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THE PRODUCTION OF CEREALS IN GREECE: A SHIFT – SHARE ANALYSIS

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Abstract
Although there have been numerous studies examining the process of regional economic development using the Shift-Share analysis, the agricultural sector has received far less attention. One important implication of this methodology is the possibility to detect groups of regions with certain growth characteristics. This paper contributes to the literature by applying the technique of Shift-Share over the period 2000-2015 using data for the production of cereals across the 13 regions of Greece. One important conclusion to emerge is that, in the case of Greek regions, applying the taxonomic procedure of Shift-Share analysis, it is possible to identify the necessary policies for the improvement of agricultural production in each region.

Key words: Agricultural production, Greek regions Shift-Share Analysis

1. Introduction

Shift-Share analysis permits comparison of growth in a specific sector of the economy in different regions. Shift-Share analysis, as Dunn (1960) argues, is conceptually simple and does not 'make impossible demands upon data' (p. 97). This paper reports an attempt to apply this method using data for the production of cereals in the 13 regions of Greece. The rest of the paper is structured as follows. Section 2 presents briefly the basic principles upon which Shift-Share Analysis is based. The results obtained by the application of Shift-Share Analysis using data from the regions of Greece are presented in section 3. Section 4 concludes the paper.

2. Shift-Share Analysis: A brief description

Shift-Share analysis, although an essentially non-spatial technique, has used extensively in regional economic analysis (Richardson, 1978a). A region, in the context of Shift-Share analysis, is simply a component or a segment of a larger whole (e.g. the national economy). The method of Shift-Share, according to Dunn (1960) is mechanically indifferent to the way the spatial units are defined. Basically, Shift-Share analysis is a simple statistical technique, appropriate for the analysis of regional statistical data. It is employed by practicing regional policy-makers[1] and planners. In spite of the lack of an explicit theoretical background[2] and long-established objections (e.g. Rosenfeld, 1959), shift-share analysis continues to be employed by regional economists and to breed dozens of academic papers (e.g. Thirlwall, 1967; Stilwell,

* The findings, interpretations and conclusions are those entirely of the authors and do not necessarily represent the official position, policies or views of the Ministry of Rural Development & Food and/or the Greek Government.

[1] Regional Economic Planning Councils in Great Britain, for example, have been employed Shift-Share Analysis as a guide to regional policy.

[2] Richardson (1969) attempts to put Shift-Share Analysis in the theory of regional growth.

1969; Esteban, 2000). Its popularity is not difficult to comprehend since, as Richardson (1978) aptly notes, 'it is very easy to apply – a harmless pastime for small boys with pocket calculators' (p. 202). This technique may be applied to anyone of several variables or indicators (e.g. per capita income, employment, industrial output, etc). Nevertheless, regional employment is the most common, perhaps owing to the concern of regional policy-makers with employment growth (Richardson, 1978, p. 203).

Regional development takes place in a national framework and depends in part upon forces operating at the national level (Dunn, 1960). Taking this as a premise, Shift-Share analysis attempts to express the factors that cause the differences of growth among regions (Esteban-Marquillas, 1972). Shift-share analysis measures the 'total change' in the region's performance relative to the nation over a given time-period. This 'total change' is defined as the region's actual growth less its 'expected' growth, i.e. the change that would take place if the region had grown at the same rate as the nation. This change, called the 'shift', can be divided into two components. The first is the 'proportional shift', which can be considered as an approximation of the influence of industrial mix (the industrial composition of the nation as a whole) on a particular region. The second component, the 'differential shift' is a measure of the degree to which industrial branches in a region grow faster or slower than their national counterparts. Put it in alternative terms, it attempts to capture the impact of the relative locational advantages that explain the tendency for industrial branches to be attracted to or grow faster in some regions than others. Mathematically, the proportional (*Ps*) and the differential shift (*Ds*) can be expressed in terms of equations (1) and (2), respectively.

$$Ps_{ir} = \left(\frac{A_{in,t}}{A_{in,0}} - \frac{A_{n,t}}{A_{n,0}} \right) A_{ir,0} \quad (1)$$

$$Ds_{ir} = A_{ir,t} - A_{ir,0} \left(\frac{A_{in,t}}{A_{in,0}} \right) \quad (2)$$

In equations (1) and (2), the variable *A* refers to a given characteristic either in a region *r* or to the nation as a whole, *n*. Subscripts 0 and *t* denote, respectively, the initial and the terminal time of the analysis. Based on the computed values of *Ps* and *Ds*, which may take a positive or a negative sign, regions can be classified into eight groups in accordance with their growth characteristics. Based on those characteristics, it is possible to formulate an appropriate policy (Boudeville, 1966).

Table 1 shows the eight distinct regional groups, implied by shift-share analysis, according to the criteria proposed by Boudeville (1966) together with the associated policy implications

Table 1: Regional Groupings according to Shift-Share Analysis

		Criterion	Characteristics	Policy Implications
1	Ps>0	Ds > 0 & |Ps|>|Ds|	Favourable Industrial structure/positive local factors	
2	Ps>0	Ds > 0 & |Ps|<|Ds|		
3	Ps>0	Ds < 0 & |Ps|>|Ds|	Favourable Industrial structure/negative local factors	Improvements in Local Infrastructure
4	Ps<0	Ds > 0 & |Ps|<|Ds|	Unfavourable Industrial structure/positive local factors	Improvements in Industrial Structure
5	Ps<0	Ds > 0 & |Ps|>|Ds|		
6	Ps>0	Ds < 0 & |Ps|<|Ds|	Favourable Industrial structure/negative local factors	Improvements in Local Infrastructure
7	Ps<0	Ds < 0 & |Ps|>|Ds|	Unfavourable Industrial structure/negative local factors	Improvements in Local Infrastructure/ Improvements in Industrial Structure
8	Ps<0	Ds < 0 & |Ps|<|Ds|		

The differential effect arises out of the fact that some regions gain over time, a differential advantage (vis-à-vis other regions) in their access to important markets and inputs for each of one or more specific activities. Here lies a fundamental objection to the use of Shift-Share Analysis. The differential effect is invariably the consequence of factors unrelated to geographical location (Buck, 1970). The proportionality effect, on the other hand, is due to the fact that some regions claim a larger (or smaller) proportion of the nation's rapid (or slow) growth industries. 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 probabilities that it offers are quite large. To that effect, section 3 applies the Shift-Share method using data for the production of main cereals. Data were obtained from the Ministry of Rural Development & Foods of Greece, which are in accordance with the Regulation (EU) 543/2009. Once it has been decided to publish regional data according to the aforementioned Regulation, there can be little objection to Shift-Share Analysis as a descriptive tool which summarizes information concisely. Indeed, as Buck (1970) notes, 'few would defend shift and share as a theory of regional growth yet the technique has been in excess of its capacity as a descriptive tool' (p. 446).

3. Applying Shift-Share Analysis in the Cereal Production in Greece

The power of the Shift-Share technique at gross levels of aggregation is revealed when one realizes how much insight can be gained by classifying regions into the eight categories, set out in Table 1, according to the possible combinations of differential and proportionally effect. This technique can be applied to any significant economic variable (e.g. income, employment, population, etc).

The principal requirement is that the data should be available for breaking the sector/industry into components. In the present case, the term 'industry' refers to the total production of cereals, which in turn are divided into eight distinct products, i.e. Common Wheat, Durum Wheat, Rye, Barley, Oats, Grain Maize and Rice. Tables 2 to 8 report the computed values of *Ps* and *Ds* for each of the aforementioned products across the 13 regions of Greece[3]. The exercise is carried out for the period 2000 to 2015.

Table 2: Shift-Share Analysis: Common Wheat, Greek Regions, 2000-2015

	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}
Ps	45,65	75,04	49,35	30,43	0,27	0,83	1,08	2,13	2,00	0,01	0,11	0,05	0,03
Ds	-4,91	10,06	-7,51	7,88	0,12	-2,46	-0,62	-0,96	-1,48	0,00	-0,03	-0,11	0,01
Favorable Industrial structure/positive local factors		√		√	√					√			√
Favorable Industrial structure/negative local factors	√		√			√	√	√	√		√	√	
Unfavourable Industrial structure/positive local factors													
Unfavourable Industrial structure/negative local factors													
Policy Recommendations													
Improvements in Local Infrastructure	√		√			√	√	√	√		√	√	
Improvements in Sectoral Structure													
Improvements in Local Infrastructure/ Improvements in Sectoral Structure													

[3] A list of the 13 Regions of Greece is provide in the Appendix

According to Table 2, cultivation of Common Wheat, despite favourable production conditions nationally, in eight regions local factors affect the production negatively. A suggested policy intervention is to build such an infrastructure in these regions that would be favouralbe to the production of Common Wheat. On the other hand, production of Durum Wheat (Table 3) exhibits a rather unfavourable structure nationally, but there are seven regions in which local factors affect positively this product. In this case, application of the Shift-Share technique suggests a policy targeted to the national production.

Table 3: Shift-Share Analysis: Durum Wheat, Greek Regions, 2000-2015

	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}
Ps	-60,03	-132,82	-37,37	-149,43	-0,01	-0,16	-2,10	-47,04	-4,08	-3,72	-0,56	-1,22	-0,02
Ds	-9,95	10,92	7,71	-31,13	0,10	0,65	-3,96	30,98	-3,95	0,76	-0,02	-2,14	0,03
Favorable Industrial structure/positive local factors													
Favorable Industrial structure/negative local factors		√	√		√	√		√		√			√
Unfavourable Industrial structure/positive local factors													
Unfavourable Industrial structure/negative local factors	√			√			√		√		√	√	
Policy Recommendations													
Improvements in Local Infrastructure													
Improvements in Sectoral Structure		√	√		√	√		√		√			√
Improvements in Local Infrastructure/ Improvements in Sectoral Structure	√			√					√		√		

A similar situation is evident for Rye (Table 4) and Barley (Table 5). Here, the recommended policy should be targeted to those regions for which local factors for the production of Barley and Rye are unfavourable.

Table 4: Shift-Share Analysis: Rye, Greek Regions, 2000-2015

	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}
Ps	1,66	5,35	15,37	1,57	0,67	0,00	0,00	0,54	0,02	0,00	0,00	0,04	0,00
Ds	0,09	-0,96	4,54	-1,75	-1,03	0,00	0,00	-1,00	0,04	0,00	0,09	-0,05	0,03
Favorable Industrial structure/positive local factors	√		√						√				
Favorable Industrial structure/negative local factors		√		√	√			√				√	
Unfavourable Industrial structure/positive local factors													
Unfavourable Industrial structure/negative local factors													
Policy Recommendations													
Improvements in Local Infrastructure		√		√	√			√				√	
Improvements in Sectoral Structure													
Improvements in Local Infrastructure/ Improvements in Sectoral Structure													

Table 5: Shift-Share Analysis: Barley, Greek Regions, 2000-2015

	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}
Ps	21,95	50,63	27,88	59,67	0,38	0,43	1,64	24,39	5,82	1,33	0,10	3,27	0,20
Ds	-9,01	8,92	14,20	9,10	0,09	-0,94	1,35	-19,41	-3,53	0,06	-0,09	-0,82	0,09
Favorable Industrial structure/positive local factors		√	√	√	√		√			√			√
Favorable Industrial structure/negative local factors	√					√		√	√		√	√	
Unfavourable Industrial structure/positive local factors													
Unfavourable Industrial structure/negative local factors													
Policy Recommendations													
Improvements in Local Infrastructure	√					√		√	√		√	√	
Improvements in Sectoral Structure													
Improvements in Local Infrastructure/ Improvements in Sectoral Structure													

The results reported in Table 6 indicate that several regions are characterized by negative local factors in the production of Oats. As previously, the technique of Shift-Share suggests region-specific policies.

Table 6: Shift-Share Analysis: Oats, Greek Regions, 2000-2015

	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}
Ps	0,29	0,99	0,08	1,22	0,38	0,04	0,74	1,12	0,97	0,09	0,07	0,12	0,05
Ds	-0,44	0,48	0,99	-1,43	-1,11	1,54	4,31	-3,10	-2,14	-1,12	2,58	-0,83	0,27
Favorable Industrial structure/positive local factors		√	√			√	√				√		√
Favorable Industrial structure/negative local factors	√			√	√			√	√	√		√	
Unfavourable Industrial structure/positive local factors													
Unfavourable Industrial structure/negative local factors													
Policy Recommendations													
Improvements in Local Infrastructure	√			√	√			√	√	√		√	
Improvements in Sectoral Structure													
Improvements in Local Infrastructure/ Improvements in Sectoral Structure													

Production of Grain Maize shows a rather complicated picture (Table 7). Unfavourable local factors are found for six regions. Given that production of this particular product seems to exhibit a rather unfavourable tendency, a combination of national and regional policy might improve the existing situation.

Table 7: Shift-Share Analysis: Grain Maize, Greek Regions, 2000-2015

	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}
Ps	-23,76	-23,25	-7,97	-18,21	-4,34	-0,01	-16,01	-5,88	-0,67	0,00	0,00	-0,02	0,00
Ds	-22,79	146,16	-15,72	5,54	-6,55	-0,16	-118,58	9,75	1,85	0,39	0,00	-0,25	0,36
Favorable Industrial structure/positive local factors													
Favorable Industrial structure/negative local factors													
Unfavourable Industrial structure/positive local factors		√		√				√	√		√		
Unfavourable Industrial structure/negative local factors	√		√		√	√	√					√	
Policy Recommendations													
Improvements in Local Infrastructure				√									
Improvements in Sectoral Structure		√						√	√		√		
Improvements in Local Infrastructure/ Improvements in Sectoral Structure	√												

Finally, for Rice region/specific policies are recommended by the results in Table 8. This should not be surprising since Rice is cultivated in selected areas of Greece.

Table 8: Shift-Share Analysis: Rice, Greek Regions, 2000-2015

	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}
Ps	4,31	49,45	0,00	0,00	0,35	0,00	1,27	2,59	0,13	0,00	0,00	0,00	0,00
Ds	-2,63	5,31	0,00	0,01	-0,22	0,00	0,45	-2,79	-0,12	0,00	0,00	0,00	0,00
Favorable Industrial structure/positive local factors		√					√						
Favorable Industrial structure/negative local factors	√				√			√	√				
Unfavourable Industrial structure/positive local factors													
Unfavourable Industrial structure/negative local factors													
Policy Recommendations													
Improvements in Local Infrastructure	√				√			√	√				
Improvements in Sectoral Structure													
Improvements in Local Infrastructure/ Improvements in Sectoral Structure													

It should be noted that since the empirical application of this statistical device is carried out over a discrete time interval, the proportionality effect contains a source of bias similar to the index number problems. The proportionality effect is based upon the spatial distribution of the rapid-growth and slow-growth products at the beginning of the period. The larger, therefore, the time period the more distortion that results from the fact that differential changes throughout the period have altered the spatial distribution of the rapid-growth products. The base for computing the proportionality effect has been gradually altered without being taken account of in the computations. For short time periods, however, this should not prove to be a very significant distortion. The technique of Shift-Share is not invalidated on this score any more that the use of index numbers.

Figure 1 portrays the spatial distribution of the Greek regions according to the characteristics identified by the application of Shift-Share analysis to the production of cereals. Clearly, this figure indicates that the Shift-Share technique summarizes data concisely and can be of considerable value if employed on a product-by-product basis as a descriptive tool by government departments anxious to appraise the essential features of a region.

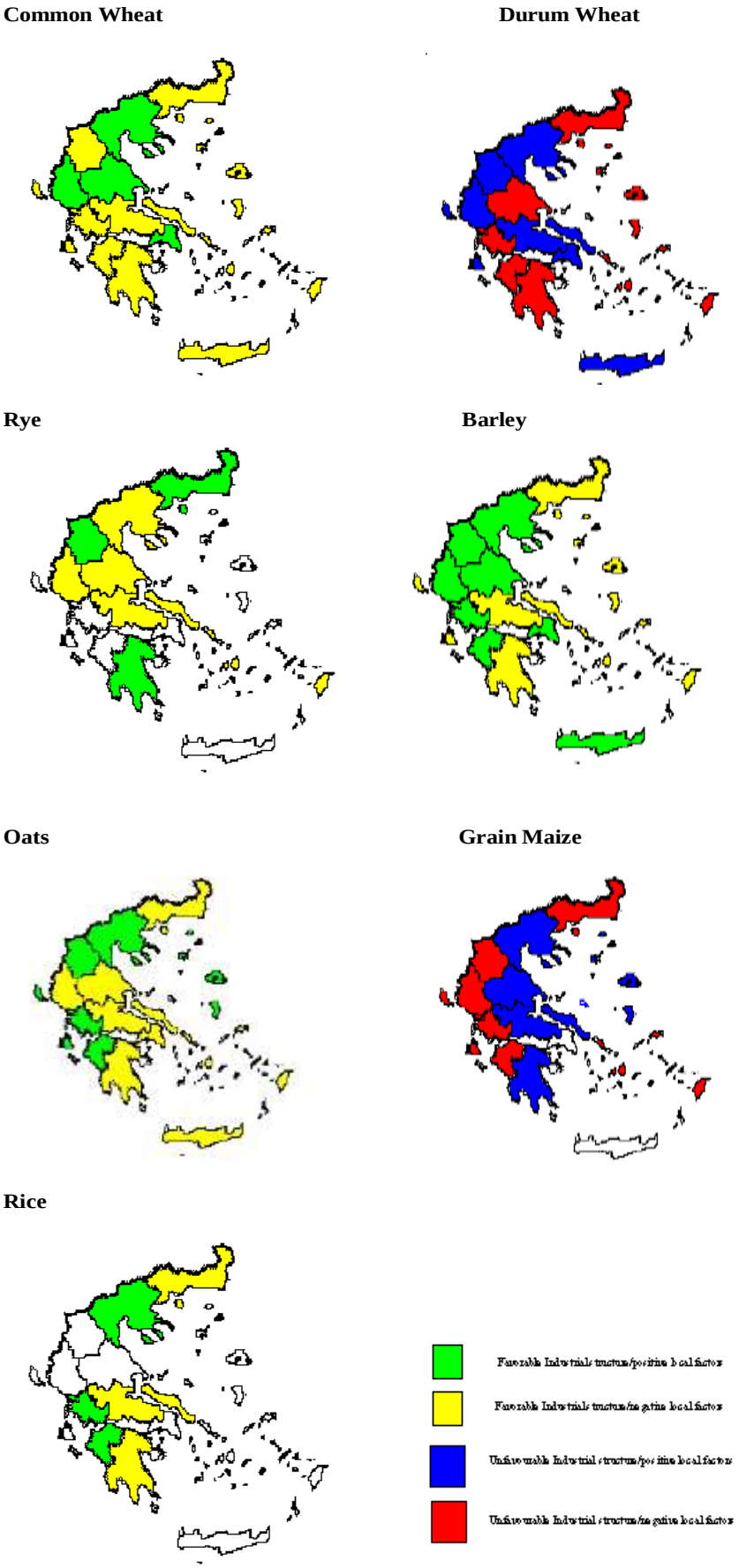

Figure 1: Shift-share Analysis: Geographical Distribution

4. Conclusions

In this paper an attempt was made to an application of the Shift Share Analysis method – with the use of statistical data on the production of cereals in Greece, enhancing the relevant literature. It has been argued that a major weakness of the Shift-Share method is the lack of well-defined theoretical background. Moreover, the statistical technique described in this paper obviously facilitates the process of describing and analyzing past behavior. While this is true, as shown in this paper, the absence of an explicit theoretical background is not an obstacle to use Shift-Share analysis as a 'tool' or a 'guide' in policy-making. From a policy point of view, the empirical findings, reported in this paper, provide support to regional policies focusing on actions producing uniform increases in the levels of productivity across regions, such as improvements in local infrastructure. Policy-making targeted to specific products in specific regions must be consistent with what seems reasonable or stable and possible for other regions and the nation as a whole. Nevertheless, more studies using different time periods are required in order to determine with confidence the degree of stability between the proportionality and differential effect with respect to their contribution to the total shifts.

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APPENDIX

The NUTS-2 regions of Greece

Code	Region
R1	Eastern Macedonia & Thrace
R2	Central Macedonia
R3	Western Macedonia
R4	Thessaly
R5	Epirus
R6	Ionian Islands
R7	West Greece
R8	Sterea Hellas
R9	Peloponnesus
R10	Attiki
R11	Northern Aegean
R12	Southern Aegean
R13	Crete