# The impact of changing diversification on stability and growth in a regional economy

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**ABSTRACT**

Economic diversification has long been considered a potential determinant of stability in regional economies, with policymakers often emphasizing efforts to diversify local economies as a means of reducing cyclical swings in unemployment. In recent years several cross sectional studies comparing different regional economies have supported the linkage of diversification and stability, while suggesting a tradeoff between stability and growth.

This study is a time series examination of employment data for a single regional economy to ascertain whether changes in diversification over a 30-year period play a statistically significant role in explaining stability and rates of growth. Multiple regression analysis is used to determine the role of diversification and other factors.

The study finds that volatility, measured as deviations from the mean growth rate of employment, is inversely related to changes in diversification. Volatility over time is positively related to the percentage of employment in resource-based industries. A division of the data into separate ten-year periods found that an increase in employment concentration (lower diversity) was associated with an increase in the variance of growth rates. Separate regressions show that the growth rate of employment is negatively related to diversification, and positively related to the growth rate of US employment and the percentage of employment in resource-based industries.

Keywords: Diversification, stability, economic growth.

## INTRODUCTION

The purported relationship between economic diversification and economic stability and growth has been a topic of debate among economists for many years. Earlier studies by Attaran (1986) and others yielded differing results regarding an empirical relationship between diversity and volatility, and between stability (volatility) and economic growth.

The Attaran study comparing the economies of the fifty US states plus the District of Columbia found a weak but statistically significant negative correlation between diversity and unemployment. He concluded that "no strict assumptions can be made regarding a clear relationship between diversification and economic growth and stability as measured solely by the composition spread of industry in a given area" (1986).

More recent studies by Baldwin and Brown (2004) and Essletzbichler (2007) suggest stronger relationships among the variables. The basic hypothesis is that greater diversity leads to greater stability over time, but that diversity may have a negative impact on the rate of economic growth by stymieing specialization according to comparative advantage. At the same time, greater specialization and growth reduce diversification and the ability to react to exogenous economic shocks. The potential trade-off between growth and stability is a factor local policy makers often fail to consider when they promote diversification of their economic base as a means to reduce volatility and associated unemployment (Baldwin and Brown, 2004).

A number of cross sectional studies have been conducted comparing diversification among regional economies to their relative economic stability and rates of economic growth. Several of the more recent studies have focused on how relative diversity among regions at a given point in time impacts stability and rates of growth in employment and income over some subsequent time period. Baldwin and Brown conducted a study of regional variations in Canada finding that there was a strong correlation between the regional level of diversification and stability, and that the more stable regions tend to have lower-than-average growth rates. A 2007 study by Jurgen Essletzbichler utilizing employment data on regional economies in the US also discovered a positive relationship between diversity and stability, and a positive relationship between growth and instability.

In this article I investigate the effect that changes in diversity over a period of time have on economic stability and growth for a specific regional economy. This is a times series approach to considering these relationships, whereas previous studies have largely utilized a cross sectional approach.

Baldwin and Brown correctly note that a cross sectional analysis does not allow one to determine how changes in characteristics such as diversity between time periods will affect changes in volatility. They investigate the issue of how changes in diversification impact volatility by developing a first order difference model that regresses the change in volatility between two time periods for each region on the change in average diversification and other explanatory factors for each region. They find that increasing diversity increases instability in the short run, which is contrary to the results of cross sectional studies that find a strong positive association between specialization and volatility. They are led to conclude that the dynamics of change cannot be inferred from the cross-section results (2004).

Diversification is not the only structural factor that is likely related to volatility. Essletzbichler (2007) included total employment in the base year, average plant size, and percent of employment in resource industries as explanatory factors. Baldwin and Brown also included average plant size in the region, plus export intensity as explanatory factors.

Baldwin and Brown found that larger regional size (employment) reduces volatility; while regions that are more specialized, have higher average growth rates, and a high proportion of employment in natural resource-based industries have significantly higher volatility levels. Essletzbichler also finds a strong positive relationship between growth and instability (volatility).

## METHODOLOGY

The current study utilizes data on employment for the Lakeland/Winter Haven MSA (Polk County Florida) over a 30-year time period to investigate how changes in diversification over time impact economic stability and growth. Regression analysis is first utilized to estimate the influence of changes in employment diversification and other factors on employment variability. A second set of regressions is conducted to estimate the influence of changes in employment diversification and other factors on employment growth rates.

A number of cross sectional studies measure economic volatility as the variance of each region's employment growth rate over a fixed time period. Attaran (1986) measures volatility as regional changes in unemployment and per capita income levels. The current study differs from those works in that it is a time series study on a specific regional economy rather than a cross sectional study over different regions. It measures volatility in a given year as the square of the deviation from the mean growth rate in employment.

$$Vt = (Xt - \bar{X})^2$$

where $Xt$ = employment in year $t$ and $\bar{X} = \sum X\,t$ / number of years observed.

There are several ways to measure economic diversification based on employment data. An earlier study by Attaran (1986) calculated an entropy measure of diversification for different economic regions, while more recent studies (Baldwin and Brown, Essletzbichler) utilize a Herfindahl index. This study calculates a Herfindahl index value for the Polk County region in each year measured as:

$$Ht = \sum s^2\,it$$

where $sit = E\,it \;/ \sum i\,E\,it$ and $E\,it$ = employment in sector $i$ in year $t$. The index is the summation of the squares of the market shares of the different economic sectors, and achieves a maximum value of one when all employment is concentrated within a single sector. A higher value for the index indicates greater concentration of employment (less diversity), while a lower value reflects higher diversity (less concentration of employment). Employment data is allocated according to SIC classifications as:

Farm Employment
Agricultural services, Forestry, and Fishing Employment

Mining Employment
Construction Employment
Manufacturing Employment
Transportation Employment
Wholesale Trade Employment
Retail Trade Employment
Finance, Insurance, and Real Estate Employment
Services Employment
Government and Government Enterprises Employment

A positive correlation between the Herfindahl index (low diversification) and volatility (high variation in annual employment growth rates) is expected.

Previous studies suggest that total employment in a region (size) and the percentage of employment concentrated in resource related industries could each have an independent influence on volatility among regions (Baldwin and Brown, Essletzbichler). The influence of changes in each of these factors is considered as a potential cause of changes in employment volatility over time in the current study.

Studies investigating the impact of size of the economy (total employment) on volatility have reached differing conclusions. Malizia and Ke (1993) proposed that larger regions tend to be more stable than smaller ones, thus rendering a positive correlation of size and stability. Essletzbichler (2007) concluded that the nature of any relationship is ambiguous. A negative correlation between total employment and volatility is expected in the present study.

Baldwin and Brown (2004) found that regions having a high share of employment in resource-based industries tend to have higher volatility in their growth rates. This result was confirmed in the Essletzbichler study (2007). We expect a positive correlation of resource-based concentration and volatility in the current study.

It is anticipated that variation in employment levels at the national level will influence volatility in the regional level of employment. A positive correlation between deviations from the mean in US employment growth rates and deviations from the mean in regional growth rates is anticipated.

A series of multiple regression analyses was performed with volatility measured as the deviation from the mean growth rate in employment for each year as the dependent variable. The estimated regression is:

$$(Xt - \bar{X}) = f\ (\text{DEVUSGROW, HERF, REBASED,TOTEMP})$$

where $(Xt - \bar{X})$ is the deviation of regional employment growth in year $t$ from the mean regional employment growth rate, DEVUSGROW is the deviation of US employment growth in year $t$ from the mean US employment growth rate, HERF is the Herfindahl index value in year $t$, REBASED is the percentage of regional employment in resource based industries in year $t$, and TOTEMP is the level of total employment in the region in year $t$.

The variance in employment growth was then calculated for each of two separate ten-year time periods $p$ (1980-1989 and 2000-2009).

$$\sigma p^{2} = \sum \frac{(Xt - \bar{X}p)^{2}}{n}$$

where $(Xt - \bar{X}p)$ is the deviation of regional employment growth in year $t$ from the mean regional employment growth rate in time period $p$.

An average Herfindahl index value was also calculated for each of the time periods. The change in variance in employment growth between the two time periods was compared with the change in the Herfindahl index value.

A second series of regressions was run with the annual growth rate in regional employment as the dependent variable. The estimated regression is:

$$(Xt - Xt-1) = f \text{ (USEMPGROW, HERF, RESBASED)}$$

where $(Xt - Xt-1)$ is the change in regional employment in year $t$ from the preceding year and USEMPGROW is the percentage change in US employment in year $t$ from the preceding year. The other explanatory variables are as defined in the preceding regressions. US employment growth and the Herfindahl index are each expected to be positively related to regional growth. The latter hypothesis is based on the premise that increasing specialization leads to more rapid growth (comparative advantage).

Attaran found evidence among state economies of a negative relationship between income levels and the percentage of employment in agriculture and resource-processing industries (Attaran 1986). If resource-based employment is associated with lower income levels, it is possible that the percentage of regional employment in resource-based industries will be negatively correlated with regional growth.

A third set of regressions was run in an attempt to confirm a relationship between changes in diversity over time and the regional unemployment rate (Attaran 1986). The regression results are the same if we regress the regional unemployment rate each year on the US unemployment rate, or if we regress the deviations from the mean regional unemployment rate on the deviations from the mean US unemployment rate. The estimated regression utilized in the current study is:

$$(Ut - \bar{U}) = f \text{ (DEVUSURATE, HERF, RESBASED, TOTEMP)}$$

where $(Ut - \bar{U})$ is the deviation of the unemployment rate in year $t$ from the mean regional unemployment rate, DEVUSURATE is the deviation of the mean US unemployment rate in year $\tau$ from the mean US unemployment rate, and the other variables are as previously defined. Deviations in the regional unemployment rate are expected to be positively related to deviations in the US unemployment rate, the Herfindahl index, and the percentage of employment in resource-based industries. The nature of any relationship between size of employment and volatility is uncertain (Essletzbichler 2007).

**RESULTS**

Results for the first set of regressions show that deviations in the growth rate of US employment, regional employment concentration (Herfindahl index), and regional percentage of employment in resource-based industries are all significant determinants of volatility over the entire 30-year period of study. The coefficients for the Herfindahl index and the percentage of employment in resource-based industries are of the expected sign. The deviation of US employment growth rates from the mean is not of the expected sign, but the relationship does not register as statistically significant. The relationship between total employment (size) and volatility is also not of the expected sign. It is noteworthy that Essletzbichler (2007) did not find the relationship between size and variation in growth rates among regions to be statistically significant.

The regression equation (with *t*-statistics in parentheses beneath the coefficients) is:

$$(X_t - \bar{X}) = -0.842722 - \underset{(-1.55)}{12.70723}DEVUSGROW + \underset{(5.02)}{1.26293}HERF +$$

$$\underset{(3.30)}{4.00647}RESBASED + \underset{(3.24)}{2.78498}TOTEMP + \varepsilon_t$$

Comparisons of data for the two distinct time periods show that the variance in growth rates rises from .0006204 in the 1980-89 period to .0008832 in the 2000-09 period, while the average Herfindahl index value increases from .136247 to .212166.

Results for the second set of regressions show that the growth rate of US employment, regional employment concentration (Herfindahl index), and regional percentage of employment in resource-based industries are all significant determinants of regional employment growth over the 30-year study period. The coefficients are of the expected sign with the exception of the percentage of employment in resource-based industries. The regression equation for regional employment growth (with *t*-statistics in parentheses beneath the coefficients) is:

$$(X_t - X_{t-1}) = -0.69687547 + \underset{(6.78)}{1.47381805}\ \text{US Employ Growth} +$$

$$\underset{(2.86)}{3.31439869}\ \text{Herfindahl} + \underset{(2.80)}{2.29214306}\ \text{Percent Resource Based} + \varepsilon_t$$

A comparison of data for two separate time periods reveals that the region's average annual employment growth was 0.98% faster than the US average employment growth rate in the 1980-89 period, and 1.29% faster than the US annual average in the 2000-2009 period.

The regression equation for deviations in the regional unemployment rate (with *t*-statistics in parentheses beneath the coefficients) is:

$$(U_t - U) = 29.040079 + \underset{(11.16)}{1.48863355}\ DEVUSURATE - \underset{(-1.60)}{137.963824}HERF -$$

$$70.2891636\text{RESBASED} - 0.00000902\text{TOTEMP} + \varepsilon_t$$
$$(-1.53) \qquad\qquad (-0.45)$$

Volatility in the region's unemployment rate is most strongly related to variations in the US unemployment rate. Deviation in the regional unemployment rate is negatively correlated to the Herfindahl index, the percentage share of resource-based industries, and the level of total employment, though the relationships are statistically insignificant.

## CONCLUSIONS

This study adds to the evidence that economic diversification is positively related to economic stability. Specifically, over a 30-year period declines in the region's degree of diversification led to greater variation in employment growth (less stability). There is also evidence that declining diversification and stability is associated with increases in employment growth rates over the study period.

Comparison of two separate ten-year time periods shows that as diversification declined over time, the regional employment growth rate went up relative to the US employment growth rate, and variance in the regional growth rate increased. These findings are consistent with those of previous cross-sectional studies of regional economies showing that volatility is less where diversity is higher. They contrast with the Baldwin and Brown finding of a negative (though statistically insignificant) association of changes in the degree of specialization and volatility (Baldwin and Brown 2004).

The current study does lend support to a number of conclusions drawn by previous researchers. Variations in employment growth rates (instability) is found to be inversely related to diversification, positively related to the percentage of employment in resource-based industries, and positively related to deviations in the growth rate of US employment.

Positive relationships are found between regional employment growth and US employment growth, and between regional employment growth and employment concentration. The potential conclusion is that increases in regional diversification over time are associated with lower employment growth rates.

A positive association is found between the growth rate in regional employment and the percentage of employment in resource-based industries. This result was somewhat unexpected, though the rationale for the initial hypothesis proposed was not strong.

Substituting variations in the region's unemployment rate in place of variations in employment growth as the measure of volatility did not change the preceding conclusions. The driving force of variations in the regional unemployment rate is variation in the US unemployment rate. Though the signs of the other coefficients were often opposite from those expected, the relationships were statistically insignificant (low "t" values. Perhaps the unemployment rate is not as good a measure of economic growth as it will be impacted by such considerations as the labor force participation rate.

The current study falls prey to several criticisms. First, it uses overly aggregate industry data in the measurement of economic diversity. Wagner and Deller conclude that

a diversity measure that focuses on the distribution of a measure such as employment across industries and does not account for inter-industry linkages is inadequate (Wagner and Deller 1998). The inability to further disaggregate employment assigned to the services sector in the current study is particularly troublesome.

Second, it is a study of a single regional economy. Similar time series studies of other regional economies with more detailed industry data and inclusion of other explanatory variables is certainly in order for the results to be generalized. The findings herein do lend support to the concept of a potential tradeoff between stability and economic growth, adding to concerns voiced by others regarding the focus of regional policymakers on efforts to diversify their economies.

## APPENDIX

TABLE 1

| **Deviation From Mean Regional Employment Growth Rate** | **Value** |
|---|---|
| Adjusted $R^2$ | 0.64 |
| Constant | -0.8427 |
| | (-3.29) |
| *Variable Coefficient (t Stat)* | |
| Deviation from Mean US Employment Rate | -12.7072 (-1.55) |
| Herfindahl Index | 1.2629 (5.02) |
| Percent Regional Employment In Resource Based Industries | 4.0064 (3.30) |
| Total Regional Employment | 2.7849 (3.24) |

Data on Regional and US Employment from Bureau of Economic Analysis

TABLE 2

| Regional Employment Growth | Value |
|---|---|
| Adjusted $R^2$ | 0.62 |
| Constant | -0.6969 |
| | (-2.84) |
| *Variable Coefficient (t Stat)* | |
| US Employment Growth Rate | 1.4738 (6.78) |
| Herfindahl Index | 3.3144 (2.86) |
| Percent Regional Employment In Resource Based Industries | 2.2921 (2.80) |
| | |

Data on Regional and US Employment from Bureau of Economic Analysis

TABLE 3

| Deviation From Mean Regional Unemployment Rate | Value |
|---|---|
| Adjusted $R^2$ | 0.94 |
| Constant | 29.0408 |
| | (2.05) |
| *Variable Coefficient (t Stat)* | |
| Deviation from Mean US Unemployment Rate | 1.4886 (11.16) |
| Herfindahl Index | -137.9638 (-1.60) |
| Percent Regional Employment In Resource Based Industries | -70.2891 (-1.53) |
| Total Regional Employment | -0.000009 (-0.44) |

Data on Regional Unemployment Rates from Florida Agency for Workforce Innovation
Data on US Unemployment Rates from US Bureau of Labor Statistics
Data on Regional Employment from Bureau of Economic Analysis Regional Economic Accounts

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