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Assessing Regional Economic Stability: A Portfolio Approach

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This paper examines regional economic stability using the analytical framework often used to study financial portfolios. The analysis shows that industrial diversification reduces economic volatility, just as portfolio diversification reduces financial risk. However, because the conditions that create a tradeoff between risk and return in financial markets do not exist for regional economies, regions do not face a tradeoff between stability and growth.

State and local government officials often want to improve economic performance by changing their region's industry mix. For example, a state or local government might offer tax abatements to relocating firms in an industry that is expected to enhance the region's economy. However, it often is unclear just which industries improve a region's economy. Specializing in a small number of fast-growing industries, or targeting fast-growing industries as promising sources of future growth, may make rapid growth possible, but the region's economy may become vulnerable to downturns in the industries in which it specializes. Thus, a specialized regional economy may be relatively volatile. If economic diversity reduces volatility, a region wishing to reduce volatility might see a diverse industrial mix as a desirable goal of economic development.

Understanding the relationship between regional economic volatility and economic growth also provides useful insights regarding a region's optimal industry mix. If, for example, regional economies face a tradeoff between stability and growth, they may be willing to accept greater instability to achieve more rapid growth. However, if no such tradeoff exists, then stability would be a desirable goal regardless of the region's aspirations regarding economic growth.

In a different context, the financial literature addresses the relationships between diversity and volatility. Portfolio theory suggests that diversification can reduce volatility, or risk. The logic of diversification is compelling for regional economies as well. Nevertheless, previous evidence regarding the relationship between regional economic diversity and regional economic instability is mixed. Conroy (1975) and Kort (1981) concluded that the extent of industrial diversity explains a significant proportion of the interregional differences in economic instability, while Jackson (1984), Steib and Rittenoure (1989), and Attaran (1986) found little evidence to suggest a relationship between diversity and instability. Others, including Brewer (1985), assumed that economic diversity explains regional differences in economic stability, and looked for the diversity measure that best captures this relationship. These studies use a variety of measures to capture diversity and instability, but all suffer from a common conceptual problem: they examine the relationship between economic diversity and *total* instability.

In contrast, the analogy with financial portfolios suggests that economic diversification should reduce only the amount of regional economic volatility that is diversifiable, or *nonsystematic*. This result is derived from risk-spreading alone, and does not depend on restrictive assumptions about the economic or statistical characteristics of the region's industries. Since diversity is expected to be related to *nonsystematic* volatility, it is not surprising the previous studies of the relationship between diversity and *total* volatility have yielded conflicting results.

Carrying the analogy with financial portfolios a step further also would suggest that the sensitivity of the region's economy to *systematic*, or nondiversifiable, factors could be associated with the regional analog to higher expected return, namely more rapid expected economic growth. If this were the case, regions might choose to accept more systematic sensitivity in exchange for higher growth. This hypothesis, however, relies on the market-clearing assumptions of the Capital Asset Pricing Model (CAPM), and those assumptions are quite tenuous for regional economies. This suggests that accepting higher systematic risk may not increase expected growth for a regional economy.

This paper discusses these relationships conceptually and tests them empirically. The analysis shows that there is, in fact, a strong correlation between diversity and nonsystematic volatility. However, systematic sensitivity is not compensated with higher economic growth.

The paper is organized as follows. Section I presents the analogy between financial market portfolios and regional economies, along with its implications. Section II explores the meaning of "diversity" in the regional economics context. Section III presents the data and variables used for the analysis. Section IV discusses the empirical evidence on the relationships among diversity, systematic and nonsystematic instability, and growth in regional economies. Conclusions and implications are drawn in Section V.

I. Financial Portfolios and Regional Economies

The finance literature distinguishes between two kinds of risk: "systematic" and "nonsystematic." *Systematic* risk is associated with broad economic and financial market conditions. As a result, it is common to all assets and cannot be diversified away. *Nonsystematic* risk, in contrast, is specific to a given asset and can be reduced through portfolio diversification.

In a portfolio, diversification benefits investors by spreading risk among various assets, where each asset's "risk" is measured by the variance in its return. For example, assume that an investor starts off with a single asset with return r_1 and variance V_1. Adding a second asset to the portfolio makes the portfolio's variance V_p, where:

$$V_p = w_1^2 V_1 + w_2^2 V_2 + 2w_1 w_2 Cov_{1,2} \qquad (1)$$

In equation (1), w_1 and w_2 reflect the weights of assets 1 and 2, respectively, in the portfolio. Thus, $0 \leq w_1$, $0 \leq w_2$, and $w_1 + w_2 = 1$.

The relationship between V_1 and V_p depends on: (a) the magnitude of V_2 relative to that of V_1, (b) the relative proportions of the assets in the portfolio, w_1 and w_2, and (c) the extent of covariance between the returns of the two assets, $Cov_{1,2}$. If V_2 is very large relative to V_1, V_p may be greater than V_1. This is more likely if w_2 is larger. Thus, adding an asset to the portfolio may or may not reduce the portfolio's variance. However, as long as the covariance among individual assets ($Cov_{1,2}$) is less than one, the variance of the portfolio is less than the weighted sum of the variances of the individual assets. This property is relatively easy to see in the case of uncorrelated returns, that is, when $Cov_{1,2} = 0$. In this case:

$$V_p = w_1^2 V_1 + w_2^2 V_2 \qquad (2)$$

Since w_1 and w_2 are between zero and one, $w_1^2 < w_1$ and $w_2^2 < w_2$. Thus, the variance of the portfolio is less than the weighted sum of the variances of the individual assets, and diversification reduces the risk associated with holding a portfolio that includes assets 1 and 2. The lower is the covariance between the returns of the two assets, the greater are the benefits of diversification, since the covariance term in equation (1) is smaller. Thus, under a wide range of circumstances, portfolio diversification reduces risk. Note that the benefits of diversification are associated with the mathematical properties of variances, and do not depend on restrictive assumptions about the market characteristics or economic properties of the assets themselves.

The benefits of diversification are even greater when the returns of the two assets are *negatively* correlated. In fact, the variance of the portfolio can fall to zero in the case of perfect negative correlation. However, in real-world markets the returns to most assets are correlated with general economic and financial conditions, so the covariances between the returns for most pairs of assets are positive. Thus, investors cannot completely eliminate risk from their portfolios. The risk that cannot be diversified away is referred to as systematic risk.

Not all assets or portfolios have the same degree of systematic risk. According to the Capital Asset Pricing Model (CAPM), investors who take on greater systematic risk can expect to receive greater returns on their investments. Investors prefer the least possible risk at any given level of return, so prices for assets that face little systematic risk are bid up (thus reducing their returns) relative to prices of assets that offer the same yield with more systematic risk. Thus, the financial market bidding process results in a tradeoff between systematic risk and return.

These principles suggest:

(1) Nonsystematic risk should fall with greater portfolio diversification.

(2) There should be a trade-off between systematic risk and return.

These expectations have been verified in the financial literature (Fama and MacBeth, 1973; Black, Jensen, and Scholes, 1972; and Gibbons, 1982).

The Analogy with Regional Economies

In the analogy with regional economies, industries play the role of assets, and the region's industrial mix represents the portfolio. The "return" becomes the economy's growth rate, while its "risk" is the economy's volatility. In such an analogy, systematic volatility is associated with general economic conditions, such as fluctuations in the national economy, and nonsystematic volatility is the regional variation that is not associated with national influences. Since the relationship between portfolio diversity and nonsystematic risk depends on the mathematical properties of variances and not on specific assumptions about the assets' characteristics, the analogous relationship between a region's industrial diversity and its nonsystematic volatility is likely to hold.[1]

In contrast, any relationship between systematic variability and growth would depend on a market-like mechanism. Under such a mechanism, risk-averse states would accept greater variability only if they were compensated in the form of stronger growth. However, several characteristics of regional economies make such a connection unlikely.

First, although a financial asset earns the same return regardless of whose portfolio it is in, a given industry may perform differently depending on where it is located. For industries producing goods that are consumed in the same locale in which they are produced, the health of the region's economy affects the pace of activity, and this can differ across regions.[2] For example, auto repair services are by their nature provided in the same region where users of those services live, and interregional differences in the types of services provided are likely to be minor. Nevertheless, between 1980 and 1986, the real (inflation-adjusted) value of auto repair services grew 48 percent in fast-growing Arizona and only 10 percent in slower-growing Oregon.

Another weakness of the analogy is that different regions have different attributes that favor production of some goods over others. Natural resource endowments and transportation infrastructure are the most obvious sources of these regional differences in comparative advantage. (See, for example, North, 1955; and Schmidt, 1989.) Even when oil prices are high, residents of non-oil-producing regions generally cannot change their industrial structures to place more emphasis on oil production. Similarly, cities with limited access to overseas transportation are unlikely to become major transshipment points for international trade. These kinds of differences in comparative advantage limit the extent to which regions can (and should) diversify their economies.

A final, and fundamental, problem with the analogy is that a region's officials cannot "trade" in a "market" for industries the way investors can trade in the market for financial assets. Although state and local governments often compete with each other to attract industries in order to improve their regions' economies, using such tools as tax incentives, infrastructure investments, and zoning variances, the "market" is thin and adjustments are slow. Since any local jurisdiction is unlikely to have its desired industry mix at a given point in time, equilibrium is not observed. Moreover, no individual has the power to change a region's industrial mix the way an investor can alter a portfolio.[3]

These differences between assets in a portfolio and industries in a regional economy suggest that a tradeoff between systematic variability and growth may not be observed for regional economies. These problems do not, however, affect the extent to which diversification should reduce nonsystematic volatility. This relationship is primarily a mathematical one, and does not rely on binding assumptions about the character of regional economies.

II. What Is "Diversity?"

An investment portfolio that mimics the market portfolio in its composition (though not its size) is referred to as a fully "diversified" portfolio. Thus, a portfolio of ten different stocks would be somewhat diversified, but in a market in which hundreds of stocks are traded, it would not be completely diversified.

Financial economists have agreed-upon standards by which to measure diversity.[4] Regional economists, in contrast, continue to debate what constitutes regional economic diversity. For the most part, this debate has been framed as a measurement issue, in which the "best" measure of diversity is the one that best explains regional differences in economic volatility. (See, for example, Conroy, 1975; Kort, 1981; and especially Brewer, 1985.)

A "diversified" regional economy has been defined variously as one in which (1) all industries are of equal size, (2) the industry mix minimizes portfolio variance, or (3) the region's industry mix is the same as the nation's. Measures that define complete diversity as equal representation by all industries ("ogive" and "entropy" measures) are particularly arbitrary, since they depend critically on industry definitions. For example, an ogive or entropy measure that uses two-digit SIC data implies that tobacco manufacturing and health services would be equally important in a completely diversified regional economy.

The portfolio variance concept currently is the most widely accepted measure of diversity, and it can be a valuable tool if used appropriately (Gruben and Phillips, 1989a and 1989b). However, it should not be used to test whether diversity reduces volatility (Conroy, 1975; and Brewer, 1985) because it does not measure diversity independent of volatility. Examining the formula for the portfolio variance measure reveals why:

$$V_p = \sum_i \sum_j w_i w_j V_{ij} \qquad (3)$$

where V_p denotes portfolio variance, V_{ij} denotes the variance ($i=j$) or covariance ($i \neq j$) for each industry or pair of industries, and w_i and w_j are industry weights. Traditionally (Conroy), regional data are used to calculate the industry weights, w, but due to data and computing constraints, or the particular task to which the measure is tailored (Gruben and Phillips, 1989b), the industry variances and covariances, V, are calculated using national data. As a general rule, if sufficient information and computing resources are available, the portfolio variance V_p should be calculated using *regional* variances and covariances. If all of the data on the right-hand side of equation (3) are consistent with each other, in terms of regional coverage as well as the economic concept they are measuring (employment, income, or gross product), the right hand side of equation (3) is simply the decomposition of the region's total variance.

Thus, the portfolio variance measure of diversity, correctly calculated, is exactly the same as the region's total *variance,* which is a frequently-used measure of economic instability. Therefore, the portfolio variance measure does not measure diversity independent of volatility, and it is not surprising that the portfolio variance measure tends to "explain" differences in volatility better than other "diversity" measures do.

If the analogy with portfolio theory holds, regional economic diversity should be defined in terms of the "market" industrial mix. Ideally, this "market" industry mix would reflect the comparative advantage of each region. However, it is impossible to calculate an ideal "diversified" industry mix that is different for each region and that distinguishes between ideal and actual industry structure. In view of these limitations, the national industry mix provides a standard with which to gauge a region's industry structure.

Such a standard implies that regions seeking to diversify their economies should attempt to duplicate, to the extent possible, the industrial structure of the United States. Of course, no region could (or should) duplicate the U.S. industrial structure precisely, since geographical differences in comparative advantage will determine the region's optimal industry structure to a significant extent. Nevertheless, for most regions, the U.S. industrial structure provides a standard for diversity that is more reasonable than the available alternatives.

III. Data and Variables

The analogy between portfolio theory and regional economic stability suggests two testable hypotheses. First, regional economic diversity should reduce nonsystematic volatility. Second, growth should be positively correlated with systematic variations in the region's economy. Gross State Product (GSP) data, released by the Bureau of Economic Analysis,[5] were used to test these hypotheses. These are annual data, adjusted for inflation, and disaggregated by state and by industry to the two-digit SIC level.[6] They are available for the years 1963 through 1986. The variables used in this analysis are defined below.

Variable Definitions

Diversity

Portfolio theory defines diversity as the extent to which a portfolio's composition approximates the "market" portfolio. Similarly, regional economic diversity is defined here as the extent to which a region's industrial structure approximates that of the nation. This measure (DIV) is derived using the following formula for each state and year.

$$D_{it} = \sum_{j=1}^{J} \frac{(GSP_{ijt} - GSP_{Sjt})^2}{GSP_{USjt}} \quad (4)$$

where GSP_{jt} denotes the share of total GSP in industry j during period t, i subscripts denote states, and US subscripts denote national figures.[7] After D_{it} is calculated, its reciprocal is taken, so that greater diversity is associated with a higher value for the diversity measure,[8] and the measured is averaged over time within each state:

$$DIV_i = \frac{1}{24} \sum_{t=1963}^{1986} \frac{1}{D_{it}} \quad (5)$$

DIV_i approaches infinity for states with economies that resemble the industrial structure of the U.S. very closely, and approaches zero for states with economies that deviate substantially from the U.S. industrial structure.

Growth

$AVGRGSP_i$ measures the long-term growth rate in real total GSP for state i. Annual percentage growth rates are calculated for each state and year ($GROWTH_{it}$), and averaged across time periods t for each state i.

Total volatility

Total volatility, $TOTSTD_i$, is measured as the standard deviation over time in the state's annual percentage growth rate, $GROWTH_{it}$. In order to decompose the variance into its systematic and nonsystematic components, the variance ($TOTVAR_i = TOTSTD_i^2$) also is calculated.

Systematic and Nonsystematic Volatility

A simple univariate regression of state growth on national growth is used to divide total volatility into its systematic and nonsystematic components:

$$GROWTH_{it} = \alpha + \beta \, GROWTH_{USt} + e_{it} \quad (6)$$

The (unadjusted) R^2 from this regression measures the proportion of total variance in state i's growth rate that is associated with contemporaneous variations in national growth.[9] This is the portion of the state's variance that is systematic. Systematic volatility (SYSV), measured in standard deviation terms, is therefore:

$$SYSV_i = \sqrt{(R_i^2)\,(TOTVAR_i)} \quad (7)$$

Nonsystematic volatility is the total volatility that is *not* associated with variations in national economic growth. In standard deviation terms:

$$NONSYSV_i = \sqrt{(1 - R_i^2)\,(TOTVAR_i)} \quad (8)$$

Systematic Sensitivity

The coefficient beta from regression (6) is analogous to the beta coefficient often calculated for individual stocks, and measures the region's *sensitivity* to national economic conditions. This measure differs from that for systematic *volatility*, described above. The beta measures the magnitude, and hence the sensitivity, of the response of state to national changes. In contrast, systematic *volatility* measures the extent to which variations in the national economy explain local fluctuations, regardless of the size of their impact.

A Look at the Variables

Table 1 presents the value of each variable calculated for each state. DIV exhibits a wide range of values across states, suggesting that states differ significantly from each other in their degree of diversity. According to this measure, Washington, D.C. is the nation's least diverse economy, while Illinois is its most diverse. The rankings implied by these values are not surprising. The District of Columbia's economy is strongly oriented toward government, and Illinois has a large and diverse economy. Moreover, the measures for Alaska's economy, which is quite specialized, and for California's economy, which is very diverse, appear reasonable. However, a few DIV values are somewhat surprising. For example, DIV values for Missouri and Colorado are higher than one might expect. Nevertheless, the overall rankings appear to be plausible.

Average GSP growth (AVGRGSP) also varies considerably from state to state. Between 1963 and 1986, Alaska was the fastest-growing state, at an 8.1 percent average annual rate. The District of Columbia experienced the slowest GSP growth, at only 1.5 percent per year. Other fast-growing states included Arizona and Florida, while West Virginia, Pennsylvania, and Illinois were among the nation's slowest growing states.

Considerable variation also is apparent in the values for the coefficient beta from equation (6), which measures systematic sensitivity. The strongest measured responses to national changes occur in the industrial states of Michigan

Table 1
Variable Values

STATE	Diversity (DIV)	GSP Growth (AVGRGSP)	Systematic Sensitivity (BETA)	Total Volatility (TOTSTD)	Variance (TOTVAR)	R^2 (RSQR)	Systematic Volatility (SYSV)	Nonsystematic Volatility (NONSYSV)
ALABAMA	3.19	3.43	1.07	2.96	8.78	0.86	2.75	1.10
ALASKA	0.49	8.08	−2.53	12.18	148.22	0.29	6.52	10.28
ARIZONA	1.55	5.55	1.17	4.14	17.18	0.52	3.00	2.86
ARKANSAS	3.49	3.76	1.09	3.22	10.36	0.75	2.80	1.60
CALIFORNIA	8.52	3.54	0.80	2.43	5.92	0.70	2.04	1.32
COLORADO	6.33	4.19	0.54	2.40	5.77	0.34	1.40	1.95
CONNECTICUT	2.24	3.20	1.10	3.33	11.06	0.72	2.82	1.76
DELAWARE	0.85	3.28	1.21	4.50	20.28	0.48	3.11	3.26
DIST OF COLUMBIA	0.22	1.55	0.40	2.43	5.92	0.18	1.04	2.20
FLORIDA	4.96	5.39	0.97	3.35	11.20	0.55	2.49	2.23
GEORGIA	2.64	4.75	1.25	3.40	11.54	0.89	3.20	1.13
HAWAII	0.97	3.51	0.31	3.42	11.70	0.05	0.80	3.33
IDAHO	1.17	3.20	0.72	3.82	14.57	0.23	1.84	3.34
ILLINOIS	8.58	1.98	1.20	3.23	10.42	0.91	3.08	0.97
INDIANA	2.98	2.18	1.71	4.53	20.48	0.94	4.39	1.12
IOWA	1.62	2.32	1.10	3.91	15.25	0.52	2.82	2.70
KANSAS	2.83	2.33	0.67	2.07	4.28	0.69	1.72	1.15
KENTUCKY	0.74	2.70	1.07	3.06	9.36	0.81	2.76	1.32
LOUISIANA	0.36	2.28	0.83	4.57	20.93	0.22	2.15	4.04
MAINE	0.88	3.23	0.85	2.77	7.68	0.62	2.18	1.71
MARYLAND	3.83	3.27	0.94	2.70	7.29	0.80	2.41	1.22
MASSACHUSETTS	4.13	3.10	1.00	3.08	9.46	0.69	2.56	1.71
MICHIGAN	0.72	2.32	2.19	6.05	36.55	0.87	5.64	2.17
MINNESOTA	2.75	3.37	1.02	2.91	8.46	0.82	2.63	1.25
MISSISSIPPI	3.15	3.09	1.02	3.32	11.01	0.63	2.63	2.03
MISSOURI	6.32	2.64	1.18	3.24	10.50	0.88	3.04	1.11
MONTANA	1.51	2.11	0.54	3.46	11.94	0.16	1.38	3.17
NEBRASKA	1.83	2.62	0.67	2.96	8.74	0.34	1.71	2.41
NEVADA	0.26	4.80	0.79	3.83	14.68	0.28	2.03	3.25
NEW HAMPSHIRE	1.91	5.46	1.17	3.77	14.20	0.64	3.01	2.27
NEW JERSEY	4.70	3.09	0.92	2.80	7.84	0.72	2.37	1.49
NEW MEXICO	0.67	2.67	0.34	2.45	6.01	0.13	0.89	2.29
NEW YORK	3.15	2.07	0.81	2.62	6.87	0.63	2.08	1.59
NORTH CAROLINA	0.40	4.08	1.08	3.01	9.06	0.86	2.79	1.14
NORTH DAKOTA	1.02	2.72	0.68	5.71	32.55	0.09	1.75	5.43
OHIO	3.70	2.11	1.56	4.08	16.67	0.97	4.02	0.71
OKLAHOMA	0.94	2.60	0.30	2.69	7.23	0.08	0.76	2.58
OREGON	0.94	3.14	1.25	3.97	15.77	0.65	3.21	2.34
PENNSYLVANIA	5.27	1.95	1.10	2.94	8.65	0.92	2.82	0.82
RHODE ISLAND	0.56	2.49	1.22	3.59	12.90	0.76	3.14	1.75
SOUTH CAROLINA	0.71	4.37	1.15	3.25	10.55	0.83	2.96	1.33
SOUTH DAKOTA	0.87	2.23	0.76	3.78	14.28	0.26	1.94	3.24
TENNESSEE	4.54	4.01	1.33	3.62	13.12	0.90	3.43	1.17
TEXAS	1.10	3.90	0.56	2.32	5.36	0.39	1.45	1.81
UTAH	2.51	3.27	0.58	2.91	8.49	0.26	1.49	2.50
VERMONT	3.31	3.86	0.99	3.22	10.38	0.63	2.55	1.97
VIRGINIA	1.32	4.07	0.85	2.47	6.08	0.78	2.18	1.15
WASHINGTON	2.34	3.31	0.99	3.75	14.05	0.46	2.54	2.76
WEST VIRGINIA	0.19	1.65	0.85	2.89	8.37	0.58	2.19	1.88
WISCONSIN	2.97	2.95	1.12	2.98	8.86	0.93	2.87	0.77
WYOMING	0.24	2.45	0.19	5.95	35.46	0.01	0.48	5.94

and Ohio. In contrast, the weakest responses are found in the energy-dependent states of Wyoming and Oklahoma.

A look at the standard deviation of the annual growth rates reveals that Alaska's was by far the most volatile state economy in the nation during this period. Other relatively volatile economies included Wyoming and North Dakota. At the other end of the spectrum, the nation's most stable economies during this period included Kansas, the District of Columbia, California, and Colorado.

Changes in the national economy affect different states in different ways, as reflected in the R^2s for equation (6), which are listed in column 6 of Table 1. National influences are relatively unimportant for Hawaii, Wyoming, and North Dakota, but they explain more than 90 percent of the total variations in the economies of Illinois, Indiana, Ohio, Pennsylvania, and Wisconsin.

The remaining columns in Table 1 decompose the total volatility into that explained by national fluctuations (SYSV) and that which is nonsystematic (NONSYSV). Nonsystematic volatility is highest for states with a combination of a high standard deviation and relatively low R^2, such as Alaska and Wyoming. Nonsystematic volatility is low for states that exhibit only moderate variation, most of which is explained by national movements. Wisconsin and Pennsylvania fall into this category.

IV. Empirical Results

This section presents the results of tests of the following two hypotheses:

(1) Nonsystematic volatility should be lower in states with more diverse economies.

(2) Growth should be positively correlated with systematic sensitivity, as measured by the beta coefficient calculated in equation (6).

Note that the discussion of the analogy between portfolios and regional economies suggests that the first hypothesis is more likely to be corroborated than is the second.

Diversity and Volatility

Correlations between diversity and volatility are summarized in Table 2.[10] The correlation coefficient between diversity and nonsystematic volatility is significantly different from zero at the 99.8 percent level, with a magnitude of -0.425. The extremely high level of statistical significance is particularly noteworthy. Thus, as expected, states with more diverse economies tend to experience less nonsystematic volatility. This suggests that risk spreading is applicable to regional economies.

To get a sense of how important the components of volatility are to this hypothesis test, Table 2 also presents correlations between diversity and both systematic and total volatility. Results suggest that no correlation between diversity and *systematic* volatility exists. The correlation coefficient is 0.087, and is significant only at the 45.4 percent level.[11] The correlation coefficient between diversity and total volatility is -0.284, and is significant at the 95.6 percent level. This relationship is slightly weaker than that between diversity and nonsystematic volatility, although it is somewhat stronger than most other measured relationships between national average diversity and total volatility.[12]

Systematic Sensitivity and Growth

The relationship between systematic volatility and growth is measured as the "security market line" relationship in the financial literature. (See, for example, Sharpe, 1985.) The equation estimating this relationship is:

$$\text{AVGRGSP} = \underset{(15.00)}{4.00} - \underset{(3.37)}{0.85}\ \text{BETA} \qquad \bar{R}^2 = .172$$

Numbers in parentheses are t-statistics. Note that the coefficient, which the portfolio analogy predicts should be *positive*, is in fact *negative* and statistically significant. However, Alaska's summary statistics in Table 1 suggest that the state may be an outlier. If Alaska is omitted from the sample, the coefficient becomes positive, but statistically insignificant:

$$\text{AVGRGSP} = \underset{(7.72)}{2.98} + \underset{(0.51)}{0.20}\ \text{BETA} \qquad \bar{R}^2 = -.015$$

Table 2
Diversity and Volatility

	Correlation	Significance level*
Diversity and Nonsystematic Volatility	−0.425	99.8
Diversity and Systematic Volatility	0.087	45.4
Diversity and Total Volatility	−0.284	95.6

*Significance level measures the probability, in percentage terms, that the correlation coefficient is different from zero.

The lack of a significant positive relationship between beta and growth strongly suggests that there is no mechanism in regional economies that generates a tradeoff between systematic sensitivity and growth.

In fact, a *negative* relationship between systematic sensitivity and growth is consistent with previous work by Sherwood-Call (1988) and with Schmidt's 1989 work on resource industries during the 1963–1986 period. Schmidt found that resource-dependent states tended to grow more rapidly during this period than did states that did not depend heavily on natural resource industries. Sherwood-Call found that resource dependence tended to be negatively correlated with the extent of linkage to the national economy. Taken together, these results suggest that resource-dependent states may have weaker associations with movements in the national economy than most states do, which could translate into smaller beta coefficients, while at the same time these states experienced relatively rapid growth during the period under study.

Summary of Empirical Results

These empirical results suggest that regions may be able to improve the stability of their economies by diversifying them.[13] Regional economic diversity is negatively correlated with the nonsystematic component of volatility in an extremely significant way. However, regions do not seem to be compensated for accepting more systematic sensitivity through higher growth rates.

V. Conclusions and Implications

Previous studies of the relationship between regional economic diversity and economic volatility have yielded mixed results. These studies focussed on measurement and econometric issues in seeking to explain the conflicting results. These measurement and econometric issues are serious ones, but this paper has focused on a fundamental conceptual problem with the previous studies. Most researchers have looked for a relationship between diversity and *total* volatility, whereas the portfolio analogy suggests that the relationship is between diversity and *nonsystematic* volatility.

In this paper, simple statistical tests have shown that the expected relationship between diversity and nonsystematic volatility does exist and is extremely strong. These observations, which parallel those in the portfolio literature, reflect the risk-spreading that occurs as regional economies diversify.

However, there is no correlation between systematic sensitivity and growth, although the portfolio analogy seems to suggest that such a relationship should exist. This result is not surprising, since the mechanism by which the tradeoff occurs in financial markets does not exist for regional economies. The financial market relationship between systematic risk and return in portfolios occurs because risk-averse investors will not hold high-risk assets unless they expect to be rewarded with higher returns. Regional economies, in contrast, lack a single omnipotent decision-maker, and the "market" for industries is illiquid and slow to adjust.

The implications for regional policy makers are relatively straightforward: greater economic diversity improves the stability of a region's economy. Thus, other things equal, regional development officials should be able to improve their region's economic stability by making their regional economies more diverse.[14] However, the instability that is associated with fluctuations in the national economy remains a significant source of instability for most states, and it is not compensated by higher growth rates as the analogy with portfolio theory suggests it should be.

While this study has focussed on issues of regional economic stability, it is important to note that regions may pursue other economic goals, such as rapid growth, instead of or in addition to seeking economic stability. For a region that has a natural resource, or an agglomeration of activity that provides it with a comparative advantage in a particular industry, pursuing that advantage may be a more effective overall strategy than a diversification strategy would be. At the same time, a region that develops an industry mix that yields strong growth need not "pay" for that rapid growth by accepting greater instability.

NOTES

1. However, because an industry is made up of many firms, small states may have more volatile economies even if they have diversified industrial mixes. Since different firms in a particular industry may experience different fortunes, diversification across firms within an industry probably has benefits as well. These issues are not addressed in this paper.

2. The differences among regions' industries are even greater than the data used in this study indicate, because industry detail is available only to the two-digit SIC level. Thus, for example, the transportation equipment category does not distinguish between motor vehicle manufacturing, which is important in Michigan, and aerospace production, which is important in California.

3. Even if local officials had control over their region's industry mix, the community's residents and politicians are likely to disagree about what industry mix the region should move toward. While some may prefer to maximize economic growth, others might prefer slower growth if it allows them to maintain the community's character.

4. The most commonly used measures include a representative "market basket" of securities, such as the stocks included in the Dow Jones or S&P 500 index. These measures do not, however, include bonds, real estate, or other non-security assets.

5. Most previous studies of the relationship between economic diversity and economic stability have used employment data. While the employment data have the advantage of being monthly, they provide a less comprehensive measure of economic activity than GSP does, and also suffer from a large number of missing values.

6. Most industries are disaggregated to the 2-digit level. A few, including construction and retail trade, are disaggregated only to the 1-digit level.

7. U.S. production for each industry was calculated by summing GSP across states.

8. The reciprocal is taken only so that a higher measure is associated with greater diversity, making results easier to interpret. It does not materially affect the results.

9. An alternative measure of the relative contribution of national changes to regional economic fluctuations was developed in Sherwood-Call (1988). That linkage measure accounted for lags in the transmission of economic changes from the national to the state level. However, the R^2 measure parallels work done in the portfolio literature.

10. The data presented in Table 1 suggest that Alaska is an outlier, which may bias the results presented in Table 2. To determine whether this is the case, all of the empirical estimates were recalculated using a sample that excludes Alaska. The results indicate that the calculations presented in Table 2 are not driven solely by Alaska.

11. The positive sign on the correlation coefficient may be due to a spurious correlation that results from the way the diversity variable is constructed. The most "diverse" economies are those with industrial structures that most closely resemble the national economy. If each industry exhibits similar fluctuations over time in various regions of the country, then the states that have industry mixes that most closely resemble the U.S. industry mix also are likely to experience economic fluctuations in concert with national economic fluctuations.

12. The differences between these results and the results of other studies that used national average diversity measures may be due to differences in the geographical or industrial coverage. Most previous studies looked at metropolitan areas rather than states, and examined only manufacturing activity.

13. The empirical work presented here examines a static measure of diversity over a cross-section of states. Thus, it does not explicitly examine the benefits that a particular state would gain from diversifying its own economy. Gruben and Phillips (1989a) address that issue directly.

14. Gruben and Phillips (1989a) suggest that regions interested in reducing total volatility target industries that have small or negative covariances with existing industries.

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