Factors Behind the Convergence of Economic Performance Across U.S. States

Keith R. Phillips, James Nordlund,
and Roberto Coronado

Research Department
Working Paper 1108

Federal Reserve Bank of Dallas

Factors behind the Convergence of Economic Performance across U.S. States

Keith R. Phillips, James Nordlund, Roberto Coronado[1]

Federal Reserve Bank of Dallas

Abstract The rolling recessions of the 1970s and 1980s were characterized by industry and region specific shocks that led to large dispersions in the economic performance of regions across the U.S. The 1970s were primarily impacted by sharply rising energy prices that hit the manufacturing states hard while stimulating growth in the energy states. The 1980s began with declines in the Farm Belt, followed by declines in the Energy Belt, the Rust (manufacturing) Belt, and finally, due to declines in defense spending, a decline in the Gun Belt. Simple measures of regional dispersion such as the population- weighted variance of job growth across states show that the economic dispersion was historically high during these two decades. The 1990s saw a continuous decline in regional economic dispersion and the 2000s has seen historically low levels of dispersion. Perhaps the biggest surprise this decade has been the low levels of dispersion of economic performance over the past several years given the significant energy price shocks and the depth of the national economic recession. In this paper, we look at the likely causes of economic dispersion across regions and test for the major influences both in the rise of dispersion in the 1970s and 1980s and the subsequent fall in the 1990s and 2000's. Major factors that we test include state industrial structure, oil prices shocks, and bank integration.

Regional growth; banking; industry diversification

JEL Classification R11, G21

---

[1]Keith R. Phillips is a Senior Research Economist and Advisor for the Federal Reserve Bank of Dallas, Roberto Coronado is a Senior Business Economist. James Nordlund was research assistant at the Federal Reserve Bank of Dallas when this article was written. The authors thank Kelly Klemme for help in compiling the bank integration variable based on bank deposits, as well as Howard Wall and the participants of the October 2009 meetings of the Federal Reserve System Committee on Regional Analysis.

Corresponding author: Keith R. Phillips, Tel: +1 210 978 1409, E-mail: keith.r.phillips@dal.frb.org.

Introduction

In recent years, there has been a growing interest in the dampening of the business cycle in the U.S. from the early 1980s up until the most recent recession. This period, termed the Great Moderation, was marked by reductions in the variance of a wide range of U.S. macroeconomic variables. Studies at the regional level have also noted a moderation in the business cycles of U.S. states. Along with this literature has been a significant amount of research on the co-movement of industry sectors within and across U.S. states. Most of this research has found positive cohesion in sectors across states and within states, although the degree of the cohesion differs across the studies. Finally, another related series of studies has looked at the impact of interstate banking – and, more generally, the increased regional integration of U.S. banking since the late 1980s – and how it has affected the feedback between real and financial shocks at the regional level and more broadly its impact on state business cycles.

In this study, we focus on a narrow but interesting element of regional growth dynamics. We focus on the variance of economic performance across states. As shown in Chart 1, the weighted variance across states of year-over-year job growth has fluctuated since the early 1960s but in general was relatively low in the 1960s, high in the in the 1970s and early 1980s and then began a pronounced decline particularly in the 1990s and has been historically low in the 2000s. Even with the sharpness and length of the 2008-2009 recession, the variance of job growth across states has remained low relative to the 1970s and 1980s.

The variance of economic performance across states can have important implications for national unemployment and policy. For any given growth rate in the national economy, higher geographic dispersion of this growth yields greater frictional unemployment since search time will increase due to information and mobility costs. Moreover, policymakers face decisions that are more difficult when regions of the economy face different economic situations. For example, if the energy or manufacturing states are declining and the rest of the nation is growing, the Federal Reserve may face more difficult decisions about monetary policy than if all areas are performing similarly.

Literature Review

This paper is related to several different areas of regional research. One area of research looks at how the business cycle in one state or region is impacted by or related to the business cycle in other states or regions. Carlino and DeFina (2004) give a good summary of the literature on this topic. Primarily papers have looked at how rates of growth in output and/or employment are related across states in total and for different industry sectors. Carlino and DeFina point out that most of these studies find important positive relationships in industry job growth across states. They add to the literature in their survey by first factoring out the business cycle movements in the data and then using the appropriate measure of cohesion to quantify the degree of cyclical co-movement. They give evidence of strong positive business cycle cohesion for given sectors across states and positive but smaller cohesion of different sectors with the same state. They also show that cohesion in state/sector pairs and cohesion within states increased from the 1942 to 1968 period to the 1969 to 1995 period and that factors that have influenced business cycle cohesion in the states include the share of jobs in manufacturing, sensitivity to monetary policy shocks and industry diversity.

Morgan, Rime and Straham (2003) (MRS) looked at the impact of regional bank integration in the U.S. and its implications for state business cycles. They note that the spread of interstate banking in the 1980s and early 1990s could have led to either increased or reduced volatility since it dampens the impact of bank capital shocks but amplifies the impact of firm collateral shocks. They find that the impact of bank integration from 1976 to 1994 resulted in a dampening of state business cycles and that the impact was greater for states with highly concentrated industries and for smaller states. More recently, Keeton (2009) uses micro data on bank lending and finds that growth in multi-market lending has reduced the sensitivity of local lending to local economic shocks, thus giving support to the MRS findings.

Owyang, Piger and Wall (2008) (OPW) use employment to model the business cycle for each of the 50 U.S. states and the District of Columbia. They then test for structural breaks in which the volatility of the employment falls. They divide the reduction in job growth variance into cyclical dampening and reductions in state idiosyncratic residual variances. They find evidence of a structural break in employment growth volatility in all but six states and the District of Columbia. Given the differing magnitudes of the breaks and the size of states, they found that seven states accounted for about 42 percent of the decline in aggregate volatility. The authors take advantage of differences in the timing and magnitudes of state-level volatility reductions to examine key hypothesis about causes of the moderation in state business cycles and thus the moderation of the U.S. business cycle. A key finding of the study is that states with higher shares of durable goods employment saw the biggest declines in their volatility. They find little evidence that bank integration played a role in the moderation of sate business cycles.

Data

3.1 Measuring Differences in State Economic Performance

While this study is related to the previous studies on state business cycles, it is more narrowly focused on the variation of job growth across states over time. Much research has been done to identify factors associated with the Great Moderation, a national trend in the dampening of job growth variance. It is also important to question how state economic performance has changed over time and what factors were likely responsible for these changes. For example, more similar performance across the states may make national economic policy more targeted and more straightforward to implement.

To address such questions, we construct a dependent variable that expresses each state's December over December job growth relative to the national average. We thus define the dependent variable of our model to be:

$$\mathbf{v}_{r,t} = \left[100\left(\frac{e_{r,t}}{e_{r,t-1}}\right) - 100\left(\frac{e_{n,t}}{e_{n,t-1}}\right)\right]^2,$$

which simplifies to

$$\mathbf{v}_{r,t} = \left[100\left(\frac{e_{r,t}}{e_{r,t-1}} - \frac{e_{n,t}}{e_{n,t-1}}\right)\right]^2,$$

where $\mathbf{e}_{r,t}$ is the employment level of state *r* at time *t* and $\mathbf{e}_{n,t}$ is the employment level of the nation at time *t*. Note that in order to prevent larger states from having more influence on average employment growth – thus potentially reducing their apparent variance of job growth – we use an unweighted average of job growth. This measure is estimated annually for each of the 46 states in our sample for the period 1976 to 2009 (Alaska, Delaware, Hawaii, and South Dakota are excluded due to missing data in key explanatory variables).

A notable difference between this and the aforementioned studies is that we make no effort to isolate business cycle movements from changes in trend rates of growth – both may contribute to the changes in the variance of job growth across states. It is also true that business cycles across states can moderate and/or become more cohesive and yet at the same time the variance of job growth across states could stay the same or increase.

3.2 Explanatory Factors

We employ several variables to explain the variance of job growth across states. They are each discussed here, with a justification for their inclusion. We utilize both time series (national) and panel (state-level) data to allow both national and state-level factors to influence our model.

3.2.1 INDUSTRY DIVERSIFICATION

We examine several factors that may play a role in the variance of job growth across states. The first variable is a measure of state industry diversification. As the industrial structure of states become more similar it is likely that their growth rates will also behave in a more similar fashion. One well-known pattern in the U.S. since the 1960s is the Sunbelt effect in which manufacturing has spread more evenly across the country after being heavily concentrated in the Northeast and Midwest. Using annual employment data by state since 1976, diversification is measured by calculating the difference between state and national employment shares and then subtracting the square root of the sum of squared differences from one:

$$\mathbf{d}_{r,t} = 1 - \sqrt{\sum_{i=1}^{10} (\mathbf{s}_{i,r,t} - \mathbf{s}_{i,n,t})^2}$$

where *s* is the employment share, *i* represents the ten broad sectors of employment[2], *r* represents the state, and *n* is the nation. If a state has exactly the same employment share as the nation, this measure is equal to one. As a state's employment share by sector becomes less similar to the nations this measure approaches zero.

This measure of industrial diversity follows an approach described by Malizia and Ke (1993). The authors note that previous papers had only considered state diversification specific to unstable industries. Under the hypothesis that states with more industrial diversification should have more stable economic growth, considering only unstable industries merely allows us to test whether states with employment concentrated in such industries have higher growth instability. The authors suggest that, under the

---

[2] The ten broad sectors are farming, mining, construction, manufacturing, transportation, wholesale trade, retail trade, FIRE (finance, insurance, and real estate), services, and government. These broad categories are used due to computational simplicity. Moreover, while employment measurement definitions changed from the Standard Industrial Classification to the North American Industry Classification System, the broad industry classifications were less impacted. During the SIC and NAICS overlap period (1990-2001), the average of the two values is used.

above hypothesis, if we wish test whether diversity (rather than simply a specialization in more volatile industries) yields stability because, for example, different industries will experience different fluctuations at different times, we should consider all broad industries in our analysis. We also recognize that the selection of only unstable industries over a given time period is subject to the opinions of the researcher.

Over time, the industrial structure of states has become increasingly similar. This trend is made apparent in Chart 2, where we present both the average state industrial diversification measure and a one standard deviation bound Not only does the average measure of diversification appear to rise, but states' variance in the degree of diversification also appears to be converging. We hypothesize that states with an industrial structure closer to the national industrial structure will have smaller deviations in job growth from the national average than states with more industry specialization than the nation. This is a rather intuitive argument; for example, states with a higher than average concentration in the oil industry will likely be more positively affected by a jump in oil prices than will other states.

3.2.2 OIL PRICE SHOCKS

A second variable we examine is a measure of oil price shocks. It is well known that oil price shocks have played an important role in the macroeconomic fluctuation in the U.S. economy since the early 1970s. Because energy-producing states benefit from increases in energy prices while states that are heavy users of energy can be sharply negatively impacted, energy price shocks can have important impacts on the variance of job growth across states. While positive real oil prices shocks have a negative impact on U.S. employment growth, we expect that both positive and negative oil price shocks will increase the dispersion of job growth across states. We can see this in chart 1 with jumps in job growth dispersion during the positive oil price shocks of the 1970s and early 1980s as well as the negative price shock in 1986. We use a modified form of net oil increases over three years as defined by Hamilton (2003) for a measure of positive oil price shocks:

$$\mathbf{oil}_t^+ = \begin{cases} \mathbf{oil}_t, & \mathbf{oil}_t > \max\{\mathbf{oil}_{t-1}, \mathbf{oil}_{t-2}, \mathbf{oil}_{t-3}\} \\ 0, & \text{otherwise} \end{cases},$$

where $\mathbf{oil}_t$ is the real oil price at year *t*. Hamilton, however, considers $\mathbf{oil}_t - \max\{\mathbf{oil}_{t-1}, \mathbf{oil}_{t-2}, \mathbf{oil}_{t-3}\}$ for $\mathbf{oil}_t > \max\{\mathbf{oil}_{t-1}, \mathbf{oil}_{t-2}, \mathbf{oil}_{t-3}\}$. We choose to keep our data in levels because relative regional employment growth may be affected by both a sudden change in oil prices as well as the level at which the sudden price change occurs. For example, oil prices may rise over a given three-year period, but if the price level is still low, new drilling may not occur. On the other hand, a price shock that launches the price of oil above some threshold level will attract new drilling and increase employment.

Note that Hamilton defines this measure for quarterly data. In a quarterly model, $\mathbf{oil}_q^+$ would be equal to $\mathbf{oil}_q$ for quarter *q* if it exceeded the maximum price level of $\mathbf{oil}_{q-1}$ through $\mathbf{oil}_{q-12}$ (and would be zero otherwise). However, we do not have the luxury of quarterly data for all of our explanatory variables, and thus we use an annual measure of oil price shocks. To maintain a similar measure as Hamilton, we take the average monthly oil price to be the annual oil price and then calculate our oil price shocks as defined above.

In this measure for positive oil price shocks, the price level, as well as its relative price to the previous three years, is important. The data series is a sparse vector, and positive oil price shocks at high price levels will have greater magnitude than positive oil price shocks at low price levels. In order to identify negative oil price shocks, we want to find an analog to the positive oil shock measure that considers the price relative to the prior three years as well as to the overall price level. In this case, we wish for negative oil price shocks at low price levels to have greater magnitude. Thus, we calculate negative oil price shocks as:

$$\mathbf{oil}_t^- = \begin{cases} \mathbf{oil}_t^{-1}, & \mathbf{oil}_t^{-1} > \max\{\mathbf{oil}_{t-1}^{-1}, \mathbf{oil}_{t-2}^{-1}, \mathbf{oil}_{t-3}^{-1}\} \\ 0, & \text{otherwise} \end{cases} .$$

Chart 3a and 3b show the calculated oil price shock variable over the period of interest.

Though this model does not distinguish between movements away from the national growth rate in the positive and negative direction, economic intuition would suspect that the positive coefficient on net oil price increases is the result of oil-producing states experiencing a boom during years of high oil prices. Heavy energy consuming states, on the other hand, likely experience job growth below the national average. The opposite can happen when oil prices fall.

3.2.3 BANK INTEGRATION

Another variable that we examine is a measure of bank integration. MRS found that banking integration in the U.S. has reduced business cycle fluctuations in states and that the reduction has not been evenly distributed across states. MRS measured bank integration as the share of total bank assets in a state that are owned by bank holding companies that also hold banking assets in other states. One weakness of this variable is that it is only available annually from 1976 to 1994. Using this data would highly restrict the sample size of the regression. Instead, we choose to consider the share of total bank deposits in a state that are owned by bank holding companies that also have bank deposits in other states. This series is similar to the MRS data series, and we are able to calculate it beginning in 1984. Over the 11-year overlap period, the two series have an average correlation of 0.74. We thus use the MRS series to extend the deposit series back to 1976. Doing this gives a reasonable approximation for what in-state deposit shares were prior to 1984 and provides more information regarding interstate banking prior to the deregulation over the mid-to-late 80s. The use of the MRS series comes at a cost – the panel data set does not include observations for Alaska, Delaware, or South Dakota, and these states thus are removed from the analysis. Given small populations and economies, the effect of losing these states is assumed minimal. As shown in Chart 4, population-weighted and unweighted national series shows a persistent increase in integration, with a large increase in integration over the late 1980s. This jump is consistent with the dates for state deregulation of banking; see MRS for a summary.

3.2.4 RECESSIONS

Finally, we consider the number of months out of a year that are classified as a recession by the National Bureau of Economic Research. We expect variance of job growth across states to be larger during recessions, given that it is generally understood that recessions are caused by different shocks that can have different impacts on different states. As shown in chart 1, recessions seem to have a temporary impact on the dispersion of economic variance. While some of this increase can be attributed to oil price shocks, we include a recession variable to account for the host of other influences that can cause.

Model and Results

We use a panel regression to estimate the relationship between the variance of job growth across states and our explanatory variables. Because we use a non-random cross-section, we include a fixed-effects specification in our model; to control for cross-section heteroskedasticity, we estimate and apply cross-section weights. We use White heteroskedasticity-consistent standard errors. The hypothesized linear model is given by:

$$\mathbf{v}_{r,t} = \beta_0 + \beta_1 \mathbf{d}_{r,t} + \beta_2 \mathbf{oil}_t^+ + \beta_3 \mathbf{oil}_t^- + \beta_4 \mathbf{bank}_{r,t} + \beta_5 \mathbf{rec}_t + \alpha_r \ , + \epsilon_{r,t}$$

where $\mathbf{d}_{r,t}$ is industrial diversification, $\mathbf{oil}_t^+$ is positive oil shocks, $\mathbf{oil}_t^-$ is negative oil shocks, $\mathbf{bank}_{r,t}$ is banking integration, $\mathbf{rec}_t$ counts the number of months in a given year that are included in a recession, and α_t is the fixed effect for each state. The results are presented in Table 1.

As hypothesized, the coefficient on our measure of diversification is negative and statistically significant, suggesting that states with a higher degree of specialization (lower values for $d_{r,t}$) in one or more industries will have a higher squared deviation from the national growth rate than states whose industry diversification more closely matches the nation. It also implies that as diversification has increased overtime, it has led to a reduction in the variance of economic performance.

The positive oil shock variable is significant and positive. This coefficient would suggest that, all else being equal, a relatively large increase in oil prices would increase the variance of job growth across states. The negative oil shock variable is positive but insignificant. Its coefficient is large relative to the positive shock variable, primarily because it is measured as the inverse of the true price.

A significant and negative coefficient for our measure of banking integration gives further credence to results, like those in MRS, that such integration played a meaningful role in the reduction of job variance across states. This result may appear inconsistent with the OPW findings. In actuality, this study and the OPW study use banking deregulation variables to try to explain two very different things. OPW concluded that deregulation of state banking industries over the 1980s could not explain the apparent reduced volatility in employment of most states during the Great Moderation. This paper is not interested in explaining individual variances in growth, but rather the observed convergence of growth rates across states over time. Our results indicate that banking deregulation is indeed useful in explaining this trend. Moreover, we choose to use a measure of bank integration that describes the *degree* to which states utilize interstate banking, as opposed to the date of banking deregulation per state, which was used by OPW. The latter approach suffers from ignoring the amount of interstate banking that occurs. A state may pass a reciprocal banking agreement but then be slow to make use of this new law to bring in outside banks. On the other hand, existing loopholes in the national banking regulations allowed some amount of interstate banking, though only under very specific circumstances, prior to state legalization. Thus, the date of legal banking deregulation may be too late or too early to recognize interstate banking activity. Based on our results, everything else equal, a state with a higher degree of interstate banking will have lower deviations from the national growth rate than a state with less integrated banking. Further, the increased occurrence of bank integration over the past three decades has helped to reduce the variances of economic performance across states. One might speculate that increased banking integration would reduce the occurrence of regional banking crises, though when a banking crisis occurred it would more likely be broadly spread across regions. Certainly, the experience of the past 10 years is consistent with that proposition.

To investigate further the impact of bank integration on the variance of economic performance across states, we multiply the banking integration panel series by the variable's estimated regression coefficient in Table 1 and present the results in Chart 5. Note that the largest effect occurred over the late 1980s, when most states began allowing reciprocal interstate banking agreements. Once banking deregulation had fully occurred, we observe a seemingly permanent reduction in variance of job growth across states. At the beginning of our series, what little interstate banking existed yielded only a 0.17 mean reduction in the squared deviation of percent job growth from the national average. By 2009, with bank deregulation in place, on average interstate banking contributed to a 1.09 mean reduction in squared deviation of a state's percent job growth from the nation's. We can further visualize this effect by removing the impact of interstate banking on our variance of job growth series. This result is presented in Chart 6, where we can again see a significant effect of banking integration beginning in the late 1980s. This chart shows that without the rise of bank integration, mean squared deviation from national job growth during this past decade would have averaged 2.76 instead of 1.75.

Finally, we find years with more months in a recession exhibit more variance of job growth across states (though this result is only significant at the 15% level). This is not a surprising result, given we do not expect all states to be affected equally by whichever factors lead to a downturn in national growth.

Conclusion

In this paper, we look at the changes in the dispersion of economic performance across states. Several patterns stand out in the charts and Table 1. First, positive oil shocks have played an important role in the relative performance across states. While real oil prices have remained volatile, shocks over the 1990s and 2000s were not as severe as those in late 1970s or 1980s. This reduction in oil price volatility thus has helped reduce the variance of economic performance across states. Oil price shocks, however, are not the only important factor impacting job growth differentials. As shown in charts 3a and 3b, there were significant oil price shocks in the 1990s and 2000s and yet the variance of job growth declined during these decades.

We find that a state's industrial specialization also played an important role its deviation from the national growth rate. States that have an industrial diversification similar to the nation experienced growth rates similar to the nation. Thus, the observed trend in increasingly similar state diversification also accounted for the dampening of employment growth divergence from the national average.

Finally, interstate banking has also played an important role. Based on our regression results, we find that the establishment of interstate banking agreements over the 1980s and 1990s had a meaningful part in the dampening of job growth variation across states. Had banking integration across states not occurred, our results that the mean squared deviation from the national growth rate would have averaged 2.76 over the past decade instead of 1.75.

Chart 1

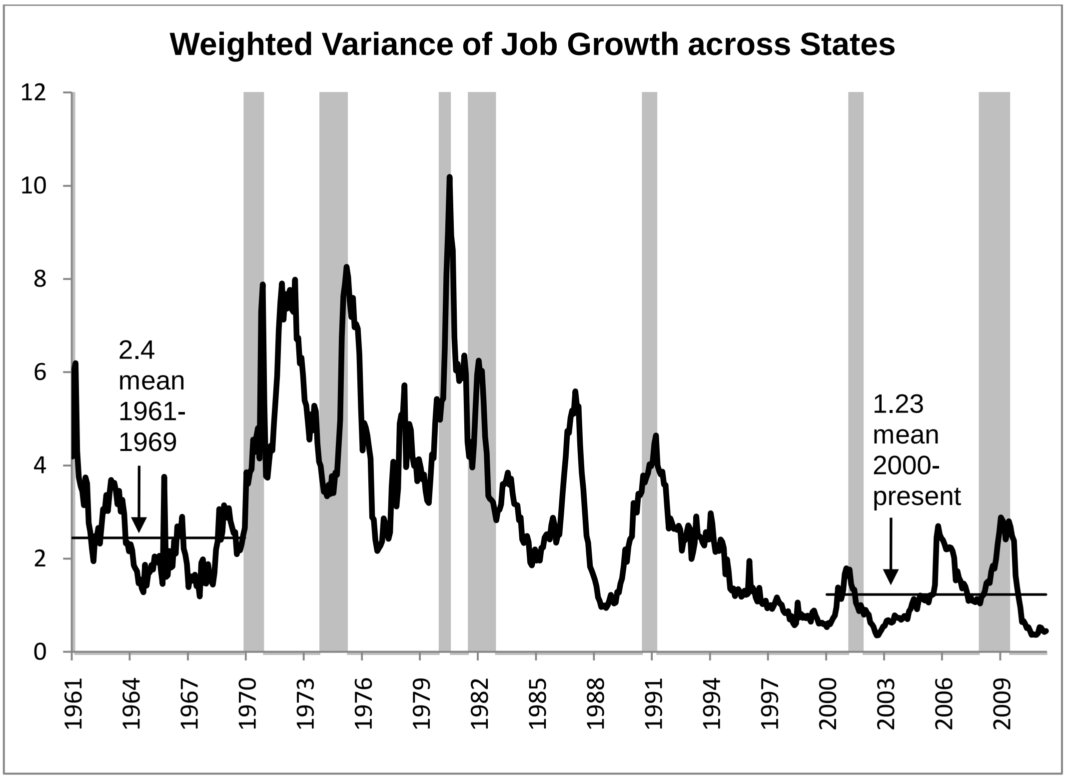


Chart 2

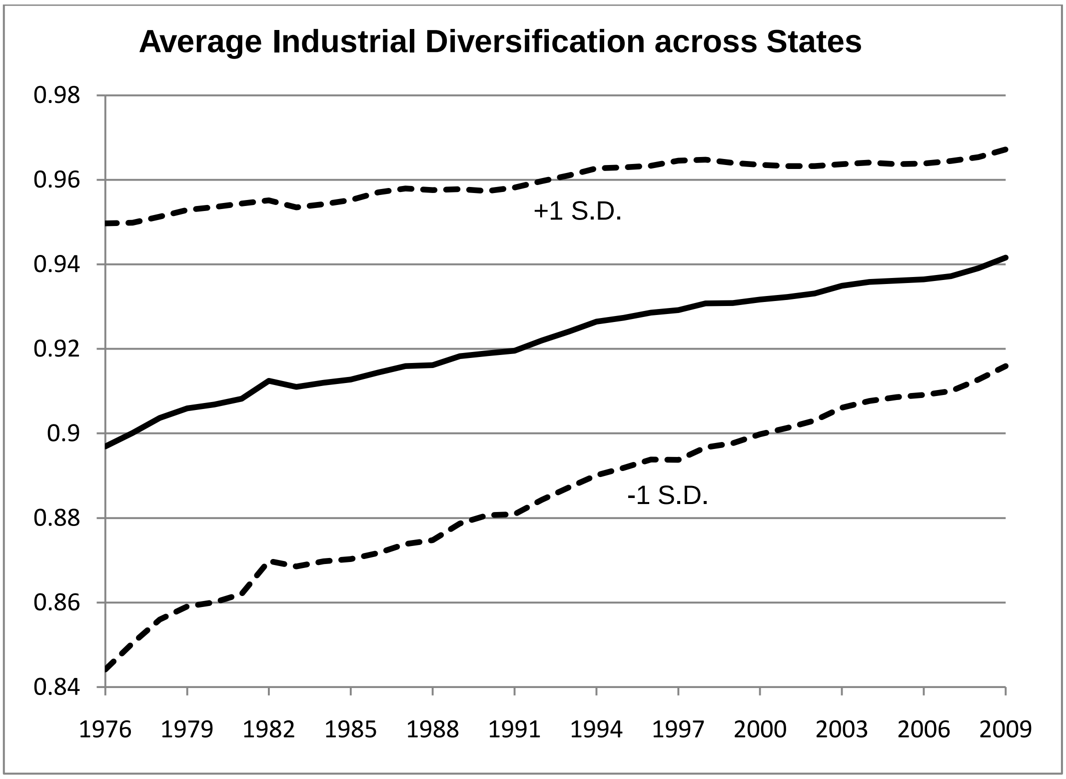


Chart 3a

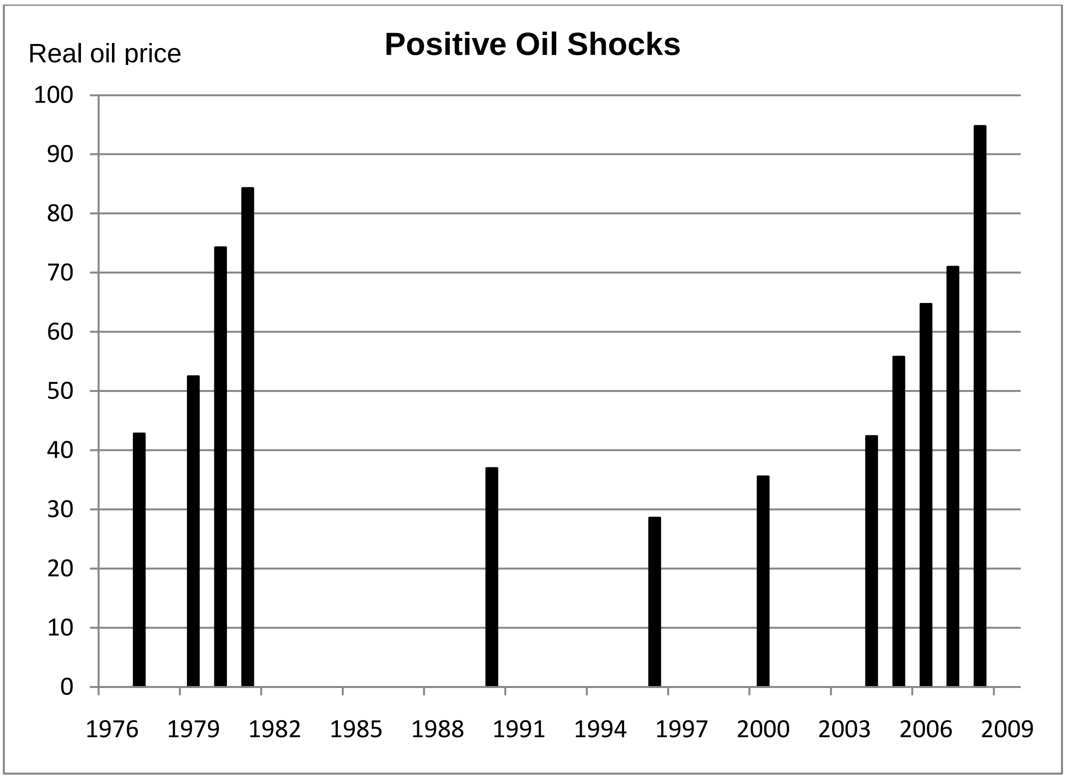


Chart 3b

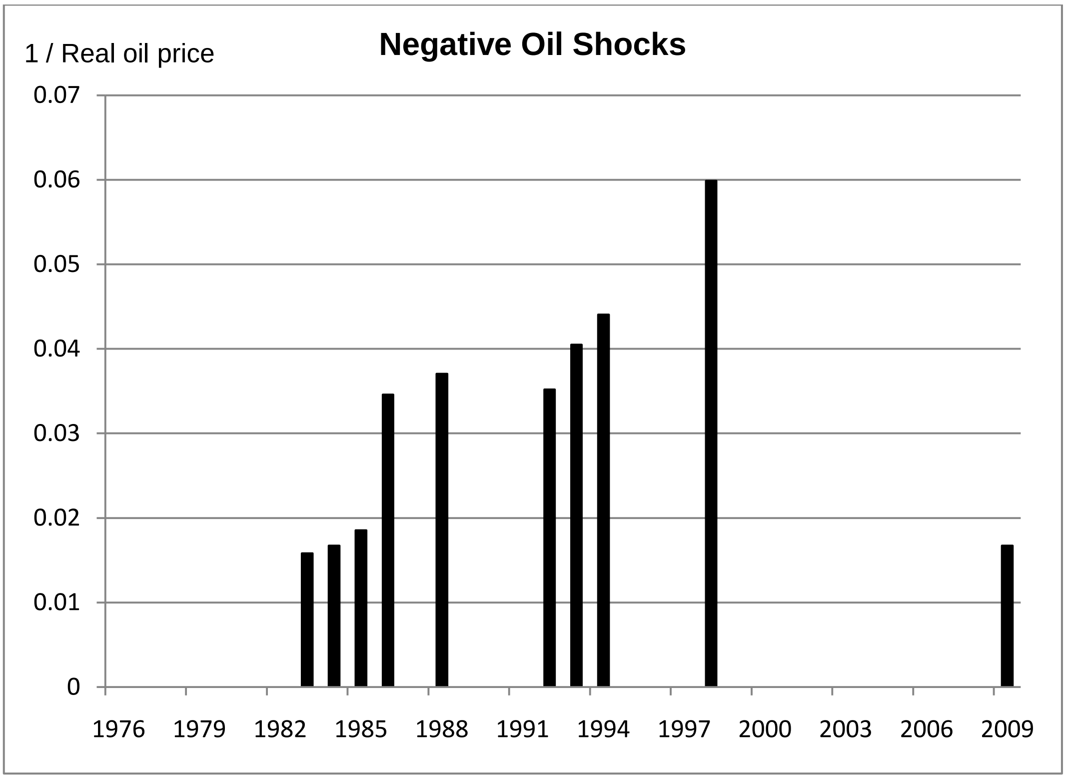


Chart 4

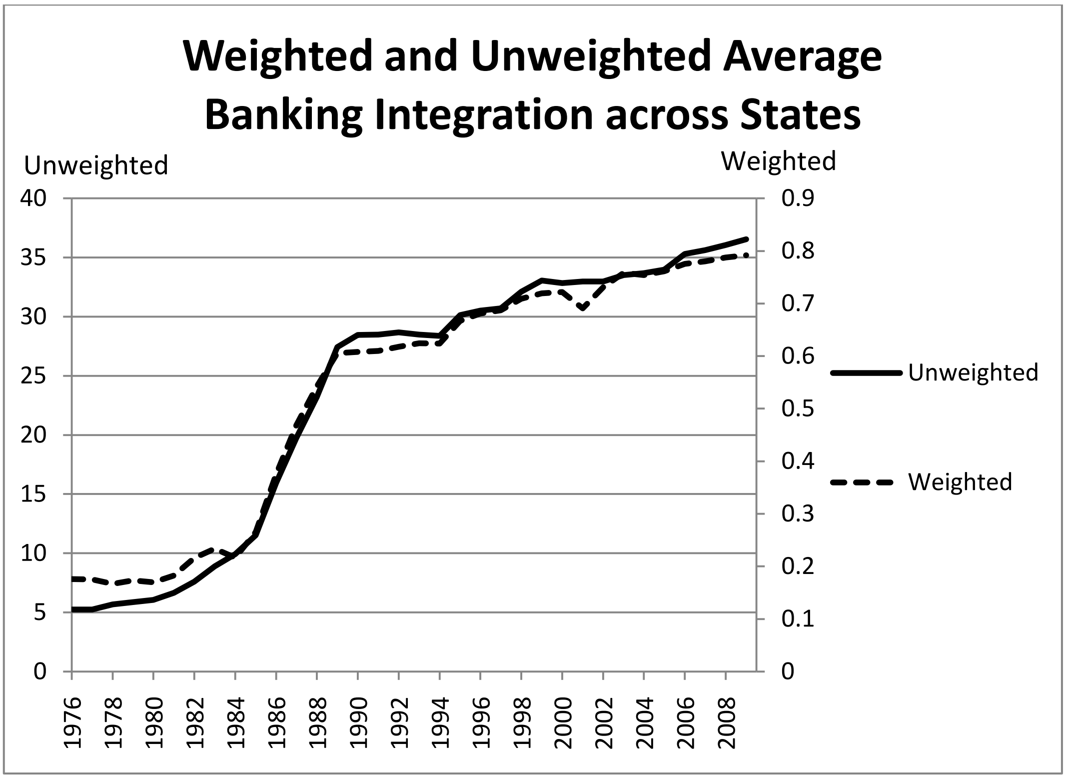


Chart 5

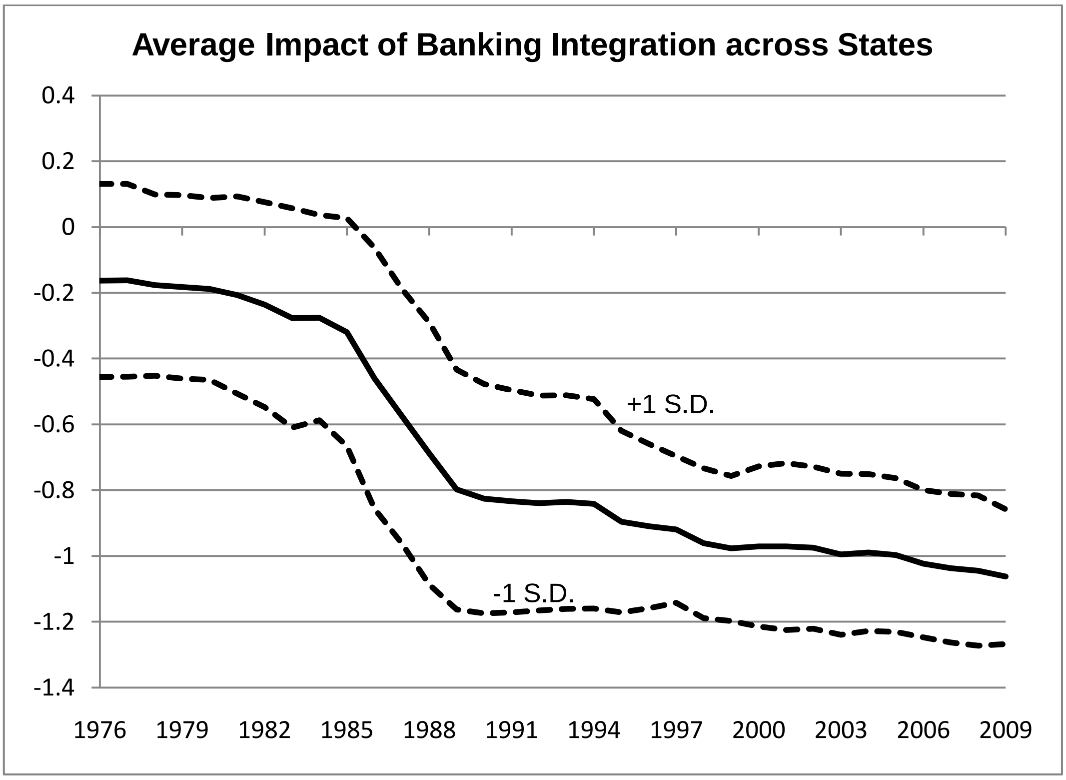
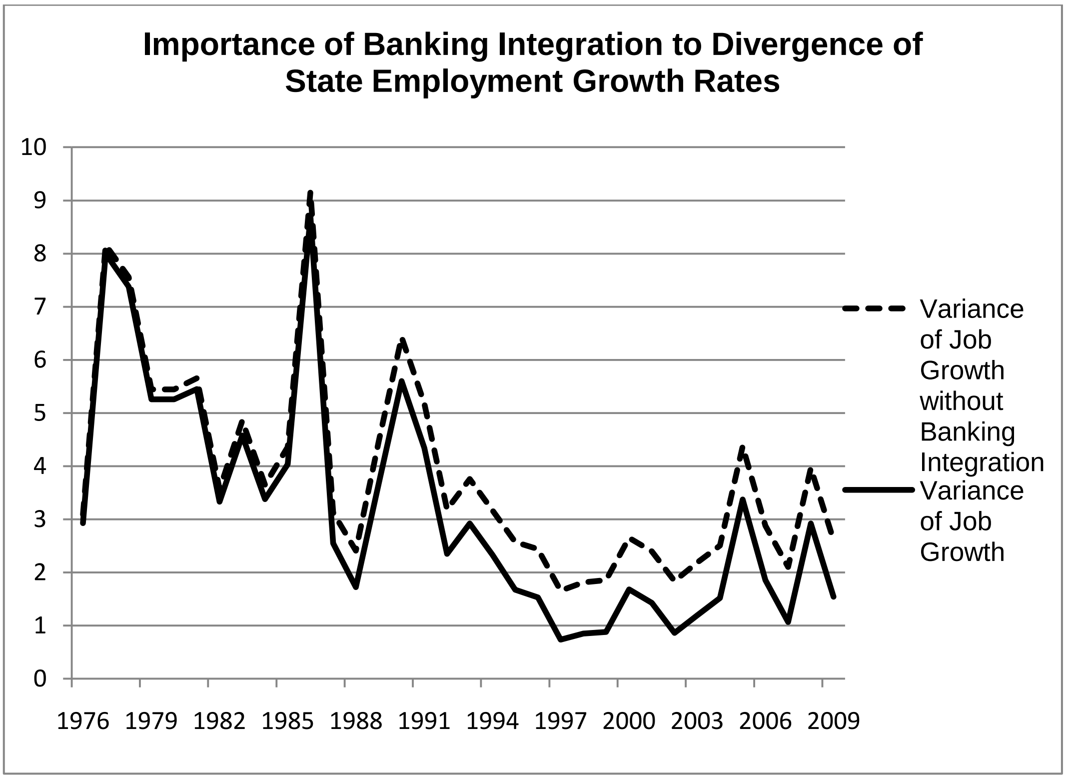


Chart 6



Importance of Banking Integration to Divergence of State Employment Growth Rates
10
9
8
7
6
5
4
3
2
1
0
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
Variance of Job Growth without Banking Integration
Variance of Job Growth

Table 1

Dependent Variable: v
Method: Panel EGLS (Cross-section weights)
Sample (adjusted): 1977 2009
Periods included: 33
Cross-sections included: 46
Total panel (balanced) observations: 1518
Iterate coefficients after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)
Convergence achieved after 12 total coef iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	32.23195	6.207184	5.192684	0.0000
d	-31.04686	6.736923	-4.608463	0.0000
oil^{+}	0.009500	0.002637	3.602777	0.0003
oil^{-}	1.426848	3.713318	0.384252	0.7008
bank	-1.427274	0.381587	-3.740367	0.0002
rec	0.043189	0.029417	1.468199	0.1423
AR(1)	0.333112	0.050905	6.543771	0.0000

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.301187	Mean dependent var	5.348389
Adjusted R-squared	0.276876	S.D. dependent var	7.926109
S.E. of regression	7.143323	Sum squared resid	74805.67
F-statistic	12.38907		
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.243994	Mean dependent var	3.151491
Sum squared resid	82239.80		

Inverted AR Roots .33

References

Carlino G., DeFina R.H. (2004) How Strong is Co-movement in Employment over the Business Cycle? Evidence from state/sector data. *J. of Urban Econ.* 55: 298-315.

Hamilton J. (2003), What is an Oil Shock? *J. of Econom.* 113(2):363-398.

Keeton W. (2009) Has Multi-Market Banking Changed the Response of Small Business Lending to Local Economic Shocks? *Econ. Rev.* 94:5-36.

Malizia E., and Ke S. (1993) The Influence of Economic Diversity on Unemployment and Stability. *J. of Reg. Sci.* 33:221-235.

Morgan D., Rime B., and Strahan P.E. (2004) Bank Integration and State Business Cycles. *Q. J. of Econ.* 119:1555-1584.

Owyang M., Piger J., and Wall H.J. (2008) A State Level Analysis of the Great Moderation. *Reg. Sci. and Urban Econ.* 38:578-589.