio. Variable definitions are shown in Table 1. The standard errors are clustered by state and are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.7: Do Banks Accept Riskier Mortgages?

Dependent variable: accept	(1)	(2)
DC	-0.006	0.001
	(0.017)	(0.018)
LTI	-0.006***	-0.004***
	(0.001)	(0.000)
DC × LTI	0.001	
	(0.001)	
High income		0.028
		(0.022)
DC × High income		-0.020
		(0.019)
Control variables	Yes	Yes
Bank FE	Yes	Yes
Year FE	Yes	Yes
Observations	7,507,465	7,507,465
Adjusted R^2	0.209	0.209

Notes: This table reports estimates of equation (1) for single state banks. The unreported control variables are $\text{Size}_{t\text{-}1}$, $\text{Capital ratio}_{t\text{-}1}$, $\text{ROA}_{t\text{-}1}$, $\text{Z-score}_{t\text{-}1}$, $\text{HPI}_{t\text{-}1}$, whether the applicant is female, and the LTI ratio. Variable definitions are shown in Table 1. The standard errors are clustered by state and are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.8: State-level Conditions

Dependent variable: OTD	(1)	(2)	(3)	(4)	(5)
DC	0.072***	0.072***	0.071***	0.075***	0.073***
	(0.021)	(0.021)	(0.022)	(0.022)	(0.023)
Homestead exemption (Ln)	-0.014				
	(0.020)				
Renegotiation rate		-0.294			
		(0.469)			
State corporate tax rate			0.005		
			(0.010)		
Control variables	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Quarter × Year FE	Yes	Yes	Yes	Yes	Yes
Observations	433,809	433,809	433,809	392,174	400,273
Adjusted R^2	0.674	0.674	0.674	0.655	0.673

Notes: This table reports estimates of equation (1) for single-state banks. In Column (1), (2), and (3), we control for various state-level characteristics. Column (4) excludes observations of banks that either merged or were acquired during the sample period. Column (5) excludes observations of banks located in California, Florida, and New York. The unreported control variables are $\text{Size}_{t\text{-}1}$, $\text{Capital ratio}_{t\text{-}1}$, $\text{ROA}_{t\text{-}1}$, $\text{Z-score}_{t\text{-}1}$, and $\text{HPI}_{t\text{-}1}$. Variable definitions are shown in Table 1. The standard errors are clustered by state and are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.9: Deposit Supply

Dependent variable: OTD	(1)	(2)	(3)	(4)	(5)	(6)
DC	0.072***	0.072***	0.075***	0.072***	0.072***	0.072***
	(0.021)	(0.021)	(0.022)	(0.021)	(0.021)	(0.021)
Population growth	-0.000					
	(0.000)					
Senior population		-0.001				
		(0.004)				
Net job creation			0.001			
			(0.001)			
Poverty				0.002		
				(0.002)		
Unemployment					-0.002	
					(0.002)	
Relocation rate						0.003*
						(0.002)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	433,809	433,809	433,809	433,809	433,809	433,809
Adjusted R^2	0.674	0.674	0.669	0.674	0.674	0.674

Notes: This table reports estimates of equation (1) for single-state banks. The unreported control variables are Size_{t-1}, Capital ratio_{t-1}, ROA_{t-1}, Z-score_{t-1}, and HPI_{t-1}. Variable definitions are shown in Table 1. The standard errors are clustered by state and are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.10: Loan Demand Effects

	(1)	(2)
Aggregation level	Bank	State
Dependent variable: Total mortgage applications		
DC	-0.024	-0.078
	(0.093)	(0.212)
Control Variables	Yes	Yes
Bank FE	Yes	No
State FE	No	Yes
Year FE	Yes	Yes
Observations	10,657	578
Adjusted R^2	0.838	0.853

Notes: This table reports estimates of equation (1) for single-state banks. We measure loan demand using the total number of mortgage applications (in natural logarithms) at the bank-year (column 1) and state-year (column 2) levels. The unreported control variables are Size_{t-1}, $\text{Capital ratio}_{t-1}$, ROA_{t-1}, Z-score_{t-1}, HPI_{t-1}, and the annual bank-level share of female applicants, and average LTI ratio. Variable definitions are shown in Table 1. The standard errors are clustered by state and are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

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