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ECONOMIC STRUCTURE AND SOURCES OF CHANGE IN THE INTERMOUNTAIN REGION, 1969-1988

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Introduction

The intermountain region of the United States has undergone profound economic change in the past two decades. The decade of the 1970s generally was characterized by strong economic growth—employment, income, and population increased more rapidly than in most other parts of the country. The national recession in the early 1980s resulted in slower growth in all regions. Special factors affecting the west led to relatively slow growth throughout the remainder of the decade for the area.

This paper first analyzes changes in employment growth within and among the several state economies in the region (i.e., Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming) for four periods between 1969 and 1988. Of particular importance is the difference in state growth rates in the region in the 1970s in contrast to growth in the 1980s which generally was much slower in both absolute and relative terms. For example, with the exception of Arizona and Nevada, employment in the other mountain states grew at approximately twice the rate during the period 1969-1979 than it did in the 1979-1988 period. Growth in the region was particularly slow in the 1984-1988 interval. This slower economic growth resulted in a number of economic and social problems for these states.

This paper makes a detailed analysis of employment changes in each state using regional shift or shift-share analysis. This analytical technique has been used widely to explain the sources of employment change in a region; essentially it involves decomposing employment change into three components or sources of change:

- A national growth component that measures the change in regional employment associated with overall change in the national economy;

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- An industry mix or structural component that identifies the change in employment due to the particular mix of industries in the region; and
- A competitive or differential component that nets out the effects of national growth and industry mix in order to identify the part of employment change associated with the unique locational advantages of the region.

That is, the competitive component measures the region's ability to compete for shares of employment independent of changes in the national economy or the region's particular mix of industries.

The shift-share analytics will allow a test of the conventional wisdom that the relative decline of most states in the region in the latter part of the study period was the result of economic decline in agriculture and mining (i.e., the hypothesis that the relative slowing in the pace of economic activity in the west was an industry mix problem). Although the aggregate shift-share analysis indicates the relative decline of the region was the result of competitive characteristics and not the mix of industries, the disaggregated shift data assign a significant part of decline not only to agriculture and mining but also to manufacturing. This analysis is developed in considerable detail later.

Finally, the stability of the competitive components is investigated using the approach outlined by Holden, Nairn, and Swales (1989). This analysis suggests relative stability in these components, at least for the region and time period under study. Because this topic is somewhat tangential to the main theme of the paper, it is reported in Appendix B.

The Shift-Share Model

The shift-share model, well-known among regional scientists, decomposes the change in some measure of regional economic activity (e.g., employment, income, output, etc.) into three aggregate components.

National Growth Component

The national growth component (N) measures the change in activity in the region if growth in the region had mirrored the national growth trend. Define:

- e_i = Regional employment in the i th industry;
- e = Total employment in the region;
- E_i = National employment in the i th industry; and
- E = Total employment in the nation.

Using the superscripts b and t to represent the base and terminal periods, respectively, the aggregate national growth component for the region is:

$$(1) N = [(E^t/E^b) - 1]e^b.$$

Industry Mix or Structural Component (M)

The growth of a region will deviate from the national growth rate because a region may have a mix of industries heavily weighted in favor of rapidly growing or slowly growing industries and/or because of the region's differential ability to compete for shares of industrial activity. The aggregate effect of the region's industrial structure is measured by the industry mix or structural component (M) where:

$$(2) M = \sum_i [(E_i^t/E_i^b) - (E^t/E^b)]e_i^b.$$

Essentially, the industry mix component is a weighted average of the net growth rates¹ for all industries in the nation, where the weights are the regional employment levels in each industry.

Competitive Share or Differential Component (C)

Finally, the specific locational advantages of the region are hypothesized to be measured by the competitive share or differential component (C), defined as:

$$(3) C = \sum_i [(e_i^t/e_i^b) - (E_i^t/E_i^b)]e_i^b$$

where:

$[(e_i^t/e_i^b) - (E_i^t/E_i^b)]$ = The differential growth rate defined as the regional growth rate minus the national growth rate for each industry.

¹ The term *net growth rate* refers to the bracketed part of equation (2) which is the difference between the industry growth rate and the national growth rate.

As the former accounts for both the national growth and industry mix effects, the difference in these growth rates is offered as a measure of a region's ability to compete for shares of economic activity.

The sum of the three components is identically equal to the change in total employment in the region. That is,

$$(4) e^t - e^b \equiv N + M + C.$$

Thus, at its most fundamental level, the shift-share model is an accounting method of decomposing an historic change in an indicator of regional economic activity.

Development and Application of the Shift-Share Model

The shift-share approach first was used some 30 years ago by Fuchs (1959), Ashby (1964), and by Perloff, Dunn, Lampard, and Muth (1960) in a major study of regional economies in the United States. Various extensions and refinements of the basic model have been offered. For example, Esteban-Marquillas (1972) demonstrates that industry specialization in a region could influence the competitive component and offers a method for adjustment. Arcelus (1984) extends the analysis to incorporate specific regional factors, and Sihag and McDonough (1989) demonstrate how the international economy could be added as another component of change or influence on the regional economy. Barff and Knight (1988) introduce the concept of dynamic shift-share analysis that involves serial change in the base year as explained below.

The shift-share approach has been subject to criticism. Houston (1967) emphasizes the lack of a strong theoretical foundation, although Casler (1989) offers such a foundation in the form of a regional input growth model. Brown (1969) shows that the competitive component is not sufficiently stable over time to allow the shift-share method to be a useful projection technique. This conclusion has been supported by others, including Andrikopolous, Brox, and Carvalho (1990) most recently. Further, MacKay (1968) is critical of the failure of the model to account specifically for interindustry relationships that form the foundation of input-output analysis.

Perhaps the most severe attack has been leveled by Holden, Nairn, and Swales (1989) who argue that as a technique for accounting for regional economic change the approach has value, but that the largely implicit theoretical basis for the model must be developed more completely. Further, they show the conditions under which the competitive and industrial mix components will be independent.

The traditional approach to shift-share analysis has been to relate all changes to a single base year. Thirlwall (1967) and others show that this can result in two problems. First, the subsequent growth rates for each industry are being weighted by the base year proportions of employment in each industry. If those proportions are changing significantly, the estimates of the industry mix and competitive components will be biased. Second, if the region is growing more (less) rapidly than the national economy, use of only one year as the base will result in an overestimate (underestimate) of the national growth effect.

Barff and Knight (1988) demonstrate these problems and recommend the use of what they term *dynamic shift-share analysis*, where the shift components are determined annually for the entire study period with the base year continuously changing. The annual components are summed over the entire multiyear period. This dynamic approach is used in this study. The shift components are computed for each year, with the base year continuously updated. Then the components are added for each of the four subperiods used in this study, i.e., 1969-1974, 1974-1979, 1979-1984, and 1984-1988.²

Mead and Ramsay (1982) outline a method for measuring the relative importance of the four basic components or determinants of change in the regional economy (i.e., the region's initial structure of industries, the national effect, the industry mix effect, and the competitive effect) between the two different time intervals. First, equation (4) is rewritten as:

$$(5) \Delta \bar{e} = \bar{w}'(\bar{N} + \bar{M} + \bar{C})$$

where:

$\Delta \bar{e}$ = (1 x n) vector of employment change in each industry in the region, ($\Delta \bar{e} = \Delta e_i, i = 1, \dots, n$);

\bar{w} = Vector of base year employment levels in each industry; and

$\bar{N}, \bar{M},$ and \bar{C} = Vectors of industry-specific national, industry mix, and competitive components of change.

Taking the total differential of equation (5) yields:

$$(6) d\Delta \bar{e} = [d\bar{w}'(\bar{N}_0 + \bar{M}_0 + \bar{C}_0)] + [\bar{w}' \cdot (d\bar{N} + d\bar{M} + d\bar{C})].$$

²Note that there are three periods of five year duration and one that is four years in length (i.e., 1984-1988). Because the last period is shorter, this must be kept in mind when interpreting the data that follow.

The first term on the right side of equation (6) is a measure of the effect of the change in the region's industrial structure, given the characteristics of the national, industry mix, and competitive effects during the first period. The second term is the change in regional employment associated with the national, industry mix, and competitive effects of the second period, holding the region's industrial structure constant.

Mead and Ramsay apply this model to data for Massachusetts for two recession periods (i.e., 1973-1975 and 1979-1980). They find that the change in the state's industrial structure eased the magnitude of the recession in 1979-1980 by more than 6,400 jobs, although the largest share of employment change (almost 84 percent) was due to what they define as exogenous pure recession effects (i.e., $\bar{w}_0 \cdot (d\bar{N} + d\bar{I})$).

Riefler (1986) uses the Mead-Ramsay framework to measure the differential response of the Nebraska economy to the two severe national recessions in 1973-1975 and 1981-1982. He shows that while the traditional shift-share analysis suggests a somewhat similar response of the state's economy in both periods, the Mead-Ramsay decomposition documents that both changes in the employment base and changes in the "regional competitiveness of the local economy during the six year period between the onset of the two recessions were significantly affected by the relative performance of the economy" (p. 29).

The Intermountain Economy, 1969-1988

The conventional explanation for the relative growth of the intermountain economy in the 1970s emphasizes the region's dependence on natural resource-based industries such as agriculture and the extraction and processing of mineral resources, including coal, oil, and gas. For most of this decade, these were growing industries. The agricultural sector expanded as rapid growth in export demand, among other factors, generated significant increases in both agricultural prices and income. Farmers responded by increasing their productive capability.³ In addition, rapid development of coal, oil, gas, and other mineral products in the 1970s followed higher relative prices for these commodities, and this resulted in significant economic opportunities for the region. During the 1969-1979 period employment in every state in the region grew faster than in the nation. The average growth rate for the

³Not only did output and income rise in agriculture, but farm employment rose in four of the eight states (i.e., Idaho, Nevada, New Mexico, and Wyoming) during the 1969-1979 period. Trends in employment in agriculture returned to their historic pattern in the subsequent decade as all eight states experienced declines in farm employment.

region was about twice that for the country. Of course, population increased as large numbers of individuals and families moved into the region to take advantage of the employment opportunities and high wage rates.

Unfortunately, the economics of these industries changed dramatically in the 1980s as energy prices fell and revised projections of demand for electric power reduced the need for planned generating plants and the associated potential coal production. Further, the agricultural sector slumped as increased production capability led to lower prices and income when export demand declined. During the period 1979-1988 not only did employment growth in the nation slow, but growth in the intermountain region generally slowed even more dramatically. Table 1 shows that between 1979 and 1984 three of the eight states grew at less than the U.S. average, with Idaho experiencing a decline in employment. Between 1984 and 1988 Arizona and Nevada continued to achieve rapid gains in employment, but the other six states recorded growth rates below the national average. Wyoming experienced a 6.7 percent decline in employment, losing some 18,000 jobs between 1984 and 1989.

Growth rates for the region of 26.5 percent and 27.6 percent for the period 1969-1974 and 1974-1979 were followed by growth rates of only 14.0 percent and 10.2 percent in the two subsequent periods. The growth rate of the region relative to that in the U.S. declined in each subperiod, but was above the national average until the 1984-1988 period. There was clearly a dramatic change in both the absolute and relative growth of the region after 1979.

The pattern of change is seen easily by reference to the graphical presentation in Figure 1, which shows employment growth in each state relative to national growth for each of the four periods. With the exception of Arizona and Nevada, where above average growth was recorded in all periods, the other six states experienced relative growth declines in the later periods. For example, relative growth was above average in all intermountain states for both the 1969-1974 and 1974-1978 periods, below the national rate in three of those states for the 1979-1984 period, and below average in six of the eight states in the recent period.

The strong economic conditions of the 1970s resulted in a new set of expectations among area residents. Some areas within the region, especially those outside the metropolitan areas that had been characterized by low incomes and declining employment, enjoyed a period of rapid growth. State tax revenues increased rapidly, allowing expansion in both the range and quality of public services. Unfortunately, these conditions changed dramatically in the 1980s. The higher expectations generated in the previous ten years were met with disappointment as

economic conditions deteriorated, bringing relative declines in employment and much slower real wage increases generally.⁴

The tales of the boom-bust cycle in such communities as Parachute Creek, Colorado; Rock Springs, Wyoming; Vernal, Utah; and a number of others are well known. As the rapid population growth of the 1970s gave way to population decline in the early 1980s in these cities, the multiplier effect of declining employment took its toll. The construction industry was especially hard hit. The rapid building pace recorded earlier had attracted numerous construction workers and firms who subsequently found little demand for their services. Population declines in the former boom towns left many residential and business properties vacant. As occupancy rates declined, so did rental and market values.

The above average employment growth in the region in the 1970s led to a similar change in relative per capita income. (See Table 2.) Per capita income was 88.5 percent of the national level in the intermountain region in 1969. It increased to 94.8 percent by 1979, but fell to 88.3 percent by 1988. This general pattern of increase from 1969 to 1979 and then decline by 1988 is observed in every state in the region. For example, in Wyoming, the per capita income relative declined from 110.9 to 82.5 between 1979 and 1988. In Utah, the combination of a stagnant economy and an unusually high birth rate led to per capita income falling to a level 26 percent below the national average by 1988.

Of course, the region was not without its success stories in the past decade. For example, the southern Arizona economy continued to grow rapidly. The Phoenix and Tucson metropolitan areas had a combined population of just over one million in 1969, but had increased to almost three million by the end of the 1980s. Nevada also continued to show dynamic growth, especially in the Las Vegas and Reno areas.

Sources of Employment Change in the Intermountain Region, 1969-1988: Aggregate Shift Effects

The changes in employment during each of the four subperiods under study here have been decomposed into the three shift-share

⁴Utah had the particularly unique situation of having experienced significant net immigration in the 1970s coupled with the highest birth rate in the nation. This left the state with the youngest population in the country. For example, nationwide 26 percent of the population is under the age of 18; in contrast, 37 percent of Utah's population is less than that age. The combination of a stagnant economy and rapid population growth resulted in an enormous public finance problem of providing educational services for a large and increasing number of school age children at the same time that the relative financial ability of state and local government to provide these services was declining.

components of change. The percentage industry mix and competitive components⁵ of change are summarized in Table 3 and shown graphically in Figures 2 and 3.

The aggregate industry mix or structural effects are positive except for Idaho for every period and Montana and Wyoming in the latest period. These structural effects tend to be small, however, relative to the size of the aggregate competitive components. For example, the typical competitive component is about ten times greater than the corresponding structural component. An initial interpretation of these data is that most of the employment change in these states is explained by factors other than the mix of industries; thus, the hypothesis that declines in mining and agriculture caused the relative decline of the intermountain economy is not supported, at least by the aggregate shift components. The data suggest that the source of the economic problems was a decline in the region's ability to compete for its share of national employment growth.

This explanation is consistent with the tendency of the percentage competitive components (Table 3 and Figure 3) to decline over time in every state. For example, for the first two periods, the competitive component is in excess of 10 percent of base year employment in all states but Montana and New Mexico. But during the 1979-1984 period only Arizona had a competitive component in excess of 10 percent, while this component was negative in three states. For the latest period the competitive component was negative in six of the eight states. Clearly this quantitative perspective indicates that one explanation for the relative decline in economic activity in the 1980s was the region's general inability to maintain its relative share of national employment.⁶

The aggregate shift components, however, may tend to obscure significant effects at the individual industry level. For example, the relatively small aggregate industry mix effect may be the result of large negative values in one set of industries being offset by large positive values for other industries.⁷ Thus, it is important to examine the shift data at a finer level of disaggregation.

⁵The percentage components are computed as the ratio of the component divided by base year employment multiplied by 100. This adjustment allows for direct comparison of these components among regional units of different economic size.

⁶The stability of the competitive component (i.e., its sensitivity to the industrial structure of the region) is examined in Appendix B. In general, the competitive effects are found to be reasonably stable.

⁷The authors are indebted to an anonymous referee for providing insight on this issue.

Sources of Employment Change in the Intermountain Region, 1969-1988: Disaggregated Shift Effects

The industry-level mix and competitive shifts for agriculture, mining, manufacturing, and all other industry for each state and subperiod are reported in Appendix A. A summary of those data showing the shifts as a percentage of total employment change for the 1984-1988 period is presented in Table 4.⁸ The industry mix effects for these three basic sectors are negative and represent a significant part of employment change. For example, the unweighted averages of these percentage industry mix effects are -30.0 for agriculture and -21.7 for mining. Further, in the manufacturing sector, the average shift is about -18.5 percent of total employment change. The explanation for the relatively small aggregate industry mix effects is that the relatively large negative effects in agriculture, mining, and manufacturing are being offset by positive structural effects in other sectors.

The competitive shifts for these three industries for the 1984-1988 period tend to be relatively small (i.e., generally less than 10 percent of the total change in employment), and 12 of the 18 shifts reported are positive. In contrast, the competitive shifts in the combined other sector tend to be large and negative. Comparing the industry mix and competitive shifts for agriculture, mining, and manufacturing sectors in each of the six states reported in Table 4 indicates that the industry mix shifts are consistently negative and that the absolute value of the industry mix shift is larger than that for the competitive shifts in all but two cases of 18 comparisons.⁹

Thus, the disaggregated data tend to support the hypothesis that agriculture and mining, along with manufacturing, were instrumental in the relative decline in the region in the latter half of the 1980s. This certainly is not obvious in the aggregate shift-share data reported in the previous section.

Summary

With the exception of Arizona and Nevada, the states in the intermountain region experienced much slower absolute economic growth in

⁸In order to reduce the volume of data reported, Arizona and Nevada are not included in this table. Because these two states continued to record above average growth over the entire study period, it is useful to focus the analysis on those states where growth was below average.

⁹That is, comparing the industry mix shift with the competitive shift for agriculture, mining, and manufacturing in each of the six states.

the 1980s than they recorded in the previous decade and generally slower growth relative to the nation. For the 1984-1988 period, average growth in the other six states was less than one-half the national rate. The conventional explanation attributed the decline to the economic problems in agriculture and mining. An aggregate shift-share analysis of employment data for these eight states suggests that it was a decline in the competitive component, not in the industry mix effect, that explained most of the relative decline and that the hypothesis that the cause of the decline was associated with dependence on agricultural and mining industries is not supported.

The aggregate data, however, tend to obscure significant implications at the individual industry level. For example, for the latter part of the study period when the relative decline of the region was most pronounced (i.e., 1984-1988), the industry mix components for agriculture, mining, and manufacturing were negative in every state and generally accounted for a large share of total employment change. These negative effects, however, tended to be offset by positive industry mix components for the other sectors, with the result that the aggregate industry mix effect was relatively small. Thus, it appears from the aggregate shift data that the competitive component was the dominant explanation for the relative decline, when the industry mix effects were important in reality.

Two conclusions, one empirical and the other methodological, are drawn from this analysis. First, relative declines in three sectors (agriculture, mining, and manufacturing) probably were fundamental in explaining the relatively poor economic of the region in the 1980s. Second, aggregate shift-share analysis may obscure rather than explain some regional economic phenomena. While the aggregate shifts may be of interest, they need to be reported with the shift components at the individual industry level.

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Table 1
Total Employment, Percentage Change, Relative
Percentage, and Sources of Change
1969-1988

State	Total Employment				
	1969	1974	1979	1984	1988
Arizona	697,730	939,235	1,221,263	1,497,394	1,803,574
Colorado	970,912	1,243,994	1,565,233	1,856,474	1,936,969
Idaho	308,848	376,260	465,148	464,240	496,754
Montana	290,273	338,653	394,002	405,565	411,093
Nevada	239,545	311,755	461,065	522,337	644,365
New Mexico	388,416	471,364	586,682	647,761	700,021
Utah	435,500	536,155	672,449	751,591	827,603
Wyoming	155,424	191,613	261,362	271,174	253,048
Region	3,486,648	4,409,029	5,627,204	6,416,536	7,073,427
U.S.	89,519.8	98,528.6	111,631.9	119,485.2	132,502.5

State	Percentage Change in Employment			
	1969-1974	1974-1979	1979-1984	1984-1989
Arizona	34.61	30.03	22.61	20.45
Colorado	28.13	25.82	18.61	4.34
Idaho	21.83	23.62	-0.20	7.00
Montana	16.67	16.34	2.93	1.36
Nevada	30.14	47.89	13.29	23.36
New Mexico	21.36	24.46	10.41	8.07
Utah	23.11	25.42	11.77	10.11
Wyoming	23.28	36.40	3.75	-6.68
Region	26.45	27.63	14.03	10.24
U.S.	10.06	13.30	7.03	10.89

State	Percentage Change Relative to the Nation			
	1969-1974	1974-1979	1979-1984	1984-1989
Arizona	3.44	2.26	3.21	1.88
Colorado	2.79	1.94	2.64	0.40
Idaho	2.17	1.78	-0.03	0.64
Montana	1.66	1.23	0.42	0.13
Nevada	3.00	3.60	1.89	2.14
New Mexico	2.12	1.84	1.48	0.74
Utah	2.30	1.91	1.67	0.93
Wyoming	2.31	2.74	0.53	-0.61
Region	2.63	2.08	1.99	0.94
U.S.	1.00	1.00	1.00	1.00

Table 2
Per Capita Income and Per Capita Income Relative to U.S.
Average in the Intermountain States
1969-1988

State	Per Capita Income				
	1969	1974	1979	1984	1988
Arizona	3,287	4,989	8,305	11,969	14,970
Colorado	3,495	5,343	8,945	14,092	16,463
Idaho	2,999	4,934	7,446	10,361	12,665
Montana	4,244	6,073	10,204	13,825	17,511
Nevada	3,130	4,776	7,412	10,826	12,866
New Mexico	2,848	4,137	7,294	10,520	12,488
Utah	2,991	4,452	7,185	10,110	12,193
Wyoming	3,261	5,156	9,657	12,252	13,609
Region	3,267	4,965	8,254	12,045	14,559
U.S.	3,698	5,434	8,706	13,825	16,489
State	Per Capita Income Relative to U.S. Average				
	1969	1974	1979	1984	1988
Arizona	88.9	91.8	95.4	86.6	90.8
Colorado	94.5	98.3	102.7	101.9	99.8
Idaho	81.1	90.8	85.5	74.9	76.5
Montana	114.1	111.8	117.2	100.0	106.2
Nevada	84.6	87.9	85.1	78.3	78.0
New Mexico	77.0	76.1	83.8	75.9	75.7
Utah	80.9	81.9	82.5	73.1	73.9
Wyoming	88.2	94.9	110.9	88.6	82.5
Region	88.3	91.4	94.8	87.1	88.3
U.S.	100.0	100.0	100.0	100.0	100.0

Source: U.S. Department of Commerce, *Statistical Abstract of the United States* (Washington, D.C.: U.S. GPO, various years)

Table 3
Industry Mix and Competitive Shift Components as a
Percentage of Base Year Employment
Intermountain States
1969-1974 and 1984-1988

State	Percentage Industry Mix Component			
	1969-1974	1974-1979	1979-1984	1984-1988
Arizona	1.17	1.24	1.59	1.29
Colorado	0.61	0.66	1.46	0.42
Idaho	-0.30	-0.98	-0.41	-0.93
Montana	0.41	0.05	0.73	-0.42
Nevada	3.38	3.09	5.18	3.15
New Mexico	1.03	0.95	1.63	0.08
Utah	0.57	0.65	0.42	0.03
Wyoming	1.30	2.55	1.37	-2.47
State	Percentage Competitive Component			
	1969-1974	1974-1979	1979-1984	1984-1988
Arizona	21.97	14.94	13.47	7.69
Colorado	16.43	11.11	9.53	-6.73
Idaho	11.47	10.11	-6.49	-2.72
Montana	5.81	2.56	-4.70	-8.62
Nevada	15.63	29.49	0.78	8.96
New Mexico	9.60	9.22	1.55	-2.83
Utah	11.78	10.53	4.13	-0.82
Wyoming	11.40	18.83	-4.76	-14.38

Table 4
Industry Mix and Competitive Shifts
as a Percentage of Total Employment Change
Selected Mountain States
1984-1988

State	Industry Mix Shift				Total
	Agriculture	Mining	Manufacturing	Other	
Colorado	-10.59	-16.07	-24.49	60.77	9.62
Idaho	-23.78	-4.30	-17.65	32.50	-13.24
Montana	-113.28	-45.35	-43.81	171.54	-30.90
New Mexico	-7.11	-13.30	-7.42	28.81	0.97
Utah	-5.02	-4.52	-12.70	22.58	0.33
Wyoming	-14.10	-46.85	-5.06	29.02	-37.00

State	Competitive Shift				Total
	Agriculture	Mining	Manufacturing	Other	
Colorado	6.47	-8.50	-4.48	-148.61	-155.12
Idaho	2.66	0.27	13.08	-54.86	-38.85
Montana	24.76	3.71	-18.88	-781.80	-772.80
New Mexico	0.66	-3.19	7.84	-40.37	-35.10
Utah	1.41	-3.03	6.77	-13.26	-8.11
Wyoming	1.90	-22.96	6.43	-200.57	-215.14

Figure 1
State Employment Growth
Relative to the Nation and the Intermountain Region
1969-1988

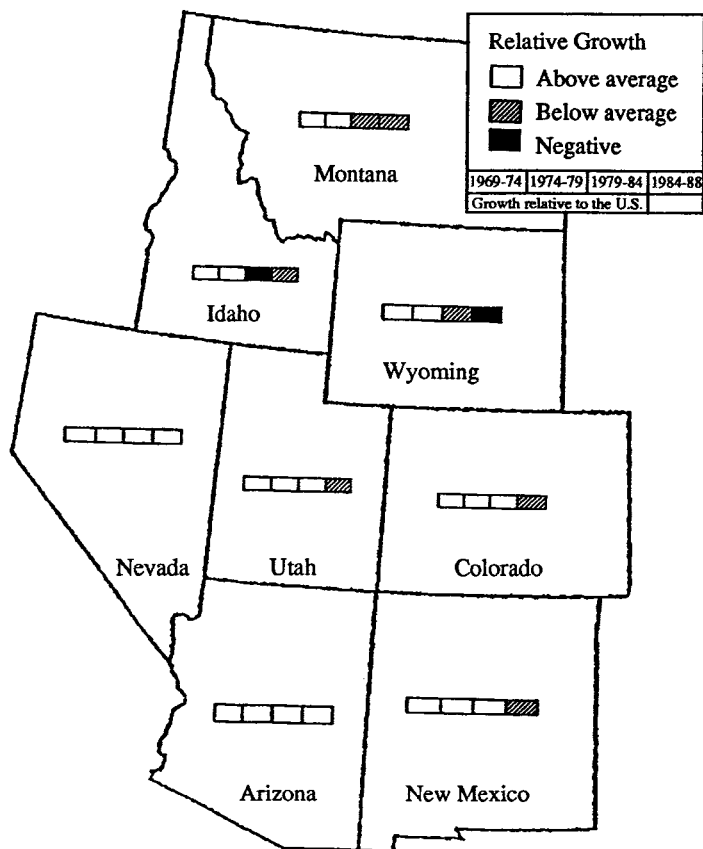


Figure 2
Industry Mix (Structural) Component
of Employment Change
Intermountain Region
1969-1988

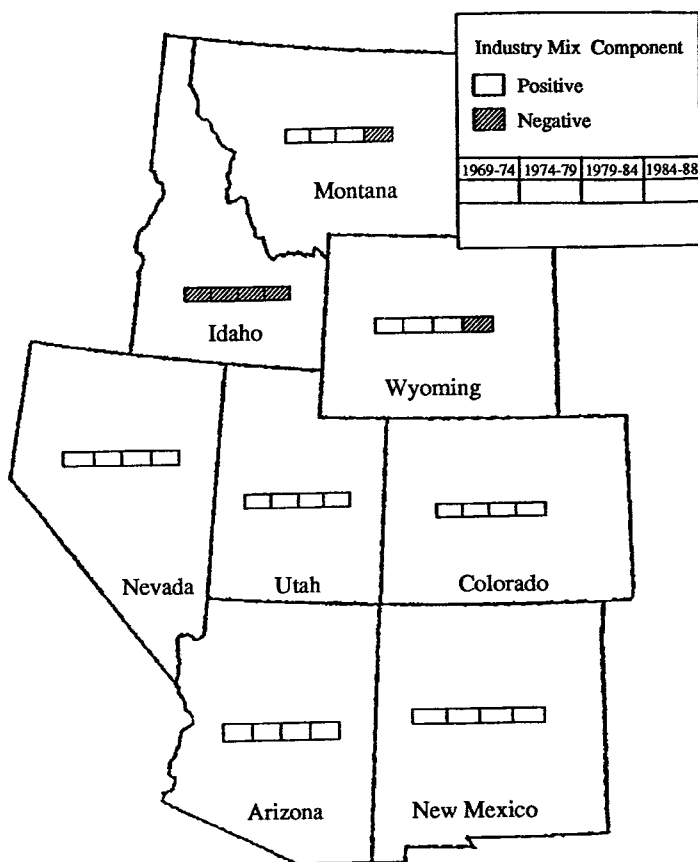
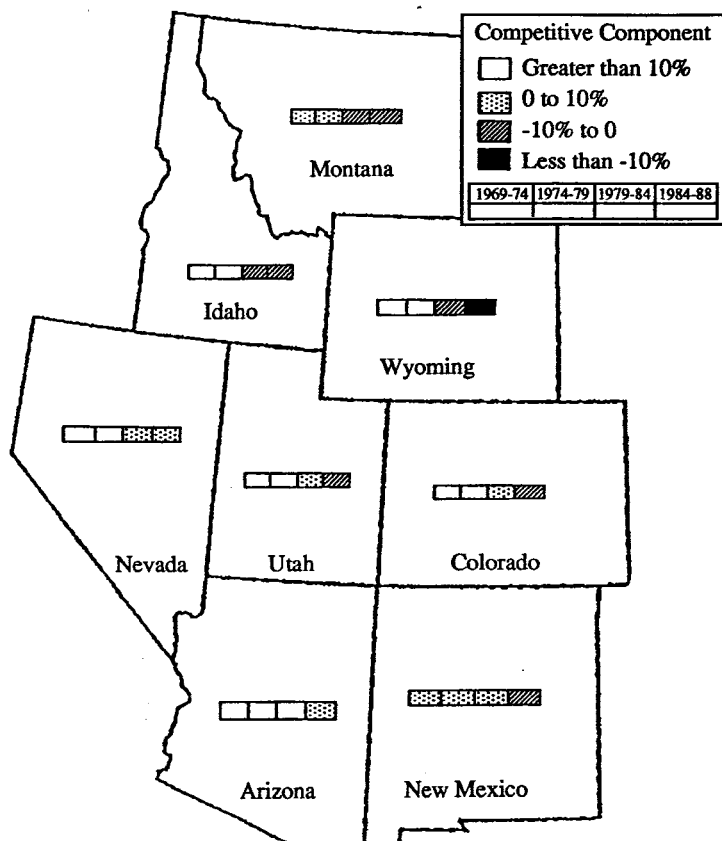


Figure 3
Competitive (Differential) Component
of Employment Change
Intermountain Region
1969-1988



Appendix A
Comparative Industry Mix (Structural) and Competitive (Differential) Shifts
Mountain States
1969-1974 to 1984-1988

State	Sector	Shift (Jobs)		Shift as a Percentage of Total Employment Change During Period ^a					
		1969-74	1974-79	1979-84	1984-88	1969-74	1974-79	1979-84	1984-88
Arizona					Industry Mix (Structural)				
	Agriculture	-2,473	-3,453	-3,089	-4,136	-1.02	-1.07	-1.06	-5.14
	Mining	523	5,410	2,211	-4,558	0.22	1.68	0.76	-5.66
	Manufacturing	-9,685	-8,102	-22,679	-18,400	-4.01	-2.52	-7.79	-22.86
	Other	19,792	17,757	42,921	46,442	8.20	5.53	14.74	57.70
	Total	8,157	11,612	19,364	19,348	3.38	3.61	6.65	24.04
					Competitive (Differential) Shift				
Agriculture	-2,106	-2,923	4,165	618	-0.87	-1.04	1.51	0.20	
Mining	5,849	-14,994	-10,603	2,090	2.42	-5.32	-3.84	0.68	
Manufacturing	17,118	28,027	40,551	19,084	7.09	9.94	14.69	6.23	
Other	132,461	130,175	130,393	93,341	54.85	46.16	47.22	30.49	
Total	153,322	140,285	164,506	115,133	63.49	49.74	59.58	37.60	
Colorado					Industry Mix (Structural)				
	Agriculture	-4,509	-7,176	-6,367	-8,527	-1.65	-2.23	-2.19	-10.59
	Mining	234	5,177	1,239	-12,937	0.09	1.61	0.43	-16.07
	Manufacturing	-12,309	-10,611	-27,350	-19,712	-4.51	-3.30	-9.39	-24.49
	Other	22,547	20,874	55,339	48,916	8.26	6.50	19.00	60.77
	Total	5,963	8,264	22,861	7,740	2.18	2.57	7.85	9.62
					Competitive (Differential) Shift				
Agriculture	-46	-3,736	5,800	5,210	-0.02	-1.16	1.99	6.47	
Mining	446	7,571	6,038	-6,840	0.16	2.36	2.07	-8.50	
Manufacturing	29,678	28,228	28,260	-3,610	10.87	8.79	9.70	-4.48	
Other	129,441	106,181	108,992	-119,621	47.40	33.05	37.42	-148.61	
Total	159,519	138,244	149,090	-124,861	58.41	43.03	51.19	-155.12	

Appendix A (continued)
Comparative Industry Mix (Structural) and Competitive (Differential) Shifts
Mountain States
1969-1974 to 1984-1988

State	Sector	Shift (Jobs)			Shift as a Percentage of Total Employment Change During Period ^a				
		1969-74	1974-79	1979-84	1984-88	1969-74	1974-79	1979-84	1984-88
Idaho					Industry Mix (Structural)				
	Agriculture	-4,253	-7,288	-6,000	-7,733	-6.31	-8.20	-660.79	-23.78
	Mining	28	872	444	-1,398	0.04	0.98	48.90	-4.30
	Manufacturing	-4,296	-3,549	-8,151	-5,740	-6.37	-3.99	-897.69	-17.65
	Other	7,584	6,276	11,784	10,566	11.25	7.06	1,163.66	32.50
	Total	-937	-3,689	-1,923	-4,305	-1.39	-4.15	-211.78	-13.24
					Competitive (Differential) Shift				
	Agriculture	672	1,510	655	864	1.00	1.70	39.10	2.66
	Mining	-306	-607	-619	88	-0.45	-0.68	-68.17	0.27
	Manufacturing	8,082	7,760	755	4,252	11.99	9.09	83.15	13.08
	Other	26,969	29,388	-30,998	-17,836	40.01	30.34	-3,413.88	-54.86
	Total	35,417	38,051	-30,207	-12,632	190.34	42.81	-3,326.76	-38.85
Montana					Industry Mix (Structural)				
	Agriculture	-3,788	-5,112	-4,713	-6,262	-7.83	-9.24	-40.76	-113.28
	Mining	132	1,650	569	-2,507	0.27	2.98	4.92	-45.35
	Manufacturing	-2,558	-1,831	-3,704	-2,422	-5.29	-3.31	-32.03	-43.81
	Other	7,396	5,449	10,739	9,483	15.29	9.84	92.87	171.54
	Total	1,190	156	2,891	-1,708	2.46	0.28	25.00	-30.90
					Competitive (Differential) Shift				
	Agriculture	901	-3,440	1,477	1,121	1.86	-6.22	12.77	24.765
	Mining	252	-1,894	-907	168	0.52	-3.42	-7.84	3.71
	Manufacturing	381	1,493	-2,132	-855	-1.77	3.85	-18.44	-18.88
	Other	17,155	12,495	-16,948	-35,400	35.46	22.57	-146.57	-781.80
	Total	18,689	8,654	18,510	-34,966	38.63	15.64	-160.08	-772.22

Appendix A (continued)
Comparative Industry Mix (Structural) and Competitive (Differential) Shifts
Mountain States
1969-1974 to 1984-1988

State	Sector	Shift (Jobs)				Shift as a Percentage of Total Employment Change During Period ^a			
		1969-74	1974-79	1979-84	1984-88	1969-74	1974-79	1979-84	1984-88
Nevada	Agriculture	-456	-818	-782	-995	-0.63	-0.55	-1.28	-0.82
	Mining	48	1,004	289	-2,274	0.07	0.67	0.47	-1.86
	Manufacturing	-916	-933	-2,955	-2,290	-1.27	-0.62	-4.82	-1.88
	Other	9,423	10,382	27,320	22,020	13.05	6.95	44.59	18.05
	Total	8,099	9,635	23,872	16,461	11.22	6.45	38.96	13.49
			Competitive (Differential) Shift						
	Agriculture	337	1,095	56	474	0.47	0.73	0.09	0.39
	Mining	-74	-1,190	1,345	5,950	-0.10	-0.80	2.20	4.88
	Manufacturing	4,303	6,440	3,494	3,972	5.96	4.31	5.70	3.25
	Other	32,874	85,582	-1,294	36,418	45.53	57.32	-2.11	29.84
	Total	37,440	91,927	3,601	46,814	51.85	61.57	5.88	38.36
New Mexico	Agriculture	-2,008	-3,252	-2,988	-3,716	-2.42	-2.82	-4.89	-7.11
	Mining	186	4,938	2,598	-6,952	0.22	4.28	4.25	-13.30
	Manufacturing	-2,239	-2,166	-5,185	-3,879	-2.70	-1.88	-8.49	-7.42
	Other	8,068	4,970	15,127	15,056	9.73	4.31	24.77	28.81
	Total	4,007	4,490	9,552	509	4.83	3.89	15.64	0.97
			Competitive (Differential) Shift						
	Agriculture	-1,353	4,239	-2,347	346	-1.63	3.68	-3.84	0.66
	Mining	768	301	-8,868	-1,669	0.93	0.26	14.52	-3.19
	Manufacturing	9,226	3,653	4,405	4,097	11.12	3.17	7.21	7.84
	Other	28,645	35,254	15,906	-21,119	34.53	30.57	26.04	-40.37
	Total	37,286	43,447	9,096	-18,345	44.95	37.68	14.89	-35.10

Appendix A (continued)
Comparative Industry Mix (Structural) and Competitive (Differential) Shifts
Mountain States
1969-1974 to 1984-1988

State	Sector	1969-74	Shift (Jobs)		1979-84	1984-88	Shift as a Percentage of Total Employment Change During Period ^a			
			1974-79	1979-84			1969-74	1974-79	1979-84	1984-88
Utah	Agriculture	-2,011	-3,117	-2,825	-3,818	-2,00	-2.29	-3.57	-5.02	
	Mining	142	3,202	1,487	-3,439	0.14	2.35	1.88	-4.52	
	Manufacturing	-5,683	-4,995	-13,010	-9,652	5.65	-3.66	16.44	-12.70	
	Other	-1,315	8,382	17,177	17,160	-1.31	6.15	21.70	22.58	
	Total	2,499	3,472	2,829	251	2.48	2.55	3.57	0.33	
			Competitive (Differential) Shift							
	Agriculture	-3,514	1,136	2,229	1,072	-3.49	0.83	2.82	1.41	
	Mining	-734	-587	-7,114	-2,304	-0.73	-0.43	-8.99	-3.03	
	Manufacturing	15,558	13,683	15,093	5,149	15.46	10.04	19.07	6.77	
	Other	39,991	42,212	17,556	-10,085	39.73	30.97	22.18	-13.26	
	Total	51,301	56,444	27,764	-6,161	50.97	41.41	35.08	-8.11	
Wyoming	Agriculture	-1,443	-2,257	-2,023	-2,556	-3.99	-3.24	-20.62	-14.10	
	Mining	243	4,941	2,777	-8,492	0.67	7.08	28.30	-46.85	
	Manufacturing	-786	-627	-1,517	-918	-2.17	-0.90	-15.46	-5.06	
	Other	4,012	2,826	4,354	5,260	11.09	4.05	44.37	29.02	
	Total	2,026	4,883	3,591	-6,706	5.60	7.00	36.60	-37.00	
			Competitive (Differential) Shift							
	Agriculture	222	735	-523	344	0.61	1.05	-5.33	1.90	
	Mining	2,324	9,187	-8,728	-4,161	6.42	13.17	-88.95	-22.96	
	Manufacturing	1,250	1,231	-742	1,165	3.45	1.76	-7.56	6.43	
	Other	13,916	24,932	-2,453	-36,344	38.45	35.75	-25.00	-200.57	
	Total	17,712	36,085	-12,446	-38,996	48.94	51.74	-126.84	-215.14	

^aThe absolute value of the change in employment was used as the base in determining these percentages

Appendix B

Test of Stability of the Competitive Component

A fundamental criticism of shift-share analysis is the apparent instability of the competitive component in some empirical tests. This has been considered by Brown (1972) and Holden, Nairn, and Swales (1989). The latter suggest testing the stability of the competitive or differential component by estimating a matrix of hypothetical percentage competitive effects where the vector of differential growth rates for each region is weighted by the industrial structure of every other region. As these data have been developed for this study, it will be useful to assess the stability of the competitive component for this group of states. This is done for the 1984-1988 period.

Define the differential growth rate as:

$$(B1) \ g_{ij}^d = g_{ij} - g_i^n,$$

where:

g_{ij} = Growth rate for the i th industry and j th region; and

g_i^n = National growth rate for that industry.

Now denoting the proportion of total employment in industry i and region k as p_{ik} , the hypothetical matrix of competitive components is given by:

$$(B2) \ C_{jk} = \sum_i g_{ij}^d p_{ik}, \quad j = 1, \dots, n; k = 1, \dots, n.$$

Thus C_{jk} is the competitive component of change based on the differential growth rates for region j and the industrial structure of region k . These values for each of the eight mountain states are shown in Table B1. Note that the diagonal elements of this matrix are the conventional competitive components¹⁰ whereas the off-diagonal elements are the hypothetical components. For example, element C_{21} represents Arizona's competitive component had its industrial structure been the same as in Colorado.

Reading down the columns of Table B1 indicates a fairly high degree of stability at least for this data set. The signs are all consistent

¹⁰The value of these components differs slightly from those reported in Table 3 because the latter are based on a dynamic shift-share analysis whereas the data in Table B1 relate a four year growth rate to one base year (i.e., 1984). Thus, Table B1 shows the competitive component for Arizona as 8.25 percent, whereas Table 3 shows that effect as 7.69 percent. The difference is due to the use of a different base.

within any state, and the absolute variation is generally within two percentage points of the values of the conventionally determined competitive component. Thus, at least for the data set used in this study, the competitive or differential components of change can be considered to be reasonably stable in the sense of not being sensitive to the particular economic structure of the regions under study.

Table B1
Hypothetical Percentage Competitive Components Using Alternative State Industrial Structures

	Arizona %	Colorado %	Idaho %	Montana %	Nevada %	New Mexico %	Utah %	Wyoming %
Arizona	8.25	-7.41	-3.88	-10.28	11.08	-2.44	-1.25	-14.25
Colorado	8.52	-7.03	-3.91	-9.80	11.75	-2.52	-1.08	-14.12
Idaho	8.36	-5.17	-2.96	-8.92	11.01	-1.34	-0.18	-11.95
Montana	8.36	-5.56	-3.80	-9.16	11.19	-2.43	-0.60	-13.87
Nevada	9.15	-6.63	-4.41	-9.97	10.41	-2.44	-0.29	-16.32
New Mexico	8.23	-6.65	-3.89	-9.35	11.94	-2.91	-1.28	-14.26
Utah	8.55	-6.38	-3.45	-9.43	11.65	-1.94	-0.72	-12.84
Wyoming	8.54	-7.27	-3.67	-8.83	18.05	-3.64	-2.72	-14.83

Note: Element j,k of this table shows the percentage competitive or differential employment change for state j weighted by the industry employment proportions in state k