**Shift-Share Analysis Revisited:
The Allocation Effect and
the Stability of Regional Structure**

Henry W. Herzog, Jr.
Richard J. Olsen

OAK RIDGE NATIONAL LABORATORY

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Henry W. Herzog, Jr.
Richard J. Olsen

Regional and Urban Studies Section
Energy Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

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Henry W. Herzog, Jr.*

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Abstract

This paper examines the Esteban-Marquillas reformulation of the "classical" shift-share equation. The revised equation is used to decompose sectoral employment growth between 1960 and 1970 into four effects that measure differential change among U.S. regions. The empirical results indicate that this new technique expands the analytic properties of shift-share analysis, but that interpretations are sensitive to the temporal representation of regional structure in the shift-share equation.

*Assistant Professor of Economics, The University of Tennessee, Knoxville, and Consultant, Energy Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

**Senior Research Associate, Charles River Associates, Inc., Cambridge, Massachusetts, formerly Head, Regional and Urban Studies Section, Energy Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

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I. Introduction

The relationship between regional growth and industrial structure is often analyzed and decomposed into various "effects," with a technique known as shift and share analysis. Founded, perhaps, on Daniel Creamer's "locational shifts" in manufacturing [17], the technique was first developed and employed as an analytic tool during the early 1960's by Ashby [2], Dunn [6], Fuchs [8], and Perloff, Dunn, Lampard and Muth [12]. In recent years shift-share analysis and various transformations of the technique have been extensively employed by regional economists.

This paper examines a recent reformulation of the "classical" shift-share equation. The empirical results will show that this new technique expands the analytic properties of shift-share analysis, but that interpretations are sensitive to the temporal representation of regional structure in the shift-share equation. In terms of the latter results, it will be shown that the attempt to correct one of the problems inherent in the original shift-share equation creates a related problem, of perhaps greater significance, in the transformed specification.

II. The Classical Shift-Share Equation

The "classical" shift-share equation is designed to decompose the growth of a regional variable such as employment, income or output into three "effects" that measure differential growth among regions. Given information by industrial sectors for one of these regional variables at two points in time, the technique divides the change, d , over the time period into the following effects: national growth, g , industry-mix, m , and competitive position, c .¹ For industry section "i" in region "j":

$$d_{ij} = g_{ij} + m_{ij} + c_{ij}. \quad (1)$$

If the analysis is applied to employment, E , then²

$$d_{ij} = E_{ij}^* - E_{ij} \quad (2)$$

$$g_{ij} = E_{ij} r_{us} \quad (3)$$

$$m_{ij} = E_{ij} (r_{i,us} - r_{us}) \quad (4)$$

$$c_{ij} = E_{ij} (r_{ij} - r_{i,us}), \quad (5)$$

where r_{ij} , $r_{i,us}$ and r_{us} represent regional and national growth rates defined as follows:

$$r_{ij} = \frac{E_{ij}^* - E_{ij}}{E_{ij}} \quad (6)$$

$$r_{i,us} = \frac{E_{i,us}^* - E_{i,us}}{E_{i,us}} \quad (7)$$

$$r_{us} = \frac{E_{us}^* - E_{us}}{E_{us}}, \quad (8)$$

and E_{ij} = employment in the i th sector in the j th region, $E_{i,us}$ = employment in the i th sector in the U.S., and E_{us} = total employment in the U.S., all measured in a base year. The superscript "*" denotes employment in the terminal year of the analysis.

For any region the national growth (3), industry-mix (4) and competitive position (5) can be evaluated for a specific industrial sector "i" or summed over all sectors and evaluated for the entire region. The shift-share equation for sector "i" in the j th region is:

$$d_{ij} = E_{ij}r_{us} + E_{ij}(r_{i,us} - r_{us}) + E_{ij}(r_{ij} - r_{i,us}). \quad (9)$$

Notice that this "classical" shift-share equation charges each regional industry with a rate of employment growth equal to that achieved by the national economy over the analysis period. The difference between the actual employment change, d_{ij} , and this national growth effect is called the "net shift" of sector "i" in the j th region. The net shift is also equal to the sum of the industry-mix and competitive effects.

The industry-mix effect (4) for the i th sector will be positive in all regions if sector "i" employment grows faster than total employment, both measured at the national level ($r_{i,us} > r_{us}$). Likewise, the industry-mix effect will either vanish or turn negative if $r_{i,us} \leq r_{us}$. The competitive position (5) for sector "i" in the j th region will be positive, zero or negative depending on whether regional employment growth in this sector is faster than ($r_{ij} > r_{i,us}$), equal to ($r_{ij} = r_{i,us}$) or slower than ($r_{ij} < r_{i,us}$) employment growth in this same

industry at the national level. In addition, a positive (negative) competitive position implies that a region's share of national employment in a particular industry is increasing (decreasing) over the analysis period.

If each of the shift-share components (effects) is summed over all sectors, the sign of the resulting total net shift indicates the direction of change, if any, in the region's share of total U.S. employment. The total industry-mix effect will be positive (negative) in regions with above average proportions of employment in sectors with rapid (static or declining) growth at the national level. Likewise, the total competitive effect will be positive (negative) in regions where employment grew faster (slower) than the industry-mix or employment structure would suggest.

At this juncture it should be emphasized that shift-share analysis is no more than a measurement technique or standardization procedure for decomposing the growth of a regional variable. The method in no way purports to explain "why," for instance, the competitive effect is positive in some regions and negative in others. Thus, equation 9 should be considered an identity rather than a behavioral relationship.

III. Two Problems with the Classical Shift-Share Equation

The theoretical and empirical limitations of shift-share analysis are well documented and will not be considered in this paper.³ However, two of these limitations or problems inherent in the classical shift-share equation warrant a brief description.

A. The Problem of "Weights"

One criticism often leveled at shift-share analysis is that the technique takes no account of changes in regional industrial structure over the analysis period [6, 8, 10, 14, 16]. Notice in equation 9 that all regional and national growth rates are "weighted" by base year employment levels. Thus, when shift-share component totals are determined for a particular region, the "weights" used represent the industrial structure of the region in the base period; and no account is made of structural change between the base and terminal year of the analysis.

Dunn [6, p. 108] compares this problem to that of index numbers: the longer the period of analysis the larger the bias resulting from changes in the weights. Fuchs [8], and Klaassen and Paelinck [10] suggest correction methods based on "average structure" over the period of analysis. Stilwell [14] proposes a specific modification of the basic shift-share equation to directly measure the employment impacts of changing industrial structure. Finally, Ashby [1] has demonstrated that the shift-share technique is perfectly capable of utilizing any convex combination of initial and terminal values as a base.

B. The Problem of "Interwoven Effects"

The competitive effect has been described as the dynamic element of change within the region [2, p. 19]. However, Rosenfeld [13] and others argue that the competitive effect, as defined in equation 5, depends not only on the dynamic nature of a sector ($r_{ij} - r_{i,us}$), but also on the concentration of regional employment in that sector, E_{ij} . Thus the competitive position and industry-mix effects are interwoven,

both depend on industrial structure. Therefore, the "classical" formulation of the competitive effect does not measure what it is often described to measure — competitive advantage and disadvantage.

A simple example will illustrate the nature of these interwoven effects.⁴ Assume that two regions, a and b, have the same total employment and identical regional growth rates for sector "k" ($r_{ka} = r_{kb}$). Thus, both regions have an identical "competitive advantage" or "disadvantage" ($r_{ka} - r_{k,us} = r_{kb} - r_{k,us}$). However, the competitive position will vary ($c_{ka} \neq c_{kb}$) if the sectoral distribution of employment (regional structure) is different in the two regions ($E_{ka} \neq E_{kb}$). In sum, because regional structure determines the magnitude of both the industry-mix and competitive effects, the two effects are interwoven and the competitive position is an impure measure of regional competitive advantage or disadvantage.

IV. A Proposed Reformulation

Esteban-Marquillas [7] (hereafter E-M) has reformulated or rearranged the classical shift-share equation in order to solve the latter problem of interwoven effects. This is accomplished by redefining the competitive position and creating a fourth shift-share component, the "allocation effect."

A. The Revised Equation

The revised shift-share equation is based on a new element, $\hat{E}_{ij}$, that E-M terms the "homothetic employment" in sector "i" of region "j".⁵ He defines this element as "the employment that sector 'i' of region 'j' would have if the structure of the employment in such a region were

equal to the national structure" [7, p. 251]. Stated another way, $\hat{E}_{ij}$ is the employment that region "j" would have in the i th sector if the "location quotient" for this sector in the region were equal to one. Thus,

$$\hat{E}_{ij} = E_j \frac{E_{i,us}}{E_{us}}, \quad (10)$$

where E_j = total employment in the j th region in the base year.

E-M utilizes homothetic employment to purge the competitive position of all regional structural influence. By substituting homothetic employment, $\hat{E}_{ij}$, for "effective employment," E_{ij} , the competitive position (5) becomes

$$c'_{ij} = \hat{E}_{ij} (r_{ij} - r_{i,us}) \quad (11)$$

The unexplained portion of employment change ($d - g - m - c'$) is called the "allocation effect" [7, p. 251]. For the i th sector in region "j" the allocation effect, a_{ij} , is expressed as

$$a_{ij} = (E_{ij} - \hat{E}_{ij}) (r_{ij} - r_{i,us}) \quad (12)$$

In analyzing the meaning of the allocation effect, E-M states that this fourth shift-share component "will show us if the region is specialized in those sectors in which it enjoys better competitive advantages" [7, p. 252]. He further states that the total allocation effect "will be the larger the better [the region's] employment is distributed among the different sectors, according to their respective advantages" [7, p. 252].

Although the sign of the allocation effect can be either positive or negative, four possible combinations of regional specialization ($E_{ij} - \hat{E}_{ij}$) and competitive advantage ($r_{ij} - r_{i,us}$) are possible.⁶ Thus, a region may either specialize ($E_{ij} - \hat{E}_{ij} > 0$) or not specialize ($E_{ij} - \hat{E}_{ij} < 0$) in sector "i" employment, and may demonstrate, for this same industry, either a competitive advantage ($r_{ij} - r_{i,us} > 0$) or disadvantage ($r_{ij} - r_{i,us} < 0$). These four possibilities for the allocation effect are listed, with an identifying code number, in Table 1.

For any region the national growth (3), industry-mix (4), revised competitive position (11) and allocation (12) effects can be evaluated for a specific industrial sector "i" or summed over all sectors and evaluated for the entire region.⁷ The E-M reformulation of the shift-share equation for sector "i" in the *jth* region is:

$$d_{ij} = E_{ij}r_{us} + E_{ij}(r_{i,us} - r_{us}) + \hat{E}_{ij}(r_{ij} - r_{i,us}) + (E_{ij} - \hat{E}_{ij}) \cdot (r_{ij} - r_{i,us}) \quad (13)$$

B. Analysis of Regional Employment Growth: 1960-1970

A shift-share analysis of employment change between 1960 and 1970 was undertaken to examine the regional dimensions of the revised competitive position and new allocation effects. The components in equation (13) were determined for 34 employment sectors over two spatial grids: 173 BEA economic areas and 8 BEA economic regions.⁸

Table 2 presents a shift-share analysis of employment change between 1960 and 1970 in a specific BEA economic area — Knoxville, Tennessee. Both the classical (model 1) and E-M (model 2) shift-share

Table 1. Possible Allocation Effects

Code No. (1-4)	Definition	Allocation effect (a_{ij})	Components	
			Specialization ($E_{ij} - \hat{E}_{ij}$)	Competitive advantage ($r_{ij} - r_{i,us}$)
1	Competitive disadvantage, specialized	-	+	-
2	Competitive disadvantage, not specialized	+	-	-
3	Competitive advantage, not specialized	-	-	+
4	Competitive advantage, specialized	+	+	+

Table 2. Shift-Share Analysis of Employment Growth: 1960-1970,
Knoxville, Tenn., BEA Economic Area

Industry name	Change in employ- ment (d)	Components of employment change ^a					
		Model No. 1			Model No. 2 ^b		
		Nat. growth (g)	Ind. mix (m)	Comp. effect (c)	Comp. effect (c')	Allocation Effect (a)	Code ^c
Agriculture	-13179	4748	-13613	-4313	-3138	-1175	1
Forestry and fisheries	190	74	-64	179	185	-6	3
Mining	-4928	2239	-2890	-4277	-998	-3278	1
Contract construction	4130	3651	-1040	1518	1307	211	4
Food and kindred products	-1221	1402	-2972	349	369	-20	3
Textile mill products	995	2195	-1764	563	196	366	4
Apparel	6067	1490	-895	5471	3473	1998	4
Printing and publishing	997	429	-37	605	1316	-710	3
Chemicals and allied products	-943	3474	-490	-3926	-793	-3133	1
Lumber products and furniture	438	2158	-2811	1091	434	657	4
Nonelectrical machinery	1807	234	119	1452	7864	-6411	3
Electrical equipment	1885	160	88	1636	12323	-10687	3
Motor vehicles and equipment	1136	80	12	1042	8852	-7809	3
Other transportation equipment	474	62	-7	418	5278	-4860	3
Paper and allied products	641	124	-31	547	2059	-1511	3
Petroleum refining	-25	24	-55	5	48	-43	3
Primary metals	357	1482	-1413	288	192	95	4
Fabricated metals and ordnance	1636	372	-79	1342	3779	-2437	3
All other manufacturing	2655	1076	-505	2083	3541	-1457	3
Railroad transportation	-1011	724	-1877	141	148	-6	3
Trucking and warehousing	456	660	64	-269	-300	31	2
Other transportation	400	441	188	-229	-376	146	2
Communications	211	550	409	-749	-903	154	2
Public utilities	2737	760	-238	2214	2115	98	4
Wholesale trade	3303	1490	1366	445	534	-88	3
Retail trade	5200	7982	2013	-4796	-4698	-98	1
Finance, insurance and real estate	2973	1211	1143	618	1112	-493	3
Lodging and personal services	1490	1621	-657	526	527	0	-
Business and repair services	1606	1152	1400	-946	-1080	133	2
Amusement and recreation services	233	281	27	-75	-112	37	2
Private households	-2960	1680	-4664	24	23	1	4
Professional services	19872	5981	16233	-2342	-2407	64	2
Public administration	2519	1656	752	109	169	-59	3
Armed Forces	19	106	-22	-64	-822	757	2
Totals	40160	51784	-12313	688	40222	-39533	-

^aModel 1 = classical shift-share; Model 2 = Esteban-Marquillas reformulation.

^bFor model 2 the national growth (g) and industry-mix (m) effects are identical to g and m in model 1. Also note that c' + a = c.

^cAllocation codes: 1 = competitive disadvantage, specialized
2 = competitive disadvantage, not specialized
3 = competitive advantage, not specialized
4 = competitive advantage, specialized

components are listed. For model 2 the allocation codes (1-4) defined in Table 1 are also noted.

The totals of the first four columns in Table 2 reveal the general character of employment growth in the Knoxville economic area between 1960 and 1970. The negative total industry-mix effect indicates that the Knoxville area had above average proportions of employment in sectors with subnormal growth at the national level. The positive total competitive effect indicates that employment grew faster in the Knoxville economic area than its industry-mix or employment structure would suggest. However, the negative total industry-mix effect more than offsets the positive total competitive effect resulting in a negative total net shift ($d - g$ or $m + c$). Thus, the Knoxville economic area grew slower than the nation and the area's share of total U.S. employment declined between 1960 and 1970.

The classical (model 1) shift-share components can also be evaluated for the individual employment sectors listed in Table 2. Notice that the natural resource industries tended to lag while the service industries tended to lead total employment growth between 1960 and 1970 at the national level. The competitive effects (c) listed in Table 2 indicate, in general, that manufacturing employment in the Knoxville economic area increased faster than manufacturing employment at the national level. Thus, the area's share of national manufacturing employment increased between 1960 and 1970.

Employment growth in the textile mill products and apparel industries in the Knoxville economic area has been typical of that in many southern regional economies. Although national employment in these two sectors

increased between 1960 and 1970, employment grew slower than total national employment over this same time period. Thus, the industry-mix effect for each of these industries is negative. On the other hand, the positive competitive effects for these two sectors in Table 2 indicate that employment in the textile mill products and apparel industries in the Knoxville area grew faster than at the national level. Thus, the area exhibited a competitive advantage ($r_{ij} - r_{i,us} > 0$) in these two industries. However, the classical shift-share (model 1) analysis does not tell us if the Knoxville economic area has "exploited" this competitive advantage. Little insight is provided on regional industrial specialization.

The E-M (model 2) shift-share analysis attempts to fill this void through the "allocation" effects listed in Table 2. Examples of each possible type of allocation effect (Table 1) can be found within the employment structure of the Knoxville economic area. For example, the Knoxville area is shown to have been specialized in both textile mill products and apparel, employment sectors in which the region had a competitive advantage (code 4). The positive competitive effects for the manufacturing sectors have already been noted. However, because regional employment was not specialized in the majority of these industries, the allocation effects for Knoxville are negative (code 3). Furthermore, while the Knoxville area had a competitive disadvantage in both the agricultural and trucking and warehousing industries, employment was specialized in the former (code 1) but not the latter (code 2).

Table 3 lists the signs of the net shift, industry-mix, competitive position and allocative effects for total employment change between 1960 and 1970 in the eight BEA economic regions.⁹ Note that of the eight economic regions listed, only the Great Lakes region has a positive total allocation effect.¹⁰ A corresponding examination of the total allocation effects for the smaller BEA economic areas shows that only 6 of the 173 areas had positive total allocation effects between 1960 and 1970.¹¹

Since positive allocation effects imply "correct" regional structure (see Table 1) an obvious question is: Why have so few areas of the United States had an employment distribution consistent with regional competitive advantage and disadvantage? The following section will demonstrate that the inference of seemingly irrational regional economic behavior, as measured by the allocation effect, is an inherent property of the E-M shift-share equation (13).

V. The Problem of Weights Once Again

As stated, the weights, E_{ij} , in the classical shift-share equation (9) represent regional employment structure in the base period and no account is made of structural change between the base and terminal year of the analysis. In the revised shift-share equation (13) the weights used in conjunction with the allocation effect, $E_{ij} - \hat{E}_{ij}$, represent the difference between "effective" and "homothetic" employment. Again, the weights are defined in base year values and no account is made of structural change over the period of analysis.

Table 3. Shift-Share Analysis of Total
Employment Growth: 1960-1970,
for Eight BEA Economic Regions

Regions	Components of employment change			
	Net shift (d-g)	Industry- mix (m)	Competitive position (c or c')	Allocation effect (a)
New England	-	+	-	-
Mideast	-	+	-	-
Great Lakes	-	+	-	+
Southeast	+	-	+	-
Plains	-	-	-	-
Southwest	+	-	+	-
Rocky Mountain	+	-	+	-
Far West	+	+	+	-

*Insignificant.

The question of appropriate weights for the allocation effect represents a serious problem for the empirical implementation of the E-M shift-share equation. Notice that the substitution of terminal year for base year weights in the classical shift-share equation (9) will alter the "magnitude" of the various growth components; while this same substitution in the revised equation (13) may change the "sign," and thus the interpretation, of the allocation effect.¹²

Changing employment structure may cause a sign change in the classical shift-share specification, but only in the case where the components are summed over all employment sectors and evaluated for an entire region. On the other hand, one would expect sign changes in the allocation effect for individual sectors to occur as a direct result of changing employment structure over the period of analysis. For example, a sector defined as "not specialized" in the base year ($E_{ij} - \hat{E}_{ij} < 0$) may become "specialized" in the terminal year ($E_{ij}^* - \hat{E}_{ij}^* > 0$). Combined with a measure of regional competitive advantage or disadvantage ($r_{ij} - r_{i,us}$) that is independent of the "weight problem," the net result is a change in both the sign and interpretation of the allocation effect for this employment sector.

The change in the allocation effect that results from the substitution of terminal year for base year weights in (12) is equal to

$$[E_{ij}^* - \hat{E}_{ij}^* - (E_{ij} - \hat{E}_{ij})](r_{ij} - r_{i,us}) \quad (14)$$

After rearrangement, the terms within the brackets in (14) represent the change in effective (actual) employment, d , less the change in homothetic (expected) employment between the base and terminal years of

the analysis. Thus, for $r_{ij} - r_{i,us} > 0$, the substitution of terminal year for base year weights will cause the allocation effect to increase (decrease) if the change in actual employment is greater than (less than) the change in expected employment. For certain regions and employment sectors this change in magnitude of the allocation effect will be accompanied by a change or switch in sign.

In order to assess the sensitivity of the sign of the allocation effect to changes in regional industrial structure, the allocation component (12) of the E-M shift-share equation was alternately computed with base year and terminal year specialization weights. This sensitivity of the allocation effect sign was examined for 34 employment sectors in 173 BEA economic areas over two time periods: 1950-1960 and 1960-1970. The results are listed in Table 4.

Two specific types of sign change resulted. In terms of the code numbers and allocation effect components listed in Table 1, these were a change from code 1 to code 2:

$$r_{ij} - r_{i,us} < 0; E_{ij} - \hat{E}_{ij} > 0; E_{ij}^* - \hat{E}_{ij}^* < 0, \text{ and} \quad (15)$$

a change from code 3 to code 4:

$$r_{ij} - r_{i,us} > 0; E_{ij} - \hat{E}_{ij} < 0; E_{ij}^* - \hat{E}_{ij}^* > 0. \quad (16)$$

In both cases the sign of the allocation effect changes from negative to positive implying a "correct" redistribution of employment specialization consistent with regional competitive advantage and disadvantage.

Table 4 lists, for each time period and each industrial sector, the number of BEA economic area allocation effects that switch from code 1 to code 2, and from code 3 to code 4. Notice that the greatest number of switches occurred between 1950 and 1960 in the business and repair

Table 4. Sensitivity of the Allocation Effect, by Industrial Sectors
(No. of BEA economic area allocation effects that change
sign when specialization weights change)

Industrial sectors	Change in allocation effects*			
	1950-1960		1960-1970	
	Specialization measured in 1960 rather than 1950		Specialization measured in 1970 rather than 1960	
	1 + 2	3 + 4	1 + 2	3 + 4
Agriculture	10	1	6	10
Forestry and fisheries	0	17	3	9
Mining	3	15	4	1
Contract construction	14	14	13	23
Food and kindred products	3	10	3	21
Textile mill products	1	4	3	3
Apparel	1	21	3	15
Printing and publishing	0	5	3	6
Chemicals and allied products	7	7	5	11
Lumber products and furniture	4	6	2	2
Nonelectrical machinery	2	4	1	8
Electrical equipment	1	11	4	16
Motor vehicles and equipment	1	4	1	2
Other transportation equipment	7	7	7	9
Paper and allied products	3	6	1	11
Petroleum refining	3	7	3	6
Primary metals	0	6	0	7
Fabricated metals and ordnance	7	11	7	18
All other manufacturing	2	7	2	14
Railroad transportation	4	0	2	7
Trucking and warehousing	15	14	16	6
Other transportation	2	5	2	3
Communications	12	17	16	8
Public utilities	10	19	10	21
Wholesale trade	9	9	10	10
Retail trade	5	15	10	3
Finance, insurance and real estate	3	5	0	4
Lodging and personal services	9	8	6	18
Business and repair services	47	3	14	5
Amusement and recreation services	11	4	9	12
Private households	3	13	0	27
Professional services	5	6	8	2
Public administration	4	6	6	7
Armed Forces	4	14	7	8
Total	212	301	187	333

*Allocation effect codes: 1 = competitive disadvantage, specialized
 2 = competitive disadvantage, not specialized
 3 = competitive advantage, not specialized
 4 = competitive advantage, specialized

services industry. Using this industry as an example, the sign of the allocation effect changes from negative to positive in 50 (29 percent) of the BEA economic areas as a result of structural change between 1950 and 1960.

Computer-printed maps were generated on the BEA economic area grid in order to examine the spatial dimensions of the allocation effect and the sensitivity of this effect to changes in regional industrial structure between 1960 and 1970. Figures 1 and 2 provide this information for the 171 contiguous BEA economic areas for two employment sectors: fabricated metals and ordnance, and public utilities, respectively. The allocation effects are classified and displayed on the basis of the four component codes listed in Table 1, and are determined with both 1960 (map A) and 1970 (map B) specialization weights. Notice the scarcity and concentration of the BEA economic areas with both a competitive advantage and a specialization in either of these two industries in Figures 1-A and 2-A; this is less evident in Figures 1-B and 2-B.

For either industry (Figure 1 or 2) a comparison of maps A and B provides an indication of the allocation effect sensitivity to changes in regional employment structure between 1960 and 1970. Many of the BEA economic areas with a competitive advantage that do not specialize in 1960 do specialize in 1970.¹³ Because the sign of the allocation effect changes from negative in map A to positive in map B for many BEA economic areas located in the central (Figure 1) or southeastern and plains (Figure 2) regions of the U.S., the economic behavior of these regions appears to have been more rational; they did tend to specialize their growth in sectors for which they had competitive advantages.

(A) 1960 Specialization Weights

(B) 1970 Specialization Weights

Key*

Competitive Disadvantage:

... = specialized (1)

+++ = not specialized (2)

Competitive Advantage:

000 = not specialized (3)

■■■■ = specialized (4)

Fig. 1. Allocation Effects in the Fabricated Metals and Ordnance Industry: 1960-70*.

(A) 1960 Specialization Weights

(B) 1970 Specialization Weights

Key*

Competitive Disadvantage:
 ... = specialized (1)
 +++ = not specialized (2)

Competitive Advantage:
 000 = not specialized (3)
 AAA = specialized (4)

Fig. 2. Allocation Effects in the Public Utilities Industry: 1960-70*.

VI. Conclusions

This paper has examined the Esteban-Marquillas reformulation of the "classical" shift-share equation. The technique was shown to purge the competitive position of all regional structural influence, and thus to solve the problem of "interwoven effects." However, the introduction of homothetic employment created a related problem, of perhaps greater significance, in the transformed specification. Identified as the problem of "weights," this latter problem was shown to affect not only the magnitude of E-M's allocation component, but also its sign.

The revised shift-share equation was used to decompose employment growth between 1960 and 1970 into four effects that measure differential change among U.S. regions. The results indicate that this new technique expands the analytic properties of shift-share analysis, but that interpretations based on empirical implementation are sensitive to the temporal representation of regional structure in the amended shift-share equation.

Notes

1. The shift-share literature varies on terminology. The national growth effect is also termed the share effect, the industry-mix effect is also named the compositional mix or proportionality shift, and the competitive position effect is sometimes called the differential shift or regional share — thus the name "shift and share analysis" [2, 6, 8, 12].
2. Employment is used as the regional variable throughout the paper.
3. For an excellent discussion of these limitations see [3, 9, 14]. Other limitations are related to the use of shift-share analysis in regional economic forecasting [4, 5, 11].
4. This example was employed by Esteban-Marquillas [7, p. 250] to illustrate this same problem.
5. This paper examines the first, and more interesting, of two shift-share reformulations proposed by E-M [7, pp. 251, 252].
6. The case of a null allocation effect ($E_{ij} - \hat{E}_{ij} = 0$) and/or ($r_{ij} - r_{i,us} = 0$) is not considered.
7. However, region to region summability of the revised components, a desirable property of the classical shift-share equation, no longer works. The authors thank Lowell Ashby for pointing out this analytical deficiency of the E-M reformulation.
8. For an excellent discussion on the delineation of boundaries of, and structural changes in, the 173 BEA economic areas, see [15].
9. Employment in these large regions was approximated by summing over constituent BEA economic areas.
10. Actually, the effect is insignificant for it represents 300 employees out of a total employment change in this region of approximately 2.5 million.
11. Rochester, New York; Lansing, Michigan; Fort Wayne and Indianapolis, Indiana; and Cincinnati and Columbus, Ohio. All of these BEA economic areas fall within the Great Lakes economic region except Rochester which is part of the Mideast region.
12. Concomitant changes are required in the specification of (9) and (13) to ensure that the components in each equation sum to d_{ij} .
13. The reverse is true for BEA economic areas with competitive disadvantages in Figure 1 or 2.

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