AN APPLICATION OF THE BISHOP-SIMPSON METHOD: A SHIFT-SHARE VARIANT

Bruce E. Lindsay and Susan E. Martin

ABSTRACT

The Bishop-Simpson model, a variant of the traditional shift-share approach, is utilized for investigation of the development of the southern New Hampshire regional economy over time. Emphasis is placed on the strengths of the new technique in counteracting some of the limitations of traditional shift-share analyses. The B and S technique gives a clearer picture than the traditional shift-share approach of the relative advantages and disadvantages for region in terms of its specialization in slow or fast growing industries.

One of the tools of regional economic analysis, utilized in looking at the development of a regional economy over time, is Shift-Share analysis. This paper focuses on a theoretical technique developed by Bishop and Simpson, hereafter known as the B and S approach, which is a variant of the traditional Shift-Share formulation. This paper represents the first empirical use of the B and S alternative method.

The original technique, utilized and promoted by Perloff, *et al* and Ashby (1965), examined the existing and historical relationships between national and regional growth. To analyze the differences in growth rates, total regional growth is divided into three components–National Growth (NG), Industrial Mix (IM), and Regional Share (RS).

By the definition contained in traditional Shift-Share literature, the NG component measures the expected change in regional employment for an industry based on the total growth rate of employment in all sectors for the reference economy (usually the nation). This is determined by multiplying the base year employment in each industry of the regional economy under study by the overall rate of growth of the reference economy for the time period chosen.

The second component, Industrial Mix (IM), compares the distribution of rapidly-expanding and slow-growing or declining industries in the region relative to the nation. A fast-growing sector is defined as one whose growth rate of employment exceeds the total national growth rate, with a slow-growing sector being the opposite case. To calculate IM for an individual sector, the national overall growth rate is subtracted from the national growth rate of the industry, and this result is multiplied by the base year regional employment figure for that industry.

Bruce E. Lindsay is Assistant Professor and Susan E. Martin is Research Assistant, Institute of Natural and Environmental Resources, University of New Hampshire.

Published with the approval of the Director of the New Hampshire Agricultural Experiment Station as Scientific Contribution No. 892.

The RS component compares the growth rate of a sector in a region to the growth of that particular sector nationally. The difference between these two growth rates is then multiplied by base year sector employment in the region.

Summed over all sectors, the three components of traditional Shift-Share give an indication of the performance of the regional economy relative to other areas or to the nation as a whole.

Three major criticisms have been cited concerning the usefulness of the traditional Shift-Share approach. First, it is argued that the Shift-Share technique is not a useful predictive tool because it contains no behavioral equations of growth (Houston, Brown 1969). Secondly, it is often stated that the Regional Share component is not stable over time (Brown 1971, Randall 1973), while others contend that the level of disaggregation or temporal demarcation generally lends to inconsistent results (Hale, Stilwell).[1]

The B and S technique combines parts of the slightly different British, or Structural Base, technique with the traditional Shift-Share method which prevails in the American regional economic literature. The British method compares industrial structure of the nation to that in the region, but uses absolute national industry growth rates.[2] Bishop and Simpson felt that measures of both relative sector growth performance and of relative industrial composition were necessary to eliminate the effects of trade cycles and national employment fluctuations, showing more clearly the relative advantages or disadvantages of a particular region's industrial composition. The use of absolute growth rates does not account for business influences that do not affect the reference and regional economies to the same degree.

The three components retain the same interpretation for their respective summed totals as those obtained by traditional Shift-Share, but there is a reallocation of contributing growth effects among the individual sectors for the National Growth and Industrial Mix components. The Regional Share component is calculated identically to traditional Shift-Share.

For each industry, the components for the B and S version are calculated as follows:

[1] Ashby responded to these criticisms by emphasizing that the Shift-Share approach is not meant to be a comprehensive growth model, but a tool for organizing an economic description of regional growth patterns.

[2] For our purposes, absolute industry growth rate is defined as the actual rate of employment expansion of an industry over a given time period. The relative growth rate is the absolute industry growth rate minus the national rate of employment expansion over an sectors combined.

$$(1)\quad NG_{ij} = E_{ijt}\left[\frac{\sum_{ij} E_{ijt+1}}{\sum_{ij} E_{ijt}} - 1\right] + \left[\left(\sum_{i} E_{ijt}\right)\left(\frac{\sum_{j} E_{ijt}}{\sum_{ij} E_{ijt}}\right)\left(\frac{\sum_{j} E_{ijt+1}}{\sum_{j} E_{ijt}} - \frac{\sum_{ij} E_{ijt+1}}{\sum_{ij} E_{ijt}}\right)\right]$$

$$(2)\quad IM_{ij} = \left[E_{ijt} - \left(\sum_{i} E_{ijt}\right)\left(\frac{\sum_{j} E_{ijt}}{\sum_{ij} E_{ijt}}\right)\right]\left[\frac{\sum_{j} E_{ijt+1}}{\sum_{j} E_{ijt}} - \frac{\sum_{ij} E_{ijt+1}}{\sum_{ij} E_{ijt}}\right]$$

$$(3)\quad RS_{ij} = E_{ijt}\left[\frac{E_{ijt+1}}{E_{ijt}} - \frac{\sum_{j} E_{ijt+1}}{\sum_{j} E_{ijt}}\right]$$

where, E is employment level, i represents a particular industrial sector, j a specific region, and t depicts time period.

APPLICATION

The region chosen for study is the southern three counties of New Hampshire–Hillsborough, Rockingham and Cheshire. This region can be viewed as a unique portion of the state, close to metropolitan Boston and in a position to attract relatively mobile industry to cross the border. Containing all the state's Metropolitan areas–Manchester, Salem, and Nashua, as well as areas included in the Haverhill-Lowell-Lawrence, Massachusetts Standard Metropolitan Statistical Area, the region is characterized by Manufacturing, Construction and Transportation industries, as well as the Service and Trade sectors (U.S. Department of Commerce 1975).

Data were acquired for ten year intervals covering 1940 to 1970 from the Department of Commerce and were disaggregated to ten industrial sectors.

EMPIRICAL RESULTS UTILIZING THE B AND S FORMULATION

The economy of the southern New Hampshire region experienced a turnaround over the thirty years studied, according to the aggregated sector totals of the B and S model (Table 1).

The Industrial Mix component remained positive over the three periods, suggesting a predominance of nationally fast-growing industries (growth rate of employment exceeds the total national growth rate for each industry). It is the Regional Share component, however, that reveals the trend of economic activity in the three county area. In the 1940's employment growth in the region lagged behind the national pace by 11,121 jobs, more than offsetting any benefits of a favorable industrial structure and creating a net lag of -5346 (sum of the RS and IM components). This sum, RS + IM, is defined in the literature as the Net Relative Change and refers to the difference between the expected employment change and actual employment change during the period. In the 1950's the Regional Share component became positive, 5,959, for a Net Relative Change of 10,089 jobs over and above the national standard of growth. The 1960's saw growth expand even more, with a net increase of 16,049 jobs, indicating that the three county region had a competitive advantage in attracting jobs and businesses relative to the rest of the country.

TABLE 1
Sector Employment Totals of Shift-Share Components Utilizing B and S Approach for 1940-1970

	National Growth	Industrial Mix	Regional Share
1940-50	23,727	5,775	-11,121
1950-60	19,683	4,130	5,959
1960-70	30,046	1,105	14,944

To illustrate how the B and S model of Shift-Share differs from the traditional Shift-Share approach, several sectors are presented in Table 2.[3]

The first notable difference is that the National Growth component may be negative even in a time of positive national employment growth, whereas in traditional Shift-Share the National Growth component will be positive for every sector if overall employment growth nationally is positive. In this sense, the National Growth component takes into account the performance of the sector nationally, indicating whether it is slow-growing or rapidly expanding, leading to a more realistic idea of expected growth for the sector in a given region. Agriculture and Mining, by this approach, are shown to be slow-growing or declining sectors based on national employment trends in those sectors and therefore would not be expected to contribute to regional growth. On the other hand, Manufacturing should be beneficial to employment growth on the basis of its positive National Growth component.

The Industrial Mix gives a comparison of the strength of representation of a particular sector in a region (based on the fraction of total employment within the sector) and the degree of representation of the sector nationally. The Industrial Mix component still compares the sector growth rate to the overall growth rate as it did in traditional Shift-Share, so it is the combination of these two factors that accounts for the sign and magnitude of the Industrial Mix component for an individual sector.

The positive Industrial Mix component of the Agricultural sector over all three decades indicates that the region's industrial structure has a relative advantage over other regions because it is not specializing in a nationally declining industry.

The easiest way to illustrate this concept is to return to the equation for calculating the Industrial Mix and note that it is made up of two parts:

$$(4)\quad IM = \underbrace{\left[E_{ijt} - \left(\sum_{i} E_{ijt}\right)\left(\frac{\sum_{j} E_{ijt}}{\sum_{ij} E_{ijt}}\right)\right]}_{A}\underbrace{\left[\frac{\sum_{j} E_{ijt+1}}{\sum_{j} E_{ijt}} - \frac{\sum_{ij} E_{ijt+1}}{\sum_{ij} E_{ijt}}\right]}_{B}$$

The first part, A, gives the relative representation of the sector in the region's labor force, compared to the sector's portion of the national labor force. If A is negative, the region

[3]Additional analysis using the B and S approach covering all ten sectors is found in Martin.

TABLE 2

B and S Shift-Share Components of Selected Industries, 1940-70

	1940-50			1950-60			1960-70		
SECTOR	NG	IM	RS	NG	IM	RS	NG	IM	RS
Agriculture	−5580	4445	575	−6241	3985	− 549	−4459	3296	596
Mining	− 413	415	− 36	− 796	763	27	− 343	337	94
Manufacturing	12726	2039	−6805	9946	963	−3918	7522	−2127	2470

specializes in that sector to a lesser degree than the nation as a whole. If positive, the region does specialize in that sector relative to the nation.

Part B indicates whether the sector is nationally fast growing (if so, B is positive) or slow growing, making B negative. If both A and B are negative, the Industrial Mix component will be positive. This is the case for the Agricultural sector. The region therefore has a relative advantage in its industrial composition because it is under-represented in a slow-growing sector. The same is true of the Mining sector.

Conversely, one would want to be over-represented in a rapidly-expanding sector, which would be shown by A and B both being positive, resulting in a positive Industrial Mix component. This is the case in the Manufacturing sector for the decades 1940-50 and 1950-60. The southern New Hampshire economy has a greater percentage of its labor force in the Manufacturing sector than the percentage of the national labor force in Manufacturing, making A positive. B is positive because it is a fast-growing industry nationally, resulting in a positive Industrial Mix contribution to the region. The region however had a negative Regional Share component, indicating that manufacturing in the region did not expand as rapidly as its national counterpart. The reason for this can be determined by a closer look at the Manufacturing sector breakdown. In 1940 25.44 percent of three county manufacturing employment was in the nationally declining textile sector (Department of Commerce 1972).

In 1970 only 8.64 percent of manufacturing employment was in textiles and the sector was dominated by the electrical equipment, chemicals and printing subsectors. In the decade 1960-70 Manufacturing made its turnaround, in spite of Manufacturing's slow growth rate nationally, resulting in a negative Industrial Mix component. The region continued to specialize in that sector, however, and a positive Regional Share component indicates the strength of that sector in guiding the economy's reversal over the thirty years.

CONCLUSIONS

By giving a clearer picture of the relative advantages and disadvantages for a regional economy due to specialization in fast- or slow-growing industries, the alternative method of shift-share analysis, the Bishop-Simpson approach, supplies additional information to the regional planner or economist. Instead of looking simply at whether a sector is fast-growing or not, the Industrial Mix component gives an indication of the degree of representation of that sector in the economy. Strong representation in a fast-growing sector is a "positive" and will be an impetus to the economy, while over-representation in a slow-growing or declining industry (at the national level) would be expected to retard regional expansion. Under-representation in a slow-growing industry also creates an advantage for the regional economy relative to the rest of the nation.

The predictive value of this new formulation of Shift-Share has not been tested. Its value to date lies in the additional information it reveals about the infrastructure of a regional economy. The technique answers some of the criticisms aimed at traditional Shift-Share. For instance, the B and S formulation gives a more realistic picture of the relative advantages or disadvantages of a region because national business cyclical impacts which may not affect individual regions to the same degree, are lessened. This is not commonplace to traditional Shift-Share.

REFERENCES

Ashby, Lowell D. *Growth Patterns in Employment by County, 1940-50 and 1950-60.* U.S. Department of Commerce, Office of Business Economics, Washington, 1965.

_____. "The Shift and Share Analysis: A Reply." *Southern Economic Journal,* 34(1968):423-425.

Bishop, K. C. and C. E. Simpson. "Components of Change Analysis: Problems of Alternative Approaches to Industrial Structure." *Regional Studies,* 6(1972):59-68.

Brown, H. J. "Shift and Share Projections of Regional Economic Growth: An Empirical Test." *Journal of Regional Science,* No. 1(1969), pp. 1-18.

_____. "The Stability of the Regional-Share Component: Reply." *Journal of Regional Science,* No. 1(1971), pp. 113-114.

Hale, Carl W. "Shift-Share Analysis as a Descriptive Tool in Regional Analysis." *Mississippi Valley Journal of Business Economics,* 6(1971):65-74.

Houston, David B. "The Shift and Share Analysis of Regional Growth: A Critique." *Southern Economic Journal,* 33(1967):577-81.

Martin, Susan E. "Employment Changes in Southern New Hampshire: A Shift-Share Approach." M. S. thesis, University of New Hampshire, 1977.

Perloff, H. S., E. S. Dunn, E. E. Lampard and R. F. Muth. *Regions, Resources and Economic Growth.* Baltimore: Johns Hopkins Press, 1960.

Randall, J. N. "Shift-Share Analysis as a Guide to the Employment Performance of West Central Scotland." *Scottish Journal of Political Economy,* No. 1(1973), pp. 1-26.

Stilwell, F. J. B. "Regional Growth and Structural Adaptation." *Urban Studies,* 6(1969):162-78.

U.S. Department of Commerce, Bureau of Economic Analysis. *Regional Employment by Industry,* 1940-1970. Washington, 1975.