Bank Expertise and Structural Transformation *

Yu Yi Gang Zhang Shengxing Zhang

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Abstract

This study investigates how bank expertise in identifying productive projects shapes economic structures. Utilizing the U.S. interstate banking deregulation of the 1980s as a quasi-natural experiment, we find that deregulation facilitated the convergence of economic structures across states. This effect is particularly pronounced among state pairs with significantly different pre-deregulation economic structures or when one state depends on external finance while the other is more financially developed. We then develop a general equilibrium model embedded in a Lucas-island framework featuring imperfect searching and matching between banks and firms. Calibrated to U.S. data, our model accounts for approximately half of the observed convergence of economic structures between service- and manufacturing-dominated states following deregulation. Furthermore, while deregulation enhances welfare, banks may deviate from the socially optimal level of entry, either under- or over-penetrating markets, due to pricing power and labor displacement effects. The extent of these deviations is determined by banks' entry costs and market concentration.

Keywords: Bank expertise, structural transformation, search and matching frictions.
JEL Classification: E44; G21; G38; O33

*Yu Yi, Nankai University, email: ivan_yyi@nankai.edu.cn; Gang Zhang, Cheung Kong GSB, email: gzhang@ckgsb.edu.cn; Shengxing Zhang, Carnegie Mellon University, Tepper School of Business, email: shengxingzhang@cmu.edu. We are grateful to Jorge Miranda-Pinto, Yan Liu, Michael Song, Eric van Wincoop, and Xiaodong Zhu, for comments. We are thankful for comments received at the CUFE, EFG, Peking University (CCER), and Wuhan University. We also thank Jing Zhang for their excellent research assistance. Zhang gratefully acknowledges financial support from the ASEAN Business Research Initiative.

1 Introduction

The expertise of financial intermediaries, particularly banks, in financing productive projects is crucial to economic growth. When banks possess the specialized ability to assess and select productive projects, the economy benefits through enhanced productivity and efficiency. Recent empirical studies suggest that such expertise, developed through cumulative experience, is often industry- or market-specific to minimize screening and monitoring costs (see, for example, Paravisini, Rappoport and Schnabl, 2023; Blickle, Parlatore and Saunders, 2023, among others). Furthermore, as banks geographically expand their operational footprint, their industry-specific expertise can, in turn, shape the economic structure of the region into which they extend. In this paper, we provide both empirical evidence and theoretical framework to analyze the relationship between bank expertise and structural transformation.

The U.S. interstate banking deregulation of the 1980s provides an ideal laboratory to examine the role of bank expertise in shaping regional economic structure. First, the segmentation of banking markets prior to deregulation allowed banks to develop specialized expertise in industries to which they provided more financing in their home states. Second, deregulation was implemented either through reciprocal agreements between states permitting cross-border bank acquisitions or through the unilateral opening of a state's banking sector to acquisitions by out-of-state banks. When two states mutually open their banking markets, incoming banks utilize their expertise previously developed in their home state to identify and finance productive projects in the new market. This process particularly benefited firms operating in industries aligned with the incoming banks' expertise, potentially reducing differences in these industries and making the overall economic structures of the two states more similar. To empirically analyze these dynamics, we apply data from Amel (1993) to construct a bilateral deregulation schedule for all state pairs with the precise timing of these regulatory changes.

We employ a three-step approach to demonstrate how bank expertise facilitates the convergence of economic structures between states following deregulation. First, utilizing the Federal Deposit Insurance Corporation's (FDIC) Summary of Deposits (SoD), we examine whether banks from one state expanded operations into another state post-deregulation. Our analysis shows that, on average, 2.7 bank holding companies (BHCs) extended their operation into the counties of the newly deregulated states. Additionally, we find that BHCs were more inclined to enter states with different pre-deregulation economic structure from their home state. This finding is consistent with that in Oberfield, Rossi-Hansberg, Trachter and Wenning (2024), who document similar entry patterns and attribute them to banks' incentives to access low-cost deposit sources.

Second, we examine whether economic structures between deregulated states con-

verged following deregulation. Utilizing seasonally adjusted state-by-industry value-added data from the U.S. Bureau of Economic Analysis (BEA) for 53 non-agriculture and non-finance private industries across 46 continental states, we define a state's economic structure as a vector of industry value-added shares relative to its private GDP. To quantify the similarity between two states' economic structures, we compute the Manhattan distance, defined as the sum of absolute differences in industry shares across sectors, following Kim (1995) and Krugman (1992). We find that deregulation facilitates the convergence of economic structures. This convergence is particularly pronounced when two states' economic structures were significantly different prior to deregulation or when one state's economy was dependent on external finance while the other was more financially developed in 1981. These findings highlight the important role of banks' specialized expertise in promoting structural transformation. Robustness checks confirm these results are not driven by the general shift from manufacturing to services in the US economy.

Third, since banks' lending portfolio (expertise) are not directly observable, we approximate pre-deregulation bank expertise using two metrics: one identifying industries with a relatively higher value-added share in one state compared to the other, and another capturing industries ranked among the top ten in value-added share within a state. Our findings show that, following deregulation, differences in value-added shares between two states decline significantly for industries aligned with the approximated bank expertise, contributing substantially to the overall convergence in economic structures. Moreover, this effect is even more pronounced in industries that depend more on external financing. These results remain robust even when core service and manufacturing industries are excluded from the analysis.

To evaluate the welfare implications of bank expertise, we develop a general equilibrium model featuring imperfect searching and matching between banks and firms, embedded in a Lucas island framework (Lucas, 1972). Our economy comprises two islands—a home island and a guest island—each inhabited by a representative household, a final good producer, intermediate-good firms in two sectors, and a fixed number of banks. Intermediate-good firms produce homogeneous inputs that are used by the final good producer. They are randomly matched with banks to borrow capital for expand their production. The household and all firms are assumed to be immobile across islands.

Initially, banks on each island operate two distinct loan departments, each specializing in lending to one of the two intermediate-good sectors. Banks employ loan officers to identify potential firms for financing and choose the loan rate and the number of loan officers to maximize their profits. Following the framework of Mortensen and Pissarides (1994), the probability of successful matching depends on both the number of firms and banks' searching efforts. Bank expertise is characterized by a parameter that governs the degree of search frictions in the matching process.

Banks may expand their operations onto the other island via mergers and acquisitions (M&As), contingent upon the net profits outweighing entry costs associated with cross-island expansion. Initially, by imposing infinite entry costs, stringent geographic restrictions prevent banks' cross-island expansion. Deregulation is modeled as a reduction in these entry costs, facilitating banks' cross-island operation.

We calibrate and estimate key parameters to replicate empirical moments from U.S. data. One island is designed to represent characteristics of states with a relatively high value-added share in service sector, while the other reflect states dominated by manufacturing sector. In our counterfactual analysis, we examine how deregulation affects on the similarity of economic structures between two islands. Specifically, we estimate entry costs to match the observed share of out-of-state BHCs for the two state groups in 1993. We find that deregulation facilitates the convergence of economic structures between the two islands, accounting for approximately half of the observed structural convergence. Moreover, we find that this convergence becomes more significant when intermediate-good firms are more dependent on external financing.

Finally, we examine the socially optimal level of bank entry and its welfare implications, where the optimal level of bank entry is determined by a social planner. Unlike banks operating in market equilibrium, the social planner weighs the marginal joint returns of production from matched firm-bank pairs against the marginal wage costs and entry costs. However, the social planner disregards the allocation of returns between firms and banks. Additionally, the planner internalizes the broader economic effects of bank entry, including credit reallocation within and across sectors and changes in labor demand by incumbent banks. We find a hump-shaped relationship between social welfare and bank entry: initially, welfare increases as intermediate-good firms that align with bank expertise are more likely to access credit and they can produce more, but it eventually declines as the marginal benefits of improved credit access diminish while entry costs remain constant.

Under our calibration, deregulation enhances welfare. Furthermore, we find that banks' entry costs and market concentration play a crucial role in determining the extent to which bank entry decisions deviate from the socially optimal level. On one hand, when a bank with higher matching efficiency enters the market, it lowers loan rates to attract more borrowers and increase revenue from intermediate-goods firms aligned with its expertise. However, while individual banks prioritize their own profits, the social planner considers total surplus across all banks and firms rather than its allocation. As a result, this pricing effect creates incentives for excessive entry (over-penetration). On the other hand, new entrants displace existing bank-firm matches, reducing labor demand from incumbent banks and thereby lowering overall labor costs for other banks. This hiring externality, which is internalized by the social planner but neglected by individual

banks, leads to insufficient entry (under-penetration).

Entry costs determine the entry of other-island banks, thereby altering the balance between the pricing effect and the hiring externality. Higher entry costs restrict the entry of guest-land banks, increasing both the pricing power and market share of those that successfully enter. As a result, both the pricing effect and the hiring externality intensify as entry costs rise. When entry costs are sufficiently low, other-island banks dominate, each capturing only a small market share. This makes the inverse of the market share per loan officer highly responsive to changes in loan rates. At the same time, the hiring externality remains limited due to the large market share of other-island banks. In this case, the pricing effect outweighs the hiring externality, leading guest-island banks to over-penetrate the market. The opposite occurs when entry costs are sufficiently high: the hiring externality becomes dominant, causing guest-island banks to under-penetrate relative to the socially optimal level.

The extent of the bank-entry deviation also depends on market concentration, measured by the inverse of the total number of banks or loan departments. As the total number of banks increases, competition intensifies in general, reducing individual banks' pricing power and compressing their profitability. Thus, both the full-penetration and no-penetration thresholds decline. However, in addition to the decline in pricing power, the no-penetration threshold is further lowered by the shrinking market share. As a result, the no-penetration threshold declines more rapidly than the full-penetration threshold, causing the inefficient entry region, the region of entry costs that cause banks over or under penetrate, to narrow as the total number of banks increases.

Literature review

Our paper contributes to three strands of the literature. The first strand is those that use quantitative models to evaluate the effects of financial (de)regulation on banks' activities and real economy. Focusing on the deregulation of geographic restrictions in banking, Oberfield, Rossi-Hansberg, Trachter and Wenning (2024) use a double-sorting model to analyze banks' location choices. They find that span-of-control sorting drives banks to select markets based on banks own size and distance to the markets, while mismatches in deposit markets incentivize larger banks to expand into more distant regions. Corbae and D'Erasmo (2022) examine the impact of deregulation on bank lending and financial stability. Mukoyama and Zhang (2023) investigate its implications for firm dynamics and labor reallocation. Boar, Knowles, Storesletten and Wang (2023) analyze the relative importance of investment and consumption channels in understanding how changes in credit conditions affect economic activity. Additionally, Ji, Teng and Townsend (2023) develop a spatial model to study the geographic expansion of bank branches follow-

ing deregulation in Thailand. Several other studies explore related themes. Corbae and D'Erasmo (2022) explore the impact of deregulation on bank lending and financial stability, Mukoyama and Zhang (2023) investigate the firm dynamics and labor reallocation, and Boar, Knowles, Storesletten and Wang (2023) examine the relative importance of investment and consumption channels in understanding the effects of credit condition changes on economic activities. Ji, Teng and Townsend (2023) develop a spatial model to investigate the geographic expansion of bank branches following banking deregulation in Thailand. Moreover, Corbae and D'Erasmo (2021) analyze the effects of heightened capital requirements on banks' risk-taking behaviors and market dynamics. Wang, Whited, Wu and Xiao (2022) explore the pass-through effects of monetary policy in an environment where imperfectly competitive banks are subject to capital restrictions. Hachem and Song (2021) explore the unintended effects of liquidity regulation on credit booms. Buchak, Matvos, Piskorski and Seru (2024) evaluate banks' balance-sheet lending and its economic consequence by considering on-balance-sheet financing and securitization. Our contribution to this literature is twofold. First, we provide empirical evidence using a causal inference approach to identify the effects of deregulation on economic structure. Second, we develop a search-and-matching model that incorporates heterogeneity in both banks and firms. Our model examines how banks' entry costs and market concentration affects bank entry decisions, relative to the socially optimal level, and their welfare implications.

Second, the U.S. and other developed economies have experienced a significant shift from manufacturing to services in the past century, which significant implications for aggregate variables such as output per worker, hours worked, and human capital, see, for example, (see, for example, Kuznets, 1966; Echevarria, 1997; Kongsamut, Rebelo and Xie, 2001, and among others). For a comprehensive survey, refer to Herrendorf, Rogerson and Valentinyi (2014). Recent research has investigated the economic forces driving this structural shift, including unbalanced productivity growth (Baumol, 1967; Ngai and Pissarides, 2007; Herrendorf, Rogerson and Valentinyi, 2013; Kehoe, Ruhl and Steinberg, 2018, among others), rising incomes and non-homothetic demand (Matsuyama, 2000, 2019; Boppart, 2014; Comin, Lashkari and Mestieri, 2021, among others), as well as factors like investment (Herrendorf, Rogerson and Valentinyi, 2021), investment rates (García-Santana, Pijoan-Mas and Villacorta, 2021; Buera, Kaboski, Mestieri and O'Connor, 2020), and exchange rates (Sposi, Yi and Zhang, 2021).[1] To our knowledge, this paper is the first to examine the role of banks' specialized industry knowledge in reshaping economic structures.

The third strand of the literature explores the effects of the 1980s U.S. banking re-

[1] In the manufacturing sector, this transformation can also be driven by import competition (Autor, Dorn and Hanson, 2013) or automation (Acemoglu and Restrepo, 2019).

forms on both banks and real economy. In their seminal work, Jayaratne and Strahan (1996) examines the effects of intra-state deregulation on output growth. The following studies utilize more granular data and undertake tests on different perspectives on output, firm dynamics, innovation, resource allocation, and borrowing cost, among others. After deregulation, states that underwent reforms experienced an initial increase in new business entries, followed by a significant number of closures in a few years (Kerr and Nanda, 2009). In these states, there was a notable rise in the proportion of very small firms (with fewer than five employees), while medium-sized firms declined substantially in number, and the largest firms remained mostly unchanged (Cetorelli and Strahan, 2006). Enhanced competition among local banks (Kroszner, 2008) and improved screening and monitoring practices led to lower borrowing costs for firms (Rice and Strahan, 2010), spurred innovation (Amore, Schneider and Žaldokas, 2013; Chava, Oettl, Subramanian and Subramanian, 2013; Cornaggia, Mao, Tian and Wolfe, 2015; Acharya and Xu, 2017; Hombert and Matray, 2017), increased productivity (Krishnan, Nandy and Puri, 2015), and enhanced the efficiency of resource allocation (Bai, Carvalho and Phillips, 2018). We contribute to this literature by investigating the effects of deregulation on economic structure. Our paper is the closest to Morgan, Rime and Strahan (2004), in which the authors utilize the same event and find that the state-level economic activity became less fluctuated after deregulation. Our paper differs in two key respects. First, while they focus on the comovement of state-level economic activity with the entire U.S. economy, we examine bilateral economic activity between pairs of states. Second, whereas their study investigates business cycle dynamics, our focus is on the evolution of economic structure.

Structure of the paper. The remainder of the paper is organized as follows. Section 2 sketches the institution background for U.S. banks. Section 3 presents the empirical evidence on how economic structure converges after deregulation. Section 4 sketches a two-state, two-sector model with heterogeneous matching friction between firms and banks across states. Section 5 characterizes equilibrium in which economic structure converges after financial deregulation. Section 6 calibrates and estimates the model and shows how entry costs and competition affect the efficient level of bank entry. Section 7 concludes.

2 Institution background

The imposition of geographical limitations on bank expansion in the U.S. has historical roots extending back to the 19th century. While the 1920s and 1930s experienced a partial easing of these constraints, the majority of states enforced bans or severe restrictions on bank branching until the 1970s, during which only 12 states implemented

unrestricted statewide branching. However, from 1970 to 1994, an era of significant change unfolded as 38 states lifted their branching restrictions, a development extensively documented by researchers like Jayaratne and Strahan (1996) and Kroszner and Strahan (1999).

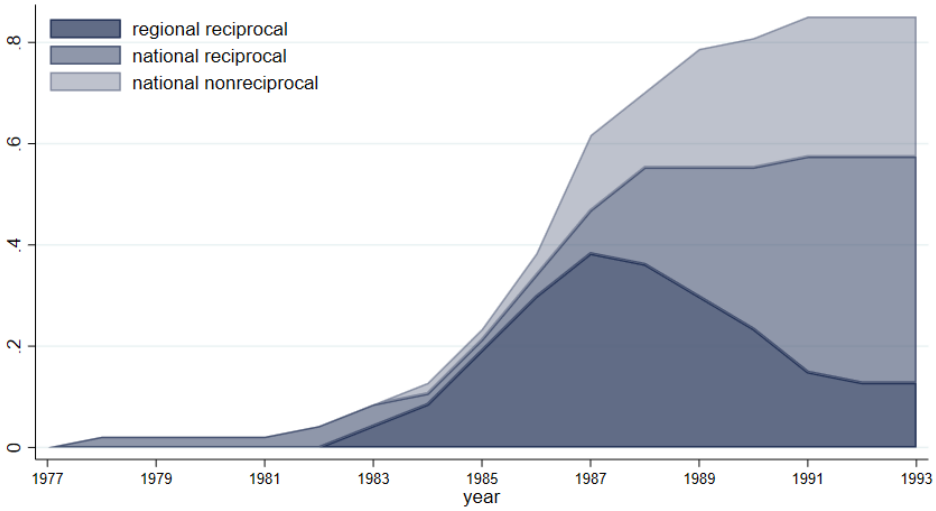
Beyond the limits imposed on branching within their own borders, banks were further constrained by the Douglas Amendment to the 1956 Bank Holding Company Act. This amendment prevented bank holding companies from acquiring banks outside their home state unless such acquisitions were permitted by the target bank's state. Initially, no states sanctioned these interstate transactions, effectively blocking the formation of interstate banking networks. Starting in the early 1980s, a shift occurred as many states began to form regional or national agreements that allowed for bank acquisitions on a reciprocal basis. This phase in banking history offers a valuable lens through which to examine how banks utilize their expertise to transform the economic landscape of non-financial sectors.

Most of these studies follow the approach of Kroszner and Strahan (1999), defining the deregulated year for a given state as the year it first allowed bank acquisitions from any other state. Drawing on Amel (1993), we observe that the timeline for adopting deregulation varied significantly across states, with many initially implementing reforms on a limited basis before gradually expanding them to include more states and eventually the entire nation. For example, Minnesota first allowed bank acquisitions on a reciprocal basis in July 1986, starting with Iowa, North Dakota, South Dakota, and Wisconsin. This policy was later extended to include Connecticut, Idaho, Illinois, Kansas, Montana, Nebraska, Washington, and Wyoming in 1988; Indiana in 1990; Michigan and Ohio in 1992; and ultimately reached nationwide application in 1994 with the enactment of the Riegle-Neal Interstate Banking and Branching Efficiency Act. Using this information, we construct a time-varying interstate banking network to analyze the impact of deregulation on economic structure.

Tracking the timing of deregulation at the state-pair level is crucial for two key reasons. First, since many agreements—particularly those before 1988—were reciprocal, and the states involved often did not implement deregulation simultaneously, then monitoring the timing at the state-pair level allows for more precise identification of when deregulation actually occurred. Second, and more importantly, this level of analysis provides an ideal setting to assess how deregulation affects economic structures. As noted by Paravisini, Rappoport and Schnabl (2023) and Blickle, Parlatore and Saunders (2023), banks typically specialize their lending in specific industries or markets to minimize screening and monitoring costs, rather than diversifying. When a state opens its banking market to out-of-state banks, the new entrants bring expertise from their home markets to finance projects in the deregulated state, benefiting firms aligned with the incoming

banks' specialized knowledge. Given that states have distinct economic structure and banks within each state develop unique areas of expertise, examining deregulation at the state-pair level—rather than a broader state level—allows us to explore how the expertise of banks from different states shapes the economic landscape of the deregulated state in a timely and nuanced manner.

Figure 1 displays the fraction of state pairs that mutually allowed bank acquisitions through one of three arrangements: regionally or nationally reciprocal agreements, or nationally nonreciprocal agreements (permitting bank acquisitions nationwide without requiring reciprocity). The figure indicates that before 1988, the majority of states adopting reforms favored regional reciprocal agreements. Subsequently, an increasing number of states proceeded to liberalize their banking sectors, despite of the popularity of reciprocal agreements. By the end of 1993, approximately 90% of state pairs had implemented the reforms. The enactment of the Interstate Banking and Branching Efficiency Act in 1994 established this open policy on a national scale.



Notes: The term "regional reciprocal" refers to a pair of states where each state allows bank acquisitions from the other, but neither of them permits such acquisitions from the all other states. "National reciprocal" describes a pair of states where both allow bank acquisitions from each other, with at least one of the states also permitting acquisitions from all other states on a reciprocal basis. "National nonreciprocal" applies to a pair of states where both allow bank acquisitions from each other, and at least one of them allows acquisitions from all other states without reciprocity. The dates of these reforms are sourced from Amel (1993).

Figure 1
Fraction of deregulated state pairs

3 Empirical evidence

In this section, we apply the interstate banking deregulation of the 1980s as a quasi-natural experiment to examine how banks utilize their expertise, developed in their home

states, to newly entered markets, thereby shaping the economic structures of the deregulated state. We find three key results. First, deregulation facilitated the expansion of banks across state borders. Second, state economic structures converged following deregulation, particularly between states that had sufficiently different structure before deregulation or where one depended heavily on external finance while the other had a more developed financial sector. Finally, at the industry level, differences in value-added shares shrinked after deregulation if they were sufficiently different before deregulation.

3.1 Data and measurement

We begin by outlining how to measure the economic structural distance between two states. Using seasonally adjusted GDP data from the U.S. Bureau of Economic Analysis (BEA), we compile the value-added contributions of 53 private industries, excluding agriculture, and finance and insurance (FI), for the continental U.S. states. Our analysis covers 46 continental states, omitting Alaska, Delaware, and South Dakota, over the period from 1972 to 1994.[2] The economic structure of a state is characterized by a vector of industry shares, calculated as each industry's value added relative to the state's non-agricultural and non-FI private GDP.

The economic structures of two states can differ in two important ways. First, industries tend to geographically concentrate in different states. To measure this concentration for a given industry, we use the Herfindahl-Hirschman Index (HHI) based on the value-added shares across states. For example, in 1982—the starting year of our empirical analysis—tobacco products had the highest geographic concentration, while railroad transportation was the most geographically dispersed. Second, states vary in the level of diversification in their industry shares. For each state, we use the HHI of value-added shares across industries as a measure of diversification. In 1982, Ohio had the most diversified industry distribution, whereas Wyoming's economic structure was the most concentrated.

To quantify the economic structure distance between two states, s and s', in a given year t, we use the Manhattan distance, following the approach of Krugman (1992) and Kim (1995):

$$\mathbf{dist}_{ss't} = \sum_{i=1}^{n} |v_{ist} - v_{is't}| \tag{1}$$

where v_{ist} represents the industry i's share in state s of year t with $\sum_{i=1}^{n} v_{ist} = 1$. The Manhattan distance ranges from 0 to 2 and captures differences in both the composition

[2]Following Kroszner and Strahan (1999), Delaware and South Dakota are excluded due to their tax incentives for credit card banks, while Alaska and the District of Columbia are omitted due to their distinct economic structures. The findings remain robust even without these exclusions.

and diversification of the economic structures between two states. A large distance may arise either from differences in industry composition—where each state has higher shares in different industries—or from differences in diversification, where one state's economic structure is more concentrated in some industries while the other is more evenly distributed across industries.[3] From now on, we call state s as the home state and s' as the guest state for simplicity. Table 1 reports its summary statistics.

Table 1
Summary Statistics

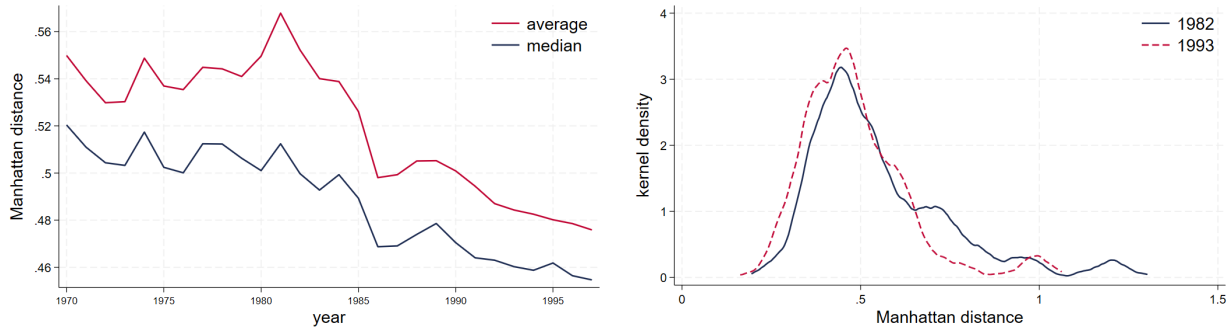
variable	obs	mean	sd	min	max
$\mathbf{dist}_{ss't}$	24840	0.511	0.171	0.158	1.300
$\mathbf{N}_{scs't}$	1,622,711	.008	.116	0	17
$\mathbf{dist}^{\text{pre}}_{ss'}$	1035	0.543	0.166	0.201	1.165
$\mathbf{L}$-to-$\mathbf{GDP}_s$	46	0.391	0.242	0.164	1.805
$\mathbf{N}_s$	46	5.989	4.613	2	24
$\mathbf{EFD}_i$	46	-0.037	0.468	-2.212	0.806
$\mathbf{EFD}_s$	46	0.062	0.058	-0.084	0.247

Note: $\mathbf{dist}_{ss't}$ is the Manhattan distance of economic structure between states s and s' in year t, as defined in Equation (1). $\mathbf{N}_{scs't}$ is the number of BHCs that operated in state s and then expanded their operation in county c of state s' in year t. $\mathbf{dist}^{\text{pre}}_{ss'}$ is the average pairwise Manhattan distance between 1972 and 1981. $\mathbf{L}$-to-$\mathbf{GDP}_s$ is the state-level loan-to-GDP ratio in 1981. $\mathbf{N}_s$ is the median number of the banks at the county-level within a given state in 1981. $\mathbf{EDF}_i$ is the external finance dependence for industry i. $\mathbf{EDF}_s$ is the external finance dependence for state s.

Each year, we use Equation (1) to calculate the distance between the economic structures of 1035 state pairs in our sample. Panel (a) of Figure 2 displays the evolution of the average and median pairwise Manhattan distances over time. Notably, both the average and median distances remained relatively stable during the 1970s but declined consistently throughout the 1980s and 1990s. Specifically, during our study period from 1982 to 1993, the average distance decreased by 6.6 percentage points, dropping from 0.55 in 1982 to 0.48 in 1993. This corresponds to an average annual decline of 0.006, or an annual compounded decline rate of 1.1%.[4] Panel (b) presents the kernel density of the pairwise Manhattan distances, revealing a pronounced leftward shift between 1982 and 1993. By 1993, the fat right tail observed in 1982 had largely diminished.

[3] Alternatively, we use cosine similarity, which measures the cosine of the angle between the vectors representing the industry shares of two states: $\mathbf{cos}_{ss't} = \mathbf{cos}(\mathbf{v}_{st}, \mathbf{v}_{s't}) = \frac{\mathbf{v}_{st} \cdot \mathbf{v}_{s't}}{|\mathbf{v}_{st}| \times |\mathbf{v}_{s't}|}$, where $\mathbf{v}_{st} = [v_{1st}, \ldots, v_{nst}]^T$ is a vector of industry shares in state s. Here, $\cdot$ denotes the dot product, and $|\mathbf{v}_{st}| = \sqrt{\mathbf{v}'_{st} \cdot \mathbf{v}_{st}}$ is the norm of vector $\mathbf{v}_{st}$. Cosine similarity focuses on differences in the composition of economic structures between two states by normalizing each state's level of diversification. This method is widely used in portfolio management and textual analysis literature (see, for example, Hanley and Hoberg, 2010, 2012; Girardi, Hanley, Nikolova, Pelizzon and Sherman, 2021; Chu, Deng and Xia, 2020). A higher cosine value indicates greater similarity in the economic structures of the two states. As shown in Appendix C, all main results hold with cosine similarity.

[4] The average absolute value of the difference in industry share also declined, from 0.010 in 1982 to 0.009 in 1993, with an average annual decrease of 1.2 basis points.



(a) Evolution (b) Kernel density

Notes: The analysis is based on seasonally adjusted GDP data from the Bureau of Economic Analysis. Value-added data from 53 private industries (excluding agriculture, finance, and insurance), across 46 continental states, excluding Alaska, Delaware, and South Dakota. Panel (a) shows the evolution of the average (red dashed) and median (blue solid) of the pairwise Manhattan distances of economic structures, calculated using Equation (1). The sample spans the period from 1970 to 1997. Panel (b) presents the kernel density of the pairwise Manhattan distances for 1982 (blue solid) and 1993 (red dashed).

Figure 2
Evolution and kernel density of the pairwise Manhattan distance

Next, to test the heterogeneous effects of interstate banking deregulation across state pairs, we examine three types of state-pair or state-level characteristics prior to deregulation: (1) the economic structure similarity, (2) the level of financial development (FD), and (3) the external financial dependence (EFD). For each state pair, we calculate the average Manhattan distance from 1972 to 1981 as a measure of pre-deregulation similarity of economic structure. Consistent with the findings presented in panel (b) of Figure 2, the mean, minimum, and maximum values of this measure are higher than the corresponding moments observed in the pairwise Manhattan distance between 1982 and 1993. For further details, refer to Appendix A.

Second, we utilize data from the Federal Deposit Insurance Corporation (FDIC) Call Report and Summary of Deposits to construct two proxies for financial development prior to deregulation.[5] Following Rajan and Zingales (1998), we first compute the total loans issued in 1981 by banks operating in a state as a share of non-agricultural and non-FI private GDP, referred to as the loan-to-GDP ratio.[6] This measure captures the extent to which financial intermediaries provide credit to the private sector, reflecting the advancement of a state's financial system. Furthermore, recent literature argue that the

[5]It is worth noting that the FDIC has provided the Summary of Deposits since 1993. For data from 1981 to 1993, we rely on a dataset constructed by Christa Bouwman, to whom we are grateful for making it publicly available. This is also why we use 1981 as the baseline year to calculate the pre-deregulation proxy for state-level financial development.

[6]In 1981, most banks, including nationally chartered ones, operated within a single state. In our sample, even at the BHC level, only 15 out of 12,131 BHCs operated in multiple states, accounting for approximately 0.13% of total assets. We exclude banks from these BHCs from our calculations here.

density of banks in a given region affects banks' decisions on geographic expansion (see, e.g., Ji, Teng and Townsend, 2023; Oberfield, Rossi-Hansberg, Trachter and Wenning, 2024). To account for this, we calculate the number of banks operating in each county and use the median county-level value within each state in 1981 as our second measure of financial development.

Third, using data from Compustat, we employ the standard two-step procedure outlined in Rajan and Zingales (1998) to calculate the EFD for each industry. Specifically, we compute the EFD for each firm, average these values over the period from 1979 to 1981, and then take the industry median as the EFD for a certain industry.[7] To derive the state-level EFD, we calculate a weighted average of EFD for each state, using the average industry shares from 1972 to 1981 as weights. Notably, we assume that the EFD of a given industry is the same across states, as in Rajan and Zingales (1998). This metric captures the extent to which a state's economic structure depends on external finance prior to deregulation.

3.2 Methodology

In this section, we outline our empirical strategies and present the main results. Ideally, a dataset with detailed firm-bank linkages would allow us to directly assess the impact of bank expertise on shaping economic structures and identify the underlying mechanisms. However, in the absence of such data, we adopt a three-step approach to demonstrate that banks' geographic expansion, following the interstate banking deregulation, facilitates the convergence of economic structures between two states, as illustrated in Figure 2. First, we verify whether banks expanded into guest state after their home state reached reciprocal agreements with guest state to open banking markets. Second, we investigate whether the economic structures of these state pairs began converging following deregulation, and how state-level and state-pair characteristics before deregulation affected this convergence. Third, we analyze whether this convergence manifests at the industry level across states.

Recent advancements in the difference-in-differences (DD) methodology have highlighted potential issues with interpreting coefficients derived from staggered DD regressions with two-way fixed effects (see, for example, de Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon, 2021; Baker, Larcker and Wang, 2022, among others). These studies argue that the estimated coefficients might be biased, where it arises when units treated at later stages are compared against a control group that includes units treated

[7] The selection of the 1979–1981 time window strikes a balance between maximizing the sample size available in Compustat before 1982 and minimizing year-specific noise. We have also tested alternative starting years, and the results remain robust.

earlier, potentially leading to estimates that contradict the true average effect.[8] Additionally, Sun and Abraham (2021) demonstrate the potential unreliability of dynamic effect estimates derived from these regressions.

To address these issues, we adopt the methodologies proposed in Gormley and Matsa (2011) and Cengiz, Dube, Lindner and Zipperer (2019). Accordingly, for each event year from 1984 to 1991, we identify pairs of states that implemented deregulation.[9] In contrast, pairs that either did not open their markets to each other before 1994 or did so at least three years later serve as the control group. We truncate observations for each cohort two years before and after the event year, stack them, and add an additional layer of cohort fixed effects to account for repeated observations across cohorts.

Alternative methodologies have been suggested in recent literature to address these critiques (Sun and Abraham, 2021; Callaway and Sant'Anna, 2021; de Chaisemartin and d'Haultfoeuille, 2023). These approaches essentially adjust the control group to form an effective contrast, rather than comparing treatment group with inappropriate controls. Given the necessity to control for various unobserved characteristics with fixed effects in our analysis, the stack method is uniquely suited due to its inherent flexibility.

3.3 Bank-holding companies expansion after deregulation

As the first step, we hypothesize that banks responded to deregulation by expanding their business into states that established agreements with their home state. For our analysis, we define a pair of states as having implemented deregulation if they have either mutually agreed to open their markets to each other or if one state unilaterally opened its market without requiring reciprocity. Since the FDIC preserved the acquired bank's identity even after acquisition throughout our sample period, we must analyze bank entry at the bank holding company (BHC) level. Within this framework, we test our hypothesis at the BHC-state-county level using the following specification:

$$\mathbf{N}_{scs't} = \mathbf{exp}\left\{\beta \mathbf{D}_{ss't} + \nu_{scs'} + \omega_{st} + \theta_{cs't}\right\} + \epsilon_{bss't} \tag{2}$$

Here, $\mathbf{N}_{scs't}$ is the number of BHCs that operated in state s in 1981 and then expanded their operation in county c of state s' in year t. $\mathbf{D}_{ss't}$ is an indicator for deregulation between a pair of states s and s', taking the value of one if deregulation occurred in year t, and zero otherwise. $\nu_{scs'}$ is the state-county fixed effects between state s and county c of state s', accounting for their time-invariant characteristics, such as their geographical distance, historical or culture connections. Meanwhile, ω_{st} denotes home-state-year

[8] For comprehensive reviews on this topic, see de Chaisemartin and d'Haultfoeuille (2022).

[9] We exclude two pairs of states (Massachusetts-Connecticut and Maine-New York) that deregulated before 1984 from our sample.

fixed effects, accounting for time-varying characteristics specific to home state, including factors like legislative or policy changes and fluctuations in loan supply. $\theta_{cs't}$ is the county-year fixed effect, which controls for unobserved, time-varying characteristics of county in the guest state, such as local loan demand. For each cohort in our stacked estimation, the treatment group comprises state-county pairs in which state s' entered into a reciprocal deregulation agreement during the cohort year with state s', where county c is located. Conversely, the control group includes state-county pairs where banks operated within either state as of 1981 but did not reach a deregulation agreement until at least three years after the event year.

It's important to point out that, in some cases, banks from one state may choose not to acquire banks in the other, even when they are permitted to do so, i.e., we have some zero-count cases in our sample. Studies by Silva and Tenreyro (2006), Cohn, Liu and Wardlaw (2022), and Chen and Roth (2023) have demonstrated that average treatment effects derived from transformations, like the log-plus-one and inverse hyperbolic functions, may carry biases and, therefore, should not be construed as indicative of a percentage impact. To deal with the zero-count cases, we employ the Poisson pseudo maximum likelihood (PPML) method as recommended in these studies.

Table 2 presents the point estimates for Equation (2), with standard errors clustered at the state-by-county-by-cohort level. Column (1) indicates that, on average, 2.7 BHCs expanded their operations into a county of the guest state, following the market's opening to the BHCs' home state. In Column (2), we examine how the pre-deregulation economic structure between two states influences BHCs' entry decisions by including an interaction term between the deregulation indicator and pre-deregulation distance. The results suggest that BHCs were more likely to enter counties in states with distinct economic structures prior to deregulation. Similarly, Oberfield, Rossi-Hansberg, Trachter and Wenning (2024) find comparable results and attribute this pattern to banks' incentives to access deposits, a less expensive source of funding. Furthermore, we conduct a similar empirical analysis at the BHC level in Appendix B.1, and the findings remain consistent.

3.4 Convergence of pairwise economic structure after deregulation

Following deregulation, banks expanded into counterpart states through mergers and acquisitions. As demonstrated by Paravisini, Rappoport and Schnabl (2023), the expertise developed by acquirer banks prior to a merger is retained and transferred to the combined entity post-merger. This enables banks to leverage their home-market expertise to finance projects in the guest state, fund firms aligned with their specialized knowledge, and shape the economic structure of the guest state. After confirming that banks successfully entered the new markets, we examine how the economic structure between two

Table 2
Regression results for Equation (2)

	(1)	(2)
$\mathbf{D}_{ss't}$	0.995***	-0.581
	(0.305)	(0.649)
$\mathbf{D}_{ss't} \times \mathbf{dist}^{\text{pre}}_{ss'}$		3.063***
		(1.185)
Obs	3,661,970	3,661,970
Pseudo R^2	0.866	0.866
state-by-county-by-cohort FE	Yes	Yes
home state-by-year-by-cohort FE	Yes	Yes
county-by-year-by-cohort FE	Yes	Yes

Note: The table reports the point estimates for β in Equation (2), following the stacking approach of Cengiz, Dube, Lindner and Zipperer (2019). Poisson pseudo maximum likelihood (PPML) is employed for estimation. For each cohort in our stacked estimation, the treatment group comprises state-county pairs in which state s' entered into a reciprocal deregulation agreement during the cohort year with state s', where county c is located. The control group includes state-county pairs where banks operated within either state as of 1981 but did not reach a deregulation agreement until at least three years after the event year. Observations of each cohort are truncated two years before and after the event year and then stacked together. The dependent variable is the number of BHCs operating in state s in 1981 that have expanded their operations into county c of state s' in year t. The main regressor is $\mathbf{D}_{ss't}$, an indicator for deregulation between a pair of states s and s', taking the value of one if deregulation occurred in year t, and zero otherwise. $\mathbf{dist}^{\text{pre}}_{ss'}$ is the average pairwise Manhattan distance between 1972 and 1981. The state-by-county-by-cohort, state-by-year-by-cohort, and county-by-year-by-cohort fixed effects are used, and all standard errors are clustered by the state-by-county-by-cohort level. $*** p < 0.01$, $** p < 0.05$, $* p < 0.1$.

states evolves once they permit cross-border bank acquisitions. Our analytical approach is outlined as follows:

$$\mathbf{dist}_{ss't} = \beta \mathbf{D}_{ss't} + \alpha' \mathbf{D}_{ss't} \times \mathbf{X}_{ss'} + \nu_{ss'} + \omega_{st} + \omega_{s't} + \epsilon_{ss't} \tag{3}$$

Here, $\mathbf{dist}_{ss't}$ represents the distance in economic structure between two states s and s' in year t, as defined in Equation (1). $\mathbf{D}_{ss't}$ is the deregulation indicator. $\mathbf{X}_{ss'}$ captures pre-deregulation state-pair or state-level characteristics, including: (1) the economic structure similarity ($\mathbf{dist}^{\text{pre}}_{ss'}$); (2) measures of financial development (such as the loan-to-GDP ratio, denoted as $\mathbf{L}$-to-$\mathbf{GDP}_s$, and the number of banks, denoted as $\mathbf{N}_s$); and (3) the state-level EFD ($\mathbf{EFD}_s$), and their interaction term. $\nu_{ss'}$ is the fixed effect for each state pair, controlling for time-invariant characteristics specific to each pair. Finally, ω_{st} and $\omega_{s't}$, respectively, represent state-year fixed effects for the home and guest states, accounting for time-varying factors at the state level.[10]

[10]It should be noted that the distance for a given state pair in a particular year is the same if we switch the roles of the home and guest states, i.e., $\mathbf{dist}_{ss't} = \mathbf{dist}_{s'st}$. Additionally, two deregulated states may independently choose to open their banking markets to other states beyond their bilateral agreements. Furthermore, as shown in Figure 1, from 1987 onward, a growing number of states adopted nationwide deregulation without reciprocity, whereas some states continued maintaining regional reciprocal agreements. Thus, each state pair appears twice in our analysis—once with each state serving alternatively as the home or guest state—and we accordingly include distinct state-year fixed effects for home and guest states.

Table 3 presents the point estimates for Equation (3), with standard errors clustered at the state-pair-by-cohort level. Column (1) reports results from the baseline model, where the point estimate is negative and statistically significant. This indicates that the economic structures of states with agreements converged following deregulation, relative to state pairs that have not yet experienced deregulation or never deregulated before 1994. This convergence accounts for half of the average annual decline observed between 1982 and 1993.

Heterogeneous effects with pre-deregulation Manhattan distance

Next, we examine the potential heterogeneous effects of interstate banking deregulation on the convergence of economic structures between states. First, we explore how the pre-deregulation economic structure affects the post-deregulation convergence. In particular, if two states exhibit greater difference in their economic structures prior to deregulation, banks in each state are more likely to develop specialized expertise in distinct industries. Following deregulation, as banks expand their operations into other states, they are more likely to transfer their industry-specific expertise to the guest state, thereby facilitating greater convergence in economic structures. To assess this mechanism, we interact the deregulation indicator ($\mathbf{D}_{ss't}$) with the pre-deregulation Manhattan distance ($\mathbf{dist}^{\text{pre}}_{ss'}$). Column (2) of Table 3 indicates that when the pre-deregulation distance is sufficiently large, namely greater than 0.44 (approximately the 28th percentile of its distribution), the pairwise Manhattan distance starts to decrease after deregulation. Otherwise, when the pre-deregulation distance is sufficiently smaller, the distance increases.

We further evaluate this mechanism by examining how the economic structures of state pairs, categorized into quartiles based on their pre-deregulation distance distribution, evolve following deregulation. Column (3) presents the point estimates for the interaction between the deregulation indicator ($\mathbf{D}_{ss't}$) and four dummy variables, each of which is equal to one if the pre-deregulation distance falls within a specific quartile of its distribution, and zero otherwise. The results are consistent with those reported in Column (2). Following deregulation, state pairs in the third quartile experience a significant reduction in Manhattan distance, with an even more pronounced decline observed for those in the fourth quartile. The magnitude of convergence for these groups exceeds the annual average decline observed between 1982 and 1993 by approximately 34% and 114%, respectively. In contrast, the distance for state pairs in the first quartile exhibits a weak increase.

Table 3
Regression results for Equation (3)

	Benchmark	Effects of pre-deregulation distance		$\mathbf{FD}_s$ = L-to-$\mathbf{GDP}_s$			$\mathbf{FD}_s = \mathbf{N}_s$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mathbf{D}_{ss't}$	-0.003***	0.021***		-0.002	-0.000	-0.001	0.0011	-0.010**
	(0.001)	(0.004)		(0.002)	(0.002)	(0.008)	(0.002)	(0.005)
$\mathbf{D}_{ss't} \times \mathbf{dist}^{\text{pre}}_{ss'}$		-0.049***						
		(0.007)						
$\mathbf{D}_{ss't} \times \mathbf{1}^{\text{1st}}_{ss'}$			0.002*					
			(0.001)					
$\mathbf{D}_{ss't} \times \mathbf{1}^{\text{2nd}}_{ss'}$			0.001					
			(0.002)					
$\mathbf{D}_{ss't} \times \mathbf{1}^{\text{3rd}}_{ss'}$			-0.008***					
			(0.002)					
$\mathbf{D}_{ss't} \times \mathbf{1}^{\text{4th}}_{ss'}$			-0.012***					
			(0.002)					
$\mathbf{D}_{ss't} \times \mathbf{FD}_s$				0.002		0.014	-0.0001	0.001*
				(0.003)		(0.023)	(0.000)	(0.001)
$\mathbf{D}_{ss't} \times \mathbf{FD}_{s'}$				-0.005**		-0.016	-0.0005***	0.001
				(0.002)		(0.016)	(0.000)	(0.001)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_s$					-0.071***	-0.032		0.022
					(0.023)	(0.078)		(0.054)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_{s'}$					0.026	0.054		0.139***
					(0.019)	(0.065)		(0.047)
$\mathbf{D}_{ss't} \times \mathbf{FD}_s \times \mathbf{EFD}_s$						0.083		-0.006
						(0.277)		(0.011)
$\mathbf{D}_{ss't} \times \mathbf{FD}_{s'} \times \mathbf{EFD}_s$						-0.145***		-0.010***
						(0.052)		(0.002)
$\mathbf{D}_{ss't} \times \mathbf{FD}_s \times \mathbf{EFD}_{s'}$						-0.272**		-0.017***
						(0.110)		(0.003)
$\mathbf{D}_{ss't} \times \mathbf{FD}_{s'} \times \mathbf{EFD}_{s'}$						0.271		-0.005
						(0.189)		(0.009)
Obs	55,805	55,805	55,805	55,805	55,805	55,805	55,805	55,805
R^2	0.991	0.992	0.992	0.991	0.992	0.992	0.991	0.992
state-by-state-by-cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
home state-by-year-by-cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
guest state-by-year-by-cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The table reports the point estimates for β in Equation (3), following the stacking approach of Cengiz, Dube, Lindner and Zipperer (2019). For each event year from 1984 to 1991, pairs of states deregulated in that year form the treatment group, and those of not-yet or never deregulated state pairs serve as the control group. Observations of each cohort are truncated two years before and after the event year and then stacked together. The dependent variable is the distance of economic structure between two states as defined in Equation (1). The main regressor is $\mathbf{D}_{ss't}$, an indicator for deregulation between a pair of states s and s', taking the value of one if deregulation occurred in year t, and zero otherwise. $\mathbf{dist}^{\text{pre}}_{ss'}$ is the average pairwise Manhattan distance between 1972 and 1981. $\mathbf{1}^{\text{1st}}_{ss'}$, $\mathbf{1}^{\text{2nd}}_{ss'}$, $\mathbf{1}^{\text{3rd}}_{ss'}$, and $\mathbf{1}^{\text{4th}}_{ss'}$ are indicator variables that set to one if the pre-deregulation distance falls within the first, second, third, or fourth quartile of its distribution, respectively. $\mathbf{L}$-to-$\mathbf{GDP}_s$ is the state-level loan-to-GDP ratio in 1981. $\mathbf{N}_s$ is the median number of the banks at the county-level within a given state in 1981. $\mathbf{EDF}_s$ is the external finance dependence for state s. The state-by-state-by-cohort and state-by-year-by-cohort fixed effects are used, and all standard errors are clustered by the state-by-state-by-cohort level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Heterogeneous effects with other pre-deregulation state characteristics

When a state opens to a more financially developed state, banks in the guest state are more likely to acquire those in the home state. This further enhances the opportunities for firms in the home state to match with these banks, particularly for those firms that are well-aligned with the bank expertise. This improved matching process facilitates even stronger convergence of economic structures between the two states. To evaluate this effect, we introduce an interaction term between the deregulation indicator ($\mathbf{D}_{ss't}$) and one of two proxies for the state-level financial development into the baseline model in Equation (3). As shown in Column (4) of Table 3, the effect of deregulation on economic convergence is affected by the financial development of the guest state. When a home state allows bank acquisitions by banks from a more financially developed state, the economic structures of the two states converge more post-deregulation, compared to state pairs that have not yet implemented reforms. In particular, opening the market to a guest state in the 75th percentile for loan-to-GDP ratio (0.447) results in a larger decline in structural distance, by 0.0008, than opening to a guest state in the 25th percentile (0.289), holding all other factors constant. This additional decline is about 28% of the average treatment effect documented in the baseline model. However, the coefficient for the number of banks in the home state is not significant, suggesting that the impact of deregulation on convergence is driven primarily by the relative financial development of the guest state.

It is notable that the industrial composition of states varies significantly, and states with higher shares of industries that depend more on external finance may benefit disproportionately more from the increased presence of the guest-state banks. This, in turn, can facilitate stronger convergence in economic structures between the two states. To capture this effect, we introduce another interaction term between deregulation indicator and the pre-deregulation state-level EFD. As shown in Column (5), when industries in the home state are, on average, more dependent on external finance, the convergence of economic structures between the two states becomes more pronounced compared to states that have not yet undergone deregulation. Specifically, when a home state in the 75th percentile for state-level EFD (0.080) opens its market to the guest state, the structural distance declines by an additional 0.0034 relative to a home state in the 25th percentile (0.032) opening its market to the same guest state, holding all other factors constant. This additional decline is approximately 18% greater than the average treatment effect observed in the baseline model. However, the extent to which industries in the guest state depend on external finance does not appear to significantly impact economic convergence following deregulation.

The results above suggest a potential complementarity between one state's finan-

cial development and the other's external financial dependence. Specifically, when two states—one with greater financial development and the other with higher share on industries depending more on external financial dependence—reach an agreement, their economic structures are expected to converge more significantly after the deregulation. To explore this, we introduce additional interaction terms between the deregulation indicator and four possible combinations of the loan-to-GDP ratio and EFD between the two states. As shown in Column (6), the point estimates for the interaction terms involving cross-combinations—namely, the guest state's loan-to-GDP ratio interacting with the home state's EFD, and vice versa—are negative and statistically significant at the 99% confidence level. In contrast, the coefficients for the interaction terms involving self-combinations—i.e., the home (or guest) state's loan-to-GDP ratio interacting with its own EFD—are not statistically significant. These findings indicate that complementary pre-deregulation characteristics between the two states are key drivers of the convergence in their economic structures following deregulation.

Last, we use the median number of the banks at the county level within a state as the proxy for the financial development, as shown in Column (7) and (8) of Table 3. Our results are robust: reaching an agreement with a state that has denser bank location distribution at the county level facilitates the convergence of economic structure. The effects are more pronounced if the other depends more on external finance.

Discussion on identification

We employ a stacked DD estimation to identify the causal effect of interstate banking deregulation on the economic structure between two states. This approach relies on two key identifying assumptions. First, there are no omitted factors that simultaneously affect both the pairwise Manhattan distance and the deregulation decision. Alternatively, state legislators may anticipate the effects of deregulation and strategically prioritize agreements with states that have significantly different economic structures, complementary financial systems, or higher demand for external finance. By doing so, they can leverage the expertise of banks in the counterpart state to support industries that are underfunded by banks in their home state.[11] In such cases, the causal effects of deregulation on the convergence of pairwise economic structures could be reversed.

To address this concern, we show in Appendix B.2 that the timing of deregulation across state pairs is not correlated with state-pair characteristics. Specifically, we mea-

[11] However, historical evidence suggests that such strategic selection is less likely to occur. Rajan and Ramcharan (2011) find that in the early 20th century, counties with more concentrated farmland ownership had significantly fewer banks per capita. Furthermore, Rajan and Ramcharan (2016) show that constituencies in these counties were more likely to oppose the McFadden Act of 1927, which granted national banks the right to open branches if state-chartered banks were allowed to do so. In these states, banks were more likely to serve the interests of agricultural elites rather than fostering industrial growth.

sure a state's deregulation timing by calculating the number of years between its first reciprocal agreement with any state and its agreement with a specific state. First, we regress this measure on the pre-deregulation Manhattan distance, physical distance, and its squared term, controlling for state fixed effects and deregulation cohort fixed effects. The estimated coefficient for pre-deregulation distance is positive but not statistically significant at the 95% confidence level. Second, we replace the pre-deregulation distance with interaction terms for the two cross-combinations between the loan-to-GDP ratio and EFD. Again, the coefficients are not statistically significant at the 95% confidence level. These findings suggest that state legislators were unlikely to have anticipated the effects of deregulation and strategically selected specific states to open their banking markets in order to leverage the expertise of banks in counterpart states. This evidence mitigates concerns about reverse causality.

The second identifying assumption is that the pre-existing time trends of the treatment and control groups are parallel. In Appendix B.3, we conduct an event study to analyze the dynamic effects of deregulation on the pairwise Manhattan distance. Using a sample spanning five years before and after deregulation, with the deregulation year normalized to zero, we find that the results remain robust. Specifically, the pairwise Manhattan distance for deregulated state pairs in the first three years after deregulation is significantly lower than that for state pairs that were either not yet deregulated or never deregulated. However, these effects decay and become statistically insignificant starting from the fourth year. Moreover, we conduct a pre-trend test and cannot reject the null hypothesis that all leading coefficents are equal to zero.

Robustness check

It is noteworthy that the U.S. economy has expierinced a significant structural shift in the 1980s and 1990s, transitioning from manufacturing to service industries. This trend, likely driven by factors such as automation (Acemoglu and Restrepo, 2018) and outsourcing (Antras, Fort and Tintelnot, 2017), coincides with the timeline of interstate banking deregulation. This convergence of trends may compound the effects observed in our results. To address this concern, we analyze the convergence of economic structures between state pairs in Appendix B.4, by separately excluding core services or manufacturing industries.[12]

First, we recalculate industry shares excluding core service industries and use Equation (1) to compute the pairwise Manhattan distance of economic structures without core

[12]Core services include hotels and other lodging places, personal services, business services, automotive repair and parking, miscellaneous repair services, motion pictures, amusement and recreation services, health services, legal services, educational services, social services, membership organizations, and other services.

services between states. We then test Equation (3) using the same methodology. As shown in Columns (1) through (3) of Table B.3, our main findings remain robust. Next, we replicate this exercise using a subsample that excludes manufacturing industries. The results, presented in Columns (4) through (6) of Table B.3, demonstrate that our main findings are robust in this context as well.

3.5 Convergence at the industry level after deregulation

When banks enter new markets, their lending decisions may be affected both by the comparative advantage of the destination market—such as productivity and resource endowments—and by the expertise they have accumulated in their home states. If banks base their decisions solely on market fundamentals, differences of industry shares between states would be expected to remain unchanged following deregulation. However, if bank expertise plays a role, even if not the sole determinant, we would expect industry shares between states to diminish after deregulation. To test this hypothesis, we analyze industry-level data to examine how differences in industry shares between states evolve post-deregulation, employing the empirical model outlined below:

$$\begin{aligned}\Delta v_{iss't} &= \beta_1 \mathbf{D}_{ss't} \times \mathbf{H}_{iss'} + \beta_2 \mathbf{D}_{ss't} \times \mathbf{EFD}_i \times \mathbf{H}_{iss'} + \beta_3 \mathbf{D}_{ss't} \times \mathbf{G}_{iss'} \\ &\quad + \beta_4 \mathbf{D}_{ss't} \times \mathbf{EFD}_i \times \mathbf{G}_{iss'} + \beta_5 \mathbf{D}_{ss't} \times \mathbf{EFD}_i + \nu_{iss'} + \omega_{it} + \theta_{ss't} + \epsilon_{ss'it} \qquad (4)\end{aligned}$$

Here, $\Delta v_{iss't} = v_{ist} - v_{is't}$ represents the difference in the industry i's share between state s and s' in year t. $\mathbf{D}_{ss't}$ is the deregulation indicator. $\mathbf{H}_{iss'}$ and $\mathbf{G}_{iss'}$ are indicators that equal one if industry i is likely to be aligned with bank expertise in the home and guest states priop to deregualtion, respectively, as discussed in detail later. $\mathbf{EFD}_i$ denotes the industry-level EFD. The term $\nu_{iss'}$ captures state-pair-by-industry fixed effects, controlling for time-invariant characteristics specific to an industry between two states, such as fuel pipelines or electricity grids. The term ω_{it} refers to industry-by-year fixed effects, accounting for time-varying industrial characteristics, including technological progress, outsourcing, and national shifts in economic structure. Additionally, $\theta_{ss't}$ represents state-pair-by-year fixed effects, which control for time-varying characteristics between states, such as trade flows, newly built infrastructure, and changes in legislation between state pairs. Notably, this fixed effect accounts for the average convergence in industry share between the two states and absorbs the deregulation indicator.

Bank expertise is more likely to develop in industries where banks provide greater lending. Since we do not directly observe the industries in which banks concentrate their lending, we instead use the pre-deregulation value-added share of important industries as a proxy for bank expertise. This approach relies on the assumption that a bank's lending portfolio within a state is highly correlated with the state's economic structure.

To approximate bank expertise, we employ two metrics. First, we identify industries for each state pair where one state had a significantly larger share of industry i before deregulation compared to the other. To formalize this, we define $\mathbf{H}iss'$ and $\mathbf{G}iss'$ as follows:[13]

$$\mathbf{H}_{iss'} = \mathbf{1}\left(v_{is}^{\text{pre}} - v_{is'}^{\text{pre}} > \alpha\right), \text{ and } \mathbf{G}_{iss'} = \mathbf{1}\left(v_{is'}^{\text{pre}} - v_{is}^{\text{pre}} > \alpha\right), \tag{5}$$

where v_{is}^{pre} ($v_{is'}^{\text{pre}}$) represents the average share of industry i in state s (s') between 1972 and 1981, and α denotes the threshold for a significantly higher share, set at 0.00035, which corresponds to the 10th percentile of the absolute pre-deregulation differences in industry shares, i.e., $|v_{is}^{\text{pre}} - v_{is'}^{\text{pre}}|$.[14] These indicators capture the relative importance of an industry for one state compared to the other.[15]

In Column (1) of Table 4, we observe that post-deregulation, the difference in industry share between two states decreases by 7 basis points when the home state had a significantly higher pre-deregulation share compared to the guest state. Conversely, the difference increases by 7 basis points when the guest state had a higher pre-deregulation share. Both effects are approximately five times larger than the annual decline in the absolute value of the difference in industry shares observed between 1982 and 1993. This suggests that industries with significant difference prior to deregulation play a disproportionately larger role in driving economic structure convergence following deregulation.

Some industries with higher value-added share may not depend on bank financing; however, these industries that depend on external finance are likely to benefit disproportionately more from increased access to such financing. As a result, following deregulation, the difference in their industry shares between two states should converge more. To test this hypothesis, we incorporate two triple interaction terms involving the deregulation indicator, relative industry importance, and industry-level EFD. As reported in Column (2), the difference in industry shares declines more significantly for industries with higher EFD when the home state had a substantially larger pre-deregulation share relative to the guest state. Conversely, the difference in industry shares increases more for these industries when the guest state had a significantly higher pre-deregulation share.

The second metric used as a proxy for bank expertise is the absolute importance of an

[13] We focus on differences in value-added shares, capturing effects on both the intensive and extensive margins. On the extensive margin, firms in the home state may expand their operations as banks enter new markets due to relationship lending. While we do not rule out this possibility, our regression results provide little evidence to support it, as we find no significant reduction in the difference between new business entry rates in industries aligned with the approximated measure of bank expertise following deregulation. These results are available upon request.

[14] We also test thresholds at the 5th, 15th, and 20th percentiles, with our main results remaining robust.

[15] To formally test this, we regress an indicator representing whether the difference in industry share is positive (negative) one year before deregulation on $\mathbf{H}_{iss'}$ ($\mathbf{G}_{iss'}$), while controlling for state and industry fixed effects. The results show that in 75% of cases where the home (guest) state had a significantly higher average industry share than the guest (home) state, this higher share persisted until one year before deregulation.

Table 4
Regression results for Equation (4)

	relative importance		absolute importance	
	(1)	(2)	(3)	(4)
$\mathbf{D}_{ss't} \times \mathbf{H}_{iss'}$	-0.0007***	-0.0007***	-0.0034***	-0.0030***
	(0.000)	(0.000)	(0.000)	(0.000)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_i \times \mathbf{H}_{iss'}$		-0.0008***		-0.0076***
		(0.000)		(0.001)
$\mathbf{D}_{ss't} \times \mathbf{G}_{iss'}$	0.0007***	0.0007***	0.0027***	0.0022***
	(0.000)	(0.000)	(0.000)	(0.000)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_i \times \mathbf{G}_{iss'}$		0.0010***		0.0084***
		(0.000)		(0.001)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_i$		0.0000		0.0001***
		(0.000)		(0.000)
Obs	2,567,720	2,567,720	2,567,720	2,567,720
R^2	0.972	0.972	0.972	0.972
state-by-state-by-industry-by-cohort FE	Yes	Yes	Yes	Yes
industry-by-year-by-cohort FE	Yes	Yes	Yes	Yes
state-by-state-by-year-by-cohort FE	Yes	Yes	Yes	Yes

Note: The table presents the point estimates for the β coefficients in Equation (4), using the stacking approach from Cengiz, Dube, Lindner and Zipperer (2019). For each event year between 1984 and 1991, industries in pairs of states that had implemented deregulation in that year form the treatment group, while industries in state pairs that had not yet deregulated act until at least three years later as the control group. Observations for each cohort are truncated two years before and two years after the event year, and then stacked. The dependent variable is the difference in either industry share. The main regressor is $\mathbf{D}_{ss't}$, an indicator of deregulation between states s and s', which interacts with the indicator $\mathbf{H}_{iss'}$ or $\mathbf{G}_{iss'}$. Here, $\mathbf{H}_{iss'}$ and $\mathbf{G}_{iss'}$ measure either the relative importance of industry i between states s and s' (as defined in Equation (5)) or the absolute importance of industry i for states s and s' (defined as one of the top 10 most important industries for the corresponding state between 1972 and 1981). $\mathbf{EDF}_i$ represents the external finance dependence of industry i. The model includes fixed effects for industry-by-state-by-state-by-cohort, state-by-state-by-year-by-cohort, and industry-by-year-by-cohort. Standard errors are clustered at the industry-by-state-by-state-by-cohort level. $*** p < 0.01$, $** p < 0.05$, $* p < 0.1$.

industry within a state. Specifically, we define a dummy variable that equals one if the industry ranks among the top ten in terms of average industry share in that state between 1972 and 1981. As shown in Columns (3) and (4) of Table 4, the results remain robust, with a substantial effect size—more than twenty times larger than the annual decline in the absolute value of the difference in industry shares observed between 1982 and 1993. This finding suggests that the observed convergence in economic structure between the two states following deregulation is primarily driven by leading industries, i.e., those with the highest pre-deregulation industry shares.

As a robustness check, we perform an additional exercise in Appendix B.5, by replicating the analysis using a sample that excludes core services or manufacturing industries. As shown in Table B.4, the main results remain consistent.

4 Model environment

To explore the implications of bank expertise on welfare, we integrate imperfect search and matching between banks and firms into a Lucas islands model (Lucas, 1972). The economy comprises two types of islands: a continuum of home islands (h) and a continuum of guest islands (g). Each island is populated by a continuum of representative households, a representative final good firm, two continua of intermediate-good firms (manufacturing and services), and a fixed number of banks. Firms in each intermediate-good sector produce homogeneous inputs for the final good firm. These firms are randomly matched with banks, from which they borrow to expand their production capacity. Following Mortensen and Pissarides (1994), the matching probability depends on the number of firms and the search efforts of banks. Bank expertise is characterized by a parameter that governs matching frictions. Households and firms are restricted from moving across islands.[16] Banks on one island endogenously decide whether to enter the loan market on the other island, subject to an entry cost. The entry costs on both islands are initially set to infinity, and deregulation is modeled as a reduction in these entry costs. The economy is modeled in discrete time, indexed by $t = 0, 1, 2, \ldots$.[17]

4.1 intermediate-good firms

There are two continua of intermediate-good firms on island $i \in \{h, g\}$, with a continuum of them in each sector $j \in \{m, s\}$, indexed by $\omega \in [0, 1]$. They use capital to produce at the productivity level A_j^i. These firms are endowed with $\underline{k}_j^i$ units of capital and face a production capacity constraint, where it can invest up to $\overline{k}_j^i$ units of capital. If the firm ω is successfully matched with a bank b, it can borrow $k_j^i \in \left[0, \overline{k}_j^i - \underline{k}_j^i\right]$ units of capital at the loan rate $r_{jb}^i(\omega)$. This enables the firm to expand its production up to $A_j^i\left(\underline{k}_j^i + k_j^i\right)$. However, if the firm fails to match with a bank, it produces using only its endowed capital, yielding $A_j^i \underline{k}_j^i$ units of output. We assume that firms are unable to save.

Let $q_{jb}^i(\omega)$ denote the probability that firm ω is matched with bank b. Given the price of intermediate goods P_j^i and the loan rate $r_{jb}^i(\omega)$, the expected profits for firm ω from

[16] Our model is designed to be flexible and can accommodate the relocation of households and firms across islands following deregulation. However, the assumption on restricting them from moving across islands is made for two primary reasons. First, this simplification helps maintain the tractability of the model. Second, and more importantly, while we acknowledge other factors that could affect the economic structure across regions, our focus is on the role of bank expertise in funding incumbent firms rather than new entrants. This is because newly established firms typically take time to accumulate sufficient creditworthiness to secure funding from banks, making them less likely to be affected in a few years following deregulation. By concentrating on incumbent firms, we can more effectively analyze the implications of bank expertise and funding dynamics in the context of deregulation.

[17] For simplicity, we omit the time index t hereafter unless explicitly required.

randomly matching with bank b are expressed as:

$$\pi^i_{jb}(\omega) = \max_{k^i_j} q^i_{jb}(\omega)\Big[P^i_j A^i_j - r^i_{jb}(\omega)\Big]k^i_j + P^i_j A^i_j \underline{k}^i_j, \tag{6}$$

The profits obtained by firm ω consist of two components. The first component, represented by the first term in Equation (6), captures profits from production expansion, conditional on a successful match with a bank. The second component reflects profits generated by utilizing the firm's initial endowment for production. Given the intermediate good price P^i_j and the loan rate r^{ib}_j, it is straightforward to show that $k^i_j = \overline{k}^i_j - \underline{k}^i_j$ if $P^i_j A^i_j > r^i_{jb}(\omega)$, and $k^i_j = 0$ otherwise. Moreover, following Train (2009), we assume that the value of firm ω, when borrowing from bank b, is subject to an idiosyncratic preference shock $z^i_{jb}(\omega)$, so that the value can be expressed as:[18]

$$v^i_{jb}(\omega) = \pi^i_{jb}(\omega) + z^i_{jb}(\omega), \tag{7}$$

where $\pi^i_{jb}(\omega)$ is as defined in Equation (6) and $z^i_{jb}(\omega)$ represents the idiosyncratic factors affecting firm ω's decision to select bank b. These factors may include, for instance, unobserved connections to bank officers or other firm-specific preference on banks.[19] We assume that z^i_{jb} is independently and identically distributed across banks and follows a Type I extreme value distribution, with the cumulative distribution function:

$$\mathbf{F}(z) = \mathbf{Pr}[z^i_{jb}(\omega) \leq z] = exp\left[-exp(-z/\sigma)\right] \tag{8}$$

where σ is the scale parameter. When $\sigma > 0$, each bank is a differentiated lender. In contrast, when $\sigma = 0$, firms are indifferent among banks and select the one that maximizes their expected profit, $\pi^i_{jb}(\omega)$.

Moreover, the firm ω is free to search for any bank on the island and chooses the bank that provides the highest value among all banks on island i available for sector j, denoted by the set $\mathbf{B}^i_j$. The value of this choice can be expressed as:

$$v^i_j(\omega) = \max_{b \in \mathbf{B}^i_j} v^i_{jb}(\omega), \tag{9}$$

where $v^i_{jb}(\omega)$ is defined in Equation (7). Thus, the probability that the firm ω chooses the bank b is given by:

$$n^i_{jb}(\omega) = \mathbf{Pr}[v^i_{jb}(\omega) = v^i_j(\omega)]. \tag{10}$$

It is noteworthy that the introduction of such idiosyncratic factors generates a non-trivial

[18] Our theoretical result remain qualitatively the same without adding the idiosyncratic preference shock.

[19] For a discussion on relationship lending, see Bernanke (1983), James (1987), Petersen and Rajan (1994, 1995), Berger and Udell (1995), and Degryse and Ongena (2005).

allocation of resources across the two sectors on both islands, which we will use for our calibration exercise.

4.2 Banks

Suppose that initially, each bank b on island $i \in \{h, g\}$ operates two loan departments: one allocating funds to the service sector and the other to the manufacturing sector. Each department hires loan officers to identify potential firms for financing. Let $l^i_{jb}(\omega)$ denote the number of loan officers hired by bank b to search for firm ω in sector j on island i. By the law of large numbers, Equation (10) implies the number of type-ω firms in sector j on island i that choose bank b for funding is given by $n^i_{jb}(\omega)$. Suppose that the total number of matches is determined by the function $\mathbf{m}_{jb}\left(n^i_{jb}(\omega), l^i_{jb}(\omega)\right)$, which is assumed to be constant returns to scale and be twice differentiable and concave in both arguments. Furthermore, as detailed in Section 5, bank expertise is characterized by a parameter within this matching function, which governs the degree of matching frictions. Thus, the matching probability between bank b and any firm ω in sector j is given by

$$q^i_{jb}(\omega) = \mathbf{q}_{jb}\left(n^i_{jb}(\omega), l^i_{jb}(\omega)\right) = \frac{\mathbf{m}_{jb}\left(n^i_{jb}(\omega), l^i_{jb}(\omega)\right)}{n^i_{jb}(\omega)}. \tag{11}$$

where $\mathbf{q}_{jb}(\cdot,\cdot)$ is the function for matching probability. We define $\theta^i_{jb}(\omega) = l^i_{jb}(\omega)/n^i_{jb}(\omega)$ the credit market tightness. Clearly, hiring more loan officers increases the matching probability (q). In this sense, the search conducted by banks is directed, while the random matching friction occurs between loan officers and firms. This friction arises after firms arrive at a bank's office. Also, Equation (11) implies that bank b affects the probability (n) of firm ω choosing it through two channels: the loan rate $r^i_{jb}(\omega)$ and the number of loan officers posted $l^i_{jb}(\omega)$. Firms are more likely to select a bank that offers a lower loan rate, as this allows them to retain higher profits, or a bank that employs more loan officers, as this increases the likelihood of a successful match.

The bank takes deposits from households in a competitive deposit market, taking the deposit rate r as given. It then lends to matched firms and charges them a loan rate. Given the deposit rate r and the wage of loan officers W^i, bank b chooses the loan rate $r^i_{jb}(\omega)$ and the number of loan officers $l^i_{jb}(\omega)$ to maximize its expected profits from lending to matched firms on both islands (after entry) as:

$$\max_{r^i_{jb}(\omega), l^i_{jb}(\omega)} \sum_i \sum_{j\in\{s,m\}} \psi^i_{jb}, \text{ s.t. } \psi^i_{jb} = \int_0^1 \left[\mathbf{m}_{jb}\left(n^i_{jb}(\omega), l^i_{jb}(\omega)\right)\left(r^i_{jb}(\omega) - r\right)k^i_j - W^i l^i_{jb}(\omega)\right] \mathbf{d}\omega \text{ and Eq (10)} \tag{12}$$

Here, W^i is the same across both sectors on island i. ψ^i_{sb} and ψ^i_{mb} denote the profits of

the service and manufacturing loan departments, respectively, of bank b. The departments' expected profits are determined by the premium it charges to matched firms, net of the labor costs associated with hiring loan officers. The producers' equilibrium outside option v_j^i is similar to the market utility in a standard directed search model. However, unlike in standard models, banks here do not take market utility as given. Due to the finite number of banks, they possess market power and recognize that their choices of loan rates and loan officer demand affect the market utility. Nevertheless, because the number of islands of each type is large, the labor market for loan officers remains competitive.

Bank entry decision and deregulation

As we will demonstrate later, banks of the same type choose identical numbers of loan officers and loan rates in equilibrium. Therefore, we replace bank index b with $b \in \{h, g\}$ when the subscript indicates the location from which the owner banks originate, whereas the superscript of a variable denotes the location where the department operates. Thus, let $M_{jg}^h(M_{jh}^g)$ denote the number of loan department j on island $h(g)$ that are subsequently acquired by guest-island (home-island) banks. Likewise, M_{jh}^h (M_{jg}^g) represents the number of loan department j on island $h(g)$ operated by banks originating from the same island. In this case, the set of loan department j on island $h(g)$, denoted as $\mathbf{B}_j^h(\mathbf{B}_j^g)$, consists of M_{jh}^h (M_{jh}^g) departments owned by home-island banks and M_{jg}^h (M_{jg}^g) ones owned by guest-island banks.

The values of M_{jg}^h and M_{jh}^g are endogenous, as banks optimally decide whether to expand into the other island's credit market through merges and acquisitions (M&As). Note that M&As do not change the total number of banks or loan departments; rather, it changes ownership. Therefore, for any $j \in \{m, s\}$, the total number of loan departments on each island satisfies:

$$M^h = M_{jh}^h + M_{jg}^h \text{ and } M^g = M_{jg}^g + M_{jh}^g. \tag{13}$$

We assume that banks from one island can independently acquire either of the two departments of a bank on the other island rather than both simultaneously, allowing the remaining department to continue operating under its original ownership. Furthermore, the expertise of acquired banks is assumed to align with that of their acquirers.[20]

Suppose there are $M_{jg}^h - 1$ units of department j on island h that have already been acquired by guest-island banks, and bank b on the guest island is considering acquiring another loan department j owned by bank b' on the home island. To acquire this department, bank b needs to pay two types of costs. First, it makes a take-it-or-leave-it offer to

[20]This assumption is supported by empirical evidence from Paravisini, Rappoport and Schnabl (2023), who find that the expertise developed by acquiring banks prior to a merger is retained and transferred to the combined entity post-merger.

bank b' at a price of $\psi_{jh}^{h}\left(M_{jg}^{h}-1\right)$. This price equals to the profits that bank b' would have earned in the absence of this acquisition. Additionally, we assume that the acquisition incurs an entry cost $\tau^{h} \geq 0$, representing a deadweight cost that banks bear due to investments of time and resources required to enter a new market. Let $\psi_{jg}^{h}\left(M_{jg}^{h}\right)$ denote the profits that bank b can earn from the acquisition. Therefore, bank will choose to make the offer and proceed with the acquisition if and only if the net profits exceed the entry cost, i.e., $\psi_{jg}^{h}\left(M_{jg}^{h}\right)-\psi_{jh}^{h}\left(M_{jg}^{h}-1\right) \geq \tau^{h}$. Otherwise, it will not do so. Banks will continue entering the market through such acquisitions until the net profits from acquiring additional loan departments fall below the entry cost or until all loan departments on that island have been acquired.

This decision process applies symmetrically to home-island banks considering the acquisition of loan departments owned by guest-island banks, where the entry cost to the guest island is denoted as $\tau^{g} \geq 0$. Additionally, banks do not acquire other banks or loan departments on the same island, as they possess identical expertise and acquisitions entail entry costs.

Due to restrictions on banks' geographic expansion, we initially assume that the cost of entry into the counterpart island is infinite. Deregulation, which removes geographic restrictions, is modeled as a reduction in entry costs, which we will discuss in detail in Section 6.2. We define the penetration level on the home (guest) island as the proportion of loan departments on the home (guest) island that are operated by banks from the guest (home) island, relative to the total number of loan departments on that island. Specifically, for sector j, the penetration level on the home island is given by M_{jg}^{h}/M^{h}, and on the guest island by M_{jh}^{g}/M^{g}.

4.3 Final good firms

There is a representative final good firm on each island, i. The final good, Y^{i}, is produced as a bundle of two intermediate inputs—one from the service sector and one from the manufacturing sector—according to the following equation:

$$Y^{i}=\left(\left(\alpha_{s}^{i}\right)^{\frac{1}{\eta}}\left(Y_{s}^{i}\right)^{\frac{\eta-1}{\eta}}+\left(\alpha_{m}^{i}\right)^{\frac{1}{\eta}}\left(Y_{m}^{i}\right)^{\frac{\eta-1}{\eta}}\right)^{\frac{\eta}{\eta-1}}, \tag{14}$$

where η measures the elasticity of substitution between the two intermediate goods, α_{s}^{i} denotes the share of inputs from the service sector, and α_{m}^{i} denotes the share of manufacturing inputs with $\alpha_{s}^{i}+\alpha_{m}^{i}=1$. The price of the final good is normalized to one. Given the prices of the intermediate goods, the final good firm selects Y_{m}^{i} and Y_{s}^{i} to maximize

its profits as:

$$\max_{Y_i^m, Y_i^s} \left(\left(\alpha_s^i\right)^{\frac{1}{\eta}} \left(Y_s^i\right)^{\frac{\eta-1}{\eta}} + \left(\alpha_m^i\right)^{\frac{1}{\eta}} \left(Y_m^i\right)^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}} - P_m^i Y_m^i - P_s^i Y_s^i, \tag{15}$$

where P_m^i and Y_s^i denote the prices of intermediate goods in the manufacturing and service sectors, respectively.

4.4 Representative households

There is a continuum of representative households, each endowed with an initial saving S_0^i at period 0. Then, each household chooses its consumption (C_t^i), labor supply as loan officers (L_t^i), and savings (S_{t+1}^i) to maximize utility, subject to a budget constraint:

$$\max_{C_t^i, S_{t+1}^i, L_t^i} \sum_{t=0}^{\infty} \beta^t \left[\ln(C_t^i) - \Psi \frac{\left(L_t^i\right)^{1+\phi}}{1+\phi} \right], \ s.t. \ C_t^i + S_{t+1}^i \leq (1 - \delta + r_t) S_t^i + W_t^i L_t^i + T_t^i, \tag{16}$$

where $\phi > 0$ determines the elasticity of labor supply, and T_t^i represents the total lump-sum transfer, including profits from banks and intermediate-good firms, as well as endowment transfers from households to intermediate-good firms.

5 Equilibrium characterization

In this section, we define the stationary equilibrium of the economy and outline the key properties of it.

Definition 1 (Stationary Equilibrium) *Given a sequence of productivity in the intermediate good $\{A_{jt}^i\}$ and sectors initial saving S_0^i on each island $i \in \{h, g\}$, a stationary equilibrium in the economy consists of a sequence of prices and rates $\left\{r_t, W_t^i, \left\{P_{jt}^i, r_{jbt}^i\right\}_{j\in\{m,s\}}\right\}$, a sequence of policy functions $\left\{C_t^i, L_t^i, S_{t+1}^i, T_t^i, Y_t^i, \left\{Y_{jt}^i, l_{jbt}^i, n_{jbt}^i, M_{jgt}^h, M_{jht}^g\right\}_{j\in\{m,s\}}\right\}$, a sequence of bank entry decisions $\left\{\mathbf{B}_j^i\right\}$, and a sequence of best responses $\left\{l_{jbt}^i(\omega), r_{jbt}^i(\omega)\right\}_{j\in\{m,s\}}$ for $i \in \{h, g\}$, such that, in period $t = 0, 1, 2, \ldots$, for each island i*

1. *Given the price of intermediate goods P_{jt}^i and loan rate $r_{jbt}^i(\omega)$, intermediate-good firm ω in sector j maximizes its expected profits as in Equation (6) and chooses a bank to maximize its value as in Equation (9).*

2. *Given the price of intermediate goods P_{jt}^i, the final good firm maximizes its expected profits as in Equation (15).*

3. *Given the wage W_t^i and deposit rate r_t, representative households maximize their utility as in Equation (16).*

4. *Banks choose the number of loan officers and loan rate to maximize their profits as in Equation (12). There is a fixed point such that $l_{jbt}^i = l_{jbt}^i(\omega)$ and $r_{jbt}^i = r_{jbt}^i(\omega)$.*

5. *Each bank of a given type is matched with an equal proportion of firms in sector j.*

6. *The following market-clearing conditions hold.*

   - *For the inter-bank lending market,*

$$\sum_{i\in\{h,g\}} S_t^i = \sum_{i\in\{h,g\}} \sum_{b\in\mathbf{B}_j^i} \sum_{j\in\{m,s\}} \mathbf{m}_{jb}\left(n_{jbt}^i, l_{jbt}^i\right)\left(\bar{k}_j^i - \underline{k}_j^i\right) + \sum_{j\in\{m,s\}} \underline{k}_j^i$$

   - *For the labor market for loan officers on island $i \in \{h,g\}$,*

$$L_t^i = \sum_{b\in\mathbf{B}_j^i} \sum_{j\in\{m,s\}} l_{jbt}^i$$

   - *For the intermediate good market of sector $j \in \{m,s\}$ on island $i \in \{h,g\}$,*

$$\sum_{b\in\mathbf{B}_j^i} n_{jbt}^i\left[\mathbf{q}_{jb}\left(n_{jbt}^i, l_{jbt}^i\right)A_j^i(\underline{k}_j^i + k_j^i) + \left(1 - \mathbf{q}_{jb}\left(n_{jbt}^i, l_{jbt}^i\right)\right)A_j^i\underline{k}_j^i\right] = Y_j^i$$

7. *The numbers of loan departments for each department j are determined by*

$$M_{jgt}^h = \max\left\{M_{jgt}^h : \psi_{jg}^h\left(M_{jgt}^h\right) - \psi_{jh}^h\left(M_{jgt}^h - 1\right) \geq \tau^h\right\} \tag{17}$$

$$M_{jht}^g = \max\left\{M_{jht}^g : \psi_{jh}^g\left(M_{jht}^g\right) - \psi_{jg}^g\left(M_{jht}^g - 1\right) \geq \tau^g\right\} \tag{18}$$

To derive an explicit solution, we specify the matching function as an urn-ball form:

$$\mathbf{m}(n,l) = \frac{l(1-\exp(-\xi n/l))}{\xi}, \tag{19}$$

where ξ is a parameter that governs matching frictions. A larger value of ξ indicates higher matching frictions. In the extreme case where $\xi = 0$, the search market becomes frictionless. The parameter ξ_{jb} represents the matching frictions between producers in sector j and bank b. Subsequently, we utilize this parameter to reflect the expertise banks developed from their home island. For instance, if a home-island bank specializes in the service sector, its matching friction with service-sector firms should be lower than with manufacturing-sector firms, i.e., of $\xi_{sh} < \xi_{mh}$. Furthermore, the matching probability is

given by:

$$\mathbf{q}(n,l) = \frac{l}{n}\frac{1-\exp(-\xi n/l)}{\xi}. \tag{20}$$

The urn-ball functional form has the advantage of ensuring that the matching probability remains less than 1, even in a discrete time setting. For any given level of credit market tightness (θ), a reduction in matching friction (ξ) results in a higher matching probability.

Without loss of generality, we assume that banks originally operating on the home island have a comparative advantage in evaluating projects in the service sector, such that $\xi_{sh} < \xi_{mh}$, whereas banks on the guest island are more proficient at screening projects in the manufacturing sector, implying $\xi_{mg} < \xi_{sg}$. Lemma 1 summarizes the convergence of economic structure after deregulation in the homogeneous case.

Lemma 1 (Banking deregulation and economic structure) *Assume that the two sectors on both islands are homogeneous, i.e.,* $A^i_j = A$, $\alpha^i_m = \alpha^i_s$, $\overline{k}^i_j = \overline{k}$, *and* $\underline{k}^i_j = \underline{k}$ *for* $\forall\ j \in \{m,s\}$ *and* $i \in \{h,g\}$, *and the entry costs are zero on both islands, i.e.,* $\tau^h = \tau^g = 0$, *except for the search efficiencies, where* $\xi_{sh} < \xi_{mh}$ *and* $\xi_{sg} > \xi_{mg}$. *Assume* $\sigma = 0$. *Before deregulation, the home island is dominated by the service sector, while the guest island is dominated by the manufacturing sector, i.e.,*

$$Y^h_s/Y^h_m > Y^g_s/Y^g_m \tag{21}$$

After deregulation, if the penetration level is symmetric across the two islands (banking structures are the same), the economic structure will be the same across the two islands, i.e.,

$$Y^h_s/Y^h_m = Y^g_s/Y^g_m \tag{22}$$

The assumption of $\sigma = 0$ implies that idiosyncratic preferences do not affect firm behavior, leading all firms to choose the bank that maximizes their expected profit. Lemma 1 indicates that before banking deregulation, the home island is dominated by the service sector, while the guest island is dominated by the manufacturing sector. This arises because home-island banks are more proficient in financing service producers, whereas guest-island banks specialize in funding manufacturing producers. Post-deregulation, banks from the other island introduce new matching technologies. If banking structures are identical across both islands, their economic structures will fully converge. Here, as the penetration levels are exogenous, Lemma 1 is a partial equilibrium result. In our quantitative analysis, we endogenize penetration levels and show that when entry costs on both islands are sufficiently small, all service (manufacturing) departments on the guest (home) island are replaced by home (guest) island banks, ultimately leading to identical banking structures across the two islands.

6 Quantitative analysis

In this section, we first calibrate and estimate key parameters to match empirical moments from the U.S. data. We then analyze the effects of banking deregulation on the convergence of economic structures, modeling deregulation explicitly as a reduction in entry costs. Finally, we determine the socially optimal penetration level and analyze the corresponding welfare implications.

6.1 Parameterization

One period in the model corresponds to one year. We first discuss the calibration of the parameters that can have values commonly used in the literature or be directly pinned down from the data. Next, we discuss the estimation of the remaining parameters. The full set of model parameters is

$$\left\{\beta,\ \Psi,\ \phi,\ \eta,\ \delta,\ \sigma,\ \underline{k}_j^i,\ \bar{k}_j^i,\ M^i,\ \left\{\alpha_j^i\right\},\ \left\{\tau^i\right\},\ \left\{\xi_{jb}\right\},\left\{A_j^i\right\}\right\}.$$

Table 5 reports their calibrated or estimated values.

Calibration

First, we calibrate the parameters $\left\{\beta,\ \Psi,\ \phi,\ \eta,\ \delta,\ \sigma,\ \underline{k}_j^i,\ \bar{k}_j^i,\ M^i,\ \left\{\alpha_j^i\right\},\ \left\{\tau^i\right\}\right\}$. Following Galí and Monacelli (2005) and Christiano, Eichenbaum and Evans (2005), the discount factor β per year is calibrated at 0.96, which implies a risk-free annual rate of 4% in the steady state. δ is set to be 10%, which correspond to annual deprecation rate at 10%. We set the parameters of labor disutility $\Psi = 1.75$, the inverse Frisch elasticity of labor supply $\phi = 0.2$, and the elasticity of substitution between two intermediate goods $\eta = 4$. These values are within the range of values typically used in the literature.

The total number of banks on each island, denoted as M^i, is set to 9. This value corresponds to the median number of BHCs at the county level in 1981. The endowments of intermediate-good firms for both sectors on both islands, $\underline{k}_j^i$, are normalized to 1. The model-implied leverage ratio, defined as the debt-to-asset ratio $(\bar{k}_j^i - \underline{k}_j^i)/\bar{k}_j^i$, is set to 58.3%, corresponding to the median leverage ratio of publicly listed firms in the manufacturing and service sectors between 1972 and 1981. Thus, the production capacity for intermediate-good firms $(\bar{k}_j^i)$ is set to 2.4. The sectoral shares for services (α_s^i) and manufacturing (α_m^i) are calibrated to 0.48 and 0.52, respectively. These values reflect the average relative value-added shares of the two sectors in the U.S. economy between 1972 and 1981.[21] Following Corbae and D'Erasmo (2021) and Wang, Whited, Wu and

[21] For further details on the classification of service and manufacturing industries, refer to Appendix A.2.

Table 5
Parameter values

Panel A: commonly used values

	Name	Value
β	discount rate	0.96
δ	depreciation rate	0.1
Ψ	labor disutility	1.75
ϕ	inverse Frisch elasticity of labor supply	0.2
η	elasticity of substitution	4

Panel B: calibrated parameters

	Name	Value	Target
M^i	number of banks	9	medium number of BHCs at county level in 1981
α_s^i	share of service inputs	0.48	average value-added share of service industries in the US between 1972 and 1981
α_m^i	share of intermediate inputs	0.52	average value-added share of manufacturing industries in the US between 1972 and 1981
$\bar{k}_j^i$	production capacity for intermediate firms	2.4	medium leverage ratio for publicly listed firms between 1972 and 1981
$\underline{k}_j^i$	capital endowment for intermediate firms	1	normalization
σ	scalar for distribution of firm-bank specific factor	1	normalization
τ^h	entry cost for acquiring loan department on home island	10^{10}	no penetration due to regulation
τ^g	entry cost for acquiring loan department on guest island	10^{10}	no penetration due to regulation

Panel C: estimated parameters

	Name	Value
ξ_{sh}	match frictions for service firms on home island	0.00785
ξ_{mh}	match frictions for manufacturing firms on home island	0.00914
ξ_{sg}	match frictions for service firms on guest island	0.00915
ξ_{mg}	match frictions for manufacturing firms on home island	0.00273
A_s^h	productivity for service firms on home island	8.53
A_m^h	productivity for manufacturing firms on home island	3.41
A_s^g	productivity for service firm on guest island	6.76
A_m^g	productivity for manufacturing firms on guest island	9.02

Xiao (2022), the scalar (σ) governing the distribution of the firm-bank-specific factor is normalized to 1. Additionally, we set banks' entry cost to the counterpart island to a sufficiently large number (10^{10}) to ensure that banks on one island never enter the other before deregulation.

Estimation

We estimate the island-by-sector productivity (A_j^i) and sector-by-bank match frictions (ξ_{jb}) by matching key empirical moments observed prior to the interstate banking deregulation of the 1980s. Without loss of generality, we assume that the home island is service-dominated, while the guest island is manufacturing-dominated. Accordingly, we classify the 46 U.S. states in our empirical sample into three groups: service-dominated, manufacturing-dominated, and other states. A state is classified as service-dominated if its average service sector share between 1972 and 1981 is in the top tercile across all

states, with a cutoff threshold of 51.5%. Likewise, a state is classified as manufacturing-dominated if its average manufacturing sector share over the same period falls within the top tercile across all states, with a cutoff threshold of 59.8%.

For each state group, we choose four groups of moments: (1) the ratio of manufacturing firms' profits to banks' profits; (2) the ratio of service firms' profits to banks' profits; (3) the ratio of wages paid by banks to bank profits; and (4) the ratio of bank loans to the service sector relative to those to the manufacturing sector.

In our model, the first two moments are derived by aggregating the profits of individual manufacturing or service firms, as defined in Equation (6), scaled by the summation of the profits of individual banks, as specified in Equation (12). In the third moment, the wage rate paid by banks is determined by the labor market-clearing condition. To establish the empirical counterparts for these three moments, we utilize operational surplus and compensation data from 1972 to 1981, based on state-by-sector GDP breakdowns provided by the BEA. The average empirical ratios for these three moments over the period 1972–1981 are 2.75, 6.26, and 0.70 in service-dominated states, compared to 7.47, 5.38, and 0.76 in manufacturing-dominated states.

To calculate the ratio of bank loans to the service sector relative to those to the manufacturing sector, we aggregate loans $\overline{k}_j^i - \underline{k}_j^i$ across all matched firms for each sector j on each island i. Since state-level bank loan data is not publicly available, we rely on Compustat to compute this ratio for each state group (service-dominated states and manufacturing states). Given that firms within each sector on each island are ex ante identical in our model, we first scale total liabilities by capital expenditure—referred to as adjusted liabilities—to account for size effects. For each firm, we calculate the average of these adjusted liabilities over the period from 1972 to 1981. Next, for each state group, we compute the average adjusted liabilities across all firms in the manufacturing and service sectors, respectively.[22] Finally, we compute the ratio of bank loans to the service sector relative to those to the manufacturing sector for each state group. The results show ratios of 1.06 for service-dominated states and 0.93 for manufacturing-dominated states.

We employ the method of moments to minimize the following criterion:

$$\min_{\{A_j^i\},\{\xi_{jb}\}} \sum_m (\text{model}(m) - \text{data}(m))^2, \tag{23}$$

where m indexes the mth moment, model(m) is mth model-generated moment, and data(m) is mth data moment. Our estimation shows that, on each island, productivity and matching frictions are consistent with their assumed comparative advantages. Specifically, the home island exhibits higher productivity and lower matching frictions in the service sector compared to the manufacturing sector, while the guest island shows the opposite pat-

[22] The state in which each firm was incorporated in 1981 is used to determine its location.

Table 6

Model fitness: targeted and untargeted moments

Panel A: targeted moments		
Moments	**Model**	**Data**
Ratio of manufacturing firms' profits to banks' profits on home island	2.75	2.75
Ratio of service firms' profits to banks' profits on home island	6.26	6.26
Ratio of wages paid by banks to bank profits on home island	0.70	0.70
Ratio of bank loans to service firms relative to those to the manufacturing firms on home island	1.06	1.06
Ratio of manufacturing firms' profits to banks' profits on guest island	7.45	7.45
Ratio of service firms' profits to banks' profits on guest island	5.38	5.38
Ratio of wages paid by banks to bank profits on guest island	0.76	0.76
Ratio of bank loans to service firms relative to those to the manufacturing firms on guest island	0.93	0.93
Fraction of out-of-state BHCs on home island after deregulation	31.88%	33.33%
Fraction of out-of-state BHCs on guest island after deregulation	9.12%	11.11%
Panel B: untargeted moments		
Moments	**Model**	**Data**
Pre-deregulation Manhattan distance between home and guest island	0.605	0.535

tern, with higher productivity and lower matching frictions in the manufacturing sector relative to the service sector. Furthermore, the home island has an absolute advantage in the service sector, and the guest island has an absolute advantage in the manufacturing sector, as evidenced by their higher productivity and lowers matching frictions compared to their counterpart islands.

Goodness of fit

Panel A of Table 6 presents the targeted moments from our estimation, demonstrating a strong fit with the empirical moments. To validate the empirical findings in Section 3, we also calculate the pairwise Manhattan distance between states based on their two-sector economies (manufacturing and service). For state pairs where one state is manufacturing-dominated and the other is service-dominated, the average distance declines from 0.535 in 1982 to 0.460 in 1993. As shown in Panel B of Table 6, our model predicts a distance of 0.605, which is slightly larger than the empirical value.

We further test Equation (3) by incorporating an interaction term between the deregulation indicator and a dummy variable, which equals one if one state is manufacturing-dominated and the other is service-dominated, and zero otherwise. The point estimate for the deregulation indicator is negative but not statistically significant. In contrast, the coefficient of the interaction term is -0.0157 and statistically significant at the 99.9% confidence level. Compared to the pre-deregulation Manhattan distance, deregulation leads to a 2.93% decline in the distance of economic structure. This decline is more than twice the observed annual average decline in Manhattan distance between 1982 and 1993.

6.2 Counterfactual: deregulation and its effect on economic structure

In our benchmark calibration, the entry costs for both islands are set at a level that restricts banks from operating across islands. To simulate the effects of interstate banking deregulation, we reduce these entry costs, and examine its effects on economic structure.

Counterfactual entry cost

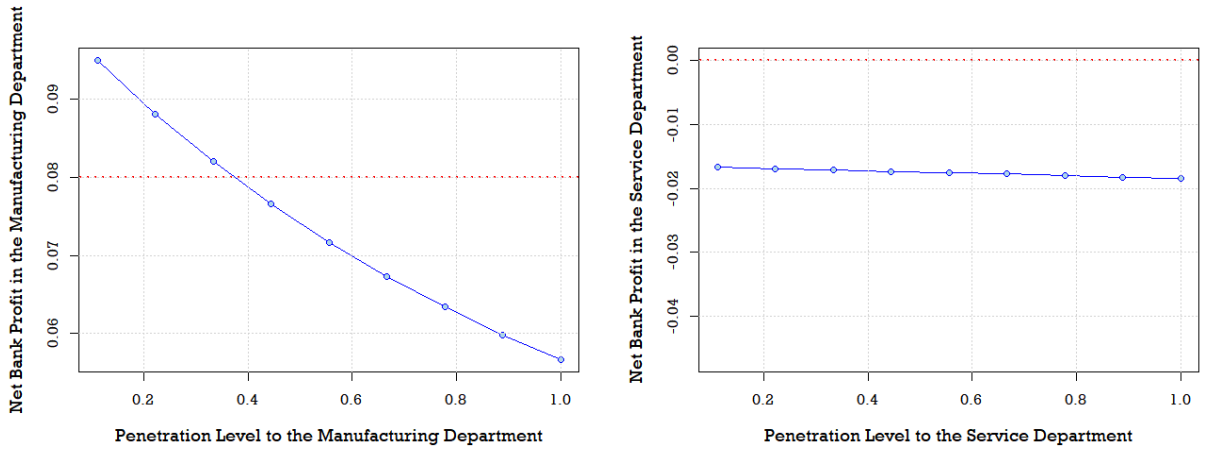
To guide our estimation for counterfactual entry costs, we first examine the relationship between market penetration levels and the net profits that a bank can generate by acquiring a loan department on the counterpart island. Without loss of generality, we focus our analysis on the home island, where banks possess a comparative advantage in evaluating projects in the service sector.

Panel (a) of Figure 3 displays the net profits that banks from the guest island can earn by acquiring the next manufacturing loan department on the home island, conditional on varying market penetration levels. Since in our baseline calibration, banks on the guest island hold an absolute advantage in matching efficiency with manufacturing firms—compared to their counterparts on the home island—their net profits remain positive across all penetration levels. However, as more departments are acquired by guest-island banks, their net profits decline due to heightened competition, which diminishes their market power.

In contrast, Panel (b) of Figure 3 demonstrates that the net profits from acquiring service loan departments remain negative across all penetration levels. It is because that under our baseline calibration, home-island banks possess an absolute advantage in matching efficiency with service-sector firms compared to the guest-island banks. Thus, banks from the home island retain full control over their service loan departments.

Therefore, in our counterfactual exercise, we adjust the banks' entry costs to match the penetration levels on each island to the observed share of out-of-state BHCs in 1993 for each corresponding state group. In particular, following the methodology outlined in Section 3.3, we designate the state in which a BHC operated in 1981 as its home state. We then calculate the share of out-of-state BHCs in each state as a proportion of the total number of BHCs in that state and compute the average share across states within each state group in 1993. The observed share of out-of-state BHCs is 31.88% for service-dominated states and 9.12% for manufacturing-dominated states.[23] To match these shares, we reduce the entry cost to $\tau^h = 0.08$ for the home island, and to $\tau^g = 0.0203$

[23] Given that the number of banks must be an integer, the model-implied penetration rates are 33.3% for the home island and 11.1% for the guest island. To estimate the post-deregulation entry cost, we first identify the range of entry costs for which Equations (17) and (18) hold at $M^h_{mg} = 3$ and $M^g_{sh} = 1$. We then take the median point of this range as the estimated value of τ after deregulation. Choosing other values within this range would not change our main results.



(a) Acquiring manufacturing department (b) Acquiring services department

Notes: The figure plots the net profits of guest-island banks from acquiring a department on the home island, $\psi_{jg}^{h}\left(M_{jg}^{h}\right) - \psi_{jh}^{h}\left(M_{jg}^{h}-1\right)$, as a function of the penetration level M_{jg}^{h}/M^{h}, for $j \in \{m,s\}$. Banks continue to enter as long as $\psi_{jg}^{h}\left(M_{jg}^{h}\right) - \psi_{jh}^{h}\left(M_{jg}^{h}-1\right) \geq \tau^{h}$. Panel (a) illustrates how such net profits evolve across different penetration levels in the manufacturing sector, while panel (b) presents the corresponding value for the service sector.

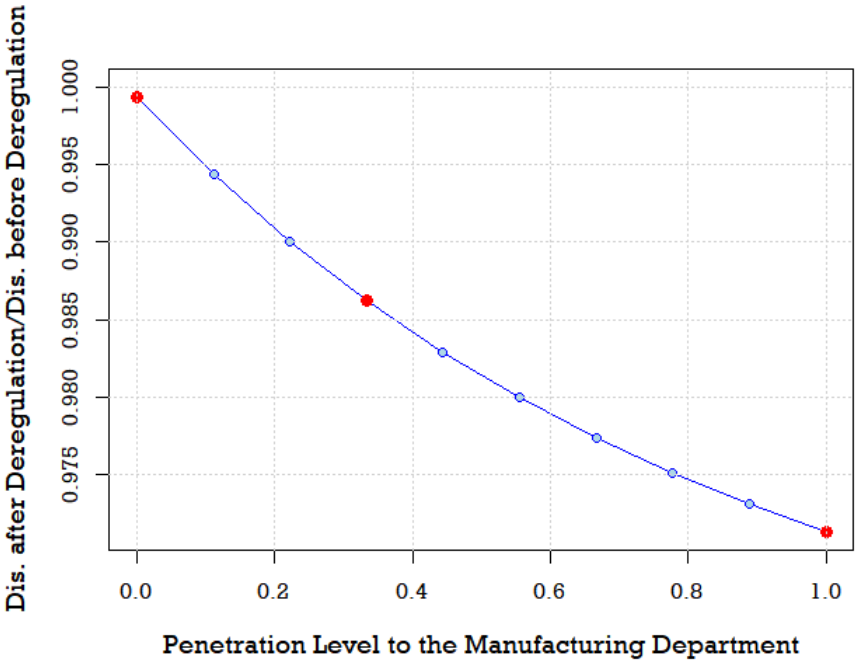
Figure 3
Bet profits of acquiring loan departments on the home island

for the guest island.

Implication on economic structure

We examine the effects of reduced entry costs, followed by deregulation, on the economic structures of the two islands. Consistent with our empirical findings, we quantify the similarity of economic structures using the Manhattan distance. To assess structural changes before and after deregulation, we define the *relative distance ratio* as the post-deregulation distance relative to the pre-deregulation distance. Figure 4 displays the relationship between the relative distance ratio and the given penetration level of guest-island banks into the manufacturing loan market on the home island, under the condition that the entry cost for home-island banks to access the guest island is reduced to 0.0203.

Notably, all relative distance ratios are below one, indicating that post-deregulation, the economic structures of the two islands converge regardless of the given penetration level. Three key points in Figure 4, marked in red, warrant particular attention. We first consider two extreme cases. First, when the post-deregulation penetration level is zero—potentially due to sufficiently high entry costs—the economic structure of the home island remains unchanged. Meanwhile, the guest island undergoes a shift toward the service sector, as home-island banks acquire one service loan department on the guest



Notes: The figure displays the relationship between the relative distance ratio, defined as the ratio of the Manhattan distance after deregulation relative to that before deregulation, and the given penetration level of guest-island banks into the manufacturing loan market on the home island. Three red points highlight key benchmark ratios: the upper-left point corresponds to the relative distance ratio when the penetration level is zero, while the lower-right point represents this ratio when the penetration level is equal to one. The middle point reflects the ratio derived from our counterfactual analysis, where $\tau^h = 0.08$. In all exercises, we assume that the entry cost to the guest island is 0.0203.

Figure 4

Effects of penetration level on convergence of economic structure

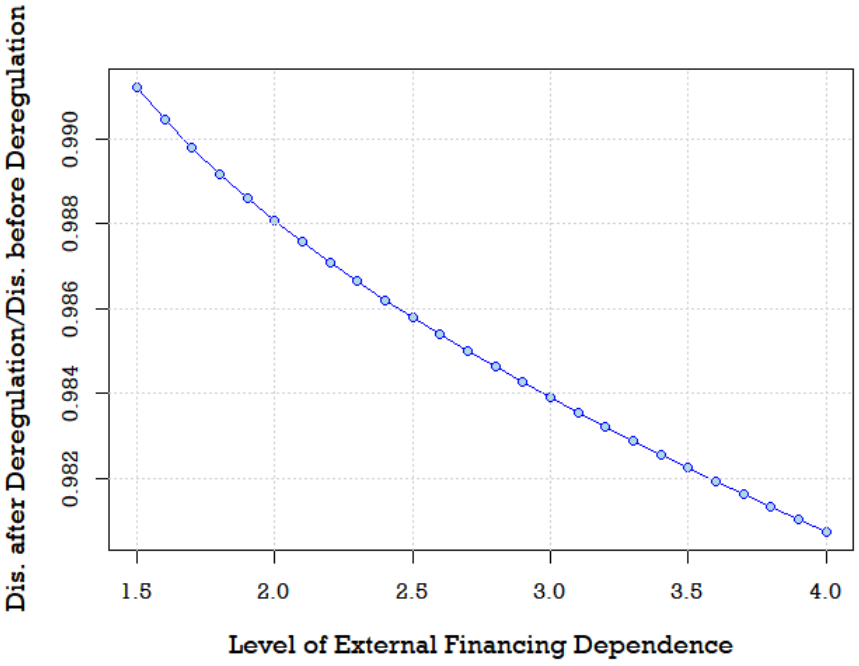
island. The economic structures of the two islands still exhibit convergence, as illustrated by the upper-left point in Figure 4. Convergence becomes more pronounced as guest-island banks acquire more manufacturing loan departments. At the other extreme, when entry costs are sufficiently low to enable full acquisition of manufacturing loan departments, the Manhattan distance between the two islands decreases by 2.87% relative to the calibrated baseline.

Finally, using the estimated reduction in entry costs for guest-island banks to enter the home market ($\tau^h = 0.08$), we find that three manufacturing loan departments are acquired by guest-island banks, resulting in a penetration level of 33.3%. In this case, the Manhattan distance between the two islands decreases by 1.38%, accounting for approximately half of the estimated convergence of economic structures between the service- and manufacturing-dominated states following deregulation. The remaining difference may be attributed to other factors, such that labor or firm mobility between the islands after deregulation.

Effect of external finance dependence

Next, we examine how the post-deregulation convergence of economic structures depends on producers' dependence on external finance. In the spirit of Rajan and Zingales (1998), we measure external finance dependence using the ratio of production capacity to producers' endowment, $\overline{k}_j^i/\underline{k}_j^i$. As the production capacity of intermediate goods producers rises, their borrowing needs increase, making them more dependent on external finance.

Figure 5 shows the relationship between external finance dependence and the relative distance ratio after deregulation, where entry costs for banks on both islands are reduced to their counterfactual levels, i.e., $\tau^h = 0.08$ and $\tau^g = 0.0203$. The results indicate that as intermediate goods producers become more dependent on external finance, the economic structures of the two islands exhibit greater post-deregulation convergence. This finding is consistent with our empirical results in Section 3. Notably, if all intermediate goods producers were entirely self-financed, banking deregulation would have no impact on economic structure.



Notes: The figure displays the relationship between the external finance dependence and the relative distance ratio after deregulation. External finance dependence is measured by the ratio of production capacity to producers' endowment, $\overline{k}_j^i/\underline{k}_j^i$. The deregulation is model as reducing the entry cost for banks on both island to their corresponding counterfactual levels, i.e., $\tau^h = 0.08$ and $\tau^g = 0.0203$.

Figure 5

Effect of external finance dependence on convergence of economic structure

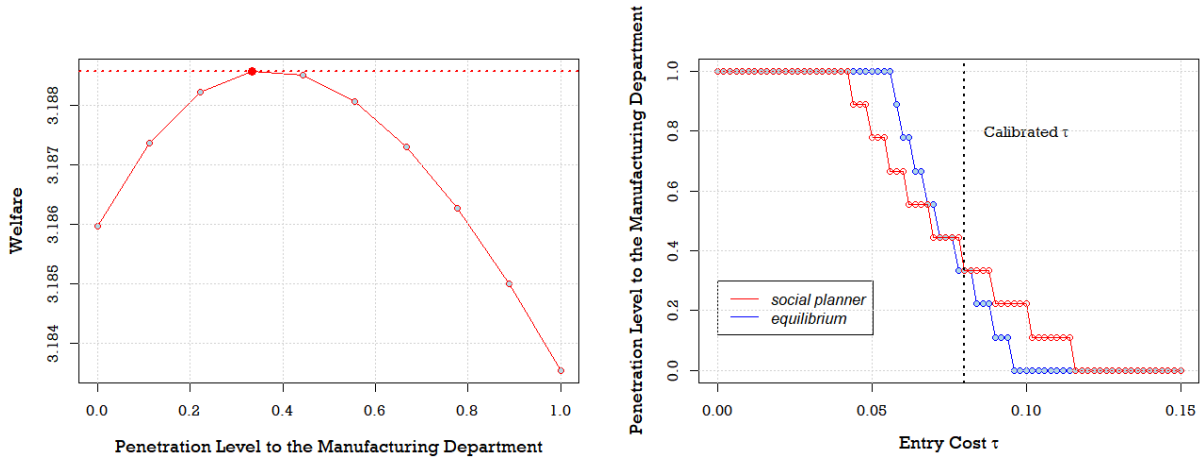
6.3 Socially optimal penetration level by banks and welfare

Finally, we examine the socially optimal level of bank entry and its welfare implications. We begin by assuming that a constrained social planner selects the optimal penetration level to maximize overall welfare on each island, which we define as the lifetime utility of the representative household on that island. In this framework, the number of banks entering the counterpart island—denoted as M_{jg}^{h} and M_{jh}^{g}—is no longer determined by individual banks' decisions, as specified in Equation (17) and (18). Instead, these penetration levels are chosen by the social planner. Importantly, even in the social planner's problem, banks continue to incur entry costs, which are deadweight losses, when penetrating the counterpart island.

Similar to the market equilibrium, the constrained social planner does not choose loan departments with an absolute advantage to be operated by banks from the counterpart island. Also, the social planner does not provide subsidies for such acquisitions, as these subsidies would merely reduce the matching probability in the affected sectors, leading to welfare losses. For instance, on the home island, the constrained social planner determines the number of manufacturing loan departments to be operated by guest-island banks while ensuring that service loan departments remain fully operated by home-island banks.

Panel (a) of Figure 6 displays that welfare on the home island exhibits a hump-shaped relationship as the given penetration level of manufacturing loan departments increases. The underlying intuition is as follows. The acquisition of manufacturing loan departments by guest-island banks generates two opposing effects. On the one hand, the presence of guest-island banks, which possess specialized expertise in manufacturing, enhances the likelihood that manufacturing firms on the home island successfully match with banks. This enhanced access to credit stimulates production and reduces the cost of manufacturing inputs, ultimately increasing final output and social welfare. On the other hand, as the social planner assigns additional manufacturing loan departments to guest-island banks, higher entry costs are incurred, reducing bank profits transferred to households and thereby reducing social welfare.

Since the matching probability exhibits decreasing return to scale, the marginal benefits of improved matching diminish as guest-island bank penetration into the manufacturing loan market increases. In contrast, the marginal costs of entry remain constant. At low penetration levels, the positive welfare effects from enhanced financing access dominate the entry costs, resulting in welfare gains. Welfare peaks when guest-island banks acquire three manufacturing loan departments; beyond this optimal point, additional entry generates costs that surpass the diminishing marginal benefits, resulting in decreased social welfare.



(a) Welfare

(b) Penetration: market vs social planner

Notes: Panel (a) displays the relationship between social welfare and the penetration level of guest-island banks into the home manufacturing loan market. Panel (b) compares the penetration level in the market equilibrium with the socially optimal level across different values of entry costs.

Figure 6

Socially optimal penetration level and welfare implication

Next, we compare the penetration level in the market equilibrium with the socially optimal level across different values of entry costs. As shown in Panel (b) of Figure 6, when entry costs are sufficiently low, both guest-island banks and the constrained social planner choose for full penetration, acquiring all manufacturing loan departments on the home island. Conversely, when entry costs are sufficiently high, no penetration occurs in either case.

For moderate entry costs, specifically when $\tau^h \in [0.044, 0.076]$ ($\tau^h \in (0.076, 0.114]$), guest-island banks tend to over-penetrate (under-penetrate) into the home-island manufacturing loan market. Under our calibration of $\tau^h = 0.08$, guest-island banks are in fact under-penetrated, even though the observed penetration level appears socially optimal in Panel (a) of Figure 6. This discrepancy arises because the model requires the number of banks to be an integer, causing the relationship between entry costs and penetration levels to follow a stepwise function. A potential remedy for this issue is to introduce mixed strategies, wherein each bank enters with a certain probability. This approach would allow penetration levels to adjust more smoothly rather than discretely.

We now examine why guest-island banks in the market equilibrium select a penetration level that differs from the socially optimal one. Specifically, the number of manufacturing loan departments acquired by guest-island banks is determined by Equation (17),

whereas the social planner's penetration decision is governed by the following conditions:

$$\underbrace{\left(P_s^h A_s^h - r\right)\Delta\left(M^h S_{sh}^h\right) + \left(P_m^h A_m^h - r\right)\Delta\left(M_{mh}^h S_{mh}^h + M_{mg}^h S_{mg}^h\right)}_{\text{reallocation of loans}}$$
$$- W^h\left(l_{mg}^h - l_{mh}^h + \underbrace{M^h \Delta l_{sh}^h + M_{mh}^h \Delta l_{mh}^h + M_{mg}^h \Delta l_{mg}^h}_{\text{effect on hiring by other banks}}\right) - \tau^h \geq 0 \tag{24}$$

where P_j^h, W^h, and S_{jb}^h represent the price of intermediate good j, the wage, and the loan supply in each firm-bank pair, respectively. The term ΔX captures the change in the corresponding variable X when the number of manufacturing loan departments assigned to guest-island banks by the social planner increases from $M_{mg}^h - 1$ to M_{mg}^h. The social planner's decision differs from individual banks' entry decisions in three key aspects. First, the social planner explicitly considers loan reallocation both within and across sectors, captured by the first term in Equation (24). Second, the planner focuses solely on the total surplus jointly generated by manufacturing firms and banks, without regard to its distribution between the two parties. Third, the social planner incorporates the effects of additional entry on labor demand by home-island banks and incumbent guest-island banks. Equation (24) implies that entry occurs when the net marginal production return from matched manufacturing and service firms exceeds the marginal wage costs and entry costs.

Deviations from the socially optimal penetration level arise primarily for two forces. First, guest-island banks have higher matching efficiency (a lower ξ) with manufacturing firms compared to home-island banks. Banks set loan rates such that the price elasticity of loans per officer, defined as $-\mathbf{d}\ln(k\mathbf{q}(\theta)/\theta)/\mathbf{d}\ln(r_{jb}^i - r)$, equals one in equilibrium. When a guest-island bank finds it profitable to acquire a manufacturing loan department previously operated by a home-island bank, the elasticity of loans per officer for the guest-island bank exceeds one because the number of matches per officer ($\mathbf{q}(\theta)/\theta$) increases. Thus, this guest-island bank has an incentive to set a lower loan rate compared to the home-island bank, thereby enhancing its lending revenue. However, when selecting the number of guest-island banks penetrating into the home island, the social planner focuses exclusively on maximizing the total surplus jointly generated by manufacturing firms and banks, disregarding how this surplus is allocated between them. Therefore, this pricing effect incentivizes banks to over-penetrate relative to the socially optimal level.

Second, the entry of additional guest-island banks increases the matching probability with manufacturing firms relative to home-island banks, thereby decreasing the proportion of manufacturing firms matched with home-island banks and incumbent guest-

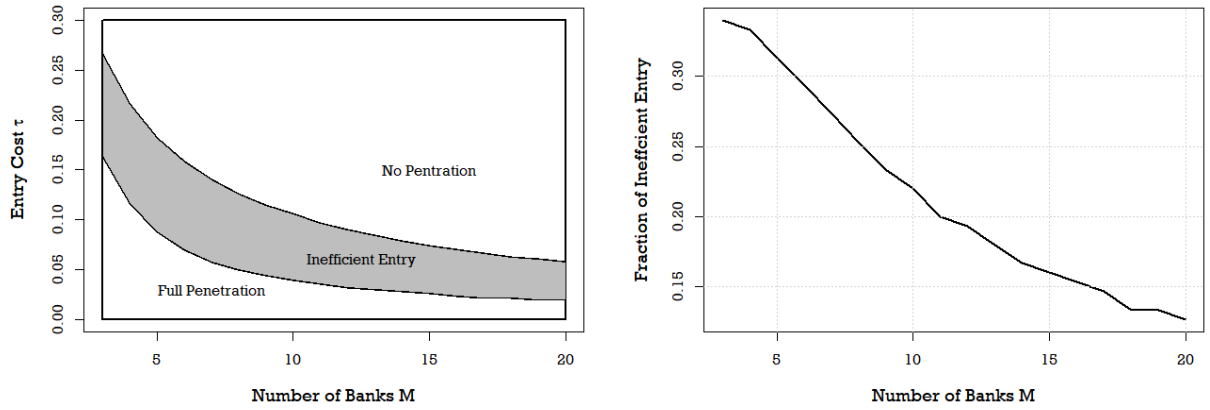
island banks. This displacement effect reduces the number of successful matches, diminishing profits and subsequently lowering these banks' labor demand. While a social planner internalizes this hiring externality, individual banks neglect it. Therefore, this hiring externality causes under-penetration, as it effectively decreases the labor costs for other banks.

These two forces operate simultaneously. Higher entry costs keep guest-land banks entering, increasing the pricing power and market share of each that successfully enters. As a result, both the pricing effect and the hiring externality increase with higher entry costs. Moreover, when entry costs are sufficiently low, guest-island banks dominate the manufacturing loan market, each capturing only a relatively small market share (n), which makes credit market tightness (θ) highly responsive to changes in loan rates. Meanwhile, as the guest-island bank's market share is small, the hiring externality is limited. In this case, the pricing effect is larger than the hiring externality, leading guest-island banks to over-penetrate the market. Conversely, when entry costs are sufficiently high, the number of guest-island banks is low, further limiting the response of credit market tightness to loan rate changes. Meanwhile, the hire externality is large as the number of guest-island banks is small. In this case, the hiring externality dominates, resulting in guest-island banks under-penetrating relative to the socially optimal level. We define the range of entry costs that induce either under- or over-penetration as the *inefficient entry region*.

Inefficiency entry and bank concentration

Furthermore, we investigate the relationship between inefficient entry region and bank concentration, defining concentration as the inverse of the total number of banks. As the number of banks rises, competition in the banking sector intensifies, thereby diminishing the pricing power of individual banks and reducing their profitability. As shown in Panel (a) of Figure 7, the thresholds for both full penetration and no penetration decrease with an increase in the total number of banks.

As the total number of banks increases, in addition to the diminishing pricing power, the no-penetration threshold is also affected by the declining market share, as the hiring externality dominates the pricing effect there. Therefore, this threshold declines more rapidly compared to the full-penetration threshold. Thus, as shown in Panel (b), the inefficient entry region narrows as the total number of banks increases.



(a) Inefficient entry region

(b) Fraction of inefficient entry

Notes: Panel (a) illustrates how inefficient entry regions evolve with varying numbers of banks M^h and entry costs τ^h. Panel (b) shows the relationship between the fraction of inefficient entry and bank market power, assuming τ a random draw from $U[0, 0.3]$.

Figure 7
Inefficient entry and bank concentration

7 Conclusion

This paper leverages the U.S. interstate banking deregulation of the 1980s as a quasi-natural experiment to explore the role of financial development in shaping economic structure. Our findings reveal that post-deregulation, the economic structures of non-financial sectors across states have become more similar. We highlight both theoretically and empirically that bankers' expertise in identifying productive projects is a crucial mechanism in this transformation. Deregulation facilitates the transfer of industry-specific knowledge across state borders, thereby shaping economic structures.

Supporting this channel, we present two key findings. First, when banks from a more financially developed state acquire a larger share of banks in another state, the economic structures of the two states converge more significantly. Second, the impact of bank deregulation on interstate structural convergence is amplified when producers are highly dependent on external finance. Our research suggests that policymakers should consider the regulatory framework of the financial sector to manage structural transformation and address economic inequality.

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A Details on data and measurement

To calculate the average Manhattan distance from 1972 to 1981, we first deflate all nominal industrial value-added series using the consumer price index (CPI) and then compute their average over the 1972–1981 period. Next, we calculate the industry share of these deflated value-added series for each state. Finally, for each pair of states, we use Equation (1) to compute the Manhattan distance, which represents the pre-deregulation distance. The average pre-deregulation distance is approximately 0.543, with a minimum value of 0.201 and a maximum value of 1.165. Figure A.1 displays the kernel density of the pre-deregulation distance, which is right-skewed with a fat right tail.

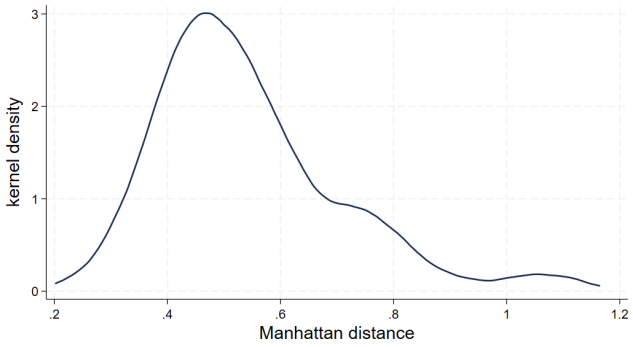


Figure A.1
Dynamic effects of interstate banking deregulation

We use data from the Call Report to compute the total loans issued in 1981 by banks operating in each state. We then calculate the state-level non-agricultural and non-financial institution (FI) private GDP for that year by summing the value-added series across all non-agricultural and non-FI private industries. The pre-deregulation loan-to-GDP ratio for each state is derived as the ratio of total loans to non-agricultural and non-FI private GDP. Table A.1 reports the pre-deregulation loan-to-GDP ratios for the 46 states in our sample.

We utilize data from the Summary of Deposits to identify the counties in which each bank operated branches in 1981. Our analysis focuses exclusively on commercial banks, excluding non-U.S. banks and branches with zero deposits. To measure banks' geographic expansion, we aggregate banks at the bank holding company (BHC) level. Notably, banks without BHC identifiers are treated as standalone BHCs, each owning a single bank. Out of 12,131 BHCs, only 15 operated across multiple states in 1981. We exclude these 15 BHCs and define the home state of each BHC as the state in which it operated in 1981. Subsequently, we track the out-of-state counties into which these BHCs expanded their operations in the following years. We then count the number of BHCs from a given state

Table A.1
STATE CHARACTERISTICS

State	Abbreviation	L-to-GDP$_s$	N$_s$	EFD$_s$
Alabama	AL	0.291	5	0.025
Arizona	AZ	0.331	4.5	0.080
Arkansas	AR	0.338	3	0.047
California	CA	0.505	7.5	0.082
Colorado	CO	0.268	3	0.089
Connecticut	CT	0.531	24	0.073
Florida	FL	0.260	4	0.072
Georgia	GA	0.256	2	0.031
Idaho	ID	0.376	3	0.015
Illinois	IL	0.662	8	0.062
Indiana	IN	0.329	4	0.045
Iowa	IA	0.407	7	0.042
Kansas	KS	0.344	5	0.065
Kentucky	KY	0.321	3	-0.021
Louisiana	LA	0.193	4	0.247
Maine	ME	0.455	8	0.015
Maryland	MD	0.289	8	0.049
Massachusetts	MA	0.548	20	0.086
Michigan	MI	0.314	5	0.028
Minnesota	MN	0.417	7	0.065
Mississippi	MS	0.335	3	0.052
Missouri	MO	0.377	5	0.052
Montana	MT	0.401	2	0.068
Nebraska	NE	0.447	4	0.049
Nevada	NV	0.208	2	0.029
New Hampshire	NH	0.469	11	0.060
New Jersey	NJ	0.304	19	0.057
New Mexico	NM	0.224	2.5	0.204
New York	NY	1.805	9	0.082
North Carolina	NC	0.257	4	-0.084
North Dakota	ND	0.365	3	0.134
Ohio	OH	0.260	6	0.044
Oklahoma	OK	0.332	5	0.159
Oregon	OR	0.385	4	0.015
Pennsylvania	PA	0.497	8	0.046
Rhode Island	RI	0.661	10	0.068
South Carolina	SC	0.164	4	0.005
Tennessee	TN	0.327	4	0.032
Texas	TX	0.303	3	0.150
Utah	UT	0.284	3	0.081
Vermont	VT	0.552	6	0.070
Virginia	VA	0.310	3	-0.015
Washington	WA	0.454	5	0.047
West Virginia	WV	0.319	3	0.033
Wisconsin	WI	0.340	8	0.039
Wyoming	WY	0.166	4	0.197

s that expanded into county c of state s', denoted as $\mathbf{N}_{scs't}$.

To measure financial development, we calculate the number of banks operating in each county in 1981 and use the median value across counties within each state as a proxy for financial development. Table A.1 presents the pre-deregulation number of banks for the 46 states included in our sample.

We apply the two-step procedure introduced by Rajan and Zingales (1998) to calculate industry-level external finance dependence (EFD). First, using Compustat data, we calculate the EFD for each firm as the fraction of capital expenditure financed through external sources (the difference between capital expenditure and cash flow from operations). We then average the firm-level EFDs over the period from 1979 to 1981 and take the median for each industry to obtain the industry-level EFD. Table A.2 presents the EFD for each industry. Notably, we only consider industries with at least five public firms; some industries, such as legal services and other services, do not have EFD values

due to insufficient data.

Next, to calculate the state-level EFD, we compute the weighted average of industrial EFD across all industries within a state, using the average industry value-added share between 1972 and 1981 as weights. Table A.1 reports the pre-deregulation EFD for the 46 states in our sample.

Table A.2
Characteristics of private non-farm and non-FI industries

Industry	Sector	**EFD**
Metal mining	mining and construction	0.16
Coal mining	mining and construction	-0.04
Oil and gas extraction	mining and construction	0.67
Nonmetallic minerals, except fuels	mining and construction	0.11
Construction	mining and construction	0.12
Lumber and wood products	manufacturing	-0.32
Furniture and fixtures	manufacturing	-0.25
Stone, clay, and glass products	manufacturing	0.01
Primary metal industries	manufacturing	-0.07
Fabricated metal products	manufacturing	0.05
Industrial machinery and equipment	manufacturing	0.08
Electronic and other electric equipment	manufacturing	0.44
Motor vehicles and equipment	manufacturing	-0.07
Other transportation equipment	manufacturing	0.07
Instruments and related products	manufacturing	0.81
Miscellaneous manufacturing industries	manufacturing	0.17
Food and kindred products	manufacturing	-0.22
Tobacco products	manufacturing	-1.17
Textile mill products	manufacturing	-0.21
Apparel and other textile products	manufacturing	-0.26
Paper and allied products	manufacturing	-0.07
Printing and publishing	manufacturing	-0.39
Chemicals and allied products	manufacturing	-0.07
Petroleum and coal products	manufacturing	-0.06
Rubber and miscellaneous plastics products	manufacturing	-0.02
Leather and leather products	manufacturing	-0.19
Railroad transportation	services	0.04
Local and interurban passenger transit	services	-0.07
Trucking and warehousing	services	-0.07
Water transportation	services	0.47
Transportation by air	services	0.72
Pipelines, except natural gas	services	-2.21
Transportation services	services	-0.56
Communications	services	0.00
Electric, gas, and sanitary services	utility	0.12
Wholesale trade	whole and retail	0.21
Retail trade	whole and retail	0.06
Real estate	FIRE	-0.06
Holding and other investment offices	FIRE	0.12
Hotels and other lodging places	services	0.00
Personal services	services	-0.52
Business services	services	0.31
Motion pictures	services	0.21
Amusement and recreation services	services	-0.29
Health services	services	0.24
Educational services	services	0.10

B Robustness check for empirical evidence

B.1 Evidence on bank expansion after deregulation

Since the FDIC preserved the acquired bank's identity even after acquisition throughout our sample period, we must analyze bank entry at the bank holding company (BHC) level. Within this framework, we test our hypothesis at the BHC-state-pair level using the following specification:

$$\mathbf{1}_{bss't} = \mathbf{exp}\{\beta \mathbf{D}_{ss't} + \nu_{ss'} + \omega_{st} + \omega_{s't} + \theta_{bt}\} + \epsilon_{bss't} \tag{B.1}$$

Here, $\mathbf{1}_{bss't}$ is an indicator that equals one if BHC b, which operated in state s in 1981, has expanded its operations into state s' by year t. $\mathbf{D}_{ss't}$ is an indicator for deregulation between a pair of states s and s', taking the value of one if deregulation occurred in year t, and zero otherwise. $\nu_{ss'}$ is the state pair fixed effects, accounting for time-invariant characteristics of each state pair, such as their geographical distance, historical or culture connections. Meanwhile, ω_{st} and $\omega_{s't}$, respectively, denote state-year fixed effects for the home and guest state, accounting for time-varying characteristics specific to each state, including factors like the business cycle, legislative or policy changes, and fluctuations in local loan demand or supply. θ_{bt} is the bank-year fixed effect, which controls for unobserved, time-varying characteristics of BHCs. For each cohort in our stacked estimation, the treatment group consists of BHCs that operated in state s in 1981 and reached an agreement with state s' in the cohort year. The control group comprises BHCs that operated in any state in 1981 but did not reach an agreement with another state until at least three years after the corresponding cohort year.

Table B.1 presents the point estimates from Equation (B.1), with standard errors clustered at the BHC-by-state-pair-by-cohort level. Column (1) shows that, on average, after a state opens its market to the guest state, 0.18% of BHCs expand their operations across state borders. Due to incomplete information on BHCs before 1986 in the Summary of Deposits dataset, some banks in our sample may be subsidiaries of BHCs but are treated as standalone entities. As a result, our estimates provide a lower bound on the effect of deregulation on bank expansion.

To further address this issue, we restrict our sample to cohorts from 1988 to 1991, following Oberfield, Rossi-Hansberg, Trachter and Wenning (2024), and define a BHC's home state based on where it operated in 1986. As shown in Column (2), our results remain robust, though the estimated effects are somewhat smaller in magnitude.

Table B.1
Regression results for Equation (2)

	Full sample (1)	Sample after 1986 (2)
$\mathbf{D}_{ss't}$	0.0018***	0.0005***
	(0.000)	(0.000)
Obs	7,785,891	4,162,932
R^2	0.166	0.148
state-by-state-by-cohort FE	Yes	Yes
home state-by-year-by-cohort FE	Yes	Yes
guest state-by-year-by-cohort FE	Yes	Yes
BHC-by-year-by-cohort FE	Yes	Yes

Note: The table reports the point estimates for β in Equation (2), following the stacking approach of Cengiz, Dube, Lindner and Zipperer (2019). The treatment group consists of BHCs that operated in state s in 1981 and reached an agreement with state s' in the cohort year. The control group comprises BHCs that operated in any state in 1981 but did not reach an agreement with another state until at least three years after the corresponding cohort year. Observations of each cohort are truncated two years before and after the event year and then stacked together. The dependent variable is an indicator that equals one if BHC b, which operated in state s in 1981, has expanded its operations into state s' by year t. The main regressor is $\mathbf{D}_{ss't}$, an indicator for deregulation between a pair of states s and s', taking the value of one if deregulation occurred in year t, and zero otherwise. The state-by-state-by-cohort, state-by-year-by-cohort, and BHC-by-year fixed effects are used, and all standard errors are clustered by the BHC-by-state-by-state-by-cohort level. $***$ $p < 0.01$, $**$ $p < 0.05$, $*$ $p < 0.1$.

B.2 Test on deregulation timing

In this section, we present evidence supporting the first assumption in our stacked DD estimation, which posits that no omitted factors simultaneously affect both the pairwise Manhattan distance and the decision to deregulate. Nonetheless, state legislators may anticipate the effects of deregulation and strategically prioritize agreements with states that exhibit significantly different economic structures, complementary financial systems, or a greater demand for external finance. If this is the case, we would expect states to enter agreements with those that have a higher pre-deregulation distance, complementary financial systems, or stronger demand for external finance.

To test these hypotheses, we employ the following strategy:

$$\Delta \mathbf{T}_{ss'} = \beta' \mathbf{X}_{ss'} + \gamma_1 \mathbf{distance}_{ss'} + \gamma_2 \mathbf{distance}^2_{ss'} + \alpha_s + \alpha_{s'} + \omega_c + \epsilon_{ss'}$$

where $\Delta \mathbf{T}_{ss'}$ represents the number of years between state s's first reciprocal agreement with any state and its agreement with state s'. $\mathbf{X}_{ss'}$ captures the pre-deregulation characteristics of the state pair. $\mathbf{distance}_{ss'}$ denotes the physical distance between the capitals of the two states. α_s and $\alpha_{s'}$ are state fixed effects for states s and s', respectively. ω_c represents cohort fixed effects.

First, we use the pre-deregulation Manhattan distance as pre-deregulation character-

istics and test whether states deliberately prioritize deregulating first with states that have a different economic structure. As shown in Column (1) of Table B.2, the estimated coefficient for pre-deregulation distance is positive but not statistically significant at the 95% confidence level. This suggests that the timing of deregulation is not correlated with the pre-deregulation distance between two states.

Table B.2
Regression results for equation (B.2)

	(1)	(2)
$\mathbf{dist}_{ss'}^{pre}$	0.450	
	(0.281)	
L-to-**GDP**$_s \times$ **EFD**$_{s'}$		-0.404
		(0.348)
L-to-**GDP**$'_s \times$ **EFD**$_s$		-0.136
		(0.142)
Obs	1,112	1,112
R^2	0.9743	0.9740
home state FE	Yes	Yes
guest state FE	Yes	Yes
cohort FE	Yes	Yes

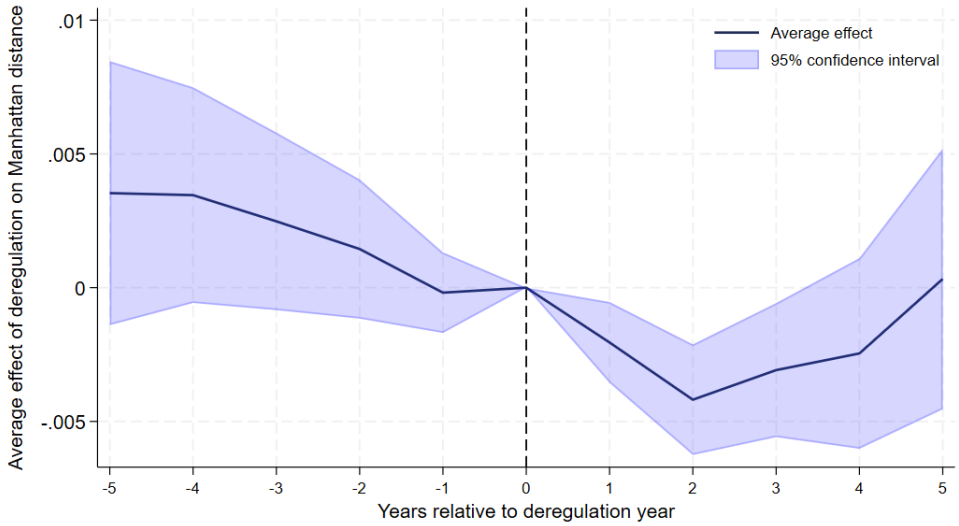
Note: The table reports the point estimates for β in Equation (B.2). The dependent variable is the number of years between state s's first reciprocal agreement with any state and its agreement with state s'. $\mathbf{dist}_{ss'}^{pre}$ is the pre-deregulation Manhattan distance. **L**-to-**GDP**$_s \times$ **EFD**$_{s'}$ and **L**-to-**GDP**$'_s \times$ **EFD**$_s$ are interaction terms for the two cross-combinations between the loan-to-GDP ratio and EFD. α_s and $\alpha_{s'}$ are state fixed effects for states s and s', respectively. ω_c represents cohort fixed effects. $***$ $p < 0.01$, $**$ $p < 0.05$, $*$ $p < 0.1$.

Second, we use interaction terms for the two cross-combinations between the loan-to-GDP ratio and EFD as pre-deregulation characteristics. This allows us to test whether states deliberately prioritize deregulating first with states that have complementary financial systems or a demand for external financing. As shown in Column (2) of Table B.2, the estimated coefficient for pre-deregulation distance is negative but not statistically significant at the 95% confidence level. These findings suggest that state legislators were unlikely to have anticipated the effects of deregulation, alleviating concerns about reverse causality.

B.3 Dynamic effects

We explore the dynamic effects of interstate banking deregulation on the similarity of economic structures. To do so, we employ the stack method to conduct an event study, using a sample spanning five years before to five years after deregulation, with the event

year as the reference point. We validate our main findings described in Cengiz, Dube, Lindner and Zipperer (2019), as shown in Figure B.1. Additionally, we observe a progressive increase in the effects during the first two years, after which the effects decay and become statistically insignificant since the fourth year post-deregulation.



Notes: The figure illustrates the dynamic effects of deregulation on the pairwise Manhattan distance. The stack method is applied to a sample spanning five years before to five years after deregulation, with the event year serving as the reference point. The blue line represents the average effects, while the light-blue shaded area indicates the 95% confidence interval.

Figure B.1
Dynamic effects of interstate banking deregulation

Moreover, a pre-trend test, the null hypothesis of which is $\beta_{-5} = \beta_{-4} = \beta_{-3} = \beta_{-2} = \beta_{-1} = 0$, has a F statistic of 0.97 with a p value of 0.44. Thus, we cannot reject the null hypothesis that all leading coefficents are equal to zero.

B.4 Convergence without core services or manufacturing

It is noteworthy that the U.S. economy has experienced a significant structural shift in the 1980s and 1990s, transitioning from manufacturing to service industries. This trend, likely driven by factors such as automation (Acemoglu and Restrepo, 2018) and outsourcing (Antras, Fort and Tintelnot, 2017), coincides with the timeline of interstate banking deregulation. This convergence of trends may compound the effects observed in our results. To address this concern, we analyze the convergence of economic structures between state pairs by separately excluding core services or manufacturing industries. Here, core services include hotels and other lodging places, personal services, business services, automotive repair and parking, miscellaneous repair services, motion pictures, amusement and recreation services, health services, legal services, educational services,

social services, membership organizations, and other services.

First, we recalculate industry shares excluding core service industries and use Equation (1) to compute the pairwise Manhattan distance of economic structures between states. We then test Equation (3) using the same methodology. As shown in Column (1) through (3) of Table B.3, our main findings remain robust.

Table B.3
Robustness check for Equation (3)

	$\mathbf{dist}^{\text{wo services}}_{ss't}$			$\mathbf{dist}^{\text{wo manufacturing}}_{ss't}$		
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbf{D}_{ss't}$	-0.004***	0.019***	-0.007	-0.003***	0.022***	0.005
	(0.001)	(0.004)	(0.009)	(0.001)	(0.004)	(0.009)
$\mathbf{D}_{ss't} \times \mathbf{dist}^{\text{pre}}_{ss'}$		-0.046***			-0.052***	
		(0.008)			(0.007)	
$\mathbf{D}_{ss't} \times \mathbf{L}\text{-to-}\mathbf{GDP}_s$			0.027			0.009
			(0.028)			(0.027)
$\mathbf{D}_{ss't} \times \mathbf{L}\text{-to-}\mathbf{GDP}_{s'}$			-0.015			-0.030*
			(0.018)			(0.018)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_s$			-0.026			-0.031
			(0.096)			(0.088)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_{s'}$			0.053			0.009
			(0.072)			(0.069)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_s \times \mathbf{L}\text{-to-}\mathbf{GDP}_s$			-0.011			0.121
			(0.342)			(0.321)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_s \times \mathbf{L}\text{-to-}\mathbf{GDP}_{s'}$			-0.114**			-0.185***
			(0.048)			(0.058)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_{s'} \times \mathbf{L}\text{-to-}\mathbf{GDP}_s$			-0.291***			-0.293**
			(0.113)			(0.119)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_{s'} \times \mathbf{L}\text{-to-}\mathbf{GDP}_{s'}$			0.281			0.445**
			(0.220)			(0.212)
Obs	55,805	55,805	55,805	55,805	55,805	55,805
R^2	0.990	0.990	0.990	0.992	0.992	0.992
state-by-state-by-cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
home state-by-year-by-cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
guest state-by-year-by-cohort FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: The table reports the point estimates for β in Equation (3), following the stacking approach of Cengiz, Dube, Lindner and Zipperer (2019). For each event year from 1984 to 1991, pairs of states deregulated in that year form the treatment group, and those of not-yet or never deregulated state pairs serve as the control group. Observations of each cohort are truncated two years before and after the event year and then stacked together. The dependent variable in Column (1) through (3) is the distance of economic structure without core services between two states as defined in Equation (1), while the one in Column (4) through (6) is the distance of economic structure without manufacturing. The main regressor is $\mathbf{D}_{ss't}$, an indicator for deregulation between a pair of states s and s', taking the value of one if deregulation occurred in year t, and zero otherwise. $\mathbf{dist}^{\text{pre}}_{ss'}$ is the average pairwise Manhattan distance between 1972 and 1981. $\mathbf{L}\text{-to-}\mathbf{GDP}_s$ is the state-level loan-to-GDP ratio in 1981. $\mathbf{EDF}_s$ is the external finance dependence for state s. The state-by-state-by-cohort and state-by-year-by-cohort fixed effects are used, and all standard errors are clustered by the state-by-state-by-cohort level. $***$ $p < 0.01$, $**$ $p < 0.05$, $*$ $p < 0.1$.

Next, we replicate this procedure using a subsample that excludes manufacturing industries. The results, presented in Column (4) through (6) of Table B.3, demonstrate that our main findings are robust in this context as well.

B.5 Industrial convergence without core services or manufacturing

We replicate the benchmark analysis from Column (1) of Table 4 using a sample that excludes core services and manufacturing industries. As shown in Table B.4, the main results remain consistent. Furthermore, the subsample excluding manufacturing industries exhibits an even greater degree of convergence after deregulation.

Table B.4
Regression results for Equation (4)

	without core services		without manufacturing	
	(1)	(2)	(3)	(4)
$\mathbf{D}_{ss't} \times \mathbf{H}_{iss'}$	-0.0007***	-0.0033***	-0.0009***	-0.0047***
	(0.000)	(0.000)	(0.000)	(0.000)
$\mathbf{D}_{ss't} \times \mathbf{G}_{iss'}$	0.0008***	0.0026***	0.0007***	0.0040***
	(0.000)	(0.000)	(0.000)	(0.000)
$\mathbf{H}_{iss'}$ / $\mathbf{G}_{iss'}$	relative	absolute	relative	absolute
Obs	2,121,160	2,121,160	1,395,500	1,395,500
R^2	0.971	0.971	0.970	0.970
state-by-state-by-industry-by-cohort FE	Yes	Yes	Yes	Yes
industry-by-year-by-cohort FE	Yes	Yes	Yes	Yes
state-by-state-by-year-by-cohort FE	Yes	Yes	Yes	Yes

Note: The table presents the point estimates for the β coefficients in Equation (4), using the stacking approach from Cengiz, Dube, Lindner and Zipperer (2019). For each event year between 1984 and 1991, industries in pairs of states that had implemented deregulation in that year form the treatment group, while industries in state pairs that had not yet deregulated act until at least three years later as the control group. Observations for each cohort are truncated two years before and two years after the event year, and then stacked. Results using subsample without core service industries are reported in Column (1) and (2), while those using subsample without manufacturing industries are reported in Column (3) and (4). The dependent variable is the difference in either industry share. The main regressor is $\mathbf{D}_{ss't}$, an indicator of deregulation between states s and s', which interacts with the indicator $\mathbf{H}_{iss'}$ or $\mathbf{G}_{iss'}$. Here, $\mathbf{H}_{iss'}$ and $\mathbf{G}_{iss'}$ measure either the relative importance of industry i between states s and s' (as defined in Equation (5)) or the absolute importance of industry i for states s and s' (defined as one of the top 10 most important industries for the corresponding state between 1972 and 1981). The model includes fixed effects for industry-by-state-by-state-by-cohort, state-by-state-by-year-by-cohort, and industry-by-year-by-cohort. Standard errors are clustered at the industry-by-state-by-state-by-cohort level. $*** p < 0.01$, $** p < 0.05$, $* p < 0.1$.

C Empirical tests with cosine similarity

Alternatively, we use cosine similarity to compute the cosine of the angle between two vectors representing the economic structures of the states:

$$\mathbf{cos}_{ss't} = \mathbf{cos}\left(\mathbf{v}_{st}, \mathbf{v}_{s't}\right) = \frac{\mathbf{v}_{st} \cdot \mathbf{v}_{s't}}{|\mathbf{v}_{st}| \times |\mathbf{v}_{s't}|} \tag{C.1}$$

where $\mathbf{v}_{st} = [v_{s1t}, \ldots, v_{snt}]^T$ is a vector of value added shares across sectors $i \in \{1, \ldots, n\}$. Here, $\cdot$ denotes the dot product, and $|\mathbf{v}_{st}| = \sqrt{\mathbf{v}_{st} \cdot \mathbf{v}_{st}}$ is the norm of vector $\mathbf{v}_{st}$. Notably, cosine similarity focuses on the composition of economic structures between two states

by normalizing the norm of each state's economic structure, which captures the degree of diversification within each state. This measure is widely used in portfolio management and textual analysis literature (see, for example, Hanley and Hoberg, 2010, 2012; Girardi *et al.*, 2021; Chu *et al.*, 2020). A higher cosine value indicates a smaller angle between the two vectors, implying greater similarity in the economic structures of the two states.

Then, we analyze how the economic structure between two states, referred to as s and s', evolves after they both agree to allow bank acquisitions across state borders. Our analysis strategy is described by the following:

$$\mathbf{cos}_{ss't} = \beta \mathbf{D}_{ss't} + \alpha \mathbf{D}_{ss't} \times \mathbf{X}_{ss'} + \nu_{ss'} + \omega_{st} + \omega_{s't} + \epsilon_{ss't} \tag{C.2}$$

Here, $\mathbf{cos}_{ss't}$represents the similarity in economic structure between two states in year t, as defined in Equation (C.1). $\mathbf{D}_{ss't}$ is an indicator for deregulation between a pair of states, set equal to one if both states allow mutual bank acquisitions in year t, and zero otherwise. $\mathbf{X}_{ss'}$ captures pre-deregulation state-pair or state-level characteristics, including: (1) the economic structure similarity ($\mathbf{cos}^{\text{pre}}_{ss'}$); (2) measures of financial development (such as the loan-to-GDP ratio, denoted as $\mathbf{L}$-to-$\mathbf{GDP}_s$, and the number of banks, denoted as $\mathbf{N}_s$); and (3) the state-level EFD ($\mathbf{EFD}_s$), and their interaction term. $\nu_{ss'}$ represents the fixed effect for each state pair, controlling for any characteristics unique to each pair of states, such as geographic distance. ω_{st} denotes the fixed effect for each state by year, accounting for time-varying characteristics at the state level that change over time, such as variations in the state's economic cycle or changes in state legislation.

Table C.1 presents the point estimates for Equation (C.2), where the standard errors are clustered at the state-pair-by-cohort level, following the approach of Cengiz, Dube, Lindner and Zipperer (2019). Most of results are robust as in Table 3, except Column (1).

D Mathematical proofs

D.1 System of equations

In the equilibrium characterization, to avoid abuse of notation, index b denotes bank types, where $b \in \{h, g\}$. This distinction is made since banks with the same expertise make identical decisions regarding loan rates and the recruitment of loan officers.

Table C.1
Robustness check for Equation (C.2)

	(1)	(2)	(3)	(4)	(5)
$\mathbf{D}_{ss't}$	-0.000	0.064***	-0.003	-0.002	-0.005
	(0.001)	(0.007)	(0.002)	(0.002)	(0.007)
$\mathbf{D}_{ss't} \times \mathbf{cos}^{\text{pre}}_{ss'}$		-0.078***			
		(0.009)			
$\mathbf{D}_{ss't} \times$ **L-to-GDP**$_s$			0.000		-0.008
			(0.002)		(0.025)
$\mathbf{D}_{ss't} \times$ **L-to-GDP**$_{s'}$			0.005***		0.023
			(0.002)		(0.016)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_s$				0.063**	0.030
				(0.028)	(0.087)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_{s'}$				-0.028	-0.039
				(0.022)	(0.067)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_s \times$ **L-to-GDP**$_s$					-0.148
					(0.297)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_s \times$ **L-to-GDP**$_{s'}$					0.170***
					(0.054)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_{s'} \times$ **L-to-GDP**$_s$					0.300***
					(0.114)
$\mathbf{D}_{ss't} \times \mathbf{EFD}_{s'} \times$ **L-to-GDP**$_{s'}$					-0.372*
					(0.201)
Obs	55,805	55,805	55,805	55,805	55,805
R^2	0.988	0.988	0.988	0.988	0.988
state-by-state-by-cohort FE	Yes	Yes	Yes	Yes	Yes
home state-by-year-by-cohort FE	Yes	Yes	Yes	Yes	Yes
guest state-by-year-by-cohort FE	Yes	Yes	Yes	Yes	Yes

Note: The table reports the point estimates for β in Equation (C.2), following the stacking approach of Cengiz, Dube, Lindner and Zipperer (2019). For each event year from 1984 to 1991, pairs of states deregulated in that year form the treatment group, and those of not-yet or never deregulated state pairs serve as the control group. Observations of each cohort are truncated two years before and after the event year and then stacked together. The dependent variable is the cosine of economic structure between two states as defined in Equation (C.1). The main regressor is $\mathbf{D}_{ss't}$, an indicator for deregulation between a pair of states s and s', taking the value of one if deregulation occurred in year t, and zero otherwise. $\mathbf{cos}^{\text{pre}}_{ss'}$ is the average pairwise Manhattan distance between 1972 and 1981. **L-to-GDP**$_s$ is the state-level loan-to-GDP ratio in 1981. **EDF**$_s$ is the external finance dependence for state s. The state-by-state-by-cohort and state-by-year-by-cohort fixed effects are used, and all standard errors are clustered by the state-by-state-by-cohort level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

intermediate-good firm

Given that $z^i_{jb}(\omega)$ follows a Type I extreme value distribution, the share of intermediate-good firms selecting home-island banks is given by:

$$n^i_{jh}(\omega) = \frac{\exp(\frac{\pi^i_{jh}(\omega)}{\sigma})}{(M^i_{jh}-1)\exp(\frac{\pi^i_{jh}}{\sigma}) + M^i_{jg}\exp(\frac{\pi^i_{jg}}{\sigma}) + \exp(\frac{\pi^i_{jh}(\omega)}{\sigma})}, \tag{D.1}$$

where M^i_{jh} represents the number of banks from the home island on island i, and M^i_{jg} denotes the number of banks from the guest island on island i. π^i_{jh} and π^i_{jg} are the expected on-equilibrium profits for firms choosing home-island and guest-island banks,

respectively. Equation (D.1) is equivalent to equations (D.2) and (D.3)

$$n^i_{jh}(\omega) + (M^i_{jh} - 1)n^i_{jh} + M^i_{jg} n^i_{jg} = 1 \tag{D.2}$$

$$\frac{\exp(\frac{\pi^i_{jh}(\omega)}{\sigma})}{1 - (M^i_{jh} - 1)n^i_{jh} - M^i_{jg} n^i_{jg}} = \frac{\exp(\frac{\pi^i_{jh}}{\sigma})}{n^i_{jh}} = \frac{\exp(\frac{\pi^i_{jg}}{\sigma})}{n^i_{jg}} \tag{D.3}$$

where n^i_{jh} and n^i_{jg} denotes the on-equilibrium share of firms across different types of banks. We then derive the first order condition of Equation (D.3) with respect to $l^i_{jh}(\omega)$:

$$\begin{aligned} &\exp(\frac{\pi^i_{jh}}{\sigma})\left[\frac{\partial n^i_{jg}}{\partial l^i_{jh}(\omega)} - n^i_{jg}\frac{k^i_j}{\sigma}\mathbf{q}'_{jh}(\cdot)(P^i_j A^i_j - r^i_{jh})\frac{l^i_{jh}}{{n^i_{jh}}^2}\frac{\partial n^i_{jh}}{\partial l^i_{jh}(\omega)}\right] \\ =&\exp(\frac{\pi^i_{jg}}{\sigma})\left[\frac{\partial n^i_{jh}}{\partial l^i_{jh}(\omega)} - n^i_{jh}\frac{k^i_j}{\sigma}\mathbf{q}'_{jg}(\cdot)(P^i_j A^i_j - r^i_{jg})\frac{l^i_{jg}}{{n^i_{jg}}^2}\frac{\partial n^i_{jg}}{\partial l^i_{jh}(\omega)}\right] \end{aligned} \tag{D.4}$$

$$\begin{aligned} &\exp(\frac{\pi^i_{jh}(\omega)}{\sigma})\left[\frac{\partial n^i_{jh}}{\partial l^i_{jh}(\omega)} + n^i_{jh}\frac{k^i_j}{\sigma}\mathbf{q}'_{jh}(\cdot)(P^i_j A^i_j - r^i_{jh}(\omega))\frac{1}{n^i_{jh}(\omega)}\left(1 + \frac{l^i_{jh}(\omega)}{n^i_{jh}(\omega)}(M^i_{jh} - 1)\frac{\partial n^i_{jh}}{\partial l^i_{jh}(\omega)} + \frac{l^i_{jh}(\omega)}{n^i_{jh}(\omega)}M^i_{jg}\frac{\partial n^i_{jg}}{\partial l^i_{jh}(\omega)}\right)\right] \\ =&-\exp(\frac{\pi^i_{jh}}{\sigma})\left[(M_{jh} - 1)\frac{\partial n^i_{jh}}{\partial l^i_{jh}(\omega)} + M_{jg}\frac{\partial n^i_{jg}}{\partial l^i_{jh}(\omega)} + n^i_{jh}(\omega)\frac{k^i_j}{\sigma}\mathbf{q}'_{jh}(\cdot)(P^i_j A^i_j - r^i_{jh})\frac{l^i_{jh}}{{n^i_{jh}}^2}\frac{\partial n^i_{jh}}{\partial l^i_{jh}(\omega)}\right] \end{aligned} \tag{D.5}$$

In the stationary equilibrium where $l^i_{jh} = l^i_{jh}(\omega)$, $n^i_{jh} = n^i_{jh}(\omega)$, $\pi^i_{jh} = \pi^i_{jh}(\omega)$, and $r^i_{jh} = r^i_{jh}(\omega)$, Equation (D.5) is equivalent to:

$$n^i_{jh}\frac{k^i_j}{\sigma}\mathbf{q}'_{jh}(\cdot)(P^i_j A^i_j - r^i_{jh})\left(\frac{1}{n^i_{jh}} + \frac{l^i_{jh}}{{n^i_{jh}}^2}M^i_{jh}\frac{\partial n^i_{jh}}{\partial l^i_{jh}(\omega)} + \frac{l^i_{jh}}{{n^i_{jh}}^2}M^i_{jg}\frac{\partial n^i_{jg}}{\partial l^i_{jh}(\omega)}\right) + M^i_{jh}\frac{\partial n^i_{jh}}{\partial l^i_{jh}(\omega)} + M^i_{jg}\frac{\partial n^i_{jg}}{\partial l^i_{jh}(\omega)} = 0 \tag{D.6}$$

Equations (D.4) and (D.6) altogether pin down the formula for $\frac{\partial n^i_{jh}}{\partial l^i_{jh}(\omega)}$ and $\frac{\partial n^i_{jg}}{\partial l^i_{jh}(\omega)}$. Following

$$\theta^i_{jh}(\omega) = \frac{l^i_{jh}(\omega)}{1 - (M^i_{jh} - 1)n^i_{jh} - M^i_{jg} n^i_{jg}} \tag{D.7}$$

We have

$$\frac{\partial \theta^i_{jh}(\omega)}{\partial l^i_{jh}(\omega)} = \frac{1}{n^i_{jh}(\omega)}\left[1 - \frac{k^i_j \mathbf{q}'_{jh}(\cdot)(P^i_j A^i_j - r^i_{jh}(\omega))\frac{l^i_{jh}(\omega)}{n^i_{jh}(\omega)}}{\sigma + k^i_j \mathbf{q}'_{jh}(\cdot)(P^i_j A^i_j - r^i_{jh}(\omega))\frac{l^i_{jh}(\omega)}{n^i_{jh}(\omega)}}\frac{M^i_{jh} - 1 + C^i_j M^i_{jg}}{M^i_{jh} + C^i_j M^i_{jg}}\right] \tag{D.8}$$

for $j \in \{s, m\}$. C_j^i is defined as

$$\frac{\partial n_{jg}^i}{\partial l_{jh}^i(\omega)} = \frac{\exp(\frac{\pi_{jg}^i}{\sigma}) + \exp(\frac{\pi_{jh}^i}{\sigma}) n_{jg}^i \frac{k_j^i}{\sigma} \mathbf{q}'_{jh}(\cdot)(P_j^i A_j^i - r_{jh}^i) \frac{l_{jh}^i}{{n_{jh}^i}^2}}{\exp(\frac{\pi_{jh}^i}{\sigma}) + \exp(\frac{\pi_{jg}^i}{\sigma}) n_{jh}^i \frac{k_j^i}{\sigma} \mathbf{q}'_{jg}(\cdot)(P_j^i A_j^i - r_{jg}^i) \frac{\pi_{jg}^i}{{n_{jg}^i}^2}} \frac{\partial n_{jh}^i}{\partial l_{jh}^i(\omega)} \equiv C_j^i \frac{\partial n_{jh}^i}{\partial l_{jh}^i(\omega)} \tag{D.9}$$

In the benchmark where $\sigma = 0$ (intermediate goods are perfect substitute) and $\xi_{jh}^i = \xi_{jg}^i$ (under url-ball matching functional form):

$$\frac{\partial \theta_{jh}^i(\omega)}{\partial l_{jh}^i(\omega)} = \frac{1}{n_{jh}^i(\omega)} \frac{1}{M_{jh}^i + M_{jg}^i} = 1$$

Therefore, on the equilibrium path, Equation (D.8) becomes:

$$\frac{\partial \theta_{jh}^i}{\partial l_{jh}^i} = \frac{1}{n_{jh}^i} \left[1 - \frac{k_j^i \mathbf{q}'_{jh}(\cdot)(P_j^i A_j^i - r_{jh}^i) \frac{l_{jh}^i}{n_{jh}^i}}{\sigma + k_j^i \mathbf{q}'_{jh}(\cdot)(P_j^i A_j^i - r_{jh}^i) \frac{l_{jh}^i}{n_{jh}^i}} \frac{M_{jh}^i - 1 + C_j^i M_{jg}^i}{M_{jh}^i + C_j^i M_{jg}^i} \right] \tag{D.10}$$

Similarly, we derive the first order condition of Equation (D.3) to $r_{jh}^i(\omega)$

$$\begin{aligned} &\exp(\frac{\pi_{jh}^i}{\sigma}) \left[\frac{\partial n_{jg}^i}{\partial r_{jh}^i(\omega)} - n_{jg}^i \frac{k_j^i}{\sigma} \mathbf{q}'_{jh}(\cdot)(P_j^i A_j^i - r_{jh}^i) \frac{l_{jh}^i}{{n_{jh}^i}^2} \frac{\partial n_{jh}^i}{\partial r_{jh}^i(\omega)} \right] \\ =& \exp(\frac{\pi_{jg}^i}{\sigma}) \left[\frac{\partial n_{jh}^i}{\partial r_{jh}^i(\omega)} - n_{jh}^i \frac{k_j^i}{\sigma} \mathbf{q}'_{jg}(\cdot)(P_j^i A_j^i - r_{jg}^i) \frac{l_{jg}^i}{{n_{jg}^i}^2} \frac{\partial n_{jg}^i}{\partial r_{jh}^i(\omega)} \right] \end{aligned} \tag{D.11}$$

$$-\exp(\frac{\pi_{jh}^i}{\sigma}) \left[(M_{jh}^i - 1) \frac{\partial n_{jh}^i}{\partial r_{jh}^i(\omega)} + M_{jg}^i \frac{\partial n_{jg}^i}{\partial r_{jh}^i(\omega)} + n_{jh}^i(\omega) \frac{k_j^i}{\sigma} \mathbf{q}'_{jh}(\cdot)(P_j^i A_j^i - r_{jh}^i) \frac{l_{jh}^i}{{n_{jh}^i}^2} \frac{\partial n_{jh}^i}{\partial r_{jh}^i(\omega)} \right] = \exp(\frac{\pi_{jh}^i(\omega)}{\sigma}) \times$$
$$\left[\frac{\partial n_{jh}^i}{\partial r_{jh}^i(\omega)} - n_{jh}^i \frac{k_j^i}{\sigma} \mathbf{q}_{jh}(\frac{l_{jh}^i(\omega)}{n_{jh}^i(\omega)}) + n_{jh}^i \frac{k_j^i}{\sigma} \mathbf{q}'_{jh}(\cdot)(P_j^i A_j^i - r_{jh}^i(\omega)) \frac{1}{n_{jh}^i(\omega)} \left(\frac{l_{jh}^i(\omega)}{n_{jh}^i(\omega)} (M_{jh}^i - 1) \frac{\partial n_{jh}^i}{\partial r_{jh}^i(\omega)} + \frac{l_{jh}^i(\omega)}{n_{jh}^i(\omega)} M_{jg}^i \frac{\partial n_{jg}^i}{\partial r_{jh}^i(\omega)} \right) \right] \tag{D.12}$$

In the stationary equilibrium, Equation (D.12) is equivalent to:

$$-n_{jh}^i \frac{k_j^i}{\sigma} \mathbf{q}_{jh}(\cdot) + n_{jh}^i \frac{k_j^i}{\sigma} \mathbf{q}'_{jh}(\cdot)(P_j^i A_j^i - r_{jh}^i) \left(\frac{l_{jh}^i}{{n_{jh}^i}^2} M_{jh}^i \frac{\partial n_{jh}^i}{\partial r_{jh}^i(\omega)} + \frac{l_{jh}^i}{{n_{jh}^i}^2} M_{jg}^i \frac{\partial n_{jg}^i}{\partial r_{jh}^i(\omega)} \right) + M_{jh}^i \frac{\partial n_{jh}^i}{\partial r_{jh}^i(\omega)} + M_{jg}^i \frac{\partial n_{jg}^i}{\partial r_{jh}^i(\omega)} = 0 \tag{D.13}$$

Equations (D.11) and (D.13) altogether pin down $\frac{\partial n_{jh}^i}{\partial r_{jh}^i(\omega)}$ and $\frac{\partial n_{jg}^i}{\partial r_{jh}^i(\omega)}$. Following equation

(D.7), we have

$$\frac{\partial \theta^i_{jh}(\omega)}{\partial r^i_{jh}(\omega)} = \frac{\frac{l^i_{jh}(\omega)}{n^i_{jh}(\omega)} k^i_j \mathbf{q}_{jh}(\cdot)(M^i_{jh} - 1 + C^i_j M^i_{jg})}{(\sigma + k^i_j \mathbf{q}'_{jh}(\cdot)(P^i_j A^i_j - r^i_{jh}(\omega))\frac{l^i_{jh}(\omega)}{n^i_{jh}(\omega)})(M^i_{jh} + C^i_j M^i_{jg})} \tag{D.14}$$

for $j \in \{s, m\}$. Therefore, on the equilibrium path, Equation (D.14) becomes

$$\frac{\partial \theta^i_{jh}}{\partial r^i_{jh}} = \frac{\frac{l^i_{jh}}{n^i_{jh}} k^i_j \mathbf{q}_{jh}(\cdot)(M^i_{jh} - 1 + C^i_j M^i_{jg})}{(\sigma + k^i_j \mathbf{q}'_{jh}(\cdot)(P^i_j A^i_j - r^i_{jh})\frac{l^i_{jh}}{n^i_{jh}})(M^i_{jh} + C^i_j M^i_{jg})} \tag{D.15}$$

We obtain 4 similar equations from first order conditions with $l^i_{jg}(\omega)$ and $r^i_{jg}(\omega)$ based on:

$$n^i_{jg}(\omega) = \frac{\exp(\frac{\pi^i_{jg}(\omega)}{\sigma})}{M^i_{jh}\exp(\frac{\pi^i_{jh}}{\sigma}) + (M^i_{jg} - 1)\exp(\frac{\pi^i_{jg}}{\sigma}) + \exp(\frac{\pi^i_{jg}(\omega)}{\sigma})}, \tag{D.16}$$

Equation (D.16) is equivalent to the following two conditions

$$n^i_{jg}(\omega) + M^i_{jh} n^i_{jh} + (M^i_{jg} - 1) n^i_{jg} = 1 \tag{D.17}$$

$$\frac{\exp(\frac{\pi^i_{jg}(\omega)}{\sigma})}{1 - M^i_{jh} n^i_{jh} - (M^i_{jg} - 1) n^i_{jg}} = \frac{\exp(\frac{\pi^i_{jh}}{\sigma})}{n^i_{jh}} = \frac{\exp(\frac{\pi^i_{jg}}{\sigma})}{n^i_{jg}} \tag{D.18}$$

Similarly, on the equilibrium path, we obtain

$$\frac{\partial \theta^i_{jg}}{\partial l^i_{jg}} = \frac{1}{n^i_{jg}} \left[1 - \frac{k^i_j \mathbf{q}'_{jg}(\cdot)(P^i_j A^i_j - r^i_{jg})\frac{l^i_{jg}}{n^i_{jg}}}{\sigma + k^i_j \mathbf{q}'_{jg}(\cdot)(P^i_j A^i_j - r^i_{jg})\frac{l^i_{jg}}{n^i_{jg}}} \frac{M^i_{jh} - C^i_j + C^i_j M^i_{jg}}{M^i_{jh} + C^i_j M^i_{jg}} \right] \tag{D.19}$$

$$\frac{\partial \theta^i_{jg}}{\partial r^i_{jg}} = \frac{\frac{l^i_{jg}}{n^i_{jg}} k^i_j \mathbf{q}_{jg}(\cdot)(M^i_{jh} - C^i_j + C^i_j M^i_{jg})}{(\sigma + k^i_j \mathbf{q}'_{jg}(\cdot)(P^i_j A^i_j - r^i_{jg})\frac{l^i_{jg}}{n^i_{jg}})(M^i_{jh} + C^i_j M^i_{jg})} \tag{D.20}$$

for $j \in \{s, m\}$.

Overall, for sector-j firms on island i that seek funding from a bank originally operating on island b, we derive eight equations (Equations (D.10),(D.15), (D.19), and (D.20)) for $\frac{\partial \theta^i_{jb}}{\partial l^i_{jb}}$ and $\frac{\partial \theta^i_{jb}}{\partial r^i_{jb}}$, where $f \in \{s, m\}$ and $b \in \{h, g\}$.

On the equilibrium path, the distribution of firms becomes:

$$n^i_{jh} = \frac{\exp(\frac{\pi^i_{jh}}{\sigma})}{M^i_{jh}\exp(\frac{\pi^i_{jh}}{\sigma}) + M^i_{jg}\exp(\frac{\pi^i_{jg}}{\sigma})}, \tag{D.21}$$

$$n^i_{jg} = \frac{\exp(\frac{\pi^i_{jg}}{\sigma})}{M^i_{jh}\exp(\frac{\pi^i_{jh}}{\sigma}) + M^i_{jg}\exp(\frac{\pi^i_{jg}}{\sigma})} \tag{D.22}$$

Banks

Bank that originally operates on island b maximize their expected profits after entry

$$\max_{r^i_{jb}(\omega), l^i_{jb}(\omega)} \sum_i \sum_{j\in\{s,m\}} \int_0^1 \left[\mathbf{m}_{jb}\left(n^i_{jb}(\omega), l^i_{jb}(\omega)\right)\left(r^i_{jb}(\omega) - r\right)k^i_j - W^i l^i_{jb}(\omega)\right] \mathbf{d}\omega, \tag{D.23}$$

On the equilibrium path, firms in sector j are distributed evenly across banks of the same type, the above optimization problem then becomes

$$\begin{aligned}
&\max_{r^i_{jb}, l^i_{jb}} \sum_{j\in\{s,m\}} \left(r^i_{jb} - r\right)\mathbf{m}_{jb}(l^i_{jb}, n^i_{jb})k^i_j - W^i l^i_{jb} \\
=&\max_{r^i_{jb}, l^i_{jb}} \sum_{j\in\{s,m\}} \left(r^i_{jb} - r\right)\frac{\mathbf{q}_{jb}(\theta^i_{jb})}{\theta^i_{jb}} l^i_{jb} k^i_j - W^i l^i_{jb}
\end{aligned}$$

The first order conditions with respect to l^i_{jb} and r^i_{jb} follow

$$\begin{aligned}
W^i &= (r^i_{jb} - r)\frac{\mathbf{q}_{jb}(\theta^i_{jb})}{\theta^i_{jb}}k^i_j + l^i_{jb}(r^i_{jb} - r)k^i_j \frac{\partial \frac{\mathbf{q}_{jb}(\theta^i_{jb})}{\theta^i_{jb}}}{\partial \theta^i_{jb}} \frac{\partial \theta^i_{jb}}{\partial l^i_{jb}} \\
&= (r^i_{jb} - r)k^i_j \frac{\mathbf{q}_{jb}(\theta^i_{jb})}{\theta^i_{jb}}\left(1 + n^i_{jb}\frac{\partial \ln\left(\frac{\mathbf{q}_{jb}(\theta^i_{jb})}{\theta^i_{jb}}\right)}{\partial \ln \theta^i_{jb}} \frac{\partial \theta^i_{jb}}{\partial l^i_{jb}}\right)
\end{aligned} \tag{D.24}$$

$$\begin{aligned}
0 &= \frac{\mathbf{q}_{jb}(\theta^i_{jb})}{\theta^i_{jb}}k^i_j + (r^i_{jb} - r)\frac{\partial \frac{\mathbf{q}_{jb}(\theta^i_{jb})}{\theta^i_{jb}}}{\partial \theta^i_{jb}} \frac{\partial \theta^i_{jb}}{\partial r^i_{jb}} k^i_j \\
&= \frac{\mathbf{q}_{jb}(\theta^i_{jb})}{\theta^i_{jb}}k^i_j \left[1 + \frac{\frac{\partial \ln\left(\frac{\mathbf{q}_{jb}(\theta^i_{jb})}{\theta^i_{jb}}\right)}{\partial \ln \theta_{jb}}}{\theta^i_{jb}} \frac{\partial \theta^i_{jb}}{\partial r^i_{jb}}(r^i_{jb} - r)\right]
\end{aligned} \tag{D.25}$$

where $f \in \{s, m\}$ and $b \in \{h, g\}$. Therefore, equation (D.24) and (D.25) represent four sets of loan rates and loan officer postings, resulting 8 equations.

Final good producers

Final good producers maximize:

$$\max_{Y_i^m, Y_i^s} \left(\left(\alpha_s^i\right)^{\frac{1}{\eta}} \left(Y_s^i\right)^{\frac{\eta-1}{\eta}} + \left(\alpha_m^i\right)^{\frac{1}{\eta}} \left(Y_m^i\right)^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}} - P_m^i Y_m^i - P_s^i Y_s^i$$

The first order conditions with respect to Y_s^i and y_m^i yield

$$\frac{Y_j^i}{\alpha_j^i} = Y^i (P_j^i)^{-\eta} \tag{D.26}$$

Since the price index is normalized to one, we have

$$1 = (\alpha_s^i {P_s^i}^{1-\eta} + \alpha_m^i {P_m^i}^{1-\eta})^{\frac{1}{1-\eta}} \tag{D.27}$$

Representative household

The representative household's problem is simplified to

$$\max_{C_t^i, S_{t+1}^i, L_t^i} \sum_{t=0}^{\infty} \beta^t \left[\ln(C_t^i) - \Psi \frac{\left(L_t^i\right)^{1+\phi}}{1+\phi} \right], \ s.t. \ C_t^i + S_{t+1}^i \leq (1 - \delta + r_t) S_t^i + W_t^i L_t^i + T_t^i$$

The first order condition for S_{t+1}^i and L_t^i follows

$$\frac{1}{C_t^i} = \beta (1 - \delta + r_{t+1}) \frac{1}{C_{t+1}^i} \tag{D.28}$$

$$W^i = \Psi C^i {L^i}^{\phi} \tag{D.29}$$

Market clearing conditions

The market clearing condition in the inter-bank market implies

$$\sum_{i \in \{h,g\}} S^i = \sum_{i \in \{h,g\}} \sum_{b \in \{h,g\}} \sum_{j \in \{s,m\}} M_{jb}^i n_{jb}^i \mathbf{q}_{jb}(\theta_{cb}^i) k_j^i + \sum_{j \in \{s,m\}} \underline{k}_j^i \tag{D.30}$$

The market clearing condition in the labor market for loan officers implies

$$L^i = \sum_{b \in \{h,g\}} \sum_{j \in \{s,m\}} M_{jb}^i l_{jb}^i \tag{D.31}$$

The market clearing condition in the intermediate good market implies

$$\sum_{b\in\{h,g\}} M^i_{jb} n^i_{jb} \left[\mathbf{q}_{jb}(\theta^i_{jb}) A^i_j (\underline{k}^i_j + k^i_j) + \left(1 - \mathbf{q}_{jb}(\theta^i_{jb})\right) A^i_j \underline{k}^i_j\right] = Y^i_j \tag{D.32}$$

Entry conditions for banks

$$M^h_{jg} = \max\left\{M^h_{jg} : \psi^h_{jg}\left(M^h_{jg}\right) \geq \psi^h_{jh}\left(M^h_{jg} - 1\right) + \tau^h\right\} \tag{D.33}$$

$$M^g_{jh} = \max\left\{M^g_{jh} : \psi^g_{jh}\left(M^g_{jh}\right) \geq \psi^g_{jg}\left(M^g_{jh} - 1\right) + \tau^g\right\} \tag{D.34}$$

Therefore, the model economy on the island i consists of $\{C^i, L^i, S^{i'}, Y^i, W^i, r, Y^i_j, p^i_j, l^i_{jb}, n^i_{jb}, r^i_{jb}, M^g_{jh}, M^h_{jg}\}_{t=0}^{\infty}$ that satisfy Equations (16), (D.21), (D.22), (D.24), (D.25),(D.26), (D.27), (D.28), (D.29), (D.30), (D.31), (D.32), (D.33), (D.34), with 24 variables and equations.

D.2 Algorithm

In this section, we present the algorithm to solve the model equilibrium in the steady state.

- Step 1: Initial guess of $n^i_{jh} = \frac{1}{M^i_{jh}+M^i_{jg}}$, for $j \in \{s,m\}$. Then $n^i_{jg} = \frac{1-M^i_{jh} n^i_{jh}}{M^i_{jg}}$, for $j \in \{s,m\}$.
- Step 2: Given $x = (P^i_s, l^i_{jh}, l^i_{jg}, r^i_{jh}, r^i_{jg})'$, we obtain θ^i_{jh} and θ^i_{jg}, for all $j \in \{s,m\}$.
- Step 3: x solves Equations (D.35), (D.24), (D.25). This a system of nine equations.

$$\frac{Y^i_s P^{i\,\eta}_s}{\alpha^i_s} = \frac{Y^i_m P^{i\,\eta}_m}{\alpha^i_m} \tag{D.35}$$

  where $P^i_m = \left[\frac{1}{\alpha^i_m}\left(1 - \alpha^i_s P^{i\,1-\eta}_j\right)\right]^{\frac{1}{1-\eta}}$, Y^i_j for $j \in \{s,m\}$ follow Equation (D.32), and $\beta(1 + r - \delta) = 1$.

- Step 4: Set the tolerance level Tol $= 10^{-6}$. Generate new n^i_{jh} and n^i_{jg} using Equations (D.21) and (D.22). When $|n^{i\,\text{new}}_{jh} - n^i_{jh}| >$ Tol or $|n^{i\,\text{new}}_{jg} - n^i_{jg}| >$ Tol, replace $n^i_{jh} = n^{i\,\text{new}}_{jh}$ and $n^i_{jg} = n^{i\,\text{new}}_{jg}$.
- Step 5: Go back to Step 1.

D.3 Proof for Lemma 1

Proof. Assume $A^i_j = A$, $\alpha^i_s = \alpha^i_m$, $\underline{k}^i_j = \underline{k}$, and $\overline{k}^i_j = \overline{k}$ for $\forall\ j \in \{m,s\}$ and $i \in \{h,g\}$, with the exceptions that $\xi_{mh} > \xi_{sh}$ and $\xi_{mg} < \xi_{sg}$. Also, assume $\sigma = 0$. These assumptions imply that (i) the two sectors are identical across islands; (ii) banks of the same type are

perfect substitutes for intermediate-good firms. Following deregulation, if the banking structures are identical across islands, the economic structures will also converge. In this sense, Lemma 1 represents a partial equilibrium result, as the penetration level is endogenous to the economy. To establish this Lemma, we focus solely on the pre-deregulation economic structure.

Before deregulation, we have $i = b$, which allows us to omit the index b without ambiguity. intermediate-good firms are evenly distributed among banks, so $n_j^i = 1/M^i$. Denote λ_j^i and Λ_j^i

$$\lambda_j^i = \frac{\xi_{ji}}{\theta_j^i} \tag{D.36}$$

$$\Lambda_j^i = \frac{1 - e^{-\lambda_j^i}}{\lambda_j^i e^{-\lambda_j^i}} \tag{D.37}$$

λ_j^i is an increasing function of ξ_{ji}, and Λ_j^i is an increasing function of λ_j^i. Note that banks from the home island are more proficient in financing the service sector so that $\xi_{sh} < \xi_{mh}$. We now prove $Y_s^h > Y_m^h$ by contraction.

Suppose $\lambda_s^h > \lambda_m^h$. Since $\xi_{sh} < \xi_{mh}$, we have $\theta_s^h < \theta_m^h$. We also obtain $\Lambda_s^h > \Lambda_m^h$, $\mathbf{q}_{sh}(\theta_s^h) < \mathbf{q}_{mh}(\theta_m^h)$, and $Y_s^h < Y_m^h$ following Equation (D.37), $\mathbf{q}_{jh}(\cdot)$ being a decreasing function of λ, and Equation (D.32). By Equation (D.35), we then have $P_s^h > P_m^h$.

On the two islands, the loan rate r_j^i and wage W^i before deregulation

$$r_j^i = \frac{(M^i - 1)r + M^i(\Lambda_j^i - 1)P_j^i A}{M^i \Lambda_j^i - 1} \tag{D.38}$$

$$W^i = \frac{\Lambda_j^i - 1}{\Lambda_j^i}(P_j^i A - r)k_j^i \frac{\mathbf{q}_{ji}(\theta_j^i)}{\theta_j^i} \tag{D.39}$$

r_j^i is an increasing function of Λ_j^i and P_j^i

$$\frac{\partial r_j^i}{\partial \Lambda_j^i} = \frac{1}{(M^i \Lambda_j^i - 1)^2} M^i (M^i - 1)(P_j^i A - r_j^i) > 0 \tag{D.40}$$

$$\frac{\partial r_j^i}{\partial P_j^i} = \frac{1}{M^i \Lambda_j^i - 1} M^i (\Lambda_j^i - 1) A > 0 \tag{D.41}$$

Since we have both $P_s^h > P_m^h$ and $\Lambda_s^h > \Lambda_m^h$, the loan rate in the service sector on the home island is higher than that in the manufacturing sector, $r_s^h > r_m^h$.

Obviously, W^i is an increasing function of Λ_j^i, P_j^i, and $\frac{\mathbf{q}_{ji}(\theta_j^i)}{\theta_j^i}$. We already have $\Lambda_s^h > \Lambda_m^h$,

$P_s^h > P_m^h$, and further

$$\frac{\mathbf{q}_{sh}(\theta_s^h)}{\theta_s^h} > \frac{\mathbf{q}_{mh}(\theta_m^h)}{\theta_m^h} \tag{D.42}$$

Equation (D.42) follows $\lambda_s^h > \lambda_m^h$ and $\xi_{sh} < \xi_{mh}$. Therefore, we obtain

$$W^h = \frac{\Lambda_s^h - 1}{\Lambda_s^h}(P_s^h A - r)k\frac{\mathbf{q}_{sh}(\theta_s^h)}{\theta_s^h} > \frac{\Lambda_m^h - 1}{\Lambda_m^h}(P_m^h A - r)k\frac{\mathbf{q}_{mh}(\theta_m^h)}{\theta_m^h} = W^h \tag{D.43}$$

This contradicts the wage offered to loan officers are the same.

Therefore, in equilibrium, we have $\lambda_s^h < \lambda_m^h$, $\mathbf{q}_{sh}(\theta_s^h) > \mathbf{q}_{mh}(\theta_m^h)$, and $Y_s^h > Y_m^h$ on the home island. Conversely, on the guest island, the higher firm-bank matching efficiency in the manufacturing sector, $\xi_{sg} > \xi_{mg}$, implies that $Y_s^g < Y_m^g$. Comparing the two islands, Equation (21) holds. ■