

EMPLOYMENT CHANGE PATTERNS: SOME EMPIRICAL TESTS

Lowell D. Ashby*

In its April issue for 1969 the Journal of Regional Science carried as its lead article "Shift and Share Projections of Regional Economic Growth: An Empirical Test" by H. James Brown [1]. Among Brown's conclusions were the following:

"these tests indicate that the shift and share technique is not a useful framework for regional projections..." since "the difference between the rate of growth of a national industry and the rate of growth of a regional industry, i. e., the competitive component, is

- (1) not stable,
- (2) not a useful way of classifying regional industries over time and
- (3) not associated with the forces others have argued determine a region's competitive position. The results raise substantial doubts even about the ability of the technique to describe economic growth."

Since these are presented as empirical findings, they can only be evaluated empirically. Can an independent investigator using the same techniques on the same data arrive at the same conclusions or not?

I have attempted to duplicate Brown's empirical results by applying the techniques he used to the data base he specified (Census of Manufactures employment for 16 SMSA's [2]). An immediate problem arose, however, regarding the data to which these techniques were to be applied. The data sets included several alternative possibilities:

- a. The actual data used by Brown. This alternative was not viable, since Brown's data file was not published in reference [1] and was not readily accessible in unpublished form.
- b. The data which might have been inferred to have used by Brown on the basis of his statements in reference [1] and
- c. The data which were available in reference [2] to be used by Brown on the basis of the categories set forth in reference [1].

The application of the χ^2 test for independence of sign to the share elements computed for the data set "b" above yielded results at wide variance from those found by Brown for two digit data and at variance also for three and four digit data, though data difficulties tend to make the three and four digit tests less satisfactory than those for the two digit data. In general, my conclusion is that the findings of Brown regarding the instability of the share element with respect to sign over time are not supported.

*Regional Economics Division, Bureau of Economic Analysis, U.S. Department of Commerce. The author accepts full responsibility for the views expressed and such views do not necessarily represent those of the Bureau of Economic Analysis or the Department of Commerce.

In a related finding Brown had concluded that a test model incorporating share elements from a previous time period performed decisively less well in terms of Theil's inequality coefficient [3] than other models without such share elements and that this was due to the random nature of the share (competitive) element. A replication of the test on data set "b" produced results at variance with those obtained by Brown, even though the order of excellence of the models as found by Brown was confirmed. Of equal importance, Brown's version of the shift share model permitted projection of implausible levels of employment--even negative employment. Moreover, his tests were performed exclusively in terms of percentage change in employment. This had the effect, for example of giving the success in employment projection for steel foundries the same weight in Portland (Ore.) as in Pittsburgh (Pa.) or for food products the same weight in Utica-Rome (N. Y.) as in New York-Northeastern New Jersey (N. Y., N. J.). When adjustments were made for implausible projections and a shift was made to absolute changes, it was found that the shift share projections were about equal in success to one of Brown's alternative models and decisively superior to the other. My tentative conclusion was that Brown's inferential case for the randomness or the non-utility in a projections context of the share element was not strongly supported.

When the data base is broadened to include data available to but not used by Brown, set "c" above, the empirical findings for the χ^2 test are greatly strengthened in the direction of indicating intertemporal stability in the sign of the share element. Likewise, the test results indicative of the utility of the share element in a projections context are strengthened.

Data in set "c" which were unused by Brown include four digit data from the Census of Manufactures for SMSA's for 1947 and a three year combination of Census of Manufactures data for 1947, 1954 and 1963 for 2 digit, 3 digit and 4 digit classification levels. Moreover Brown did not use Census of Population data on employment in either his χ^2 or Theil type inequality coefficient tests. My own use of the χ^2 test on Census of Population data found stability in the sign of the share element in manufacturing industries (at the .05 or better level) for major regions, 50 States and D. C., the 13 economic areas which contain Brown's selected SMSA's and the 53 counties contained within the SMSA's. Even stronger significance for stability was found when the entire industrial spectrum was tested for the same areas. In Brown's one test with Census of Population data he has applied the χ^2 test to the manufacturing industries in 20 randomly selected SMSA's selected from the 1967 listing. He found a χ^2 test value of 3.69 which fell short of the required 3.84 at the .05 level [4]. My own test on the identical data (Census of Population data for 20 SMSA's attained by combining data for counties from [5] in accordance with 1967 composition) resulted in a χ^2 test value of 4.40 which is significant at the .05 level.

My test of Census of Population data using the Theil inequality coefficient has been performed only for States for the entire industrial spectrum consisting of 32 individual groupings. On a percentage change basis there was little difference in the results for the models tested. On an absolute basis, distinctly superior results were obtained for the shift share models (Brown's version and the adjusted share model) compared with Brown's two alternatives.

In a related development the work of Edward Miller [6] has demonstrated the projections utility of summary line industry mix and regional share components for States and counties in both a percentage change and absolute change context based on Census of Population data from [5]. Generalizations for individual industries have not yet been drawn.

More important than the narrow quantitative results, however, is the fact that in his tests projections Brown is using simple models made up of parts which are integral components of the shift-share technique. The only one of these which performs in a distinctly unsatisfactory manner on an absolute basis is Brown's Ingrow model which relates growth in a region to national growth in a previous period. This is the only model which departs essentially from the standard technique which relates growth in a region's industries to the national growth in those same industries during the same time period.

Brown also raised the question whether industries in a given region which are relatively fast, average or slow growth in one period will remain so classified in a later period. Brown's empirical tests indicate that this form of stability is not realized in the data base he uses. I have not yet performed this test on the data base I have developed. It is to be expected, of course, that our results would differ since our data bases are different for the 16 SMSA's. Nor have I performed this test with Census of Population data for a wider range of areas and regions.

As noted, Brown has further argued that "the competitive component is ... not associated with the forces others have argued determine a region's competitive position." The nature of Brown's test on this matter is of such a nature that it is very difficult to replicate the technique used, apart from the problem of replicating the data base. Experience of Daniel Garnick and Allen Olson, on the other hand [7] has shown successful correlations of the differential (competitive or share) component with such variables as

"prior differential effects (PDE), regional size (RE), change in region size (ΔRE), per capita income relatives (PCI), change in per capita income relatives (ΔPCI), regional specialization (RS) inter-industry linkages (IO) and market access (MA)."

In summary, I have tried to replicate Brown's empirical findings but have found substantially different results in two of the four tests undertaken. One of his tests remains to be replicated both for the 16 SMSA's and in other contexts. The other test will not be replicated because of my uncertainty concerning its construction.

On the basis of the review thus far, I cannot accept Brown's statements that his results "give a very strong indication," and are "every decisive." My own examination of his data base and of data which he did not consider suggests the possibility that his empirical findings are tenuous and in numerous cases in need of reversal. These findings, however, are not meant to disparage Brown's efforts in putting the stability properties of the technique to severe tests. He has asked many of the right questions. My demurrer at this point, concerns only whether he has gotten the right answers.

For example, Brown's statement that "The results raise substantial doubts even about the ability of the technique to describe economic growth" goes quite beyond the empirical data base which he is using. It is quite true, of course, that "shift-share" was developed as a neutral descriptive technique. It analyzes change in data cells from a clearly specified (and replicatable) point of view. When the analytical parts are summed the data cells are restored. At the industry level no information is lost and none is thrown out. It is as useful with rough or "noisy" data terrain as with smooth and systematic terrain.

If, in addition to affording a particular viewpoint on the data, it turns out that growth, industry mix or regional share components for a particular

series in a particular setting have certain reticular properties of stability or consistency over time, that is interesting and possibly even useful. But it has no bearing one way or the other on the underlying integrity of the shift-share algorithm itself.

Although often stated before, it is worth reemphasis that shift-share as a technique in and of itself is not a model of economic or any other kind of behavior. It makes no hypotheses and discovers no ultimate causes for anything. I can only agree with Brown's implication that for purposes of predicting precise growth behavior in the particular limited case he has examined (16 geographically stable SMSA's using Census of Manufactures data) the final answer is probably not to be found in the simple lagged competitive component of shift-share. However, this is no cause for surprise, since no one to my knowledge has urged that such final answers do lie in such a formulation either as used in Brown's version of a shift share projections model or as I have crudely adjusted and improved it for comparison.

Moreover, such answers have not been put forward elsewhere in quantitatively testable form in either simple or complex models with successful general applicability to areal, industrial, temporal and data series settings. Furthermore, the future being as "original" as it appears to be, it is probably several times more complex than any constructible model can fully cope with in such a broad context.

In a related closing statement states that

"One might agree that a standard for reference is useful but the question is if it follows that any standard is useful. Can we get the same 'utility' using as the comparison the growth of some other areas, e.g. the growth of world employment? Yet, is the growth rate of the Nation any more relevant than the world for a regional industry marketing only a small section of the Nation? One might suspect that in either of the above cases subtracting an irrelevant national or world growth from a regional industry's growth would leave a residual (competitive component) that would yield little if any useful information."

The interesting thing about the above statement is not what is explicit but rather what is implicit. Of course, if we are willing to accept the idea that national totals of a defined industry have no relation to or are "irrelevant" to sub-national totals, then we must agree with Brown. But note that what we are agreeing is irrelevant is not the neutral application of an objective technique. We are instead implying that our concept of an industry is invalid. Likewise, we may well conclude that the concept of an industry does not survive when stretched between Nations or between alien cultures. But such a judgment, I repeat, goes to the integrity of the data and not to the integrity of the technique-whatever it may be. If data are valid on the other hand, they are generally worth analysis of some kind. But no analytical technique will add information where none exists. At best, it merely highlights or focuses our attention on information already present.

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