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We investigate how integration of bank ownership across states has affected economic volatility within states. In theory, bank integration could cause higher or lower volatility, depending on whether credit supply or credit demand shocks predominate. In fact, year-to-year fluctuations in a state's economic growth fall as its banks become more integrated (via holding companies) with banks in other states. As the bank linkages between any pair of states increase, fluctuations in those two states tend to converge. We conclude that interstate banking has made state business cycles smaller, but more alike.

## I. INTRODUCTION

The United States banking system was once anything *but* united. Until 1978, every state in the union barred banks from other states, so instead of one national banking system, we had more like 50 little banking systems, one per state.<sup>1</sup> Once states opened their borders to out-of-state banks, bank holding companies marched in and bought up (or merged with) banks all over the country. In 1975, just 10 percent of the bank assets in the typical state were owned by a multistate bank holding company. By 1994 this interstate bank asset ratio had risen to 60 percent (Figure I). Our paper investigates how the advent of interstate banking integration in the United States has affected economic volatility within states.

With the United States' balkanized banking system, the fate of a state and its banks were closely tied; as went the state, so went the banks. The farm price deflation in the early 1980s bankrupted many farmers and many farm banks. Falling oil prices in the mid-1980s wiped out a lot of Texans and a lot of Texas banks. Shocks to commodity prices probably caused these contractions, but frictions in the banking sector may have aggravated them. By allowing a freer flow of bank capital and lending among states, we maintain that interstate banking will reduce the drag that banking frictions can have on economic contractions.

\* The authors' views do not necessarily reflect those of the Federal Reserve System or the Swiss National Bank. We thank Lawrence Katz, Edward Glaeser, Jean Tirole, and anonymous referees for their comments.

1. Most states also prohibited branching into other cities *within* the state, so we really had countless little banking systems, one per city.

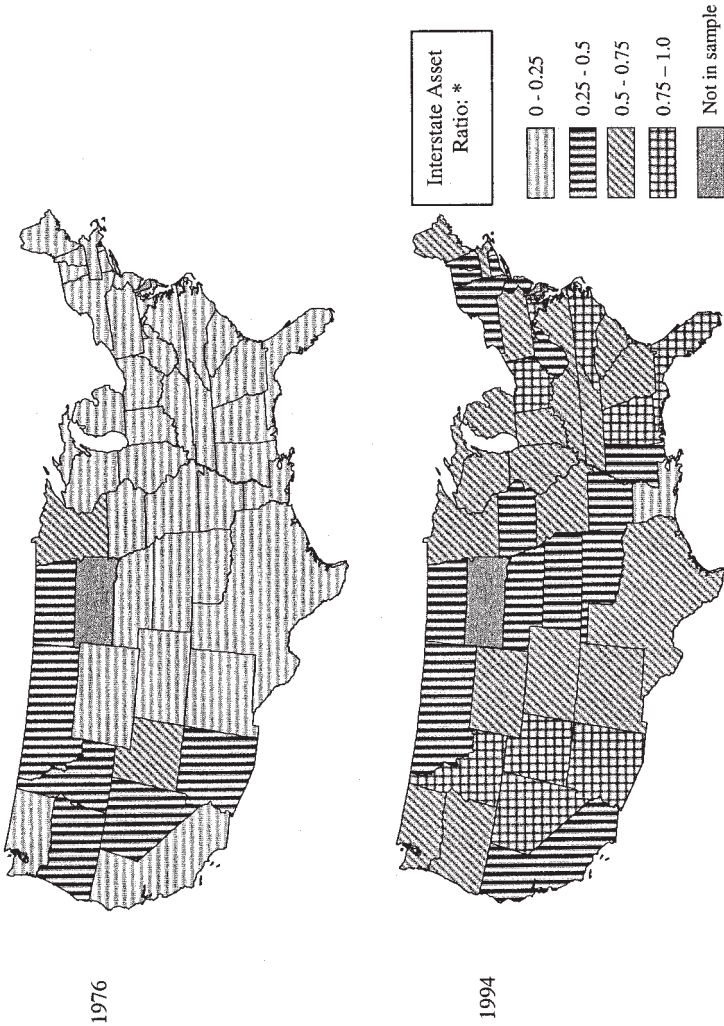


FIGURE I

Interstate Asset Ratios by State: 1976 and 1994

\*Percent of bank assets in a state held by out-of-state bank holding companies (including foreign BHCs).

Precisely *how* bank integration affects volatility—by what mechanism—is far from obvious. The literature on international capital (stock and bond) market integration focuses on the risk sharing and consumption smoothing provided by cross-country asset holdings.<sup>2</sup> On the question of volatility, however, the real business cycle models popular in that literature suggest that capital market integration may *increase* output (versus consumption) volatility within countries as capital can flow from slumping economies toward booming ones.

Williamson [1989] studies an early form of bank integration in his comparison of the experiences of the United States and Canada during the Depression. Canadian banks were highly integrated across provinces during the 1930s, and virtually all survived the Depression. U. S. banks were highly fragmented across states, and thousands failed during the Depression. Despite the stark differences in bank structure and performance, the economic contraction in Canada was as severe as it was in the United States. Bank integration may stabilize the banking system, he concludes, but not necessarily output.

Our interstate version of the banking model in Holmstrom and Tirole [1997] produces a similar sort of ambiguity about the relationship between integration and volatility. The increased mobility of bank capital under interstate banking tends to dampen the adverse effect of bank capital/loan supply shocks on state lending and spending, we argue, while amplifying the impact of firm collateral/loan demand shocks. Whether the net effect is more or less volatility ultimately depends on which shocks matter most.

In this paper we estimate reduced-form regressions with measures of state-level fluctuations in economic growth on the one side and measures of interstate bank linkages on the other. We test whether interstate integration is associated with smaller or larger fluctuations within states. Using a panel of state-year data over 1976–1994, we find that growth fluctuations within a state subside significantly as that state's banks become more

2. We do not consider the possible risk-sharing and consumption smoothing benefits of interstate banking. Even when the United States was fragmented, savers could share risk *via* stock and (municipal) bond markets. In fact, Asdrubali, Sorensen, and Yasha [1996] find that U. S. capital markets play a more vital role in income and consumption smoothing across states than do credit markets. Demyanyk, Ostergaard, and Sorensen [2004] find better cross-state risk sharing, measured by how closely state income stocks mirror state output shocks, following bank branching deregulation.

closely linked to banks in other states. The declines in volatility are especially pronounced in “oil” states. We also find that as banks in any two particular states become more linked, business cycles in those states tend to converge. Additional evidence suggests that this stabilization and convergence do not reflect endogenous integration or mere coincidence, hence our conclusion: interstate banking has made state business cycles smaller, and more alike.<sup>3</sup>

Our findings should inform other research. Interstate banking should be considered as still another explanation for the downward trend in *aggregate* U. S. economic volatility documented by McConnell and Perez-Quiros [2000] and Blanchard and Simon [2001]. Reduced volatility of inventory investment has been advanced as one explanation of that trend; better finance via interstate banking may explain smoother inventory investment. Increased mobility of bank capital may also reduce the surprisingly large labor flows whereby state economies adjust to shocks [Blanchard and Katz 1992]. The stabilizing benefits of interstate banking in the United States are also relevant to the bank integration in Europe, and financial “globalization” generally.<sup>4</sup>

## II. BANKING GEOGRAPHY: A BRIEF HISTORY

By geography, we mean the myriad state and federal laws that have limited where banks operate. The history can be confusing because banks can expand within states or between them, and they can expand by several means. Branching is the simplest and cheapest way to grow because branches do not require

3. In more speculative analysis, Morgan, Rime, and Strahan [2003] investigate the possible mechanisms linking banking integration to economic fluctuations. We computed the correlation between collateral values (based on housing prices) and economic growth, and between bank capital (based on book values, from Call Reports) and economic growth. Consistent with theory, the collateral-growth correlation *increases* significantly with banking integration, whereas the bank capital-growth correlation *weakens* with integration. Integration therefore seems to stabilize by reducing a state’s vulnerability to downturns in its local banking system. This stabilizing force outweighs a state’s greater sensitivity to changes in the value of collateral. Because we are not able to isolate exogenous shocks to collateral and bank capital, this analysis is difficult to interpret structurally.

4. In contrast to the experience in the United States, there is less evidence that foreign bank entry has stabilized small and developing economies. Morgan and Strahan [2004] find, if anything, that business cycle volatility increased with foreign-bank ownership, although the result is not statistically robust. Constructing powerful instruments for foreign-bank penetration (and even measuring foreign bank entry) is much harder across a wide panel of countries than across the panel of states used here.

separate charters, capital, management teams, or boards of directors. When branching is forbidden, a bank can grow by buying other banks, or by opening new (de novo) ones. Four cases are possible (hence the potential confusion): interstate banking, interstate branching, intrastate banking, and intrastate branching.<sup>5</sup>

The Douglas Amendment to the 1956 Bank Holding Company (HC) Act gave states the prerogative to exclude out-of-state banks or holding companies from buying or building a bank or branch in their state. All states exercised this option, effectively barring interstate banking. In 1978 Maine passed a law allowing entry by bank holding companies from any state that allowed entry by Maine banks. Alaska, and New York passed similar laws in 1982. By 1992, all states but Hawaii had passed reciprocal entry laws of some sort.

The transition to interstate banking was completed with passage of the Reigle-Neal Interstate Banking and Branching Efficiency Act of 1994. Reigle-Neal made interstate banking a bank right, not a state right; banks or holding companies could now enter another state without permission.

One more piece of legislation bears mention. In 1982 federal legislators amended the Bank Holding Company Act to permit the acquisition of *failed* thrifts and banks by out-of-state banks or holding companies. Banks and thrifts failed by the hundreds in some states in the early 1980s after the recessions of 1980 and 1981–1982 and the “third world debt” crises. Surviving institutions in hard-hit states were often not fit to recapitalize the failed ones, so Congress acted to let in healthy banks from out of state. Note that the interstate banking boom following this act coincided with severe downturns in certain states. We bring this up again later.

States were also relaxing restrictions on intrastate branching in the 1970s and 1980s. Table I lists states by the year they entered an interstate banking compact and the year they permitted intrastate branching. States deregulated in waves, or cohorts, rather than all at once, which we exploit in identifying how interstate banking affects fluctuations in economic growth within states.

5. Adding to the confusion is the bank versus bank holding company distinction: a bank holding company (BHC) is just a corporate entity comprising one or more separately chartered banks.

TABLE I  
STATES (ACRONYM), BY THE YEAR OUT-OF-STATE BANK ENTRY AND INTRASTATE  
BRANCHING PERMITTED

	Interstate banking	Intrastate branching
Maine (ME)	1978	1975
Alaska (AK)	1982	*
New York (NY)	1982	1976
Connecticut (CT)	1983	1980
Massachusetts (MA)	1983	1984
Kentucky (KY)	1984	1990
Rhode Island (RI)	1984	*
Utah (UT)	1984	1981
Washington, DC (DC)	1985	*
Florida (FL)	1985	1988
Georgia (GA)	1985	1983
Idaho (ID)	1985	*
Maryland (MD)	1985	*
Nevada (NV)	1985	*
North Carolina (NC)	1985	*
Ohio (OH)	1985	1979
Tennessee (TN)	1985	1985
Virginia (VA)	1985	1978
Arizona (AZ)	1986	*
Illinois (IL)	1986	1988
Indiana (IN)	1986	1989
Michigan (MI)	1986	1987
Minnesota (MN)	1986	1993
Missouri (MO)	1986	1990
New Jersey (NJ)	1986	1977
Oregon (OR)	1986	1985
Pennsylvania (PA)	1986	1982
South Carolina (SC)	1986	*
Alabama (AL)	1987	1981
California (CA)	1987	*
Louisiana (LA)	1987	1988
New Hampshire (NH)	1987	1987
Oklahoma (OK)	1987	1988
Texas (TX)	1987	1988
Washington (WA)	1987	1985
Wisconsin (WI)	1987	1990
Wyoming (WY)	1987	1988
Colorado (CO)	1988	1991
Delaware (DE)	1988	*
Mississippi (MS)	1988	1986
South Dakota (SD)	1988	*
Vermont (VT)	1988	1970
West Virginia (WV)	1988	1987
Arkansas (AR)	1989	1994
New Mexico (NM)	1989	1991
Nebraska (NE)	1990	1985
Iowa (IA)	1991	*
North Dakota (ND)	1991	1987
Kansas (KS)	1992	1987
Montana (MT)	1993	1990
Hawaii (HI)	Not permitted (as of 1994)	1986

Branching date reflects when states permitted branching via merger and acquisition (usually before de novo branching permitted). Dates from Amel [1993] and Kroszner and Strahan [1999].

\* pre-1970.

### III. INTERSTATE BANKING DOES NOT NECESSARILY REDUCE VOLATILITY

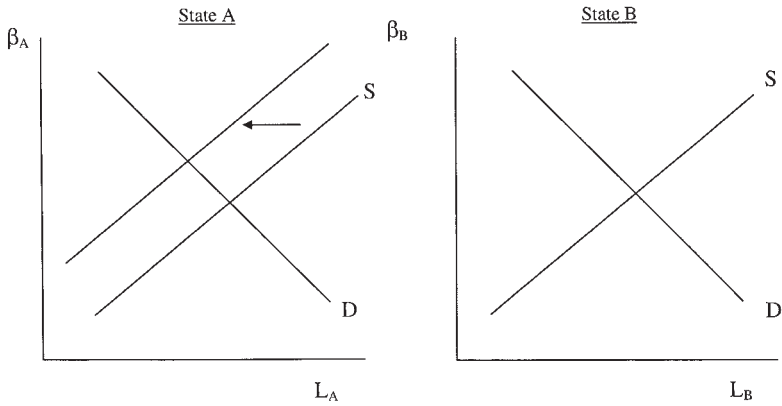
Our interstate version of Holmstrom and Tirole's [HT 1997] banking model suggests that bank integration could cause higher or lower volatility. Bankers in the HT model can prevent moral hazard by monitoring firms, but they can also commit moral hazard by neglecting to monitor. These frictions make the flow of credit and investment spending dependent on the stock of firm collateral and bank capital; contractions in either cause contractions in aggregate investment spending.

Our interstate version of the model includes a second physical place ("state") where bank capital can flow (Appendix). We compare the impact of collateral and bank capital shocks under an *interstate* banking regime, where capital can flow freely across states, versus an *intrastate* regime where capital flows across states are restricted. Collateral and capital shocks are still contractionary under interstate banking, but the magnitudes change: bank capital shocks have a smaller impact on investment under interstate banking, while the impact of firm collateral shocks gets amplified by interstate banking. The intuition is simple: a holding company operating banks in two states will import capital to state *A* if the returns to lending the banks' capital are still good, but a collateral shock in state *A* will lead the holding company to export capital and lending away from that state.

If we identify bank capital and firm collateral with loan supply and demand curves, we can illustrate these ideas graphically (Figure II). With a segregated banking system, a reduction in bank loan supply in state *A* increases bank returns in *A*, but has no effect on credit markets in state *B*; borrowers in state *A* bear the full brunt of the shock in the form of higher loan interest rates ( $\beta_A$  in Figure II) and smaller loan quantities ( $L_A$  in Figure II). Under *interstate* banking, by contrast, the higher return on bank capital in state *A* attracts credit from state *B*. The inflow from *B* partially offsets the initial impact on loans supplied in state *A*. When loan demand is weak in state *A*, due to declines in borrower wealth or collateral, integration amplifies the decline in investment by facilitating the flow of banking resources out of state *A* and into *B* (Panel B). The main point we take from this model is that integration could be positively or negatively related to volatility, depending on whether loan supply or demand shocks

Interstate Banking Prohibited

Supply shock in State A raises returns on bank capital ( $\beta_A$ ) and lowers lending ( $L_A$ ). B is unaffected.

Interstate Banking

Increase in  $\beta_A$  partially offset by capital inflow/loan supply from state B.

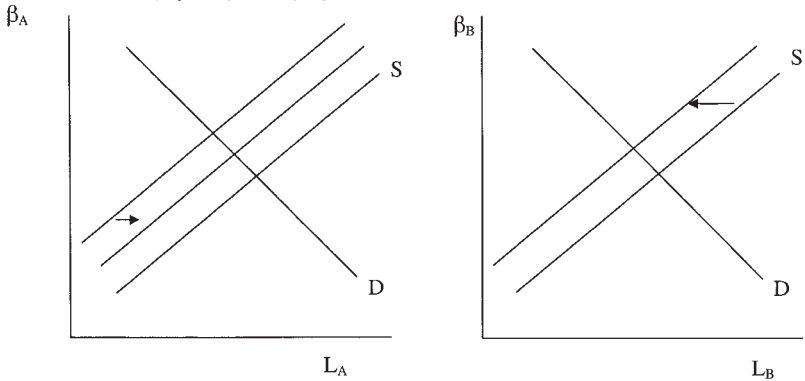


FIGURE II, PANEL A

Interstate Banking May Dampen the Impact of Bank Capital/Loan Supply Shocks

are the larger source of volatility. In the next section we test whether integration following banking deregulation was followed by more or less economic volatility.

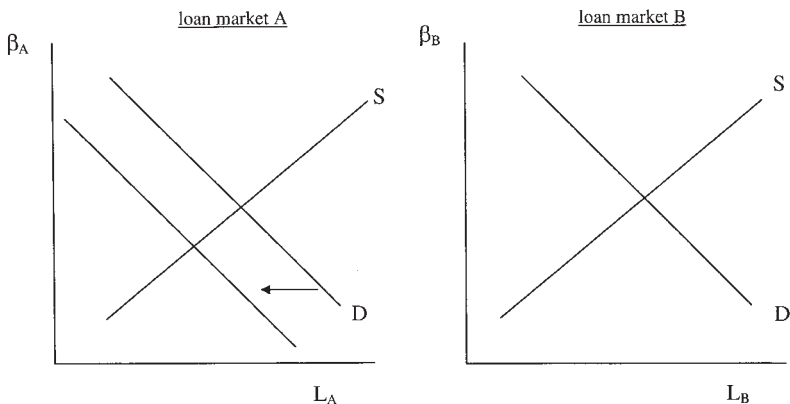
## IV. REGRESSION STRATEGY AND DATA

To test whether state volatility has changed with banking integration, we estimate regressions with the following structure:



Interstate Banking Prohibited

Loan demand (D) contracts in State A, lowering bank returns ( $\beta_A$ ) and lending ( $L_A$ ). B is unaffected.

Interstate banking

Decline in  $\beta_A$  lessened and decline in lending ( $L_A$ ) worsened by capital/loan out flow from A to B.

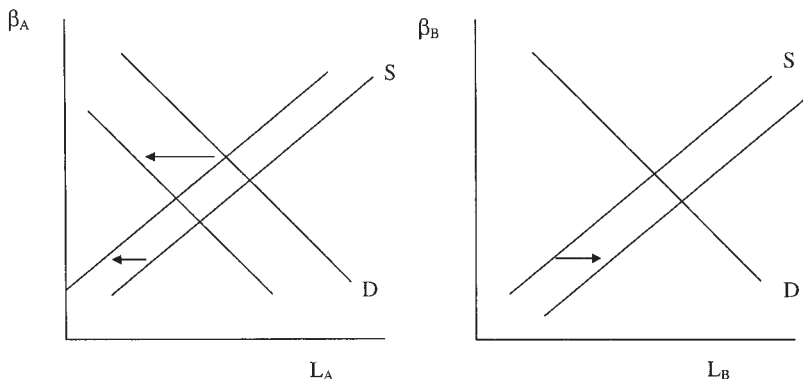


FIGURE II, PANEL B

Interstate Banking Amplifies Impact of Firm Collateral/Loan Demand Shocks

$$(1) \text{ Fluctuation}_{it} = a_i + a_t + \beta \times \text{Integration measure}_{it} + \varepsilon_{it}.$$

The integration measures, described below, vary across states ( $i$ ) and years ( $t$ ), and  $a_i$  and  $a_t$  represent state and year fixed effects.  $\text{Fluctuation}_{it}$  equals the absolute deviation from conditional mean growth in either gross state product, employment, or personal income, where the conditional means are estimated by regressing growth in each state-year on year and state fixed effects, and indicators for whether the state permitted interstate

banking and intrastate branching (discussed below). In particular;

$$(2) \quad Growth_{it} = c_i + c_t + \gamma \times Deregulation\ Indicators_{it} + v_{it},$$

where  $i$  indexes states and  $t$  indexes years. And,

$$(3) \quad Fluctuation_{it} = |v_{it}|.$$

Roughly speaking, the fluctuation in economic growth for a given state-year equals the size of the deviation from average growth for that state (over 1976–1994) and from average growth for all states in that year.<sup>6</sup>

Banking integration is measured by two variables. Both use interstate banking affiliations *via* bank holding companies. Holding company affiliations are really the only way to measure interstate bank integration (interstate credit flows are not available), but it is the right conceptual measure for our purposes. Houston, James, and Marcus [1997] show that loan growth of a subsidiary bank depends more on cash flow and capital of the holding company than on the subsidiary's own cash flow and capital. They conclude that holding companies represent internal capital markets through which scarce funds get allocated among subsidiary banks in different locations. These internal capital market flows are precisely the flows that will transmit economic shocks across states.<sup>7</sup>

The first measure of integration, the *interstate asset ratio*, equals the fraction of bank assets in state  $i$  that are owned by a holding company that owns bank assets in one or more other states. Suppose that bank assets are distributed across states  $A$  and  $B$  like this:

$A$	$B$
1	10
2	20

6. We prefer to model absolute rather than squared deviations for two reasons. First, absolute deviations maintain the same units as growth, so the coefficients are easily interpreted. Second, the squared deviations exhibited very large outliers for several small states (e.g., Alaska, North Dakota, and Wyoming). When these states are dropped, the results are similar using squared deviations to those reported below in terms of economic and statistical significance. When these three states are included, the coefficients on banking integration lose significance for deviations in both income and gross state product growth but remain about the same for employment growth (which does not have the outlier problem).

7. Ashcraft [forthcoming] finds federal funds rate shocks have a smaller impact on bank lending in states where banks are better linked (via holding companies) with banks in other states.

where each number represents a bank and the amount of its assets. If  $A1$  and  $B10$  are jointly owned (by a holding company) but  $A2$  and  $B20$  are unaffiliated, *interstate asset ratio* equals  $1/3$  for both states.

The second measure, *other state asset ratio*, equals total out-of-state assets held by holding companies operating in the state, divided by total assets in that state. *Other state asset ratio* equals  $10/3$  for state  $A$  in the example above and  $1/30$  for state  $B$ . The *other state asset ratio* captures differences in state or banking system size that the *interstate asset ratio* misses entirely. In the example above, capital flows from state  $B$  to state  $A$  may matter a lot to  $A$ , but flows the other way may hardly matter to state  $B$ .<sup>8</sup> The correlation between *interstate asset ratio* and *other state asset ratio* over 1976–1994 was 0.34, so they do measure different dimensions of integration.

We take *other state asset ratio* as given because it depends mostly on a state's (relative) size and location, factors that are largely exogenous with respect to the size of a fluctuation in a given state-year. Nevada has a high *other state asset ratio* because it happens to be near California.<sup>9</sup> *Interstate asset ratio*, by contrast, might be correlated with contemporaneous fluctuations in a state. Economic contractions, especially if accompanied by banking crises, may attract bargain-hunting banks from other states (or drive local banks to look outward for lending opportunities). A positive correlation between fluctuations in a given state-year and the *interstate asset ratio* in that state-year would bias the OLS estimates upwards.

To address that potential bias, we report instrumental variable (IV) regressions using three deregulation indicators as (identifying) instruments for *interstate asset ratio*. The first indicator, *after interstate deregulation*, switches on (from zero to one) the year a state permits entry by out-of-state banks and stays on thereafter. *Five years after interstate deregulation* switches on five years after deregulation and stays on thereafter.<sup>10</sup> *After*

8. *Interstate asset ratio*, by contrast, captures changes that are missed by *other state asset ratio*. *Interstate asset ratio* for state  $A$  would increase from  $1/3$  to 1 if, in the example above,  $B10$  acquired  $A2$ , but *other state asset ratio* would not change. The change in *interstate asset ratio* would capture the potential for credit from  $B10$  to flow throughout state  $A$ .

9. Hawaii never passed an interstate banking agreement (before Congress did), presumably because it is so distant from every other state.

10. Lagging allows for delays between deregulation and the actual mergers and acquisitions that increase interstate bank affiliations.

*intrastate branching*, the third indicator variable, switches on the year a state permitted its own banks to branch within the state.<sup>11</sup>

The first stage regression of *interstate asset ratio* on these indicators (reported below) measures the change in that ratio within a state after deregulation, and the difference in that ratio between deregulated states and still regulated states. As long as state deregulation is *not* driven by contemporaneous fluctuations in a state (evidence on that later), changes in *interstate asset ratio* after deregulation can be taken as exogenous with respect to current fluctuations in a given state.<sup>12</sup>

Over time, a contemporaneous correlation might show up as a *constant* difference in the relationship between fluctuations and *interstate asset ratio*. States that are prone to big cycles (because of different resource endowments, say) and banking crises may wind up more integrated if the banking crises are followed by waves of buyouts from banks in other states. We deal with this possibility by including fixed state effects that eliminate any constant differences (across states) in fluctuations. We also report regressions that include labor force composition as well; big mining (oil, gas, or mineral) states may be subject to bigger fluctuations than big government states, for example. We also include the sum of squared labor shares as a measure of labor force concentration. All else equal, we would expect states with less diversified economies to be more volatile.

Table II summarizes our data, definitions, etc. All data (except gross state product) start in 1976, just before Maine passed the first interstate banking law (GSP data start in 1978). All data end in 1994, the year Congress passed the Riegle-Neal Interstate Banking Act. Apart from its symbolic importance, certain book-keeping consolidations enabled by Reigle-Neal make it impossible to distinguish holding company assets in different states.<sup>13</sup>

A few summary statistics in Table II warrant note. *Other state asset ratio* is roughly ten times larger than *interstate asset*

11. Using *intrastate branching* to instrument for *interstate banking* is odd, but we wanted a complete measure of states' stance toward geographic expansion, whether inward or outward. None of our conclusions depend on this variable. Conceivably, states that permit branching may attract more interstate linkages from holding companies that seek a presence all over a state.

12. If deregulation *does* depend on the contemporaneous fluctuations in a state, then our instruments are endogenous too.

13. Reigle-Neal enables a holding company to consolidate businesses across states into its headquarters bank. For example, when NationsBank consolidated into its headquarters in North Carolina (NationsBank NC N.A.), its "North Carolina assets" more than doubled between 1994 and 1995.

TABLE II  
VARIABLE NAMES, DEFINITIONS, SUMMARY STATISTICS, AND SOURCES

	Mean	St. Dev.	Source
<b>Interstate banking ratios:</b>			
Interstate asset ratio = bank assets in state <i>i</i> affiliated with out-of-state bank holding company/total bank assets in state <i>i</i>	0.34	0.28	Bank reports of income and condition data. Authors' calculations.
Other state asset ratio = bank assets in state <i>j</i> affiliated (via holding company) with banks in state <i>i</i> /total bank assets in state <i>i</i> .	3.31	5.62	
<b>Deregulation Indicators (0/1):</b>			
After interstate banking deregulation (switches on after deregulation)	0.40	0.49	Dates in Table I. Authors' calculations.
Five years after interstate deregulation (switches on five years after deregulation)	0.20	0.40	
Intrastate branching deregulation (switches on after intrastate branching permitted)	0.55	0.50	
<b>Economic growth (annual %):</b>			
Employment	2.0	2.2	Dept. of Commerce, Bureau of Economic Analysis data.
Personal income (real)	2.3	3.0	
Gross state product (real)	2.1	4.5	Authors' calculations.
<b>Growth fluctuations (absolute deviation from state-year average growth rate × 100):*</b>			
Employment	1.1	1.0	Dept. of Commerce, Bureau of Economic Analysis data.
Personal income (real)	1.5	1.6	
Gross state product (real)	2.3	2.7	Authors' calculations.
<b>Labor shares (state employment in each sector × 100/total, nonfarm state employment):</b>			
Mining	1.4	2.2	Dept. of Commerce, Bureau of Economic Analysis data.
Construction	5.5	1.3	
Manufacturing	5.4	6.7	Authors' calculations.
Transportation	5.1	1.0	
Trade	21.7	2.5	
Finance	7.4	1.4	
Services	25.5	4.8	
Government	18.1	5.2	
Sum of squared labor shares	19.1	2.3	

Statistics (except for gross state product) calculated over 931 state-years: 49 states (SD and DE omitted; DC included) over 1976–1994. Statistics for gross state product calculated over 833 state-years: 49 states × 1978–1994 (1976–1977 unavailable).

\* State-year average is calculated by regressing annual growth in each variable on indicators for state, year, after interstate banking deregulation, and after intrastate branching deregulation. Fluctuations equal the absolute value of the residual from this regression.

*ratio* (because of the different numerator in each ratio). The three measures of state economic activity—employment, income, and gross product—grew 2.0–2.3 percent per year over the relevant

sample period. Our measure of *fluctuations* in growth averaged 1.1 percent for employment, 1.5 percent for personal income, and 2.3 percent for gross product. Our *conditional* measure of fluctuation in each series is only half as large as the corresponding standard deviation, but the rankings are identical: employment fluctuates least, gross product most (income in the middle).<sup>14</sup> Note that mining employment is highly variable (relative to its mean share of employment). The high standard deviation of mining employment reflects both the ups and downs in this sector within states, and the larger variation in the mining share across states.

Figure III plots *interstate asset ratio* by state cohorts, grouped by when the state first permitted interstate banking.<sup>15</sup> The surge in several states in the mid-1980s reflects the buying of *failed* banks and thrifts enabled by Congress in 1982.

Figure IV plots the change (difference-in-differences) in employment growth fluctuations before and after deregulation. We computed the change in the mean employment growth volatility after interstate banking reform, relative to the change in volatility over the same years in states that were still regulated. Though a bit crude (because the “control group” composition changes as more states deregulate), this calculation reveals whether most states experienced more or less volatility after deregulation. In fact, all but four states experienced lower employment growth fluctuations after deregulation.<sup>16</sup> Some of the largest declines were in “oil states” [Blanchard and Katz 1992]: Wyoming (WY), Montana (MT), Oklahoma (OK), Texas (TX), North Dakota (ND), and Louisiana (LA).<sup>17</sup>

14. Gross product growth fluctuates more than personal income growth because personal income also includes residents' income earned in other states (stock market wealth, etc.). Income from other states may diversify residents against changes in income from their own state.

15. Positive levels of *interstate asset ratio* before deregulation represent assets of multistate bank holding companies that predated the Douglas Amendment (that were grandfathered under that act).

16. Using a similar analysis, we find declines in personal income growth volatility in 39 of 48 states, and we find declines in gross state product volatility in 37 of 48 states.

17. Blanchard and Katz [1992, p. 10] define oil and mineral states as states where 2 percent or more of total state earnings are derived from oil and mineral earnings (in 1980). Their list comprises the five states listed in the text, plus Alaska (AL), Colorado (CO), New Mexico (NM), and West Virginia (WV).

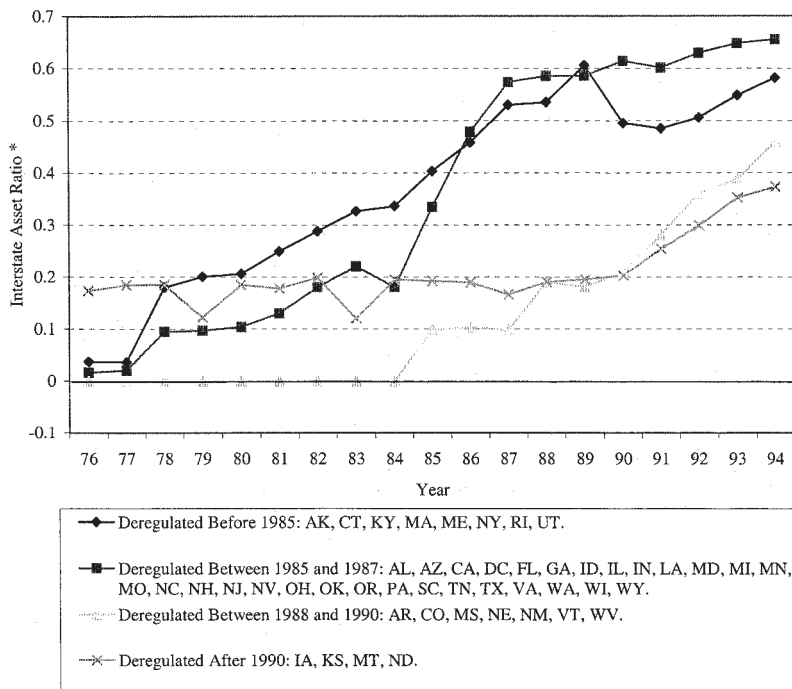


FIGURE III  
Interstate Asset Ratio by State Deregulation

Interstate asset ratio = percent of bank assets in a state held by out-of-state bank holding companies (including foreign BHCs).

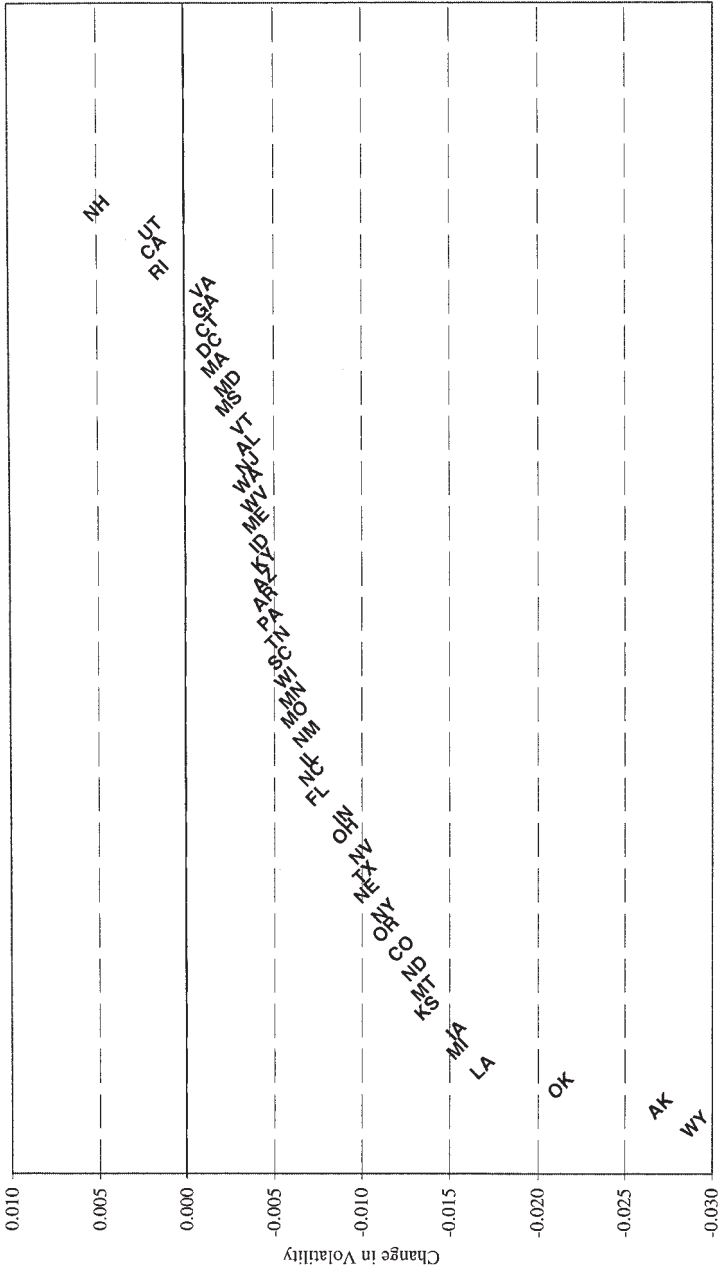
## V. RESULTS

### V.A. Main Findings

Table III reports coefficients from a set of preliminary regressions. The standard errors are clustered by states to allow for correlation across states [Bertrand, Duflo, and Mullainathan 2004].<sup>18</sup> Also reported [in square brackets] are 95 percent confidence intervals generated by repeated sampling over state-clusters. Sampling over states reveals whether results depend on particular states (oil states, for example).

The first regression shows that *interstate asset ratio* in-

18. Our adjustment follows Bertrand, Duflo, and Mullainathan [2004], who study this problem in the context of difference-in-differences estimators and recommend clustering observations by state.



State

FIGURE IV

Employment Growth Fluctuations Fall After States Permitted Interstate Banking

The figure plots the change in employment growth fluctuations before and after deregulation. We compute the change in the mean employment growth volatility after interstate banking reform, minus the average change in volatility over the same years for states that were still regulated (as a control for volatility trends).



TABLE III  
 INTEGRATION RISES AND STATE FLUCTUATIONS FALL WITH INTERSTATE DEREGULATION: OLS REGRESSION COEFFICIENTS  
 (STANDARD ERRORS-CLUSTERED BY STATE) [95 PERCENT CONFIDENCE INTERVALS-BOOTSTRAPPED FROM SAMPLING OVER STATES]

	Dependent variables			
	(1) Interstate asset ratio	(2) Employment growth fluctuations	(3) Personal income growth fluctuations	(4) Gross state product growth fluctuations
Other state asset ratio***	0.17 (0.42) [-0.2/1.1]	-0.04* (0.02) [-0.07/0.03]	-0.06** (0.03) [-0.11/0.02]	-0.13** (0.06) [-0.19/0.02]
After interstate deregulation***	17.0** (4.0) [10.0/24.0]	-0.3** (0.1) [-0.5/-0.2]	-0.02 (0.2) [-0.6/0.3]	-0.6** (0.2) [-0.98/-0.23]
Five years after interstate deregulation***	8.0** (3.0) [4.0/15.0]	-0.1 (0.1) [-0.4/0.2]	-0.3 (0.2) [-0.18/0.7]	-0.1 (0.3) [-0.7/0.4]
After intrastate branching deregulation***	1.0 (3.0) [-5.0/7.0]	-0.3** (0.1) [-0.5/-0.04]	0.2 (0.2) [-0.5/0.08]	0.1 (0.2) [-0.5/0.2]
F-test for joint significance of identifying instrument: After interstate deregulation; Five years after interstate deregulation; and After intrastate branching deregulation	7.68**	8.45**	—	—
Labor shares Included?	No	No	No	No
Within-state R <sup>2</sup> (%)	65.8	11.2	7.5	18.7
	Yes	Yes	Yes	Yes
	71.3	14.5	15.1	22.2

Regressions (1)–(3) estimated over 931 state-years: 49 states (DC included, SD and DE excluded) × 1976–1994. Regressions (4) estimated over 833 state-years: 49 × 1978–1994 (1976–1977 not available). Variables are defined in Table II. All regressions include state and year effects.

\* Significant at 10 percent.

\*\* Significant at 5 percent.

\*\*\* Coefficient multiplied by 100.

creased significantly—by 14 to 17 percentage points—after deregulation. *Five years after deregulation* is also significant, suggesting a long-run increase in the *interstate asset ratio* of 21 to 25 percentage points. The “within”  $R^2$  is 71 percent with labor shares, 66 percent without. This first regression is also the first-stage for the IV regressions we report later. The joint significance of the three deregulation indicators, our identifying instruments, suggests that the instrument set is reasonable ( $p$ -values less than 0.001 for both specifications).<sup>19</sup>

The other regressions in Table III show that fluctuations in all three growth measures—gross product, income, and employment—tend to subside after interstate deregulation. These regressions can be interpreted as reduced-form models linking changes in regulations directly to economic volatility. The decline after reform is significant for every measure when the regressions include the labor shares. Without the labor shares, the decline in employment and gross state product fluctuations is significant, but the decline in personal income is not.<sup>20</sup> The results also suggest (weakly) that the effects of deregulation on volatility build over time—the coefficients on *five years after interstate deregulation* are always negative (although not significantly so). This result is consistent with the changes in banking integration, which also increase gradually after a state deregulates restrictions on interstate banking.

Table IV reports OLS (fixed effect) regressions of fluctuations on our banking integration measures. *Other state asset ratio*—the exogenous measure—enters negatively in every regression. Its coefficient is significant between the 5 percent and 10 percent level. The 95 percent confidence interval is centered in the negative range, but it reaches into the positive range.

*Interstate asset ratio*—the endogenous measure—enters negatively in five of six regressions, but the coefficient is never statistically significant. The associated confidence interval is centered in the negative range, but the intervals are wide. When the labor shares are included, the coefficient on *interstate asset ratio* is two-to-six times more negative. This interaction reinforces the possibility (raised above) that *interstate asset ratio* might be *higher* in states

19. The insignificance of *intrastate branching deregulation* means that permitting branching within a state is not associated with increased affiliation across states.

20. Income can come from out of state, so it makes sense that income fluctuations are less sensitive to bank integration.

TABLE IV  
STATE FLUCTUATIONS FALL WITH BANKING INTEGRATION: OLS REGRESSION COEFFICIENTS (STANDARD ERRORS-CLUSTERED BY STATE)  
[95 PERCENT CONFIDENCE INTERVALS-BOOTSTRAPPED FROM SAMPLING OVER STATES]

	Dependent variables		
	(1) Employment growth fluctuations	(2) Personal income growth fluctuations	(3) Gross product growth fluctuations
Interstate asset ratio***	-0.1 (0.3) [-0.6/0.4]	0.2 (0.5) [-0.8/1.3]	-0.1 (0.5) [-1.2/0.47]
Other state asset ratio***	-0.04* (0.02) [-0.06/0.03]	-0.06*** (0.03) [-0.09/0.03]	-0.13*** (0.05) [-0.19/0.04]
<i>Labor share coefficients (government omitted):</i>			
Mining	—	—	—
Construction	0.22* (0.11) [0.17]**	0.29** (0.14) [0.37]**	0.78** (0.22) [0.36]
Manufacturing	0.05 (0.06) [0.06]	0.09 (0.09) [-0.01]	0.29 (0.29) [0.22*]
Transportation	0.06 (0.06) [-0.04]	0.08 (0.08) [-0.12]	0.13 (0.13) [-0.10]
Trade	0.05 (0.17) [0.05]	0.31 (0.31) [0.40*]	0.38 (0.38) [0.51]**
Finance	0.05 (0.10) [0.17]	0.22 (0.22) [0.45]**	0.20 (0.20) [0.60]**
Services	0.11 (0.11) [0.06]	0.14 (0.14) [0.02]	0.25 (0.25) [0.01]
Sum of squared labor shares	0.07 (0.07) [0.08]	0.09 (0.09) [0.54]**	0.14 (0.14) [0.74]**
Sum of squared labor shares	0.08 (0.10)	0.54** (0.17)	0.74** (0.20)
Within state $R^2$ (%)	9.98	6.9	18.2
	13.4	14.4	21.7

Regressions (1)–(2) estimated over 931 state-years: 49 states (DC included; SD and DE excluded)  $\times$  1976–1994. Regressions (3) estimated over 833 state-years: 49  $\times$  1978–1994 (1976–1977 not available). All regressions include state and year effects. Variables are defined in Table II.

\* Significant at 10 percent.

\*\* Significant at 5 percent.

\*\*\* Coefficient multiplied by 100.

that are inherently more volatile (because of their resource endowment) because such states are more prone to banking crises and buyouts by banks in other states (if permitted). Controlling for labor shares—a reasonable proxy for endowments—this apparent bias in the OLS estimates is diminished.<sup>21</sup>

Table V reports instrumental variable (IV) regressions, where the (identifying) instruments for *interstate asset ratio* are the three deregulation indicators. The IV estimates of *interstate asset ratio* are significant in all but one regression, and in every regression that includes labor shares. The IV estimates imply a substantial stabilizing effect of interstate bank affiliations, especially given labor shares. A state with *interstate asset ratio* 0.28 above average (one standard deviation) would have fluctuations in personal income growth 0.9 percentage points ( $0.28 \times 0.032 \times 100$ ) lower than a state where interstate asset ratio was average. The typical fluctuation in personal income growth was 1.6 percent, so 0.9 is sizable.<sup>22</sup>

#### V.B. *Endogenous Deregulation Does Not Explain Reduced Volatility*

Our deregulation instruments *might* be correlated with contemporaneous fluctuations in a state. Economic fluctuations, especially contractions, may pressure legislators to allow entry by out-of-state banks or exit by local banks seeking greener pastures. If so, smaller fluctuations after deregulation might just reflect increased volatility before deregulation and reversion to average fluctuations after. Not so. In Table VI we reestimate the regulatory reduced form models from Table III with an additional indicator variable equal to one during the five-year period preceding regulatory change. This indicator never enters significantly positive; nor does its inclusion in the model change the

21. The coefficient on *other state asset share*, by contrast, is not nearly as sensitive to inclusion of the labor shares. The insensitivity of the *other state asset coefficient* to labor mix reinforces our treatment of that measure as a largely accidental, or exogenous measure reflecting state size and location (near big or large states) and not fluctuations within the state.

22. We found similar results when we allowed a full set of interactions between the year effects and the state-level industry employment share variables (in case the impact of the aggregate shock depends on a state's industry mix). In an earlier draft, we found a more pronounced stabilizing effect of integration in small states. Finally, we have also estimated the IV model with just the *interstate asset ratio* as a single integration measure. In these specifications, the coefficients increase slightly in magnitude (i.e., become more negative), whereas the levels of statistical significance do not change (i.e., in five of the six specifications, the coefficient is significant at the 5 percent level).

TABLE V  
 STATE FLUCTUATIONS FALL WITH BANKING INTEGRATION: IV REGRESSION COEFFICIENTS (STANDARD ERRORS-CLUSTERED BY STATE)  
 [95 PERCENT CONFIDENCE INTERVALS-BOOTSTRAPPED FROM SAMPLING OVER STATES]\*\*\*

	Dependent variables		
	(1) Employment growth fluctuations	(2) Personal income growth fluctuations	(3) Gross state product growth fluctuations
Interstate asset ratio****	-1.7** (0.6)	-0.8 (1.5)	-3.2** (1.6)
Other state asset ratio****	[-2.9/0.05] -0.03 (0.03)	[-2.4/2.2] -0.06* (0.03)	[-6.7/0.12] -0.12* (0.07)
<i>Labor share coefficient (government omitted)</i>	[-0.07/0.05]	[-0.10/0.03]	[-0.20/0.08]
Mining	—	—	—
Construction	0.29* (0.13)	0.36** (0.15)	0.92** (0.22)
Manufacturing	0.28** (0.09)	0.49** (0.11)	0.51 (0.31)
Transportation	0.12 (0.08)	0.07 (0.10)	0.36** (0.15)
Trade	-0.03 (0.22)	-0.11 (0.33)	0.03 (0.53)
Finance	0.30** (0.15)	0.68** (0.24)	1.00** (0.27)
Services	0.23 (0.14)	0.51** (0.15)	0.76** (0.26)
Sum of squared labor shares	0.22** (0.08)	0.20* (0.12)	0.23 (0.18)
Within state $R^2$	-0.01 (0.14)	0.44* (0.24)	0.67** (0.26)
	4.6	5.7	14.8
	10.1	11.8	19.6

Regressions (1)–(2) estimated over 931 state-years: 49 states (DC included; SD and DE excluded)  $\times$  1976–1994. Regression (3) estimated over 833 state-years: 49  $\times$  1978–1994 (1976–1977 not available). Variables are defined in Table II. All regressions include state and year effects.

\* Significant at 10 percent.

\*\* Significant at 5 percent.

\*\*\* Instruments for *interstate asset ratio*: three deregulation indicators (Tables I and II).

\*\*\*\*coefficient multiplied by 100.

TABLE VI  
 FLUCTUATIONS FALL AFTER DEREGULATION (NOT BEFORE): OLS REGRESSION COEFFICIENTS (STANDARD ERRORS-CLUSTERED BY STATE)  
 [95 PERCENT CONFIDENCE INTERVALS-BOOTSTRAPPED FROM SAMPLING OVER STATES]

	(1) Employment growth fluctuations	(2) Personal income growth fluctuations	(3) Gross state product growth fluctuations
Other state asset ratio***	(1) -0.04** (0.02)	(2) -0.03* (0.01)	(3) -0.06** (0.03)
After interstate deregulation***	(1) [-0.06/0.03] -0.5*** (0.2)	(2) [-0.06/0.01] -0.4* (0.2)	(3) [-0.2/0.03] -1.5* (0.6)
Five years after interstate deregulation***	(1) [-0.9/-0.2] -0.2 (0.2)	(2) [-0.8/-0.03] -0.3 (0.2)	(3) [-3.3/-0.1] -0.2 (0.2)
Five years prior to interstate deregulation***	(1) [-0.5/0.1] -0.2 (0.2)	(2) [-0.6/0.1] -0.1 (0.2)	(3) [-0.8/0.1] -0.7* (0.4)
After intrastate branching deregulation***	(1) [-0.5/0.5] -0.3* (0.1)	(2) [-0.3/0.2] -0.2 (0.1)	(3) [-2.0/0.2] -0.2 (0.2)
Labor shares included?	(1) [-0.5/-0.1] No	(2) [-0.5/0.1] No	(3) [-0.7/0.2] No
Within R <sup>2</sup>	11.4	14.3	19.2
		Yes	Yes
		15.3	22.4

Regressions (1)-(2) estimated over 931 state-years: 49 states (DC included; SD and DE excluded) × 1976-1994. Regressions (3) estimated over 833 state-years: 49 × 1978-1994 (1976-1977 not available). Variables are defined in Table II. All regressions include state and year effects.

\* Significant at 10 percent.

\*\* Significant at 5 percent.

\*\*\* Coefficient multiplied by 100.

main results. All three fluctuation measures subside *after* deregulation (significantly so for employment and gross state product), but none were unusually high in the five years prior to deregulation.<sup>23</sup>

### V.C. *Convergence in State Cycles*

Banking integration also affects the spillover of credit shocks from one state to others. Whether integration causes state cycles to become more or less alike, however, depends on whether supply or demand shocks are the predominant source of disruptions to credit markets. Recall Figure II. If bank capital/loan supply contracts in state *A*, a holding company in *A* will import bank capital from some healthier state where it also holds banks, say *B*. The capital import from *B* contracts loan supply there and expands loan supply in *A*, thus narrowing the divergence in lending (and spending) between *A* and *B* (compared with an *intrastate* banking structure with immobile capital).<sup>24</sup> A contraction in loan *demand* in *A* (and the resulting decline in bank capital returns) motivates interstate holding companies to shift capital from *A* to *B*. The capital exported from *A* contracts loan supply there (further reducing the quantity of lending in *A*), and expands loan supply in *B*, thus widening the divergence between *A* and *B* (compared with *intrastate* banking). The net effect is ambiguous; whether differences between state fluctuations widen or narrow with interstate banking depends on which shock—loan supply or loan demand—predominates. Given our finding that fluctuations fall after interstate banking deregulation, we can infer that loan supply/capital shocks predominate (else we would have found the opposite). Hence, we expect interstate banking will narrow differences between state business cycles.

We test this “integration *cum* convergence” hypothesis here using pairwise comparisons across states. For every pair of states over 1976–1994 (state-pair-year), we computed the value of bank assets in the two states (say *A* and *B*) that are jointly owned (by a holding company), divided by the sum of bank assets in *A* and *B*. The higher that ratio, the more integrated the two states’ banking systems. As a discrete alternative, we also constructed

23. The *five years prior to interstate deregulation* dummy in the Table VI regressions effectively “dummies out” those years.

24. Peek and Rosengren [2000] find that the capital contractions of Japanese banks in the 1990s caused them to reduce their lending in the United States (California, in particular).

an indicator that switches on (from zero to one) if  $A$  and  $B$  have *any* bank assets that are jointly owned. The dependent variable equals the absolute difference in the growth residual between state-pairs in a given year, where the growth residual ( $v_{it}$ ) is computed as before (see equation (2) above). To be precise,

$$(4) \quad \textit{Absolute Difference in Growth}_{i,j,t} = |v_{it} - v_{jt}|.$$

We expected a smaller difference between growth in  $A$  and  $B$  as their banks become more integrated (and compared with other, less integrated, state-pairs). To construct standard errors, we cluster the data for each state-year.

In fact, states' cycles do converge along with their banking systems (Table VII). Absolute differences between growth in all three measures—employment, personal income, and gross product—decline significantly as the share of commonly owned bank assets increases. The indicator of any jointly owned assets is also significant in every regression. The absolute difference in employment growth is 0.4 percentage points lower for states with some jointly owned assets than for states whose banking sectors are completely segregated (column 2). The mean absolute difference in employment growth is 1.6 percent. Note that business cycles' differences *increase* with differences between states' industry mix, as we would expect, but interstate bank linkages narrow business cycle differences even after controlling for differences in labor force composition.<sup>25</sup>

#### *V.D. Interstate Trade Does Not Explain Our Results*

The negative correlation between bank integration and state business fluctuations is almost certainly *not* an artifact of increased trade (“*real*” integration) among the states. It is not obvious that trade is stabilizing; trade permits specialization, and specialization is the opposite of diversification. Recall from Tables III and IV that fluctuations in state income and output growth increase with the sum of squared labor shares (a measure of concentration). If anything, increased trade (if it begets specialization) might cause larger fluctuations. We also examined the data available on interstate shipping (as a proxy for trade), and

25. The difference between two states' industry mix is measured by the square root of the sum of squared differences between the two states' employment shares in the 8 one-digit SIC sectors listed in Table I. The regressions in Table VII also include state-pair fixed effects to absorb permanent similarities between states (such as proximity) and annual fixed effects to remove trends.



TABLE VII  
 STATE BUSINESS FLUCTUATIONS CONVERGE WITH BANK INTEGRATION  
 OLS REGRESSION COEFFICIENTS (STANDARD ERRORS-CLUSTERED BY STATE-YEAR)  
 [95 PERCENT CONFIDENCE INTERVALS-BOOTSTRAPPED FROM SAMPLING OVER STATE-YEARS]

	(1) Employment growth	(2) Personal income growth	(3) Gross state product growth
Share of jointly owned bank assets in any state-pair	-0.010** (0.002) [-0.014/-0.007]	-0.004* (0.002) [-0.008/0.001]	-0.012** (0.004) [-0.016/-0.005]
Indicator = 1 if state-pair has any commonly owned banks	-0.004** (0.0004) [-0.0043/-0.003]	-0.003** (0.00005) [-0.004/-0.002]	-0.004** (0.00009) [-0.006/-0.003]
Difference between employment shares	0.050** (0.002) [0.032/0.072]	0.123** (0.017) [0.082/0.142]	0.288** (0.033) [0.226/0.341]
Dependent variable mean	0.016	0.023	0.033
Number of clusters	931	931	833
Within R <sup>2</sup>	9.3	7.0	14.6
		7.1	19.6

Regressions estimated using state-pair-year observations from 1976 to 1994. The dependent variable equals the absolute value of the difference in the growth residual for a pair of states. Standard errors are calculated using just one observation per state-year by clustering all observations for a given state-year. The difference (Euclidean "distance") between employment shares equals the square root of the sum of squared differences between the two states' employment shares in the 8 one-digit SIC sectors listed in Table I. All regressions include dummies indicating year and state-pair (i.e., a fixed effect for each unique pair of states).

\* Significant at 10 percent.

\*\* Significant at 5 percent.

found no correlation between the change in interstate shipping between 1977 and 1993 for each state and the corresponding change in *interstate asset ratios*.<sup>26</sup>

## VI. CONCLUSION

The United States once had 50 little banking systems, one in every state. Now we have a much more integrated banking system, with holding companies operating banks across many states. Interstate banking appears to have helped stabilize growth fluctuations within states, and to reduce divergence between states. State business cycles have become smaller, in other words, but more alike.

This conclusion has implications in several dimensions. Banks in Europe are still relatively *disintegrated* across nations [Berger 2003]. As integration accelerates, along with unification generally, our findings suggest that business cycles in European nations will also diminish and converge. Interstate bank integration may also help explain the decline in *aggregate* U. S. economic volatility over the past twenty years documented in McConnell and Perez-Quiros [2000] and Blanchard and Simon [2001]. Researchers have already ventured several explanations for this trend; better finance *via* bank integration may be yet another.<sup>27</sup> Our findings also relate to “regional evolutions” studied by Blanchard and Katz [1992]. They find that labor migration played a surprisingly large role in the adjustment of state economies to shocks. By increasing the ease with which financial capital can flow into states, banking integration could potentially reduce the incentive for people to leave states during downturns. It would be interesting to test whether increased mobility of bank capital, via

26. Out-of-state shipping ratios are available periodically from the *Commodity Flow Surveys* conducted by the Department of Transportation and the Department of Commerce. The closest surveys to our (1976–1994) sample were in 1977 and 1993. We plot the data in Morgan, Rime, and Strahan [2003] but omit that plot here for brevity. The correlation of 0.103 was not significantly different from zero ( $p$ -value = .49).

27. Better inventory management [Kahn, McConnell, and Perez-Quiros 2002], reduced volatility of sales with nonconvexities in the production process [Ramey and Vine 2004] better monetary policy [Blanchard and Simon 2001], and better luck [Stock and Watson, 2002]. Better finance fits best with the inventory-management hypothesis. According to this view, firms began smoothing production better in the post-1984 period by building up inventories during periods of low sales growth, and vice versa during periods of high sales growth [Kahn, McConnell, and Perez-Quiros 2002]. These countercyclical movements in inventories are only possible if banks are able to provide countercyclical credit; interstate banking may contribute in that direction.

interstate banking, has altered the role of labor mobility in the adjustment to shocks.

APPENDIX: INTERSTATE BANKING IN THE HOLMSTRÖM  
AND TIROLE (HT) MODEL<sup>28</sup>

The basic model comprises firms, banks, and investors. All are risk neutral. Firms choose between a good project and either of two bad projects. The “good” project succeeds with probability  $p_H$ ; both “bad” projects succeed with probability  $p_L$ . A key parameter in the model is the good and bad projects’ relative likelihood of success:  $\Delta p = p_H - p_L > 0$ . All of the projects return  $R$  (per-unit invested) if they succeed and 0 if not. The two bad projects also produce differing amounts of *private* benefits to the firm: type  $b$  bad projects produce a small private benefit ( $b$ ); type  $B$  bad projects produce a larger private benefit ( $B > b$ ). Banks can prevent  $B$  investments by monitoring, but not  $b$  investment. Monitoring costs  $c$  per unit of investment. Banks must invest enough of their own capital in the project to be credible monitors.

*Contracts.* Firms borrow from both the bank (*informed capital*) and investors (*uninformed capital*). If the project succeeds, the firm, bank monitor, and uninformed investors receive  $Rf$ ,  $Rm$ , and  $Ru$ .  $Rf$  must be large enough to induce the firm to choose the good project ( $Rf \geq bI/\Delta p$ ).  $Rm$  must be large enough to induce the bank to monitor ( $Rm \geq cI/\Delta p$ ). At equilibrium, the two incentives’ constraint and the firm’s budget constraint will bind. The *maximum pledgeable income*, defined by HT as the maximum expected income per unit of investment that can be promised to uninformed investors without destroying incentives, is then equal to  $p_H(R - (b + c)/\Delta p)$ .

### *Intrastate Banking*

By *intrastate* banking, we mean that informed capital is completely immobile across states. That immobility means the equilibrium in each state is the same as in the HT one-state model. Let  $\gamma$  and  $\beta$  denote the rates of return required by uninformed investors and by banks, respectively. Let  $Kf_1$  be the aggregate amount of firm capital in state 1,  $Km_1$  the aggregate amount of informed capital in state 1, and  $Ku_1$  the aggregate supply of uninformed capital in state 1. The first two are fixed,

28. Morgan, Rime, and Strahan [2003] elaborate on this interstate version of the HT model.

while the third is determined so that the demand for uninformed capital (the sum of the pledgeable expected returns of individual firms, discounted by  $\gamma$ ) equals the supply of uninformed capital. Equilibrium in the uninformed capital market in state 1 requires that

$$\frac{p_H(Kf_1 + Km_1 + Ku_1)(R - (b + c)/\Delta p)}{\gamma} = Ku_1.$$

The equilibrium quantity of uninformed capital in state 1 is determined by

$$Ku_1 = \frac{p_H(-b - c + R \cdot \Delta p)(Kf_1 + Km_1)}{p_H(b + c - R \cdot \Delta p) + \Delta p \cdot \gamma}.$$

The equilibrium rates of return in informed capital markets is defined by

$$\beta_1 = p_H \cdot c(Kf_1 + Km_1 + Ku_1)/(Km_1 \cdot \Delta p).$$

### Interstate Banking

Under *interstate* banking, we assume that informed capital can move freely to equalize  $\beta$  across states. Define  $\pi_1$  as the share of aggregate informed capital ( $Km_1 + Km_2$ ) invested in state 1. Let  $Ku_1^i$  and  $Ku_2^i$  be the quantities of uninformed capital attracted by firms in each state (note the superscript  $i$  for interstate banking). Equilibrium with interstate banking is determined by these three equations:

$$\frac{p_H(Kf_1 + \pi_1(Km_1 + Km_2) + Ku_1^i)(R - (b + c)/\Delta p)}{\gamma} = Ku_1^i;$$

$$\frac{p_H(Kf_2 + (1 - \pi_1)(Km_1 + Km_2) + Ku_2^i)(R - (b + c)/\Delta p)}{\gamma} = Ku_2^i;$$

$$\begin{aligned} \beta &= \frac{p_H \cdot c(Kf_1 + \pi_1(Km_1 + Km_2) + Ku_1^i)}{\Delta p \cdot \pi_1(Km_1 + Km_2)} \\ &= \frac{p_H \cdot c(Kf_2 + (1 - \pi_1)(Km_1 + Km_2) + Ku_2^i)}{\Delta p(1 - \pi_1)(Km_1 + Km_2)}. \end{aligned}$$

The equilibrium quantities attracted by firms in each state and the share of informed capital invested in state 1 are

$$Ku_1^i = \frac{p_H(-b - c + R \cdot \Delta p)(Kf_1 + Kf_2 + Km_1 + Km_2)Kf_1}{(p_H(b + c - R \cdot \Delta p) + \Delta p \cdot \gamma)(Kf_1 + Kf_2)}$$

$$Ku_2^i = \frac{p_H(-b - c + R \cdot \Delta p)(Kf_1 + Kf_2 + Km_1 + Km_2)Kf_2}{(p_H(b + c - R \cdot \Delta p) + \Delta p \cdot \gamma)(Kf_1 + Kf_2)}$$

$$\pi_1 = \frac{Kf_1}{Kf_1 + Kf_2}.$$

### Comparative Statics

Proposition 1: the negative impact of a bank capital crunch in state 1 (a decrease in  $Km_1$ ) on the amount of *informed* and of *uninformed capital* invested in state 1 is smaller under *interstate* banking. Intuitively, the increase in  $\beta$  caused by the bank capital crunch attracts bank capital from state 2. This capital inflow mitigates the impact of the bank capital crunch on the availability of external finance in two ways. First, the bank capital inflow leads to a lower decrease in the amount lent by banks to firms in state 1 (this effect is shown in Figure I, Panel A). Second, because the amount lent by banks to firms in state 1 decreases less, we also have a smaller reduction in the pledgeable income that can be promised to uninformed investors by firms in state 1. As a result, we have a smaller reduction in the amount of uninformed capital that firms in state 1 can attract. With unit banking, these mitigating effects do not take place, since bank capital cannot move across states. Formally, Proposition 1 implies that  $\partial \pi_1(Km_1 + Km_2)/\partial Km_1 < \partial Km_1/\partial Km_1$  and  $\partial Ku_1^i/\partial Km_1 < \partial Ku_1/\partial Km_1$ . The proofs, available in Morgan, Rime, and Strahan [2003], are straightforward under the *symmetry* conditions  $Kf_1 = Kf_2$  and  $Km_1 = Km_2$  at initial values.

Proposition 2: the negative impact of a collateral squeeze in state 1 (a decrease in  $Kf_1$ ) on the amount of *uninformed* and *informed capital* invested in state 1 is larger under *interstate* banking. With interstate banking, the decrease in  $\beta$  after the collateral squeeze drives bank capital from state 1 to state 2. Here again, two effects must be distinguished. First, the bank capital flight leads to a decrease in the amount lent by banks to firms in state 1 (this effect is shown in Figure I, Panel B). Second, because of this reduction of the amount lent by banks to state 1 firms, we also have a decrease in the pledgeable income that can be promised to uninformed investors. As a result, firms in state 1 can attract less uninformed capital. With unit banking, these amplifying effects do not take place, since bank capital cannot move across states. The proofs of Proposition 2 can be found in Morgan, Rime, and Strahan [2003].

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## REFERENCES

- Amel, Dean, "State Laws Affecting the Geographic Expansion of Commercial Banks," unpublished manuscript, Board of Governors of the Federal Reserve System, 1993.
- Ashcraft, Adam, "New Evidence on the Lending Channel," *Journal of Money, Credit and Banking*, forthcoming.
- Asdrubali, Pierfederico, Bent Sorensen, and Oved Yosha, "Channels of Interstate Risk Sharing: United States 1963–1990," *Quarterly Journal of Economics*, CXI (1996), 1081–1110.
- Berger, Allen N., "Global Integration in the Banking Industry," *Federal Reserve Bulletin*, LXXXIX (2003), 451–460.
- Bertrand, Marianne, Esther Dufo, and Sendhil Mullinathan, "How Much Should We Trust Difference-in-Differences Estimators?" *Quarterly Journal of Economics*, CXIX (2004), 249–276.
- Blanchard, Olivier, and Lawrence F. Katz, "Regional Evolutions," *Brookings Papers on Economic Activity*, No. 1 (1992), 1–74.
- Blanchard, Olivier, and John Simon, "The Long and Large Decline in U. S. Output Volatility," *Brookings Papers on Economic Activity*, No. 1 (2001), 135–174.
- Holmstrom, Bengt, and Jean Tirole, "Financial Intermediation, Loanable Funds, and the Real Sector," *Quarterly Journal of Economics*, CXII (1997), 663–691.
- Houston, Joel, Christopher James, and David Marcus, "Capital Market Frictions and the Role of Internal Capital Markets in Banking," *Journal of Financial Economics*, XLVI (1997), 135–164.
- Kahn, James A., Margaret McConnell, and Gabriel Perez-Quiros, "On the Causes of the Increased Stability of the U. S. Economy," Federal Reserve Bank of New York, *Economic Policy Review*, VIII (2002), 183–202.
- Kroszner, Randall S., and Philip E. Strahan, "What Drives Deregulation: Economics and Politics of the Relaxation of Bank Branching Restrictions," *Quarterly Journal of Economics*, CXIV (1999), 1437–1467.
- McConnell, Margaret, and Gabriel Perez-Quiros, "Output Fluctuations in the United States: What Changed Since the Early 1980s?" *American Economic Review* XC (2000), 1464–1476.
- Morgan, Donald, Bertrand Rime, and Philip E. Strahan, "Bank Integration and State Business Cycles," NBER Working Paper No. 9704, 2003.
- Morgan, Donald P., and Philip E. Strahan, "Foreign Bank Entry and Business Volatility: Evidence from U. S. State and Other Countries," in *Banking Market Structure and Monetary Policy*, Luis Antonio Ahumada and J. Rodrigo Fuentes, eds. (Central Bank of Chile, 2004).
- Peek, Joseph, and Eric Rosengren, "Collateral Damage: Effects of the Japanese Bank Crisis on the United States," *American Economic Review*, XC (2000), 30–45.
- Ramey, Valerie A. and Daniel J. Vine, "Tracking the Source of the Decline in GDP Volatility: An Analysis of the Automobile Industry," National Bureau of Economic Research Working paper No. 10384, March 2004.
- Stock, James, and Mark W. Watson, "Has the Business Cycle Changed and Why?" mimeo, August 2002.
- Stockman, Alan, and Linda Tesar, "Tastes and Technology in a Two-Country Model of the Business Cycle: Explaining International Comovements," *American Economic Review*, LXXXV (1995), 168–185.
- Williamson, Stephen, "Restrictions on Financial Intermediaries and Implications for Aggregate Fluctuations: Canada and the United States 1870–1913," in *NBER Macroeconomics Annual: 1989*, O. Blanchard and S. Fischer, eds. (Cambridge, MA and London, UK: MIT Press, 1989).