Bank Integration and Business Volatility

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Abstract

We investigate how bank migration across state lines over the last quarter century has affected the size and covariance of business fluctuations within states. Starting with a two-state version of the unit banking model in Holmstrom and Tirole (1997), we conclude that the theoretical effect of integration on business cycle size is ambiguous, because some shocks are dampened by integration while others are amplified. Empirically, we find that integration diminishes employment growth fluctuations within states, and decreases the deviations in employment growth across states. In other words, business cycles within states become smaller with integration, but more alike. Our results for the United States bear on the financial convergence under way in Europe, where banks remain highly fragmented across nations.

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Introduction

Banking in the United States was once highly *dis*united. Instead of a few, very large banks branched out across the states, we had essentially 50 separate banking systems, one for every state. Integration began in the late 1970s, as states began opening their doors to out-of-state banks. Big bank holding companies marched in, forming even bigger companies by merging and buying up other holding companies and unit banks. This integration has not only produced larger (but fewer) U.S. banks, as many have noted, it has also transformed our fragmented banking industry of twenty-five years ago into a much more nationally integrated, geographically diversified system (Map).

What of it? Why should bank integration warrant attention here? Under segregated banking, the fate of the state and its banks were closely tied; as went the states, so went the banks. Farm price deflation in the early 1980s bankrupted many farmers and many farm banks, just as falling oil prices in the late 80s wiped out a lot of Texans and Texas banks. Falling prices may have precipitated these events, but the associated financial distress—the deterioration in bank capital and borrower collateral in particular--may have amplified the ultimate impact of the shocks, or so a large literature maintains (Bernanke, Gertler et al).

This paper investigates how the integration of our banking system has altered state business cycle dynamics, both within and across states. To investigate the theoretical effects, we add a second (physical) state to Holmstrom and Tirole (1997) unit-banking model. By stylizing results from other models, they manage to incorporate the firm collateral and bank capital shocks considered in isolation in other models. Both

shocks are contractionary with unit banking, not surprisingly, but the impact is transmitted not just through falling investment demand but also via contracting bank credit supply. When we add the second state, we find that interstate banking dampens the own-state effect of bank capital but amplifies the impact of firm collateral shocks. As a theoretical matter, we conclude that bank integration has an ambiguous affect on state business volatility.

Our empirical findings suggest that the net effect of integration on state business volatility is stabilizing.[1] State and year specific fluctuations in employment growth diminish significantly as banks within the state commingle with out-of-state banks (via holding companies). The results are even stronger when we control for the composition of employment within states, and when we instrument for integration using dummy variables indicating the year each state entered an interstate banking agreement with one or more other states. Differences in growth across states tend to diminish with integration, suggesting increased covariance of state business cycles. We conclude that state business cycles become smaller with integration, but more alike.

Our findings for the United States, where integration is far along, should be glad tidings for Europe, where international bank integration is just commencing. Judging from their *liability* mix (Chart 1), European nation banks are still highly fragmented.[2] Applied there, our findings suggest that further bank integration in Europe will lead to smaller, but more correlated, national business cycles. More generally, our results may

[1] Conceptually, there is more likely one shock that gets distributed to various parties by preexisting contractual structure, bankruptcy arrangements, etc.

[2] Except, of course, for the banking centers of Switzerland and the U.K. and the three "Benelux" nations. Garcia Blandon (2001) finds that foreign bank entry in Europe is impeded by various *non*-regulatory barriers, such as cultural distance between consumers, while export levels and the presence of multinationals are positively correlated with foreign bank penetration.

inform thinking about worldwide financial integration, since "globalization" is just a scaled-up version of the natural integration studied here.

II. Integration and Volatility: Some Literature

Capital and banking market integration have been considered in a variety of contexts. The international literature on capital market integration (across nations) focuses mostly on the risk-sharing benefits of integration; cross-country diversification of asset portfolios tends to smooth aggregate consumption within nations. We doubt that banking integration in the U.S. has important risk-sharing effects since capital (i.e., stock) markets have been well-integrated across U.S. states for decades. In fact, Asdrubali et al. (1996) find that U.S. capital markets play a more vital role in income and consumption smoothing across states than do credit markets. The international literature does find, however, that increased capital market integration may actually amplify the own-country effect of productivity shocks as capital is able to flee a country afflicted with a productivity slump. Our model of interstate banking has some of that flavor.

Williamson (1989) compares the unit banking system in the U.S. to the more integrated system in Canada. Using an equilibrium costly monitoring model, he argues that the cross-province banking in Canada should have stabilized the banking system there relative to the unit banking system in the U.S. His model also implies, somewhat counter-intuitively, that integration amplifies the aggregate impact of aggregate real shocks. Integrated banking systems are less volatile, in other words, but the economy as a whole becomes more volatile.[3] Our paper, by contrast, investigates how banking

[3] The counterintuitive result that integration amplifies the effect of real shocks seems to stem from the type of shock considered (a mean preserving increase in the projected technology risk) and on a hard-to-explain effect of bank diversification on the elasticity of credit demanded by firms. His evidence from the pre-War period is mixed.

integration affects *state* volatility (rather than bank or aggregate volatility). Our model (below) is also quite different from his.

III. An Interstate Banking Model

We add a state to the (unit) banking model in Holmstrom and Tirole (1997) and explain how interstate banking alters the impact of various shocks. As it turns out, interstate banking is *not* necessarily stabilizing since some types of shocks get dampened, but other types get amplified.

3.1 The Holmstrom and Tirole Model

The HT model comprises three players: firms, financial intermediaries, and investors. All are risk neutral. Firms have access to identical project technologies, but they differ in their initial capital endowments: A_0. Financial intermediaries ("banks") and investors can both lend to firms, but only the banks have monitoring know-how; the uninformed investors must rely on monitoring by the banks. Investors have access to an alternative investment opportunity.

Technology. 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 are successful and 0 if not. R is public. 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 ($B > b$).

Moral Hazard and Monitoring. Moral hazard arises because of the private benefits from bad investments; firms may choose bad projects over good projects (with

higher expected returns) because the former produce private (i.e., unshared) benefits. Monitoring by a bank can prevent type *B* investment, but not type *b* investment. The idea here is that monitoring is an effective deterrent against obvious fraud and abuse (e.g., simply absconding with the borrowed funds), but smaller abuses, (shirking, etc.) must be remedied through incentive schemes. Monitoring costs are proportional to the amount invested; if investment is *I*, monitoring costs = *cI*. Monitoring is itself a private activity, in that savers cannot determine if bankers have actually monitored a given firm. Private monitoring creates a second moral hazard; unless it is worthwhile, bankers will only pretend to monitor. Banks' must invest enough of their own capital in the project to ensure that they will monitor adequately.[4]

Contracts. Firms will always choose a mix of liabilities, borrowing from both the bank and investors. If the project succeeds, the firm, bank monitor, and uninformed investors receive *Rf*, *Rm* and *Ru* percent of the return. These shares are determined endogenously, of course, by the opportunity costs of the three parties. We prefer the *intermediation* interpretation of financing structure offered by HT: investors deposit their money with the bank; banks fund the firms they monitor with those deposits and the bank's own capital. The bank's ability to attract deposits depends on its own capital (which is needed to assure uninformed investors that it will monitor firms adequately).[5]

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[4] Project risk is not completely diversifiable so banks need a stake in the project (or else they would shirk on monitoring).

[5] Under the *certification* interpretation, uninformed investors invest directly in the firm, but only after the monitor has taken a large enough financial interest in the firm that the investor can be assured that the firm will behave diligently.

Equilibrium and Comparative Statics. Given the rates of return required by investors (g) and savers (b), a firm with initial assets A_0 chooses investment (I), its own capital contribution (A), and its mix of liabilities to maximize its expected profits:

$$\max U(A_0) = p_H RI - p_H Rm - p_H Ru + g(A_0 - A) \quad \text{subject to:}$$

$$Rf + Rm + Ru \# RI \qquad (1)$$

$$\Delta pRf \geq bI \qquad (2)$$

$$\Delta pRm \geq cI \qquad (3)$$

The main budget constraint (1) limits the sum of returns to the three parties to the total return on the investment.[6] Eq. (2) is an incentive constraint; the gain in expected payments to the firm from choosing the good project cannot be less than the private benefit from choosing the first bad project. Eq. (3) is an incentive constraint on the intermediary; the expected gain in return to the bank from forcing the firm to choose the good project must exceed the cost of monitoring, else the bank will not monitor. In equilibrium, all constraints will bind.

After solving the model, Holmstrom and Tirole show how shocks to each players' capital affect the equilibrium returns to investors (g) and banks (b) and the rate of investment by firms. With just one state, a reduction in savings supply (a savings "squeeze") increases g and decreases b. Intuitively, the changes in equilibrium returns reflect the changes in the relative scarcity of the different forms of capital. A decrease in informed capital (a capital "crunch") decreases g and increases b. A fall in firms'

[6] The other budget constraints (i,ii,iii,iv, and vii in HT p. 680) are omitted here for brevity.

capital (a collateral "squeeze") decreases g and decreases b. All three shocks have a contractionary effect on firms' investment spending.

3.2 Interstate Banking in the HT Model

We extend the HT model to interstate banking by simply adding another physical state. The only subtlety is in the treatment of capital mobility across states under the two banking regimes (unit and interstate) that we want to compare. For simplicity, we make the extreme assumption that capital is completely immobile across states under unit banking. In other words, unit banking is equivalent to the single state world HT considered. At the opposite extreme, we assume that capital is completely mobile across states under interstate banking. These extreme assumptions are not necessary for our results below, however; we obtain qualitatively similar results so long as capital is relatively less mobile under unit banking.

The appendix contains details on the extended model, the equilibrium, and the comparative statics. Table 1, below, compares the impact of the various capital shocks under unit banking and interstate banking. In short, the own-state effects of savings and bank capital shocks are diminished under interstate banking because savings and bank capital can flow from other states that did not experience a shock. The own-state impact of a firm collateral shock is amplified under interstate banking because banks in the affected state are free to shift their lending across the border to firms with better collateral. Thus, the net effect of integration on volatility is ambiguous. The following propositions compare the impact of the three shocks under unit banking and interstate banking.

Proposition 1: interstate banking reduces the negative impact of a savings squeeze in state 1 on the amount of investment in uninformed capital in state 1.

Intuitively, the increase in g necessary to compensate for the savings squeeze in state 1 is smaller under interstate banking because uninformed capital can be attracted from state 2. By mitigating the increase in g, cross-state capital flows reduce the impact of the shock on *creditworthy* demand for uninformed capital.

Proposition 2: with interstate banking, the negative impact of an informed capital crunch in state 1 on the amount of uninformed capital invested in that state is smaller than with unit banking. The intuition for this result (see Table 2) is that with interstate banking, the increase in b necessary to compensate the informed capital crunch in state 1 is smaller than with unit banking, since informed capital can be attracted from state 2. This mitigates the increase in b and its negative impact on the demand for uninformed capital in state 1.

Proposition 3: with interstate banking, a collateral squeeze in state 1 has a positive impact on the amount of uninformed capital invested in state 2. Hence, the amounts of uninformed capital invested in the two states move in opposite directions following a state specific collateral shock. The intuition for this result is that with interstate banking, the drop in the creditworthy demand for uninformed capital implied by the collateral squeeze in state 1 leads to a flight of uninformed and informed capital to state 2, which decreases b and g in that state. As a result, the creditworthy demand for uninformed capital in state 2 increases.

In sum, cross-state banking amplifies the effects of local shocks to entrepreneurial wealth (or, equivalently, productivity shocks) because capital chases the highest return. Capital flows into the state when collateral (productivity) is high and out when it is low, making the highs higher and the lows lower. Integration dampens the impact of bank

capital and savings supply. These sources of instability become *less* important because entrepreneurs are less dependent on local sources of funding (banks and consumers) in an integrated market since funds or bank capital can be imported from other states.

IV. Empirical Strategy and Data

Identifying the separate shocks just discussed seems like an impossible task. Even with the requisite data, the high correlation between bank capital and borrower collateral would require incredible identifying assumptions. Instead, we ask a more tractable (but still useful) question: how has banking integration across states affected overall volatility within states? Do state-specific business fluctuations get bigger or smaller as banks in that state become increasingly integrated with banks in other states? We know from the model that if capital and savings shocks are a larger source of volatility than collateral shocks, the net effect of integration should be stabilizing. Integration, in other words, should reduce volatility.

Endogenous Integration?

Reverse causality of two sorts concerns us. First, increased cross-state banking may indicate merely that states' economies are becoming more integrated; banks may simply follow their customers across state lines. If so, and if "real" integration affects business volatility, our results may confuse the effects of state integration and bank integration. Reverse causality could arise also via banking "hangovers" (from too much farming, or too much oil) as the associated distress and volatility may attract bargain-hunting banks from other states. To guard against these or other potential endogeneity problems, we instrument for integration using an indicator for the year a state entered an interstate banking agreement and the number of years elapsed since the agreement.

A Brief History of Interstate Banking

Restrictions on interstate banking in the U.S. date back to the infamous Douglas Amendment to the 1956 Bank Holding Company (BHC) Act. With that amendment, banks or holding companies headquartered in one state were prohibited from acquiring banks in another state unless such acquisitions were permitted by the second state's government. No states allowed such transactions in 1956, so the amendment effectively barred interstate banking. Change began in 1978, when Maine passed a law allowing entry by out-of-state BHCs if, in return, banks from Maine were allowed to enter those states. No states reciprocated, however, so the integration process remained effectively stalled until 1982, when the states of Alaska, Massachusetts, and New York passed laws similar to Maine's.[7] State deregulation was nearly complete by 1992, by which time all states but Hawaii had passed similar laws.[8] The process was completed in 1994 with the passage of the Interstate Banking and Branching Efficiency Act of 1994 (IBBEA) that mandated complete interstate banking as of 1997 and gave states the option to permit interstate branching.[9]

This roughly 15-year history provides an excellent experiment to see how the resulting integration has affected volatility. Luckily for us, the states did not deregulate all at once, and the subsequent integration across states proceeded at different rates (Chart 2). These staggered deregulatory events provide us with both cross-sectional and time

[7] As part of the Garn-St Germain Act, federal legislators amended in 1982 the Bank Holding Company Act to allow failed banks and thrifts to be acquired by any bank holding company, regardless of state laws (see, e.g., Kroszner and Strahan, 1996).

[8] State-level deregulation of restrictions on branching also occurred widely during the second half of the 1970s and during all of the 1980s.

[9] IBBEA permitted states to opt out of interstate branching, but only Texas and Montana chose to do so. Other states, however, limited entry by requiring entrants to buy their way into the market.

series variation with which to identify the effects of integration; also, the deregulatory events themselves provide a good instrument for integration.

Measuring Integration and Volatility

Bank integration equals the share of total state bank assets in a state that are owned by banks affiliated with an out-of-state bank holding company. To illustrate, if a state had one unit bank and one affiliated bank of equal size, integration in that state would equal ½. We associate volatility with the year-to-year deviations (from average) in various measures of business activity. Starting with the annual growth rate of series x for state i in year t, we first subtract off the mean growth rate in x for state i over time. "Demeaning" by the state average accounts for long-run growth differences across states. We then subtract off the mean growth rate of series x across states in year t. Demeaning by the national average each year helps control for aggregate business fluctuations. Our volatility measures will be the square of the resulting deviations, or the log of the squared deviations.

The three series we demean in this way are the annual growth rates of total state employment, small firm employment (N < 20), and commercial loans at banks. Numbers on total employment are available from 1975-96 from the Census Bureau. Small firm employment is available from the Bureau's County Business Patterns starting in 1977 (1978 after converting to growth rates). [10] In principal, the more bank-dependent firms in the latter category may be more affected by banking integration. Commercial

[10] From small firm employment, we remove the state-specific shock to employment that is common to *both* small and large firms. We do not use data beyond 1996 because banks began to operate across state lines after that year. This makes it impossible to estimate our integration variable. The small firm and total employment data are not directly comparable as the former excludes self-employed individuals, employees of private households, railroad employees, agricultural production employees, and most government

loans include loans to businesses and commercial real estate loans. These numbers are available starting in 1985 on banks' Call Reports. For each state, we calculate the growth rate of commercial business loans and commercial real estate loans made by all of the banks headquartered in that state. Banks do not have to report the state where the borrower is located, so lending to out-of-state businesses and developers will be a source of noise in the loan volatility series. The late start of the series is also problematic, as the big burst of interstate banking occurred between 1984 and 1987. Our loan series begins, in other words, at the beginning of the end of the fragmented era of the banking system. While loan volatility seems like the natural place to look for evidence that integration matters, the noisy and short series available to us will make the effects difficult to detect.

The integration and volatility measures are summarized in Table 2. The mean share of integrated bank assets over the full sample of state-years was 0.35. Overall employment grew 2 percent per year on average over the sample of state-years. Employment growth v*olatility*, as just defined, averaged 0.04%. Small firm employment growth was more than an order of magnitude less volatile than overall employment growth, but of course, the sample periods are not the same. Business loans grew over 7 percent per year on average (nominally), with average volatility of 1.6%.

VI. Results

In view of the ambiguous theoretical relationship between integration and volatility, we choose to report a variety of relationships between the two variables. For each of the three measures of business volatility, we report both OLS and instrumental variable estimates. IV seemed advisable since the pace of integration may itself depend

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employees. We drop Delaware and South Dakota as these two states' banking sectors are dominated by credit card banks due to their liberal usury laws. See Jayaratne and Strahan, 1999 for details.

on volatility. As our instrument, we use a dummy variable equal to zero before a state allowed interstate banking agreement, and one after. We report results using the squared deviation in each of the three business measures as a dependent variable (volatility), and the log of the squared deviations (log volatility). Logging seemed advisable to ensure our results were not driven by outliers. Since the employment volatility will obviously depend on labor force compositions, we also control for the share of employment in each one digit SIC sector (manufacturing, services, etc.) and employment concentration (the sum of the squared shares). We report results with and without the employment controls. In all specifications we control for the year and state, so the resulting fixed effect estimates reveal how increased integration within a state in a given year is related to volatility within the same state and year. [11]

Table 3 reports the estimated coefficient estimates on the banking integration variable for various specifications. All but one of the estimates are negative, suggesting that integration has, on net, a stabilizing influence on state business volatility. The coefficient is statistically significant in many cases, most especially for total employment volatility (Panel A). The IV coefficient estimates are considerably larger than the corresponding OLS estimates, implying that the stabilizing influence of integration is larger (if less precisely estimated) when we use the deregulation dummy variables to parcel out the endogenous variation in integration. Controlling for state's labor force

[11] But other important changes occurred during the 1980s, such as rapid adoption of sophisticated financial models and increased use of securitization, not just for residential mortgages but also for consumer loans, commercial real estate loans and even commercial and industrial loans (Mishkin and Strahan, 1999). These new technologies seem to have increased the efficient scale in banking and may be responsible, in part, for greater integration. For an exhaustive review of the causes and consequences of financial consolidation in the U.S., see Berger, Demsetz and Strahan (1999).

composition also tends to increase the size and significance of the integration coefficient, at least for the two employment volatility measures (Panels A and B).

The IV estimates (with employment controls) imply a substantial stabilizing benefit from integrating bank assets across states. The share of integrated bank assets rose from 10 percent in 1975 to 60 percent in 1996, implying a reduction in state employment growth volatility of .2 percent, a large number compared to mean employment volatility over the sample (.04 percent)

The significance levels trail off as we move to narrower business activity measures. For business loans, the insignificance may be due to the short, noisy series we have available. Integration and volatility of small firm employment growth are significant for half of the estimates. The weaker results here are harder to explain, as the data are better and we have more of it.

Integration and Convergence

If integration dampens idiosyncratic fluctuations in growth within states, as our results suggest, we would expect the national or systematic component of state growth to increase with integration. As banks branch out across the nation, in other words, state business fluctuations become smaller but more alike. To investigate, we calculated the absolute deviation in employment growth in each state from the national average each year:

$$|x_{it} - \sum_{i=1}^{49} x_{it} / 49|$$

where x = total state employment growth or employment growth at certain sized, smaller firms.[12] This deviation measure for each state-year was regressed on the integration used before; the share of state i bank assets in t held by non-state i bank holding companies. All regressions included fixed effects (state and year), and if indicated, controls for state employment composition and concentration. Both OLS and IV coefficients were estimated, where the instruments were the year of and years since a state entered an interstate banking agreement.

Integration is associated with convergence in state business cycles toward the national average (Table 4). For total employment (Panel A), *Integration* enters every specification with a negative and significant coefficient. Controlling for state employment composition and concentration makes the coefficient more negative, sensibly, as differences in employment composition must certainly reflect the deviations between state and national growth rates.[13] Also sensible is the large difference between the IV and OLS estimates; the bias in the OLS estimates presumably reflects that states with below average growth, and the banking problems attending such recessions, may attract out-of-state bank buyers. IV parcels out this endogenous component, hence the larger coefficients. Panels B and C show that the IV estimates are also significant when we examine only deviations from average among smaller firms. Note, however, that the coefficients do not change monotonically as one might expect; the coefficient is larger for firms with under 50 workers (panel C) than for firms with under 20 (Panel B), whereas one might expect more convergence among the smaller, more bank dependent firms.

[12] The sum goes to 49 because DE and SD are excluded (due of credit card banks) while DC is included.

[13] Deviations from average growth were larger, for example, for states with larger than average construction sectors, while those with large financial sectors were closer to average.

Perhaps we are asking too much of the data when we split it so finely. We have found, for example, that when we split the data at firms with more than 100 or more workers, integration has no effect (to be added). Broadly speaking, then, integration seems to promote convergence only among smaller firms.

VI. Conclusion

The U.S. used to have essentially 50 banking systems, one in every state. With deregulation over the last twenty-five years, we have moved toward a more integrated, national banking system with holding companies operating banks in many different states. As a theoretical matter, the impact of cross-state banking on business volatility is ambiguous, as integration immunizes borrowers from shocks to their own banks but exposes them to shocks in other states. Empirically, integration seems stabilizing on net; employment growth fluctuations in a state diminish as its banks commingle with other states' banks. The results are less significant with narrower measures, but the signs are the same, suggesting that the fragmented U.S. banking system before the mid-1980s was, in all likelihood, a source of state business volatility. Integration also promotes convergence across states; deviations in employment growth from the national average tend to fall as integration increases. State business cycles are becoming smaller, in other words, but more alike. As the French say: the more things change, the more they stay the same.

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Appendix: Interstate Banking in the HT Model Equilibrium

The optimal investment (*I)* and liability mix are determined by

$$A_0 + I\frac{p_H c}{b\Delta p} + I\frac{p_H}{g}\left(R - \frac{b+c}{\Delta p}\right) = I\,.$$

The first term represents the firm's own contribution, the second term represents the demand for informed capital and the third term represents the demand for uninformed capital. Aggregating across firms (who all choose identical programs) yields the economy-wide equilibrium. Let Kf be the aggregate amount of firm capital, Km the aggregate amount of informed capital, and Ku the aggregate supply of uninformed capital. The first two are fixed, while the third is determined so that the demand for informed capital equals the supply of uninformed capital $S(g) = s + tg$. Let $g(Ku)$ be the inverse supply function. The equilibrium in the market for uninformed capital requires

$$(1)\quad p_H(Kf + Km + Ku)\left(R - (b+c)/\Delta p\right) = g(Ku)Ku\,.$$

The equilibrium rates of return in the two capital markets are

$$(2)\quad g(Ku) = p_H K\left(R - (b+c)/\Delta p\right)/Ku$$

$$(3)\quad b = p_H cK/(Km\Delta p)\,,$$

where $K = Kf + Km + Ku$ *is the total amount of capital invested.*

Now suppose there are two states. Under unit banking (i.e., before interstate banking was allowed), and assuming capital cannot move across states, the above equilibrium holds in each state. Interstate banking changes the equilibrium in two ways. Assuming capital *can* move freely across states to equalize the return to uninformed savers in the two states, there will be a single, aggregate (statewide) inverse supply of uninformed capital

(i) $\qquad g(Ku_1, Ku_2) = -(s_1 + s_2)/(t_1 + t_2) + (Ku_1 + Ku_2)/(t_1 + t_2)\,.$

Secondly, the shares p_1 and (1-p_1) of aggregate informed capital Km_1+Km_2 invested in each state adjust endogenously to equalize the return on informed capital across states. Assuming complete capital immobility under unit banking and completely mobile capital under interstate banking is extreme, of course. All we really need for the results below is that capital is *more* mobile under interstate banking than under unit banking, which seems innocuous.

Equilibrium in the uninformed capital market under interstate banking requires

$$(4)\quad p_H\left(Kf_1+\boldsymbol{p}_1(Km_1+Km_2)+Ku_1\right)\left(R-(b+c)/\Delta p\right)=g(Ku_1,Ku_2)Ku_1$$

$$(5)\quad p_H\left(Kf_2+(1-\boldsymbol{p}_1)(Km_1+Km_2)+Ku_2\right)\left(R-(b+c)/\Delta p\right)=g(Ku_1,Ku_2)Ku_2.$$

The equilibrium rates of return are:

$$(6)\, g(Ku_1,Ku_2)=p_HK_1\left(R-(b+c)/\Delta p\right)/Ku_1=p_HK_2\left(R-(b+c)/\Delta p\right)/Ku_2$$

$$(7)\; \boldsymbol{b}=p_HcK_1/\left(\Delta p\boldsymbol{p}_1(Km_1+Km_2)\right)=p_HcK_2/\left(\Delta p(1-\boldsymbol{p}_1)(Km_1+Km_2\right).$$

Proof of proposition 1:

In the unit banking case, the derivative of Ku_1 with respect to s_1 is

$$\frac{\partial Ku_1^u}{\partial s_1}=\frac{1}{2}\left(1+\frac{p_Ht_1(-b-c+R\Delta p)+s_1\Delta p}{\sqrt{-4\Delta p(Kf_1+Km_1)p_Ht_1(b+c-R\Delta p)+\left(p_Ht_1(b+c-R\Delta p)-s_1\Delta p\right)^2}}\right)$$

$\partial Ku_1^u/\partial s_1$ is positive, since the positiveness of the payment promised to uninformed investors, $Rm=K(R-(b+c)/\Delta p)>0$, implies $p_H(-b-c+R\Delta p)>0$.

In the interstate banking case, the derivative of Ku_1 with respect to s_1 is

$$\frac{\partial Ku_1^i}{\partial s_1}=\frac{1}{4}\left(1+\frac{p_Ht_1(-b-c+R\Delta p)+s_1\Delta p}{\sqrt{-4\Delta p(Kf_1+Km_1)p_Ht_1(b+c-R\Delta p)+\left(p_Ht_1(b+c-R\Delta p)-s_1\Delta p\right)^2}}\right)$$

under the symmetry conditions $Kf_1 = Kf_2$, $Km_1 = Km_2$, $t_1 = t_2$ and $s_1 = s_2$ at initial values.

Under the above mentioned symmetry conditions, $\partial Ku_1^u / \partial s_1$ is twice as large as $\partial Ku_1^i / \partial s_1$

Proof of proposition 2:

For the unit banking case, the derivative of Ku_1 with respect to Km_1 is

$$\frac{\partial Ku_1^u}{\partial Km_1} = \frac{p_H t_1(-b-c+R\Delta p)}{\sqrt{-4\Delta p(Kf_1+Km_1)p_H t_1(b+c-R\Delta p)+\left(p_H t_1(b+c-R\Delta p)-s_1\Delta p\right)^2}}$$

$\partial Ku_1^u / \partial Km_1$ is positive.

For the interstate banking case, the derivative of Ku_1 with respect to Km_1 is

$$\frac{\partial Ku_1^i}{\partial Km_1} = \frac{p_H t_1(-b-c+R\Delta p)}{2\sqrt{-4\Delta p(Kf_1+Km_1)p_H t_1(b+c-R\Delta p)+\left(p_H t_1(b+c-R\Delta p)-s_1\Delta p\right)^2}}$$

under the above mentioned symmetry conditions.

$\partial Ku_1^u / \partial Km_1$ is twice as large as $\partial Ku_1^i / \partial Km_1$.

Proof of proposition 3:

For the unit banking case, the derivative of Ku_1 with respect to Kf_1 is

$$\frac{\partial Ku_1^u}{\partial Kf_1} = \frac{p_H t_1(-b-c+R\Delta p)}{\sqrt{-4\Delta p(Kf_1+Km_1)p_H t_1(b+c-R\Delta p)+\left(p_H t_1(b+c-R\Delta p)-s_1\Delta p\right)^2}} .$$

$\partial Ku_1^u / \partial Kf_1$ is positive.

For the interstate banking case, the derivative of Ku_1 with respect to Kf_1 is equal to

$$\frac{\partial Ku_1^i}{\partial Kf_1} = \frac{s_1\Delta p + t_1 p_H(-b-c+R\Delta p)}{4\Delta p Kf_1} +$$
$$\frac{Kf_1 t_1\left(p_H(b+c-R\Delta p)\left(p_H(b+c-R\Delta p) - 2\Delta p(3Kf_1+2Km_1)/t_1\right) + \Delta p^2 s_1^2/t_1^2 - 2p_H s_1\Delta p(b+c-R\Delta p)\right.}{4\Delta p\sqrt{Kf_1^4\left(\left(p_H(b+c-R\Delta p) - s_1\Delta p/t_1\right)^2 - 4\Delta p(Kf_1+Km_1)p_H(b+c-R\Delta p)/t_1\right)}}$$

under the above mentioned symmetry conditions. $\partial Ku_1^i/\partial Kf_1$ is positive.

The difference between the two derivatives is[14]

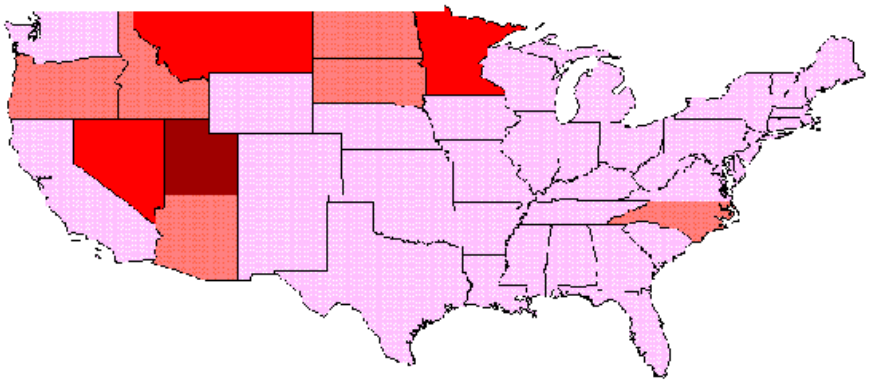
$$\frac{\partial Ku_2^i}{\partial Kf_1} - \frac{\partial Ku_2^u}{\partial Kf_1} = \frac{s_1\Delta p + t_1 p_H(-b-c+R\Delta p)}{4\Delta p Kf_1} +$$
$$\frac{Kf_1 t_1\left(p_H(b+c-R\Delta p)\left(p_H(b+c-R\Delta p) - 2\Delta p(Kf_1+2Km_1)/t_1\right) + \Delta p^2 s_1^2/t_1^2 - 2p_H s_1\Delta p(b+c-R\Delta p)/t\right.}{4\Delta p\sqrt{Kf_1^4\left(\left(p_H(b+c-R\Delta p) - s_1\Delta p/t_1\right)^2 - 4\Delta p(Kf_1+Km_1)p_H(b+c-R\Delta p)/t_1\right)}}$$

$\partial Ku_2^i/\partial Kf_1 - \partial Ku_2^u/\partial Kf_1$ is positive.

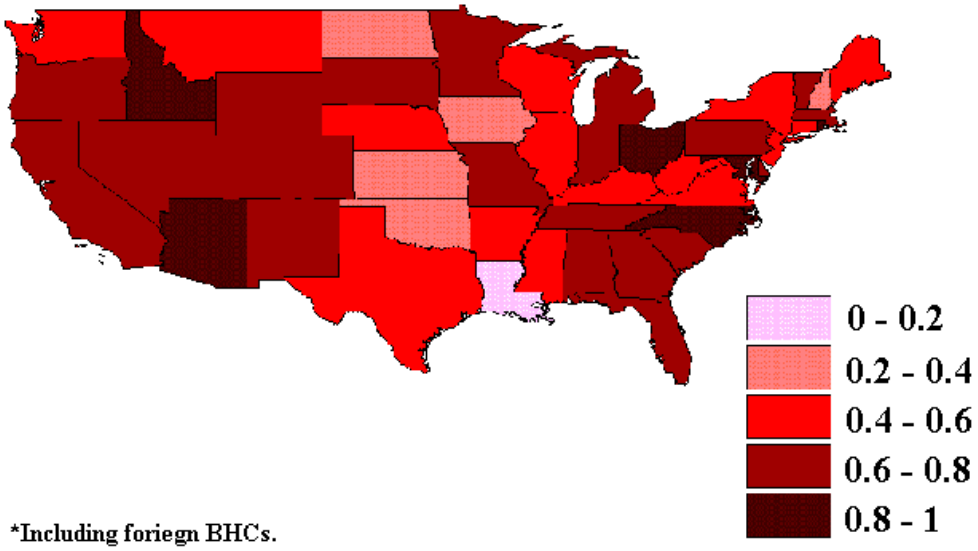
[14] Since we assume symmetry between the two states, $\partial Ku_2^i/\partial Kf_1 - \partial Ku_2^u/\partial Kf_1$ is equivalent to $-\partial Ku_2^i/\partial Kf_1$ or $-\partial Ku_1^i/\partial Kf_2$. This provides a direct and convenient way for computing the difference between the two derivatives.

Percent of Assets in Each State Held by Banks Affiliated with Out-of-State Bank Holding Companies*

1975



1995



*Including foriegn BHCs.

Table 1: Savings, Capital, and Collateral Shocks Under Unit Banking and Interstate Banking

Panel A : Savings squeeze in state 1

Unit banking: State 1	Interstate banking: State 1	State 2
scarce uninformed capital ⇓ **8** return on uninformed capital ⇓ decrease in the amount of uninformed capital firms can attract	scarce uninformed capital in state 1 ⇓ 8 return on uninformed capital in state 1 ⇓ uninformed capital flows from state 2 ⇓ return on uninformed capital in state 1 increases less than with UB ⇓ this mitigates the negative impact on the amount of informed capital firms can attract in state 1	⇒ ⇓ return on informed capital increases in state 2 ⇓ negative impact on the amount of uninformed firms in state 2 can attract

Panel B: Capital crunch in state 1

Unit banking: State 1	Interstate banking: State 1	State 2
intermediary capital becomes more scarce ⇓ return on informed capital increases and monitoring activity decreases ⇓ decrease in the amount of uninformed capital firms can attract	intermediary capital becomes more scarce in state 1 ⇓ return on informed capital increases ⇓ intermediary capital attracted from state 2 ⇓ state 1 monitoring activity decreases less than with UB ⇓ this mitigates the negative impact on the amount of uninformed capital firms can attract in state 1	⇒ ⇓ monitoring activity decreases in state 2 ⇓ negative impact on the amount of uninformed capital firms can attract in state 2

Panel C: Collateral squeeze in state 1

Unit banking: State 1	Interstate banking: State 1	State 2
firm capital becomes scarcer ⇓ inward shift of the demand for uninformed capital ⇓ returns on informed and intermediary capital have to decrease ⇓ this mitigates the decrease in the quantity of uninformed capital demanded by firms	firm capital scarcer in state 1 Y 9 demand for uninformed capital in state 1 ⇓ state 1 return on intermediary and uninformed capital must ⇓ capital flees to state 2 Y return on uninformed and intermediary capital in state 1 decreases less than with UB ⇓ quantity of uninformed capital demanded by state 1 firms 9 more than with UB	⇒ ⇓ returns on informed and intermediary capital decrease in state 2 ⇓ increase in the quantity of uninformed capital demanded by firms in state 2

Table 2
Bank Integration and Business Volatility Measures: Summary Statistics
Statistics calculated using number of state-year observations indicated. Integration = share of bank assets in each state held by banks affiliated with out-of-state bank holding companies. Volatility of x is the deviation in the annual growth rate of x from the mean for each state (across years) and mean across states (each year), where x = total state employment, small firm employment, and commercial loans (business and real estate) by banks.

	Observations	Mean	Standard Deviation
Integration	1078	0.351	0.281
A. Employment			
Growth (annual)	1078	0.022	0.023
Volatility	1078	$3.5e^{-4}$	0.001
Log Volatility	1078	-9.683	2.440
B. Small Firm Employment			
	Observations	Mean	Standard Deviation
Growth (annual)	931	1.029	0.046
Volatility	931	0.002	0.018
Log Volatility	931	-9.858	2.334
C. Business Loan Growth			
	Observations	Mean	Standard Deviation
Growth (annual)	588	1.074	0.142
Volatility	588	0.016	0.054
Log Volatility	588	-5.941	2.212

Table 3

Cross-State Banking Integration and State Business Volatility Regression Coefficients

"Integration" = share of state i bank assets held by non-state i bank holding companies. "Volatility" = squared deviation in growth of business measure *X* from average X for each state and each year. *X* = total state employment (panel A), small firm employment (panel B), or business loans at banks (panel C). Coefficients estimated with state-year observations over 1975-96 (robust standard errors in parenthesis). All models include state and year fixed effects and, if indicated, controls for state employment composition (single digit SIC sector shares) and concentration (sum of squared SIC sector shares). Business volatility tend to diminish as cross-state bank integration increases.

A. Total Employment Growth

	OLS Estimates				IV Estimates			
	Volatility		Log (Volatility)		Volatility		Log (Volatility)	
Employment Controls	N	Y	N	Y	N	Y	N	Y
Integration	-0.000	-0.001**	-1.107*	-1.577**	-0.002**	-0.004**	-1.368	-2.424
	(0.000)	(0.000)	(0.503)	(0.581)	(0.001)	(0.001)	(1.451)	(1.603)
R^2: Within	0.042	0.256	0.080	0.112				
Between	0.002	0.365	0.067	0.135	_	_	_	_
Overall	0.034	0.120	0.047	0.075				
Observations[2]	1078	1007	1078	1007	1078	1007	1078	1007

B. Small Firm Employment (<19)

	OLS Estimates				IV Estimates			
	Volatility		Log (Volatility)		Volatility		Log (Volatility)	
Employment Controls	N	Y	N	Y	N	Y	N	Y
Integration	-0.003	-0.007	-1.158**	-1.493*	-0.017	-0.023	-2.704	-4.616**
	(0.004)	(0.005)	(0.531)	(0.603)	(0.013)	(0.015)	(1.656)	(1.786)
R^2: Within	0.020	0.045	0.104	0.118				
Between	0.001	0.430	0.016	0.059	_	_	_	_
Overall	0.016	0.042	0.090	0.007				
Observations[2]	931	884	931	884	931	884	931	884

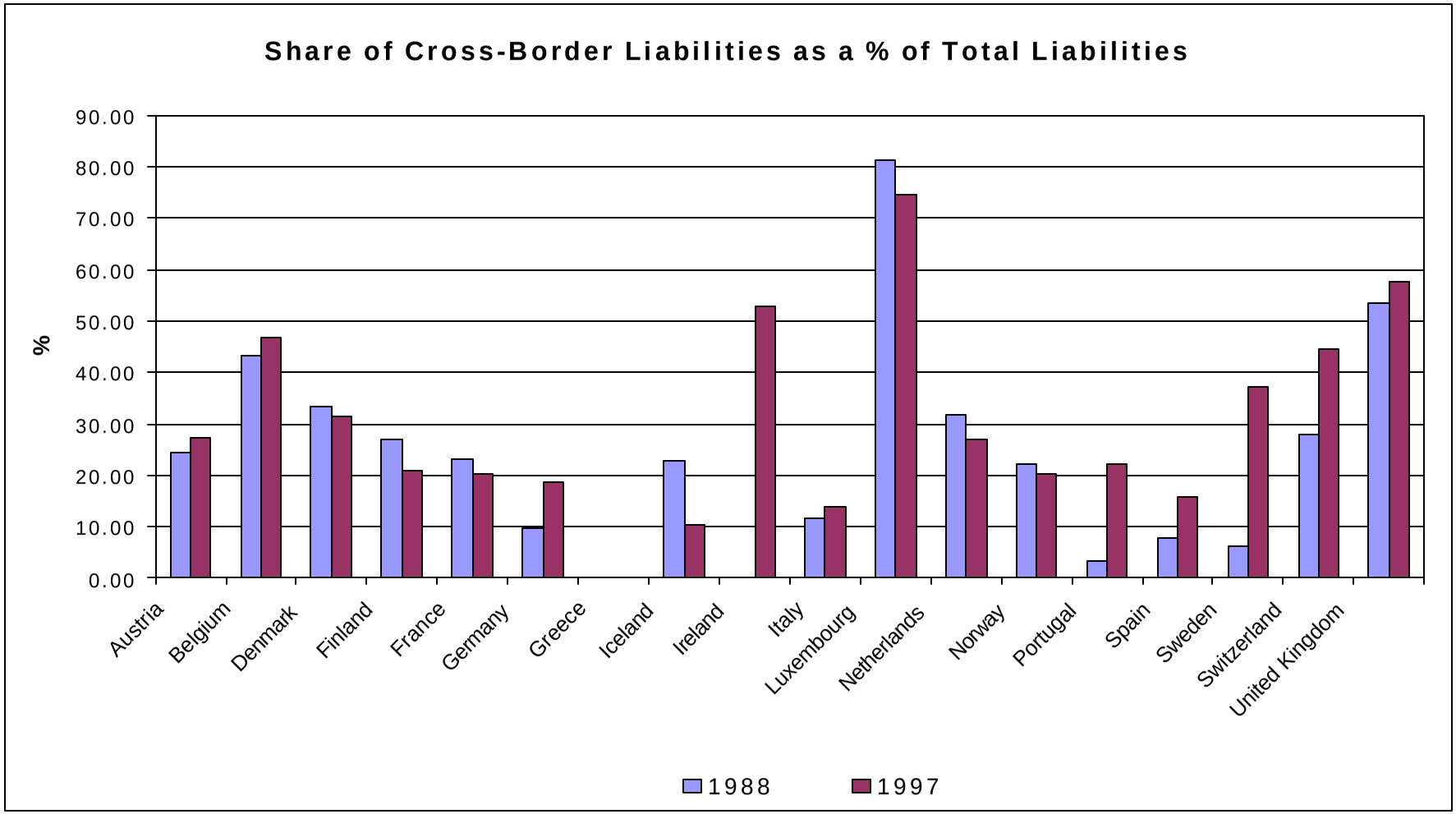
C. Commercial Loans of Banks

	OLS Estimates				IV Estimates			
	Volatility		Log (Volatility)		Volatility		Log (Volatility)	
Employment Controls	N	Y	N	Y	N	Y	N	Y
Integration	-0.053**	-0.040*	-1.502	-0.679	-0.090	-0.064	-1.636	2.113
	(0.020)	(0.020)	(0.800)	(0.791)	(0.051)	(0.050)	(2.048)	(1.978)
R^2: Within	0.101	0.138	0.085	0.153				
Between	0.083	0.028	0.000	0.075	_	_	_	_
Overall	0.034	0.014	0.053	0.027				
Observations[2,3]	588	576	588	576	588	576	588	576

* significant at 5% level ** significant at 1% level

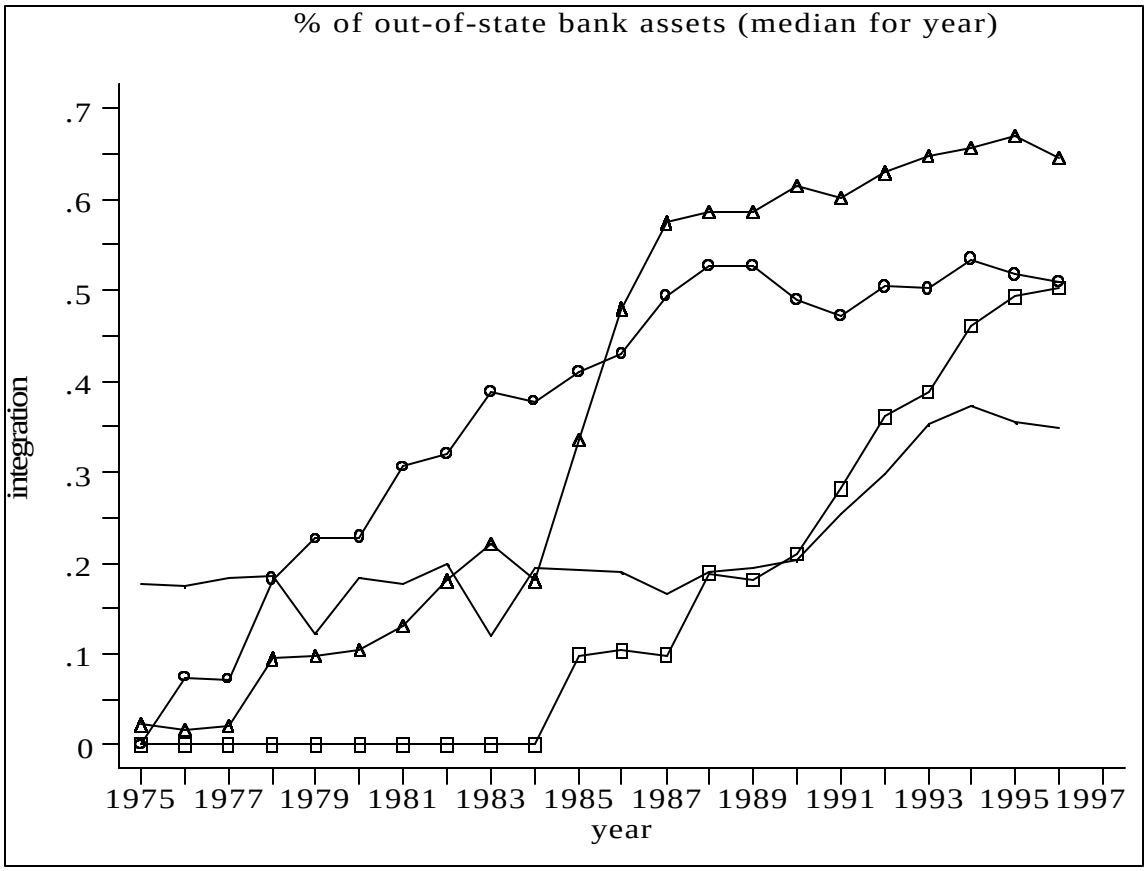
1. Controls: D.C. included. DE and S.D. excluded due to presence of national credit card banks in those states.
2. Commercial Loan data available from 1985-1996.

Chart 1: Cross-Nation Bank Liabilities in Europe (1988 and 1997)



Source: Bank of International Settlements

Chart2: Cross-State Banking Waves



Interstate banking agreements occurred in waves between 1982 and 1993. States were grouped by the year that they entered into an agreement. Plotted for each wave is the median share of out-of-state banking assets for states in each wave.

o: 1982-1984 wave
Δ: 1985-1987 wave
□: 1988-1990 wave
: 1991-1993 wave

Table 4: Bank Integration and State Business Cycle Convergence

Reported are regression coefficients and standard errors (in parenthesis). Dependent variable equals absolute deviation in state i employment growth in year t from national average in year t (excluding DE and SD): $| x_{it} - \sum_{i=1}^{49} x_{it} / 49 |$ where x = total state employment growth (panel A), growth in employment at firms with less than 20 employees (Panel B), and growth in employment at firms with less than 50 employees (panel C). Primary independent variable, *Integration*, equals share of state i bank assets held by non-state i bank holding companies. Coefficients estimated with state-year observations over 1975-96. All regressions include state and year fixed effects. If indicated, regressions also include share of employment in each SIC sector (single digit) and the sum of squared shares. Negative coefficient on *integration* indicates that deviations in state employment growth fluctuations from national average fall as integration increases.

A. Total Employment Growth

	OLS Estimates		IV Estimates	
Employment Controls	N	Y	N	Y
Integration	-0.009**	-0.014**	-0.022**	-0.042**
	(0.003)	(0.003)	(0.008)	(0.008)
R^2: Within	0.103	0.220		
Between	0.035	0.322	–	–
Overall	0.055	0.167		
Observations	1078	1007	1078	1007

B. Growth in Employment at Firms with Less than 20 Employees

	OLS Estimates		IV Estimates	
Employment Controls	N	Y	N	Y
Integration	-0.006	-0.004	-0.029*	-0.036*
	(0.005)	(0.005)	(0.014)	(0.015)
R^2: Within	0.083	0.124		
Between	0.002	0.341	–	–
Overall	0.066	0.118		
Observations	930	883	930	883

C. Growth in Employment at Firms with Less than 50 Employees

	OLS Estimates		IV Estimates	
Employment Controls	N	Y	N	Y
Integration	-0.005	-0.010	-0.058**	-0.080**
	(0.006)	(0.007)	(0.019)	(0.021)
R^2: Within	0.066	0.106		
Between	0.001	0.349	–	–
Overall	0.053	0.122		
Observations	917	871	917	871

*significant at 5% level ** significant at 1% level.

Note: D.C. included; DE and S.D. excluded due to presence of national credit card banks in those states.