Internet Appendix to: "Deregulation, Market Structure, and the Evolution of U.S. Banking"

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A.I Economic Framework

We begin by extending the workhorse models of Keeley (1990) and Allen and Gale (2000), which examine how the removal of entry barriers affects deposit competition, investment opportunities, profitability, and risk-taking.[A.I.1] Our main departure from the Keeley (1990) and Allen and Gale (2000) models is to allow for multiple markets (which we call islands) and exogenous entry barriers between markets.[A.I.2] Our stylized model is designed to highlight the reciprocal nature of the interstate banking deregulation agreements, and to provide testable predictions to guide our empirical tests.

A.I.1 Baseline Model

The model is static and features two islands denoted by a and b. Each island is home to an infinite number of prospective bankers. At the beginning of the period, each prospective banker can pay a cost κ_m, with $m \in \{a; b\}$ to set up a bank and compete for local deposit opportunities. Local competition and free entry within each island are such that only a finite number of bankers finds it profitable to pay the startup cost and open a bank. We denote by n_a the equilibrium number of banks operating on island a, and by n_b the equilibrium number of banks operating on island b. We index banks operating in island a by $i = 1, 2, \ldots, n_a$, and banks operating in island b by $j = 1, 2, \ldots, n_b$.

Once set up, banks compete for deposits. The total supply of deposits in each island is represented by an upward-sloping inverse supply curve, denoted by $r_D(\cdot)$, with $r_D(0) \geq 0$, $r_D' > 0$, and $r_D'' \geq 0$. These deposit inverse supply curves are identical across the two islands. Denote by D_{im} the total deposits raised in island $m \in \{a; b\}$ by a generic bank i from state a, and by D_{jm} the total deposits raised in island $m \in \{a; b\}$ by a generic bank j from state b. We model bilateral

[A.I.1] Since we find that changes in NIM in the data are mainly driven by deposit interest expense, we view these models as a closer description of our deregulation laboratory than other models focusing on lending competition such as Boyd and De Nicolo (2005) and Martinez-Miera and Repullo (2010).

[A.I.2] For simplicity, we focus the model around "traditional" organic bank entry rather than entry via acquisitions. However, our theoretical predictions on incumbents and entrants' profitability and risk-taking are identical if we allow banks to enter by acquiring a local bank. Allowing banks to enter by acquisition also predicts a change in local market structure if the acquired banks become more efficient after being acquired, a finding which is consistent with Rhoades (1998), Houston, James, and Ryngaert (2001), Berger and Mester (2003), and other papers (summarized in DeYoung, Evanoff, and Molyneux, 2009), and with the more general evidence in Maksimovic and Phillips (2001) and Braguinsky, Ohyama, Okazaki, and Syverson (2015). Our model also shares many parallels with theories of international trade that examine linkages between export and import markets in the presence of trade barriers (see Redding (2011), Burstein and Melitz (2013), and Allen and Arkolakis (2015) for an overview of this literature).

barriers to entry by imposing that for all $i = 1, 2, \ldots, n_a$, $D_{ib} = 0$, and that for all $j = 1, 2, \ldots, n_b$, $D_{ja} = 0$. In words, we model barriers to entry by assuming that local banks compete to raise deposits *within their home island*, and cannot raise deposits in the other island. Total deposits raised in island a are then the sum of the deposits of banks from island a, and total deposits raised in island b are the sum of the deposits of banks from island b. Within each island, the rate on deposits is a function of total deposits available within the island. For example, the rate of deposits in island a is $r_D = r_D\left(\sum_{i=1}^{n_a} D_{ia}\right)$.

Banks use deposits to invest in a one-period risky loan. Loans are indexed by their risk profile S, and are such that riskier loans yield higher returns. Specifically, for one unit of input, loan S returns S units of output with probability $p(S)$ and 0 otherwise, where $p(\cdot)$ is such that $p(0) = 1$, $p(\bar{S}) = 0$, $p' < 0$, and $p'' \leq 0$ for all $S \in [0, \bar{S}]$. As in the case of deposits, lending opportunities (i.e., the set of all possible values for S) and the function $p(\cdot)$ are identical across islands, and barriers to entry exist such that banks are allowed to lend only in their own island. For simplicity, we also assume that the levels of risk by any two loans in islands a and b are independent.

At the end of the period, uncertainty is resolved. If the bank is solvent, the banker obtains S units of output and returns r_D to depositors for each unit of deposits. If the bank is insolvent, the banker gets nothing. As in Allen and Gale (2000), we assume that deposits are fully insured at no cost, such that depositors are fully repaid by the government in the event of a bank default.[A.I.3]

In a Nash equilibrium, each bank i in island a chooses the level of risk and deposit quantities $(S_{ia}, D_{ia}) \in [0, \bar{S}] \times \mathbb{R}_+$ that are best responses to the strategies of the other banks. Taking island a, this deposit size is chosen to maximize bank profits, denoted by π_{ia}:

$$p(S_{ia}) \left[S_{ia} D_{ia} - r_D \left(\sum_{i=1}^{n_a} D_{ia} \right) D_{ia} \right] - \kappa_a. \tag{A.I.1}$$

In a symmetric equilibrium, the first-order conditions for this problem are

$$p'(S_a) \left[S_a - r_D(n_a D_a) \right] + p(S_a) = 0, \tag{A.I.2}$$

$$S_a - r_D(n_a D_a) - r_D'(n_a D_a) D_a = 0. \tag{A.I.3}$$

[A.I.3] This assumption ensures that deposit supply does not depend on bank risk. As in Allen and Gale (2000), the assumption that banks do not pay deposit insurance does not play a role for the results of this section.

Allen and Gale (2000) show that this system of equations has a unique interior solution with $(S_a, D_a) > 0$, and that S_a and D_a are respectively increasing and decreasing in the number of banks n_a (i.e., in local competition). To show this result in closed form, and to obtain closed-form solutions for bank profits, we assume that $p(S) = 1 - \lambda S$ over the support $\left[0, \lambda^{-1}\right]$, and that $r_D(X) = \phi_0 + \phi_1 X$, with ϕ_0 and ϕ_1 positive constants.[A.I.4] Plugging these values into (A.I.2) and (A.I.3) shows that bank deposits and risk in island a are, respectively,

$$D_a = \frac{1/\lambda - \phi_0}{(n_a + 2)\,\phi_1}, \qquad S_a = \frac{1}{\lambda} - \frac{1/\lambda - \phi_0}{n_a + 2}, \tag{A.I.4}$$

confirming that the equilibrium levels of deposits is decreasing in the number of banks n_a, while the level of risk-taking is increasing in n_a. Intuitively, competition decreases local banks' rents and increases their risk-taking incentives. Substituting these expressions into the profit functions, we get that the equilibrium level of (expected) profits are

$$\pi_a \;=\; \frac{1}{\tilde{\phi}_1}\left(\frac{1 - \tilde{\phi}_0}{n_a + 2}\right)^3 - \kappa_a, \tag{A.I.5}$$

where $\tilde{\phi}_0 \equiv \phi_0\lambda$ and $\tilde{\phi}_1 \equiv \phi_1\lambda^2$. In turn, (A.I.5) determines the equilibrium number of banks operating on island a as

$$n_a \;=\; \frac{1 - \tilde{\phi}_0}{\left(\kappa_a \tilde{\phi}_1\right)^{1/3}} - 2. \tag{A.I.6}$$

From (A.I.6), an increase in the startup cost κ_a decreases the number of banks operating in equilibrium in island a.[A.I.5] Closed-form solutions for equilibrium deposits, risk, profits, and number of banks in island b can similarly be obtained by replacing n_a and κ_a with n_b and κ_b in (A.I.4)-(A.I.6).

[A.I.4] These parametric forms are common in the literature (see, e.g., Boyd and De Nicolo, 2005). To ensure the existence of an equilibrium, we assume that $\phi_0\lambda < 1$.

[A.I.5] In (A.I.6) and in what follows, we assume that the parameters are such that the equilibrium number of banks is large enough and integer constraints do not bind. To ensure that more than one bank enters the market in equilibrium, we also assume that $\kappa_m \leq (1 - \tilde{\phi}_0)^3 / (64\tilde{\phi}_1)$ for $m \in \{a; b\}$.

A.I.2 Entry, Competition, and Investment Opportunities

Now suppose that immediately after bankers have paid the fixed startup costs, but before banks start competing for deposits, island-a banks can enter island b, while island-b banks are still prevented from entering island a.[A.I.6] We assume that island-a banks differ in their entry cost into island b. Specifically, we assume that $n_a^e < n_a$ banks from island a need to pay a fixed cost $\chi_a^{lo} < \kappa_b$ to enter island b's market, while the remaining $n_a - n_a^e$ need to pay a fixed cost $\chi_a^{hi} > \kappa_b$ to enter island b's market.[A.I.7] We think of these entry cost differences as reduced-form proxies for differences in proximity, productivity, and synergies that can affect a bank's decision to enter another island. For example, small banks bound by local economies of density may have relatively higher costs of entry into other states, consistent with the findings of Aguirregabiria, Clark, and Wang (2016).

Under the stated assumptions, only island-a banks with low entry costs find it profitable to enter island b, while banks with high entry costs do not enter—consistent with the fact that only a fraction of banks enter out-of-state markets during the deregulation period we focus that our empirical tests focus on (see Figure 2). For notational convenience, we normalize $\chi_a^{lo} = 0$, and we index banks such that the first $i = 1, 2, \ldots, n_a^e$ are those to enter island b.[A.I.8] Treating the startup cost κ_a as sunk, banks from island a now make deposit and lending choices in both islands by maximizing the objective

$$p\left(S_{ia}\right)\left[S_{ia} - r_D\left(\sum_{i=1}^{n_a} D_{ia}\right)\right] D_{ia} + \mathbb{I}_{i \leq n_a^e} p\left(S_{ib}\right)\left[S_{ib} - r_D\left(\sum_{i=1}^{n_a^e} D_{ib} + \sum_{j=1}^{n_b} D_{jb}\right)\right] D_{ib}, \tag{A.I.7}$$

where $\mathbb{I}_{i \leq n_a^e}$ is an indicator equal to one if bank i can enter island b and zero otherwise. Note that, by treating the probability of repayment of the two loans as independent, the objective function (A.I.7) abstracts from portfolio diversification incentives (e.g., Martinez-Miera and Repullo, 2010)

[A.I.6] The assumption that the shock hits after banks have entered the market allows us to compare risk and profits keeping the initial number of banks in island b fixed to n_b.

[A.I.7] Entry by acquisitions could be integrated in our framework, for example, by assuming that there are n_a^e incumbent in island b earning negative profits, that each one of these banks is acquired by another bank from island a, and that acquisitions improve acquired banks' efficiency by setting their production parameters to those of the other n_b banks.

[A.I.8] We also assume that there are no economies of scale nor internal capital markets, such that every dollar of deposits raised by bank i in island b is invested in a loan on the same island. Our assumptions, while admittedly strong, greatly simplify the equilibrium characterization and allow us to focus on the profitability and risk-taking incentives purely driven by deposit competition.

that are not at the core of our mechanism. While we do not directly model portfolio diversification benefits, in Proposition A.I.1 we show that risk-reduction benefits arise endogenously from the channel of deposit competition: by accessing less competitive islands, entrants can earn rents and reduce the bank's overall risk. Additionally, in Section A.I.3.2 we study how relaxing the assumption that loan defaults are independent across islands modifies our main result on bank profitability.

On the other hand, the typical bank j from island b is still allowed to operate only in island b while facing competition from island-a banks. Banks from island b make deposit and lending choices in island b by maximizing

$$p\left(S_{jb}\right)\left[S_{jb}-r_D\left(\sum_{i=1}^{n_a^e} D_{ib}+\sum_{j=1}^{n_b} D_{jb}\right)\right]D_{jb}. \tag{A.I.8}$$

From (A.I.7), the equilibrium level of deposits and risk in island a are still given by those in (A.I.4). Moreover, in a symmetric equilibrium banks from a and b choose the same size and risk in island b, or

$$\tilde{D}_b=\frac{1/\lambda-\phi_0}{\left(n_a^e+n_b+2\right)\phi_1}, \qquad \tilde{S}_b=\frac{1}{\lambda}-\frac{1/\lambda-\phi_0}{n_a^e+n_b+2}, \tag{A.I.9}$$

which show a reduction in deposits and an increase in risk-taking by island-b banks proportional to the number of new entrants from island a.

We can now compare the risk-taking behavior of island-a and island-b banks when the islands are subject to the removal of entry restrictions. We refer to the effect of the removal of entry restrictions on island-b banks' profits and risk-taking as a competition effect. We refer to the effect of the removal of entry restrictions on island-a banks' profits and risk-taking as an investment opportunities effect.

Proposition A.I.1.

1. ***Competition:*** *The removal of entry restrictions from island a to island b decreases island-b banks' profits and increases their risk-taking.*

2. ***Investment opportunities:*** *The removal of entry restrictions from island a to island b increases*

island-a banks' profits and, if the number of entrants is sufficiently small, it decreases their risk-taking.

Proof.

1. **Competition:** The (symmetric) profits of banks headquartered in b become

$$\tilde{\pi}_b \quad = \quad \frac{1}{\tilde{\phi}_1}\left(\frac{1-\tilde{\phi}_0}{n_a^e+n_b+2}\right)^3 - \kappa_b \quad < \quad \pi_b. \tag{A.I.10}$$

   Moreover, for island-b banks, clearly $\tilde{S}_b < S_b$, as higher competition from island-a entrants reduces local rents and increases risk-taking.

2. **Investment Opportunities:** The profits of bank i headquartered in a become

$$\tilde{\pi}_{ia} \quad = \quad \frac{1}{\tilde{\phi}_1}\left[\left(\frac{1-\tilde{\phi}_0}{n_a+2}\right)^3 + \mathbb{I}_{i\leq n_a^e}\left(\frac{1-\tilde{\phi}_0}{n_a^e+n_b+2}\right)^3\right] - \kappa_a \quad \geq \quad \pi_a, \tag{A.I.11}$$

   with strict inequality for $i \leq n_a^e$, where π_a are the original profits from (A.I.5).[A.I.9] Moreover, if $n_b < n_a - n_a^e$, then $\tilde{S}_b < S_a$. Since island-a banks' risk-taking is a loan-weighted average of their risk-taking in islands a and b,

$$\tilde{S}_{ia} \quad = \quad \delta_i S_a + (1-\delta_i)\,\tilde{S}_b, \tag{A.I.12}$$

   with $\delta_i \equiv D_a/\left(D_a + \mathbb{I}_{i\leq n_a^e}\tilde{D}_b\right)$, then $\tilde{S}_{ia} \leq S_a$.[A.I.10] In words, if the number of entrants is small enough (or if competition in island b is relatively low), then the removal of entry restrictions decreases island-a banks' risk-taking.

□

[A.I.9] The profits of banks headquartered on island a are not symmetric and depend on their efficiency. Hence the subscript i in (A.I.11).

[A.I.10] Plugging in the value for the equilibrium number of banks in each island, this condition reduces to

$$n_a^e \quad < \quad \left(\kappa_a^{-1/3} - \kappa_b^{-1/3}\right)\frac{1-\lambda\phi_0}{\tilde{\phi}_1^{1/3}},$$

which confirms that a necessary condition for a reduction in island-a banks' risk-taking is that island b is initially less competitive (i.e., faces higher entry costs) than island a.

A.I.3 Cross-sectional Predictions for Bank Profitability

A.I.3.1 Bank Heterogeneity and the Effects of Competition

We now show that the negative effects of competition shocks are larger for ex-ante more profitable banks. To do so, we focus on banks based on island b. Again, we assume that this competition shock happens after bankers have paid the start up cost, so that this does not affect their entry decision. The argument can be extended to an increase in competition from island-a banks as described in Section A.I.2, at the expense of more complex notation.

Suppose that the first $j = 1, 2, \ldots, n_b^{in} < n_b$ are inefficient and have to pay a non-negative marginal cost $c > 0$ per unit of deposits raised, while the remaining $j = n_b^{in} + 1, n_b^{in} + 2, \ldots, n_b$ are efficient and do not need to pay such cost. As a result, the first n_b^{in} banks are ex-ante less profitable than the remaining banks. Denote by D_{jb}^{in} the deposits raised by ex-ante unprofitable banks, and by D_{jb}^{f} the deposits raised by the ex-ante profitable banks. The profits of the first n_b^{in} banks, denoted by π_{jb}^{in}, are

$$\pi_{jb}^{in} = p\left(S_{jb}^{in}\right)\left[S_{jb}^{in} - r_D\left(\sum_{j=1}^{n_b^{in}} D_{jb}^{in} + \sum_{j=n_b^{in}+1}^{n_b} D_{jb}^{e}\right) - c\right] D_{jb}^{in}, \tag{A.I.13}$$

while the profits of the ex-ante profitable banks, denoted by π_{jb}^{e}, are

$$\pi_{jb}^{e} = p\left(S_{jb}^{e}\right)\left[S_{jb}^{e} - r_D\left(\sum_{j=1}^{n_b^{in}} D_{jb}^{in} + \sum_{j=n_b^{in}+1}^{n_b} D_{jb}^{e}\right)\right] D_{jb}^{e}, \tag{A.I.14}$$

In the Appendix, we use the same parametrization as in the previous sections to show that the equilibrium profits of the unprofitable banks can be expressed as the profits of the profitable banks (a function of the number of banks operating on the island), minus a term ω that is decreasing in the number of banks operating in island b:

$$\pi_b^{in}\left(n_b\right) = \pi_b^{e}\left(n_b\right) - \omega\left(n_b\right), \tag{A.I.15}$$

such that

$$\frac{\partial}{\partial n_b}\pi_b^{in}(n_b) = \frac{\partial}{\partial n_b}\pi_b^{e}(n_b) - \frac{\partial}{\partial n_b}\omega(n_b) > \frac{\partial}{\partial n_b}\pi_b^{e}(n_b). \tag{A.I.16}$$

This result allows us to formulate the following testable prediction.

Proposition A.I.2. *An increase in competition in island b decreases island-b banks' profits more when island-b banks are ex-ante more profitable.*

Proof. To prove this claim, we show that the equilibrium profits of ex-ante less-profitable (i.e., inefficient) banks can be expressed as the profits of profitable banks (a function of the number of banks operating on the island), minus a term that is decreasing in the number of banks operating in island b:

$$\pi_b^{in}(n_b) = \pi_b^{e}(n_b) - \omega(n_b), \tag{A.I.17}$$

such that

$$\frac{\partial}{\partial n_b}\pi_b^{in}(n_b) = \frac{\partial}{\partial n_b}\pi_b^{e}(n_b) - \frac{\partial}{\partial n_b}\omega(n_b) > \frac{\partial}{\partial n_b}\pi_b^{e}(n_b). \tag{A.I.18}$$

The first-order conditions for ex-ante profitable and unprofitable banks are

$$p'\left(S_{jb}^{e}\right)\left[S_{jb}^{e} - r_D\left(\sum_{j=1}^{n_b^{in}} D_{jb}^{in} + \sum_{j=n_b^{in}+1}^{n_b} D_{jb}^{e}\right)\right] + p\left(S_{jb}^{e}\right) = 0, \tag{A.I.19}$$

$$S_{jb}^{e} - r_D\left(\sum_{j=1}^{n_b^{in}} D_{jb}^{in} + \sum_{j=n_b^{in}+1}^{n_b} D_{jb}^{e}\right) - r_D'\left(\sum_{j=1}^{n_b^{in}} D_{jb}^{in} + \sum_{j=n_b^{in}+1}^{n_b} D_{jb}^{e}\right) D_{jb}^{e} = 0, \tag{A.I.20}$$

$$p'\left(S_{jb}^{in}\right)\left[S_{jb}^{in} - r_D\left(\sum_{j=1}^{n_b^{in}} D_{jb}^{in} + \sum_{j=n_b^{in}+1}^{n_b} D_{jb}^{e}\right) - c\right] + p\left(S_{jb}^{in}\right) = 0, \tag{A.I.21}$$

$$S_{jb}^{in} - r_D\left(\sum_{j=1}^{n_b^{in}} D_{jb}^{in} + \sum_{j=n_b^{in}+1}^{n_b} D_{jb}^{e}\right) - r_D'\left(\sum_{j=1}^{n_b^{in}} D_{jb}^{in} + \sum_{j=n_b^{in}+1}^{n_b} D_{jb}^{e}\right) D_{jb}^{in} - c = 0. \tag{A.I.22}$$

Using the previous parametrization, in a symmetric equilibrium across bank types the system

becomes

$$-\lambda\left[S_b^e-\phi_0-\phi_1\left(n_b^{in}D_b^{in}+\left(n_b-n_b^{in}\right)D_b^e\right)\right]+1-\lambda S_b^e = 0, \quad \text{(A.I.23)}$$

$$S_b^e-\phi_0-\phi_1\left(n_b^{in}D_b^{in}+\left(n_b-n_b^{in}\right)D_b^e\right)-\phi_1 D_b^e = 0, \quad \text{(A.I.24)}$$

$$-\lambda\left[S_b^{in}-\phi_0-\phi_1\left(n_b^{in}D_b^{in}+\left(n_b-n_b^{in}\right)D_b^e\right)-c\right]+1-\lambda S_b^{in} = 0, \quad \text{(A.I.25)}$$

$$S_b^{in}-\phi_0-\phi_1\left(n_b^{in}D_b^{in}+\left(n_b-n_b^{in}\right)D_b^e\right)-\phi_1 D_b^{in}-c = 0. \quad \text{(A.I.26)}$$

Combining (A.I.23) and (A.I.25) we get

$$S_b^{in} = S_b^e+\frac{c}{2}, \quad \text{(A.I.27)}$$

while combining (A.I.24) and (A.I.26) we get

$$D_b^{in} = D_b^e-\frac{c}{2\phi_1}, \quad \text{(A.I.28)}$$

and we note that (eliminating the functional dependency of r_D on its arguments)

$$S_b^e-r_D = \phi_1 D_b^e, \quad \text{(A.I.29)}$$

$$S_b^{in}-r_D-c = \phi_1 D_b^{in}. \quad \text{(A.I.30)}$$

Then, the expected profits of ex-ante unprofitable banks can be written as

$$\pi_b^{in} = \left(1-\lambda S_b^{in}\right)\left(S_b^{in}-r_D-c\right)D_b^{in}, \quad \text{(A.I.31)}$$

$$= \phi_1\left(1-\lambda S_b^{in}\right)\left(D_b^{in}\right)^2 \quad \text{(A.I.32)}$$

$$= \left(1-\lambda\left(S_b^e+\frac{c}{2}\right)\right)\left(\phi_1\left(D_b^e\right)^2+\frac{c^2}{4\phi_1}-cD_b^e\right) \quad \text{(A.I.33)}$$

$$= \left(1-\lambda S_b^e\right)\phi_1\left(D_b^e\right)^2-\left(1-\lambda S_b^e\right)\frac{c}{2}\left(2D_b^e-\frac{c}{2\phi_1}\right)-\lambda\frac{c}{2}\phi_1\left(D_b^{in}\right)^2 \quad \text{(A.I.34)}$$

$$= \pi_b^e-\left(1-\lambda S_b^e\right)\frac{c}{2}\left(2D_b^e-\frac{c}{2\phi_1}\right)-\lambda\frac{c}{2}\phi_1\left(D_b^{in}\right)^2 \quad \text{(A.I.35)}$$

$$= \pi_b^e-\omega, \quad \text{(A.I.36)}$$

where

$$\omega \equiv \frac{c}{2}\left[(1-\lambda S_b^e)\left(2D_b^e - \frac{c}{2\phi_1}\right) + \lambda\phi_1\left(D_b^{in}\right)^2\right]. \tag{A.I.37}$$

Since S_b^e is increasing in n_b and D_b^e is decreasing in n_b, the term in square brackets is decreasing in n_b. □

A.I.3.2 Correlation Between Lending Markets and Investment Opportunities

As highlighted above, the profit function (A.I.7) assumes that loan repayment probabilities are uncorrelated between islands. In this section, we relax this assumption by focusing on the opposite case where repayment probabilities are perfectly correlated, and study how entrants' profits change as a result. To maintain tractability and obtain closed-form solutions, we abstract from a full-fledged analysis of loan competition and diversification. See, e.g., Martinez-Miera and Repullo (2010) for a detailed theoretical analysis.

When loan repayment probabilities are perfectly correlated, island-a banks that enter island b can only choose an overall level of risk S_{ic}^e. As in the previous section, this also means that the returns that these banks obtain on their loans are also identical across islands. In sum, the profit function (A.I.7) for banks $i = 1, \ldots, n_a^e$ becomes

$$p\left(S_{ia}^e\right)\left[S_{ia}^e\left(D_{ia}^e + D_{ib}^e\right) - r_D\left(\sum_{i=1}^{n_a^e} D_{ia}^e + \sum_{i=n_a^e+1}^{n_a} D_{ia}\right) D_{ia}^e - r_D\left(\sum_{i=1}^{n_a^e} D_{ib}^e + \sum_{j=1}^{n_b} D_{jb}\right) D_{ib}^e\right], \tag{A.I.38}$$

where the superscript e again denotes state-a banks that can enter state b, and the rest of the variables have the same meaning as in the previous sections. Denote by $\hat{\pi}_{ia}$ the equilibrium value of (A.I.38).

Proposition A.I.3. *$\tilde{\pi}_{ia} \geq \hat{\pi}_{ia}$. That is, entrant banks' equilibrium profits in the economy where loan defaults are perfectly correlated across states are greater than or equal to equilibrium profits in the economy where loan defaults are independent across states.*

Proof. Note that the profit function (A.I.38) can be written as

$$p\left(S_{ia}^{e}\right)\left[S_{ia}^{e}-r_{D}\left(\sum_{i=1}^{n_{a}^{e}}D_{ia}^{e}+\sum_{i=n_{a}^{e}+1}^{n_{a}}D_{ia}\right)\right]D_{ia}^{e}+p\left(S_{ia}^{e}\right)\left[S_{ia}^{e}-r_{D}\left(\sum_{i=1}^{n_{a}^{e}}D_{ib}^{e}+\sum_{j=1}^{n_{b}}D_{jb}\right)\right]D_{ib}^{e}, \quad \text{(A.I.39)}$$

while the profit function (A.I.7) for entrants can be rewritten as

$$p\left(S_{ia}\right)\left[S_{ia}-r_{D}\left(\sum_{i=1}^{n_{a}^{e}}D_{ia}+\sum_{i=n_{a}^{e}+1}^{n_{a}}D_{ia}\right)\right]D_{ia}+p\left(S_{ib}\right)\left[S_{ib}-r_{D}\left(\sum_{i=1}^{n_{a}^{e}}D_{ib}+\sum_{j=1}^{n_{b}}D_{jb}\right)\right]D_{ib}. \quad \text{(A.I.40)}$$

Since entrants faced with the problem of maximizing (A.I.7) can always choose $S_{ia} = S_{ib} = S_{ia}^{e}$, $D_{ia} = D_{ia}^{e}$, and $D_{ib} = D_{ib}^{e}$ from (A.I.39), the maximum value of (A.I.7) has to be at least as large as the maximum value of (A.I.39).

□

A.II *States In*, *States Out*, and *Net States In*: The Colorado Example

Figure A.1 provides an illustration of the construction of our deregulation measures, taking Colorado as the focal state. In the figure, arrows indicate whether banks from a given state are allowed to enter another state through interstate banking. In 1988, Colorado signed a regional reciprocal agreement with Nebraska (along with six other states), which Nebraska did not reciprocate immediately. While seminal work in the deregulation literature (e.g., Kroszner and Strahan, 1999) usually codes 1988 as Colorado's deregulation year, Panel (a) of Figure A.1 shows that nothing actually changed in 1988, since Colorado banks could not enter Nebraska (and vice versa) until Nebraska reciprocated the agreement.[A.II.1]

Nebraska ultimately reciprocated the agreement in 1991, allowing Colorado banks to enter Nebraska and Nebraska banks to enter Colorado (Panel (b)). From the perspective of Colorado banks, this corresponds to an increase in both competitive pressure (a one-state increase in *States In*) and investment opportunities (a one-state increase in *States Out*). Our *Net States In* measure remains unchanged, thus eliminating from our reduced-form estimates all joint variation in competitive threats and investment opportunities.

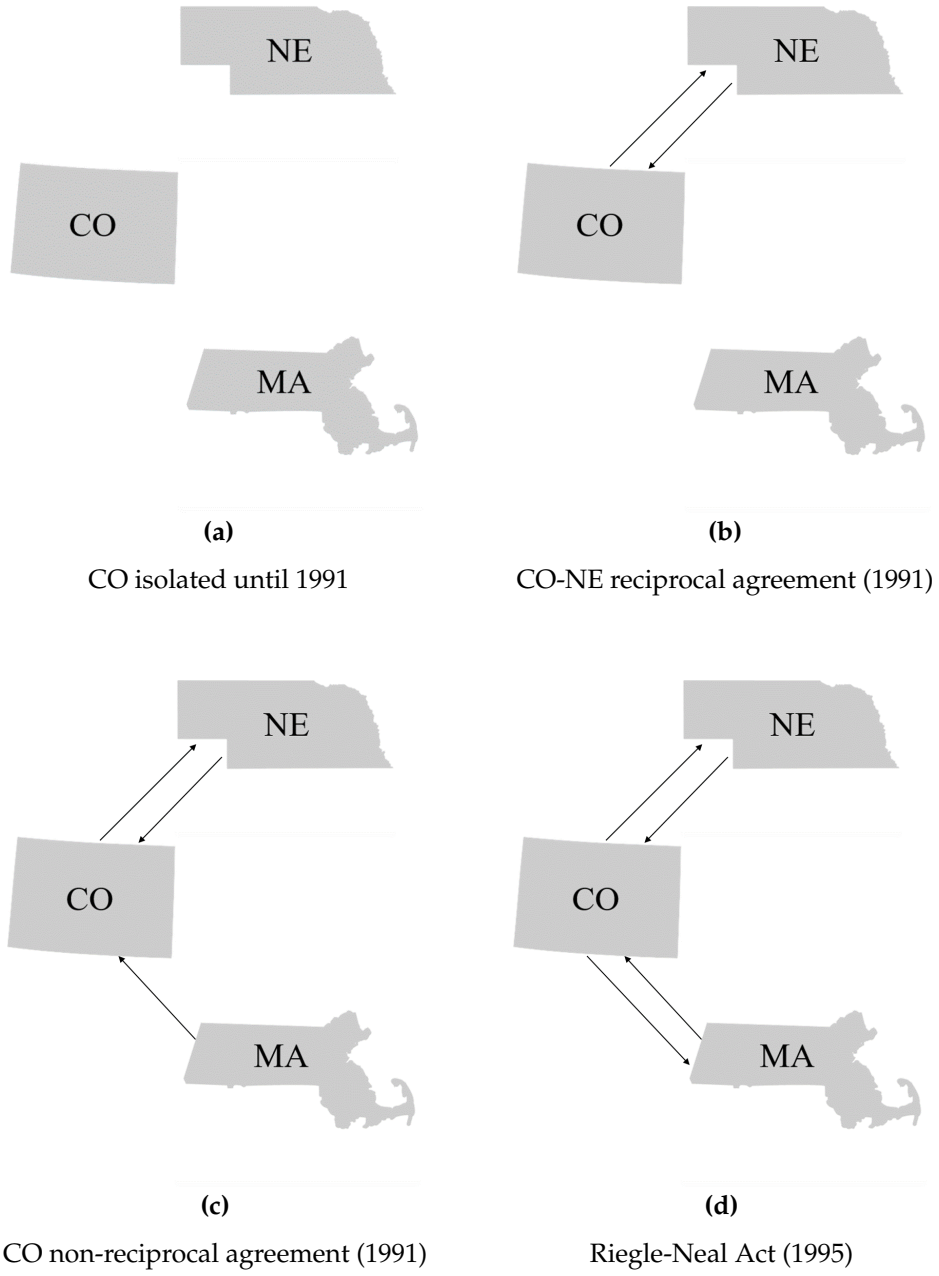
Later in 1991, Colorado signed a national non-reciprocal agreement allowing banks from all other states to enter Colorado. This means that (say) Massachusetts banks can enter Colorado, but Colorado banks cannot enter Massachusetts (visualized in Panel (c) of Figure A.1). Hence, there is a one-state increase in *States In* (since Massachusetts banks can enter Colorado), but no change in *States Out*. As a result, *Net States In* increases by one, allowing us to capture shocks to entry threats not offset by shocks to investment opportunities. Finally, the Riegle-Neal Act of 1994 allowed Colorado banks to expand to all other US states in 1995, including Massachusetts (Panel (d)). In the case of Colorado and Massachusetts, the Riegle-Neal Act therefore represent a one-state increase in *States Out* for Colorado with no corresponding change in *States In* and hence a one-state decrease in Colorado's *Net States In*, allowing us to capture shocks to investment opportunities not offset by shocks to entry threats.

[A.II.1] Like us, more recent studies such as Goetz, Laeven, and Levine (2016) and Jiang, Levine, and Lin (2016) also take into account the reciprocal nature of the interstate banking deregulation process. However, these studies do not account for the common variation in entry threats and investment opportunities due to reciprocity. That is, while they construct measures that appear similar to *States In* and *States Out*, these papers do not include both measures in their regressions, and thus do not capture the unbiased effects of either competition or investment opportunities.

Figure A.1

Identification Example: Colorado, Nebraska, and Massachusetts

This figure provides a visual illustration of the deregulation process that we use to identify shocks to competition (*States In*) and shocks to investment opportunities (*States Out*), taking Colorado as focal state. Arrows indicate whether banks from a given state are allowed to enter another state through interstate banking.



(a) CO isolated until 1991

(b) CO-NE reciprocal agreement (1991)

(c) CO non-reciprocal agreement (1991)

(d) Riegle-Neal Act (1995)

A.III Additional Evidence

In this section, we present the results of several ancillary tests for our main profitability and risk-taking results.

A.III.1 Bank Size and Efficiency

We first ask how competitive threats affect the size of the average local bank. In Appendix Table A.1, we start by showing that the asset size (columns (1) and (2)) and the deposit size (columns (3) and (4)) of the average incumbent bank are negatively affected by inbound competitive threats: our estimates imply that a one-state increase in *States In* is associated with a 0.19% decrease in the asset size and a 0.17% decrease in the deposit size of the average incumbent bank (while controlling for outbound investment opportunities). Table A.1 also confirms a positive association between outbound investment opportunities and size: a one-state in *States Out* is associated with a 0.32% increase in the asset and deposit size of the average bank in our sample.

In Appendix Table A.2, we dig deeper into how banks adjust their branch footprints in response to competitive threats. This table shows that, after controlling for investment opportunities, competitive threats are associated with a decrease in local branch openings (columns (1) and (2)) and an increase in branch closures (columns (3) and (4)). Investment opportunities yield opposite effects.[A.III.1] Overall, the estimates presented in Table A.2 help us reconcile our baseline results on local market concentration in Table 3 with a shift in the distribution of deposits between less productive incumbent banks and more productive entrants from other states.

Do competitive threats also induce efficiency improvements among incumbents? In the first two columns of Table A.3, we show that the dollar value of bank salaries declines by 0.2% for a one-state increase in *States In* (column (1)) and *Net States In* (column (2)), suggesting that the salaries that incumbent banks pay to their employees are negatively affected by competitive threats. Although these effects may just be a reflection of the overall downsizing documented in this section, columns (3) and (4) also show that salaries decline relative to total noninterest expense, consistent with the interpretation that banks faced with higher competitive threats attempt to increase their cost efficiency.

[A.III.1] Consistent with Johnson and Rice (2008), we do not find statistically significant evidence of de-novo branch openings by out-of-state banks during the pre-1994 period.

A.III.2 Dynamic (Stacked) Difference-in-differences Tests

To study banks' dynamic responses to competitive threats, we also run a series of dynamic (stacked) difference-in-differences tests (e.g., Cengiz et al., 2019) that focus on the time periods surrounding each deregulation shock. For each state, we first measure year-by-year changes in *States In* and *Net States In*, which we use as (net) inbound entry shocks for our dynamic specification. We then construct a stacked panel starting three years before and ending three years after each inbound shock (an "event"), and merge this state-event panel with the bank-state-quarter panel containing repeated quarterly NIM observations for each state where the bank has at least one branch. Our specification is:

$$y_{imt} = \alpha + \beta_1 \, \Delta States \; In_{mt} + \beta_2 \; Post_t + \beta_3 \, \Delta States \; In_{mt} \times \; Post_t + \gamma_{FE} + \varepsilon_{imt} \; , \tag{A.III.1}$$

where y represents an outcome variable such as NIM, profitability, or risk-taking, $\Delta States \; In$ (or $\Delta Net \; States \; In$) is the change in *States In* (or *Net States In*) in the year of the competition shock, *Post* is an indicator equal to one for the post-period within each even (and zero otherwise), i indexes banks, m indexes states, and t indexes quarters. Standard errors are clustered at the state level.

The results of our tests are reported in Figure A.2 and Table A.4. For ease of interpretation, in Figure A.2 we also plot the pre-event and post-event average point estimates. The results validate our baseline findings. Comparing the estimates in columns Table A.4 to their panel counterparts in Table 4, we find quantitatively similar estimates in our panel and dynamic difference-in-differences tests. The figure and table show that NIM falls significantly due to increased competition (even after removing confounding variation from investment opportunities) in the years following each deregulation event, and remains well below the pre-event NIM even three years after deregulation is implemented.[A.III.2]

We also find that banks' interest margins start shrinking in year $t-1$ (the baseline year in Figure A.2), which is the passage year for most deregulation statutes and is associated with some degree of within-state changes in market structure, as discussed in Section 3.5.[A.III.3] This result is

[A.III.2] Figure A.3 presents the results of the dynamic difference-in-differences tests using the extended sample period and finds similar results.

[A.III.3] For example, the Riegle-Neal Act was passed in 1994 but did not become effective until 1995. We manually verified the passage year for approximately one-third of the sample of deregulation laws in Amel (1993), and we found that the passage year precedes the effective year in nearly all the cases we examined.

consistent with early theories on limit pricing (e.g., Milgrom and Roberts, 1982) and complements recent evidence from the airline industry (Sweeting, Roberts, and Gedge, 2020) by confirming that firms preemptively adjust their pricing (in our case, deposit rate-setting) to deter entry when markets become more contested.[A.III.4] To the best of our knowledge, our paper is the first to document evidence consistent with such dynamic price adjustments in the context of US banking deregulation.

It is also important to note again here that our *Net States In* is zero on average and zero for all states both before and after deregulation (see Figure 1). Because this treatment measure exhibits no trend and varies every year with the deregulation decisions of focal states and other states, it avoids many of the concerns in standard staggered difference-in-differences estimation in which all units are eventually treated (see, e.g., Goodman-Bacon, 2021). In Table A.15, we also use the 1994 Riegle-Neal Act as a single event that differentially affects a wide cross-section of states and perform a simple static difference-in-differences estimation around this event. We obtain quantitatively similar coefficients and statistical significance relative to our main results, further alleviating potential concerns related to treatment timing.

We perform two sets of additional dynamic tests. First, to study the dynamic patterns of profitability and risk-taking, we run the same dynamic difference-in-differences tests described above on our risk and profitability variables. The estimates based on these tests are reported in Table A.5 and shown graphically in Figure A.5: ROE and ROA decrease significantly around the time that interstate banking laws are passed, and remain low for at least three years. All four risk-taking measures exhibit no pre-trends before the law passage dates, jump significantly around the same time period, and remain higher until at least three years later. These results provide additional validation for the risk-taking and profitability results in Tables 6 and 7.

Next, we extend the sample to include the entire period before the Global Financial Crisis (i.e., we let our sample begin with the first quarter of 1984 and end with the last quarter of 2006), and study persistence in our estimated effects on profitability and risk-taking. Consistent with our previous evidence, the top two panels of Figure A.6 show that, after an initial drop around each deregulation event, profitability slowly reverts back to the pre-deregulation levels. In contrast,

[A.III.4] In a similar spirit, Tomy (2019) shows that banks engage in strategic financial reporting during the deregulation period to deter competitors' entry.

the bottom two panels of Figure A.6 show that the effects of deregulation on bank risk-taking and portfolio composition appear to be extremely persistent. The bottom-left panel shows that a one-state increase in *States In* leads to a 1.5% increase in the standard deviation of ROE over a 2-3 year horizon, and approximately 0.5% increase over a horizon of more than 5 years. This increase in risk-taking is statistically significant at the 95% confidence level throughout the entire period. Similarly, the bottom-right panel shows that a one-state increase in *States In* leads to a 0.5% decrease in loans to assets for horizons of more than 4 years.[A.III.5] In sum, while long-run inference is complicated by potential confounding factors, Figure A.6 suggests that banks persistently shifted to riskier activities and were able to recover some of the profitability they lost after deposit market rents were eroded by competition.

A.III.3 Investment Opportunities, Interstate Banking, and Interstate Branching

In Table A.6, we ask whether the correlation between investment opportunities (as measured by *States Out*), NIM, profitability, and risk-taking variables studied in the previous sections is mainly driven by interstate *banking* or subsequent interstate *branching* agreements. As we show in Section 3.5, the changes in *States In* induced by interstate banking deregulation lead to increased contestability, M&A transactions, and changes in local market structure that have an immediate effect on incumbent charters' NIM. In contrast, the effect of *States Out* on local charters' NIM is less clear. Following interstate banking deregulation, charter-level NIM can increase in *States Out* only because of reduced *local* competition: lower interest expense from operating in less-competitive markets will affect interest expense at the BHC level, not at the charter level. However, once interstate branching is allowed the charter can open branches in other states and its interest expense can be directly affected by out of state expansion.

In Table A.6, we interact *States Out* with an indicator equal to one for all years after 1994 (when most interstate branching agreements are passed), thus capturing incremental effects arising from interstate branching agreements in the years 1994 and 1995.[A.III.6] Consistent with Table 3, column (1) of A.6 shows that the relationship between *States Out* and NIM is driven by both reduced

[A.III.5] The standard deviation of ROE decreases mechanically after the large drop in ROE around the deregulation shock is dropped out of the rolling window. In this sense, loans to assets are a better forward-looking measure of risk and changes in business models in our long-run tests.

[A.III.6] *States Out* is equal to 50 for all states after 1995, such that both the baseline coefficient estimate and the interaction term are identified before 1995.

local competition and, to a lesser extent, out-of-state branching opportunities. On the other hand, columns (2) to (7) show that the correlation between *States Out* and ROE, ROA, and our main risk-taking variables is strongest before the interstate branching period, suggesting that banks become more efficient and make less risky investments when they are allowed to acquire banks in other states.

A.III.4 Other Deregulation Events

For comparison with the literature, we also examine the relationship between ROE and other bank deregulation events—namely, intrastate and interstate branching. We construct measures of intrastate branching deregulation following Jayaratne and Strahan (1998) and interstate branching deregulation following Rice and Strahan (2010). Since intrastate branching affects all banks in the state at the same point in time, we construct a single dummy variable taking the value of one if a state has deregulated (and therefore, we are not able to separate entry threats and entry opportunities). For interstate branching, we construct two indicators based on the indicators in Rice and Strahan (2010) that (roughly) capture a bank's exposure to entry threats (the Rice and Strahan 2010 index, inverted) and entry opportunities (the average of other states' entry threat indicators). We then examine the relationships between ROE and four different types of deregulation measures—our interstate banking deregulation measures (*States In*, *States Out*, and *Net States In*), the interstate banking deregulation measure of Kroszner and Strahan (1999), an intrastate branching indicator based on Jayaratne and Strahan (1998) and Kroszner and Strahan (1999), and two interstate branching indicators based on Rice and Strahan (2010).

Table A.7 shows that the effects of deregulation on profitability are similar across various types of deregulation events. In particular, the *net* effects of intrastate branching on ROE are positive on average. For interstate branching deregulation, where we are able to separate events into rough *States In* and *States Out* equivalents, we find similar results to the baseline results in Table 6 using interstate banking deregulation: entry threats are associated with lower ROE, while investment opportunities are associated with higher ROE. Collectively, these findings reinforce the idea that separating entry threats from entry opportunities is important for understanding the full effects of deregulation, show that our results are robust to different types of deregulation events, and high-

light that at least in the context of the commercial banking industry, deregulation seems improve bank profitability on average.

Figure A.2

Identification Robustness: NIM Stacked Difference in Differences

This figure depicts estimated coefficients and 95% confidence intervals for our dynamic difference in differences. The horizontal dashed lines are average coefficient values in the pre-event and post-event periods. The baseline year is $t-1$, the year of passage of most state-level deregulation laws. The sample period for the stacked difference in difference is 1984-2000.

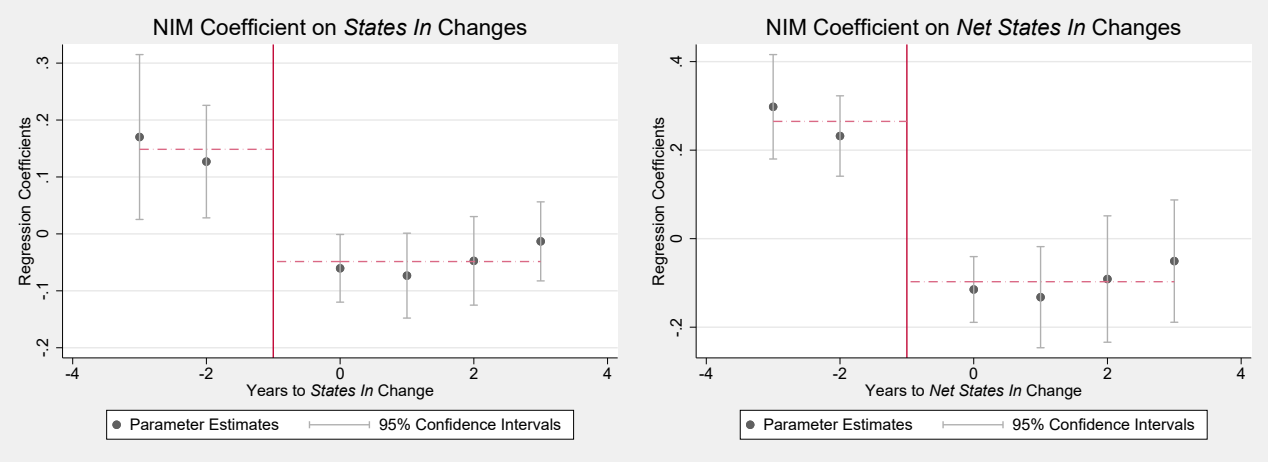


Figure A.3

NIM Stacked Difference in Differences with Extended Window

This figure provides a robustness test on Figure A.2 by adding one year before each *States In* and *Net States In* event to the event window. The sample period is 1984-2000.

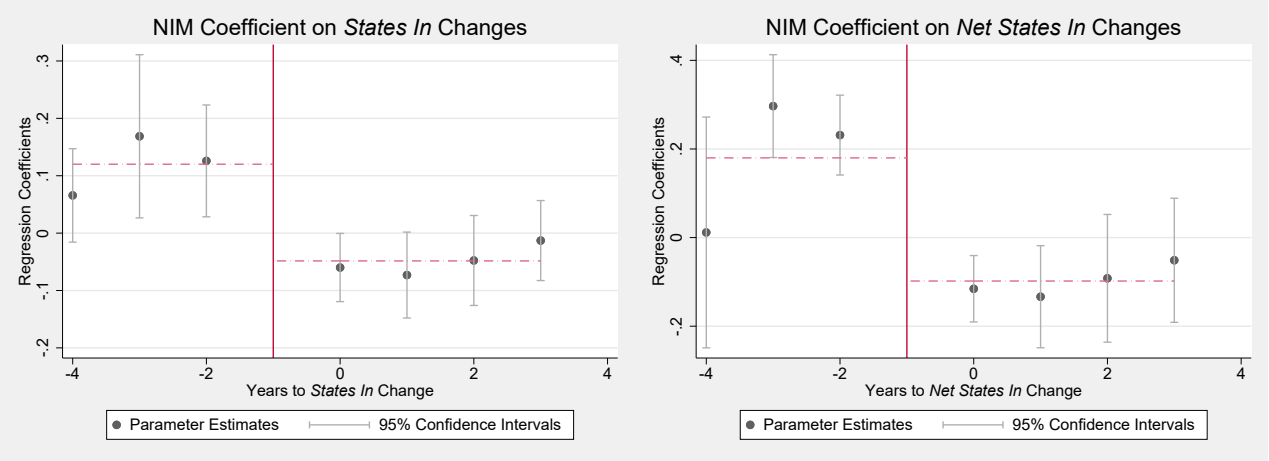


Figure A.4

Stacked Difference in Differences: NIM Components

This figure disaggregates the results of Figure A.2 by showing the dynamic effects of *States In* and *Net States In* changes on interest revenues to earning assets, interest expense to earning assets, and deposit interest expense to earning assets (defined as in Table 5). The figure is otherwise identical to Figure A.2.

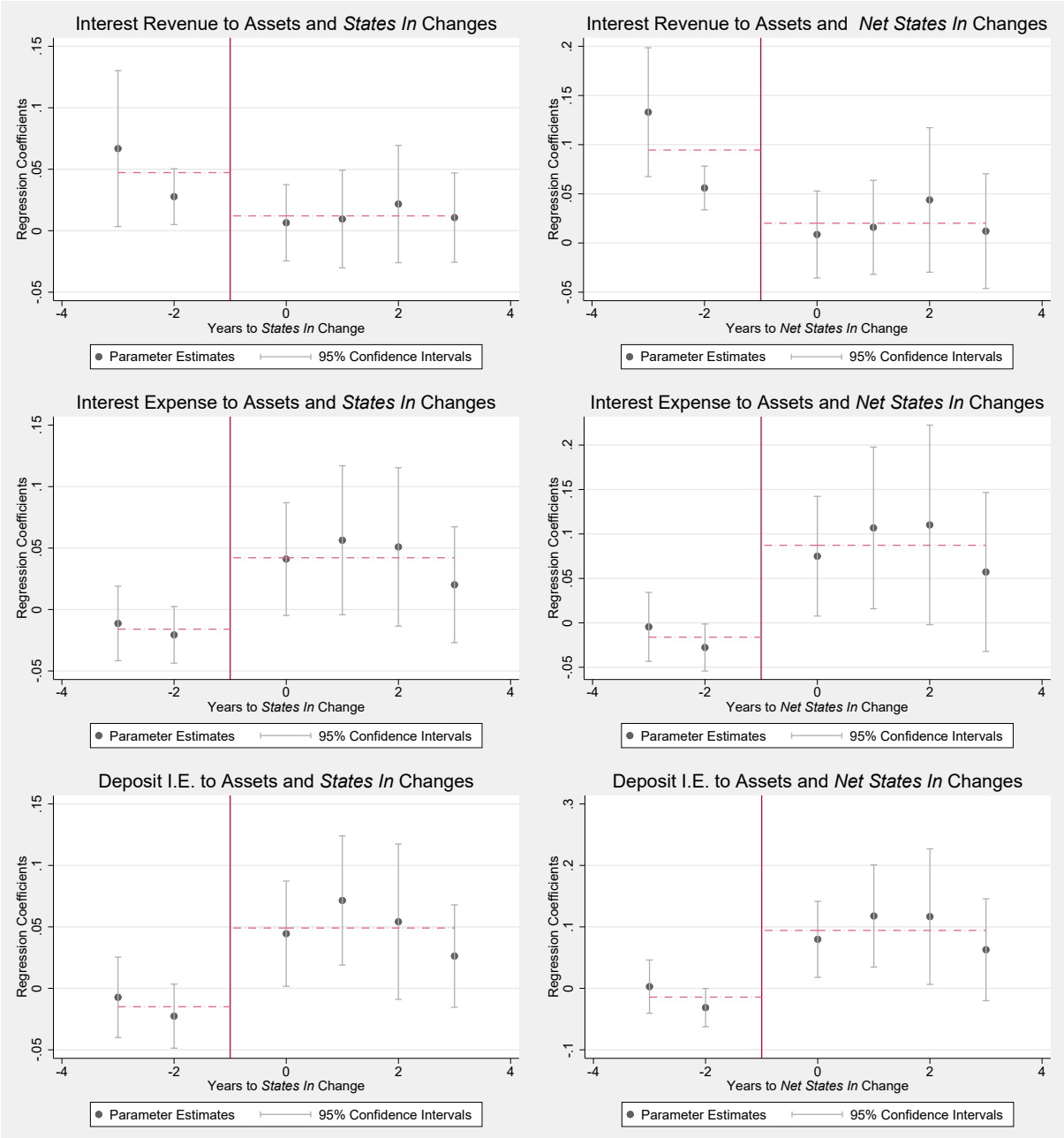


Figure A.5

Stacked Difference in Differences: Profitability and Risk

This figure repeats the same exercise as in the left panel of Figure A.2, using our measures of profitability (ROE and ROA) and risk (ROE and ROA standard deviations, LLPs to loans, and charge-offs to loans) as dependent variables.

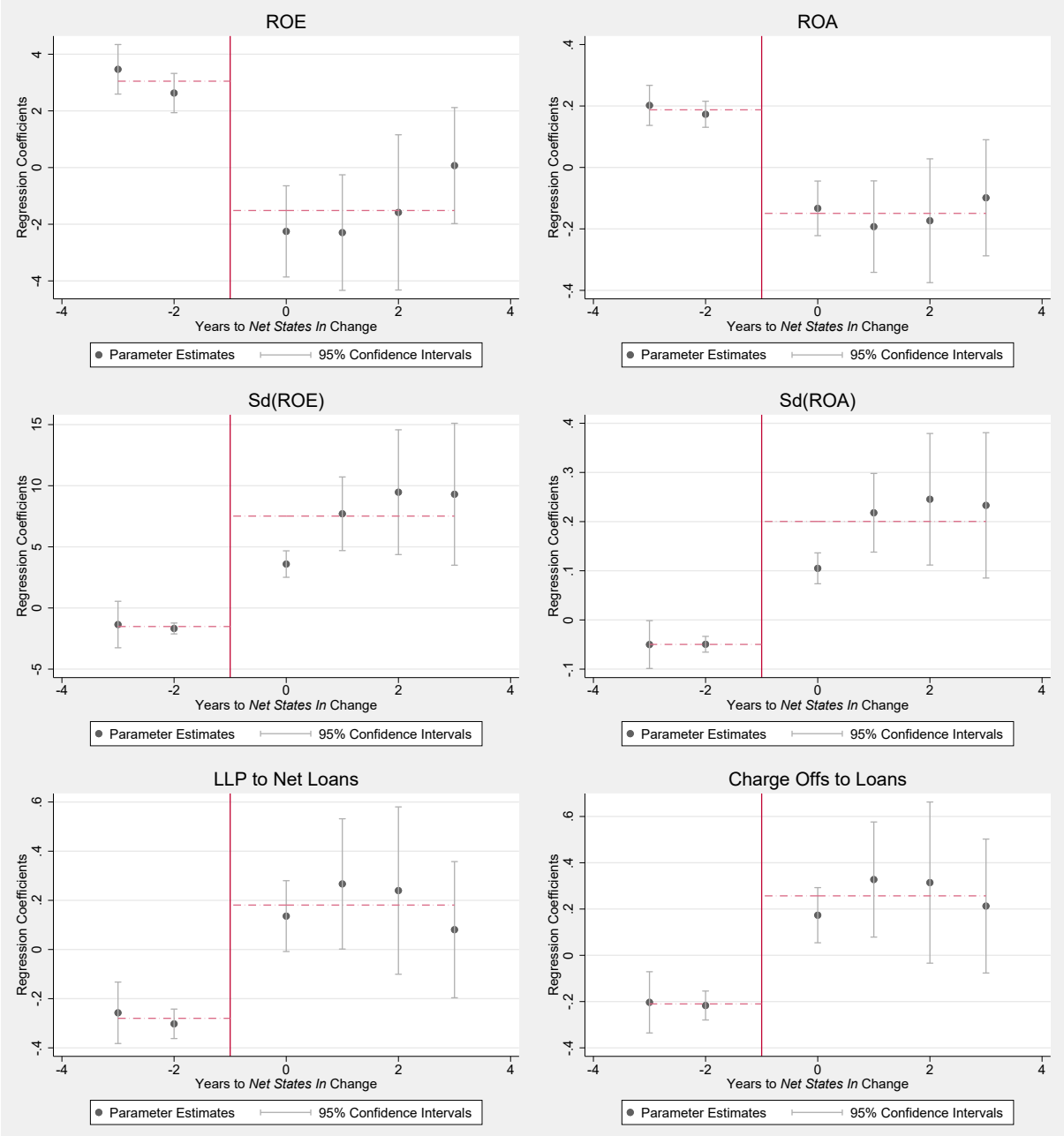


Figure A.6

Long-Run Effects: Profitability, Risk, and Portfolio Composition

This figure studies the long-run dynamics of bank profitability (measured by NIM and ROE), risk-taking (measured by the standard deviation of ROE) and portfolio allocation (measured by loans to assets) for the ten years following a deregulation event. The figure is constructed using the same methodology as Figure A.2 over the extended sample period 1984-2006. The horizontal dashed lines are average coefficient values in the pre-event and post-event periods. The baseline year is $t-1$, the year of passage of most state-level deregulation laws.

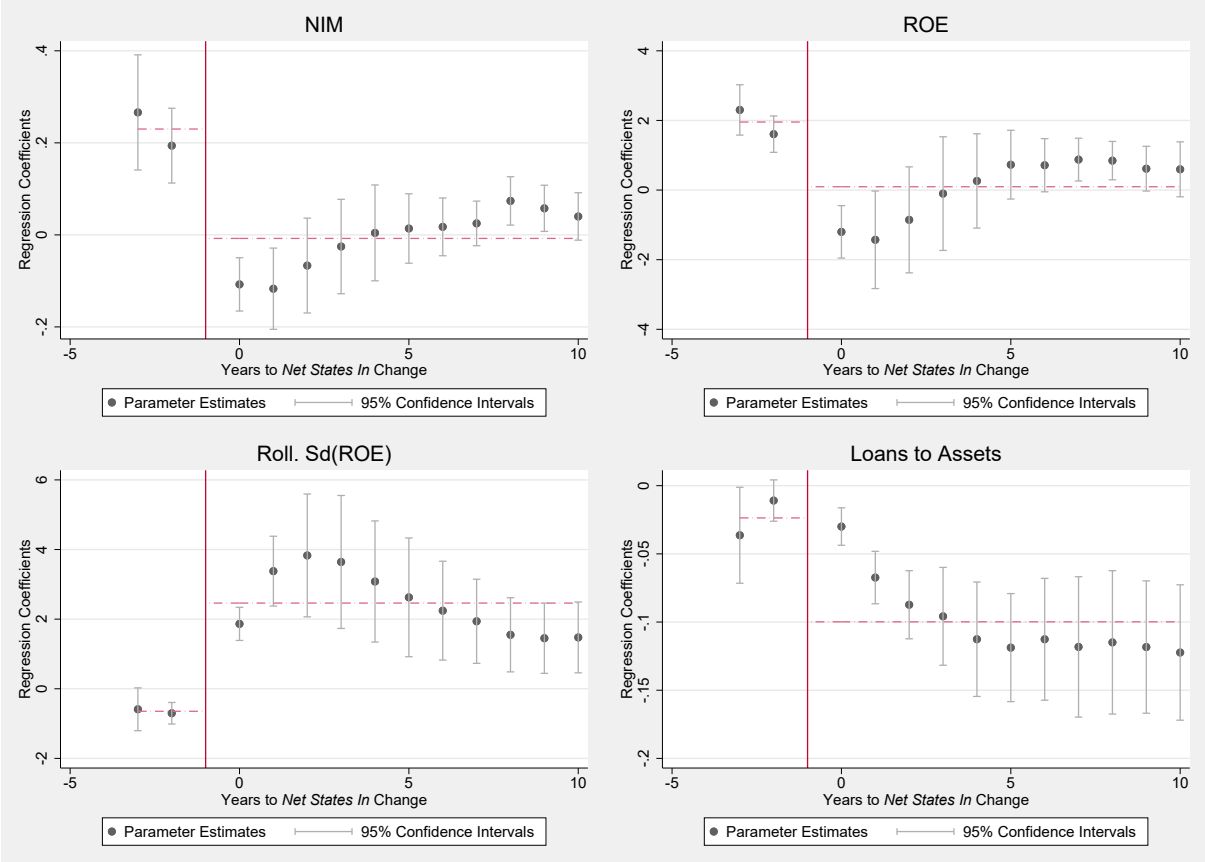


Table A.1

Deregulation and Local Banks' Size

In this table, we ask whether deregulation affects the asset and deposit size of incumbent banks. The dependent variable in columns (1) and (2) is the dollar value of a bank's assets, and the dependent variable in columns (3) and (4) is the dollar value of a bank's deposits. Since both assets and deposits are unscaled, we use Poisson regressions to account for potential skewness in their distribution. The sample period is 1984-2000.

	Assets		Deposits	
	(1)	(2)	(3)	(4)
States In	-0.0019**		-0.0017**	
	(0.001)		(0.001)	
States Out	0.0032*		0.0032*	
	(0.002)		(0.002)	
Net States In		-0.0015*		-0.0012*
		(0.001)		(0.001)
Bank FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
R-Squared				
Observations	812,916	812,916	810,892	810,892

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.2

Local Banks' Branching

In this table, we use a state-year panel to ask how our competition shocks are correlated with local branch openings and closures by local (incumbent) banks. The dependent variable in columns (1) and (2) is the number of branches opened by local banks in a given quarter. The dependent variable in columns (3) and (4) is the number of branches that local banks close in a given quarter. We identify branch openings (closings) using the first (last) time a branch's unique identifier appears in the SOD data, which is available from 1987. The other variables have the same definitions as in the main paper. All specifications are estimated using Poisson regressions to account for the count-like nature of the data. The sample period is 1987-2000.

	Branch Openings		Branch Closures	
	(1)	(2)	(3)	(4)
States In	-0.009**		0.011**	
	(0.00)		(0.01)	
States Out	0.018*		-0.026*	
	(0.01)		(0.01)	
Net States In		-0.006**		0.004
		(0.00)		(0.01)
State FE	Yes	Yes	Yes	Yes
yearm	Yes	Yes	Yes	Yes
R-Squared				
Observations	686	686	637	637

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.3

Deregulation and Banks' Salary Expense

In this table, we ask whether deregulation affects the salary expense of incumbent banks. The dependent variable in columns (1) and (2) is the dollar value of a bank's salary expense. The dependent variable in columns (3) and (4) is the dollar value of a bank's salary expense, scaled by contemporaneous non-interest expense. In columns (1) and (2) we use Poisson regressions to account for potential skewness in the salary expense distribution. Columns (3) and (4) are estimated using OLS regressions. The sample period is 1984-2000.

	Salary		$\frac{\text{Salary}}{\text{Non-interest Expense}}$	
	(1)	(2)	(3)	(4)
States In	-0.002**		-0.064***	
	(0.00)		(0.01)	
States Out	0.004**		0.095***	
	(0.00)		(0.02)	
Net States In		-0.002**		-0.054***
		(0.00)		(0.02)
Bank FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
R-Squared			0.543	0.543
Observations	807,446	807,446	806,299	806,299

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.4

Identification Robustness: NIM Stacked Difference in Differences

In this table, we present the results of a difference in differences exercise aimed at measuring the dynamic impact on NIM of changes in *States In* and *Net States In*. For each state, we first measure year-by-year changes in *States In* and *Net States In*, which we use as competition shocks for our dynamic specification. Then, we construct a panel starting three years before and ending three years after each competition shock, and merge this state-event panel with our bank-state-quarter panel containing quarterly NIM observations. In specification (1), we present the results of a test where we regress each bank-state-quarter NIM observation on the event-specific shock (a change in *States In*), an indicator named *Post Shock* that equals one in the shock year and the following three years and equals zero otherwise, and on an interaction term that represents the difference-in-differences estimate. In specification (2), we present these we repeat the same exercise using changes in *Net States In* as competition shocks. The sample period is 1984-2000.

Dependent Variable: NIM		
	Comp. Shock: States In Change	Comp. Shock: Net States In Change
	(1)	(2)
Comp. Shock × Post-Shock	-0.148**	-0.274***
	(0.07)	(0.08)
Low-Order Terms	Yes	Yes
Bank FE	Yes	Yes
Year-Quarter FE	Yes	Yes
State FE	Yes	Yes
Distance to Shock Year FE	Yes	Yes
Event FE	Yes	Yes
R-Squared	0.610	0.610
Observations	1,313,463	1,313,463

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.5

Stacked Difference in Differences: Profitability and Risk

This table repeats the same exercise performed in Specification (2) of Table A.4, using our measures of profitability (ROE and ROA) and risk (ROE and ROA standard deviations, LLPs to loans, and charge-offs to loans) as dependent variables. The sample period is 1984-2000.

	ROE	ROA	Roll. Sd(ROE)	Roll. Sd(ROA)	$\frac{\text{LLP}}{\text{Net Loans}}$	$\frac{\text{Charge Offs}}{\text{Net Loans}}$
	(1)	(2)	(3)	(4)	(5)	(6)
NSI Change × Post	-3.609***	-0.274***	8.295***	0.228***	0.368***	0.394***
	(1.15)	(0.08)	(1.43)	(0.04)	(0.11)	(0.10)
Low-Order Terms	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Distance to Shock Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Event FE	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.391	0.510	0.484	0.544	0.403	0.409
Observations	1,304,618	1,304,631	1,304,068	1,304,075	1,303,030	1,303,837

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.6

Interstate Banking, Interstate Branching, and *States Out*

In this table, we ask whether the effects of *States Out* on NIM, profitability, and risk-taking are primarily driven by interstate banking agreements or by subsequent interstate branching agreements. To do so, we interact *States Out* with an indicator equal to one for all years after 1994, which is the year in which most state started implementing interstate branching deregulation (Rice and Strahan, 2010). All variables and the sample period are otherwise identical to those in the main tables of the paper.

	NIM	ROE	ROA	Sd(ROE)	Sd(ROA)	$\frac{\text{LLP}}{\text{Net Loans}}$	$\frac{\text{Charge Offs}}{\text{Net Loans}}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
States In	-0.323***	-4.541***	-0.333***	8.828***	0.297***	0.458***	0.478***
	(0.11)	(1.54)	(0.11)	(1.42)	(0.05)	(0.15)	(0.13)
States Out	0.420*	7.128**	0.473**	-11.418***	-0.382***	-0.627*	-0.651**
	(0.24)	(3.39)	(0.23)	(3.08)	(0.13)	(0.33)	(0.26)
States Out × Post-1994	0.199*	1.363	0.134	-2.500	-0.041	-0.164	-0.157
	(0.12)	(1.47)	(0.10)	(2.45)	(0.09)	(0.17)	(0.16)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.479	0.243	0.310	0.423	0.491	0.220	0.209
Observations	812,843	807,432	807,446	805,897	805,901	806,748	807,857

Note: Standard errors (in parentheses) are clustered at the state × deregulation period (i.e., pre- and post-1993) level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.7

The Many Faces of Deregulation and Bank Profitability

This table studies the impact of different forms of deregulation on bank profitability. *Net States In*, *States In*, and *States Out* are defined as in the rest of the paper. As in Kroszner and Strahan (1999), Intrastate Branching is an indicator equal to one if state *m* passes a law allowing *intrastate branching* for the first time, and Inter-State Deregulation is an indicator equal to one if state *m* passes a law allowing *interstate banking* for the first time. Interstate Branching Competition is an index from 1 to 5 that characterizes post-1994 *interstate branching* restrictions at the state-level. The data source for these indicators are the indicators of Rice and Strahan (2010), but for consistency with our *States In* measure, high values of the Interstate Branching Competition Indicator are associated with high levels of local competition (and low entry barriers), and low values of the indicator are associated with low levels of local competition (and high entry barriers). We restrict this indicator to be equal to 5 in all years before 1994. Interstate Branching Investment Opportunities for state *m* is the average of "Interstate Branching Competition" for all states but state *m*, and represents the average openness to interstate branching for state-*m*-banks in a given year. Interstate Branching Local Investment Opportunities is the average of "Interstate Branching Competition" for all states geographically neighboring state *m* in a given year. For consistency with Rice and Strahan (2010), the sample period is 1984-2005.

	Dependent Variable: ROE								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
States In	-3.726***			-4.118***	-4.112***	-4.138***			
	(1.24)			(1.23)	(1.22)	(1.25)			
States Out	6.439**			6.205**	6.181**	6.265**			
	(2.72)			(2.70)	(2.70)	(2.78)			
Net States In		-2.863**					-3.496***	-3.493***	-3.499***
		(1.08)					(1.06)	(1.05)	(1.07)
Intra. Br.			32.947*	44.180**	44.104**	44.303**	45.616**	45.381**	45.674**
			(19.19)	(17.52)	(17.59)	(17.62)	(17.72)	(17.78)	(17.82)
Inter. Deregulation			18.021	37.434**	37.250**	38.081**	40.492**	39.931**	40.765**
			(22.54)	(17.04)	(17.14)	(17.21)	(16.77)	(16.95)	(17.07)
Inter. Br. Competition			-4.340*	-4.179	-4.465	-4.758*	-5.238*	-5.980**	-5.470**
			(2.56)	(2.81)	(2.98)	(2.65)	(2.61)	(2.74)	(2.70)
Inter. Br. Inv. Opp.					2.673			7.156	
					(5.95)			(6.43)	
Inter. Br. Local Inv. Opp.						2.241			0.869
						(4.72)			(4.43)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.260	0.260	0.258	0.262	0.262	0.262	0.261	0.261	0.261
Observations	972,229	972,229	972,229	972,229	972,229	972,229	972,229	972,229	972,229

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

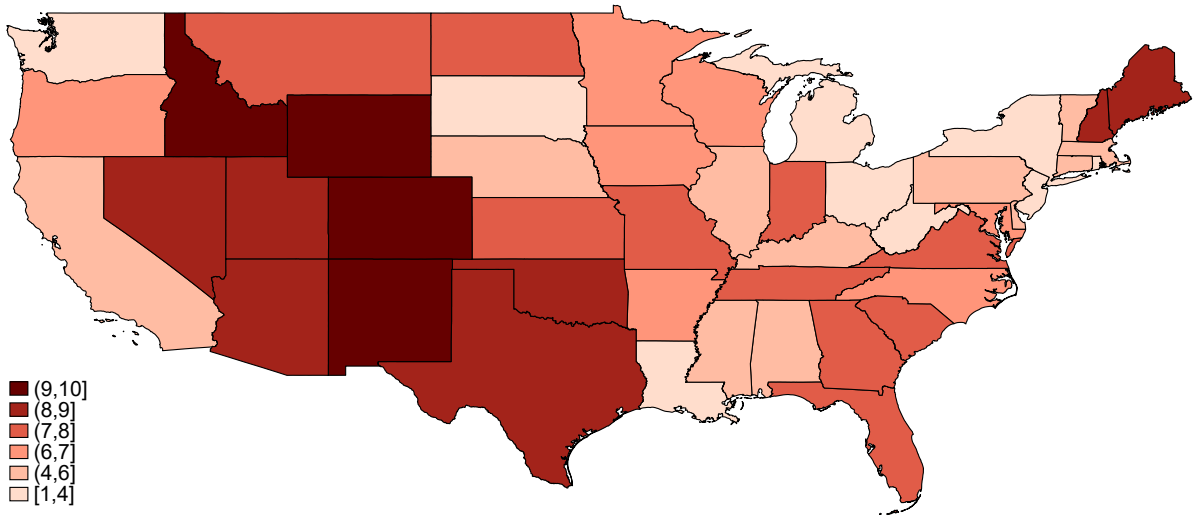
A.IV Additional Figures and Tables

Figure A.7

The Cross-section of Net States In Changes

In this figure, we study the distribution of changes in *Net States In* in the cross-section of US states before the Riegle-Neal Act. In Panel A, we show the number of times that *Net States In* changes for any given state. In this panel, lighter colors identify states that experienced relatively few changes in *Net States In* before the Riegle-Neal Act. In Panel B, we show the number of *Net States In* that are on average added to a given state, conditional on a *Net States In* change. In this panel, lighter colors identify states with negative changes in *Net States In* on average—states that are on average "exporters" of competition, for which the effect of *States Out* dominates. Conversely, darker colors identify states with positive changes in *Net States In* on average—states that are on average "importers" of competition, for which the effect of *States In* dominates.

Panel A: Number of *Net States In* Changes, 1984-1994



Panel B: Average *Net States In* Additions, 1984-1994

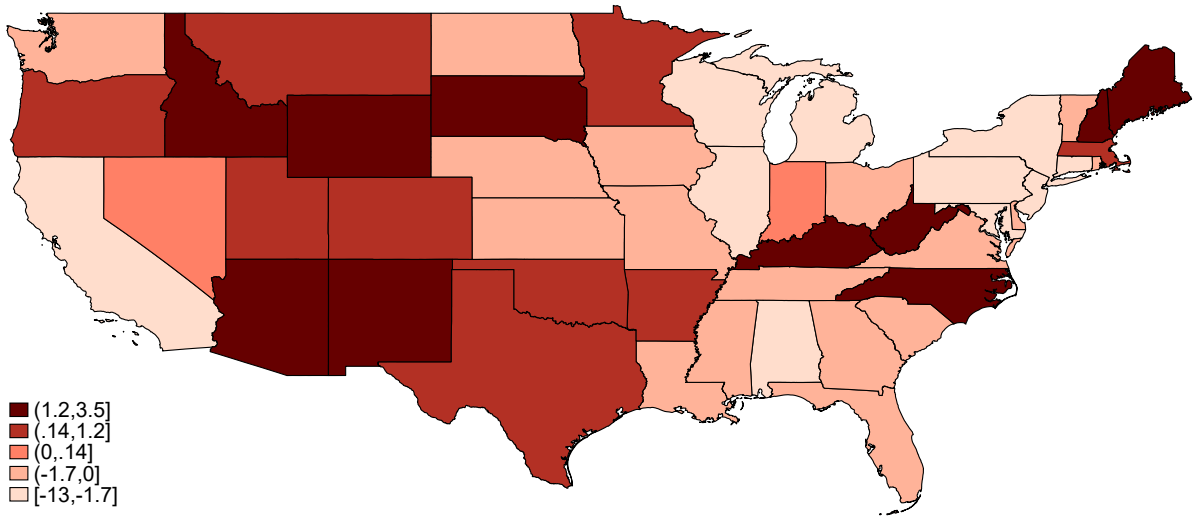


Figure A.8

Distribution of Estimated *t*-statistics across Placebo Samples

The left and right panels of this figure respectively show the distribution of estimated *t*-statistics when we run specifications (2) and (3) of Table 4 in 1,000 placebo samples that randomize state reciprocation events. In each placebo sample, we take random permutations of the square matrix whose element (m, m') is the first year in which banks from state m can enter state m', and we construct placebo *States In* and *Net States In* measures using these placebo reciprocation years instead of the actual reciprocation years from Amel (1993). In this way, we preserve the overall distribution of reciprocation years but we randomly assign deregulation years to state couples. The left panel of the figure reports the distribution of estimated *t*-statistics for regression coefficients of NIM on placebo *States In* (controlling for *States Out*), while the right panel reports the distribution of estimated *t*-statistics for regression coefficients of NIM on placebo *Net States In*. Both sets of regressions include bank, year-quarter, and state fixed effects. Each panel also reports the average *t*-statistics across all placebo simulations as well as the estimated *t*-statistics from specifications (2) and (3) of Table 4 using actual reciprocation years. The sample period is 1984-2000.

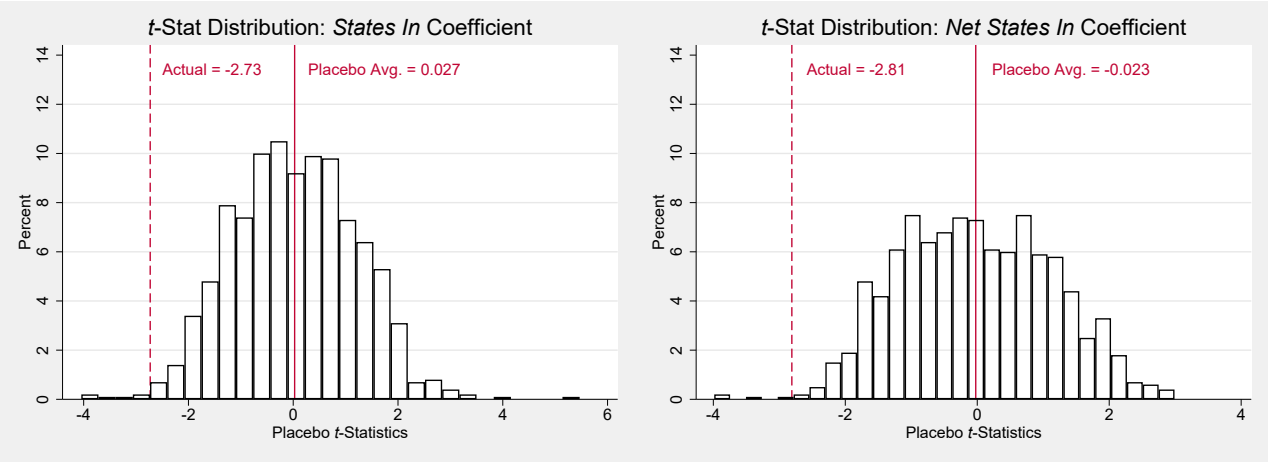


Table A.8

County-Level Concentration and Net Interest Margin: Extended Sample

This table presents the results of our regression analysis of the link between NIM and county-level deposit HHI. This table is identical to Table 2 but uses a longer sample period (1984-2010 rather than 1984-2000).

	Dependent Variable: NIM		
	(1)	(2)	(3)
Deposit HHI	0.083***	0.081***	0.061***
	(0.03)	(0.03)	(0.02)
Bank FE	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	No
State FE	No	Yes	No
State × Year-Quarter FE	No	No	Yes
R-Squared	0.468	0.468	0.504
Observations	1,127,555	1,127,555	1,127,555

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.9

Distance- and Asset-weighted States In and States Out

In this table, we modify our main specification from Table 4 to account for the geographic distance between different states, as well as for the (pre-deregulation) size of the other states' banking markets. In each year, we weigh our state network nodes by the inverse of the distance between the two most populous cities of each state. *Distance-Weighted States In* is then the distance-weighted sum of the states whose banks can access the home state, and *Distance-Weighted Net States In* is equal to *Distance-Weighted States In*, minus the distance-weighted sum of the states that home state's banks can access (i.e., *Distance-Weighted States Out*). Similarly, we compute the pre-deregulation relative size of each state's banking market as total bank assets in that state in 1980, divided by the total US bank assets in 1980. *Asset-Weighted States In* is then the sum of the states whose banks can access the home state weighted by these other states' relative banking market size. *Asset-Weighted Net States In* is equal to *Asset-Weighted States In*, minus the sum of the states that the home state can access, weighted by these other states' relative banking market size (i.e., *Asset-Weighted States Out*). The sample period is 1984-2000.

	Dependent Variable: NIM			
	(1)	(2)	(3)	(4)
Distance-Weighted States In	-0.216**			
	(0.09)			
Distance-Weighted States Out	0.229**			
	(0.10)			
Distance-Weighted Net States In		-0.211**		
		(0.09)		
Asset-Weighted States In			-17.437**	
			(6.78)	
Asset-Weighted States Out			34.444**	
			(13.87)	
Asset-Weighted Net States In				-11.424**
				(5.17)
Bank FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
R-Squared	0.479	0.479	0.479	0.478
Observations	811,014	811,014	812,843	812,843

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.10

Identification Robustness: Deregulation and Net Interest Margin

This table presents robustness tests on our main results from Table 4. In the first column, we focus on one-way, non-reciprocal agreements that allow banks from other states to enter state *m*, without allowing banks from state *m* to enter those other states. We call such arrangements *One-Ways In*. In the second and third columns, *National States In* are *States In* that arise from national agreements, and *Net National States In* are *National States In* minus *States Out* that arise from national agreements. NIM (expressed in basis points) is computed as in Table 1, and it is measured at the bank-quarter level. The sample period is 1984-2000.

	Dependent Variable: NIM		
	(1)	(2)	(3)
One-Ways In	-0.430***		
	(0.13)		
National States In		-0.320***	
		(0.10)	
National States Out		0.609**	
		(0.30)	
Net National States In			-0.237***
			(0.08)
Bank FE	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
R-Squared	0.479	0.479	0.478
Observations	812,843	812,843	812,843

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.11

Deregulation Predictive Regressions

In this table, we ask whether state-level economic variables can predict changes in our deregulation measures by regressing state-level (log) firm growth, establishment growth, and employment growth as well as average bank ROE and quarterly asset growth on changes in *States In*, *States Out*, and *Net States In*. The number of establishments, firms, and employees comes from the Business Dynamics Survey. Bank ROE and asset growth are computed from the call reports. The sample frequency is annual, and the sample period is 1984-2000.

	States In Change	States Out Change	Net States In Change
	(1)	(2)	(3)
Lag-1 Firm Growth	-1.124	0.065	-1.189
	(1.20)	(0.42)	(0.97)
Lag-1 Establishment Growth	0.895	-0.322	1.217
	(1.28)	(0.47)	(1.01)
Lag-1 Employment Growth	-0.084	0.106	-0.189
	(0.21)	(0.10)	(0.13)
Lag-1 Bank ROE	-0.056	0.011	-0.067
	(0.12)	(0.06)	(0.08)
Lag-1 Bank Asset Growth	-0.057	-0.001	-0.056
	(0.28)	(0.07)	(0.24)
State FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R-Squared	0.172	0.522	0.022
Observations	765	765	765

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.12

Robustness: State × Time Fixed Effects

In this table, we show that our results hold even within state-time by interacting our deregulation variables with two gravity measures of competition borrowed from Jiang et al. (2023) (JLL). The JLL measures are BHC-specific *effective* gravity measures capturing the competitive threat that the BHC faces in its banking markets (i.e., the banking markets of its subsidiaries) from out-of-state banks. The gravity measures are weighted by the geographic distance between banking markets (distance-weighted, D-W), and by both the geographic distance and the size of the banking markets (distance and bank-weighted, D&B-W). When out-of-state banks cannot access the BHC subsidiaries' banking markets, these gravity measures are equal to zero. As in Table A.14, we use quarterly BHC data from the BHC Y-9C Forms. Consistent with Jiang et al. (2023), we conduct our tests at the BHC-level, and we restrict the sample period to 1987-1995.

	Dep. Variable: NIM			
	(1)	(2)	(3)	(4)
JLL Gravity (D-W)	2.204*	0.390		
	(1.24)	(0.89)		
JLL Gravity (D-W) × States In	-0.081**			
	(0.03)			
JLL Gravity (D-W) × Net States In		-0.072*		
		(0.04)		
JLL Gravity (D&B-W)			1.926	0.562
			(1.25)	(0.90)
JLL Gravity (D&B-W) × States In			-0.071**	
			(0.03)	
JLL Gravity (D&B-W) × Net States In				-0.055*
				(0.03)
BHC FE	Yes	Yes	Yes	Yes
State × Year-Quarter FE	Yes	Yes	Yes	Yes
R-Squared	0.754	0.753	0.754	0.753
Observations	10,045	10,045	10,045	10,045

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.13

Deregulation and NIM: Additional Specifications

In this table, we augment our main specifications from Table 4 with additional control variables, namely the natural logarithm of total assets, leverage (total liabilities divided by total assets), net charge-offs to earning assets, deposits to total liabilities, and non-interest income to earning assets. The sample period is 1984-2000.

	Dependent Variable: NIM		
	(1)	(2)	(3)
States In	-0.085*	-0.169**	
	(0.05)	(0.08)	
States Out		0.246	
		(0.20)	
Net States In			-0.144**
			(0.06)
log(Assets)	3.692***	3.669***	3.664***
	(0.96)	(0.95)	(0.95)
Leverage	-2.283***	-2.267***	-2.270***
	(0.17)	(0.16)	(0.16)
$\frac{\text{Net Charge-Offs}}{\text{Earning Assets}}$	-40.492***	-40.400***	-40.418***
	(1.06)	(1.03)	(1.03)
$\frac{\text{Deposits}}{\text{Total Liabilities}}$	0.358***	0.353***	0.355***
	(0.04)	(0.04)	(0.04)
$\frac{\text{Non-Interest Income}}{\text{Earning Assets}}$	30.452***	30.453***	30.456***
	(2.47)	(2.47)	(2.48)
Bank FE	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
R-Squared	0.545	0.545	0.545
Observations	806,347	806,347	806,347

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.14

Deregulation and NIM: BHC Panel

In this table, we repeat the main exercise from Table 4 using a BHC-quarter panel instead of a bank-quarter panel. The sample period is 1984-2000.

	Dependent Variable: NIM	
	(1)	(2)
States In	-0.200**	
	(0.08)	
States Out	0.227	
	(0.22)	
Net States In		-0.189***
		(0.06)
BHC FE	Yes	Yes
Year-Quarter FE	Yes	Yes
State FE	Yes	Yes
R-Squared	0.722	0.722
Observations	65,728	65,728

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.15

Riegle-Neal Deregulation

In this table we examine the impact of the Riegle-Neal (RN) Act on bank Net Interest Margins and profitability. Similar to Table 4, we define *RN States In* as the number of residual states whose banks can access the focal state following the 1994 Riegle-Neal Act, which we compute as 50 minus *States In* in 1994 (right before the passage of the Act). Similarly, we define *RN States Out* as the number of residual states that the focal state's banks can access following the Riegle-Neal Act—50 minus *States Out* in 1994. *RN Net States In* represents the number of states whose banks can access the focal state following the Riegle-Neal Act, net of the number of states that focal state's banks can access following the Act. As in Bertrand et al. (2004), we collapse the panel at the bank level, with one bank-level observation for average pre-RN NIM, ROE, and ROA, and one observation for average post-RN NIM, ROE, and ROA. We interact our measures of residual deregulation induced by the Riegle-Neal Act with an indicator for the post-RN period. The coefficients on these interaction terms represent estimates of treatment intensity following Riegle-Neal deregulation. NIM, ROE, and ROA are measured in basis points. The sample focuses on the symmetric window 1990-2000 around the Riegle-Neal Act.

	NIM		ROE		ROA	
	(1)	(2)	(3)	(4)	(5)	(6)
RN States In × Post-RN	-0.239***		-1.446***		-0.125***	
	(0.03)		(0.35)		(0.03)	
RN States Out × Post-RN	0.353***		2.901***		0.221***	
	(0.07)		(0.68)		(0.05)	
RN Net States In × Post-RN		-0.166***		-0.502**		-0.063***
		(0.02)		(0.21)		(0.02)
Post-RN Indicator	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.862	0.862	0.719	0.719	0.749	0.749
Observations	21,655	21,655	21,555	21,555	21,555	21,555

Note: Robust standard errors in parentheses. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.16

State Presence Robustness

In this table, we show that our main results hold when we do not control for incorporation state fixed effects (Columns (1) and (2)), and when we add 51 state presence indicators equal to one if the bank if the bank operates one or more branches in a state and equal to zero otherwise (Columns (3) and (4)). The sample period is 1984-2000.

	Dependent Variable: Net Interest Margin			
	(1)	(2)	(3)	(4)
States In	-0.328***		-0.328***	
	(0.12)		(0.12)	
States Out	0.476*		0.476*	
	(0.25)		(0.25)	
Net States In		-0.282***		-0.281***
		(0.10)		(0.10)
Bank FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
State Presence FE	No	No	Yes	Yes
R-Squared	0.479	0.478	0.479	0.479
Observations	812,843	812,843	812,843	812,843

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.17

Deregulation and Net Interest Margin: Branch-level Panel

In this table, we present a robustness test on the results of Table 4 using a branch-level panel. Under this panel structure, the dependent variable (NIM) is repeated across all bank branches owned by the same bank in any given quarter. On the other hand, the independent variable varies across states depending on branch location, and it is repeated across all branches that a bank owns in a given state. Therefore, this panel gives more weight to competition and investment opportunities effects in states where the bank has a stronger geographic presence. The sample period is 1984-2000, and it is otherwise identical to the sample in Table 4.

	Dependent Variable: NIM				
	(1)	(2)	(3)	(4)	(5)
States In	-0.101***	-0.191***		-0.189***	
	(0.02)	(0.05)		(0.05)	
States Out		0.245**		0.231**	
		(0.10)		(0.11)	
Net States In			-0.172***		-0.174***
			(0.04)		(0.04)
Inter-State Deregulation				1.019	1.119
				(1.20)	(1.10)
Bank FE	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
R-Squared	0.501	0.501	0.501	0.501	0.501
Observations	4,558,911	4,558,911	4,558,911	4,558,911	4,558,911

Note: Standard errors (in parentheses) are clustered at the bank level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.18

Deregulation and Net Interest Margin: Incorporation State Measures

In this table, we present a robustness test on the results of Table 4 where we use deregulation measures at the bank state of incorporation level rather than weighting the measures for the bank's branch presence in each state. The sample period is 1984-2000, and it is otherwise identical to the sample in Table 4.

	Dependent Variable: Net Interest Margin				
	(1)	(2)	(3)	(4)	(5)
States In	-0.182**	-0.349***		-0.351***	
	(0.08)	(0.12)		(0.12)	
States Out		0.495**		0.505*	
		(0.24)		(0.25)	
Net States In			-0.303***		-0.303***
			(0.11)		(0.11)
Inter-State Deregulation				-0.570	-0.093
				(1.26)	(1.14)
Bank FE	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
R-Squared	0.478	0.479	0.479	0.479	0.479
Observations	812,843	812,843	812,843	812,843	812,843

Note: Standard errors (in parentheses) are clustered at the bank level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.19

Alternative NIM Construction

This table repeats the same exercise performed in Table 4 using a slightly different variation on the definition of Net Interest Margin, namely net interest income (interest income minus interest expense) divided by earning assets (as opposed to tax-adjusted earning assets as in the main paper). The sample period is 1984-2000.

	Dependent Variable: Net Interest Income to Earning Assets				
	(1)	(2)	(3)	(4)	(5)
States In	-0.084**	-0.169***		-0.164***	
	(0.04)	(0.06)		(0.06)	
States Out		0.251*		0.222	
		(0.14)		(0.14)	
Net States In			-0.143***		-0.146***
			(0.05)		(0.05)
Inter-State Deregulation				1.166*	1.412**
				(0.66)	(0.60)
Bank FE	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
R-Squared	0.597	0.597	0.597	0.597	0.597
Observations	806,347	806,347	806,347	806,347	806,347

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.20

Deregulation and Net Interest Margin: Extended Sample

In this table we link our deregulation measures to bank-level Net Interest Margin. This table is identical to Table 4 but uses a longer sample period (1984-2010 rather than 1984-2000).

	Dependent Variable: NIM				
	(1)	(2)	(3)	(4)	(5)
States In	-0.175**	-0.356***		-0.353***	
	(0.08)	(0.11)		(0.11)	
States Out		0.538**		0.518**	
		(0.24)		(0.25)	
Net States In			-0.298***		-0.302***
			(0.10)		(0.10)
Inter-State Deregulation				0.786	1.536
				(1.29)	(1.18)
Bank FE	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
R-Squared	0.470	0.471	0.470	0.471	0.470
Observations	1,127,555	1,127,555	1,127,555	1,127,555	1,127,555

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.21

Robustness on Deregulation and Net Interest Margin: Extended Sample

This table presents robustness tests on our main results from Table A.10 using a longer sample period (1984-2010 rather than 1984-2000).

	Dependent Variable: NIM		
	(1)	(2)	(3)
One-Ways In	-0.460***		
	(0.12)		
National States In		-0.337***	
		(0.10)	
National States Out		0.637**	
		(0.27)	
Net National States In			-0.252***
			(0.08)
Bank FE	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
R-Squared	0.471	0.471	0.470
Observations	1,127,555	1,127,555	1,127,555

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.22

Residual Interest Expense

In this table we link our deregulation measures to nondeposit interest expense. We first regress normalized interest expense (i.e., the dependent variable in columns (3) and (4) of Table 5 in the main paper) on normalized deposit interest expense (i.e., the dependent variable in columns (5) and (6) of Table 5 in the main paper). We then regress our deregulation measures on the resulting regression residuals. The specifications are otherwise identical to those in Table 5 of the main paper. The sample period is 1984-2000.

	Residual Int. Exp.		
	(1)	(2)	(3)
States In	-1.354	2.134	
	(1.51)	(2.74)	
States Out		-10.281	
		(7.22)	
Net States In			-0.460
			(2.21)
Bank FE	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes
State FE	Yes	Yes	Yes
R-Squared	0.371	0.371	0.371
Observations	801,061	801,061	801,061

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.23

NIM and Pre-deregulation Bank Characteristics

In this table we examine the interaction between (*Net*) *States In* and pre-deregulation bank characteristics. In the first two columns, we interact *States In* with pre-deregulation (PD) bank core profitability (an indicator equal to one if the bank's NIM in 1984 is above the state-level median, and equal to zero otherwise). In column (3), we interact the same profitability indicator with *Net States In* instead of *States In*. In columns (4) to (6), we repeat the same exercise using indicators for pre-deregulation deposit dependence (an indicator equal to one if the bank's deposits to total assets in 1984 are above the state-level median, and equal to zero otherwise). The sample period is 1984-2000.

	Net Interest Margin					
	(1)	(2)	(3)	(4)	(5)	(6)
States In	0.051	-0.132		-0.083	-0.262**	
	(0.08)	(0.12)		(0.08)	(0.12)	
States Out		0.543**			0.527**	
		(0.25)			(0.24)	
Net States In			-0.225**			-0.249**
			(0.11)			(0.10)
States In × High PD NIM	-0.416***	-0.417***				
	(0.02)	(0.02)				
Net States In × High PD NIM			-0.113*			
			(0.06)			
States In × High PD Dep. Leverage				-0.170***	-0.169***	
				(0.01)	(0.01)	
Net States In × High PD Dep. Leverage						-0.076**
						(0.03)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.454	0.456	0.442	0.443	0.444	0.442
Observations	712,242	712,242	712,242	712,060	712,060	712,060

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.24

Bank Size and Investment Opportunities

In this table, we ask whether banks that are large before the deregulation period are the ones benefiting the most from out-of-state investment opportunities. To do so, we build a bank-level indicator, *High PD Asset*, equal to one if a bank's pre-deregulation (PD) asset size is above the state-level median, and equal to zero otherwise. We then interact this indicator with *States Out* in isolation (column (1)) and while controlling for *States In*. The procedure used to construct this table is otherwise identical to the procedure described in our main Table 4. The sample period is 1984-2000.

	NIM	
	(1)	(2)
States Out	-0.183	0.465*
	(0.11)	(0.25)
States Out × High PD Asset	0.128***	0.129***
	(0.03)	(0.03)
States In		-0.344***
		(0.12)
Bank FE	Yes	Yes
Year-Quarter FE	Yes	Yes
State FE	Yes	Yes
R-Squared	0.440	0.443
Observations	712,242	712,242

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

Table A.25

Early Competitive Exposure and Investment Opportunities

In this table, we use two complementary strategies ask whether banks' early exposure to competitive threats limits their ability to benefit from investment opportunities later on. In column (1), we interact *States Out* with *Early,* an indicator equal to one for years before 1989 and equal to zero otherwise (while controlling for *States In*). This interaction term is informative of whether the investment opportunities effects on NIM are larger early in the deregulation period. In column (2), we follow a two-step procedure to study the effects of early competitive exposure on the subsequent benefits from accessing new markets. To do so, we first focus only on the early deregulation period and regress *Net States In* on interest expense at the bank-level for each bank in the pre-1989 sample. We then interact *States Out* with *High Comp. Exposure,* an indicator equal to one if the estimated interest expense sensitivity to *Net States In* in the pre-1989 period is higher than the median, and equal to zero otherwise. To ensure a sufficient time for the competitive effects estimated in the pre-deregulation period to negatively affect banks' ability to expand, the post-deregulation period in column (2) covers the period 1991-2000. The sample period in column (1) is 1984-2000.

	NIM	
	(1)	(2)
States In	-0.331***	-0.180*
	(0.12)	(0.09)
States Out	0.453*	0.469***
	(0.25)	(0.17)
States Out × Early	0.733**	
	(0.30)	
States Out × High Comp. Exposure		-0.090**
		(0.04)
Bank FE	Yes	Yes
Year-Quarter FE	Yes	Yes
State FE	Yes	Yes
R-Squared	0.479	0.596
Observations	812,843	314,039

Note: Standard errors (in parentheses) are clustered at the state level. ***, **, and * respectively denote statistical significance at the 1%, 5%, and 10% levels.

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