Financial Integration and Business Cycle Synchronization: Evidence from U.S. States*

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Abstract

We analyze the effect of the geographic expansion of banks across U.S. states on the co-movement of economic activity between states. To estimate the causal effect of financial integration on business cycle synchronization, we exploit the removal of restrictions to interstate banking to construct instrumental variables to identify exogenous changes in integration over time at the state pair level. We find a strong positive effect of bilateral banking integration on business cycle synchronization between states, conditional on national shocks and state pair heterogeneity. This effect is stronger for states experiencing periods of financial turmoil. Moreover, we find that, within a given state pair, banking integration has a larger positive effect on output synchronization for industries that rely more on external financing. These findings are consistent with theories highlighting the role of banks in transmitting financial shocks across regions, and show that integration has made U.S. state business cycles more similar.

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Keywords: banking integration; business cycles; co-movement; financial deregulation; synchronization

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1 Introduction

This paper analyzes the effect of the geographic expansion of banks across U.S. states on the co-movement of economic activity between states. Since the late 1970s, the removal of restrictions on interstate banking has allowed banks to expand, leading to a significant increase in the integration of states' banking systems. This increasing financial integration might change the exposure of states to different shocks and could have an effect on the transmission of shocks across states. In this paper, we analyze how financial integration through banks has affected the synchronization of state business cycles, by exploiting the removal of restrictions to bank entry between states to construct instrumental variables to identify exogenous changes in integration over time at the state pair level.

The effect of financial integration (through banks) on business cycle synchronization is theoretically ambiguous, and depends on the nature of the shocks that drive local economic fluctuations (Morgan et al., 2004, Kalemli-Ozcan et al., 2013a).[1] On the one hand, if real shocks dominate, financial integration can amplify local cycles and decrease the co-movement of economic activity between regions. In a financially integrated world, if firms in a given region experience a negative shock to their productivity or collateral values, multi-market banks will reduce lending in this region and increase it in non-affected regions, causing a further divergence in growth and reducing business cycle synchronization.[2] On the other hand, if financial shocks dominate, integration can dampen local cycles and increase the co-movement of economic activity between regions. If multi-market banks in a given region face a negative shock (e.g., to their capital) they may respond by reducing lending in other regions, including ones that were not hit by the shock, transmitting the finan-

[1]Morgan et al. (2004) develop a multistate version of the banking model of Holmstrom and Tirole (1997) and show that the effect of banking integration on volatility and business cycle synchronization depends on the nature of the underlying shocks. Using a dynamic stochastic general equilibrium model, Kalemli-Ozcan et al. (2013a) draw similar conclusions.

[2]See, among others, Backus et al. (1992), Obstfeld (1994), and Heathcote and Perri (2004).

cial shock across regions. Moreover, banks from regions that were not affected by the shock may increase their lending in the affected regions, taking over from local lenders which might be in distress. These two effects would increase business cycle synchronization.[3]

Identifying the causal effect of banking integration on business cycle synchronization raises a number of empirical challenges. First, regions with closer economic ties may have both more synchronized business cycles *and* higher levels of financial integration. Empirical evidence suggests that commonalities and proximity are among the most significant predictors of business cycle synchronization and financial integration across countries (Baxter and Kouparitsas, 2005). Moreover, changes in real economic integration across regions, such as bilateral trade, could exert an independent influence on output co-movement, and might also be correlated with changes in banking integration. Second, the integration of banking sectors across regions is driven by banks' choice on where and when to expand. This decision may be correlated with (changes in) output synchronization between regions, raising the possibility of reverse causality. For instance, banks might expand into regions that exhibit a different business cycle than their home area, as this may provide them with greater hedging possibilities. Alternatively, it may be easier for banks to assess investment opportunities in geographic areas that exhibit a more similar business cycle to their home, encouraging them to expand into regions with higher business cycle synchronization with their home.

We address these concerns and identify the causal effect of banking integration on the co-movement of business cycles by employing an instrumental variable estimation based on the removal of interstate banking restrictions in the U.S. Starting in the late 1970s, individual states removed restrictions on the entry of out-of-state banks. This process advanced in a somewhat chaotic manner, with states removing

[3]See, among others, Calvo and Mendoza (2000), Allen and Gale (2000), Mendoza and Quadrini (2010), and Devereux and Yetman (2010).

entry restrictions in different years and through different methods, such as unilaterally opening up their banking systems to bank holding companies from all other states, opening their banking systems on a reciprocal manner to all other states at once, or signing bilateral interstate banking agreements with particular states. This process culminated with the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 (Riegle-Neal Act), which removed all remaining barriers to entry at the federal level. We exploit cross-state, cross-time variation in the removal of interstate banking restrictions and construct instrumental variables to identify exogenous changes in banking integration over time at the state pair level.[4]

There are good economic and statistical reasons for treating the process of interstate banking deregulation as exogenous to output synchronization between two states. Restrictions on interstate banking protected banks from out-of-state competitors for much of the 20th century. Starting in the 1970s, technological and financial innovations eroded the value of these restrictions. For example, Kroszner and Strahan (1999) find that checkable money market mutual funds facilitated banking by mail and phone, and improvements in data processing, telecommunications, and credit scoring weakened the advantages of local banks. They argue that these innovations reduced the willingness of banks to fight for the maintenance of protective regulations, triggering deregulation. Furthermore, as described above, interstate banking deregulation occurred in a somewhat chaotic manner over time and through different methods. A closer inspection of this process shows that the most common method for allowing entry was the unilateral removal of entry restrictions to bank holding companies from other states.[5] This form of deregulation does not occur

[4]To the extent of our knowledge, this is the first paper to exploit interstate banking deregulation at the state pair-level to instrument for bilateral financial integration between states. Michalski and Ors (2012) analyze the reduced form effect of interstate deregulation on bilateral trade between states. Loutskina and Strahan (2012) use state-level regulations on interstate branching after the Riegle-Neal Act of 1994 to construct instruments at the state pair-level, but the regulations they exploit are not specific to each state pair.

[5]State-pairs in which at least one of the states in the pair deregulated entry in a national non-reciprocal (unconditional) manner account for almost 60 percent of the state pairs that had

at the state-pair level, and thus is unlikely to be driven by state-pair characteristics, such as (past or expected) changes in output synchronization between two particular states. Furthermore, we find no statistical evidence that business cycle synchronization or changes in synchronization affected the timing of deregulation between states.

Using a panel dataset at the state pair level over the 1976-1994 period and different sets of instrumental variables based on the timing of interstate deregulation, we find a strong positive effect of banking integration on business cycle synchronization between states, conditional on national time-varying shocks and state pair fixed effects. Our findings hold for different definitions of the banking integration variables, alternative business cycle synchronization measures, and when controlling for several state pair time-varying variables suggested by the literature, including gravity factors, differences in income levels and industrial composition between states, and measures of bilateral state trade and migration, as well as when including state-pair linear time trends. We also find similar results when we focus our analysis on differences in integration and synchronization for state pairs that share a metropolitan statistical area (MSA) to control for potential omitted variables, suggesting that our findings are not driven by time-varying regional shocks. Moreover, our results also hold when we extend our sample to cover the period 1976-2007, using an alternative measure of banking integration based on the distribution of deposits across bank branches.[6] The finding of a positive effect of banking integration on the co-movement of economic activity is consistent with the argument that integration contributed to the transmission of shocks to banks across states, making state business cycles more alike (Morgan et al., 2004), and suggests that shocks to the supply of capital

deregulated interstate banking before the Riegle-Neal Act of 1994.

[6]We focus our main analyses on the period 1976 to 1994 because data on bank assets and ownership structure from regulatory filings become available in 1976. After 1994 it is impossible to distinguish assets of the same bank holding company in different states, since the Riegle-Neal Act allowed banks to consolidate bank charters across states.

may have been a significant source of state business cycle fluctuations in the U.S. over our sample period.

To better understand the channels underlying the effect of banking integration on state business cycle synchronization, we also analyze whether this effect varies across state pairs and industries, and over time. First, we study whether the effect of banking integration on the co-movement of business cycles differs between tranquil times and periods of financial turmoil. We construct new time-varying measures of the extent of bank failures at the state level and find that the positive effect of banking integration on the synchronization of economic activity between two states is stronger when one (or both) of the states faces significant bank failures. This finding is consistent with arguments that highlight that integration makes business cycles more similar between regions by transmitting financial shocks. Second, we analyze whether the effect of integration on output synchronization differs across industries within a given state pair. We find that banking integration has a larger positive effect on output synchronization between states for those industries that rely more on external finance, consistent with the argument that banks contribute to the transmission of shocks across regions.

This paper relates to several strands of research. First, several papers have analyzed the effect of financial integration on business cycle synchronization, using mostly cross-country data.[7] These papers in general tend to find a positive relation between financial integration and synchronization (Kose et al., 2004; Baxter and Kouparitsas, 2005; Imbs, 2006; Rose, 2009), but they do not identify causal effects, as the observed correlations may be driven by global shocks and/or unobserved

[7] A related literature focuses on the transmission of financial shocks across countries, looking at particular events. For instance, Peek and Rosengren (1997, 2000) show how shocks to Japanese banks led their U.S. branches to reduce lending. Chava and Purnanandam (2011) and Schnabl (2012) present evidence on how the 1998 Russian crisis was transmitted across borders. Also, the literature on contagion studies how shocks spread internationally, highlighting the role financial linkages. See, among others, Kaminsky and Reinhart (2000), Kaminsky et al. (2003), and Cetorelli and Goldberg (2011).

country-pair heterogeneity. More recent research has documented a negative relationship when analyzing panel data at the country pair-level for developed countries and trying to identify causal effects (Kalemli-Ozcan et al., 2013a; Kalemli-Ozcan et al., 2013b). Closer to our paper, Morgan et al. (2004) analyze the impact of banking integration across U.S. states on state-level volatility over period 1976-1994 and find a negative effect. They also find a positive relationship between banking integration and the co-movement of economic activity between states. Building on this finding, we contribute to the literature by identifying the causal effect of integration on business cycle synchronization, exploiting the removal of restrictions to bank entry between states to construct instrumental variables at the state pair level. Moreover, we expand on these results and present new empirical evidence on the relation between financial integration and the co-movement of state economic activity, showing that the positive effect of banking integration on business cycle synchronization is stronger (a) for states that experience significant bank failures and (b) for industries that tend to rely more on external finance.

Second, this paper is also related to a large literature that analyzes the effects of banking deregulation in the U.S. Jayaratne and Strahan (1996) analyze the real effects of intrastate branching deregulation, finding that growth increases following deregulation.[8] Several papers have documented that intrastate branching and interstate banking deregulations are associated with an acceleration in business formation, increased entry and exit by new firms, and improved financing conditions for small firms (Black and Strahan, 2002; Cetorelli and Strahan, 2006; Kerr and Nanda, 2009; Rice and Strahan, 2010). Research also analyzes the effects of deregulation on the integration of U.S states, finding that interstate personal income insurance

[8]Intrastate branching regulations limited the ability of banks to expand their branch networks within a state. Interstate banking refers to the ability of a bank holding company to own and operate separate banks in more than one state. Since we are interested in the effects of integration across states, in this paper we focus our analyses on interstate banking restrictions. We control for intrastate deregulation in our regressions to capture the potential effects of this reform on state banking systems.

is higher following deregulation (Demyanyk et al., 2007) and that deregulation is associated with a reduction in cyclical variations in consumption risk sharing among states (Hoffmann and Shcherbakova-Stewen, 2011). Michalski and Ors (2012) show that banking integration across states increases bilateral trade.

The remainder of the paper is organized as follows. Section 2 describes the data we use in our empirical estimations. Section 3 presents OLS estimations of the relationship between integration and synchronization. Section 4 describes the process of interstate banking deregulation and presents our base 2SLS results on the causal effect of banking integration on output co-movement. Section 5 presents robustness tests. Section 6 analyzes differences in the effects of integration on synchronization across state pairs and industries. Section 7 concludes.

2 Data

2.1 Banking Integration across U.S. States

To measure banking integration across U.S. states, we construct several variables based on interstate bank affiliations through bank holding companies. We link each bank to the bank holding company that holds at least 50 percent of its equity and use this information on ownership structure to measure banking system integration between two states. Specifically, following Morgan et al. (2004), we measure the banking integration for each state pair i, j using two main variables based on bank holding company affiliations. First, we construct a dummy variable that takes on the value of one if bank assets or deposits in state i are held by a bank holding company that also holds assets or deposits in state j, and zero otherwise (*Dummy =1 if jointly owned assets or deposits*). Second, we construct a continuous measure of banking integration by computing the percentage of common banking assets and deposits, defined as the total value of assets and deposits in a state pair that are jointly owned by a bank holding company divided by the sum of the total bank assets and deposits in both states (*share of jointly owned assets and deposits*).[9] For our regressions, we take the natural logarithm of one plus this variable.[10] To account for the fact that the size of the banking system relative to the size of the local economy may differ across states, in unreported robustness tests we also estimated our regressions scaling the jointly owned assets and deposits of each state pair, alternatively, by (a) the sum of the Gross State Product (GSP) of both states and (b) the sum of the population of both states, and obtained results similar to those reported throughout the paper.

We consider both assets and deposits for constructing our measures of banking system integration across states to analyze a broad measure that captures different dimensions of integration. This also makes our variables comparable to those used in previous work on financial integration. We also estimated all the regressions reported throughout the paper computing the banking integration measures using, alternatively, only assets and only deposits and obtained similar results.

Data on bank assets and ownership structure are obtained from the Report of Condition and Income (*"Call Reports"*). All banking institutions in the United States regulated by the Federal Deposit Insurance Corporation, the Federal Reserve, or the Office of the Comptroller of the Currency, must file these reports on a regular basis. These reports hold balance sheet, income, and ownership information for all banks. Data on the geographic location of deposits come from the Federal Deposit Insurance Corporation's (FDIC) Summary of Deposits, which provides detailed branch-level data on deposits, location, and ownership for all branches of

[9] For each state pair i, j we calculate the jointly owned assets and deposits as the sum of the assets and deposits in state i held by bank holding companies that also hold assets or deposits in state j plus the sum of the assets and deposits in state j held by bank holding companies that also hold assets or deposits in state i. We scale this variable by the sum of total bank assets and deposits in states i and j.

[10] Results similar to those reported throughout the paper are obtained if we use this variable without taking logarithms in our regressions.

insured banks.

For our analyses, we consider the 48 contiguous states of the United States and therefore exclude Alaska and Hawaii. Moreover, we omit Delaware and South Dakota since the banking sector of these two states was heavily affected by state specific changes to their usury laws (Jayaratne and Strahan, 1996). These changes were followed by a relocation of bank holding companies headquarters, affecting the measurement of integration with South Dakota and Delaware. Our sample consists of 1,035 (46 * 45 /2) unique state pairs for the years 1976 to 1994. In unreported robustness tests, we also estimated all our regressions excluding those states where financial centers are located (namely, California, Connecticut, Illinois, Massachusetts, Minnesota, North Carolina, and New York), as there might be some concerns that integration with financial centers may have different effects, and obtained results similar to those reported throughout the paper. We focus our main analyses on the period 1976 to 1994 because the Riegle-Neal Act allowed banks to consolidate bank charters across states, which makes it impossible to distinguish assets of the same bank holding company in different states after 1994. Using a measure of banking integration based only on the geographic distribution of deposits, we find that our results also hold when we consider the period 1976-2007.

2.2 Synchronization of Economic Activity

We measure the synchronization of business cycles between two states using three different variables based on Gross State Product (GSP), which is the state-level equivalent of Gross Domestic Product (GDP). First, we compute the deviation of a state's growth rate from its average growth rate and the nationwide growth rate by estimating the following regression, including separate state and year fixed effects

(Morgan et al., 2004):

$$\text{real GSP growth}_{i,t} = \alpha_i + \delta_t + \varepsilon_{i,t} \tag{1}$$

The residuals $\varepsilon_{i,t}$ capture deviations of a state's real growth rate in a given year from that state's conditional mean real growth rate for our whole sample period and the average growth rate across all states in that year. The co-movement of business cycles between states i and j is then calculated as the negative of the absolute difference of the residuals between these the two states:

$$Synchronization1_{i,j,t} = - \mid \varepsilon_{i,t} - \varepsilon_{j,t} \mid \tag{2}$$

Our second measure of synchronization between states i and j is based on differences in real growth rates between the two states, and is computed as the negative absolute difference of real growth rates between states i and j (Giannone et al., 2008):

$$Synchronization2_{i,j,t} = - \mid \text{real GSP growth}_{i,t} - \text{real GSP growth}_{j,t} \mid \tag{3}$$

Finally, we measure the synchronization of economic activity by estimating the correlation of the cyclical component of states' real GSP growth for each state pair. In particular, we first determine the business cycle component of output for each state using a Baxter and King (1999) band-pass (2,8) filter (Baxter and Kouparitsas, 2005; Imbs, 2004). Then we calculate for each state pair i, j the correlation of the business cycle component over a five year period, where the correlation at year t is estimated in a forward-looking manner using information for the years t to $t + 4$. We calculate this measure for non-overlapping five-year periods in our sample.

These synchronization measures are constructed so that higher values indicate that output co-moves more between two states: as synchronization increases, the negative absolute difference in residual and real GSP growth rates between two states becomes larger (i.e., less negative) and the correlation of their business cycles increases. We construct our measures of business cycle synchronization using real GSP growth to make our results comparable to the literature on financial integration, which tends to use real GDP growth to measure the synchronization of economic activity across countries. We also estimated all the regressions reported throughout the paper computing the different business cycle synchronization measures using, alternatively, personal income and employment, instead of GSP, and obtained similar results.

Data on GSP come from the Bureau of Economic Analysis. These data are expressed in current U.S. dollars and we convert them into constant U.S. dollars by deflating the GSP series with the national U.S. consumer price index (CPI) provided by the Bureau of Labor Statistics. We calculate the annual growth rate of real GSP as the change in the natural logarithm of this variable.

In our regressions, we also include several additional control variables at the state pair and year level suggested by the literature. First, we control for differences in industrial structure across states by including the square root of the sum of squared differences between the share of total employment across the eight one-digit SIC sectors in each state pair and year, since differences in states' industrial mix may also affect the co-movement of their business cycles (Obstfeld, 1994; Kalemli-Ozcan et al., 2001).[11] Second, we control for differences in the level of economic development between two states by including the lagged value of the absolute difference in (the log of) per capita real GSP between them (Kalemli-Ozcan et al., 2013b). States with different income levels might experience different growth paths and thus have

[11] These sectors are mining, construction, manufacturing, transportation, trade, services, government, and finance, insurance and real estate. Data on employment by industry at the state level come from the Bureau of Economic Analysis. We obtain similar results if we control for the sum of the absolute value of the differences in employment shares across sectors in each state pair and year.

lower business cycle synchronization, and income differences could also be associated with banking system integration (e.g., banks from richer states may look for higher returns by acquiring assets in poorer states). Third, we control for variables associated with size, which reflect gravity factors that might affect both banking system integration and business cycle synchronization between two states. In particular, we control for the size of the two states in each pair by including (1) the product of the logarithms of the two states' real GSP and (2) the product of the logarithms of the two states' population. Finally, in addition to these state-pair specific variables, we also control for whether a state has deregulated intrastate branching. Intrastate branching regulations limit the ability of banks to expand their branch networks within a state, and many states lifted these restrictions during our sample period. The evidence suggests that this deregulation was associated with changes in state economic activity and the functioning of local banking systems (Jayaratne and Strahan, 1996; Black and Strahan, 2002; Cetorelli and Strahan, 2006; Kerr and Nanda, 2009). We control for this by including a dummy that equals one after at least one of the states in a given state pair eliminates restrictions to intrastate branching (and zero otherwise).

2.3 Descriptive Statistics

Table 1 shows descriptive statistics for the main variables employed in our empirical analyses. The summary statistics for the banking integration measures show that only 18 percent of the state-pair year observations in our sample have any jointly owned assets or deposits, and that these jointly owned assets and deposits represented on average 2.5 percent of the total assets and deposits of a given state pair, with a maximum of 87.8 percent (for Idaho and Oregon in 1992). Regarding the measures of business cycle synchronization, the negative absolute difference in real GSP growth rates between state pairs averages 3.3 percent over our sample period, while the correlation of the cyclical component of states' real GSP growth averages 57.1 percent.

The integration of states' banking systems in the U.S. increased during the sample period. Figure 1 illustrates the evolution of integration from 1976 to 1994. The top panel shows the fraction of all unique state pairs in our sample that were integrated (i.e., had any jointly-owned bank assets or deposits) in each year. While only 9 percent of all state pairs were integrated in 1976, more than a third of all state pairs shared common banking assets or deposits in 1994.[12] The bottom panel of Figure 1 illustrates the evolution of banking integration at the state pair level, using the example of California. It shows the evolution of the share of jointly owned assets and deposits between California and three other states (Washington, Texas, and Florida) over our sample period. As this graph illustrates, the banking integration of a given state with other states can show significant variation, both across-states and over time. For instance, the integration between the banking systems in California and Washington increased significantly after 1984, whereas the integration between banks from California and Florida remained fairly low and changed little over the sample period. Moreover, integration at the state-pair can be quite volatile over time, as illustrated by the case of California and Texas.

Figure 2 illustrates the evolution of business cycle synchronization over our sample period. The top panel shows the evolution of the average of our main synchronization measure, the negative of the absolute difference of the residuals of real GSP growth, from 1976 to 1994. The average level of business cycle synchronization across states showed some volatility during the 1980s, but was fairly stable after 1988. The bottom panel of Figure 2 illustrates the co-movement of business cycles

[12]The state pairs that were integrated before the process of interstate banking deregulation started in the early 1980s are due to the fact that some states allowed out-of-state bank entry before the Douglas Amendment to the 1956 Bank Holding Company Act effectively restricted interstate banking. Existing multi-state bank holding companies at the time were grandfathered by the Bank Holding Company Act.

at the state pair level, showing the evolution of our main synchronization measure between California and three other states (Washington, Texas, and Florida) over our sample period. As this graph illustrates, the business cycle synchronization a given state with other states can show significant variation, both across states and over time

3 Banking Integration and Business Cycle Co-Movement: OLS Results

We start our analysis of the relationship between business cycle synchronization and banking system integration by estimating the following regression using OLS:

$$Synchronization_{i,j,t} = \alpha_{i,j} + \delta_t + \beta * Banking\ Integration_{i,j,t} + \mathbf{X'}_{i,j,t}\gamma + \varepsilon_{i,j,t}, \quad (4)$$

where $Synchronization_{i,j,t}$ is a measure of the synchronization of business cycles between states i and j; $Banking\ Integration_{i,j,t}$ measures the integration of state i and j's banking system; and $\mathbf{X}_{i,j,t}$ are a set of state pair time-varying control variables. We also include time fixed effects δ_t to capture common national time-varying factors. State pair fixed effects ($\alpha_{i,j}$) account for time-invariant characteristics at the state pair level, such as geographical distance, which might be correlated with both banking integration and output synchronization. The coefficient β estimates the relationship between within-state pair changes in banking integration and output synchronization. Standard errors are clustered at the state pair level.

Table 2 presents OLS results from this regression model. Column (1) shows our baseline specification, using as dependent variable the negative absolute difference in residual real growth rates and measuring banking integration using a dummy variable equal to one if the two states in a given pair have any common assets or deposits. Following Morgan et al. (2004), we only control for differences in employment shares between states in this specification. The results show that higher banking integration is associated with a greater synchronization of business cycles between states. In column (2) we add additional state pair control variables, including gravity factors and differences in income levels between states, and also include a dummy that equals one after states eliminate restrictions to intrastate branching (and zero otherwise). Our findings are robust to the addition of these controls, and we find that banking integration is positively associated with business cycle synchronization. Regarding the other control variables, the results show that the size of the two states in a given pair and differences in employment shares and in real GSP per capita between states are negatively correlated with business cycle synchronization and that synchronization increases after states deregulate intrastate branching.

Results in columns (3) to (8) show that our findings are not sensitive to the definition of banking integration or the definition of output synchronization. In particular, columns (3) and (4) show regressions using the share of jointly owned assets and deposits as a measure of integration. In columns (5) and (6) we measure the co-movement of economic activity as the negative absolute difference of real growth rates between two states, and in columns (7) and (8) we use the correlation of the business cycle component of growth rates between two states as dependent variable. Consistent with the aforementioned results, in all these regressions we find that integration is associated with greater business cycle co-movement, although the relationship is not statistically significant in some specifications.

The results in Table 2 are similar to those reported by Morgan et al. (2004), who document that banking integration between U.S. states during our sample period is positively correlated with the synchronization of their business cycles. These findings are consistent with the argument that banking integration contributed to the transmission of shocks to banks across states, making their business cycles more alike.

However, it is not possible to draw causal inferences from these OLS results. While the state pair fixed effects capture time-invariant characteristics that affect both synchronization and integration between two states, and the time fixed effects capture any common national shocks, concerns about reverse causality or omitted variables remain. We cannot rule out that omitted time-varying state-pair factors may affect both business cycle synchronization and banking system integration. Moreover, the integration of states' banking sectors is driven by banks' choice on where to expand. Banks' expansion decision may be correlated with (changes in) output synchronization and may thus bias our results, although the direction of this bias is not clear. On the one hand, banks might expand into states that exhibit lower co-movement with the economic activity of their home states, as this provides them with greater hedging possibilities (Pyle, 1971).[13] In this case, increases in output synchronization between states would lead to reductions in integration, and OLS results would underestimate the true effect of integration on output co-movement. On the other hand, it may be easier for banks to assess investment opportunities in states that exhibit a more similar business cycle to their home states (Aguirregabiria et al., 2012). In this case, increases in output synchronization would lead to higher integration, and OLS estimates would be biased upwards. To address these concerns and identify the causal effect of banking integration on the co-movement of business cycles, we employ an instrumental variable estimation based on the removal of interstate banking restrictions, which we describe in Section 4.

[13] In an international setting, Heathcote and Perri (2004) present a model showing that an increase in the correlation of productivity shocks across countries reduces the optimal level of international portfolio diversification and that this reduction in portfolio diversification further increases the correlations of output, employment, and investment across countries.

4 The Effect of Banking Integration on Output Synchronization

4.1 Interstate Banking Deregulation

For many decades, banks in the U.S. were not allowed to expand their geographical scope beyond certain areas. States imposed limits on the location of bank branches and offices in the 19th century, and these impediments restricted the expansion of banks both within states through branches (intrastate branching restrictions) and across state lines (interstate banking restrictions). While state-chartered banks were always subject to state banking laws, the McFadden Act of 1927 extended the application of these laws to national-chartered banks. The ability of states to exclude out-of-state banks or bank holding companies from entering was further strengthened in the Douglas Amendment to the 1956 Bank Holding Company Act.[14] These restrictions were supported by the argument that allowing banks to expand freely could lead to a monopolistic banking system, with detrimental effects for economic development. Furthermore, the granting of bank charters was a profitable income source for states, increasing incentives for states to enact regulatory policies.

Starting in the 1970s, technological and financial innovations eroded the value of these restrictions for banks. Particularly, improvements in data processing, telecommunications, and credit scoring weakened the advantages of local banks, reducing their willingness to fight for the maintenance of restrictions on entry by out-of-state banks and triggering deregulation (Kroszner and Strahan, 1999). Maine was the first state to allow entry by out-of-state bank holding companies in 1978. In particular, bank holding companies from other states were allowed to enter Maine if

[14]The Douglas Amendment prohibited a bank holding company that had its principal place of business in one state from acquiring a bank located in another state, unless the acquisition was "specifically authorized by the statute laws of the State in which such bank is located, by language to that effect and not merely by implication." Since no state provided such authorization, bank holding companies were in practice prohibited from crossing state lines.

that other state reciprocated and also allowed entry by bank holding companies headquartered in Maine. While Maine enacted this policy in 1978, no other state changed its entry restrictions on out-of-state bank holding companies until 1982, when New York put in place a similar legislation and Alaska completely removed its entry restrictions. Over the following 12 years, states removed entry restrictions by unilaterally opening their state borders and allowing out-of-state banks to enter, or by signing reciprocal bilateral and multilateral agreements with other states to allow interstate banking. The Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 was the culmination of this liberalization process, and removed all remaining barriers to entry at the federal level.[15]

To analyze the process of interstate banking deregulation, we use data from Amel (2000) and our own updates on the dates of changes in state laws that affect the ability of commercial banks to expand across state borders. In particular, we identify the effective dates of deregulation for each state pair i, j as those dates in which the deregulation by a given state i could lead to entry by bank holding companies headquartered in state j, or vice versa. For instance, if state i opens up its banking system on a reciprocal manner to all states, the date of effective integration corresponds to the date when state j allows entry of state i's banks as well.

Figure 3 illustrates the evolution of the interstate banking deregulation process, showing the cumulative fraction of state pairs in our sample that had removed barriers to bank entry among each other by each year, differentiating between different methods for removing restrictions. Although Maine opened up its banking system to all states on a reciprocal manner in 1978, the fraction of state pairs that removed

[15] The Riegle-Neal Act allowed both unrestricted interstate banking (effective in 1995) and interstate branching (in effect in 1997). Interstate banking means the ability of a bank holding company to own and operate separate banks in more than one state. Interstate branching means that a bank can expand its branch network into more than one state without requiring separate capital and corporate structures for each state.

restrictions remained at zero until 1982, when New York reciprocated and put in place similar legislation.[16] The pace of interstate deregulation accelerated significantly in the second half of the 1980s, and by 1993 (before the Riegle-Neal Act removed all remaining barriers at the federal level), 76 percent of the state pairs in our sample had removed restrictions to bank entry among each other. Moreover, Figure 3 shows that the most common method for removing entry restrictions (accounting for about 60 percent of interstate banking deregulations at the state-pair level) was the unilateral opening of entry to bank holding companies from all other states. The second most frequent form of deregulating interstate banking (accounting for about 18 of all state-pair deregulations) was for states to enact nationwide reciprocal agreements with all other states.

Figure 4 illustrates the geographic distribution of the deregulation process at the state pair level, looking in particular at the case of Massachusetts. The figure shows for each state, the year when bank holding companies from Massachusetts were allowed to enter that state. For instance, in 1987, bank holding companies from Massachusetts were only allowed to enter nine states and only banks from these nine states were allowed to enter Massachusetts.[17] Massachusetts signed several interstate banking agreements with states on the East Coast, the Midwest, and West before it allowed entry in 1995 to banks from all remaining states following the passage of the Riegle-Neal Act.

4.2 Empirical Strategy: Timing of Interstate Banking Deregulation

To identify the causal effect of banking integration on business cycle synchronization, we posit that the timing of interstate banking deregulation directly impacts the

[16] Although Alaska eliminated all entry restrictions in 1982, it is not part of the sample used for our analyses, as we focus on the 48 contiguous states. Thus it is not included for the construction of Figure 3.

[17] In particular, bank holding companies from MA could enter AZ, CT, ME, NH, OK, RI, SD, TX, and UT.

degree of banking system integration. A change in banking integration then affects the co-movement of business cycles between states. Thus, the state pair-specific timing of interstate banking deregulation serves as an instrument to identify the exogenous component of banking integration for each state pair. The first stage regression is given by:

$$Banking\ Integration_{i,j,t} = \alpha_{i,j} + \delta_t + \beta * Deregulation_{i,j,t} + \mathbf{X'}_{i,j,t}\gamma + \varepsilon_{i,j,t}, \quad (5)$$

where $Banking\ Integration_{i,j,t}$ is a measure of banking system integration between states i and j; $Deregulation_{i,j,t}$ is a variable based on the timing of interstate banking deregulation between states i and j; and $\mathbf{X}_{i,j,t}$ are a set of state pair-specific control variables. We also include time fixed effects δ_t to capture general trends at the country level. State pair fixed effects ($\alpha_{i,j}$) account for time-invariant characteristics at the state pair level.

The removal of interstate banking restrictions directly affects the level of banking integration between states, as once these barriers are removed, banks can expand their activities geographically (Goetz et al., 2013). Moreover, the timing of the removal of these restrictions varies at the state pair level, which implies that we have an instrument for every unique state pair in our sample, and we hypothesize that state pairs that deregulated earlier have a greater degree of banking integration.

The underlying assumption of our econometric strategy is that the timing of the state pair-specific liberalization is not associated with expected changes in output synchronization between states, or with unobserved variables that might drive these changes (note that we account for cross-sectional differences across state pairs by including state pair fixed effects). Several arguments support this hypothesis. First, as described above, deregulation occurred in a somewhat chaotic manner over time and through different methods. The most common method for removing entry restrictions was the unilateral opening of entry to bank holding companies from all other states. Changes in business cycle synchronization with a particular state are unlikely to have played a role in the decision to allow entry by banks in all other states. The second most frequent form of deregulating interstate banking was for states to eliminate restrictions to entry by enacting nationwide reciprocal agreements with all other states. In these cases, the date of effective deregulation for a given state pair depends not only on the decision of the state that deregulated on a reciprocal manner, but also on the other state's decision to reciprocate. Second, empirical evidence suggests that the removal of geographical restrictions was driven by political economy considerations related to the private benefits of local banks, but not to overall economic activity, or business cycle synchronization (Kroszner and Strahan, 1999).

To provide additional evidence to support the underlying assumption of our econometric strategy, we examine the relationship between the timing of interstate banking deregulation and the co-movement of business cycles, prior to the removal of banking entry restrictions at the state-pair level. Specifically, we examine whether the level of (or changes in) business cycle synchronization for a state pair i, j is correlated with the date of interstate deregulation between i and j. We focus on the five-year period prior to interstate banking deregulation and compute the median (a) level and (b) change of our main synchronization measure before deregulation. To account for state i specific differences, we compute the within-state difference in the timing of deregulation, the level of synchronization, and the change in this variable. Figure 5 shows the relationship between these variables. In particular the top (bottom) panel plots the relationship between the timing of interstate banking deregulation and the median level (median change) of synchronization for each state-pair i, j. Because we account for within-state differences in the timing of deregulation and synchronization, these figures are centered on zero. The dashed line represents the linear relationship between the timing of interstate banking deregulation and synchronization. The scatter plots in Figure 5 indicate that there is no relationship between the date of interstate banking deregulation and the levels of and changes in synchronization in our sample. These results support our assumption that banking deregulation between two states meets the exclusion restriction for our regressions.

To examine the dynamic effects of the removal of interstate banking restrictions on banking system integration across state pairs, we estimate the following regression:

$$Integration_{i,j,t} = \alpha_{i,j} + \delta_t + \sum_{r=-10}^{+10} \beta_r Y_{r,t} + \varepsilon_{i,j,t}, \tag{6}$$

where $Integration_{i,j,t}$ is the natural logarithm of one plus the share of jointly owned assets and deposits for state pair i, j; $Y_{r,t}$ is a dummy variable taking on the value of one if in year t, state i and j deregulated r years before; δ_t and $\alpha_{i,j}$ are year and state pair fixed effects, respectively. The coefficient on integration in the year of interstate banking liberalization is dropped due to collinearity, so the coefficients β_r capture differences relative to the year of interstate banking deregulation. Standard errors are adjusted for clustering at the state pair level.

Figure 6 plots the estimated coefficients β_r, as well as the 99 percent confidence interval for these coefficients. As hypothesized, Figure 6 shows that the removal of interstate banking restrictions is associated with a significant increase in banking integration between states i and j. The pattern shows that integration does not significantly change prior to the liberalization of these restrictions, but once states remove entry barriers, integration increases, suggesting that the removal of interstate banking restrictions has first order effects on the integration of state banking systems.

Based on the discussion above, to obtain a consistent estimate of the effect of banking integration on business cycle synchronization, we use the state pair-specific process of interstate bank deregulation to identify exogenous increases in banking integration between two states. In particular, we construct three sets of time-varying state pair-level instruments based on interstate banking deregulation. First, we use a dummy variable taking on the value of one once a state pair liberalized restrictions on bank entry, and zero before. To capture variation over time in the effect of deregulation on banking integration, we construct two additional sets of instruments. First, we use the number of years since a state pair first removed its banking restrictions, and a square term to allow for a quadratic relationship between the time since deregulation and integration. Second, we implement a nonparametric specification that includes separate dummy variables for each year since two states liberalized entry restrictions, taking a value of one all the way through the first ten years after deregulation, and zero otherwise.

4.3 2SLS Estimates: Causal Effect of Banking Integration on Synchronization

Regression results from this 2SLS estimation of the effects of banking integration on business cycle synchronization are reported in Table 3. As in Table 2, we include state pair and time fixed effects and the full set of additional controls, and examine the effect of integration on synchronization using two alternative measures of banking integration: A dummy variable equal to one if the two states in a given pair have any common assets or deposits, and the natural logarithm of one plus the share of jointly owned assets and deposits.[18] Standard errors are clustered at the state pair-level.

Panel B of Table 3 reports first stage regression results based on our set of instrumental and endogenous variables. Consistent with Figure 6, the results in

[18]The control variables included in the regressions are those used in Table 2, namely, the product of the natural logarithm of population and real GSP of the two states, the absolute difference in real GSP per capita between states, the difference in employment shares at the sector level between states, and a dummy that equals one after states deregulate intrastate branching. We only report results including all these controls due to space considerations. Similar results are obtained if we do not include these additional controls.

columns (1) through (6) show that the removal of interstate banking restrictions has a significant positive effect on the degree of banking integration between two states. These results hold across the different measures of financial integration and for the different sets of instruments, conditioning on state pair and time fixed effects and the full set of additional controls. F-test statistics of the instruments' joint significance are very high, indicating that our instruments explain the pattern of banking integration between states, after controlling for several additional factors.

Second stage results examining the causal impact of banking integration on output synchronization are reported in Panel A of Table 3. These results show that the coefficient on the different integration measures is positive and significant in all specifications, indicating that within-state pair increases in banking system integration lead to a higher co-movement of economic activity between states. Our findings hold for different definitions of the banking integration variables, different sets of instruments, and alternative business cycle synchronization measures. In particular, columns (1) to (6) show regressions using as dependent variable the negative absolute difference in residual real growth rates and measuring banking integration considering, alternatively, a dummy variable equal to one if the two states in a given pair have any common assets or deposits (columns (1) to (3)), and the natural logarithm of one plus the share of jointly owned assets and deposits (columns (4) to (6)). Each column reports results for a different set of instruments. In columns (7) to (10) we examine whether our findings are sensitive to the definition of output synchronization, and use the negative absolute difference of real growth rates between states (columns (7) and (8)) and the correlation of business cycles between states (columns (9) and (10)) as dependent variables.[19]

The results reported in Table 3 imply that, conditional on state pair fixed effects,

[19]To save space, in these regressions we only report results using separate dummy variables for each year since two states liberalized entry restrictions as instruments. Similar results are obtained if we use the other sets of instruments.

common national time-varying factors, and additional controls (including gravity factors, differences in income level and industrial composition between states, and intrastate branching deregulation), the exogenous component of banking integration due to interstate banking deregulation leads to an increase in business cycle synchronization between states. This is consistent with the argument that banking integration contributed to the transmission of shocks to banks across states, making state business cycles more alike.

Our results are similar to those found by Morgan et al. (2004), but differ from those reported by Kalemli-Ozcan et al. (2013b), who find a negative effect of financial integration on business cycle synchronization when analyzing a sample of European countries and trying to address endogeneity by exploiting differences in financial regulation between countries. This different findings may reflect differences in the nature of shocks between our samples: while shocks to the supply of capital may have been a significant source of business cycle fluctuations in the U.S. in the 1980s and early 1990s (Bernanke and Lown, 1991), the developed European countries studied by Kalemli-Ozcan et al. (2013b) did not experience major credit supply shocks during their sample period. The different findings might also reflect differences in the nature of banking integration within and across countries.

Results from Table 3 indicate that our 2SLS coefficients are about six times larger than the coefficients obtained from OLS estimations (Table 2), indicating a downwards bias in those estimates. This bias is consistent with the idea that banks may choose to expand into states which exhibit a different business cycle than their home states to limit their exposure to idiosyncratic state shocks.[20] Our 2SLS estimates suggest that the integration of banking systems has a positive and economically significant impact on the synchronization of business cycles. The results in column

[20]The bias in the OLS estimates may also reflect attenuation bias due to measurement error. For instance, focusing on bilateral banking integration between states may miss indirect linkages through the banking system.

(4), for example, imply that an exogenous increase of one standard deviation in the within state-pair share of jointly owned assets and deposits increases the co-movement of GSP between two states by about 12 percent of the within state-pair standard deviation of this variable.

5 Robustness Checks and Extensions

In this section we conduct a series of tests to confirm the robustness of our results. For the remainder of the paper, we only report results using our main measures of business cycle synchronization (negative absolute difference in residual growth rates between states) as the dependent variable. We obtain similar results if we use our other measures of synchronization.

5.1 State and State Pair Time Trends

As a first robustness check, we analyze whether our results can be accounted for by unobservable (or difficult to measure) state or state pair dynamics. In the regressions reported in Table 3, we control for national time-varying shocks by including time fixed effects and capture time-invariant differences between states by including state-pair fixed effects. However, it is possible that time-varying factors, either at the state or state pair level, that are correlated both with financial integration and with output synchronization, and that were not accounted for through our instrumental variables approach, could affect our results.

To account for time-varying, unobservable factors at the state- or state-pair-level we control, alternatively, for state and state pair linear time trends. These results are reported in Table 4. In particular, columns (1) to (4) report results including a separate linear time trend for each state in our sample. Columns (5) to (8) display results controlling for a linear time trend for each of the 1,035 unique state pairs in our sample. These time trends capture unobservable factors that occur linearly over time either at the state or the state pair level, which might be correlated with both banking integration and output synchronization between states.

The results in Table 4 show that our findings are robust to these time trends. That is, banking system integration significantly increases output synchronization, controlling for unobservable state- or state pair-specific linear time effects. Moreover, the F-test statistics of the instruments' joint significance in the first stage regressions are very high, indicating that our instruments still explain banking integration between states even when we control for state- or state-pair-specific time trends.

5.2 Changes in Interstate Migration and Trade

To further explore the robustness of our results, we re-estimate our regressions controlling for two additional state pair variables that may be correlated with financial integration and might also affect output synchronization across states, namely, interstate migration and trade.

Blanchard and Katz (1992) and Fatas (2000) show that migration across states plays an important role in reducing unemployment and wage differentials across regions in the U.S. and is one of the main adjustment mechanisms in response to regional labor market shocks. This suggests that interstate migration is likely to be correlated with business cycle synchronization across states. Also, changes in interstate migration might be associated with other changes in real integration between two states.[21]

Bilateral integration through trade may affect business cycle synchronization (Frankel and Rose, 1998; Clark and van Wincoop, 2001; Imbs, 2004) and trade in

[21] Most of the literature on the determinants of business cycle synchronization does not control for migration, since cross-country migration flows are relatively small and thus unlikely to affect output co-movement between countries. However, interstate migration in the U.S. is quite large. For instance, Molloy et al. (2011) find that about 1.5 percent of the U.S. population moves to another state every year.

goods and in financial assets tend to move together (Rose and Spiegel, 2004; Aviat and Coeurdacier, 2007).[22] Michalski and Ors (2012) analyze banking integration across U.S. states and find that the integration of two states' banking systems increases bilateral trade. Given that trade can impact output synchronization, this finding suggests that banking integration can indirectly affect output synchronization between states through its effect on bilateral trade, in addition to any potential direct effects. By controlling for trade in our regressions, we can abstract from this channel of influence.

Table 5 reports results controlling, alternatively, for interstate migration and trade. In particular, columns (1) to (4) report regression results similar to those in Table 4 including state pair linear time trends and controlling for the fraction of interstate migrants in the total population of each state pair.[23] Specifically, for each state pair i, j and year we first determine the number of migrants from state i to j and from state j to i, and then scale the total number of migrants by the total number of people in both states. Following Molloy et al. (2011), we construct our measures of interstate migration using data on tax returns, and the unit of observation is a tax filer.[24,25] We include the natural logarithm of this variable as a control in our regressions, to mitigate the effect of outliers. Columns (5) to (8) report regression results controlling for interstate trade. In particular, we control for

[22]From a theoretical perspective, the impact of trade integration on business cycle synchronization is ambiguous (Frankel and Rose, 1998; Calderón et al., 2007). On the one hand, if demand shocks dominate, then business cycles may become more similar across regions as trade increases. On the other hand, the effect of trade on business cycle co-movement is not clear if industry-specific shocks are the main source of fluctuations. In this case, the relationship between trade integration and business cycle synchronization will depend on the patterns of specialization in production. If increasing specialization in production leads to inter-industry trade, then trade will result in more asymmetric business fluctuations. In contrast, if intra-industry trade prevails, then increased trade will result in higher business cycle synchronization.

[23]Similar results are obtained if we do not control for any linear time trends in our regressions or if we only include state-specific linear trends.

[24]We thank Raven Molloy, Christopher L. Smith, and Abigail Wozniak for providing us the data on interstate migration.

[25]Our results also hold when we calculate interstate migration using data from the Current Population Survey (CPS). Unfortunately, the CPS data on interstate migration start in 1982, whereas the data from Molloy et al. (2011) start in 1975.

the log of bilateral trade between two states divided by the sum of their GSPs. Data on interstate trade come from the Commodity Flow Survey conducted by the Department of Transportation, which provides information on interstate shipments.[26] Unfortunately, only two surveys were conducted during our sample period, in the years 1977 and 1993, and thus we cannot make use of the full time series available in our data. Therefore, for these regressions we limit our dataset to two observations per state pair and use as a dependent variable the average synchronization between two states calculated over a five year period around these two years (1977 and 1993) to mitigate the effect of measurement error on our synchronization variable.[27] For all the control variables, including our measures of banking integration, we take data as of 1977 and 1993. Given that we only have two data points for these regressions, we cannot include state-pair linear trends in this estimation, and thus only include year fixed effects.

The results in Table 5 show that our results are robust to including these additional measures of integration between states. That is, greater banking integration leads to greater co-movement of business cycles, controlling for interstate migration and trade. In addition, our results show that both bilateral migration and trade are negatively correlated with business cycle synchronization between states. Moreover, our instruments are highly significant in the first stage, even in the regressions controlling for trade where we only have two observations per state pair.

5.3 Differences between State Pairs that Share an MSA

Next, to try to account for any unobserved state pair time-varying shocks that may be correlated with both financial integration and business cycle synchronization,

[26] We are grateful to Tomasz Michalski and Evren Ors for providing us with their data on interstate trade.

[27] For 1977, we determine the average synchronization between two states over the years 1976 to 1980; for 1993, we compute the average synchronization between states over the years 1990 to 1994.

and that were not accounted for through our instrumental variables approach, the inclusion of state pair linear time trends, and controlling for bilateral trade and migration, we focus our analysis on differences in integration and synchronization for state pairs that share a metropolitan statistical area (MSA).[28]

In particular, we follow the approach of Michalski and Ors (2012), who analyze the effects of interstate banking deregulation on trade by comparing trade flows from a given state to two different adjacent states that share an MSA, and with which deregulation took place at different points in time. We adapt this approach to our setting and, for each state pair m, k that shares an MSA, we analyze whether the difference in output synchronization between every state i and states k and m, respectively, changes more when i and k become more financially integrated (compared to i and m). Under the assumption that states that share a common MSA are subject to similar shocks, this allows us to control for time-varying state pair unobserved variables that we may have not accounted for in our specifications.

Using the 1993 MSA definitions from the Census Bureau, there are 47 state pairs in our sample that share a common MSA. We then determine the difference in synchronization and integration between those states with every other state i, that does not share a common MSA with either k and/or m.[29,30] To identify the effect

[28] MSAs are geographic entities that contain a core urban area of 50,000 or more inhabitants and also include any adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban core.

[29] We order the data such that the state in the pair k, m that liberalized its banking restrictions with i earlier will be the subtrahend. This ensures that the differenced instruments are always positive.

[30] A state can also share a MSA with more than two states. We do not include these states in our analysis to isolate the differential effect of integration on synchronization. Consider, for instance, the states of Alabama and Georgia that share a common MSA (Columbus, AL-GA). Georgia also shares a common MSA with South Carolina (Augusta-Aiken, GA-SC) and Tennessee (Chattanooga, TN-GA). Thus we take each of the remaining 44 states in our sample and compute the difference in synchronization and integration between that state and Alabama and Georgia, respectively. The same applies, for instance, when computing differences in synchronization and integration between the state-pair Georgia-South Carolina and all other states.

of integration on synchronization, our regression model then becomes:

$$\begin{aligned}\Delta Synchronization_{i,k,m,t} &= \alpha_{i,k,m} + \delta_t + \beta * \Delta Banking\ Integration_{i,k,m,t} + \\ &\quad + \Delta \mathbf{X'}_{i,k,m,t}\gamma + \varepsilon_{i,k,m,t}, \end{aligned} \tag{7}$$

where $\Delta Synchronization_{i,k,m,t} = Synchronization_{i,k,t} - Synchronization_{i,m,t}$ and thus measures the difference in co-movement between states i and k and states i and m, respectively. Similarly $\Delta Banking\ Integration_{i,k,m,t}$ measures the difference in banking integration between states i and k and states i and m, respectively, and $\Delta \mathbf{X'}_{i,k,m,t}$ measure the differences in the additional state pair time-varying control variables between these two sets of states. Furthermore, we also difference our instrumental variables following a similar approach (i.e., taking the difference in our instrumental variables between states i and k and states i and m, respectively) and use 2SLS estimation to identify the causal impact of integration on output co-movement. We also include time fixed effects δ_t and state-triplet fixed effects ($\alpha_{i,k,m}$). The coefficient of interest is β: a positive value of β indicates that greater integration with a state (compared to the other state with which it shares an MSA) leads to higher synchronization.

Regression results for these estimations are reported in Table 6. Columns (1) to (4) report results for the specification described above, while columns (5) to (8) report regressions including state pair linear time trends. The results in Table 6 confirm our findings and show that greater integration with another state significantly increases the synchronization of economic activity. In particular, these results indicate that higher banking integration between states i and k (relative to the integration between states i and m, where m shares an MSA with k) significantly increases the co-movement of their business cycles, beyond the level of synchronization between i and m. Thus, even when using a pair of states that share an MSA to control for potential omitted variables, banking integration leads to higher output synchronization, suggesting that our findings are not driven by time-varying regional shocks.

5.4 Longer Time Period

In all the estimations reported above, we end our sample period in 1994 because the Riegle-Neal Act allowed bank holding companies to consolidate bank charters across states, which makes the accurate measurement of the geographic location of bank assets impossible after 1994. In this section, we extend our sample beyond 1994 by using an alternative measure of integration that relies only on bank deposits, for which data on geographic location are available for a longer period. In particular, we measure banking integration between two states based on the deposits held by bank holding companies that are active in both states.

Aside from examining the robustness of our results, we are also interested in examining whether the impact of financial integration on the co-movement of economic activity has changed over time. The empirical evidence suggests that the U.S. banking system has become more efficient since the mid-1990s, which may have affected the relationship between banking integration and the co-movement of states' business cycles.[31] Moreover, the nature of shocks underlying regional economic fluctuations may have changed over time, which may also affect the effect of banking integration on output synchronization. Loutskina and Strahan (2012) analyze the effects of financial integration on housing prices over the period 1994-2006 and find that areas that are more integrated with each other have less synchronized movements in prices.

Table 7 present regression results considering only bank deposits to measure

[31] For instance, Stiroh and Metli (2003) find that the share of non-performing loans dropped during the early 1990s, suggesting that banks became safer. Similarly, Stiroh and Strahan (2003) show that more efficient banks gained market share following the deregulation of inter- and intrastate branching restrictions. Dick (2006) finds that banks became more efficient in the provision of deposit services after the Riegle-Neal Act.

integration and analyzing a longer time period.[32] In particular, in columns (1) and (2) we replicate our analyses for the period 1976-1994, but define banking integration across states using only information on deposits. Similar to the results reported above, we find that greater integration of states' banking markets leads to greater co-movement of states' economic output. Columns (3) and (4) present results analyzing a longer time period, namely 1976 to 2007.[33] These results show that financial integration increases business cycle synchronization between states, even when considering a longer time period. However, the size of the coefficients on financial integration in these columns is smaller than in the regressions considering a shorter period (columns (1) and (2)), which suggests that the effect of banking integration on business cycle co-movement may be weaker after the mid-1990s. To formally test this, in columns (5) and (6) we re-estimate the regressions for the period 1976-2007 including an interaction between our financial integration measures and a dummy variable which takes on the value of one for all years after 1994, and zero before.[34,35] The results indicate that banking integration has a significant positive effect on the synchronization of state business cycles both before and after 1994, but this effect is considerably smaller in the later period. This difference in magnitude could be the result of changes in the banking system that might have affected its role in transmitting shocks across states, or may reflect that financial shocks were a smaller source of business cycle fluctuations in the U.S. since the mid-1990s.

[32] In Table 7 we only report results using years since the interstate deregulation and its square term to instrument for banking integration. Results are similar if we use the nonparametric instrument.

[33] We end our sample period in 2007 to avoid capturing the effects of the global financial crisis.

[34] We use 2SLS estimation to identify the causal impact of integration on output co-movement. Given that we have two endogenous variables in these estimations (banking integration and the interaction between integration and the after-1994 dummy) we use two sets of instruments: our variables based on interstate branching deregulation and the interaction between these variables and the after-1994 dummy.

[35] To account for the fact that the relationship between all our control variables and business cycle synchronization may have also changed after the mid-1990s, in these regressions we include the interaction between all of our controls and the after-1994 dummy variable.

6 Differences across States and Industries

In this section, we analyze whether the effect of banking integration on business cycle synchronization varies across state pairs and over time depending on state characteristics. Furthermore, we also test whether integration has a different effect on the synchronization of economic activity between certain industries within a state-pair. These analyses provide novel information to better understand the channels underlying the effect of banking integration on state business cycle synchronization.

6.1 Differences between State-Pairs: Bank Failures

First, we study whether the effect of banking integration on the co-movement of business cycles differs between tranquil times and periods of financial turmoil. If integration makes business cycles more similar between regions by transmitting financial shocks, we would expect this effect to be stronger when the financial sector in one (or both) of the integrating regions is in distress. Consistent with this hypothesis, Kalemli-Ozcan et al. (2013a) find that international financial integration is associated with greater output synchronization during financial crises.

To identify periods of banking system distress at the state level, we rely on measures of the intensity of bank failures.[36] In particular, we first determine the total assets and deposits held by all commercial banks located in each state that failed in a given year.[37] During our sample period there were 1,729 commercial bank failures in the U.S., with average total assets and deposits of 435 million

[36]Cross-country studies typically date systemic banking crises based either on narratives from supervisors and experts (Caprio and Klingebiel, 1996; Reinhart and Rogoff, 2009), or on some quantitative measures of the performance of the financial system, such as the ratio of non-performing loans to total loans being higher than ten percent (Demirguc-Kunt and Detragiache, 2005) or bank restructuring costs above three percent of GDP (Laeven and Valencia, 2008), or a combination of both.

[37]To identify failures, we use the FDIC's Historical Statistics on Banking, which report detailed information on the provision of assistance or the failure of commercial banks starting in 1934. We combine these data with balance sheet data and use a failed institution's last reported assets and deposits.

dollars at 1994 prices per failure. We then compute the fraction of the total assets and deposits in a given state and year held by failing institutions. This fraction is relatively low since large bank failures are infrequent.[38] However, it shows large variation, both across states and over time within states. Finally, we classify states as being in financial distress if the fraction of the total assets and deposits held by failing institutions exceeds one percent.[39] Based on this definition, the banking sectors of 26 states are considered to be in financial distress for an average of more than two years over our sample period. Appendix Table 1 lists the states and years that are classified as being in distress. Our classification identifies regions that are commonly considered to have faced banking crises during our sample period, including the Southern states (particularly Texas, Louisiana, and Oklahoma) in the second half of the 1980s (Grant, 1998) and New England in the early 1990s (Jordan, 1998).[40]

Table 8 presents our 2SLS results analyzing whether the effect of banking integration on the synchronization of state business cycles differs during periods of banking distress. In particular, Table 8 shows regressions similar to those in Table 5, including a dummy variable that equals one if at least one of the states in a given pair is classified as facing banking distress, and the interaction between this dummy and our measures of financial integration.[41] The coefficient on this interaction term is positive and statistically significant in all specifications, indicating that financial integration tends to increase output synchronization relatively more when (at least) one of the states in the pair experiences a period of financial turmoil. These

[38]The median fraction of total assets and deposits held by failing banks in states that experience bank failures is 0.2 percent.

[39]The one percent threshold we use to define banking system distress is the 79 percentile of the distribution of this variable.

[40]See FDIC (1997) for an overview of regional banking crises in the U.S. in the 1980s.

[41]Given that we have two endogenous variables in these estimations (banking integration and the interaction between integration and the financial distress dummy) we use two sets of instruments: our variables based on interstate branching deregulation and the interaction between these variables and the distress dummy.

findings are consistent with the notion that multi-market banks transmit financial shocks across states, which contributes to making state business cycles more alike.[42] Kalemli-Ozcan et al. (2013a) report similar results in a cross-country setting; different from their OLS results, our instrumental variable strategy allows a causal interpretation.

In unreported robustness tests, we find that our results hold if (1) we consider different cut-off values of the fraction of the total assets and deposits held by failing institutions to define states facing periods of banking system distress (alternatively, two and three percent) and (2) we scale the assets of failing banks by a state's GSP to define systemic bank distress at the state level.

6.2 Differences across States and Industries: Dependence on External Financing

Due to technological reasons, some industries may rely relatively more on external funding, such as bank loans, to finance their operations (Rajan and Zingales, 1998). If banks contribute to the transmission of shocks across states, banking integration might have a larger effect (in absolute terms) on output synchronization for those industries that are more bank-reliant.

To test this hypothesis, we construct measures of output synchronization between states for different industry groups based on their dependence on external funding. We first calculate the dependence on external finance at the industry level following the methodology of Rajan and Zingales (1998). In particular, we collect data on U.S. firms from Compustat for the period 1980 to 1990 and aggregate firm-level data on reliance on external funds (proxied by the fraction of investment not financed with

[42] Note that a state-pair is considered to experience an episode of financial turmoil if at least one state experiences many bank failures. Our results also hold if we exclude observations where both states in a state-pair experience either (a) financial turmoil according to our definition, or (b) any bank failures in a year. This suggests that the results on the interaction between financial integration and our bank distress dummy reflect the transmission of shocks across states.

funds from operations) up to the two-digit SIC sector, which gives us a sample of 72 industries. Then, we define high (low) financial dependence industries as those that are above (below) the median of the external financial dependence measure across industries. Using this industry classification, we then calculate for each state the aggregate annual growth rate of real GSP for high and low financial dependence industries, and use this variable to construct our measures of output synchronization between states.[43] Thus, we have two measures of output synchronization for each state pair, one for industries with high financial dependence and one for industries with low dependence.[44]

To identify the effect of integration on output synchronization across industries, we estimate the following regression at the industry-type state pair level:

$$\begin{aligned} Synchronization_{i,j,f,t} \quad = \quad & \alpha_{i,j,f} + \delta_{t,f} + \rho Banking\ Integration_{i,j,t} + \\ & \beta * Banking\ Integration_{i,j,t} * Industry\ Type_f + \\ & \mathbf{X'}_{i,j,t}\gamma + \varepsilon_{i,j,f,t}, \end{aligned} \tag{8}$$

where $Synchronization_{i,j,f,t}$ is a measure of the output synchronization of industry type f (high/low external financial dependence) between states i and j; $Banking\ Integration_{i,j,t}$ measures the integration of state i and j's banking system; and $\mathbf{X}_{i,j,t}$ are a set of state pair time-varying control variables. $Industry\ type_f$ is a dummy variable that equals one (zero) for high (low) financial dependence in-

[43]Data on state GSP at the industry level come from the Bureau of Economic Analysis. For each state and year, we aggregate the GSP of all industries in each group (high/low financial dependence) and convert these data into constant U.S. dollars by deflating the aggregate GSP series with the national U.S. CPI. We calculate the annual growth rate of real GSP for each industry group and state as the change in the logarithm of this variable. We then use this variable to construct the different measures of output synchronization between states described in Section 2. To calculate the residual real growth rates, we estimate separate regressions of the real growth rate for each industry type in a state and year, on state and year fixed effects.

[44]While it would be possible to perform this analysis at the industry level, we aggregate the data by industry type (high/low financial dependence) because some industries are very small in certain states, which generates significant volatility in their growth rates over time and affects the measurement of synchronization.

dustries. We also include industry type-time fixed effects $\delta_{t,f}$ to capture common national time-varying factors at the industry level. State pair-industry type fixed effects $\alpha_{i,j,t}$ account for time-invariant characteristics at the state pair industry type level. The coefficient of interest is β, which estimates whether the effect of banking integration on output co-movement differs for industries with low and high financial dependence.

We use 2SLS estimation to identify the causal impact of integration on output co-movement. The cross-sectional unit of observation (i, j, f) for our analysis is now a industry type (f) within a state-pair (i, j). Our instrumental variables, however, only apply at the state-pair level (i, j). To account for this, we use a split-sample IV technique (Angrist and Krueger, 1994; Angrist and Pischke, 2009) where we first use our sets of instruments to estimate the exogenous component of banking integration at the state-pair level i, j, and then use this estimate in an OLS regression at the industry type-state-pair level (i, j, f).[45] Following Bjoerklund and Jaenetti (1997), we estimate standard errors via bootstrapping.

Table 9 reports the results of these estimations controlling, alternatively, for state (columns (1) to (4)) and state pair (columns (5) to (8)) linear time trends. The results show that banking integration has a larger positive effect on output synchronization between states for those industries that rely relatively more on external finance. In particular, the coefficient on the interaction between the high financial dependence dummy and financial integration is positive and statistically significant in all specifications. Moreover, the results show that the effect of financial integration on synchronization is not always significant for industries with low dependence on external finance, but financial integration significantly increases the co-movement of output among industries that depend more on external finance, consistent with

[45] To identify any differential effects of integration on output synchronization between industries (β), we interact the estimated exogenous component of banking integration with the industry type dummy.

the idea multi-market banks contribute to the transmission of shocks across states.

7 Conclusion

This paper analyzes the effect of the geographic expansion of banks across U.S. states on the co-movement of economic activity between states. Estimating the causal effect of banking integration on business cycle synchronization raises a number of empirical challenges, which we address by exploiting cross-state, cross-time variation in the removal of interstate banking restrictions to construct instrumental variables to identify exogenous changes in banking integration over time at the state pair level. Using this approach, we find that, conditional on state pair fixed effects, common national time-varying factors, and several additional state pair variables, banking integration increases the synchronization of state business cycles. These findings are consistent with the argument that integration contributed to the transmission of financial shocks across states, making state business cycles more alike.

Moreover, we find that the within-state pair impact of integration on output co-movement is larger when the banking system in (at least) one of the states is in distress. We also analyze differences across industries within a given state pair and find that banking integration has a larger positive effect on output synchronization between states for those industries that rely relatively more on external finance. Both these findings are consistent with the argument that multi-market banks contributed to the transmission of shocks across states.

Our findings provide novel information on the effects of interstate banking deregulation and financial integration across U.S. states and also offer insights about current policy debates, including debates about international and cross-border banking. In particular, our findings highlight the role of multi-market banks in the transmission of shocks across regions and suggest that increased financial integration can contribute to making business cycles more alike, especially during periods of systemic bank distress. Future research may explore the extent to which our findings may reflect the particular types of shocks that drove business cycle fluctuations in the U.S. over our sample period and the way in which banking integration across U.S. states occurred, to understand whether these findings may apply to other settings and, in particular, to international integration through cross-border banking.

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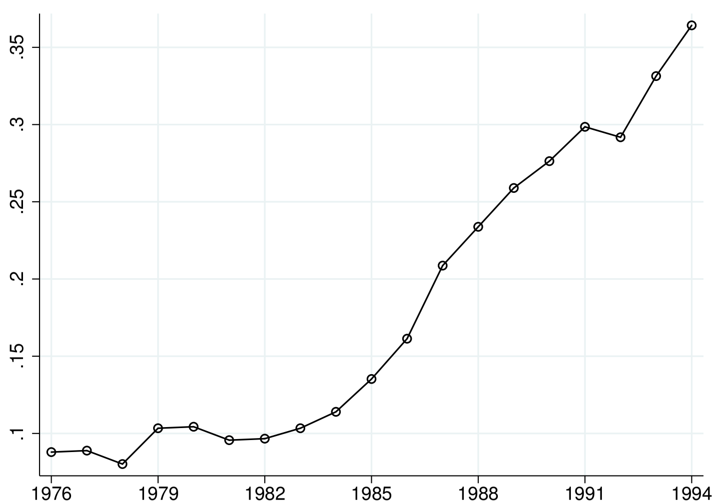
Figures

Figure 1

Evolution of Banking Integration between States

This figure illustrates the evolution of banking integration between states. Panel A shows the fraction of all unique state pairs in our sample that were integrated (i.e., had any jointly-owned bank assets or deposits) in each year over the period 1976-1994. We consider the 48 contiguous states of the United States, excluding Delaware and South Dakota. Panel B shows the evolution of the share of jointly-owned assets and deposits between California and three other states (Washington, Texas, and Florida) over our sample period.

Panel A: Fraction of State-Pairs with Jointly-Owned Bank Assets or Deposits



Panel B: Fraction of Jointly Owned Bank Assets and Deposits (selected state pairs)

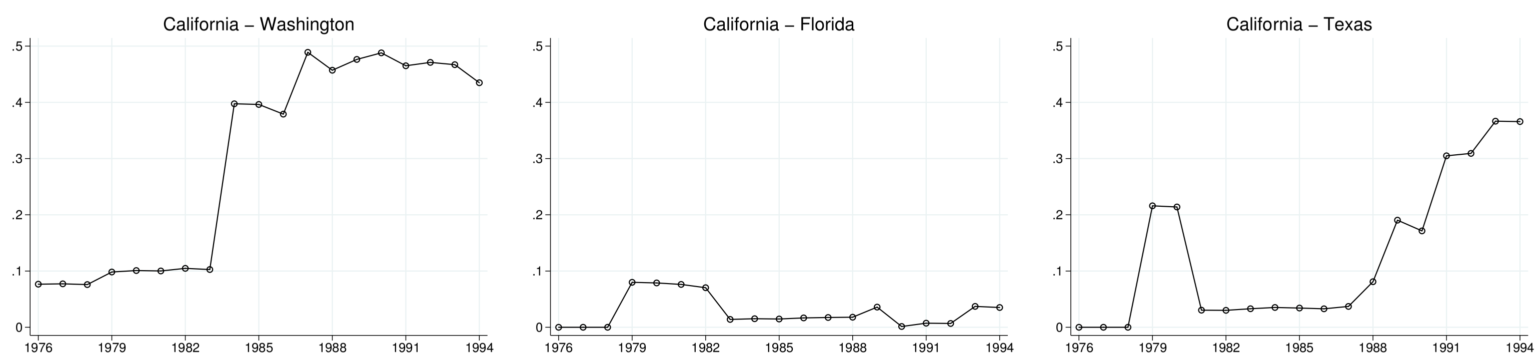
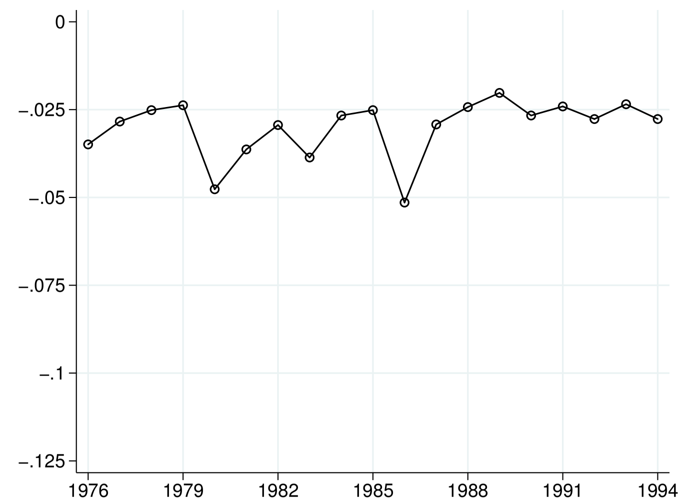


Figure 2

Evolution of Business Cycle Synchronization between States

This figure illustrates the evolution of the synchronization of state business cycles. Panel A shows the mean across all unique state pairs in our sample of the negative absolute difference in residual real growth rates over the period 1976-1994. We consider the 48 contiguous states of the United States, excluding Delaware and South Dakota. Panel B shows the evolution of the negative absolute difference in residual real growth rates between California and three other states (Washington, Texas, and Florida) over our sample period.

Panel A: Business Cycle Synchronization (average across all state pairs)



Panel B: Business Cycle Synchronization (selected state pairs)

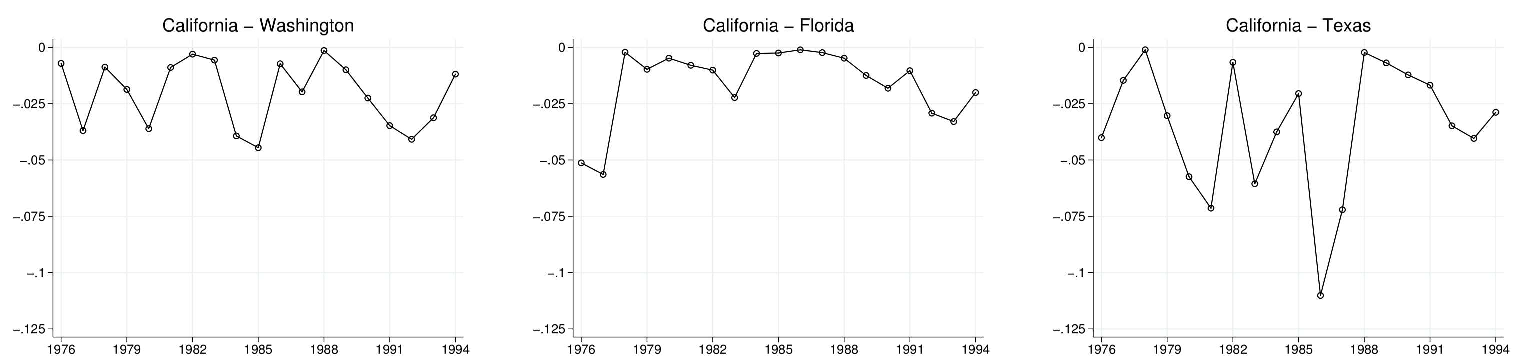


Figure 3
Evolution of Interstate Banking Deregulation

This figure shows the cumulative fraction of state pairs in our sample that had removed barriers to bank entry among each other by each year over the period 1976-1994, differentiating between different methods for removing restrictions. Unilateral deregulation refers to cases in which (at least) one of the states in a given pair unilaterally allowed entry by bank holding companies from all other states. Reciprocal deregulation are cases in which states enacted nationwide reciprocal agreements with all other states. In these cases, the date of effective deregulation for a given state pair depends not only on the decision of the state that deregulated on a reciprocal manner, but also on the other state's decision to reciprocate. Bilateral deregulation refers to cases in which the two states in a given pair allowed entry by signing a bilateral interstate banking agreement. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota.

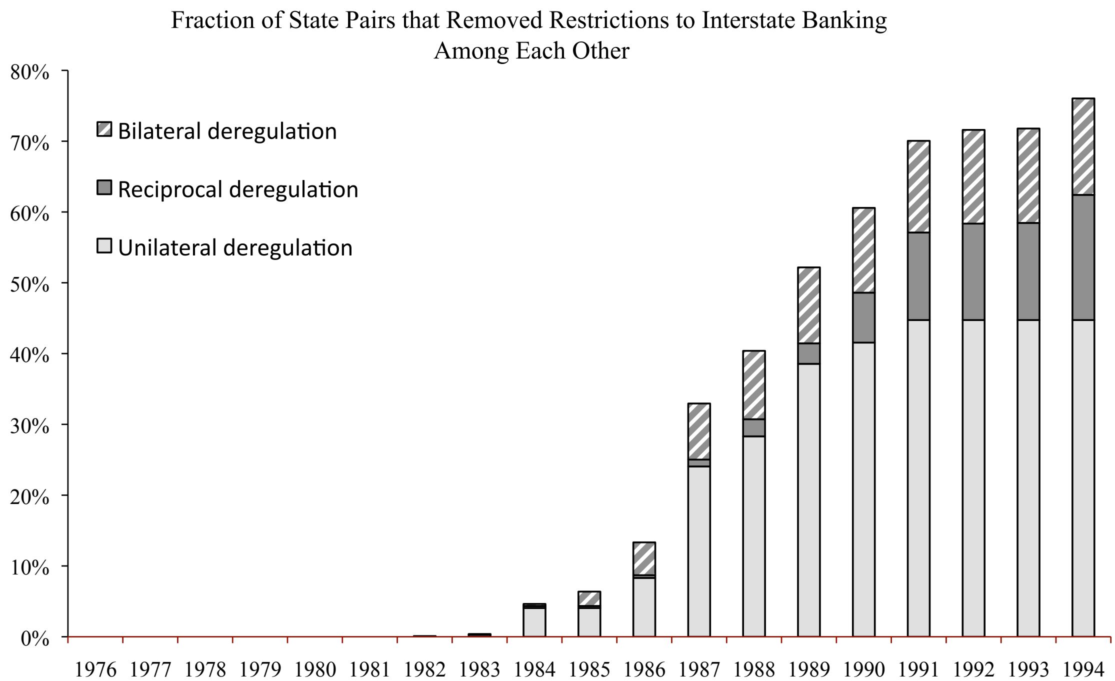


Figure 4

Interstate Banking Deregulation at the State Level - The Case of Massachusetts

This figure illustrates the interstate banking deregulation at the state pair level, looking in particular at the case of Massachusetts. The figure shows for each state, the year when bank holding companies from Massachusetts were allowed to enter that state.

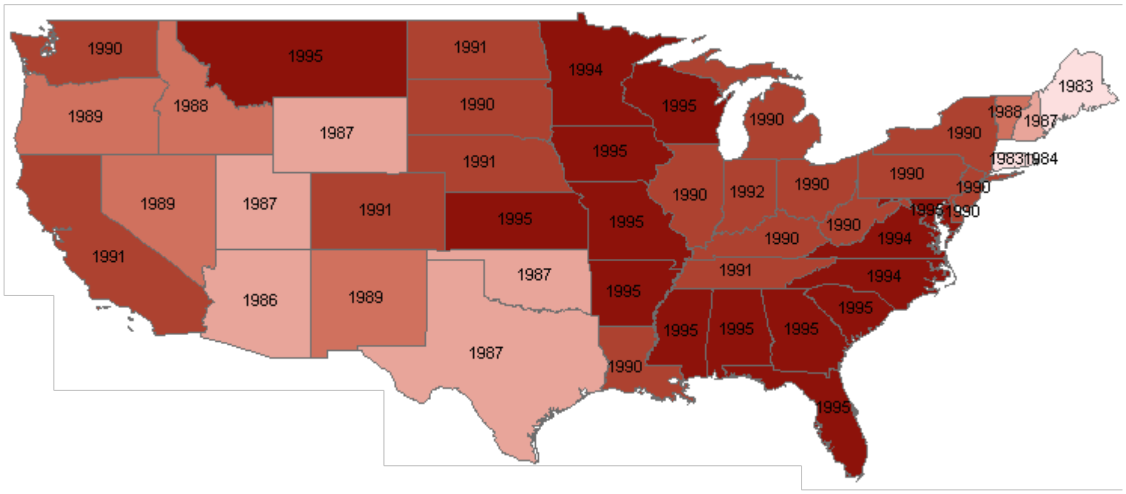
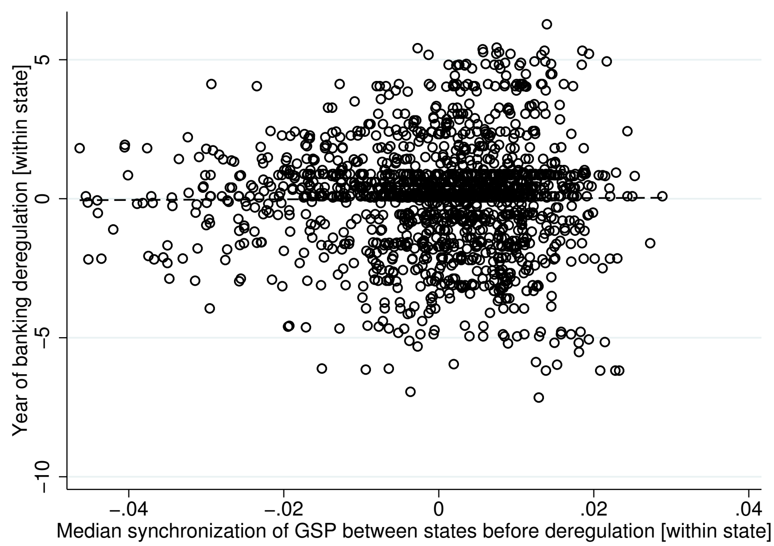


Figure 5

Interstate Banking Deregulation and Synchronization - Within State Differences

This figure plots the relationship between the timing of interstate banking deregulation and the level (Panel a) or changes (Panel b) of synchronization 5 years prior to deregulation. For each state-pair i, j, we first determine the year of interstate banking deregulation and compute the median level (a) or median change (b) of the negative of the absolute difference of state's residual growth rates for the 5 years prior to interstate banking deregulation. To focus on within state differences in the timing of deregulation and synchronization prior to deregulation, we subtract the average year of deregulation or the average median level (a) or median change (b) from these variables. The dashed line represents the linear relationship of the year of interstate banking deregulation and the median level (a) or change (b) of synchronization before interstate deregulation.

Panel A: Level of Synchronization before interstate banking deregulation



Panel B: Change of Synchronization before interstate banking deregulation

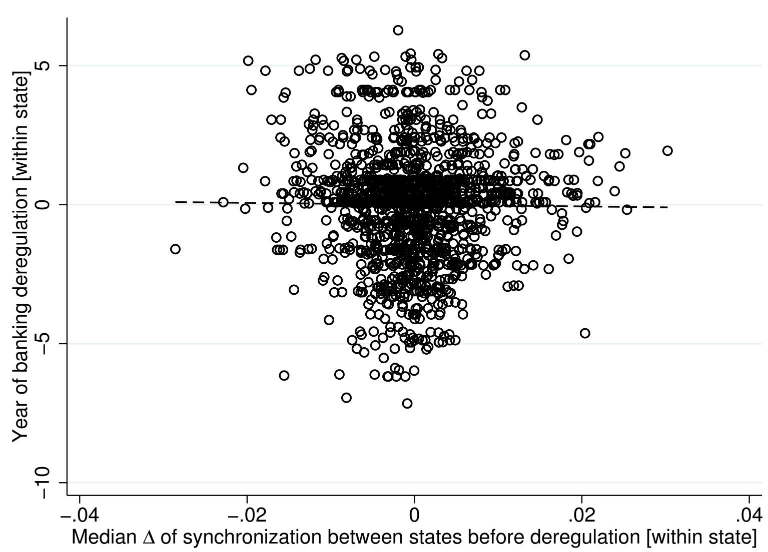


Figure 6

Dynamic Effect of Interstate Banking Deregulation on Banking Integration

This figure shows the impact of interstate banking deregulation on banking integration. In particular the figure reports coefficients from the following regression:

$$Integration_{i,j,t} = \alpha_{i,j} + \delta_t + \sum_{r=-10}^{+10} \beta_r Y_{r,t} + \varepsilon_{i,j,t},$$

where $Integration_{i,j,t}$ is the natural logarithm of one plus the share of jointly owned assets and deposits for state pair i, j; $Y_{r,t}$ is a dummy variable taking on the value of one if in year t, state i and j deregulated r years before; δ_t and $\alpha_{i,j}$ are year and state pair fixed effects, respectively. The dots denote the estimated br coefficients, while the dashed lines show the 99 percent confidence interval. The coefficients are centered on the year of deregulation. Standard errors are adjusted for clustering at the state pair level.

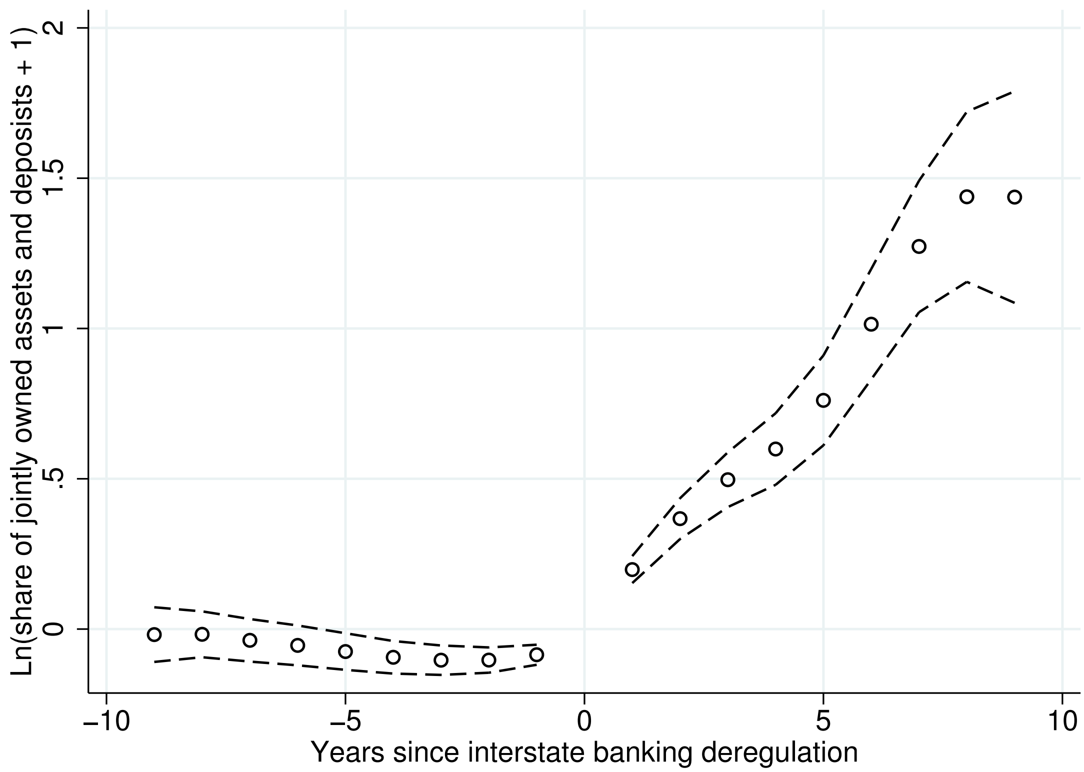


Table 1
Summary Statistics

This table shows descriptive statistics for the main variables employed in our empirical analyses over the period 1976-1994. Data correspond to observations at the state pair level. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota.

	N	Mean	Std.Dev	Min	Max	Median
Business cycle synchronization measures						
Negative absolute difference in residual real growth rates between states * 100	19,665	-3.00	2.92	-27.26	0.00	-2.21
Negative absolute difference in real growth rates between states * 100	19,665	-3.26	3.06	-26.94	0.00	-2.45
Correlation of real growth between states * 100	4,140	57.14	38.33	-86.62	99.89	70.30
Banking integration measures						
Dummy =1 if jointly owned assets or deposits between states	19,665	0.181	0.385	0	1	0
Share of jointly owned assets and deposits (jointly owned assets and deposits/sum of assets and deposits of both states) * 100	19,665	2.49	7.93	0	87.78	0
Additional state pair variables						
ln(population of state *i*)*ln(population of state *j*)	19,665	225.694	19.975	168.729	288.960	225.921
ln(GSP of state *i*)*ln(GSP of state *j*)	19,665	92.443	2.432	85.216	101.470	92.354
Absolute difference in lagged log per capita real GSP between states	19,665	0.173	0.134	0.000	1.004	0.145
Dummy =1 if intrastate branching allowed in any of the two states	19,665	0.402	0.490	0	1	0
Difference in employment shares between states	19,665	0.106	0.055	0.009	0.351	0.095

Table 2
Interstate Banking Integration and Business Cycle Co-movement - OLS Regressions

This table reports OLS regressions at the state pair level over the period 1976-1994. The dependent variable in columns (1) to (4) is the negative absolute difference in residual real growth rates between two states. In columns (5) and (6) the dependent variable is the negative absolute difference of real growth rates between two states and in columns (7) and (8) it is the correlation of the business cycle component between two states, calculated using a Baxter-King (1999) band-pass (2,8) filter. All regressions include state pair fixed effects and year fixed effects. Standard errors are clustered at the state pair level, and reported in parentheses below. *, **, *** represent significance at ten, five, and one percent level, respectively. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Negative absolute difference in residual real growth rates between states				Negative absolute difference in real growth rates between states		Correlation of real growth between states	
Dummy =1 if jointly owned assets or deposits between states	0.317***	0.350***			0.138		9.825***	
	(0.088)	(0.080)			(0.087)		(2.239)	
ln(Share of jointly owned assets and deposits+1)			0.080**	0.135***		0.047		4.260***
			(0.038)	(0.035)		(0.039)		(1.032)
ln(population of state *i*)*ln(population of state *j*)		-0.146***		-0.150***	-0.239***	-0.240***	0.794**	0.753*
		(0.018)		(0.018)	(0.020)	(0.020)	(0.380)	(0.389)
ln(GSP of state *i*)*ln(GSP of state *j*)		-0.267***		-0.266***	-0.159***	-0.158***	0.825*	0.850*
		(0.023)		(0.023)	(0.024)	(0.024)	(0.489)	(0.497)
Absolute difference in lagged per capita real GSP between states		-1.837***		-1.863***	-1.213***	-1.223***	32.062***	30.881***
		(0.339)		(0.338)	(0.303)	(0.303)	(7.438)	(7.472)
Dummy =1 if intrastate branching allowed in any of the two states		0.541***		0.549***	0.707***	0.710***	2.146	2.545
		(0.067)		(0.067)	(0.076)	(0.076)	(1.702)	(1.710)
Difference in employment shares between states	-16.561***	-12.012***	-16.463***	-12.072***	-12.896***	-12.905***	-45.641	-45.097
	(1.955)	(1.554)	(1.958)	(1.562)	(1.650)	(1.654)	(34.508)	(34.664)
Year fixed effects	x	x	x	x	x	x	x	x
State pair fixed effects	x	x	x	x	x	x	x	x
Observations	19,665	19,665	19,665	19,665	19,665	19,665	4,140	4,140

Table 3 - Panel A

Interstate Banking Integration and Business Cycle Co-movement - 2SLS Regressions

This panel reports 2nd stage regression results from 2SLS analysis. The dependent variable in columns (1) to (6) is the negative absolute difference in residual real growth rates between two states. In columns (7) and (8) the dependent variable is the negative absolute difference of real growth rates between two states and in columns (9) and (10) it is the correlation of the business cycle component between two states. The endogenous variables are the banking integration measures: 'Dummy =1 if jointly owned assets or deposits between states' and 'ln(Share of jointly owned assets and deposits+1)'. The excluded instruments are given in the rows titled 'Excluded instruments': 'Dummy =1 if state-pair has deregulated' is a dummy that equals one after the liberalization of interstate banking restrictions between two states. 'Years since interstate deregulation' is the number of years since the liberalization of interstate banking restrictions between two states. 'Years since interstate deregulation [nonparametric]' are separate dummy variables for each year since two states liberalized bank entry restrictions, taking a value of one all the way through the first ten years after deregulation, and zero otherwise. All regressions include state pair fixed effects and year fixed effects. Additional state pair controls include the product of the natural logarithm of population and real GSP of the two states, the absolute difference in real GSP per capita between states, and the difference in employment shares at the sector level between states. Standard errors are clustered at the state pair level, and are reported in parentheses below. *, **, *** represent significance at ten, five, and one percent level, respectively. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota, over the period 1976-1994.

Panel A: Second Stage										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Negative absolute difference in residual real growth rates between states						Negative absolute difference in real growth rates between states		Correlation of real growth between states	
Dummy =1 if jointly owned assets or deposits between states	2.584*** (0.445)	2.288*** (0.361)	2.478*** (0.365)				1.557*** (0.365)		18.532** (7.363)	
ln(Share of jointly owned assets and deposits+1)				1.061*** (0.179)	0.752*** (0.121)	0.806*** (0.121)		0.467*** (0.122)		4.923** (2.227)
State pair controls	x	x	x	x	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x	x	x	x	x
State pair fixed effects	x	x	x	x	x	x	x	x	x	x
Observations	19,665	19,665	19,665	19,665	19,665	19,665	19,665	19,665	4,140	4,140
F-test of instruments' joint significance	116.9	74.60	19.85	140.7	93.12	23.00	19.85	23.00	140.3	315.9
Excluded instruments										
Dummy =1 if state-pair has deregulated	x			x						
Years since interstate deregulation		x			x					
(Years since interstate deregulation)^2		x			x					
Years since interstate deregulation [nonparametric]			x			x	x	x	x	x

Table 3 - Panel B

Interstate Banking Integration and Business Cycle Co-movement - 2SLS Regressions

This panel reports 1st stage regression results from 2SLS analysis. The dependent variable in columns (1) to (3) is a dummy that equals one if there are any jointly owned assets or deposits between states. The dependent variable in columns (4) to (6) is the ln(Share of jointly owned assets and deposits+1). All regressions include state pair fixed effects and year fixed effects. Additional state pair controls include the product of the natural logarithm of population and real GSP of the two states, the absolute difference in real GSP per capita between states, and the difference in employment shares at the sector level between states. Standard errors are clustered at the state pair level,and are reported in parentheses below. *, **, *** represent significance at ten, five, and one percent level, respectively. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota, over the period 1976-1994.

Panel B: First Stage						
	(1)	(2)	(3)	(4)	(5)	(6)
	Dummy =1 if jointly owned assets or deposits between states			ln(Share of jointly owned assets and deposits+1)		
Dummy =1 if state pair has deregulated	0.158***			0.385***		
	(0.015)			(0.032)		
Years since interstate deregulation		0.078***			0.185***	
		(0.008)			(0.017)	
(Years since interstate deregulation)^2		-0.004***			-0.003	
		(0.001)			(0.002)	
=1 if 1 year after state pair deregulated interstate banking			0.126***			0.274***
			(0.014)			(0.028)
=1 if 2 years after state pair deregulated interstate banking			0.178***			0.425***
			(0.016)			(0.036)
=1 if 3 years after state pair deregulated interstate banking			0.204***			0.533***
			(0.019)			(0.042)
=1 if 4 years after state pair deregulated interstate banking			0.238***			0.623***
			(0.022)			(0.051)
=1 if 5 years after state pair deregulated interstate banking			0.281***			0.775***
			(0.026)			(0.064)
=1 if 6 years after state pair deregulated interstate banking			0.339***			1.015***
			(0.030)			(0.077)
=1 if 7 years after state pair deregulated interstate banking			0.436***			1.273***
			(0.034)			(0.091)
=1 if 8 years after state pair deregulated interstate banking			0.418***			1.389***
			(0.043)			(0.123)
=1 if 9 year after state pair deregulated interstate banking			0.403***			1.382***
			(0.052)			(0.157)
=1 if 10 or more years after state pair deregulated interstate banking			0.412***			1.288***
			(0.063)			(0.183)
State pair controls	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x
State pair fixed effects	x	x	x	x	x	x
Observations	19,665	19,665	19,665	19,665	19,665	19,665
F-test of instruments' joint significance	116.9	74.60	19.85	140.7	93.12	23.00

Table 4
Interstate Banking Integration and Business Cycle Co-movement - 2SLS Regressions
State and State Pair Time Trends

This panel reports 2nd stage regression results from 2SLS regressions at the state pair level. The dependent variable is the negative absolute difference in residual real growth rates between two states. Columns (1) to (4) include state linear time trends. Columns (5) to (8) include state pair linear time trends. The endogenous variables are the banking integration measures: 'Dummy =1 if jointly owned assets or deposits between states' and 'ln(Share of jointly owned assets and deposits+1)'. The excluded instruments are given in the rows titled 'Excluded instruments': 'Years since interstate deregulation' is the number of years since the liberalization of interstate banking restrictions between two states. 'Years since interstate deregulation [nonparametric]' are separate dummy variables for each year since two states liberalized bank entry restrictions, taking a value of one all the way through the first ten years after deregulation, and zero otherwise. All regressions include state pair fixed effects and year fixed effects. Additional state pair controls include the product of the natural logarithm of population and real GSP of the two states, the absolute difference in real GSP per capita between states, and the difference in employment shares at the sector level between states. Standard errors are clustered at the state pair level, and reported in parentheses below. *, **, *** represent significance at ten, five, and one percent level, respectively. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota, over the period 1976-1994.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Negative absolute difference in residual real growth rates between states							
Dummy =1 if jointly owned assets or deposits between states	1.058***	1.370***			2.356***	2.905***		
	(0.260)	(0.271)			(0.644)	(0.635)		
ln(Share of jointly owned assets and deposits+1)			0.289***	0.367***			0.789***	0.942***
			(0.077)	(0.079)			(0.227)	(0.224)
State pair controls	x	x	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x	x	x
State pair fixed effects	x	x	x	x	x	x	x	x
State linear time trends	x	x	x	x				
State pair linear time trends					x	x	x	x
Observations	19,665	19,665	19,665	19,665	19,665	19,665	19,665	19,665
F-test of instruments' joint significance	81.14	19.58	118.2	27.08	42.37	14.44	68.90	18.07
Excluded instruments								
Years since interstate deregulation	x		x		x		x	
(Years since interstate deregulation)^2	x		x		x		x	
Years since interstate deregulation [nonparametric]		x		x		x		x

Table 5
Interstate Banking Integration and Business Cycle Co-movement - 2SLS Regressions
Changes in Interstate Migration and Trade

This panel reports 2nd stage regression results from 2SLS regressions at the state pair level. The dependent variable is the negative absolute difference in residual real growth rates between two states. Columns (1) to (4) include state pair linear time trends. Columns (5) to (8) report regressions with only observations per state pair, for the years 1977 and 1993. The endogenous variables are the banking integration measures: 'Dummy =1 if jointly owned assets or deposits between states' and 'ln(Share of jointly owned assets and deposits+1)'. The excluded instruments are given in the rows titled 'Excluded instruments': 'Years since interstate deregulation' is the number of years since the liberalization of interstate banking restrictions between two states. 'Years since interstate deregulation [nonparametric]' are separate dummy variables for each year since two states liberalized bank entry restrictions, taking a value of one all the way through the first ten years after deregulation, and zero otherwise. All regressions include state pair fixed effects and year fixed effects. Additional state pair controls include the product of the natural logarithm of population and real GSP of the two states, the absolute difference in real GSP per capita between states, and the difference in employment shares at the sector level between states. Standard errors are clustered at the state pair level, and reported in parentheses below. *, **, *** represent significance at ten, five, and one percent level, respectively. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota, over the period 1976-1994.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Negative absolute difference in residual real growth rates between states							
Dummy =1 if jointly owned assets or deposits between states	2.401***	2.983***			1.279***	2.036***		
	(0.643)	(0.636)			(0.390)	(0.329)		
ln(Share of jointly owned assets and deposits+1)			0.799***	0.957***			0.398***	0.558***
			(0.226)	(0.223)			(0.122)	(0.098)
ln(Share of Migration between state-pair and year+1)	-1,331.996***	-1,325.640***	-1,369.469***	-1,371.693***				
	(354.124)	(353.204)	(386.879)	(391.528)				
ln(Share of trade between state-pair and period +1)					-169.954	-56.157	-258.373	-216.389
					(172.706)	(167.535)	(165.812)	(161.187)
State pair controls	x	x	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x	x	x
State pair fixed effects	x	x	x	x	x	x	x	x
State pair linear time trends	x	x	x	x				
Observations	19,665	19,665	19,665	19,665	2,070	2,070	2,070	2,070
F-test of instruments' joint significance	42.33	14.45	68.86	18.05	41.12	63.45	67.00	56.48
Excluded instruments								
Years since interstate deregulation	x		x		x		x	
(Years since interstate deregulation)^2	x		x		x		x	
Years since interstate deregulation [nonparametric]		x		x		x		x

Table 6
Interstate Banking Integration and Business Cycle Co-movement - 2SLS Regressions
Differences between State Pairs that Share an MSA

This panel reports 2nd stage regression results from 2SLS regressions. For each state pair *m,k* that shares an MSA, we analyze whether the difference in output synchronization between every state *i* and states *k* and *m*, respectively, changes more when *i* and *k* become more financially integrated (compared to *i* and *m*). Observations are at the state triplet level (*i,k,m*). All variables are defined as differences between states *i* and *k* and states *i* and *m*, respectively. The dependent variable is the negative absolute difference in residual real growth rates between two states. Columns (5) to (8) include state triplet linear time trends. The endogenous variables are the banking integration measures: 'Dummy =1 if jointly owned assets or deposits between states' and 'ln(Share of jointly owned assets and deposits+1)'. The excluded instruments are given in the rows titled 'Excluded instruments': 'Years since interstate deregulation' is the number of years since the liberalization of interstate banking restrictions between two states. 'Years since interstate deregulation [nonparametric]' are separate dummy variables for each year since two states liberalized bank entry restrictions, taking a value of one all the way through the first ten years after deregulation, and zero otherwise. We difference our instrumental variables following a similar approach (i.e., taking the difference in our instrumental variables between states *i* and *k* and states *i* and *m*, respectively). We order the data such that the state in the pair *k,m* that liberalized its banking restrictions with *i* earlier will be the subtrahend. All regressions include state triplet fixed effects and year fixed effects. Additional state pair controls include (differences in) the product of the natural logarithm of population and real GSP of the two states, the absolute difference in real GSP per capita between states, and the difference in employment shares at the sector level between states. Standard errors are clustered at the state triplet level, and reported in parentheses below. *, **, *** represent significance at ten, five, and one percent level, respectively. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota, over the period 1976-1994.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Negative absolute difference in residual real growth rates between states							
Dummy =1 if jointly owned assets or deposits between states	1.723***	1.709***			5.234***	4.627***		
	(0.361)	(0.297)			(0.865)	(0.778)		
ln(Share of jointly owned assets and deposits+1)			0.367***	0.731***			1.702***	1.859***
			(0.120)	(0.123)			(0.318)	(0.303)
State pair controls	x	x	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x	x	x
State triplet fixed effects	x	x	x	x	x	x	x	x
State linear time trends	x	x	x	x				
State triplet linear time trends					x	x	x	x
Observations	36,347	36,347	36,347	36,347	36,347	36,347	36,347	36,347
F-test of instruments' joint significance	53.05	17.52	65.23	22.47	34.74	8.715	46.55	13.19
Excluded instruments								
Years since interstate deregulation	x		x		x		x	
(Years since interstate deregulation)^2	x		x		x		x	
Years since interstate deregulation [nonparametric]		x		x		x		x

Table 7
Interstate Banking Integration and Business Cycle Co-movement - 2SLS Regressions
Longer Period

This panel reports 2nd stage regression results from 2SLS regressions at the state pair level. The dependent variable is the negative absolute difference in residual real growth rates between two states. Columns (1) and (2) include data only for the period 1976-1994. Columns (3) to (6) include data for the period 1976-2007. The endogenous variables are the banking integration measures: 'Dummy =1 if jointly owned assets or deposits between states' and 'ln(Share of jointly owned assets and deposits+1)'. The excluded instruments are given in the rows titled 'Excluded instruments': 'Years since interstate deregulation' is the number of years since the liberalization of interstate banking restrictions between two states. All regressions include state pair fixed effects, state pair linear time trends, and year fixed effects. Additional state pair controls include the product of the natural logarithm of population and real GSP of the two states, the absolute difference in real GSP per capita between states, and the difference in employment shares at the sector level between states. In columns (5) and (6) all controls variables are itneracted with a dummy that equals one after 1994, and zero before. Standard errors are clustered at the state pair level, and reported in parentheses below. *, **, *** represent significance at ten, five, and one percent level, respectively. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota.

	(1)	(2)	(3)	(4)	(5)	(6)
	Negative absolute difference in residual real growth rates between states					
	1976-1994		1976-2007		1976-2007	
Dummy =1 if jointly owned deposits between states	2.142***		1.252***		3.081***	
	(0.737)		(0.277)		(0.818)	
Dummy =1 if jointly owned deposits between states * (Dummy =1 if after 1994)					-2.189**	
					(0.899)	
ln(Share of jointly owned deposits+1)		0.748***		0.554***		1.146***
		(0.267)		(0.124)		-0.297
ln(Share of jointly owned deposits+1) * (Dummy =1 if after 1994)						-0.682*
						(0.357)
State pair controls	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x
State pair fixed effects	x	x	x	x	x	x
State pair linear time trends	x	x	x	x	x	x
Observations	19,665	19,665	33,120	33,120	33,120	33,120
Effect of integration after 1994					0.891***	0.464***
					(0.342)	(0.190)
Excluded instruments						
Years since interstate deregulation	x	x	x	x	x	x
(Years since interstate deregulation)^2	x	x	x	x	x	x
Interactions					x	x

Table 8
Interstate Banking Integration and Business Cycle Co-movement - 2SLS Regressions
Differences between State-Pairs: Bank Failures

This panel reports 2nd stage regression results from 2SLS regressions at the state pair level. The dependent variable is the negative absolute difference in residual real growth rates between two states. Columns (1) to (4) include state linear time trends. Columns (5) to (8) include state pair linear time trends. The endogenous variables are the banking integration measures: 'Dummy =1 if jointly owned assets or deposits between states' and 'ln(Share of jointly owned assets and deposits+1)'. The excluded instruments are given in the rows titled 'Excluded instruments': 'Years since interstate deregulation' is the number of years since the liberalization of interstate banking restrictions between two states. 'Years since interstate deregulation [nonparametric]' are separate dummy variables for each year since two states liberalized bank entry restrictions, taking a value of one all the way through the first ten years after deregulation, and zero otherwise. All regressions include state pair fixed effects and year fixed effects. Additional state pair controls include the product of the natural logarithm of population and real GSP of the two states, the absolute difference in real GSP per capita between states, and the difference in employment shares at the sector level between states. Standard errors are clustered at the state pair level, and reported in parentheses below. *, **, *** represent significance at ten, five, and one percent level, respectively. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota, over the period 1976-1994.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Negative absolute difference in residual real growth rates between states							
Dummy =1 if jointly owned assets or deposits between states	0.749***	1.075***			2.152***	2.623***		
	(0.249)	(0.252)			(0.638)	(0.599)		
Dummy =1 if jointly owned assets or deposits between states * (Dummy =1 if share of failing assets in a state >1%)	1.472***	1.341***			1.205***	1.077***		
	(0.398)	(0.369)			(0.406)	(0.379)		
ln(Share of jointly owned assets and deposits+1)			0.195***	0.285***			0.728***	0.855***
			(0.075)	(0.075)			(0.223)	(0.209)
ln(Share of jointly owned assets and deposits+1) * (Dummy =1 if share of failing assets in a state >1%)			0.461***	0.375***			0.385***	0.295**
			(0.134)	(0.118)			(0.138)	(0.121)
(Dummy =1 if share of failing assets in one state >1%)	-0.456***	-0.430***	-0.277***	-0.239***	-0.377***	-0.353***	-0.226***	-0.179**
	(0.104)	(0.099)	(0.075)	(0.072)	(0.106)	(0.101)	(0.077)	(0.073)
State pair controls	x	x	x	x	x	x	x	x
Year fixed effects	x	x	x	x	x	x	x	x
State pair fixed effects	x	x	x	x	x	x	x	x
State linear time trends	x	x	x	x				
State pair linear time trends					x	x	x	x
Observations	19,665	19,665	19,665	19,665	19,665	19,665	19,665	19,665
Excluded instruments								
Years since interstate deregulation	x		x		x		x	
(Years since interstate deregulation)^2	x		x		x		x	
Years since interstate deregulation [nonparametric]		x		x		x		x
Interactions	x	x	x	x	x	x	x	x

Table 9

Interstate Banking Integration and Business Cycle Co-movement - 2SLS Regressions

Differences across Industries: Dependence on External Financing

This panel reports 2nd stage regression results from 2SLS regressions at the state-industry type pair level. Industries are classified in two groups: High/low financial dependence depending on whether they are above below the median across industries of the Rajan and Zingales (1998) external financial dependence measure. The regressions include two observations per state pair and year, one for each of the industry groups. The dependent variable is the negative absolute difference in residual real growth rates between industries across two states. Columns (1) to (4) include state pair-industry type linear time trends. Columns (5) to (8) include state pair-industry type linear time trends. The endogenous variables are the banking integration measures: 'Dummy =1 if jointly owned assets or deposits between states' and 'ln(Share of jointly owned assets and deposits+1)'. The excluded instruments are given in the rows titled 'Excluded instruments': 'Years since interstate deregulation' is the number of years since the liberalization of interstate banking restrictions between two states. 'Years since interstate deregulation [nonparametric]' are separate dummy variables for each year since two states liberalized bank entry restrictions, taking a value of one all the way through the first ten years after deregulation, and zero otherwise. All regressions include state pair-industry type fixed effects and year-industry type fixed effects. Additional state pair controls include the product of the natural logarithm of population and real GSP of the two states, the absolute difference in real GSP per capita between states, and the difference in employment shares at the sector level between states. Standard errors are clustered at the state pair level, and reported in parentheses below. *, **, *** represent significance at ten, five, and one percent level, respectively. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota, over the period 1976-1994.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Negative absolute difference in residual real growth rates between industry segments and states							
Dummy =1 if jointly owned assets or deposits between states	-0.355	0.253			1.638**	1.655**		
	(0.360)	(0.346)			(0.727)	(0.658)		
Dummy =1 if jointly owned assets or deposits between states * (Dummy = 1 if industries above external finance sample median)	1.172***	1.988***			1.628**	2.266***		
	(0.328)	(0.326)			(0.698)	(0.632)		
ln(Share of jointly owned assets and deposits+1)			-0.018	0.068***			0.342***	0.792***
			(0.001)	(0.098)			(0.254)	(0.239)
ln(Share of jointly owned assets and deposits+1) * (Dummy = 1 if industries above external finance sample median)			0.383***	0.548***			0.867***	1.314***
			(0.093)	(0.090)			(0.247)	(0.231)
State pair controls	x	x	x	x	x	x	x	x
Year-industry type fixed effects	x	x	x	x	x	x	x	x
State pair-industry type fixed effects	x	x	x	x	x	x	x	x
State-industry type linear time trends	x	x	x	x				
State pair-industry type linear time trends					x	x	x	x
Observations	39,330	39,330	39,330	39,330	39,330	39,330	39,330	39,330
Effect of integration on industries with high external financial dependence	0.818	2.241***	0.364**	0.616***	3.266**	24.047***	1.209**	2.106***
	(0.574)	(0.582)	(0.183)	(0.179)	(1.413)	(7.268)	(0.498)	(0.468)
Excluded instruments								
Years since interstate deregulation	x		x		x		x	
(Years since interstate deregulation)^2	x		x		x		x	
Years since interstate deregulation [nonparametric]		x		x		x		x
Interactions	x	x	x	x	x	x	x	x

Appendix Table 1
Periods of State-level Banking Distress

This table shows those states and years in which the fraction of the total assets and deposits held by failed commercial banks exceeds one percent. The sample covers the 48 contiguous states of the United States, excluding Delaware and South Dakota, for the period 1976-1994.

	Northeast Region
Connecticut	1990, 1991, 1992, 1993
New Hampshire	1990, 1991, 1992
Maine	1990
Massachusetts	1990, 1991, 1992
New York	1991, 1992
New Jersey	1991, 1992
Pennsylvania	1992
Rhode Island	1992
Vermont	1992
	Midwest Region
Iowa	1985, 1986
Missouri	1985, 1992
North Dakota	1989
Nebraska	1985
Kansas	1985, 1986, 1987, 1992
	South Region
Florida	1985, 1989, 1991
Louisiana	1976, 1986, 1987, 1988, 1989, 1990
Mississippi	1984
Oklahoma	1984, 1985, 1986, 1987, 1988, 1989
Tennessee	1983
Texas	1983, 1986, 1987, 1988, 1989, 1990, 1992
	West Region
Montana	1986
Idaho	1986
Colorado	1987, 1990
New Mexico	1985, 1986
Arizona	1989
Utah	1985