

McGowan, Danny; Nguyen, Huyen; Schaeck, Klaus

Working Paper

Deposit competition and securitization

IWH Discussion Papers, No. 6/2021

Provided in Cooperation with:

Halle Institute for Economic Research (IWH) – Member of the Leibniz Association

Suggested Citation: McGowan, Danny; Nguyen, Huyen; Schaeck, Klaus (2022) : Deposit competition and securitization, IWH Discussion Papers, No. 6/2021, Halle Institute for Economic Research (IWH), Halle (Saale)

This Version is available at:

<https://hdl.handle.net/10419/266554>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



Halle Institute for Economic Research
Member of the Leibniz Association

Discussion Papers

No. 6

May 2021



Deposit Competition and Securitization

Danny McGowan, Huyen Nguyen, Klaus Schaeck

Authors

Danny McGowan

University of Birmingham
E-mail: d.mcgowan@bham.ac.uk

Huyen Nguyen

Halle Institute for Economic Research (IWH) –
Member of the Leibniz Association,
Department of Financial Markets, and
Friedrich Schiller University Jena
E-mail: huyen.nguyen@iwh-halle.de
Tel +49 345 7753 756

Klaus Schaeck

University of Bristol
E-mail: klaus.schaeck@bristol.ac.uk

The responsibility for discussion papers lies solely with the individual authors. The views expressed herein do not necessarily represent those of IWH. The papers represent preliminary work and are circulated to encourage discussion with the authors. Citation of the discussion papers should account for their provisional character; a revised version may be available directly from the authors.

Comments and suggestions on the methods and results presented are welcome.

IWH Discussion Papers are indexed in RePEc-EconPapers and in ECONIS.

Editor

Halle Institute for Economic Research (IWH) –
Member of the Leibniz Association

Address: Kleine Maerkerstrasse 8
D-06108 Halle (Saale), Germany
Postal Address: P.O. Box 11 03 61
D-06017 Halle (Saale), Germany

Tel +49 345 7753 60
Fax +49 345 7753 820

www.iwh-halle.de

ISSN 2194-2188

Deposit Competition and Securitization*

First version: 03.05.2021

This version: 08.12.2022

Abstract

We provide novel evidence that deposit competition incentivizes banks to securitize loans. Exploiting the state-specific removal of deposit market caps across the U.S. as an exogenous source of competition, we document a 7.1 percentage point increase in the probability that banks securitize their assets. This result is driven by an 11 basis point increase in costs of deposits and a corresponding decrease in banks' deposit growth. Our results are strongest among small and single state incumbent banks that rely more on deposit funding. These findings highlight an unintended regulatory cause that motivates banks to adopt the originate-to-distribute model.

Keywords: competition, deposits, originate-to-distribute (OTD), securitization

JEL classification: G21, G28, K11

* We are grateful for helpful comments and suggestions from Toni Ahnert, Tobias Berg, Christa Bouwman, Martin Götz, Reint Gropp, Iftekhar Hasan, Thomas Kick, Thomas Krause, Michael Koetter, Xiang Li, Elena Loutschina, Camelia Minoiu, Trang Nguyen, Felix Noth, Enrico Onali, Amiyatosh Purnanandam, Arisyi Raz, Farzad Saidi, Talina Sondershaus, Iryna Stewen, Daniel Streitz, Lena Tonzer, John Turner, and seminar and conference participants at the DGF Annual Conference 2021, the IFABS Oxford, the WEAI Annual Conference 2021, Curtin University, University of Exeter, University of Münster, University of Nottingham, Queen's University Belfast, FMA Europe, and the Royal Economic Society.

1 Introduction

We investigate the importance of competition in deposit markets for banks' propensity to securitize loans. Despite the significance of deposits for funding bank lending, and the need to understand the drivers of the securitization boom prior to the global financial crisis, there is little understanding of the role that deposit market competition plays for motivating banks' decision to enter the securitization market. 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). Our research contributes to this literature by presenting novel evidence that deposit market competition plays a significant and hitherto undocumented role for banks' incentives to securitize 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). Intensifying deposit market competition could thus make securitization more attractive by eroding a bank's deposit base (Han et al., 2015; Drechsler et al., 2017). In markets featuring tough deposit competition, banks set high deposit rates to prevent a drain of liquidity. Securitization therefore provides banks with a cheaper funding source because securitized loans do not appear on the bank's balance sheet, allowing it to avoid issuing relatively expensive equity or holding non-interest bearing reserves to comply with capital regulations (Pennacchi, 1988; Gorton and Pennacchi, 1995).

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 staggered removal of the deposit concentration limitation as part of the Interstate Banking and Branching Efficiency Act of 1994 (IBBEA). As explained in greater detail below, this law enabled individual states in the United States (U.S.) to relax the limitation of deposit concentration of 30% for interstate bank mergers, which, in turn, increases deposit competition faced by incumbent banks upon the entry of out-of-state banks.

Our results highlight two key issues. First, the removal of limitations on deposit market caps triggers statistically and economically significant increases in banks' funding costs and, correspondingly, declines in their deposit growth. Second, and more importantly, this shortage of deposit funding motivates banks to significantly increase their securitization activities. We document a 7.1 percentage point (pp) increase in the probability that banks' shift towards the originate-to-distribute (OTD) model after the deposit market caps are removed.

Further tests reveal considerable heterogeneity in the data. Small and single-state banks are most affected by the removal of deposit market caps because these institutions are most reliant on funding loans via deposits. Using Ratewatch.com data, we show that single-state banks experience a 9.6 basis point increase in average deposit cost. These banks also experience a 1.2 pp contraction in deposit growth. In contrast, we find no change in multi-state banks' deposit costs, and unlike incumbent banks, they exhibit no significant change in the probability of operating an OTD model, consistent with the increase in their greater availability of deposit funding from out-of-state markets. Our findings are also externally valid: we obtain similar results using alternative measures of deposit market competition during the period 2007 to 2020.

We rule out that our results are driven by confounding effects and measurement issues. Robustness tests show that removing interstate branching restrictions does not motivate banks to adopt the OTD model. 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. Further sensitivity checks confirm that regulatory reforms implemented through the Gramm-Leach-Bliley Act of 1999 (GLBA), Basel II requirements, intrastate branching deregulation, and changes 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 at least two reasons. First, we offer novel evidence for a hitherto undocumented, unintended regulatory cause that motivates banks to move away from the originate-to-hold to the 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.

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. In other words, banks use securitization in wholesale markets as a substitute for retail deposits. This is important because Hanson et al. (2015) show that deposits account for over three quarters of bank funding.

Second, unlike prior work that focuses on large multi-state banks (Rice and Strahan, 2010; Favara and Imbs, 2015), we highlight a missing puzzle piece 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. Common to these papers is their view that investors neglected the risk of substantial nationwide downturns of house prices 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 the monetary tightening between 2003 and 2006 provoked a shift towards non-agency lending led by non-bank institutions. In contrast to their work, we find an increase in banks' OTD 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]

This strand of literature also documents how advancements in securitization have changed the nature of banking. Loutskina (2011) documents a link between credit supply and the liquidity of bank loans. By providing a new source of funds in the form of existing loans, securitization reduces the sensitivity of banks' willingness to supply credit to the availability of deposits and liquid funds.

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

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

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. More closely related 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 there are constraints in pricing credit risk into mortgage contracts. A unique contribution of our work is that it sheds new light on the question why securitization accelerated in the late 1990s by establishing a causal link between the relaxation of deposit market caps, deposit supply, and an increase in securitization.

Moreover, this paper also speaks to the literature on deposit competition. Since deposits account for the majority of U.S. 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 debate on 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 measures of 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. Our work extends this literature and sheds light on a largely unexplored dimension of deregulation by illustrating how it incentivizes banks to change their business models.

Finally, our study offers important insights for policy makers about the substitution effect between traditional deposit taking and non-traditional securitization activities that is applicable beyond the U.S. context. For example, the 2020 EU Securitization Regulation applies across 19 EU member states and introduces a framework for simple, transparent, and standardised (STS) 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 rather than only when they experience shortages in wholesales funding.

The paper proceeds as follows. We describe the data in Section 2. Section 3 provides a discussion of the lifting of deposit market caps as part of the interstate bank branching deregulation episode. Section 4 presents the identification strategy and our main results. We conduct robustness tests in Section 5, and draw conclusions in Section 6.

2 Data

We obtain quarterly bank-level data for commercial and savings banks in the U.S. 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. To classify whether a bank operates an OTD model, we generate an OTD dummy variable that equals 1 if a bank reports that it securitizes loans during the quarter or if it receives mortgage servicing fees, 0 otherwise. Equivalently, we construct Mortgage, Autos, Credit card, and commercial and industrial (C&I) OTD dummy variables if a bank securitizes mortgage, auto, credit card, and C&I loans during the quarter, respectively. The data allows us to construct the quarterly bank deposit growth rate and the deposit share of liabilities.

The Call Reports also provide us with information about bank size (total assets), return on assets (ROA), and information 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, banks with no loans, and banks with 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.

To capture deposit competition, we collect quarterly information on the statewide deposit cap from Rice and Strahan (2010). This is the limit the state sets on the share of within state deposits held by a target bank that is subject to a takeover. Lower deposit caps lead to more intense deposit competition by limiting the extent to which mergers precipitate consolidation and increase deposit market power.

Ratewatch.com provides monthly, bank branch-level information from 1997 to 2020 on the interest rate paid on each deposit product. Using this data, we construct the quarterly average interest rate paid on 1) all main deposit products (i.e., 12 month certificates of deposit products

³The 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.

(CD), money market 25k funds (MM), and internet checking accounts), 2) 12 month CD, and 3) MM 25k funds.⁴ To capture other deposit pricing determinants, we merge information on total branch deposits and branch deposit growth rates (FDIC Summary of Deposits database), bank size in terms of total assets, Z-score, equity capital ratio, and return on assets (Call Reports).

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 the loan-to-income (LTI) ratio. We restrict the sample to observations of loans originated by banks (deposit-taking institutions).

[Insert Table 1] [Insert Table 2]

Table 1 provides a description of each variable in the data set. Table 2 tabulates summary statistics. Between 1994Q1 and 2006Q4, 28.2% banks in our sample adopted an OTD model and the average bank pays an interest rate of 2.28% on its deposits.

3 Institutional Background and Empirical strategy

Historically, U.S. 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 affect 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 began to remove intrastate barriers to entry between 1970 and 1994 (Kroszner and Strahan, 1999).

Lawmakers passed the Interstate Banking and Branching Efficiency Act of 1994 to allow interstate branching (Kroszner and Strahan, 1999; Strahan, 2003; Goetz et al., 2013). 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. Specifically, states can set a statewide deposit market cap. This prohibits mergers where the target institution’s share of statewide deposits

⁴We focus on 12 month certificates of deposits and money market 25k funds because these products account for the majority of deposits held by most banks. They are therefore representative of the cost of deposits a bank faces. We use quarterly rather than monthly data to mirror the frequency of the bank-level data.

exceeds the deposit market cap limit to avoid that mergers create market power. This restriction 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 1.A provides information on the sequencing of the removal of deposit market caps.

3.1 Identification Strategy

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

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

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; 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.

We use the same approach in the deposit cost tests with the exception that the dependent variable is measured at the bank-branch-state-year 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).

Critical to our identification strategy is the exogeneity of changes in deposit competition with respect to banks' OTD status and deposit costs. Previous research highlights that the process of removing deposit caps was somewhat chaotic, suggesting the gradual removal of barriers to entry appeared at random (Goetz et al., 2013; Goetz, 2018). We complement these studies by presenting parallel trends tests using the Imbens and Wooldridge (2009) normalized difference methodology to examine anticipatory trends in the dependent variables. In this framework, normalized differences of less than 0.25 in a variable during the pre-treatment period between the treated and control groups indicate parallel trends. All the absolute normalized difference values in Table 3 remain below the 0.25 threshold, indicating parallel trends in the data.

[Insert Table 3]

Online Appendix Table 2.A presents corroborating results. Column 1 presents dynamic coefficient estimates during the 8 quarters before the removal of the statewide deposit cap. Relative

to banks in untreated states, treated banks do not show significantly higher OTD incidences during any quarter.

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 therefore use a Cox Proportional Hazard model to estimate

$$h(t) = h_0(t) \times \exp(\beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n), \quad (2)$$

where t represents time until the removal of the deposit cap limit, $h_0(t)$ is the baseline hazard, and X_1, X_2, \dots, 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 the OTD business model, 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 Results

Table 5 presents estimates of equation (1) using the OTD indicator as the dependent variable. We first examine how deposit competition influences securitization along the extensive margin. Column 1 shows that the deposit competition coefficient estimate is positive and statistically significant at the 1% level. Removing the 30% statewide deposit market cap increases the probability that a bank operates an OTD model by 7.1 percentage points. The magnitude of this effect is large and equivalent to a 25% increase considering 28.2% of banks in the sample operate an OTD model.

[Insert Table 5]

Among the control variables, we find in column 1 show that large banks are significantly more likely to operate an OTD model. OTD status is also significantly more likely among more profitable banks.

It is plausible to assume that the effect of removing statewide deposit market caps on banks' OTD status is conditional on a bank's branch network and size. The shock to deposit competition

is likely to be greater for an incumbent bank with branches exclusively inside the state compared to a bank with branches across state lines because the latter can source deposits from out of state regions 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 incumbent (single state) banks. In contrast, when we constrain the sample to multi state banks in column 3, we find an insignificant relationship between deposit competition and OTD status. This suggests that these financial institutions face less intense competition for deposits because their presence across state lines allows them to collect deposits from less competitive markets.

Moreover, the effects of deposit competition on OTD status are potentially more pronounced among banks that are more reliant on deposit funding. Deposits account for 87% of the average small bank's liabilities compared to 83% for the average large bank.⁵ More intense deposit competition may therefore constitute a stronger incentive to adopt the OTD model for small banks because they are subject to proportionately higher deposit costs. We therefore split the sample into small and large banks based on total assets. Column 4 and 5 of Table 5 highlight that, irrespective of size, the deposit competition coefficient estimate is positive and statistically significant. However, in line with our prediction, the magnitude of the effect is economically larger for smaller banks.

Markets for securitized products have grown unevenly across asset classes. In the remainder of Table 5 we establish how deposit competition affects the likelihood that a bank operates an OTD model for mortgage, auto, credit card, and C&I loans. In column 6, the deposit competition coefficient is significant, showing that removing the statewide deposit market cap limit raises the probability a bank operates an OTD model for mortgage loans by 7.2 percentage points. In contrast, throughout columns 7 to 9, we find no significant relationship between deposit competition and auto, credit card, and C&I loans and securitization.

The differences in how deposit competition influences OTD status across asset classes is potentially explained by profitability opportunities and the depth of secondary markets. The net interest margin on mortgage lending is often narrow, implying that an increase in deposit funding costs creates a large incentive to use securitization to fund these loans. Secondary markets are also liquid due to the presence of GSEs and private purchasers. In contrast, C&I loans feature greater information asymmetries due to their size and often syndicated nature (Raz et al., 2022). This increases the interest rate banks charge leading to a wider net interest margin, suggesting that increases in deposit costs erode profits to a lesser extent. Loan sales in this asset class are also

⁵We define small (large) banks as those with assets below (above) the median.

more difficult as information opacity makes it more important to align the lender’s screening and monitoring incentives.

[Insert Table 6]

The preceding analysis highlights the centrality of mortgage securitization in explaining the overall increase in OTD status in the face of tougher deposit market competition. We therefore turn to HMDA mortgage loan-level data to study the intensive and extensive margins of securitization. Column 1 of Table 6 reports estimates of equation (1) using an indicator that equals 1 if an originated loan is securitized, 0 otherwise. In addition to the vector of bank-level controls, we include further borrower-level controls for gender and risk, measured by the LTI ratio. We find that following the increase in deposit competition, the probability that a loan is securitized increases by 1.3 pp. The coefficient estimate is significant at the 5% level.

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). The cost of funding a mortgage loan using deposits is equivalent for GSE and non-GSE loans. However, as deposit costs increase, the return on investment on GSE-eligible loans falls proportionately more because of the lower interest rate borrowers pay. Consistent with this conjecture, we find in column 2 of Table 6 that deposit competition increases the probability that a GSE-eligible loan is securitized by 1.6 pp. The coefficient estimate is significant at the 1% level. However, we find no significant relationship in column 3 when we restrict the sample to non-GSE loans. These findings underscore that the overall increase in the extensive margin of securitization reflects banks entering the market to sell GSE-eligible mortgages.

Next, we ask how deposit competition affects the intensive margin of securitization. We estimate equation (1) using the quantity of securitized loans (in natural logarithms) by bank-state-year. This allows us to identify the parameter γ using within bank variation during a fixed period of time. The estimates in column 4 of Table 6 show that deposit competition significantly increases the volume of securitized mortgages by 27.1%, relative to the implied counterfactual. Hence, as deposit competition intensifies, lenders sell a greater share of mortgage loans in the secondary market. This effect is present for both GSE- and non-GSE-eligible loans in columns 5 and 6. While deposit competition does not seem to induce banks to begin securitizing non-GSE-eligible loans, it motivates existing securitizers to sell loans more intensively.

Together, these findings show that deposit competition not only incentivizes lenders to enter the GSE-eligible securitization market for the first time, but it also intensifies securitization among financial institutions that are already active in the securitization market. The magnitudes of these effects are fairly large, and imply that regulatory-driven changes to deposit market competition are an important contributor to the increase in securitization activity prior to the financial crisis. For the non-GSE-eligible market, lenders face a higher sunk cost of entry (e.g., from packaging loans into security deals). While deposit competition increases deposit funding costs, the extent of this increase does not appear sufficiently large to overcome the entry costs. In contrast, lenders that have entered form their securitization decisions based on the opportunity cost of different funding mechanisms, reiterating that deposit competition creates incentives for banks to engage in loan sales.

4.1 Deposit Costs

To understand the mechanism underlying the deposit competition-securitization relationship, we analyze the evolution of deposit costs using the branch-level data set. We test how deposit competition influences the average deposit rate, that is, the average cost of deposit funds across all deposit products. The estimates in column 1 of Table 7 show deposit competition provokes a 11.4 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 2.28%, the magnitude of the effect is economically meaningful and equivalent to 5%.

To mirror our earlier tests, columns 2 and 3 of Table 7 constrain the sample to observations belonging to single and multi state banks, respectively. A consistent pattern of results emerges. Deposit competition provokes a significant increase in the average deposit rate of single state banks. Economically, the effect size equates to a 9.6 basis point rise in deposit funding costs. In contrast, column 3 shows that deposit competition does not significantly affect the average deposit rate of multi state banks.

[Insert Table 7]

Our next test examines how deposit competition affects the rate paid on 12 month CD and MM 25k funds, two of the most important sources of deposit funding. Column 4 in Table 7 shows that the interest rate paid on CD increases by 11.9 basis points. The tendency towards higher CD costs holds for both single- and multi-state banks in columns 5 and 6, respectively. We also find that greater deposit competition triggers an increase in the rates paid on MM 25k funds, although

the effect is only significant at the 10% level in column 8, and holds exclusively among single state banks.

The estimates suggest that as deposit competition intensifies, incumbent banks experience a reduction in deposit growth. This forces them to set higher equilibrium deposit interest rates to prevent a drain of liquidity. To test this channel, we estimate equation (1) using the deposit growth rate as the dependent variable. The estimates in column 10 of Table 7 show the average bank experiences a 1.2 pp decrease in deposit growth after the removal of deposit market caps. This is consistent with competitors eroding incumbents' deposit base. Columns 11 and 12 highlight, however, that only single state banks experience a contraction in deposit supply whereas multi state banks do not.

4.2 Bank funding structure

So far, our results suggests that banks turn to securitization to finance loans as deposit growth decreases and the cost of deposits increases following the removal of deposit market caps. The extent of the changes in securitization behavior may therefore vary according to a bank's ex ante liability structure as financial institutions with greater reliance on deposit (wholesale) funding are more (less) exposed to deposit competition.

[Insert Table 8]

To examine this conjecture, we first split the sample at the median of the deposits-to-liabilities ratio. The estimates in column 1 of Table 8 show that for banks with a deposit-to-liabilities ratio below the median, deposit competition provokes a significant 4.5 pp increase in the probability that they operate an OTD model. However, the effects are more pronounced among financial institutions with a deposit share above the median. For this group, we estimate the average treatment effect to be an 8.4 pp increase in the likelihood of OTD status in column 2. A Chow test F-statistic indicates that the differences in economic magnitude is statistically significant at conventional levels.

We find similar evidence when splitting the sample according to a bank's wholesale funding ratio in columns 3 and 4 of Table 8. Specifically, the deposit competition point estimate is larger when the sample contains banks with a wholesale funding ratio below the median relative to those with a ratio greater than or equal to the median. Columns 5 and 6 investigate whether banks' reaction to deposit market competition differs according to their loan-to-asset ratio. Consistent with the previous findings, more intense deposit competition exerts a larger effect on OTD status for banks with loan-to-asset ratios greater than or equal to the median.

4.3 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-securitization nexus holds, we should obtain similar findings during other time periods. Call Reports do not contain OTD status data before 1994. We therefore design an external validity test using information between 2007 and 2019. This period does not feature regulatory-driven variation in states' deposit competition. We follow Drechsler et al. (2017) and Li et al. (2019) and construct three measures of deposit competition using Herfindahl-Hirschman Indices (HHI).

The first measure is a Branch-HHI variable. Using branch-level data from the FDIC's Summary of Deposits database, we calculate a 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 second measure, a Bank-HHI, defined as the weighted average of Branch-HHIs across all of bank b 's branches. 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 our third measure. The County-HHI is the weighted average of the Bank-HHI across all banks operating in a given county, using their share of deposits in the county as weights. This measure captures the exposure of a given local market to funding conditions across all banks operating within it.

We merge the HHI variables into the bank-level data and estimate the equation:

$$y_{bct} = \beta HHI_{jt} + \delta_b + \delta_t + \varepsilon_{bct}, \quad (3)$$

where y_{bct} is the OTD status of bank b in county c in year t ; HHI_{jt} , $j = b, c$, is one of the three HHI indexes where higher HHI values indicate lower deposit market competition.⁶ 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.

⁶While both the Branch-HHI and County-HHI vary at the county-year level, our Bank-HHI varies at the bank-year level.

Estimates of equation (3) are shown in Table 9. We find that more intense deposit competition significantly increases the probability that a bank operates an OTD model between 2007 and 2019. Estimates in column 1 of the table show that a bank operating in a county with a Branch-HHI one standard deviation above the mean (i.e. a less competitive market for deposits) is 1.3 pp less likely to operate an OTD model compared to a bank with a Branch-HHI one standard deviation below the mean.⁷ Column 2 provides similar results using the Bank-HHI. A bank with a Bank-HHI one standard deviation above the mean is 2.4 pp less likely to operate an OTD model relative to one with a Bank-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 1.4 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.

5 Robustness Tests

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

5.1 Methodological sensitivity checks

The identification strategy leverages the staggered removal of statewide deposit cap limits across U.S. 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 terms, 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 an interaction-weighted 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

⁷The standard deviation of the Branch-HHI is 0.1351. The effect size is calculated as $2 \times 0.1351 \times (-0.0561) \times 100 = 1.3$ pp

Table 2.A reports the results of this test. During the eight pre-treatment quarters, the coefficient estimates are insignificant. However, after the deposit competition shock, the dynamic coefficient estimates are positive and statistically significant. They are also in 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 2.A 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.

5.2 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 observed or unobserved 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 10]

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 jumbo loan ratio (the ratio of jumbo loans to total loans originated by the institution), the female loan ratio (the ratio of loans to females to total loans originated by the institution), the urban ratio (the ratio of loans for properties in metropolitan statistical areas to total loans originated by the institution), and the refinancing ratio (the ratio of refinancing loans to total loans originated by the institution). While the HMDA securitization rate pertains only to mortgage loans, this is informative given the earlier results showing the increase in banks' OTD status is mainly due to mortgage securitization.

Using only data on non-banks we estimate the equation

$$s_{ist} = \beta DC_{st} + \gamma X_{ist-1} + \delta_i + \delta_t + \varepsilon_{ist}, \quad (4)$$

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-banks and year fixed effects, respectively; ε_{ist} is the error term.

We present estimates of equation (4) in Table 10. Column 1 shows that deposit competition has no significant effect on a non-bank's securitization rate. The deposit competition coefficient estimate is economically small and close to zero. Column 2 of Table 10 demonstrates that this finding remains unaffected by the inclusion of control variables.

In sum, the removal of statewide deposit market caps has no effect on non-banks' securitization decisions. If an omitted variable drives the inferences for banks, the deposit competition coefficient should be statistically significant and comparable in economic magnitude to Table 5 for non-banks. The placebo check also suggests 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 securitization incentives change. This suggests our findings have a causal interpretation.

5.3 Lending Market

We next present tests that rule out the increase in securitization is simply driven by expansions of credit supply. To do so, we estimate equation (1) using bank loan growth as the dependent variable. Column 1 of Table 3.A illustrates that deposit competition has no significant effect on the rate of loan growth. Column 2 of the table shows similar effects on the rate of mortgage lending growth. This suggests that banks do not expand or contract credit supply in the face of more intense deposit competition. Rather, they turn towards securitization to maintain credit supply.

5.4 The Legal Environment

Next, we test the robustness of the findings to legal and regulatory issues. 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 1 in Table 11 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.

[Insert Table 11]

The Basel II Accord, published in June 2004, proposed changes to international banking standards, including higher capital ratios. We therefore exclude observations from 2004Q2 onward and report estimates of equation (1) in column 2 of Table 11. We continue to find the deposit competition coefficient is positive and significantly related to OTD status.

Between the early 1970s and 1994 U.S. states removed restrictions on intrastate bank branching. While this deregulation episode was completed prior to the start of our sample in 1994, 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. Despite this change, we continue to find statistically significant effects arising from the removal of deposit market caps on OTD status in column 3 of Table 11.

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. Columns 4 and 5 of Table 11 leave our inferences unaffected.⁸

During the sample period states repeal barriers to interstate branching by imposing a minimum age of the target institution, allowing de novo interstate branching, and limiting the acquisition of individual bank branches.⁹ Column 6 of Table 11 shows that the deposit competition effect remains when we control for these liberalization episodes.

5.5 Mortgage Market Factors

Given the OTD response to deposit competition is strongest for mortgages, we augment equation (1) with several 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, 2012). We capture these forces using the bank-level ratio of jumbo to total mortgage loan applications (secondary market thickness), LTI ratio (borrower

⁸Online Appendix Table 6.A tests the sensitivity of the results to state-level factors shown elsewhere in the literature to affect banks' securitization behavior. The key finding is robust to controlling for homestead exemptions, the rate of renegotiation on delinquent mortgages (McGowan and Nguyen, 2022), and state corporate tax rates (Han et al., 2015).

⁹The 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.

riskiness), and loan denial rates (screening intensity). Table 12 shows that these changes do not affect our inferences.

[Insert Table 12] [Insert Table 13]

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 13 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 13 show that demand-side factors do not confound our inferences.

Banks may adopt an OTD model to unload prepayment risk due to refinancing or the credit risk of mortgage default (Pence, 2006; McGowan and Nguyen, 2022). House prices may influence OTD status through their effect on collateral values. Columns 5 to 7 of Table 13 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 8 in Table 13 presents estimates of equation (1) with the additional controls for Bank-HHI and the Bank-HHI-Fed rate interaction. We find that 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 for banks. Furthermore, in line with the findings of Drechsler et al. (2020), we observe that when the Fed 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 for OTD status.

5.6 Risk Taking, Liquidity, and Regulatory Capital

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 the loan-level data by estimating

$$A_{ilst} = \beta_1 DC_{st} + \beta_2 W_{ilst} + \beta_3 DC_{st} \times W_{ilst} + \gamma X_{ilst-1} + \delta_i + \delta_t + \varepsilon_{ilst}, \quad (5)$$

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 4.A presents estimates of equation (5) 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 remains insignificant. Together, these tests highlight that financial institutions do not lower lending standards by originating riskier loans when deposit competition increases.

Banks experience a drain of liquidity from losing deposits as deposit competition intensifies. The securitization effects we detect could be an attempt to either maintain asset liquidity by raising cash holdings, or to maintain the maturity profile of assets and liabilities (Raz et al., 2022). To understand whether this mechanism is present, we split the sample at the median liquid assets ratio.¹⁰ If liquidity issues are the primary motivation for securitization, one would anticipate deposit competition only influences securitization among banks with less liquid asset positions. The estimates in columns 1 and 2 of Online Appendix Table 5.A show deposit competition provokes a significant increase in securitization irrespective of banks' liquid assets ratio. This is consistent with

¹⁰The liquid assets ratio is the sum of cash, fed funds, investment securities and government securities to total assets.

deposit competition triggering securitization due to funding constraints rather than asset liquidity concerns.

Our next test addresses out that our findings may reflect concerns about regulatory capital. Banks operating close to the minimum regulatory capital threshold could securitize loans to improve their risk weighted assets. Under this view one would anticipate deposit competition only affects securitization among lowly capitalized banks. Columns 3 and 4 in Online Appendix Table 5.A show that deposit competition provokes similar securitization responses across the capitalization distribution. The results therefore do not appear to be due to regulatory capital considerations.

5.7 Supply of Deposits

Our final test revisits 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 U.S. Irrespective of the inclusion of these additional variables, we continue to find in Table 7.A that deposit competition significantly affects banks' propensity to engage in securitization.

6 Conclusion

We present novel evidence that deposit competition spurs banks' securitization activity. As banks compete more intensively for deposits, cost of deposits increases and banks' deposit growth declines. This motivates banks to turn to capital markets to fund lending via securitization. Our estimates show deposit competition increases the probability a bank operates an OTD model by 7.1 percentage points. This is mainly driven by banks securitizing mortgages, although deposit competition spurs securitization in other asset classes to a lesser extent. Mortgage loan-level analyses show that on the extensive margin, the removal of deposit caps leads to a 1.3pp increase in the probability that a mortgage is securitized. A novel outcome of our work is the substitutability of deposit and securitization funding models in the face of deposit competition.

It is important to highlight 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 almost 25% 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 the deposit markets may produce similar outcomes.

References

- Acharya, V. and Mora, N. (2014). A crisis of banks as liquidity providers. *Journal of Finance*, 70(1):1–43.
- Agarwal, S., Chang, Y., and Yavas, A. (2014). Adverse Selection in Mortgage Securitization. *Journal of Financial Economics*, 105(3):640–660.
- Allen, F. and Gale, D. (2004). Competition and financial stability. *Journal of Money, Credit and Banking*, pages 453–480.
- Arping, S. (2017). Deposit competition and loan markets. *Journal of Banking & Finance*, 80:108–118.
- Baker, A., Larcker, D. F., and Wang, C. C. Y. (2022). How much should we trust staggered difference-in-differences estimates? *Journal of Financial Economics*, 144(2):370–395.
- Berger, A., El Ghoul, S., Guedhami, O., and Roman, R. (2020). Deregulation and Banks’ Cost of Equity Capital. *mimeo*.
- Blundell-Wignall, A., Atkinson, P., and Lee, S. H. (2009). The current financial crisis: Causes and policy issues. *OECD Journal: Financial Market Trends*, 2008(2):1–21.
- Callaway, B. and Sant’Anna, P. H. (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics*, 225(2):200–230.
- Chernenko, S., Hanson, S. G., and Sunderam, A. (2016). Who neglects risk? investor experience and the credit boom. *Journal of Financial Economics*, 122(2):248–269.
- Danisewicz, P., McGowan, D., Onali, E., and Schaeck, K. (2017). The real effects of banking supervision: evidence from enforcement actions. *Journal of Financial Intermediation*, 35(A):86–101.
- Danisewicz, P., McGowan, D., Onali, E., and Schaeck, K. (2018). Debt priority structure, market discipline and bank conduct. *Review of Financial Studies*, 31(11):4493–4555.
- Danisewicz, P., McGowan, D., Onali, E., and Schaeck, K. (2020). Debtholder monitoring incentives and bank earnings opacity. *Journal of Financial and Quantitative Analysis*, 56(4):1408–1445.
- Demyanyk, Y. and Van Hemert, O. (2011). Understanding the Subprime Mortgage Crisis. *Review of Financial Studies*, 24(6):1848–1880.

- Drechsler, I., Savov, A., and Schnabl, P. (2017). The deposits channel of monetary policy. *The Quarterly Journal of Economics*, 132(4):1819–1876.
- Drechsler, I., Savov, A., and Schnabl, P. (2020). How monetary policy shaped the housing boom. Technical report, National Bureau of Economic Research.
- Egan, M., Hortaçsu, A., and Matvos, G. (2017). Deposit competition and financial fragility: Evidence from the U.S. banking sector. *American Economic Review*, 107(1):169–216.
- Favara, G. and Imbs, J. (2015). Credit Supply and the Price of Housing. *American Economic Review*, 105(1):958–992.
- Gennaioli, N., Shleifer, A., and Vishny, R. (2012). Neglected Risks, Financial Innovation, and Financial Fragility. *Journal of Financial Economics*, 104(3):452–468.
- Gerardi, K., Lehnert, A., and Sherlund, S. (2008). Making Sense of the Subprime Crisis. *Brookings Papers on Economic Activity*, 2008:69–145.
- Ghent, A. and Valkanov, R. (2016). Comparing securitized and balance sheet loans: Size matters. *Management Science*, 62(10):2784–2803.
- Gilje, E., Loutskina, E., and Strahan, P. (2016). Exporting liquidity: Branch banking and financial integration. *Journal of Finance*, 71(3):1159–1184.
- Goetz, M. (2018). Competition and Bank Stability. *Journal of Financial Intermediation*, 35(A):57–69.
- Goetz, M., Laeven, L., and Levine, R. (2013). Identifying the Valuation Effects and Agency Costs of Corporate Diversification: Evidence from the Geographic Diversification of U.S. Banks. *Review of Financial Studies*, 27(7):1787–1823.
- Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*, 225(2):254–277. Themed Issue: Treatment Effect 1.
- Gorton, G. and Metrick, A. (2013). Securitization. in *George M. Constantinides, Milton Harris, and Rene M. Stulz, eds.: Handbook of the Economics of Finance*, 2:1–70.
- Gorton, G. and Pennacchi, G. (1995). Banks and Loan Sales Marketing Nonmarketable Assets. *Journal of Monetary Economics*, 35(3):389–411.

- Griffin, J. and Tang, D. (2012). Did Subjectivity Play a Role in CDO Credit Ratings? *Journal of Finance*, 67(4):1293–1328.
- Han, J., Park, K., and Pennacchi, G. (2015). Corporate Taxes and Securitization. *Journal of Finance*, 70(3):1287–1321.
- Hanson, S. G., Shleifer, A., Stein, J. C., and Vishny, R. W. (2015). Banks as patient fixed-income investors. *Journal of Financial Economics*, 117(3):449–469.
- Hellmann, T. F., Murdock, K. C., and Stiglitz, J. E. (2000). Liberalization, moral hazard in banking, and prudential regulation: Are capital requirements enough? *American Economic Review*, 90(1):147–165.
- Imbens, G. W. and Wooldridge, J. M. (2009). Recent developments in the econometrics of program evaluation. *Journal of Economic Literature*, 47(1):5–86.
- Jayarathne, J. and Strahan, P. (1998). Entry Restrictions, Industry Evolution, and Dynamic Efficiency: Evidence from Commercial Banking. *Journal of Law and Economics*, 41:239–273.
- Jiang, L., Levine, R., and Lin, C. (2016). Competition and Bank Opacity. *Review of Financial Studies*, 29(7):1911–1942.
- Johnson, C. and Rice, T. (2008). Assessing a Decade of Interstate Bank Branching. *Washington and Lee Law Review*, 65(1):73–127.
- Keil, J. and Müller, K. (2020). Bank branching deregulation and the syndicated loan market. *Journal of Financial and Quantitative Analysis*, 55(4):1269–1303.
- Keys, B., Mukherjee, T., Seru, A., and Vig, V. (2010). Did Securitization Lead to Lax Screening? Evidence from Subprime Loans. *Quarterly Journal of Economics*, 125(1):307–362.
- Keys, B., Seru, A., and Vig, V. (2012). Lender Screening and the Role of Securitization: Evidence from Prime and Subprime Mortgage Markets. *Review of Financial Studies*, 25(7):2071–2108.
- Kroszner, R. S. and Strahan, P. E. (1999). What drives deregulation? Economics and politics of the relaxation of bank branching restrictions. *Quarterly Journal of Economics*, 114(4):1437–1467.
- Li, L., Loutskina, E., and Strahan, P. E. (2019). Deposit market power, funding stability and long-term credit. Technical report, National Bureau of Economic Research.

- Loutskina, E. (2011). The Role of Securitization in Bank Liquidity and Funding Management. *Journal of Financial Economics*, 100(3):663–684.
- Loutskina, E. and Strahan, P. (2009). Securitization and the Declining Impact of Bank Financial Condition on Loan Supply: Evidence from Mortgage Originations. *Journal of Finance*, 64(2):861–922.
- McGowan, D. and Nguyen, H. (2022). To securitize or to price credit risk? *Journal of Financial and Quantitative Analysis*, forthcoming.
- Mian, A. and Sufi, A. (2009). The Consequences of Mortgage Credit Expansion: Evidence from the 2007 Mortgage Default Crisis. *Quarterly Journal of Economics*, 124(4):1449–1496.
- Parlour, C. A. and Winton, A. (2013). Laying off credit risk: Loan sales versus credit default swaps. *Journal of Financial Economics*, 107(1):25–45.
- Pence, K. (2006). Foreclosing on Opportunity: State Laws and Mortgage Credit. *Review of Economics and Statistics*, 88(1):177–182.
- Pennacchi, G. (1988). Loan Sales and the Cost of Bank Capital. *Journal of Finance*, 43:375–396.
- Raz, A., McGowan, D., and Zhao, T. (2022). The Dark Side of Liquidity Regulation: Bank Opacity and Liquidity Risk. *Journal of Financial Intermediation*, (forthcoming).
- Rice, T. and Strahan, P. (2010). Does Credit Competition Affect Small-Firm Finance? *Journal of Finance*, 65(3):861–889.
- Stiroh, K. and Strahan, P. (2003). Competitive Dynamics of Deregulation: Evidence from U.S. Banking. *Journal of Money, Credit, and Banking*, 35(5):801–828.
- Strahan, P. (2003). The Real Effects of U.S. Banking Deregulation. *Federal Reserve Bank of St. Louis Working Paper*.
- Sun, L. and Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, 225(2):175–199.

Tables

Table 1: Variable Descriptions

Variable	Description	Source
State-level data		
Deposit market cap lift	Dummy variable that equals 1 if the host state relaxes the deposit market cap for interstate mergers to above 30%, 0 otherwise	Rice and Strahan (2010)
Branching Expansion	Interstate branching expansion Index	Rice and Strahan (2010)
Denovo branching lift	Dummy variable that equals 1 if the host state allows de novo branching, 0 otherwise	Rice and Strahan (2010)
Branching acquisition lift	Dummy variable that equals 1 if the host state allows acquisition of an existing local branch, 0 otherwise	Rice and Strahan (2010)
Age limit lift	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)
Bank-level data		
OTD	Dummy variable that equals 1 if a bank reports any securitized loans in its call report, 0 otherwise	WRDS
Deposit Share (%)	Ratio of deposits to total assets	WRDS
Bank HHI	The weighted average of Branch-HHIs across all of its branches	FDIC SoD and Authors' Calculation
Mortgage loan securitization	Dummy variable that equals 1 if a bank reports any securitized mortgage loans in its call report, 0 otherwise	WRDS
Auto loan securitization	Dummy variable that equals 1 if a bank reports any securitized auto loans in its call report, 0 otherwise	WRDS
Credit card securitization	Dummy variable that equals 1 if a bank reports any securitized credit card in its call report, 0 otherwise	WRDS
C&I securitization	Dummy variable that equals 1 if a bank reports any securitized C&I loans in its call report, 0 otherwise	WRDS
Bank size (Ln total assets)	Natural logarithm of a bank's total assets	WRDS
Return on assets (%)	Ratio of profits to total assets	WRDS
Z-score (ln)	The logarithm of the Z-score	WRDS and authors' calculation
Capital ratio (%)	Ratio of bank equity capital to total assets	WRDS
Wholesale share (%)	Ratio of wholesale funding to total assets	WRDS
Loans to assets (%)	Ratio of total loans to total assets	WRDS
Single state bank	Dummy variable that equals 1 if a bank operates in one state only, 0 otherwise	WRDS
Fed charter	Dummy variable that equals 1 if a bank is regulated by the FED, 0 otherwise	Chicago Fed
FDIC regulator	Dummy variable that equals 1 if a bank is regulated by the FDIC, 0 otherwise	Chicago Fed
OCC regulator	Dummy variable that equals 1 if a bank is regulated by the OCC, 0 otherwise	Chicago Fed

Table 1 Cont'd: Variable Descriptions

Variable	Description	Source
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 Deposit Rate	Quarterly average interest rate that a branch pays for its depositors for the savings product Certificate of Deposits 12 months	RateWatch.com
MM25K	Quarterly average interest rate that a branch pays for its depositors for the savings product Money Markets 25K	RateWatch.com
Deposit Growth	Annual difference in the natural logarithm of branch deposit in year t compared to year t-1	SoD
County-level data		
Securitization of non-banks	Ratio of securitized loans to total originated loans by a non-bank	HMDA
Jumbo loan	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 county	HMDA
Denial (Employment)	Average denial rates of mortgage loans due to employment reasons in a county	HMDA
Denial (Credit History)	Average denial rates of mortgage loans due to credit history in a county	HMDA
Denial (Collateral)	Average denial rates of mortgage loans due to collateral in a county	HMDA
Denial (Insufficient Cash)	Average denial rates of mortgage loans due to insufficient cash in a county	HMDA
Denial (Missing Information)	Average denial rates of mortgage loans due to missing information in a county	HMDA
Population Growth (%)	The growth rate of population in a county	BEA
Elderly Population (%)	The percentage of people who are 65 years old and above in a county	BEA
Poverty Population (%)	The percentage of people who live under the poverty threshold in a county	BEA
Net Job Creation (%)	The percentage of net job creation over total labor forces in a county	BEA
Reallocation Rate (%)	The percentage of people who relocate over total population in a county	BEA
Accept Rate (%)	Average acceptance rates of mortgage loans in a county	HMDA
Third Party Purchased (%)	The percentage of mortgage loans got purchased by a third party in a county	HMDA
GSE Purchases (%)	The percentage of mortgage loans got purchased by a GSE in a county	HMDA
Private Purchases (%)	The percentage of mortgage loans got purchased by a private institution in a county	HMDA
Mortgage Default (%)	Average mortgage default rates of mortgage loans in a county	HUD
House Price Index (Ln)	Average house price index in a county	HUD
Branch HHI	A sum of squared deposit market shares for all bank branches operating in a given county	FDIC SoD and Authors' Calculation
County HHI	A weighted average of all bank HHIs operating in the county	FDIC SoD and Authors' Calculation
Loan-level data		
Mortgage securitization	A dummy variable that equals 1 if the mortgage is securitized, 0 otherwise	HMDA
Female	A dummy variable that equals 1 if the mortgage is applied by a female applicant, 0 otherwise	HMDA
LTI Ratio	The Loan-to-income ratio of a mortgage loan	HMDA
Accept (Dummy)	A dummy variable that equals 1 if the mortgage is accepted, 0 otherwise	HMDA
Bank-state level data		
Securitized mortgages (Ln)	The amount of mortgages that get securitized by a bank at a given state in a given year	HMDA
GSE securitized mortgages (Ln)	The amount of mortgages that get securitized by a bank to a GSE at a given state in a given year	HMDA
Non-GSE securitized mortgages (Ln)	The amount of mortgages that get securitized by a bank to a non-GSE at a given state in a given year	HMDA
Fed rates	The annual effective Fed funds rate	NY Fed

Notes: This table defines each variable in the data set and the data source. 'WRDS' denotes Wharton Research Data Services. '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. 'BEA' denotes the Bureau of Economic Analysis. 'HUD' denotes the U.S. Department of Housing and Urban Development.

Table 2: Summary statistics

Variable	Mean	Std. dev.	Min.	Max.	Observations
State-level data					
Deposit Market Cap Lift	0.5185	0.4997	0	1	438,212
Denovo Branching Lift	0.2312	0.4216	0	1	438,212
Branching Acquisition Lift	0.3126	0.4636	0	1	438,212
Age Limit Lift	0.1785	0.3829	0	1	438,212
Branching Expansion	1.1474	1.3625	0	4	438,212
Bank-level data					
OTD	0.282	0.45	0	1	438,212
Deposits/Total Assets (%)	84.108	8.2721	9.6858	93.0962	438,212
Total Deposits (Ln)	11.2623	1.1983	8.6465	15.507	438,212
Net Interest Income/Total Assets (%)	2.4981	1.1533	0.5253	5.6055	438,212
Securitizability of loan portfolio (%)	20.5846	9.2145	6.5453	48.3002	438,212
Mortgage loan securitization (Dummy)	0.2822	0.4501	0	1	438,212
Auto loan securitization (Dummy)	0.0031	0.0558	0	1	438,212
Credit Card securitization (Dummy)	0.0041	0.0637	0	1	438,212
C&I loan securitization (Dummy)	0.0017	0.0416	0	1	438,212
Bank size (Ln Total Assets)	11.4411	1.2099	9.1103	15.3346	438,212
Return on Assets (%)	0.6955	0.5108	-0.9219	2.0622	438,212
Z-score (Ln)	3.3828	0.3794	2.5843	4.3411	438,212
Capital Ratio (%)	10.3796	3.4637	6.0238	28.0624	438,212
Wholesale funding/Total Liabilities (%)	4.4756	7.6627	0	64.6759	438,212
Loan to Assets (%)	61.2032	15.1154	9.1935	93.2087	438,212
Loan growth (%)	2.8243	5.8689	-9.0346	26.8649	438,212
Single state bank (Dummy)	0.9900	0.0997	0	1	438,212
Fed Charter (Dummy)	0.3594	0.4798	0	1	438,212
FDIC Regulator (Dummy)	0.515	0.4998	0	1	438,212
FRS Regulator (Dummy)	0.3594	0.4798	0	1	438,212
OCC Regulator (Dummy)	0.2523	0.4343	0	1	438,212
OTS Regulator (Dummy)	0.1963	0.3972	0	1	438,212
Securitization of non-banks	0.8544	0.3526	0	1	48,744
Bank HHI (1994 to 2006)	0.2136	0.1142	0.0285	0.5730	438,212
Bank HHI (2007 to 2019)	0.2162	0.1126	0.0285	0.5730	338,893

Table 2 Cont'd: Summary statistics

Variable	Mean	Std. dev.	Min.	Max.	Observations
County-level data					
Jumbo Loan	0.0288	0.068	0	1	438,212
LTI Ratio	1.5226	0.5297	0.119	5.2692	438,212
Denial (Debt To Income)	0.0263	0.067	0	1	438,212
Denial (Employment)	0.0042	0.0313	0	1	438,212
Denial (Credit History)	0.0662	0.1165	0	1	438,212
Denial (Collateral)	0.0318	0.0832	0	1	438,212
Denial (Insufficient Cash)	0.0044	0.0279	0	1	438,212
Denial (Missing Information)	0.0035	0.023	0	1	438,212
Population Growth (%)	0.8766	1.4675	-2.6915	5.8903	438,212
Elderly Population (%)	14.1711	4.0414	2.4120	37.8520	438,212
Poverty Population (%)	12.2907	3.1857	4.5	25.7	438,212
Net Job Creation (%)	2.2711	1.8655	-7.0693	9.3041	438,212
Reallocation Rate (%)	26.6078	3.0631	18.45	37.25	438,212
Accept Rate (%)	0.5533	0.2385	0	1	438,212
Third party purchases (%)	68.2775	23.0611	0	100	438,212
GSE Purchases (%)	38.984	25.5327	0	100	438,212
Private Purchase (%)	29.2103	26.6349	0	100	438,212
Mortgage Default (%)	1.429	0.5091	0.202	3.6095	438,212
House Price Index (Ln)	4.6032	0.1921	4.2311	5.2207	438,212
Branch HHI (2007 to 2019)	0.2229	0.1351	0.0648	0.7718	338,836
County HHI (2007 to 2019)	0.2303	0.0847	0.1194	0.5996	338,836
Loan-level data					
Mortgage securitization	0.3026	0.4594	0	1	542,746
Female	0.2134	0.4097	0	1	542,746
LTI Ratio	1.8561	0.9700	0.1538	5.2667	542,746
Accept (Dummy)	0.8672	0.3392	0	1	625,808
Bank-state level data					
Amount of securitized mortgages (Ln)	6.0971	1.5152	0	13.0702	12,668
Amount of GSE securitized mortgages (Ln)	6.0207	1.4802	0	12.6573	12,421
Amount of non-GSE securitized mortgages (Ln)	6.4417	1.0188	5.3181	12.4304	2,369
Fed rates	0.0393	0.017	0.01	0.06	438,212

Notes: This table presents descriptive statistics for the variables used in the empirical analysis. Variable definitions and data sources are shown in Table 1. 'Ln' denotes that a variable is measured in natural logarithms.

Table 3: Parallel Trends Test

Variable	Treatment		Control		ND
	Mean	SD	Mean	SD	
OTD	0.272	0.445	0.251	0.434	0.03
Deposit Rates (%)	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. ‘SD’ 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 the Timing of Changes to the Deposit Market Cap

Dependent variable	(1)	(2)	(3)
	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*** (0.606)	0.004 (0.129)	-0.022 (0.075)
Capital Ratio	-0.345 (0.473)	-0.323** (0.139)	-0.163*** (0.052)
ROA	-3.224*** (0.547)	1.339* (0.712)	0.607*** (0.231)
Z-score	0.285 (3.513)	1.750 (1.759)	-0.085 (0.463)
Unemployment Rates	-0.264 (0.245)	0.224 (0.348)	0.462*** (0.077)
Poverty Rates	-0.026 (0.080)	0.004 (0.027)	0.011 (0.016)
Net Job Recreation Rates	0.050 (0.187)	-0.131 (0.283)	0.097*** (0.033)
Observations	299	127	148
p-value of χ^2	0.00	0.00	0.00

Notes: This table reports estimates of a Cox Proportional Hazards model. We define the hazard function as $h(t) = h_0(t) \times \exp(\beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n)$ where t represents time until the removal of the deposit cap limit, $h_0(t)$ is the baseline hazard, and X_1, X_2, \dots, X_n denote state-level covariates. 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 Market Competition and OTD Status

Sample Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All	Single state	Multi state	Smaller banks	Larger Banks	All		All	
	OTD status								
						Mortgage	Autos	Credit card	C&I
Deposit Competition	0.071*** (0.020)	0.072*** (0.020)	-0.059 (0.063)	0.077*** (0.023)	0.044*** (0.012)	0.072*** (0.020)	0.001 (0.001)	0.000 (0.001)	0.000 (0.001)
Size _{t-1}	0.127*** (0.008)	0.126*** (0.009)	0.003 (0.043)	0.114*** (0.013)	0.093*** (0.012)	0.127*** (0.008)	0.001** (0.001)	0.004 (0.003)	0.002 (0.001)
Capital ratio _{t-1}	0.001 (0.001)	0.001 (0.001)	0.000 (0.007)	0.002** (0.001)	-0.004** (0.002)	0.001 (0.001)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
ROA _{t-1}	0.007** (0.003)	0.007** (0.003)	-0.019 (0.022)	0.009*** (0.003)	0.001 (0.006)	0.007** (0.003)	0.000 (0.000)	0.000 (0.001)	0.001 (0.000)
Z-score _{t-1}	-0.007 (0.006)	-0.006 (0.006)	-0.005 (0.060)	-0.019*** (0.006)	0.004 (0.010)	-0.006 (0.006)	0.000 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Observations	438,212	433,809	4,403	217,517	220,693	438,212	438,212	438,212	190,161
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R ²	0.678	0.673	0.812	0.585	0.692	0.678	0.598	0.677	0.707

Notes: This table reports estimates of equation (1). Variable definitions are shown in Table 1. Single state banks are those with all branches inside a single state. Multi state banks are those with branches across more than one state. Smaller (Larger) banks are those with assets less than (greater than or equal to) the sample median. 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 Mortgage Securitization

Level of aggregation Dependent variable	(1)		(2)		(3)		(4)		(5)		(6)	
	Loan level		Mortgage securitization		Non-GSE		All		GSE		Non-GSE	
	All	GSE	All	GSE	All	GSE	All	GSE	All	GSE	All	GSE
Deposit Competition	0.013** (0.006)	0.016*** (0.005)	-0.001 (0.014)	-0.001 (0.014)	0.271*** (0.096)	0.259*** (0.092)	0.291* (0.172)	0.291* (0.172)	0.271*** (0.096)	0.259*** (0.092)	0.291* (0.172)	0.291* (0.172)
Size _{t-1}	-0.009 (0.011)	-0.008 (0.011)	0.000 (0.012)	0.000 (0.012)	0.092* (0.050)	0.092* (0.048)	0.128 (0.083)	0.128 (0.083)	0.092* (0.050)	0.092* (0.048)	0.128 (0.083)	0.128 (0.083)
Capital ratio	-0.001 (0.002)	0.001 (0.002)	-0.012** (0.005)	-0.012** (0.005)	-0.020* (0.011)	-0.020* (0.011)	0.037 (0.031)	0.037 (0.031)	-0.020* (0.011)	-0.020* (0.011)	0.037 (0.031)	0.037 (0.031)
ROA _{t-1}	-0.018** (0.007)	-0.019*** (0.007)	0.001 (0.011)	0.001 (0.011)	-0.056 (0.035)	-0.056 (0.034)	-0.078 (0.080)	-0.078 (0.080)	-0.056 (0.035)	-0.056 (0.034)	-0.078 (0.080)	-0.078 (0.080)
Z-Score _{t-1}	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.003 (0.002)	0.003 (0.002)	0.003 (0.005)	0.003 (0.005)	0.002*** (0.001)	0.002*** (0.001)	0.003 (0.005)	0.003 (0.005)
Female	-0.010*** (0.002)	-0.011*** (0.002)	-0.012*** (0.003)	-0.012*** (0.003)	-0.236** (0.105)	-0.212* (0.107)	0.204 (0.280)	0.204 (0.280)	-0.012*** (0.003)	-0.012*** (0.003)	0.204 (0.280)	0.204 (0.280)
LTI	0.007*** (0.002)	0.012*** (0.002)	-0.000 (0.000)	-0.000 (0.000)	0.206*** (0.045)	0.194*** (0.041)	0.036 (0.075)	0.036 (0.075)	0.206*** (0.045)	0.194*** (0.041)	0.036 (0.075)	0.036 (0.075)
Observations	542,746	488,348	54,398	54,398	12,145	11,943	2,229	2,229	12,145	11,943	2,229	2,229
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R ²	0.263	0.264	0.189	0.189	0.355	0.353	0.154	0.154	0.355	0.353	0.154	0.154

Notes: This table reports estimates of equation (1). The dependent variable in columns 1, 2, and 3 is a dummy variable equal to 1 if a loan is securitized, 0 otherwise. The dependent variable in columns 4, 5, and 6 is the natural logarithm of the amount of mortgages that a bank securitizes in state s during year t . '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 8: Loan Funding Source

Splitting variable	(1)	(2)	(3)	(4)	(5)	(6)
	Deposit Share		Wholesale Share		Loan to Asset Ratio	
Sample	< p50	≥ p50	< p50	≥ p50	< p50	≥ p50
Dependent variable	OTD status					
Deposit Competition	0.045*** (0.016)	0.084*** (0.023)	0.078*** (0.022)	0.055*** (0.016)	0.065*** (0.021)	0.076*** (0.019)
Size _{t-1}	0.118*** (0.011)	0.138*** (0.013)	0.115*** (0.012)	0.122*** (0.011)	0.102*** (0.012)	0.121*** (0.011)
Capital ratio _{t-1}	0.000 (0.001)	0.004** (0.002)	0.002* (0.001)	-0.002 (0.001)	-0.000 (0.001)	0.001 (0.002)
ROA _{t-1}	0.008* (0.004)	0.008** (0.004)	0.006 (0.004)	0.007 (0.004)	0.004 (0.003)	0.011** (0.004)
Z-score _{t-1}	0.004 (0.009)	-0.019** (0.007)	-0.013* (0.007)	0.008 (0.010)	0.001 (0.007)	-0.006 (0.010)
Observations	218,480	219,732	216,948	221,264	219,121	219,091
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter*Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.725	0.684	0.681	0.698	0.692	0.693
F stat Chow Test	8.55		4.22		5.06	

Notes: This table reports estimates of equation (1). Columns 1 and 2 split the sample according to whether a bank's deposit-to-liability ratio is below or above (or equal) to the median, respectively. Columns 3 and 4 split the sample according to whether a bank's wholesale funding share ratio is below or above (or equal) to the median, respectively. Columns 5 and 6 split the sample according to whether a bank's loan to asset ratio is below and above or equal to the median, respectively. Variable definitions are shown in Table 1. The standard errors are clustered by state and the corresponding t -statistics are reported in parentheses. *** indicates statistical significance at the 1% level.

Table 9: External Validity Tests

	(1)	(2)	(3)
Dependent variable		OTD status	
Branch-HHI	-0.057*** (0.010)		
Bank-HHI		-0.107*** (0.013)	
County-HHI			-0.082*** (0.016)
Control variables	Yes	Yes	Yes
Observations	338,836	338,836	338,893
Bank FE	Yes	Yes	Yes
Quarter * Year FE	Yes	Yes	Yes
Adjusted R^2	0.88	0.87	0.88

Notes: This table reports estimates of the equation (1). The sample contains observations from 2007Q1 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 using the Branch-HHI, the Bank-HHI, and the County-HHI. The vector of unreported control variables includes $Size_{t-1}$, $Capital\ ratio_{t-1}$, ROA_{t-1} , and $Z\text{-score}_{t-1}$. Variable definitions are shown in Table 1. The standard errors are clustered at the bank level and reported in parentheses. *** indicates statistical significance at the 1% level.

Table 10: Falsification Tests

	(1)	(2)
Dependent variable	Securitization rate	
Deposit Competition	0.002	0.002
	(0.002)	(0.002)
LTI		0.036***
		(0.004)
Jumbo loans		-0.124***
		(0.032)
Gender		-0.083***
		(0.017)
Urban		0.076***
		(0.014)
Refinancing		0.036***
		(0.009)
Observations	46,461	46,461
Firm FE	Yes	Yes
Year FE	Yes	Yes
Adjusted R^2	0.78	0.78

Notes: This table reports estimates of equation (4). The sample includes annual firm-level data on non-banks using data from HMDA. The control variables are the firm-year averages of LTI, the ratio of jumbo loans to total loans, gender, the share of urban loans, and the ratio of refinancing to total loans. Variable definitions are shown in Table 1. The standard errors are reported in parentheses and clustered at the state level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 11: Banking Regulatory Robustness Tests

Sample	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: OTD status	Exclude GLBA	Exclude Basel II	All	All	All	All
Deposit Competition	0.075*** (0.017)	0.071*** (0.020)	0.071*** (0.020)	0.071*** (0.020)	0.071*** (0.020)	0.074*** (0.015)
Time since intrastate deregulation			-0.003 (0.004)			
Denovo Branching Deregulation						0.061** (0.026)
Age Limit Deregulation						0.002 (0.024)
Branching Acquisition Deregulation						-0.030* (0.017)
Observations	205,599	407,805	433,132	438,212	438,212	438,212
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
Charter * Quarter Year FE	No	No	No	Yes	No	No
Regulator * Quarter Year FE	No	No	No	No	Yes	No
Adjusted R^2	0.757	0.682	0.677	0.678	0.678	0.678

Notes: This table reports estimates of equation (1). Column 1 excludes observations from 1997Q4 onward when the GLBA was enacted. Column 2 excludes observations after 2004Q2 following implementation of the Basel II Accord. We control for the long-term effect of intrastate bank branching deregulation in column 3. Column 4 reports the robustness of our findings after controlling for differences in banks' charter and regulator by including Charter \times Quarter \times Year fixed effects in equation (1). Column 5 includes a Branching Expansion Index to control for other facets of the interstate deregulation period (denovo branching, age limits, branch acquisitions). Variable definitions are shown in Table 1. The standard errors are clustered by state and the corresponding t -statistics are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 12: Borrower Credit Quality Tests

Dependent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				OTD status			
Deposit Competition	0.071*** (0.020)	0.071*** (0.020)	0.072*** (0.020)	0.071*** (0.020)	0.071*** (0.020)	0.071*** (0.020)	0.071*** (0.020)
Jumbo share	0.003 (0.036)						
LTI ratio		0.005 (0.003)					
Denial rate (DTI ratio)			-0.021* (0.011)				
Denial rate (employment history)				0.004 (0.027)			
Denial rate (collateral)					-0.001 (0.009)		
Denial rate (insufficient cash)						-0.000 (0.020)	
Denial rate (missing information)							-0.008 (0.031)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	438,212	438,212	438,212	438,212	438,212	438,212	438,212
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.678	0.678	0.678	0.678	0.678	0.678	0.678
Number of banks	14,574	14,574	14,574	14,574	14,574	14,574	14,574

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

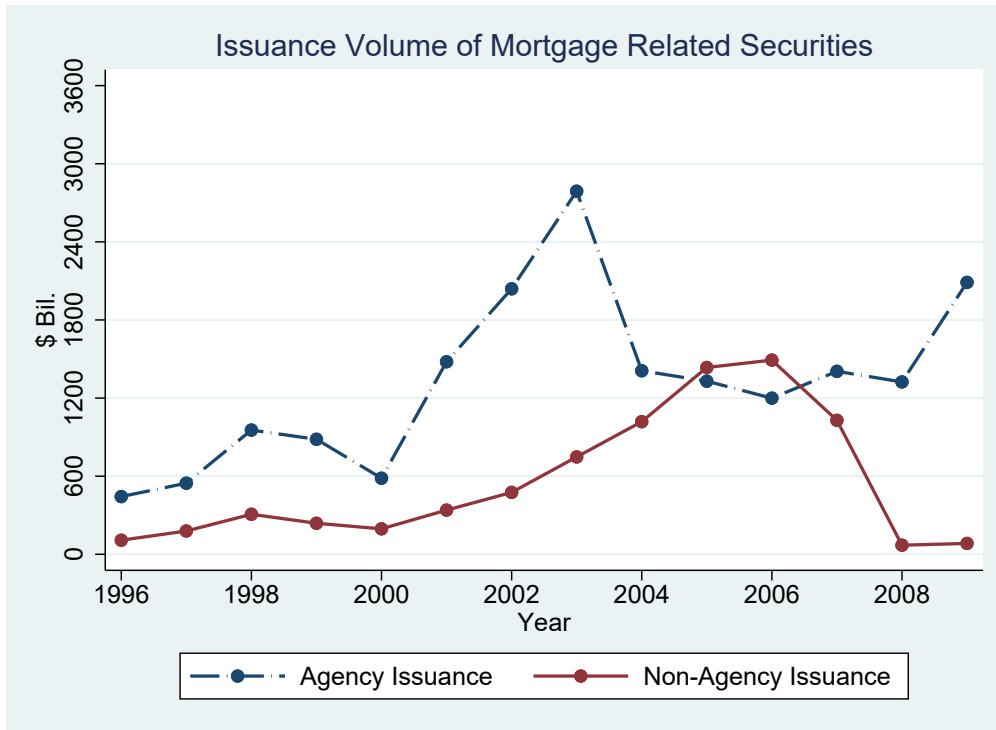
Table 13: Lending Environment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable				OTD status				
Deposit Competition	0.071*** (0.020)	0.072*** (0.020)	0.072*** (0.020)	0.071*** (0.020)	0.071*** (0.020)	0.072*** (0.021)	0.071*** (0.020)	0.071*** (0.020)
Acceptance rate	-0.004 (0.007)							
Third party purchases		0.000* (0.000)						
GSE purchases			0.000 (0.000)					
Private purchases				0.000 (0.000)				
Refinancing					0.007 (0.007)			
House price index						-0.142** (0.059)		
Mortgage Default							0.030*** (0.010)	
Bank HHI*FED rates								0.045*** (0.189)
Bank HHI								-0.109* (0.062)
Observations	438,212	438,212	438,212	438,212	438,212	438,212	438,212	438,212
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter*Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.678	0.678	0.678	0.678	0.678	0.678	0.678	0.678
Number of banks	14,574	14,574	14,574	14,574	14,574	14,574	14,574	14,574

Notes: This table reports estimates of equation (1) controlling for factors affecting the lending environment. Variable definitions are shown in Table 1. The vector of unreported control variables includes $Size_{t-1}$, ROA_{t-1} , ROA_{t-1} , and $Z\text{-score}_{t-1}$. The standard errors are clustered by state and the corresponding t -statistics are reported in parentheses. * and *** indicate statistical significance at the 10% and 1% levels, respectively.

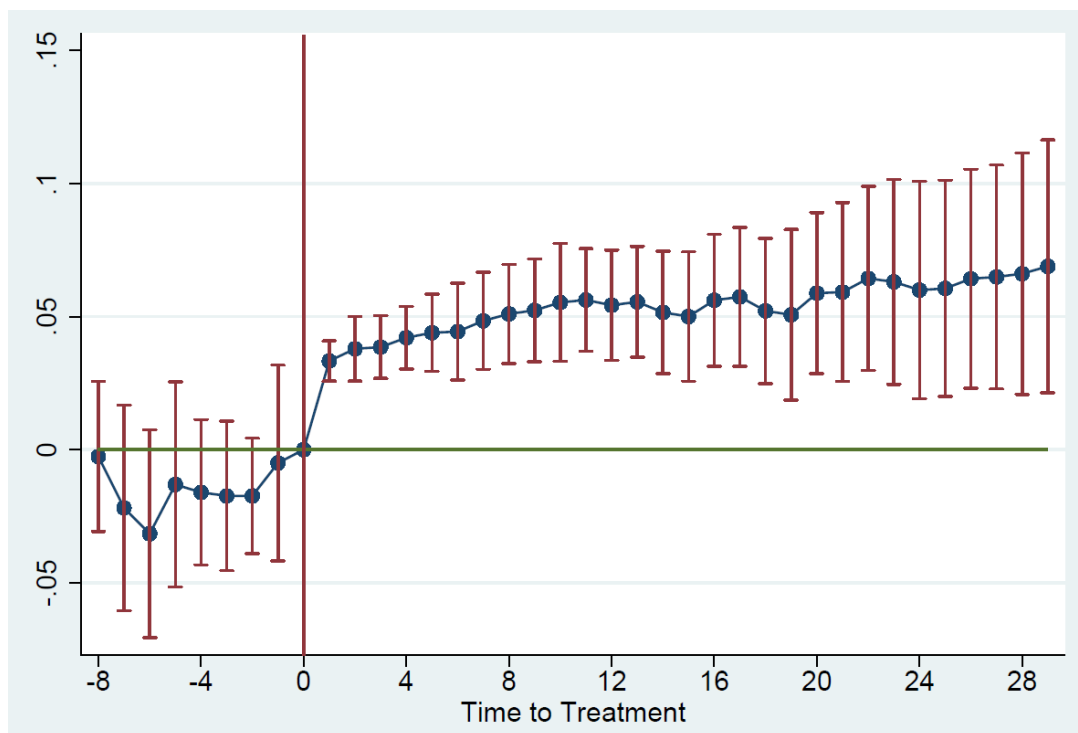
Figures

Figure 1: Quarterly Issuance of Traditional and Non-traditional 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. Non-Agency mortgage related securities are issued by private entities. The data is collected from The Securities Industry and Financial Markets Association (SIFMA). The y-axis measures securitizations in billions of US\$.

Figure 2: Dynamic treatment effects of the deposit competition on banks' OTD status



Notes: This figure shows the dynamic treatment effects of the deposit competition shock on banks' OTD status relative to the control group. The blue dots plots two way fixed effects (TWFE) event-study coefficient estimates and 95% confidence intervals for relative-time periods from 8 quarters before to 28 quarters after the date of deposit market deregulation. The red vertical lines indicate 95% confidence intervals.

A Online Appendix

Table 1.A: 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	25
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 relies on data from Johnson and Rice (2008) and Rice and Strahan (2010). It reports the effective date that a state relaxes the concentration limitation with respect to interstate mergers, and the concentration limitation.

Table 2.A: Methodological Sensitivity Checks

Estimator	1 IW-DID	2 Logit	3 Bootstrap
Deposit competition _{t-8}	0.035 (0.053)		
Deposit competition _{t-7}	0.008 (0.051)		
Deposit competition _{t-6}	-0.002 (0.050)		
Deposit competition _{t-5}	0.013 (0.034)		
Deposit competition _{t-4}	0.011 (0.025)		
Deposit competition _{t-3}	0.017 (0.040)		
Deposit competition _{t-2}	0.065 (0.065)		
Deposit competition _{t-1}	0.052 (0.046)		
Deposit competition _{t+1}	0.083* (0.044)		
Deposit competition _{t+2}	0.088** (0.044)		
Deposit competition _{t+3}	0.089** (0.045)		
Deposit competition _{t+4}	0.090** (0.046)		
Deposit competition _{t+5}	0.093** (0.046)		
Deposit competition _{t+6}	0.091** (0.045)		
Deposit competition _{t+7}	0.092** (0.045)		
Deposit competition _{t+8}	0.093** (0.045)		
Deposit competition		0.092*** (0.031)	0.071*** (0.002)
Observations	438,212	438,212	438,212
Control Variables	Yes	Yes	Yes
Bank effects	Yes	Yes	Yes
Quarter * Year effects	Yes	Yes	Yes
<i>PseudoR</i> ² or Adjusted <i>R</i> 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 an interaction-weighted difference-in-difference estimator. 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 the corresponding *t*-statistics are reported in parentheses. * and *** indicate statistical significance at the 10% and 1% levels, respectively.

Table 3.A: Deposit Competition and Loan Growth

	1	2
Dependent variable	Bank Loan Growth	Bank-State Mortgage Growth
Deposit Competition	0.001 (0.002)	-0.018 (0.027)
Size _{t-1}	-0.028*** (0.002)	0.058** (0.023)
Capital ratio _{t-1}	0.003*** (0.000)	-0.023*** (0.008)
ROA _{t-1}	-0.009*** (0.001)	0.027 (0.030)
Z-score _{t-1}	0.008*** (0.001)	0.002 (0.002)
Observations	438,212	20,131
Bank FE	Yes	Yes
Quarter*Year FE	Yes	Yes
Adjusted R^2	0.221	0.200

Notes: This table reports estimates of equation (1). The dependent variable in column 1 is the quarterly bank loan growth rate at the bank-quarter level computed using data from Quarterly Call Reports between 1994Q1 and 2006Q4. The dependent variable in column 2 is the annual rate of growth in mortgage lending by bank-state-year computed using data from HMDA between 1994 and 2006. Variable definitions are shown in Table 1. Standard errors are in parentheses and clustered at the state level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4.A: Do Banks Accept Riskier Mortgages?

	(1)	(2)
	Accepted	Accepted
Deposit Competition	0.012 (0.013)	0.036 (0.022)
LTI	-0.010*** (0.003)	
LTI \times Deposit Competition	0.001 (0.004)	
Applicant Income		0.090*** (0.004)
Applicant Income \times Deposit Competition		-0.007 (0.005)
Control variables	Yes	Yes
Observations	625,808	625,808
Bank FE	Yes	Yes
Year FE	Yes	Yes
Adjusted R^2	0.141	0.161

Notes: This table reports estimates of equation (1) using the loan-level HMDA data. The dependent variable is a dummy variable equal to 1 if a mortgage application is accepted, 0 otherwise. The unreported control variables are Size_{t-1} , $\text{Capital ratio}_{t-1}$, ROA_{t-1} , and Z-score_{t-1} . Variable definitions are shown in Table 1. The standard errors are clustered by state (except in column 3) and the corresponding t -statistics are reported in parentheses. * and *** indicate statistical significance at the 10% and 1% levels, respectively.

Table 5.A: Bank Asset Liquidity and Capitalization

	(1) More Liquid Assets	(2) Less Liquid Assets	(3) Highly Capitalized	(4) Lowly Capitalized
Deposit Competition	0.060*** (0.020)	0.088*** (0.019)	0.062*** (0.017)	0.074*** (0.021)
Control variables	Yes	Yes	Yes	Yes
Observations	224,450	213,762	219,648	218,564
Bank FE	Yes	Yes	Yes	Yes
Quarter*Year FE	Yes	Yes	Yes	Yes
Adjusted R^2	0.687	0.685	0.694	0.697

Notes: This table reports estimates of equation (1). Column 1 (2) reports estimates using a sample of banks with a liquid assets ratio greater than or equal to (below) the median. Column 3 (4) reports estimates using a sample of banks with a capital ratio greater than or equal to (below) the median. The unreported control variables are Size_{t-1} , $\text{Capital ratio}_{t-1}$, ROA_{t-1} , and Z-score_{t-1} . Variable definitions are shown in Table 1. The standard errors are clustered by state (except for column 3) and the corresponding t -statistics are reported in parentheses. * and *** indicate statistical significance at the 10% and 1% levels, respectively.

Table 6.A: State-level Conditions

	1	2	3
Dependent variable: OTD status			
Deposit Competition	0.071*** (0.021)	0.071*** (0.021)	0.071*** (0.021)
Homestead exemption	-0.0099*** (-3.97)		
Renegotiation rate		-0.1289*** (-3.18)	
State corporate tax rate			0.0091*** (3.11)
Control variables	Yes	Yes	Yes
Observations	438,212	438,212	438,212
Bank FE	Yes	Yes	Yes
Quarter * Year FE	Yes	Yes	Yes
Adjusted R^2	0.88	0.87	0.88

Notes: This table reports estimates of the equation (1) controlling for several state-level conditions that potentially could affect banks' OTD status. We include the homestead exemption level in column 1, the mortgage renegotiation rate in column 2, and the state corporate tax rate in column 3. The unreported control variables are $Size_{t-1}$, $Capital\ ratio_{t-1}$, ROA_{t-1} , and $Z\text{-score}_{t-1}$. Variable definitions are shown in Table 1. The standard errors are clustered by state and the corresponding t -statistics are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7.A: Deposit Supply

	1	2	3	4	5	6
Dependent variable: OTD status						
Deposit Competition	0.072*** (0.020)	0.071*** (0.020)	0.071*** (0.020)	0.072*** (0.021)	0.071*** (0.020)	0.072*** (0.020)
Population growth	-0.001 (0.001)					
Senior population		-0.000 (0.004)				
Net job creation			0.000 (0.001)			
Poverty				0.003 (0.002)		
Unemployment					-0.000 (0.002)	
Relocation rate						0.003* (0.002)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	438,212	438,212	438,212	438,212	438,212	438,212
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter*Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.678	0.678	0.678	0.678	0.678	0.678

Notes: This table reports estimates of equation (1) with additional control variables to capture deposit supply at the county-level. We include the population growth rate in column 1, the percentage of senior population over total population in column 2, the net job creation ratio in column 3, the poverty rate in column 4, the unemployment rate in column 5, and the relocation rate in column 6. The unreported control variables are $Size_{t-1}$, Capital ratio $_{t-1}$, ROA_{t-1} , and $Z\text{-score}_{t-1}$. 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.

Halle Institute for Economic Research –
Member of the Leibniz Association

Kleine Maerkerstrasse 8
D-06108 Halle (Saale), Germany

Postal Adress: P.O. Box 11 03 61
D-06017 Halle (Saale), Germany

Tel +49 345 7753 60
Fax +49 345 7753 820

www.iwh-halle.de

ISSN 2194-2188