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SHIFT- AND SHARE ANALYSIS REVISITED

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Quite a few articles have been devoted to presently well-known shift- and share analysis.

It is, however, still possible to add new points of view to the classical interpretation. Two such contributions were sent in at about the same time; as they are obviously complementary, they appear hereafter under a common label. (JHPP, Editor).

I. A REINTERPRETATION OF SHIFT-SHARE ANALYSIS

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1. The problem

Shift-share analysis, in spite of its rudimentary character, has had quite a remarkable success among the specialists of regional economics. It has probably been due to the fact that the statistical information required is very elementary and the analytical possibilities that it offers are quite large. These reasons are even more conclusive when one considers that statistical information at the regional level is very deficient.

This technique of analysis intends to express the factors that cause the differences of growth among the regions. [1] For a given period of time the regional growth of each sector can be divided into three components: national growth, industry-mix and competitive effect. [2]

Let d_{ij} be employment growth in sector i of region j, g_{ij} national growth effect in sector i of region j, k_{ij} industry-mix effect in sector i of region j, and c_{ij} competitive effect in sector i of region j. Then

$$d_{ij} = g_{ij} + k_{ij} + c_{ij} \tag{1}$$

$$g_{ij} = b_{ij} r_{oo} \tag{2}$$

$$k_{ij} = b_{ij} r_{io} - b_{ij} r_{oo} = b_{ij}(r_{io} - r_{oo}) \tag{3}$$

$$c_{ij} = b_{ij} r_{ij} - b_{ij} r_{io} = b_{ij}(r_{ij} - r_{io}) \tag{4}$$

where b_{ij} = employment in sector i of region j, r_{oo} = national average rate of growth, r_{io} = national average rate of growth of sector i, and r_{ij} = growth rate of sector i of region j.
Therefore,

$$d_{ij} = b_{ij} r_{oo} + b_{ij}(r_{io} - r_{oo}) + b_{ij}(r_{ij} - r_{io}) \,. \tag{5}$$

This shows that each sector i of each region j has a standard growth, given by g_{ij}, to which has to be added the contributions to its growth (positive or negative) caused by specifically regional factors, k_{ij} and c_{ij}. The difference $(d_{ij} - g_{ij})$ – or, which is the same, $k_{ij} + c_{ij}$ – is called net-shift of the sector, and represents the effects of the specifically regional factors on the standard growth of the sector. The industry-mix effect, k_{ij}, represents the positive or negative effects of the specialisation of the regional employment in sectors where the rate of growth at the national level is more or less fast. The competitive effect, c_{ij}, shows the contribution to growth due to the special dynamism of the sector in that region compared with the average growth that such a sector has at national level.

There are some objections to the exposed formulation of the shift-share analysis. We will concentrate particularly on Rosenfeld's (1959) criticisms. Rosenfeld argues that the values that c_{ij} can take (4) are not only due to the special dynamism of the sector $(r_{ij} - r_{io})$, but also to the specialisation of the regional employment in this activity, b_{ij}. In other words, if we consider two regions, a and b, with the same quantity of regional employment $(b_{oa} = b_{ob})$ and the same rate of growth in sector i $(r_{ia} = r_{ib}$, and therefore, $r_{ia} - r_{io} = r_{ib} - r_{io})$, the respective c_{ia} and c_{ib} will be different if $b_{ia} \neq b_{ib}$ i.e. if the sectorial distribution of the employment in both regions is different. All these things seem to indicate that the competitive effect, as it is normally formulated, does not reflect exactly what it pretends, but is influenced and interwoven with the industry-mix effect.

The aim of this article is to rearrange the formulation in an attempt to solve this problem. [3]

2. Proposed solution

The new formulation is based on the definition of a new element b'_{ij}, that we can call the *homothetic employment* in sector i of region j. The homothetic employment is defined 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.

Let b'_{ij} = homothetic employment in sector i of region j, b_{io} = national employment in sector i, b_{oo} = total national employment, and b_{oj} = total employment in region j; then

$$b'_{ij} = b_{oj} \frac{b_{io}}{b_{oo}} = b_{io} \frac{b_{oj}}{b_{oo}} . \tag{6}$$

If we use the homothetic employment instead of the effective employment to express the competitive effect, the problem mentioned above is solved. In fact, using the homothetic employment, the industry-mix effect is left without any influence on the competitive effect. The competitive effect, as we have just defined it, could be expressed as

$$c_{ij} = b'_{ij}(r_{ij} - r_{io}) . \tag{7}$$

Now, if we express the competitive effect in such a way, we leave something of the regional growth unexplained. However, this could be explained by an additional component that we will call *allocation effect*, which could be formulated in the following way,

$$a_{ij} = (b_{ij} - b'_{ij})(r_{ij} - r_{io}) . \tag{8}$$

So, the employment growth of sector i of region j would be

$$d_{ij} = g_{ij} + k_{ij} + c_{ij} + a_{ij} , \tag{9}$$

being

$$g_{ij} = b_{ij} r_{oo} \tag{2}$$

$$k_{ij} = b_{ij}(r_{io} - r_{oo}) \tag{3}$$

$$c_{ij} = b'_{ij}(r_{ij} - r_{io}) \tag{7}$$

$$a_{ij} = (b_{ij} - b'_{ij})(r_{ij} - r_{io}) \, . \tag{8}$$

Therefore,

$$\begin{aligned} d_{ij} = b_{ij} r_{oo} + b_{ij}(r_{io} - r_{oo}) + b'_{ij}(r_{ij} - r_{io}) \\ + (b_{ij} - b'_{ij})(r_{ij} - r_{io}) \end{aligned} \tag{10}$$

Let us analyse in more detail the meaning of the allocation effect. This component will show us if the region is specialised in those sectors in which it enjoys better competitive advantages. The allocation effect will be positive if the region is specialised, $(b_{ij} - b'_{ij} > o)$, in those sectors of faster regional growth, $(r_{ij} - r_{io} > o)$, or if it is not specialised, $(b_{ij} - b'_{ij} < o)$, in the sectors in which it is lacking in competitive advantages, $(r_{ij} - r_{io} < o)$. On the contrary, the allocation effect will be negative if the region is specialised in sectors for which at the moment the region is lacking in advantages, or if it is not specialised in the sectors in which it has those competitive advantages. For a whole region the allocation effect will be the larger the better its employment is distributed among the different sectors, according to their respective advantages. On the other hand, if the region is not specialised in a given sector, $(b_{ij} - b'_{ij} = o)$, or if it does not enjoy any competitive advantage $(r_{ij} - r_{io} = o)$, the allocation effect becomes null, i.e., this sector does not contribute to regional growth through the allocation effect.

3. Other interpretations

The concept of homothetic employment can be used to give a different formulation to the other components of shift-share analysis: net shift, national growth and industry-mix effect.

If we pretend that the net shift reflects the difference existing between the effective growth of sector i in region j, and the growth it would have had it been dispossessed of all its specifically regional characteristics, then we should formulate national growth as

$$g_{ij} = b'_{ij} r_{io} \, , \tag{11}$$

that is to say, the growth that sector i in region j would have had if the region had had a standard (national) distribution of its employment and the growth of its sectors had been equal to the correspondent national rate. In such a way the net shift could be stated as

$$n_{ij} = d_{ij} - g_{ij} = d_{ij} - b'_{ij} r_{io} = b_{ij} r_{ij} - b'_{ij} r_{io} . \tag{12}$$

So, any difference between the effective growth of employment in sector i of region j ($b_{ij} r_{ij}$) and its standard growth ($b'_{ij} r_{io}$) will be necessarily due to the specific characteristics of the region. These differences, then, can be interpreted as if they were due to the industry-mix, to the competitive and/or to the allocation effect.

The industry-mix effect can be expressed in still another way. If we want to express the effect on regional growth of the fact that employment is concentrated in fast or slow growing industries on a national basis, the industry-mix effect can be formulated as

$$k_{ij} = r_{io}(b_{ij} - b'_{ij}) . \tag{13}$$

Expressing it in that way, the industry-mix effect for region j which will be larger when its employment is concentrated in those sectors in which r_{io} is higher, and it will be less when the contrary happens.

Summarizing, the employment growth of sector i in region j can be expressed as

$$d_{ij} = g_{ij} + k_{ij} + c_{ij} + a_{ij} , \tag{14}$$

where

$$g_{ij} = b'_{ij} r_{io} , \tag{11}$$

$$k_{ij} = r_{io}(b_{ij} - b'_{ij}) , \tag{13}$$

$$c_{ij} = b'_{ij}(r_{ij} - r_{io}) , \tag{7}$$

$$a_{ij} = (b_{ij} - b'_{ij})(r_{ij} - r_{io}) , \tag{8}$$

and therefore

$$d_{ij} = b'_{ij} r_{io} + r_{io}(b_{ij} - b'_{ij}) + b'_{ij}(r_{ij} - r_{io}) + (b_{ij} - b'_{ij})(r_{ij} - r_{io}) . \tag{15}$$

The advantage of such a modified formulation is based on the fact that it divides in a clearer way the different components of the employment growth in each sector of each region. We consider the effective growth, and the standard growth without the specific characteristics of the region (the employment specialization and the effective dynamism of its sectors), and we analyse separately the influence of each of the latter characteristics. In such a way we consider the consequences of the specialization of its employment as being independent of the sectorial dynamism (industry mix effect) (13) and the consequences of the sectorial dynamism independently of the specialization of its employment (competitive effect) (7). Finally, we analyse the effects on regional growth caused by the adequate or inadequate specialization of its employment, considering the competitive advantages of the different sectors of the region (allocation effect) (8).

4. Rates of growth

If we want to consider the components of the rate of growth of employment of sector i in region j, we divide expression (15) by b_{ij} and obtain

$$r_{ij} = \frac{b'_{ij}}{b_{ij}} r_{io} + r_{io}\left(1 - \frac{b'_{ij}}{b_{ij}}\right) + \frac{b'_{ij}}{b_{ij}}(r_{ij} - r_{io}) + \left(1 - \frac{b'_{ij}}{b_{ij}}\right)(r_{ij} - r_{io}) . \tag{16}$$

Since b'_{ij}/b_{ij} is the inverse of the numerical value of the Location Quotient [4], which we shall call L_{ij}, substituting in (16) we are left with the following suggestive expression

$$r_{ij} = \frac{1}{L_{ij}} r_{io} + r_{io}\left(1 - \frac{1}{L_{ij}}\right) + \frac{1}{L_{ij}}(r_{ij} - r_{io}) + \left(1 - \frac{1}{L_{ij}}\right)(r_{ij} - r_{io}) . \tag{17}$$

Footnotes

[1] For a more detailed explanation of the shift-share analysis cf. Dunn (1960), Perloff et al. (1960) or Ashby (1965).

[2] Though shift-share analysis could be applied to different topics, here we are only concerned with the explanation of the growth of regional employment. This could give rise to some objections which we are not going to refute since this is not our aim in this article.

[3] Some of the ideas expressed here were the object of a previous article by the author; see Esteban (1968).

[4] As formulated in Isard (1960), p. 252. The location quotient can be formulated as $(b_{ij}/b_{io})/(b_{oj}/b_{oo})$ which can be transformed into

$$\frac{b_{ij}}{b_{io}\,\dfrac{b_{oj}}{b'_{oo}}} = \frac{b_{ij}}{b'_{ij}} = L_{ij}\,.$$

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