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Heterogeneous Competition in Banking: Evidence from Multiple Loan and Deposit Products

By *Amanda Rae Heitz and John Kandrac*

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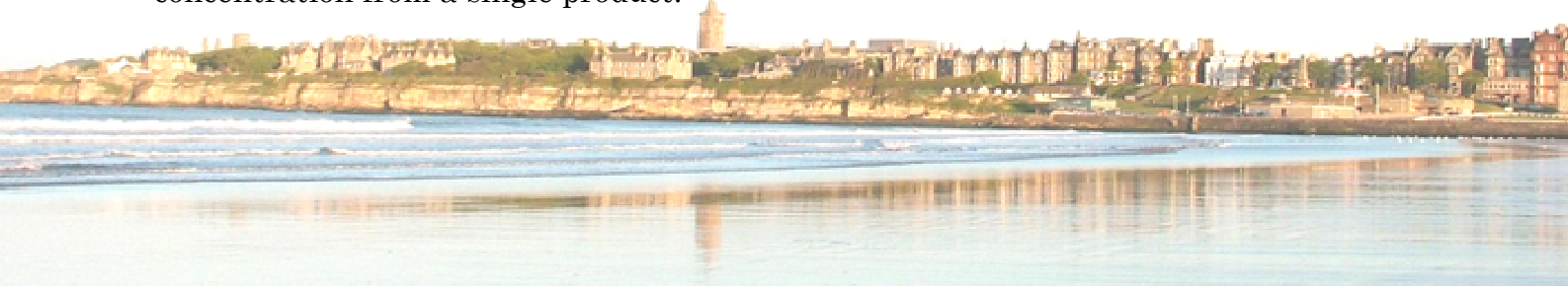
WP Nº 24-026

4th Quarter 2024



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March 19, 2024

Abstract

We document extensive heterogeneity in bank competition across multiple loan and deposit products. Our analysis focuses on a sudden shock to a previously unstudied banking regulation that simultaneously targets certain banks' loans and deposits. Importantly, our identification strategy permits us to separately measure the effects on banks subject to the regulation as well as their local competitors in a consistent setting and without using one cohort as a counterfactual for the other. In this way, we demonstrate how competitive interactions can invalidate common research designs, and that a failure to account for such interactions can undermine policy goals. Further, we show that the complex interactions between banks are influenced by a wide range of product-specific factors such that competition among banks varies at the product level. Thus, our results caution against measuring the intensity of bank competition with a simple ad hoc measure of concentration from a single product.

JEL classification: G21, G28, C18, R32

Keywords: bank lending, bank competition, spillovers, bank regulation, mortgages, deposits, government policies

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We are grateful for helpful comments from Stephen Karolyi, Elena Loutskina, Andrew MacKinlay, Robert Prilmeier, Marcelo Rezende, Tom Schneider, Charles Taragin, and Morad Zekhnini; seminar and workshop participants at the Federal Deposit Insurance Corporation (FDIC), the Federal Reserve Board, and the Academic Female Finance Committee (AFFECT); conference participants at the FMA Annual Conference; and former National City Corp. executives including Bob Ellis, John Gellhausen, and William MacDonald. We thank Emma Bomfim for excellent research assistance. The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of anyone else associated with the Federal Reserve System.

1 Introduction

Policymakers and researchers continually scrutinize the effects of policy and external shocks on banks' loans and deposits. The pronounced interest in these activities reflects the importance of deposits to the payments system, loans to economic potential, and both to risk and charter value in the banking sector. In fact, the simultaneous provision of loans and deposits by the same institution distinguishes banks as financial intermediaries and offers a rationale for their existence (Kashyap et al., 2002; Gatev et al., 2009). While banks enjoy synergies between these two fundamental activities, competition and spillovers among banks can vary dramatically across different asset and liability products. However, competitive dynamics and spillovers unique to each banking product are often overlooked in both research and policy designs. Nevertheless, such interactions warrant special consideration in the banking industry given the economic importance of competitive dynamics (Drechsler et al., 2017), numerous competitors, and profusion of regulations and shocks that affect only a subset of banks.

In this paper, we document extensive heterogeneity in competition across different loan and deposit products and demonstrate the importance of heterogeneous spillovers to proper research and policy design. Our analysis centers on an exogenous shock to a previously unstudied regulation that simultaneously targets banks' loans and deposits. This feature of our setting enables us to reveal complex competitive interactions within the two crucial facets of bank liquidity creation. Importantly, we observe unique competitive spillovers not just between loans and deposits, but also between different types of loans and deposits.

To address the identification challenges arising from inconsistent competitive interactions in the banking sector, we focus on a regulation established by Section 109 of the Riegle-Neal Act. Section 109 was inserted into the Act by legislators to help ensure that banks expanding beyond their home state lend in areas where they gather deposits. Specifically, the regulation requires banks branching outside of their home state to meet minimum loan-to-deposit (LTD) ratios in each of the states that host their out-of-state expansion.

Thus, the regulation does not apply to regulated banks' branches within their home state or to banks that operate within only a single state. State-specific LTD ratios change annually based on regulators' approximation of the LTD ratios maintained by the home-state banks only, thereby tying out-of-state banks' requirements to the operations of their competitors that are native to each state. However, the rule's implementation introduces the potential for arbitrary variation in minimum requirements that is exogenous to local economic or banking activity. As a result, large changes in a state's ratio can emerge without presenting the selection and endogeneity issues that plague the analysis of many regulatory changes and banking shocks. Banks enjoy considerable discretion in the types of loan-making and deposit-taking actions that they pursue to comply with the regulation, permitting us to study competitive interactions between banks and across products within a single uniform setting. Unlike existing studies examining external shocks that target only one product class or involve a change in branch network structure, we can more easily draw comparisons between the competitive dynamics of different products.

Our setting centers on the effects of the largest-ever increase in a state's minimum LTD ratio, which occurred in Indiana because of the corporate reorganization of a single bank. Because of the reorganization, a subset of banks with branches in Indiana were suddenly required to maintain a plausibly binding minimum LTD ratio within that state. We explore the subsequent effects on multiple loan and deposit products offered by both the regulated banks' branches and their competitors operating in the same local markets.

We find that suddenly higher LTD requirements expanded the credit supply of targeted institutions in relatively low-information residential real estate loans. On average, banks subject to the more stringent LTD requirement reduced denial rates for mortgage applications, lowered mortgage rates, and significantly increased loan originations. Furthermore, these regulated banks expanded their lending to lower-income individuals and increased the share of loans to minority borrowers.

Given the aggressive actions by out-of-state banks to boost mortgage lending to Indiana borrowers, we next examine the response of the unregulated home-state banks operating in the same markets. We observe offsetting declines in real estate credit among these banks, as they passively ceded lending business to the treated banks. In contrast to the treated hosted banks, the banks home to Indiana maintained their credit standards as measured by denial rates and scarcely reduced rates on mortgage loans. Consequently, the number and volume of mortgages originated by the home banks declined meaningfully. Aggregate credit volume increased only modestly because of the competitive interactions between treated and untreated banks within Indiana.

We observe a different response in the commercial real estate loan market. Out-of-state banks subject to higher LTD ratios did not increase their commercial lending, which reflects the higher information intensity and less transactional nature of these loans. Moreover, the more valuable relationships associated with commercial lending increases the likelihood that competing banks not subject to the LTD requirement will defend this loan segment more fiercely than commoditized residential mortgages. The anticipation of such competitive behavior further discouraged regulated banks from accumulating loan volume in this category.

The response within the retail deposit market also contrasts with our observations in the residential mortgage market. As with many residential mortgage products, retail deposits exhibit substantial product homogeneity across banks conditional on rates, but different pricing practices and the importance of deposits to a bank's franchise elicit a different competitive response. First, we observe that banks subject to instantaneously higher LTD minimums do not comply with the new requirement by shedding local deposits. Instead, banks address the higher ongoing funding needs stemming from larger loan portfolios by boosting rates on deposit products available to customers nationally through deposit brokers and listing services. This practice permits banks to book those deposits outside of Indiana, which does not undermine their efforts to meet the higher LTD requirement. In

response, local competitors leave rates on retail deposits similarly unchanged. However, they defensively react to the rate increases on the less common deposit products that would otherwise result in the exit of some high-value local depositor relationships. These differential responses highlight the nuanced and adaptive nature of competitive dynamics within the banking sector.

We derive a causal estimate of the effects of the heightened lending requirement via a within bank-time and bank-market-time identification strategy. This approach enables us to highlight crucial aspects of bank interactions within a single uniform setting, avoiding the need for additional shocks or identifying assumptions. Moreover, our approach avoids bias introduced by violations of the critical "no interference" component of the stable unit treatment value assumption (SUTVA), which holds that the treatment status of one institution should have no effect on other institutions. Our results demonstrate that SUTVA violations are common in banking studies that estimate the effects for treated institutions by forming counterfactuals from purportedly untreated banks—an approach that is standard in difference-in-differences designs. This practice overlooks first-order competitive interactions and results in an invalid research design with a potentially unsignable bias that depends on the nature of the interactions within a product market (Berg et al., 2021). Other studies employ designs using more distant treated banks as control units, which limits contamination from within-market interactions but presents challenges in controlling for changing loan demand and ignores the effects on in-market "untreated" banks. In contrast, our approach separately measures the effects of the lending rule on both groups of banks under a consistent identification assumption. This strategy allows us to determine whether the non-targeted banks amplify, dampen, or exert minimal influence on the effects of the policy.

Our results contain important insights for both researchers and policymakers. First, we show that it is often necessary for researchers to adopt a broader treatment definition when assessing the effects of shocks that superficially affect only a subset of banks. This practice is crucial because untreated banks can still be affected through competitive interac-

tions and changes in customer behavior. The presence of competition and spillovers across various banking products implies that many research designs violate the SUTVA. Similarly, regulators often target specific regulations at only a subset of banks, yet our study demonstrates that this practice can still affect untargeted institutions, potentially undermining the intended economic goals of the regulation. Second, our results caution against measuring the intensity of bank competition with a simple ad hoc measure of concentration, such as a deposit or branch HHI. Specifically, we show that bank products with ostensibly similar characteristics exhibit substantially different competitive interactions. Third, we find that the relevant competitors and the nature of interbank spillovers vary across products. Factors such as the information intensity in a lending category or the type of customer targeted by different deposit products can meaningfully affect both the sensitivity to shocks and the nature of the competitive interactions between banks. These considerations therefore hold significant implications for how regulatory inconsistencies and other banking shocks shape the distribution of banks' credit provision, risk, liquidity creation, and the industrial organization of the banking system itself. In our setting, competitive considerations thwarted policymakers' objectives, as banks subject to the higher Section 109 requirement boosted loans with limited economic value. Competitors' reluctance to originate such loans at lower prices resulted in minimal overall credit growth. By contrast, commercial lending that possesses more economic value and a stronger tie to banks' charter value showed no reaction by either group of banks. This fact pattern highlights the nuanced but crucial impact of competitive dynamics on policy outcomes. In sum, our analysis emphasizes how effective policy design and evaluation requires a comprehensive understanding of which products are likely to be affected and whether untargeted institutions amplify or dampen the effects observed among targeted institutions.

This paper contributes to an important literature on competition within the banking industry. Prior studies predominately focus on competitive effects arising from changes in concentration, most commonly as a result of branching deregulation (Jayaratne and Strahan,

1996; Stiroh and Strahan, 2003; Zarutskie, 2006; Jiang et al., 2019; Bisetti et al., 2020) or mergers (Berger et al., 1998; Nguyen, 2019; Saidi and Streitz, 2021). In contrast to examining the effect of changes in the structure of the local banking sector, we study a competitive shock at the product level that holds the market structure constant. Importantly, the entry or exit of competitors entails disruptions in market power, relationship networks, and core competencies among local banks. Our approach avoids these confounding factors, which can otherwise inhibit the ability to isolate competitive dynamics across products. Moreover, focusing on a regulation that simultaneously and directly targets the products that define banks represents a key contribution of our paper. This unique setting enables us to achieve insights into bank competition within different lending and deposit markets.

This paper also complements existing literature that addresses the empirical challenges presented by within-market spillovers when shocks affect only a portion of firms in the market (Ferracci et al., 2014; Berg et al., 2021). Our study employs a design-based approach to address competitive interactions that can result in both effects on unregulated banks and heterogeneous treatment effects among regulated banks operating in different markets. Similarly, our work aligns with recent studies that reflect the surge of interest in accurately measuring treatment effects in difference-in-differences designs. We show that even in the absence of time-varying covariates (Sant'Anna and Zhao, 2020), continuous measures of treatment exposure (Callaway et al., 2021), and staggered treatment dates (Goodman-Bacon, 2021), such designs often suffer from violations of a fundamental assumption required to obtain causal inference. Despite numerous advances in the empirical literature, none of these papers explore the potential heterogeneity of competition across products.

Finally, our work relates to existing studies that examine spillovers across institutions. Studies such as Plantin (2015), Buchak et al. (2018), and Chernenko et al. (2022) focus on how regulation in one sector causes activity to spill into another unregulated sector. Other research focuses on spillovers and competition following non-regulatory shocks, such as natural disasters (Cortés and Strahan, 2017), bailouts (Dávila and Walther, 2020), fire sales

(Greenwood et al., 2015), and exposure to shale oil booms (Shakya, 2020). Regulatory shocks such as the one we examine are set apart by three important distinctions. First, regulations are motivated by particular policy goals that can be empirically evaluated. Second, banking regulations target banks in a deterministic manner, whereas the assignment and intensity of natural disasters and other shocks can entail measurement error. A third key distinction is that while the Section 109 requirement is meant to directly target credit *supply* (conditional on deposit volume), non-regulatory banking shocks often impact loan demand (Cortés and Strahan, 2017), which poses additional identification challenges.

2 Institutional Background

2.1 Statewide Loan-to-Deposit Requirements

The passage of the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 (IBBEA) significantly expanded banks' ability to own and operate branches in more than one state. In anticipation of the consolidation and growth in the banking sector that would follow this geographic deregulation, lawmakers included a number of provisions to prevent banks from becoming excessively large or engaging in undesirable practices.

One safeguard against unwanted banking practices included in Section 109 of IBBEA required bank regulators to devise a rule to prohibit banks from operating out-of-state branches primarily for the purpose of deposit production. This provision was designed to ensure that banks did not use their new branching authority to farm deposits from out-of-state communities without also lending to households and businesses in those areas. The rule-making authority granted by Section 109 reflected legislators' concern that banks opening interstate branches might not help meet the credit needs of the communities in which they operated.

The final rule, codified in October 1997, establishes separate minimum loan-to-deposit (LTD) ratios for each state that are updated annually. Regulators require banks operating

branches outside of their home state to satisfy the minimum LTD ratio for each of the so-called "host states" in which the bank maintains a physical presence.

Bank examiners assess a bank's compliance with this requirement by periodically requesting the *actual* loan and deposit totals for each of the bank's host states during the course of regularly scheduled bank exams or "as deemed appropriate by the agencies" (Federal Register, 1997). Penalties for violating Section 109 include the forced closing of the interstate branches in the host state, a prohibition against opening new branches in the host state, and/or the establishment of an agreed-upon plan to better meet the credit needs in the host state.[1]

To establish a state's minimum LTD ratio for out-of-state banks, banking regulators first attempt to calculate a weighted average LTD ratio based on the statewide activity of the "home" banks. Home-state banks are identified based on their charter or organization type. For example, the location of the main office establishes the home state for nationally chartered banks, while state chartered banks receive home-state designation in the state that granted the charter. After defining the set of home-state banks, a statewide LTD calculation requires the volume of in-state loans and deposits held by these banks. For this task, regulators must rely on existing supervisory data to approximate in-state loans and deposits because Section 109 of IBBEA stipulates that regulators should administer the rule without imposing new regulatory filing burdens. Specifically, a home bank's in-state deposits are measured using the Summary of Deposits, which allocates all deposits to a specific branch, and in-state loans are measured using Call Reports. Because Call Reports lack geographic information for the loan portfolio, each bank's statewide loan total is estimated by multiplying total domestic loans by the fraction of in-state deposits reported in the Summary of Deposits. Formally, the host-state LTD ratio for state S is calculated based on the lending and deposits of each home-state bank, b_{home}, as follows:

[1]Regulatory agencies may grant special consideration to banks in violation of minimum LTD ratios in certain circumstances. For example, banks could still receive a satisfactory credit needs determination if the out-of-state branches contributing to the violation were formerly part of a failed institution or if the branches were acquired with low preexisting LTD ratios.

$$\text{Host State LTD Ratio}_S = \frac{\sum_{b_{home}} Loans_b \cdot \frac{Deposits_b \cdot \mathbb{1}_{branch}(S)}{Deposits_b}}{\sum_{b_{home}} Deposits_b \cdot \mathbb{1}_{branch}(S)}. \quad (1)$$

Relying on the Summary of Deposits and the Call Reports to determine statewide loan and deposit totals of home banks entails several drawbacks that limit the connection to local activity. First, while the Summary of Deposits ostensibly contains a precise geographic tally of a bank's deposits, banks have substantial discretion in how they assign deposits to a given branch (FDIC, 2022). For example, banks may choose to centrally book corporate deposits, brokered deposits, or deposits obtained via a listing service at a single office. The estimate of statewide loan volume embeds this same measurement error because each bank's total domestic loans are prorated by the fraction of home-state deposits reported in the Summary of Deposits. A second drawback of the statewide LTD calculation is the assumption that lending and deposit activities are geographically identical. Even if the geographic dispersion of deposits is accurately reported in the Summary of Deposits, the statewide loan total is likely to be inaccurate. A third drawback relates to the decision by regulatory agencies to compute the *weighted* average LTD ratio for home banks, which exposes the calculation to substantial year-to-year swings if a large bank changes its home state because of a reorganization, merger, or desire to obtain a more favorable regulatory or legal environment.

Due in part to the challenges stemming from the assumptions required to calculate LTD ratios of the home-state banks, regulators stipulate that out-of-state banks need only maintain a minimum LTD ratio of only 50% of each host state's value, as calculated according to equation (1). Lowering the minimum LTD requirement in this manner limits the extent to which Section 109 requirements bind most multi-state banks, which in turn contributes to the relative lack of attention that state-level LTD requirements receive. For example, the average state LTD ratio in 2022 is 73%—for an effective regulatory requirement of about 37%—which compares with an LTD ratio for larger banks of 57.5% according to the Federal Reserve's 2022Q3 H.8 data. Two other factors contribute to the limited salience of the

regulation. First, the rule does not affect the overwhelming majority of banks, which do not branch outside of their home state. Second, besides being largely nonbinding for banks with interstate branches, host-state LTD ratios exhibit relatively low within-state variation over time. Nevertheless, regulators make official announcements to promulgate new host-state ratios and trade publications and law firms commonly advertise these updates to their subscribers and clients.

2.2 The 2004 Indiana LTD Requirement Shock

When the regulatory agencies announced updated host-state LTD ratios in the third quarter of 2004, Indiana witnessed a marked increase to 163% from 114% in the previous year. This 49 percentage point increase represents the largest recorded change and stands in stark contrast to the 95th percentile change of just 8 percentage points.[2] Taking into account the requirement for hosted banks to meet half of the published LTD ratio, out-of-state banks were suddenly required to satisfy a minimum LTD ratio of about 82%, an increase of 25 percentage points. Indiana's minimum LTD ratio remained elevated in the following year.

The dramatic increase in Indiana's LTD ratio was due almost entirely to an organizational restructuring by National City Corp. (NCC) of Ohio, which operated separately chartered national banks in several Rust Belt states, including Indiana.[3] As National City's nationwide mortgage lending business began to expand in 2002, NCC reclassified its nonbank mortgage lending companies as subsidiaries of National City Bank of Indiana (NCBI), which was Indiana's largest home bank by total assets. The reorganization of NCC's nonbank lenders reflected a desire to obtain more favorable regulatory treatment and to make regulatory compliance less onerous for these lenders. Organizing state-chartered nonbank lenders as subsidiaries of a national bank allowed NCC to take advantage of federal preemption

[2]At 163%, the *level* of Indiana's 2004 LTD ratio has only ever been exceeded by North Dakota for a few years during the GFC and shale oil boom.

[3]The information in this section draws heavily from interviews with former National City Corp. executives Bob Ellis, John Gellhausen, and William MacDonald. We are grateful to these individuals for providing crucial information about the motivation behind National City Corp.'s actions.

rules whereby federal law preempts state law for federally chartered financial institutions.[4] Thus, as NCC's mortgage companies and the loans they originated played a greater role in NCC's overall strategy in the early 2000s, organizing these entities as subsidiaries of a national bank helped avoid litigation and simplified the set of regulations with which its dispersed and numerous lenders must comply. Of its several national banks, NCC chose NCBI to house the mortgage companies because of the most favored lender doctrine. The most favored lender doctrine—derived from case law and federal agency interpretations of the National Bank Act of 1864—holds that national banks may charge the highest interest rates and fees that any other lender in its home state is permitted to charge for the same type of transaction, regardless of other states' usury limits that would otherwise apply to activity within that state. Because borrower and collateral location are irrelevant in most favored lender doctrine interpretations, NCC selected its Indiana affiliate as the preferred parent of its mortgage subsidiaries given Indiana's more favorable usury, interest rate, and other relevant state laws compared to the laws of other states where NCC operated federally chartered banks.

The reassignment of NCC's mortgage lenders to NCBI dramatically increased NCBI's reported loans with no concomitant increase in deposits. For the 2004 host-state loan ratio calculation, NCBI reported loans that increased $21.2 billion (85%) over the prior year, while deposits rose by less than $0.5 billion (5%). This dramatic increase in the reported LTD ratio for NCBI accounted for 45 of the 49 percentage point increase in Indiana's statewide LTD ratio. Importantly, the loan growth reported on the balance sheet of NCBI did not reflect changes in Indiana's economic conditions or the operations of NCC's Indiana affiliate. Instead, mortgage lenders scattered around the country were responsible for the new lending and overseen by executives in Ohio. NCBI was not involved in the origination, loan servicing, marketing, or other related functions, which were all responsibilities of the separate mortgage

[4]Ultimately, the courts vindicated this approach in *National City Bank of Indiana v. Turnbaugh 367 Fed Supp 2nd 805*, which held that one of NCC's mortgage lenders was not bound by Maryland's prepayment penalty law because federal preemption applied given the company's status as a subsidiary of NCBI.

companies (National City, 2003). Two additional facts underscore the geographic separation between Indiana and the location of the new loans reported by NCBI. First, although NCC's mortgage loans were reported by NCBI on the Call Reports because of the reorganization, more than 80% of mortgage originations at this time were concentrated on the west and east coasts (National City, 2003). In fact, NCC's largest mortgage company was located in San Jose, California, and California alone accounted for 45% of mortgage originations. Second, while NCBI's subsidiaries more than doubled between June 2002 and June 2003 as a result of the nominal reorganization within the corporate hierarchy, almost all were located in a mid-Atlantic or west coast state and none of the newly assigned subsidiaries were based in Indiana or a neighboring state.

The sharp increase in Indiana's host state LTD ratio following National City's reorganization is an appealing natural experiment for several reasons. First, NCC's restructuring was not driven by a change in NCBI's lending or deposit-taking in Indiana, but was instead spurred by court challenges and decisions pertaining to rules governing mortgage lenders located around the country. Second, the announcement of the higher LTD ratios to a potentially binding level likely came as a surprise to banks, which typically comply with the Section 109 rule with little effort. A third consideration is that there was a large temporal separation between the reorganization and the announcement of the higher LTD ratios in 2004. Because NCC's restructuring began in the second half of 2002 just after the data collection date for the 2003 ratios, approximately two full years separated the reorganization and the announcement of the 2004 LTD ratios.

3 Identification Strategy & Methodology

We use a difference-in-differences (DiD) design to evaluate the effect of the sudden increase in the minimum LTD requirement applied to Indiana's hosted banks. For the cross-sectional

difference, we focus on the spatial variation in the application of the Section 109 requirement rather than the variation in treatment between home and host banks within Indiana.

An important feature of this design is that it permits an analysis within a bank and month such that counterfactual lending and deposit-taking activity are formed by the same bank's activity, in the same time period, outside of Indiana. In this way, we can absorb time-varying changes in loan supply at the individual bank level. This feature may be particularly important during the early stages of the 2000s mortgage boom, as many banks altered their overall residential real estate strategy at this time.

Moreover, the within bank-month design helps avoid violations of the frequently overlooked stable unit treatment value assumption (SUTVA). Though many studies that examine changes in banking regulation use untreated institutions to form a counterfactual for treated banks, untreated banks can still be affected by a regulatory shock through ordinary competitive dynamics. For example, if a treated bank facing a higher LTD requirement lowers mortgage rates to attract more business in a given area, competing banks in that same area may follow suit or, lacking the regulatory need to boost LTD ratios, forgo lending at the lower rates of their competitors. In either case, a violation of the SUTVA occurs because prices or quantities at the untreated banks would be affected as a result of the regulations. By contrast, the within bank-month design enables us to separate the effects of the lending rule on both the group of banks that are targeted by the regulation and the group of banks that are indirectly affected via competition and other spillovers.

To achieve sensible bounds on the geographic reach of the within-bank comparisons, we focus on Indiana MSAs that span multiple states. As shown in Figure 1, there are five Indiana MSAs that include parts of nearby states, including Illinois, Kentucky, Michigan, Ohio, and Wisconsin. Focusing on multi-state MSAs has two benefits. First, MSAs group cities with surrounding areas based on the extent of social and economic interaction. Consequently, examining bank responses in MSAs not only helps to ensure that we compare more similar areas, but it also allows for finer controls for loan demand and within-bank loan supply

differences across local areas. A second benefit of the focus on MSAs is that the quality and coverage of the data are better in these areas. For example, MSA boundaries play an important role in reporting requirements for mortgage activity, and MSAs contain more information on branch-level lending and deposit rates.

In general, our estimating equations take the following form:

$$Y_{b,c,t} = \beta \cdot (Post_t \times Treat_S) + \gamma_c + \phi_{b,t} + \varepsilon_{b,c,t} \tag{2}$$

$$Y_{b,c,t} = \beta \cdot (Post_t \times Treat_S) + \gamma_c + \phi_{b,msa,t} + \varepsilon_{b,c,t}. \tag{3}$$

where $Y_{b,c,t}$ represents an outcome variable for bank b in county c during period t, which is either a month or day. The indicator $Post_t$ takes a value of one for loans made after August 25, 2004 for daily analysis or September 1, 2004 for monthly analysis. The indicator variable $Treat_S$ takes a value of one for loans originated in counties within Indiana. The variable $\phi_{b,t}$ denotes bank-time fixed effects that control for time-varying bank credit supply-side effects that are unrelated to the regulation but may confound our estimates of the treatment effect. In Equation 3, we include more granular bank-MSA-time fixed effects, $\phi_{b,msa,t}$, which can capture more local shifts in bank credit supply over time, while the within MSA-time aspect of these fixed effects can also control for more geographically specific developments, including changes in loan demand each period.

Because the implementation of our research design does not involve staggered treatment (Goodman-Bacon, 2021; Baker et al., 2022), time-varying covariates, or a continuous measure of treatment (Callaway et al., 2021), the β parameter in equations (2) and (3) recovers a standard DiD estimate of the average treatment effect on the treated if two additional assumptions are satisfied. First, the defining assumption underlying a DiD design is the parallel trends assumption (PTA), which requires that treatment and control groups would follow similar trends in the absence of the regulatory change, conditional on the fixed effects. Second, the SUTVA requires that a bank's response to the increase in the LTD ratios in a

given area does not depend upon the treatment status of other banks. Although untreated home banks can be affected via competition and spillovers from treated institutions operating in the same area, our within bank-market-time comparisons require that a bank's branches within an MSA outside of Indiana do not interfere with branches of the same bank across the state border. This no-interference component of the SUTVA is likely to be satisfied in the latter case because of standard banking practices designed to prohibit competition within its own branching network.

4 Data

We use four main datasets to measure banks' reactions to the change in the Section 109 host-state LTD ratio. First, we appeal to the confidential Home Mortgage Disclosure Act (cHMDA) data to gather information on residential mortgage loans and applications, which permits us to measure total loan volume, the number and size of originated loans, denial rates, loan securitization rates, and demographic and income characteristics of the applicants. This information is reported at the county level by banks that operate an office in an MSA. Because the host-state LTD ratios change upon announcement in the middle of each year, we require the confidential version of the cHMDA dataset that includes the precise dates for each mortgage application and action. However, compared to more recent vintages, the cHMDA data from the early 2000s contain relatively limited information.

Second, we gather data on banks' commercial real estate lending from the CoreLogic Real Estate database, which comprises property-level data on voluntary liens for commercial properties. The mortgage liens recorded on properties detail the loan origination date and amount, the borrower location, and the name of the lender. We drop any GSE-eligible loans to ensure that the loan characteristics and lending technology does not closely resemble that of residential mortgages.[5]

[5]In order to identify home and host banks in this data set, we use string matching and a manual checking process to link lender names to their RSSD IDs available in our other datasets. We first download all CRE

Third, we obtain branch-level survey responses of standardized lending and deposit rates from RateWatch. Although the number of branches reporting to RateWatch expanded dramatically in the second half of the 2000s, the data exhibit substantial coverage across MSAs during our sample period. We use the RateWatch data to construct a branch-month panel of 30- and 15-year mortgage rates. A desirable property of the mortgage rates recorded in the RateWatch data is that these rates are comparable across institutions and do not differ based on non-price terms or borrower characteristics. To the extent that banks adjust prices to expand or limit loan origination, baseline interest rates would reflect this change irrespective of any attendant changes in borrower composition. In addition to the mortgage rates, we also observe reported interest rates paid on several standard demand and time deposit accounts.

Our fourth main data set is the FDIC's Summary of Deposits, which allows us to identify branch-level deposit volumes reported by banks. The Summary of Deposits data is also necessary to determine whether banks are subject to the Section 109 LTD ratio in Indiana. To identify the status of each bank, we first identify banks with branches located in Indiana. Next, we merge this information with the NIC database to record the organizational structure, entity and charter type, and primary federal regulator of each institution. Banks with an Indiana main office or charter are (depending on the charter type) identified as home banks that are not subject to Indiana's minimum Section 109 LTD requirement. Hosted banks subject to Indiana's LTD ratio are out-of-state institutions that operate branches in Indiana. We limit the sample to banks that exist from 2002 through 2005, which spans a pre-announcement and post-announcement period. In Table 1, we report descriptive statistics for the sample of 18 banks hosted by Indiana and 11 home banks that operate in more than one interstate MSAs, as of 2004. As expected, hosted banks are larger overall with median assets of $12 billion (98th percentile among depository institutions), though multi-

loans in our geographic region of interest and use the Fedmatch (Cohen et al., 2021) algorithm to match CRE lenders with bank names in the National Information Center (NIC) database that maintained branches in Indiana. We manually discard incorrect or ambiguous matches.

state banks home to Indiana are also relatively large for this time period, with median assets of $1.1 billion (94th percentile).[6]

In Table 2, we present descriptive statistics for the hosted (panel A) and home (panel B) banks' loan and deposit activity during the pre- and post-announcement periods for counties within Indiana's multi-state MSAs. Loan-level variables are drawn from the cHMDA data and observed by bank-county-month, while the loan and deposit rate variables from RateWatch are sampled at the branch-month level. The summary statistics demonstrate that both host and home banks make more loans to counties outside of Indiana, which reflects the larger populations within the non-Indiana counties on average. Similarly, loans made to counties within Indiana are smaller than those made to counties outside Indiana. During the post-period, the summary statistics demonstrate that the host banks continue to make more loans to counties outside of Indiana, though they tend to deny more loans overall, yet originate a larger percentage of loans to minority borrowers. All rates offered by host banks on deposit and mortgage products are higher during the post period. Table 2 Panel B shows that these patterns also emerge for home banks during the pre- and post-periods. The pre- to post-announcement rate of change in residential real estate loan volume for hosted banks in Indiana counties is 15 percentage points higher than that of the non-Indiana counties. In contrast, Indiana's home state banks realized a 13 percentage point *lower* growth rate in residential loan volume within Indiana counties.

[6]As noted earlier, some Indiana home banks are affiliates of much larger institutions. Reporting values for home banks in Table 1 on a consolidated basis would result in a more similar size profile of home and hosted institutions.

5 Results

5.1 Competitive Responses in the Market for Loans

5.1.1 Residential Real Estate Lending

We begin our analysis by focusing on credit provision in the residential real estate (RRE) market. If host-state banks in Indiana subject to higher LTD ratios increased lending in response, the relative ease of scaling this loan category should reveal significant effects. Panel A of Table 3 reports the estimated treatment effects for several outcome variables using bank-month-county observations. The leftmost columns show that treated banks increased total loan volume in Indiana counties by between 27 and 14% on average. Decomposing the total loan volume into the number and size of mortgage originations in the middle columns of Table 3 reveals that the increase is mostly driven by the number of mortgages as opposed to the average loan amount. This pattern would be expected if banks boost loan volume in an effort to increase LTD ratios, because individual loan amounts are constrained by collateral values. Consequently, loan volume is most efficiently expanded via additional, rather than larger, mortgages. In the rightmost columns, we show that as banks sought to increase total loan volume, they denied proportionally fewer mortgage applications, which can at least partly explain the additional loan originations. Overall, the results reported in Table 3 are consistent with an increase in loan supply among targeted out-of-state banks' branches.

In Figure 2, we show binned scatterplots of the four outcomes in Table 3 for host bank loans originated inside and outside of Indiana. For this exercise, we compute weekly averages by bank and county for the 20 weeks before and after the announcement of the new LTD requirement, which is indicated with a vertical line. The effect of the regulation is evident upon announcement of the higher LTD ratios, with loan volume, the number of loans, and the (noisier) average loan amount all increasing immediately within Indiana. By contrast, the drop in denial rates at the affected branches apparently emerged over time. Lending activity in neighboring counties outside of Indiana remained unchanged. Importantly, all

outcomes depicted in Figure 2 demonstrate common trends prior to the announcement of the new LTD ratios, which bolsters the plausibility of the PTA.

In panel B of Table 3, we observe a striking response from local branches of home banks in Indiana competing with the explicitly treated host bank branches. Home state banks substantially reduced lending volumes in Indiana, primarily because of a reduction in the number of originated loans. However, the decline in Indiana loan originations among these banks was not accompanied by a change in denial rates, suggesting a passive forfeit of mortgage business to the institutions that were suddenly required to boost their Indiana LTD ratios. The substantial decrease in loan volume among nominally untreated home state bank branches highlights the violation of the no-interference component of the SUTVA that would arise in a research design using branches "untreated" by the regulation to form a control group.

To obtain a more complete picture of the competitive interaction between home and host state bank branches in Indiana, we leverage branch-level RateWatch data to explore whether Indiana host-bank branches lowered mortgage rates to boost lending. We define an indicator variable $Treat_{branch(S)}$ that takes a value of one for bank branches located in an Indiana county, and interact this term with the $Post_{t_m}$ indicator taking a value of one for monthly observations starting in September 2004. In this exercise, the data permit us to include more granular branch- rather than county-level fixed effects. Beyond controlling for time-invariant county characteristics, branch-level fixed effects absorb more geographically specific characteristics, while also controlling for attributes of each branch, such as whether a branch is subject to a uniform rate-setting practice or if it sets its own rates. In panel A of Table 4, we report the results for a sample of all 30- and 15-year mortgage rates in the first two columns, including an indicator variable that takes a value of one for 15-year mortgages. Subsequent columns limit the sample to only 30- or 15-year rates. Across samples and specifications, we find that rates on standardized mortgage products at Indiana branches fall between 10 and 14 basis points. Importantly, these results obtain even in the presence

of bank-month and bank-MSA-month fixed effects, which subsume substantial variation in rates due to banks' pricing practices.

In panel B of Table 4, we observe that baseline mortgage rates offered by home banks in Indiana declined only a few basis points at most in the months following the implementation of the higher LTD requirements for host-state banks in the state. Given the largely standardized nature of most residential mortgages, competition within the market primarily centers on pricing terms. The limited response from home state banks further demonstrates that these institutions, lacking regulatory pressure to boost lending in Indiana, were unwilling to accept a lower net interest margin on largely transactional and commoditized RRE loans.

In Table 5, we use loan-level observations to examine changes in borrower characteristics and the likelihood that newly originated loans are sold. We find a statistically and economically significant decrease in the income of the average borrower of about 5% for hosted bank branches, which accords with the lower rate of denials and points to an increase in credit risk among treated branches. Panel B reveals that average borrower income fell by a more modest 2–3% for home state banks. Using a minority borrower indicator to estimate a linear probability model (LPM) in the middle columns of Table 5, we note a 1–2 percentage point increase in the share of minority borrowers (approximately 10% of the baseline average) among treated branches. In contrast, home bank branches exhibit no statistically significant change. Finally, we examine whether treated branches are less likely to sell loans following the higher lending requirement. Host banks may elect to hold more treated loans on their balance sheets in an effort to boost their LTD ratios and comply with Section 109. The far right columns of Table 5 estimate an LPM using an indicator denoting the sale of an originated loan by the end of the calendar year. Depending on the specification, we obtain either a null effect or a modest (2 percentage point) decrease in the share of loans sold. Of course, even an unchanged *share* of loans sold to securitizers would result in a larger loan portfolio among out-of-state branches given the substantial increase in loan

volume documented earlier. At the same time, home banks untargeted by the regulation are 1–3 percentage points more likely to sell an Indiana mortgage after the shock.

Taken together, the results from Tables 3–5 demonstrate that host banks increased their supply of loans to borrowers within Indiana in order to meet the Section 109 requirement. To comply with the regulation, host banks made loans to borrowers with lower incomes, sold fewer loans, and decreased mortgage rates in order to attract customers in treated areas.

The response of the home banks depicts a competitive interaction that resulted in offsetting declines in credit at their Indiana branches that compete most directly with the affected host-bank branches. Home banks originated fewer loans in Indiana as a result of the regulation despite an unchanged denial rate. This pattern suggests that the drop in loan volume was driven by potential borrowers moving to the host-state banks rather than a shift in home banks' credit standards. The loss of potential borrowers is supported by the essentially unchanged mortgage rates among home banks, which increases the likelihood that attentive borrowers would instead opt for host banks. Furthermore, the lower average borrower income of Indiana loans made by home banks aligns with the notion that home banks lose borrowers to host banks, because higher-income households are more responsive to price differentials that arise as host banks try to attract new customers. While host banks might refrain from lending at these lower rates because of the concomitant deterioration in net interest margins, more rate-sensitive borrowers shopping for lower rates at other institutions would also present greater prepayment risk, which in turn reduces the value of the associated mortgage servicing rights.[7] Finally, the increase in the share of Indiana loans sold by home-state banks may also be understood in the context of the change in borrower composition. If preexisting securitization rates are decreasing in credit risk such that banks are more likely to sell riskier loans, as documented by Elul (2016), then the deterioration

[7]If the set of borrowers departing for branches of out-of-state banks are in fact wealthier, the income effect for host bank branches in Indiana reported in Table 5 reflects the net effect of this factor and the lower denial rates that screen out fewer low-to-moderate income borrowers.

in borrower quality in Indiana for the home banks would mechanically result in a greater proportion of securitized loans.

Examining the effects of the regulatory shock separately for home and host banks brings clarity to the banks' responses, and aids in understanding the effects on untargeted banks and on the overall effect of the regulation. The offsetting credit decline among competitors limits the net credit provided to Indiana communities and demonstrates the perils of using nominally untargeted banks to form a counterfactual control group. In Appendix B, we include an analysis aggregated to the county-month level. While this approach is sometimes used to assess the importance of spillovers, Berg et al. (2021) explain that the key estimated parameter will be sensitive to the distribution of units across markets, leading to a different result compared to a "clean" estimation of the same data-generating process. Nevertheless, in Appendix B, we find only limited evidence of an increase in lending within Indiana counties. The average mortgage rate falls regardless of loan term, albeit with more limited declines than observed for the targeted out-of-state bank branches. We additionally report a null effect on home price indices in Table B4, which aligns with a mostly unchanged net credit supply relative to non-Indiana counties. According to these results, Indiana mortgage borrowers at most enjoyed lower rates following the host banks' incentive to boost lending within the state.

5.1.2 Commercial Real Estate Lending

We next shift our focus to the commercial real estate (CRE) lending market to investigate the differences in competitive spillovers within another category of loans. While CRE lending and RRE lending compose the vast majority of most banks' loan portfolios, CRE lending exhibits substantially different relationship characteristics and information production requirements. The varied nature of businesses, specialized real estate needs, and less securitizable mortgages can require more screening and monitoring on the part of banks. Thus, customers often demand numerous other financial services provided by the bank. As a result, a marginal

CRE loan requires a greater investment by a bank, but it is likely to be part of a much larger relationship-based stream of revenue.

Similar to RRE loans, we aggregate the sample of over 20,000 individual CRE loans by bank, month, and borrower county. As shown in Table 6, we observe noisy null effects for the number, volume, and size of CRE loans among both home and host banks. To provide context for the magnitudes, we present the regressions in levels in Table 7, revealing point estimates that imply less than a loan per month in each jurisdiction. Once again, we obtain estimates that are imprecise, inconsistently signed, and not statistically different from zero.[8]

In contrast to RRE loans, host-state banks do not increase their Indiana loan volume by boosting CRE loans. Several factors may contribute to this result, including the larger administrative burden and less scalable CRE lending apparatus compared with RRE lending. Further, CRE loans are more information intensive and can take longer to underwrite, which limits that ability of regulated banks to comply with suddenly higher LTD ratios by originating additional CRE loans. The competitive response from home-state banks can also factor in the decision of hosted institutions to pursue RRE over CRE lending. In particular, the charter value derived from relationship-based lending means that the home state banks are more likely to compete aggressively to retain CRE borrowers, which contrasts with the behavior observed in the RRE lending market. Although our CRE loan sample is somewhat smaller than our RRE loan sample, we corroborate the null result among host and home banks using commercial small business lending data from the Community Reinvestment Act collection in Table C1.

In total, we observe highly dissimilar competitive interactions across different loan products. From a policy standpoint, our results demonstrate how the lack of consideration for spillovers and competition in loan markets inhibited the effectiveness of the Section 109 LTD requirement. First, banks achieved compliance with higher LTD requirements by supplying loans with less economic value. RRE lending is a category that is no longer

[8]We do not observe the interest rate for the overwhelming majority of loans in our CRE dataset.

dominated by banks, which underscores the poorly targeted nature of the regulation. Second, the nature of this lending category led unregulated banks to largely forgo competing for these loans at the lower rates, resulting in little change in net credit provision to the wider community, although pricing terms on RRE loans did improve on average. In contrast, the more economically valuable small business loans that dominate our CRE sample were not meaningfully changed by either group of banks subsequent to the LTD shock, which also suggests no change to the average terms of such loans.

5.2 Competitive Responses in the Market for Deposits

5.2.1 Retail Demand Deposits

The Section 109 rule mandates that banks meet a minimum ratio of loans to deposits within a state. Consequently, out-of-state banks in Indiana might comply with the higher LTD requirement by reducing deposits. The presence or absence of such behavior in different classes of deposits can reveal competitive insights in the important market for deposits.

We explore the relationship between the increase in the minimum LTD ratio and the deposit rates offered by hosted bank branches in Indiana in panel A of Table 8. In this analysis, we use branch-level observations from RateWatch to measure relative changes in rates for three standard retail deposit products: $0 minimum checking accounts, $2,500 minimum checking accounts, and $2,500 minimum savings accounts. We observe no economically meaningful effect within retail savings and checking accounts. Point estimates indicate that advertised rates change by no more than 2 basis points and display directional inconsistency. The results for home bank branch competitors presented in panel B are similarly economically insignificant, with no consistent pattern evident across the products.

Two factors counteract host bank branches' incentive to boost LTD ratios by shedding deposits. First, there is substantial evidence that deposits contribute significantly to a bank's franchise value (Hellmann et al., 2000; De Jonghe and Vander Vennet, 2008; Drechsler et al., 2021; Egan et al., 2022). This feature produces a starkly different competitive response from

banks in the deposit market compared with the mortgage market. A second reason banks may not respond to higher LTD requirements by deterring deposits is that the larger loan portfolios amassed by treated branches must be supported with funding that could, at least in part, comprise deposits.

5.2.2 High-Minimum Time Deposits

Given the necessity for regulated banks to fund their larger loan portfolios, we expand our analysis of deposits to high-minimum time deposit products, including $10,000 minimum 6-month and 1-year CDs. These products are important for amassing deposits but unobtainable for many local retail clients. For this reason, high-minimum CDs are offered in wider, often national, markets. In panel A of Table 9, we find that in contrast to ordinary checking and savings accounts, rates on 6- and 12-month CDs increase by roughly 30% of the average value reported in panel A of Table 2. Thus, we find no evidence that these banks lower deposit rates; in fact, we observe a meaningful rate *increases* within time deposit products.

The finding that banks only increase rates on time deposits likely reflects a response to the regulation beyond the need for host bank branches to fund the additional loan volume. Specifically, retail demand deposits at Indiana branches would almost certainly be reported as Indiana deposits (FDIC, 2022), thereby reducing treated banks' LTD ratios. Conversely, CDs offered to geographically dispersed depositors via brokers and listing services permits banks more discretion in the branch to which such deposits are assigned. In this way, Indiana branches of out-of-state banks can raise funds to support the higher loan volumes without meaningfully reducing their LTD ratios via additional deposits. In the final columns of Table 9, we corroborate this explanation by using branch-level deposit totals as an outcome variable. Despite the substantial relative increase in rates, we find no statistically or economically significant change in reported deposits between host-bank branches in Indiana that increase their CD rates and the same bank's branches just across the state border.

This result supports the idea that banks strategically fund the additional loan volume with deposits that do not hinder their effort to comply with the LTD requirement.

In panel B of Table 9, we find evidence that home banks partially respond to the increase in high-minimum CD products. Although the results are subject to RateWatch sampling differences compared to the host-bank branches, the partial response evident among home banks can be understood in the context of the market for these products. As mentioned above, banks compete for high-minimum time deposits in national markets against a large set of banks and for depositors that reside outside of Indiana. Despite this, we observe some reaction among banks home to Indiana because these products are still available to more affluent depositors. High-net-worth clients constitute valuable relationships for banks given the opportunities for cross-selling other products, so it is sensible that the home-state bank branches react to the rate increases of the host bank branches. In this way, home state banks aim to remain competitive within this market and retain lucrative relationships even though Indiana branches have a reduced relative need for funding.

The competitive interaction in deposit product markets differs markedly from what we observe in the market for RRE loans. The residential mortgage market reveals substantial reaction to the LTD regulatory requirement. With credit standards largely set by securitizers, insensitivity to relationship-based private information, and a substantial infrastructure already in place to market and underwrite these loans, banks immediately respond to a higher lending requirement by lowering their advertised rates on mortgages. Given the relatively limited value of residential mortgage loans to banks, local competitors in this market do not respond by lowering their rates or changing their credit standards, which results in fewer mortgage originations among these banks. In contrast, similarly homogenous deposit products are not used as a margin of adjustment to achieve regulatory compliance. Banks do not attempt to comply with a higher LTD requirement by reducing retail demand deposits, evincing the value banks derive from this category of liabilities. In fact, the additional funding requirement stemming from the larger loan portfolio results in higher rates on high-

minimum time deposit products among regulated institutions. The increase in rates on these deposit products reflects the deeper market for larger-denomination time deposits compared with low-minimum checking and savings accounts. Nevertheless, some attentive and wealthy local depositors may be enticed by the higher rates, prompting local competitors to respond by boosting rates on these products as well, albeit with a pass-through that is less than one-to-one.

6 Conclusion

In this study, we examine the effects of a sudden change in a bank lending and deposit requirement for a specific group of banks. Employing a within bank-time identification strategy, we document substantially different competitive interactions and spillovers across different bank products. We observe an impact of the regulation on both regulated and unregulated banks, which holds important implications for the design of policy and empirical banking research.

Our findings demonstrate the effectiveness of the higher lending requirement in expanding credit supply among targeted institutions, although the additional credit is limited to less economically valuable residential real estate lending. In contrast, there is a simultaneous and meaningful decline in lending activity among home-state banks that are not subject to the regulation, which emphasizes the importance of competitive interactions. Contrary to the goal of the policy, the crowding out of residential lending dampened the net effect of the regulatory lending requirement. In the market for more economically valuable commercial loans to small businesses, we observe no response among regulated or unregulated banks, highlighting the different competitive dynamics in this market.

Turning to the market for deposits, we find that banks do not attempt to comply with the minimum loan-to-deposit ratio via retail deposit runoff. This behavior reflects the importance of retail deposits to banks' charter values. In fact, banks that boosted their loan

portfolios in response to the regulation increased rates offered on high-minimum time deposit products that are easy to book in branches not subject to higher loan-to-deposit minimums. Competing banks respond to higher rates on time deposits by increasing the rates that they offer on such products, even though these institutions lack an additional funding imperative stemming from a larger loan book.

By demonstrating how differences in competitive interactions and spillovers between banks can vary across products even within a broad class of assets or liabilities, our research contains important lessons for researchers and policymakers. First, our results provide a corrective to a common practice in the empirical banking literature wherein measures of geographic competition from one market, such as deposits, are used to proxy for the extent of lending competition. In fact, we highlight competitive differences between specific products even *within* banks' lending and deposit funding portfolios. These differences are influenced by a myriad of factors including regulation, information frictions, government guarantees, the economic function of the banking product, and the contribution of the asset or liability to a bank's charter value. Second, within-market competitive dynamics can invalidate research designs that use untreated banks to form counterfactuals for banks subject to a particular shock, because untreated entities can still be affected through numerous channels. Third, we demonstrate how these considerations are crucial to understand the effects of policy on untargeted institutions and anticipate the net effect of regulatory policy. Thus, our study reveals how variable competition can undermine program evaluation studies. Moreover, our research emphasizes the importance for policymakers to consider a regulation's effects on untreated banks in both the design and evaluation of policy.

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Figure 1: Indiana Multi-State MSAs
This figure depicts the five MSAs in Indiana that share counties with neighboring states.

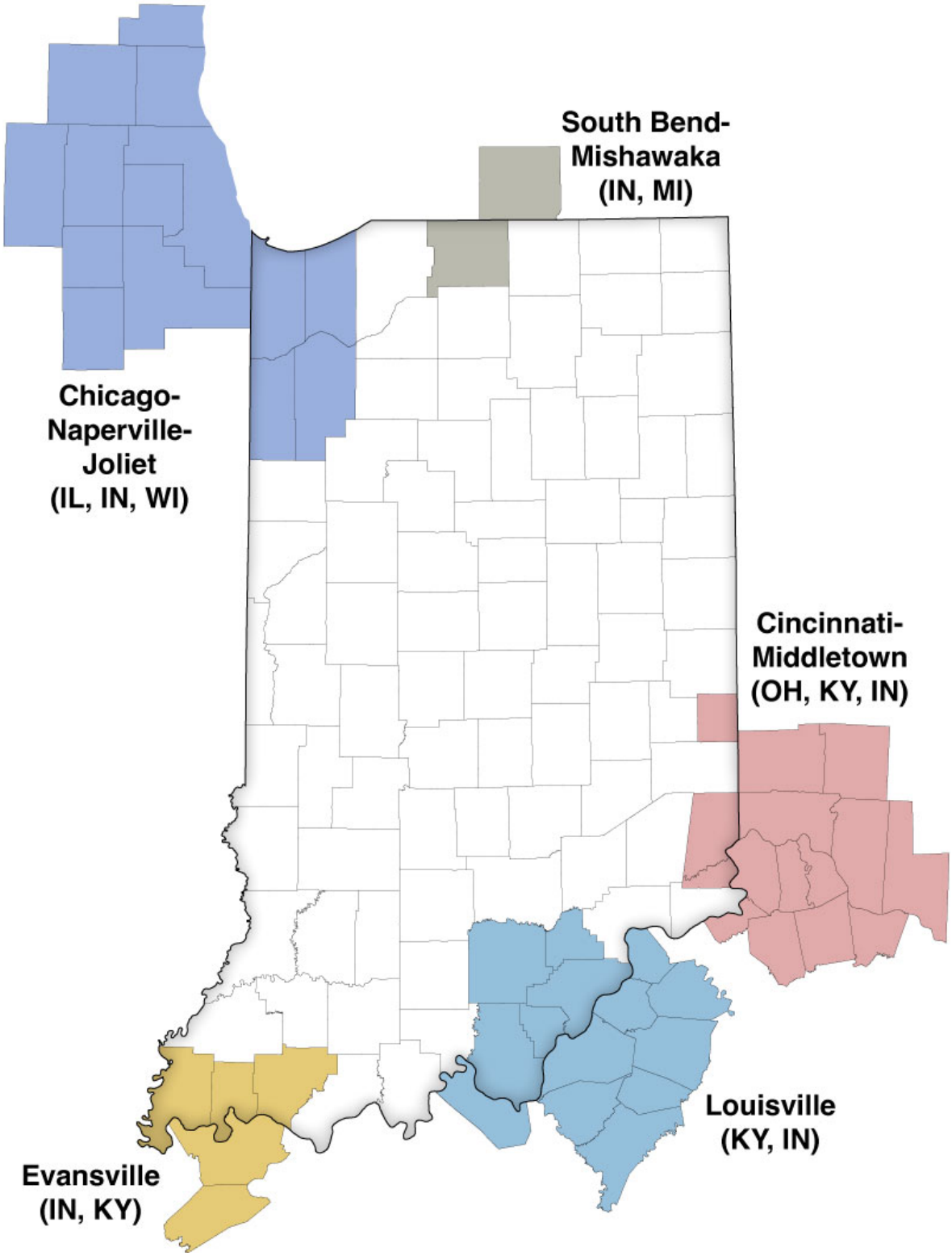
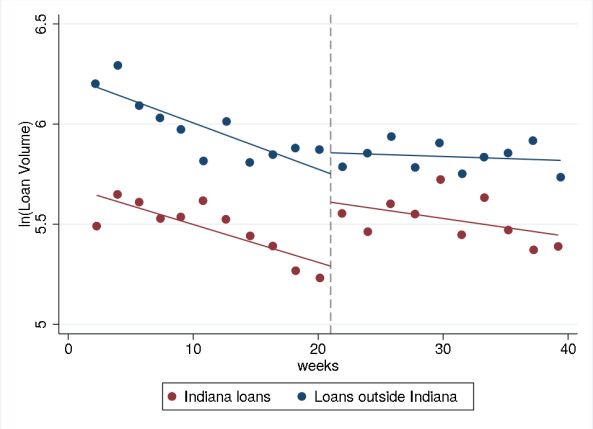
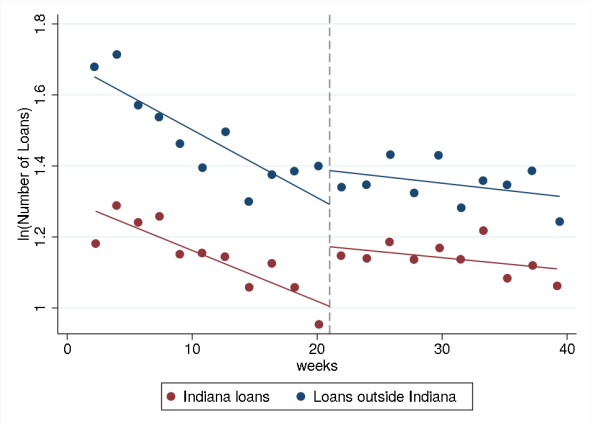


Figure 2: Trends in Bank Lending

Trends in Bank Lending. This figure depicts binned scatter plots of weekly lending averages to borrowers residing in multi-state MSAs that include Indiana counties. Prior to binning and plotting the averages, we absorb bank-MSA fixed effects to aid comparisons between Indiana and non-Indiana lending activity. Subfigure a shows the natural logarithm of the total volume of loans. Subfigure b shows the natural logarithm of the total number of loans. Subfigure c shows the natural logarithm of the loan amount, and subfigure d shows the denial rates.



(a)



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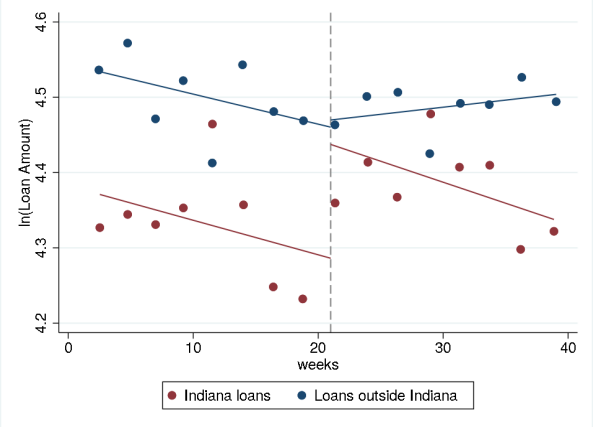
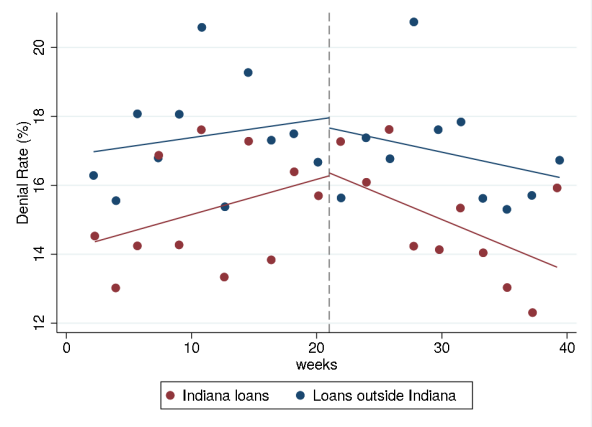


(c)



(d)

Table 1: Home and Host Bank Summary Statistics
This table shows summary statistics for Indiana home and hosted banks that branch in more than one state as of June 2004. Hosted banks are banks with branches in Indiana but home states elsewhere. We report the median and interquartile range for each variable, as indicated. Source: Summary of Deposits, Call Report, National Information Center database

		Hosted Banks	Home Banks
Assets ($bn)	p25	0.9	0.6
	p50	12.0	1.1
	p75	43.0	3.2
Total Branches	p25	15	5
	p50	173	22
	p75	551	60
Indiana Branches	p25	1	7
	p50	6	15
	p75	22	31
Indiana Deposit Share (%)	p25	0.6	78.5
	p50	3.7	92.8
	p75	7.7	94.0
Total States	p25	2	2
	p50	2	2
	p75	6	4
N		18	11

Table 2: Loan and Deposit Summary Statistics

This table shows summary statistics for the key variables. In panel A, we report key variables of interest for Indiana Hosted banks, which are banks with branches in Indiana but home states elsewhere. We report the mean, standard deviation, and observation number for each variable at the county-month for Indiana and Non-Indiana Counties. Variables are shown for the pre-period, spanning September 1, 2002 – August 24, 2004, and the post period, spanning August 25, 2004 – June 13, 2006. Panel B shows analogous variables for Indiana home banks, which are national banks with a main office in Indiana or state banks chartered in Indiana. Home and host state designations, along with branch locations, are determined using the FDIC's Statement of Deposit data. Variables are constructed using the confidential Home Mortgage Disclosure Act data (cHMDA), RateWatch, and the CoreLogic Commercial Real Estate database.

Panel A: Indiana Hosted Banks

Pre-Period						
	Indiana Counties			Non-Indiana Counties		
	Mean	Std. Dev.	N	Mean	Std. Dev.	N
RRE Loan Volume ($ mil)	1.3	2.3	1,819	7.7	21.7	4,582
Number of RRE Loans	11.9	21.4	1,819	52.0	130.7	4,582
Loan Size ($000s)	101.5	96.1	1,819	127.4	186.5	4,582
Denial Rate (%)	14.7	20.1	1,819	17.1	19.3	4,582
Minority Share (%)	17.6	27.9	1,896	17.4	23.6	4,777
Borrower Income ($000s)	68.0	53.0	1,857	79.4	57.8	4,745
Securitized Share (%)	56.8	43.7	1,896	54.6	40.8	4,777
15-year Rate (%)	5.4	0.4	129	5.4	0.4	1,456
30-year Rate (%)	6.0	0.3	113	6.0	0.3	1,460
CRE Loan Volume ($ mil)	0.3	0.7	27	7.3	22.2	550
Number of CRE Loans	1.9	0.9	27	8.5	14.2	550
$0 Min. Checking (%)	0.2	0.2	196	0.2	0.2	2,733
$2.5K Min. Checking (%)	0.3	0.2	196	0.2	0.2	2,736
$2.5K Min. Savings (%)	0.3	0.1	212	0.2	0.1	2,815
$10K 6-month CDs (%)	0.9	0.3	212	0.8	0.3	2,815
$10K 1-year CDs (%)	1.0	0.4	212	1.0	0.4	2,815

Post-Period						
	Indiana Counties			Non-Indiana Counties		
	Mean	Std. Dev.	N	Mean	Std. Dev.	N
RRE Loan Volume ($ mil)	0.9	2.2	1,654	4.3	13.4	4,408
Number of RRE Loans	8.9	18.5	1,654	28.6	74.6	4,408
Denial Rate (%)	18.0	22.4	1,654	22.5	22.2	4,408
Minority Share (%)	12.7	24.7	1,577	14.7	23.4	4,213
Borrower Income ($000s)	68.4	51.8	1,563	82.7	93.9	4,191
Securitized Share (%)	48.5	42.9	1,577	41.9	40.0	4,213
15-year Rate (%)	5.7	0.4	384	5.8	0.5	1,806
30-year Rate (%)	6.2	0.3	369	6.2	0.4	1,798
CRE Loan Volume ($ mil)	0.3	0.6	41	8.2	23.0	583
Number of CRE Loans	1.2	0.5	41	7.0	14.2	583
$0 Min. Checking (%)	0.5	0.6	467	0.3	0.3	3,640
$2.5K Min. Checking (%)	0.5	0.6	467	0.3	0.3	3,640
$2.5K Min. Savings (%)	0.4	0.1	467	0.3	0.2	3,640
$10K 6-month CDs (%)	2.4	0.8	467	1.9	0.9	3,640
$10K 1-year CDs (%)	2.8	0.8	467	2.3	1.0	3,640

Panel B: Indiana Home Banks

Pre-Period						
	Indiana Counties			Non-Indiana Counties		
	Mean	Std. Dev.	N	Mean	Std. Dev.	N
Loan Volume ($ mil)	2.0	4.2	2,920	7.9	24.2	2,365
Number of Loans	21.1	43.8	2,920	50.5	143.1	2,365
Denial Rate (%)	8.5	13.7	2,920	10.5	17.3	2,365
Minority Share (%)	8.6	19.6	2,807	17.7	26.8	2,274
Borrower Income ($000s)	70.1	42.9	2,765	82.5	94.2	2,233
Securitized Share (%)	50.0	42.5	2,807	70.2	39.9	2,274
15-year Rate (%)	5.6	0.6	324	5.4	0.4	42
30-year Rate (%)	6.1	0.3	257	6.1	0.3	41
CRE Loan Volume ($ mil)	1.3	2.8	182	1.1	3.3	501
Number of CRE Loans	8.4	14.5	182	2.6	3.9	501
$0 Min. Checking (%)	0.4	0.3	781	0.3	0.2	160
$2.5K Min. Checking (%)	0.4	0.3	781	0.3	0.2	160
$2.5K Min. Savings (%)	0.5	0.4	798	0.6	0.3	160
$10K 6-month CDs (%)	1.0	0.3	798	1.1	0.3	160
$10K 1-year CDs (%)	1.3	0.3	798	1.4	0.4	160

Post-Period						
	Indiana Counties			Non-Indiana Counties		
	Mean	Std. Dev.	N	Mean	Std. Dev.	N
Loan Volume ($ mil)	1.1	2.2	2,375	5.6	17.4	1,713
Number of Loans	11.9	21.8	2,375	32.9	92.8	1,713
Denial Rate (%)	10.2	15.3	2,375	13.9	18.7	1,713
Minority Share (%)	7.7	18.9	2,488	13.4	24.1	1,804
Borrower Income ($000s)	71.5	51.2	2,436	90.1	163.5	1,743
Securitized Share (%)	36.9	40.7	2,488	61.1	43.0	1,804
15-year Rate (%)	5.9	0.5	718	5.8	0.3	163
30-year Rate (%)	6.3	0.3	528	6.3	0.3	140
CRE Loan Volume ($ mil)	1.3	2.5	412	1.6	4.7	454
Number of CRE Loans	5.4	7.2	412	3.2	5.0	454
$0 Min. Checking (%)	0.4	0.3	1,331	0.3	0.2	240
$2.5K Min. Checking (%)	0.5	0.3	1,331	0.3	0.2	240
$2.5K Min. Savings (%)	0.5	0.4	1,373	0.4	0.2	240
$10K 6-month CDs (%)	2.3	0.8	1,373	2.3	0.8	240
$10K 1-year CDs (%)	2.8	0.8	1,373	2.7	0.7	240

Table 3: Host and Home Bank County-Level Monthly RRE Lending

This table reports ordinary least squares estimates for the hosted (panel A) and home (panel B) banks' monthly county lending variables in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The sample consists of county-level monthly averages for Indiana hosted banks from September 2002 through May 2006. An Indiana hosted bank is a bank with branches located in Indiana but a home state elsewhere. Indiana home banks are national banks with a main office in Indiana or state banks chartered in Indiana. Specification (1) includes both county-level fixed effects and bank × month fixed effects. Specification (2) includes both county-level fixed effects and bank × MSA × month fixed effects. The variable $Post_{t_m}$ is an indicator variable that takes a value of one for months starting September 2004, and $Treat_S$ is an indicator variable that takes a value of one for counties located in Indiana. Outcome variables are constructed using the confidential Home Mortgage Disclosure Act (cHMDA) dataset. Standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$.

Panel A: Indiana Hosted Banks

	ln(Loan Vol.)		ln(# of Loans)		ln(Loan Size)		Denial Rate (%)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_S$	0.24***	0.13***	0.19***	0.09***	0.04*	0.03	-2.12***	-1.87***
	(0.05)	(0.04)	(0.04)	(0.03)	(0.02)	(0.02)	(0.68)	(0.74)
Adj. R^2	0.68	0.79	0.65	0.79	0.57	0.63	0.38	0.41
N	12,392	12,137	12,392	12,137	12,392	12,137	12,392	12,137
County FEs	✓	✓	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓	–	✓

Panel B: Indiana Home Banks

	ln(Loan Vol.)		ln(# of Loans)		ln(Loan Size)		Denial Rate (%)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_S$	-0.16**	-0.18***	-0.11*	-0.14**	-0.05*	-0.03	0.73	0.36
	(0.07)	(0.07)	(0.06)	(0.06)	(0.03)	(0.03)	(0.76)	(0.82)
Adj. R^2	0.46	0.55	0.43	0.53	0.30	0.31	0.17	0.21
N	8,910	8,559	8,910	8,559	8,910	8,559	8,910	8,559
County FEs	✓	✓	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓	–	✓

Table 4: Host and Home Bank Branch Mortgage Rates

This table reports ordinary least squares estimates for the Indiana hosted (panel A) and home (panel B) bank branches' mortgage rates in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The sample consists of average monthly mortgage rates over the period from September 2002 to May 2006. An Indiana hosted bank is a bank with branches located in Indiana but a home state elsewhere. Indiana home banks are national banks with a main office in Indiana or state banks chartered in Indiana. Specification (1) includes both branch-level fixed effects and and bank × month fixed effects. fixed effects. Specification (2) includes both branch-level fixed effects and bank × MSA × month fixed effects. The variable $Post_{t_d}$ is an indicator variable that takes a value of one for days after August 25, 2004, and $Treat_{branch(S)}$ is an indicator variable that takes a value of one for branches located in Indiana. Outcome variables are constructed using the RateWatch dataset. Standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$.

Panel A: Indiana Hosted Banks

	30 & 15 year Mortgages (%)		30 year Mortgages (%)		15 year Mortgages (%)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_{branch(S)}$	-0.11***	-0.14***	-0.13***	-0.14***	-0.10***	-0.14***
	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)	(0.01)
Adj. R^2	0.95	0.95	0.98	0.99	0.99	0.99
N	7,468	7,442	3,642	3,527	3,639	3,539
Branch FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓
15-year Dummy	✓	✓	–	–	–	–

Panel B: Indiana Home Banks

	30 & 15 year Mortgages (%)		30 year Mortgages (%)		15 year Mortgages (%)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_{branch(S)}$	-0.02	-0.03	-0.05***	-0.05***	0.00	-0.02**
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Adj. R^2	0.96	0.96	0.99	0.99	0.99	0.99
N	2,076	2,075	674	673	838	837
Branch FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓
15-year Dummy	✓	✓	–	–	–	–

Table 5: Host and Home Bank Loan Origination Characteristics
This table reports ordinary least squares estimates for the Indiana hosted (panel A) and home (panel B) banks' monthly county lending variables in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The sample consists of daily loan origination variables for banks active in Indiana from September 1, 2002 through June 13, 2006. An Indiana hosted bank is a bank with branches located in Indiana but a home state elsewhere. Indiana home banks are national banks with a main office in Indiana or state banks chartered in Indiana. Specification (1) includes both county-level fixed effects and bank × day fixed effects. Specification (2) includes both county-level fixed effects and bank × MSA × day fixed effects. The variable $Post_{t_d}$ is an indicator variable that takes a value of one for days after August 25, 2004, and $Treat_S$ is an indicator variable that takes a value of one for counties located in Indiana. Outcome variables are constructed using the confidential Home Mortgage Disclosure Act (cHMDA) dataset. Standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$.

Panel A: Indiana Hosted Banks

	ln(Borrower Income)		Minority Borrower		Loan Sold	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_d} \times Treat_S$	-0.05***	-0.04***	0.02***	0.01**	0.01	-0.02***
	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)
Adj. R^2	0.11	0.15	0.08	0.11	0.51	0.53
N	380,603	376,490	399,689	395,537	399,689	395,537
County FEs	✓	✓	✓	✓	✓	✓
Bank×Day FEs	✓	–	✓	–	✓	–
Bank×MSA×Day FEs	–	✓	–	✓	–	✓

Panel B: Indiana Home Banks

	ln(Borrower Income)		Minority Borrower		Loan Sold	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_d} \times Treat_S$	-0.03***	-0.02**	0.01*	0.00	0.03***	0.01**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
Adj. R^2	0.13	0.16	0.13	0.15	0.55	0.57
N	237,690	235,795	260,537	258,609	260,537	258,609
County FEs	✓	✓	✓	✓	✓	✓
Bank×Day FEs	✓	–	✓	–	✓	–
Bank×MSA×Day FEs	–	✓	–	✓	–	✓

Table 6: Host and Home Bank County-Level Monthly CRE Lending
This table reports ordinary least squares estimates for the hosted (panel A) and home (panel B) banks' monthly county lending variables in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The sample consists of county-level monthly averages for Indiana hosted banks from September 2002 through May 2006. An Indiana hosted bank is a bank with branches located in Indiana but a home state elsewhere. Indiana home banks are national banks with a main office in Indiana or state banks chartered in Indiana. Specification (1) includes both county-level fixed effects and bank × month fixed effects. Specification (2) includes both county-level fixed effects and bank × MSA × month fixed effects. The variable $Post_{t_m}$ is an indicator variable that takes a value of one for months starting September 2004, and $Treat_S$ is an indicator variable that takes a value of one for counties located in Indiana. Outcome variables are constructed using the CoreLogic loan-level CRE dataset. Standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$.

Panel A: Indiana Hosted Banks

	ln(CRE Loan Vol.)		ln(CRE # of Loans)		ln(CRE Loan Size)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_S$	-0.08	-0.62	-0.18	-0.40	0.10	-0.22
	(0.52)	(0.58)	(0.25)	(0.28)	(0.43)	(0.48)
Adj. R^2	0.48	0.54	0.55	0.61	0.32	0.38
N	1,114	1,011	1,114	1,011	1,114	1,011
County FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓

Panel B: Indiana Home Banks

	ln(CRE Loan Vol.)		ln(CRE # of Loans)		ln(CRE Loan Size)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_S$	0.51	0.53	0.15	0.12	0.36	0.42*
	(0.36)	(0.38)	(0.21)	(0.24)	(0.25)	(0.25)
Adj. R^2	0.32	0.33	0.28	0.25	0.31	0.36
N	1,100	1,000	1,100	1,000	1,100	1,000
County FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓

Table 7: Host and Home Bank County-Level Monthly CRE Lending in Levels
This table reports ordinary least squares estimates for the hosted (panel A) and home (panel B) banks' monthly county lending variables in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The sample consists of county-level monthly averages for Indiana hosted banks from September 2002 through May 2006. An Indiana hosted bank is a bank with branches located in Indiana but a home state elsewhere. Indiana home banks are national banks with a main office in Indiana or state banks chartered in Indiana. Specification (1) includes both county-level fixed effects and bank × month fixed effects. Specification (2) includes both county-level fixed effects and bank × MSA × month fixed effects. The variable $Post_{t_m}$ is an indicator variable that takes a value of one for months starting September 2004, and $Treat_S$ is an indicator variable that takes a value of one for counties located in Indiana. Outcome variables are constructed using the CoreLogic loan-level CRE dataset. Standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$.

Panel A: Indiana Hosted Banks

	CRE Loan Vol. ($mil.)		CRE # of Loans		CRE Loan Size ($mil.)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_S$	2.17	-1.39	0.82	-0.83	-0.14	-0.41
	(5.96)	(7.25)	(3.42)	(4.11)	(1.02)	(0.69)
Adj. R^2	0.32	0.34	0.43	0.46	0.17	0.73
N	1,114	1,011	1,114	1,011	1,114	1,011
County FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓

Panel B: Indiana Home Banks

	CRE Loan Vol. ($mil.)		CRE # of Loans		CRE Loan Size ($mil.)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_S$	1.28	1.50	0.91	0.67	0.18	0.28*
	(0.94)	(0.99)	(1.84)	(2.11)	(0.22)	(0.23)
Adj. R^2	0.05	0.14	0.13	0.09	0.03	0.07
N	1,100	1,000	1,100	1,000	1,100	1,000
County FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓

Table 8: Branch Retail Deposit Rates

This table reports ordinary least squares estimates for four types deposit products and deposit volumes for Indiana host bank branches in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The deposit rate sample consists of average monthly deposit rates over the period from September 2002 to May 2006. The sample for branch deposit volumes is an annual measurement at the end of the second quarter from 2003 to 2006. An Indiana hosted bank is a bank with branches located in Indiana but a home state elsewhere. Specification (1) includes both branch-level fixed effects and bank × month fixed effects. Specification (2) includes both bank branch fixed effects and bank × MSA × month fixed effects. The variable $Post_{t_m}$ is an indicator variable that takes a value of one for months after September 2004, and $Treat_S$ is an indicator variable that takes a value of one for counties located in Indiana. Outcome variables are constructed using RateWatch and the Summary of Deposits. Standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$.

Panel A: Indiana Hosted Banks

	\$0K Min. Checking (%)		\$2.5K Min. Checking (%)		\$2.5K Min. Savings (%)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_{branch(S)}$	0.00	-0.01**	0.02*	0.01**	-0.02***	0.01**
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Adj. R^2	0.91	1.00	0.90	0.99	0.94	0.97
N	6,975	6,856	6,981	6,856	7,077	6,952
Branch FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓

Panel B: Indiana Home Banks

	\$0K Min. Checking (%)		\$2.5K Min. Checking (%)		\$2.5K Min. Savings (%)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_{branch(S)}$	-0.02***	-0.02***	-0.01***	-0.02***	0.03***	-0.00
	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
Adj. R^2	0.99	0.99	0.99	0.99	0.99	0.99
N	1,865	1,844	1,865	1,844	1,922	1,901
Branch FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓

Table 9: Branch CD Rates and Deposit Levels

This table reports ordinary least squares estimates for four types deposit products and deposit volumes for Indiana host bank branches in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The deposit rate sample consists of average monthly deposit rates over the period from September 2002 to May 2006. The sample for branch deposit volumes is an annual measurement at the end of the second quarter from 2003 to 2006. An Indiana hosted bank is a bank with branches located in Indiana but a home state elsewhere. Specification (1) includes both branch-level fixed effects and bank × month fixed effects. Specification (2) includes both bank branch fixed effects and bank × MSA × month fixed effects. The variable $Post_{t_m}$ is an indicator variable that takes a value of one for months after September 2004, and $Treat_S$ is an indicator variable that takes a value of one for counties located in Indiana. Outcome variables are constructed using RateWatch and the Summary of Deposits. Standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$.

Panel A: Indiana Hosted Banks

	\$10K 6-month CDs (%)		\$10K 1-year CDs (%)		ln(Deposit Volume)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_{branch(S)}$	0.22***	0.30***	0.26***	0.34***	-0.01	0.01
	(0.02)	(0.01)	(0.02)	(0.02)	(0.04)	(0.05)
Adj. R^2	0.97	0.99	0.98	0.99	0.94	0.94
N	7,077	6,952	7,077	6,952	3,892	3,884
Branch FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓

Panel B: Indiana Home Banks

	\$10K 6-month CDs (%)		\$10K 1-year CDs (%)		ln(Deposit Volume)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_{branch(S)}$	0.33***	0.04	0.11***	0.10***	0.04	0.03
	(0.03)	(0.03)	(0.03)	(0.04)	(0.07)	(0.08)
Adj. R^2	0.97	0.98	0.98	0.98	0.95	0.95
N	1,942	1,921	1,942	1,921	1,438	1,436
Branch FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓

Appendices

Appendix A Data Appendix

Variable	Definition	Source
$10K 1-year CDs	*$10K 1-year CDs* is the monthly branch-level rate that is paid to customers holding a $10K 1-year certificate of deposit (CD). This rate is reported as a percentage.	RateWatch
$1K 6-month CDs	*$1K 6-month CDs* is the monthly branch-level rate that is paid to customers holding a $1K 6-month certificate of deposit (CD). This rate is reported as a percentage.	RateWatch
$2.5K Min. Checking	2.5K Min Checking* is the monthly branch-level rate that is paid to customers holding a checking account with a $2.5K minimum. This rate is reported as a percentage.	RateWatch
$2.5K Min. Savings	*$2.5K Min Savings* is the monthly branch-level rate that is paid to customers holding a savings account with a $2.5K minimum. This rate is reported as a percentage.	RateWatch
30-year Mortgage	*30 year Mortgage* is the monthly branch-level mortgage rate reported to RateWatch. This rate is reported as a percentage.	RateWatch
Denial Rate	*Denial Rate* is the percentage of mortgages that are denied	cHMDA
Home Bank	For nationally chartered banks, the home State is the state in which the main office is located. For banks with a state charter, a Home State is the state that granted the charter. A Home Bank is considered a bank operating in its home state	Call Reports
Hosted Bank	If a given bank has a branch in a state that is not defined as its home state, the bank is a *hosted bank*.	Summary of Deposits
ln(CRE # of Loans)	*ln(# of Loans)* is the natural logarithm of the number of commercial real estate loans originated	cHMDA
ln(CRE Loan Size)	*ln(Loan Size)* is the natural logarithm of the size of a commercial real estate loan measured in dollars	CoreLogic
ln(CRE Loan Vol.)	*ln(Loan Vol.)* is the natural logarithm of the volume of commercial real estate loans originated in dollars	cHMDA
ln(Borrower Income)	*ln(Borrower Income)* is the natural logarithm of the borrower's income measured in dollars	cHMDA
ln(Loan Vol.)	*ln(Loan Vol.)* is the natural logarithm of the volume of mortgages originated in dollars	cHMDA
ln(Loan Size)	*ln(Loan Size)* is the natural logarithm of the size of a mortgage measured in dollars	cHMDA
ln(# of Loans)	*ln(# of Loans)* is the natural logarithm of the number of mortgages originated	cHMDA
Loans Sold	*Loans Sold* is the fraction of mortgages sold to securitizers	cHMDA

Minority Borrower	*Minority Borrower* is an indicator variable that takes a value of one for minority mortgages borrowers	cHMDA
Post	*Post* is an indicator variable that takes a value of one for days after August 25, 2004.	
$Treat_{branch(S)}$	$Treat_{branch(S)}$ is an indicator variable that takes a value of one for branches located in Indiana.	

Appendix B Aggregate Effects

Table B1: County-Level Credit Aggregation

This table reports ordinary least squares estimates for the monthly county-level aggregate lending outcomes by Indiana home and hosted banks for counties in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The sample consists of daily loan origination variables for Indiana home and hosted banks over the period September 1, 2002 through June 13, 2006. Indiana home banks are national banks with a main office in Indiana or state banks chartered in Indiana, and hosted banks have bank branches in Indiana but home states elsewhere. Specification (1) includes both county-level fixed effects and month fixed effects. Specification (2) includes both county-level fixed effects and MSA × month fixed effects. The variable $Post_{t_m}$ is an indicator variable that takes a value of one for months after September 2004, and $Treat_S$ is an indicator variable that takes a value of one for counties located in Indiana. Outcome variables are constructed using the confidential Home Mortgage Disclosure Act (cHMDA) dataset. Standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$.

	ln(Loan Vol.)		ln(# of Loans)		ln(Loan Size)		Denial Rate (%)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_S$	0.02	0.03	0.03	0.04*	-0.01	-0.01	-0.03***	-0.03***
	(0.03)	(0.03)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)
Adj. R^2	0.97	0.97	0.98	0.98	0.77	0.77	0.45	0.45
N	2,296	2,296	2,296	2,296	2,296	2,296	2,296	2,296
County FEs	✓	✓	✓	✓	✓	✓	✓	✓
Month FEs	✓	–	✓	–	✓	–	✓	–
MSA×Month FEs	–	✓	–	✓	–	✓	–	✓

Table B2: County-Level Mortgage Rates

This table reports ordinary least squares estimates for the monthly county-level mortgage rates in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The sample consists of monthly mortgage rates for Indiana home banks over the period September 1, 2002 through June 13, 2006. Indiana home banks are national banks with a main office in Indiana or state banks chartered in Indiana. Specification (1) includes both branch-level fixed effects and month fixed effects. Specification (2) includes both county-level fixed effects and MSA × month fixed effects. The variable $Post_{t_m}$ is an indicator variable that takes a value of one for months after September 2004, and $Treat_S$ is an indicator variable that takes a value of one for branches located in Indiana. Outcome variables are constructed using the confidential Home Mortgage Disclosure Act (cHMDA) dataset. Standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$..

	30 & 15 year Mortgages (%)		30 year Mortgages (%)		15 year Mortgages (%)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_{branch(S)}$	-0.10***	-0.13***	-0.05***	-0.09***	-0.15***	-0.17***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Adj. R^2	0.80	0.81	0.83	0.85	0.73	0.74
N	9,730	9,730	4,707	4,698	5,023	5,012
County FEs	✓	✓	✓	✓	✓	✓
Month FEs	✓	–	✓	–	✓	–
MSA×Month FEs	–	✓	–	✓	–	✓
15-year Dummy	✓	✓	–	–	–	–

Table B3: County-Level Loan Origination Characteristics

This table reports ordinary least squares estimates for the county-level aggregate lending outcomes by Indiana home and hosted banks for counties in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The sample consists of daily loan origination variables from September 1, 2002 through June 13, 2006. Indiana home banks are national banks with a main office in Indiana or state banks chartered in Indiana, and hosted banks have bank branches in Indiana but home states elsewhere. Specification (1) includes both county-level fixed effects and month fixed effects. Specification (2) includes both county-level fixed effects and MSA × month fixed effects. The variable $Post_{t_d}$ is an indicator variable that takes a value of one for days after August 25, 2004, and $Treat_S$ is an indicator variable that takes a value of one for counties located in Indiana. Outcome variables are constructed using the confidential Home Mortgage Disclosure Act (cHMDA) dataset. Standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$.

	ln(Borrower Income)		Minority Borrower		Loan Sold	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_d} \times Treat_S$	-0.02***	-0.02***	0.05***	0.04***	0.01***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Adj. R^2	0.05	0.06	0.06	0.07	0.13	0.17
N	658,743	658,537	703,701	703,491	703,701	703,491
County FEs	✓	✓	✓	✓	✓	✓
Month FEs	✓	–	✓	–	✓	–
MSA×Month FEs	–	✓	–	✓	–	✓

Table B4: County-Level Home Price Indices

This table reports ordinary least squares estimates for the monthly Corelogic home price indexes in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The sample consists of monthly, county-level home price indexes over the period September 2002 through June 2006. Specification (1) includes both county-level fixed effects and year-month fixed effects. Specification (2) includes both county-level fixed effects and MSA $\times$ year-month fixed effects. The variable $Post_{t_m}$ is an indicator variable that takes a value of one for months after September 2004, and $Treat_S$ is an indicator variable that takes a value of one for Indiana Counties. Outcome variables are constructed using the CoreLogic Home Price Index (HPI) dataset. Robust standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$.

	ln(Single Family HPI)		ln(Single Family HPI) $< 0.75 \cdot Median$		ln(Single Family HPI) $> 1.25 \cdot Median$	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_S$	0.04	0.11	0.01	0.08	-0.05	0.07
	(0.11)	(0.12)	(0.16)	(0.20)	(0.13)	(0.16)
Adj. R^2	0.06	0.17	0.07	0.17	0.05	0.19
N	1,665	1,620	1,125	1,035	1,305	1,260
County FEs	✓	✓	✓	✓	✓	✓
Month FEs	✓	–	✓	–	✓	–
MSA×Month FEs	–	✓	–	✓	–	✓

Appendix C Commercial Lending Results – Alternate Sample

Table C1: Host and Home Bank County-Level Small Business CRA Lending
This table reports ordinary least squares estimates for the hosted (panel A) and home (panel B) banks' monthly county lending variables in the five Metropolitan Statistical Areas (MSAs) that span both Indiana and a bordering state. The sample consists of county-level yearly totals for Indiana hosted banks from 2002 through 2006. An Indiana hosted bank is a bank with branches located in Indiana but a home state elsewhere. Indiana home banks are national banks with a main office in Indiana or state banks chartered in Indiana. Specification (1) includes both county-level fixed effects and bank × month fixed effects. Specification (2) includes both county-level fixed effects and bank × MSA *times* month fixed effects. The variable $Post_{t_m}$ is an indicator variable that takes a value of one starting in 2004, and $Treat_S$ is an indicator variable that takes a value of one for counties located in Indiana. Outcome variables are constructed using the Community Reinvestment Act (CRA) dataset. Standard errors are reported in parentheses. Statistical significance: *** $p \leq 0.01$,** $p \leq 0.05$,* $p \leq 0.10$.

Panel A: Indiana Hosted Banks

	ln(Loan Vol.)		ln(# of Loans)		ln(Loan Size)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_S$	0.03	-0.04	0.01	-0.16	0.02	0.13
	(0.25)	(0.27)	(0.20)	(0.20)	(0.12)	(0.17)
Adj. R^2	0.56	0.78	0.55	0.81	0.44	0.53
N	919	786	919	786	919	786
County FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓

Panel B: Indiana Home Banks

	ln(Loan Vol.)		ln(# of Loans)		ln(Loan Size)	
	(1)	(2)	(1)	(2)	(1)	(2)
$Post_{t_m} \times Treat_S$	-0.04	-0.51	-0.00	-0.30	-0.04	-0.21
	(0.28)	(0.42)	(0.23)	(0.34)	(0.15)	(0.26)
Adj. R^2	0.38	0.63	0.39	0.64	0.22	0.29
N	672	456	672	456	672	456
County FEs	✓	✓	✓	✓	✓	✓
Bank×Month FEs	✓	–	✓	–	✓	–
Bank×MSA×Month FEs	–	✓	–	✓	–	✓

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