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REGIONAL CLASSIFICATIONS OF THE AGRICULTURAL SECTOR: THE CASE OF SOUTHERN - CENTRAL RUSSIA

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ABSTRACT

Indices of the external environment get special attention because of their all-inclusive nature which focuses on location specific characteristics. An analysis of producers' decision making indicates that the weights used for the regional characteristics considered and included in the index should not vary across regions. Given this, a quality of the external business environment index for the agricultural sector is computed for the Southern - Central part of Russia. All regional characteristics considered are scaled from 0 - 100, so that the index is independent of units of measurement; the regional characteristics incorporated in the index are variables of the external business environment of each country that may affect production costs and the possibilities for a development of the agricultural sector. According to the adopted index/criterion, Krasnodar Krai is on the top of the ranking followed by Kursk Oblast, Samara Oblast, Astrakhan Oblast, Saratov Oblast, Voronezh Oblast, Rostov Oblast, Stavropol Krai, Volgograd Oblast, Belgorod Oblast, Ulyanovsk Oblast, Lipetsk Oblast, Tambov Oblast, and Penza Oblast.

KEYWORDS:

REGIONAL CLASSIFICATIONS, AGRICULTURAL POLICY, RUSSIA

INTRODUCTION

Interregional comparisons of almost any sort attract attention. The contention is that the well being of economic agents (in terms of either utility or profit) depends on various factors such as climate, environmental quality, crime, public services, as well as more traditional pecuniary factors such as the prices of inputs and outputs, the cost of living, the technology that is available and its cost, the conditions of the business environment etc. These are all important location factors.

Today, enterprises express their need to improve their knowledge and information about all aspects of their business environment, that eventually determine their profitability and costs in various ways. Therefore, it is important to bring economics, business reports and statistics to life. Towards this end, the development of relevant indices can be extremely useful just as indices of prices, unemployment, quality of life, and output are widely and successfully used

to summarise various aspects of our economies. Overall justifications for developing indices can be found in Hope and Parker (1990), Hope et al (1991; 1992). A common characteristic of all indices developed till today for various purposes is one which allows for the form of a weighted average of a set of variables (see for example, Blomquist et al (1985) and (1988), Roback (1982), and Giannias (1996)). The purpose of this paper is 1) to develop a composite index, which is offered for a comparative evaluation of the agricultural sectors in Southern - Central Russia and 2) to investigate the meaning of it in terms of the theory. To be more specific, in this paper an investigation of the meaning of the index in terms of microeconomics and an analysis of the decision making process of producers indicate that the same set of weights should be used for each region, unlike Hope and Parker (1995), who use different weights for different countries to compute an environmental index. Our sectoral index may be interpreted as an index of the external environment of a sector that is available to its producers or as an index of the relative development of the sector since it takes into consideration variables that all together as a set can approximate the overall conditions of the external environment of the sector under consideration.

A THEORETICAL FRAMEWORK FOR INDEX DEVELOPMENT AND INTERPRETATION

In the following, a model of the effects of interregional differences of various characteristics of the external business environment on the decision making process of individual firms is presented. We then show how this theoretical framework can be used to obtain rankings of regions based on the relative importance of these differences for a sector of the economy, e.g., the agricultural sector in Southern - Central Russia.

In modelling the above using the principles of the theory of the firm, it is assumed that capital is completely mobile within a region, production technologies are identical across companies and exhibit constant returns to scale, and, finally, that companies have chosen locations in their regions such that they could not be made better off by relocating. Across regions capital or labour mobility is not possible either because of high moving costs or institutional and legal barriers.

In our analysis, locations are fully described by a bundle of characteristics comprising the external environment of a firm. These characteristics of a site or region i are: a1i, a2i, ..., aNi, where, aki is the kth attribute of the site or region i, k = 1, 2, ..., N, and N is the number of the attributes. A producer sees and perceives in his own way the attributes of a region or site and these may have a different value for different producers. These characteristics specify the value of a composite index of the external business environment, which we name Sectoral Development Index, SDI; SDI incorporates all aspects of its external business environment that may affect the profitability and development of a producer. This index of the external business environment, SDI, summarises the effects of various aspects of the external business environment on the costs of a producer which may vary from one producer to another depending mainly on the technology that each one of them is using.

Producers do not assign the same SDI value to identical bundles of characteristics of an external business environment because their ability to use and face the advantages and disadvantages of the various aspects of their external environment is not the same to all of them. To be more specific, the quality of the external business environment is assumed to be scalar and that the value, SDIji, that producer j assigns to a bundle of attributes a1i, a2i, ...,

aNi is[1]:

$SDI_{ji} = f_j(a_{1i}, a_{2i}, ..., a_{Ni})$

We will see below that the quality of the external business environment affects the costs of production which are assumed to be described by a cost function, C(.).

A cost minimising firm of region j solves the following problem:

min I L + r K + R(SDI_{jj}) h'

with respect to L, K, h, SDI_{jj}

subject to X = f(K,L,h,SDI_{jj})

where K is capital, L is labour, I is the wage income paid to each unit of labour employed in the production, P(.) is the equilibrium rental hedonic equation, r is the unit price of capital, f(.) is a constant returns to scale production function in K and L, and h is a vector of characteristics that fully describes the office and building facilities of a company as well as the land that it may use. We note at this point that the index SDI is one of the choice variables of a cost minimising firm[2]. Choosing an optimum SDI index is equivalent to choosing an optimum location, since for each producer each location is characterised by an SDI value which is specified by the above f(.) function.

The rental price of an office, building or land in region j is a function of the vector of its characteristics, h, and the quality of the external business environment, that is, the rental price is specified by a function of the following form: $P_j = P_j(h,SDI_{jj})$. It is assumed that $P_j(h,SDILjj) = Rj(SDI_{jj})$ h', where h' is the transposition of h, and $R_j(.)$ is the vector of implicit prices that corresponds to a vector of characteristics of the rented office, building or land in region j. Rents, $P_j(h,SDI_{jj})$, may depend on the equilibrium of the SDI value that a producer places on the bundle of the characteristics of the external business environment that he faces, because these may determine to a significant extent the use and the market value of the office, building or land, its value to him, and, consequently, the rent he pays. The latter is equivalent to assuming that there may exist price differentiation in the rental office/building/land market. Equilibrium must be characterised by equal unit costs for identical producers within a region.

Let SDI_{jj}*, h*, K* and L* be the solutions to the above cost minimisation problem specifying, respectively, the site where the production activity takes place, SDI_{jj}*, the kind of building, office or land the company uses h*, and how much capital and labour is employed (K*,L*). Furthermore, the rent a firm pays for the building facilities or land inputs it uses is: $P_j^* = Pj(h^*,SDIjj^*) = R_j^*$ h*', where $R_j^* = R_j(SDI_{jj}^*)$. Equivalently, the problem can be stated in terms of a unit cost function C(.) where,

$C_j(SDI_{jj}^*,I,r) =$ min I L + r K + R_{jj}^* h'

with respect to L, K, h

subject to X = f(K,L,h,SDI_{jj}^*)

Equilibrium for a producer of a region j requires that his unit cost is the same at all sites

[1] We note that all producers consider the same vector of characteristics, which is provider defined, and that the function that defines the sectoral index is indexed by j. This means that if, for example, the function f(.) is linear, each consumer defines his own weights for each characteristic.

[2] SDI is one of the arguments of the production function, which is one of the constraints of the producer's cost minimisation problem. The distribution of the SDI for a producer j is exogenous since the distribution of (a_{1i}, a_{2i}, ..., a_{Ni}) is exogenous and SDI is specified by the function $SDI_{ji} = fj(a_{1i}, a_{2i}, ..., a_{Ni})$. However, a producer will choose the SDI index value that minimises his or her cost, and equivalently a location that corresponds to the optimum SDI value (since each location is characterised by a SDI value).

within region j, that is, $C_j(QOBE,I,r) = c_{jj}$, where c_{jj} is a constant for all sites in region j. If the overall external business environment characteristics of a region provide a net productivity or cost advantage to firms, they will pay for it in terms of higher rents.

The model described above is illustrated in Figure 1. The upward sloping curve in Figure 1, labelled Cj(SDI,I), shows combinations of quality of external business environment and wage income which imply the same cjj unit cost to all producers of region j for a given capital price r. All these (SDI,I) combinations can be represented by a single curve like that of Figure 1, because capital suppliers usually operate internationally, which means that all buyers of capital/producers within a region, as well as buyers of capital/producers in different regions buy capital at the same price. In Figure 1 a producer is indifferent among the combinations 1, 2, and 3, each one of which corresponds to a different site in region j and is associated with a unit cost cjj, which is the minimum cost that a producer of region j would face if located at any site in region j. Figure 2 gives the quality of the external business environment - income isocost curves for j = 1, 2, 3 that correspond to the minimum cost that a producer of these regions actually faces in equilibrium in case he is located in his region. In Figure 2, we have that $c_{33} < c_{22} < c_{11}$. This is so because unit costs decrease as the quality of the external business environment increases for a given wage income and given that the price of capital is the same across regions.

To compare the possibilities for the development of a sector across regions, we must compare the minimum unit costs across regions. This can be done by looking at either the c_{jj} values for all j or the c_{ji} values for all regions i and a given j, where $c_{jj} = C_j(SDI_{jj},I)$ and $c_{ji} = C_j(SDI_{ji},I)$. If for our comparisons we use the c_{jj} values for all j, we compare the minimum unit costs that each producer faces in his region (e.g., a farmer of Voronezh in Voronezh Oblast, a farmer of Rostov in Rostov Oblast, etc.). If for our comparison the c_{ji} values are used for all i and a given j, we compare the minimum unit costs that the producer we have chosen, the producer of a region j, would face in case he were located in region i, for all regions i we want to compare (e.g., if j = Rostov, then we compare the minimum unit costs of a farmer of Rostov in Rostov Oblast, Voronezh Oblast, etc.). The problem, however, is that the c_{jj} and c_{ji} values are not readily available or easily obtained.

A ranking based on the cjj values, could be obtained if we knew the positions of the C(SDI,I) curves. For example, if the information of Figure 2 were available, we could conclude that region 3 is preferred to 2, and that region 2 is preferred to 1, that is, R(3) < R(2) < R(1) since $c_{33} < c_{22} < c_{11}$, where R(i) is the ranking of region i, i = 1, 2, 3, R(3) = 1, R(2) = 2, R(1) = 3. This ranking compares the minimum unit costs that different firms would have in different regions. It would be conceptually more correct, however, for such comparisons to look at the minimum unit costs of the same producer at different regions, an information that is provided by a ranking based on the cji values.

For a given income, it can be seen from Figure 3 that there is a monotonic relationship between cji and SDIji. This implies that a cji based ranking and one based on SDI_{ji} will be identical. That is, both $SDI_{j3} > SDI_{j2} > SDI_{j1}$ and $c_{j3} < c_{j2} < c_{j1}$ imply R(3) < R(2) < R(1), where R(3) = 1, R(2) = 2, R(1) = 3. These conditions apply given that 1) the lower the minimum unit cost, the higher the position of a region on the relevant ranking (the lower the R(i) value), and 2) the higher the SDI value, the higher the position of a region on the relevant ranking (the lower the R(i) value).

The above implies that we are able to obtain a ranking of regions i based on the cji cost levels and the cost structure of a producer of region j if we are able to compute the SDIji values.

To apply the above theory and obtain a ranking of a set of regions, the quality of the

external business environment can be defined in the following way:

$SDI_{ji} = Ó_{k=1}^{N} (w_{kj}\, a_{ki}) / Ó_{k=1}^{N} (w_{kj})$ for i = 1, 2, 3, ..., m

where aki is the kth characteristic of the external business environment of region i, wkj is the weight for the characteristic k of producer j, N is the number of the characteristics considered, and m is the number of regions being examined. The weights wkj are not necessarily the same across regions since individual producers may put a different value and perceive in a different way the various characteristics. That is, the quality of the external business environment of a region i will depend on whose weights are used to compute it. For example, in the above formula the weights of a producer of region j are used, which implies that SDI_{ji} is the quality of the external business environment that a producer of region j would assign to region i in case he was moving to it. In general, the weights can take any value. For example, they can be all equal to 1/N or be assigned theoretically by using principal component or survey results.

The above analysis shows: 1) that a regional ranking based on the SDI_{ji} values and one based on the cji minimum unit costs are identical, 2) that such a ranking can be obtained by using the above formula for the SDI index, and 3) that when using the above formula to obtain our ranking we must first choose a region or a group j that will be used as a reference point for our comparisons and then compute the SDIji value for all i regions considered.

The latter requires that for each region i, we substitute in the above formula the aki values of the region and compute the quality of the external business environment value using the same weights w_{kj} of a producer of region j. The ranking based on the quality of the external business environment values is equivalent to a ranking based on the minimum cost that a producer, that of region j, can face if he were moving to other regions for given input prices.

In our application SDI incorporates factors that may affect the development and growth of the agricultural sectors. It then puts together a ranking of the regions of Southern - Central Russia, namely.

APPLICATION

The index specified above can be computed to compare the external business environment of the agricultural sectors in the regions of Southernern - Central Russia. These regions share similar climatic conditions and economic conditions, and they are well known for their good quality soil. Because of the latter, these are known as the black-soil regions of Russia. The black soil regions of Russia are: Belgorod Oblast, Voronezh Oblast, Kursk Oblast, Lipetsk Oblast, Tambov Oblast, Astrakhan Oblast, Volgograd Oblast, Penza Oblast, Samara Oblast, Saratov Oblast, Ulyanovsk Oblast, Krasnodar Krai, Stavropol Krai, and Rostov Oblast. The regions considered in our analysis are shown in Map 1. A ranking of these regions is obtained based on the SDI value of each one of them. To compute a sectoral index, we usually consider a variety of variables. The variables that were available for all regions and eventually considered are the following:

1. CL - Crop Land (1000 Hectares), weight 0,75;
2. PCCL - Percentage Change In Cropland Area, weight 0,50;
3. CEL - Cereal Land (1000 Hectares), weight 0,55;
4. PCCEL - Percentage Change In Cereal Land, weight 0,42;
5. SCLS - Spring Crop Land Area (1000 Hectares), weight 0,39;
6. CSCLA - Change In Spring Crop Land Area (1000 Hectares), weight 0,30;
7. PV - Potato And Vegetables(1000 Hectares), weight 0,84;

8. FC - Feed Cereals(1000 Hectares), weight 0,91;
9. HY - Hay Yield (1000 Hectares), weight 0,61;
10. CHY - Percentage Change In Hay Yield, weight 0,47;
11. AGY - Average Grain Yield (Centners Per Hector), weight 0,89;
12. CAGY - Percentage In Average Grain Yield, weight 0,80;
13. ASY - Average Sunflower Yield (Centners Per Hector), weight 0,86;
14. CASY - Percentage Change In Average Sunflower Yield, weight 0,78;
15. ACY - Average Crop Yield (Centners Per Hectares), weight 0,75;
16. CACY - Percentage Change In Average Crop Yield, weight 0,70;
17. ACEY - Average Cereals Yield (Centners Per Hectares), weight 0,67;
18. CACEY - Percentage Change In Average Cereals Yield, weight 0,61;
19. TGP - Total Grain Production (1000 Tons), weight 0,89;
20. CTGP - Percentage Change In Total Grain Production, weight 0,61;
21. AAAFP - Average Annual Animal Feed Production (1000 Tons), weight 0,64;
22. MPP - Meat And Poultry Production (1000 Tons), weight 0,84;
23. CMPP - Percentage Change In Meat And Poultry Production, weight 0,80;
24. MP - Milk Production(1000 Toes), weight 0,92;
25. CMP - Percentage Change In Milk Production, weight 0,80;
26. EP - Eggs Production (Ml., Pcs.), weight 0,72;
27. CEP - Percentage Change In Eggs Production, weight 0,55;
28. VAP - Volume Of Agricultural Production (rate of growth from January to December 1997 (% in real prices), weight 0,94;
29. APPRP - Agricultural Production As Percentage Of Russian Production, weight 0,97;
30. PLFWA - Percent Of Labor Force Working In Agriculture, weight 0,67;
31. LF - Labor Force (In thousands), weight 0,45;
32. UL - Unemployment Level (In %), weight 0,50;
33. SPBL - Share Of Population Below Poverty Level (In %), weight 0,58;
34. RTP - % of regional budget covered by tax revenues, weight 0,77;
35. TR - Total Road (1000 Km.), weight 0,39;
36. RT - Railroads (1000 Km.), weight 0,30.

The above variables have been chosen because it can be argued that they can directly or indirectly affect the cost of the production activities under consideration. The values of each one of the above variables were scaled from 0 to 100 using the formula:

$X^* = 100 (X - \min(X))/[\max(X) - \min(X)]$

where X^* is the scaled value of the variable X, X is any of the above variables, min (X) is the minimum value of X, and max is the maximum value of X. The scaling is such that the value 100 is reserved for the country with the «best» value (the highest or the lowest depending on the variable considered) and the 0 for the «worst», while all the other values lie in between

The index is weighted and the weight of each variable is given above. To identify the weights, in early 1998, 164 Russian experts, who have a working experience in the sector of interest, were asked to value on 0-1 scale the information they could receive from each one of the above variables relevant to the conditions of the agricultural sector of a region and the

prospects for its development. The following formula was used for the identification of weights:

w_i / N

where, w_i / N is the weight of each examined variable (sum of positive scales) and N is the number of questionnaire participants (164). The weights are given above with the list of the (36) variables that are incorporated in the index.

The SDI value for a region was then taken to be the weighted average of the scaled values of the variables of the region. The SDI indices were computed using using 1997 data of the Russian Governmental Statistical Committee (Goskomstat) for all variables.
The results and a ranking which is based on the SDI values is given below; where the SDI values are given in the parenthesis next to each region.

- Krasnodar Krai (92.88)
- Kursk Oblast (90.79)
- Samara Oblast (72.58)
- Astrakhan Oblast (63.15)
- Saratov Oblast (53.85)
- Voronezh Oblast (48.04)
- Rostov Oblast (47.25)
- Stavropol Krai (47.01)
- Volgograd Oblast (43.62)
- Belgorod Oblast (42.74)
- Ulyanovsk Oblast (39.04)
- Lipetsk Oblast (32.04)
- Tambov Oblast (31.11)
- Penza Oblast (28.97).

The above ranking represents the preferences of the Russian experts who were questioned. Map 2 presents the results of our analysis. Note that in Map 2, the lighter the colour the greater the value of the RDI index[3].

CONCLUSIONS

Interregional comparisons attract attention of policy makers, producers, and consumers. Indices referring to various aspects of an external environment get special attention because of their all-inclusive nature which focuses on location-specific characteristics. The basic problem in constructing such indices is developing a method for weighting the different characteristics. Our theoretical analysis indicates that these weights should not change from one region to another.

Given that weights must be the same across regions, an index of the external business environment for the agricultural sector is computed for Belgorod Oblast, Voronezh Oblast, Kursk Oblast, Lipetsk Oblast, Tambov Oblast, Astrakhan Oblast, Volgograd Oblast, Penza Oblast, Samara Oblast, Saratov Oblast, Ulyanovsk Oblast, Krasnodar Krai, Stavropol Krai, and Rostov Oblast using the weights obtained from an experts survey in Russia among economists and managers who have working experience in the sector and regions of interest.

[3] Moreover, note that in Map 2, 1 is Astrahan Region, and 2 is the Belgorod Region.

Thus, the index computed is the weighted mean of a set of variables that describe and affect various aspects of the external business environment of the agricultural sector. To compute this index, we scale all variables from 0 - 100, so that the values of the index are independent of the units of measurement.

The analysis indicates that according to the adopted criterion the agricultural sector of Krasnodar Krai is on the top of the ranking followed by Kursk Oblast, Samara Oblast, Astrakhan Oblast, Saratov Oblast, Voronezh Oblast, Rostov Oblast, Stavropol Krai, Volgograd Oblast, Belgorod Oblast, Ulyanovsk Oblast, Lipetsk Oblast, Tambov Oblast, and Penza Oblast.

Map 1. Investigated regions

Map 2. Presentation of results/SDI based ranking

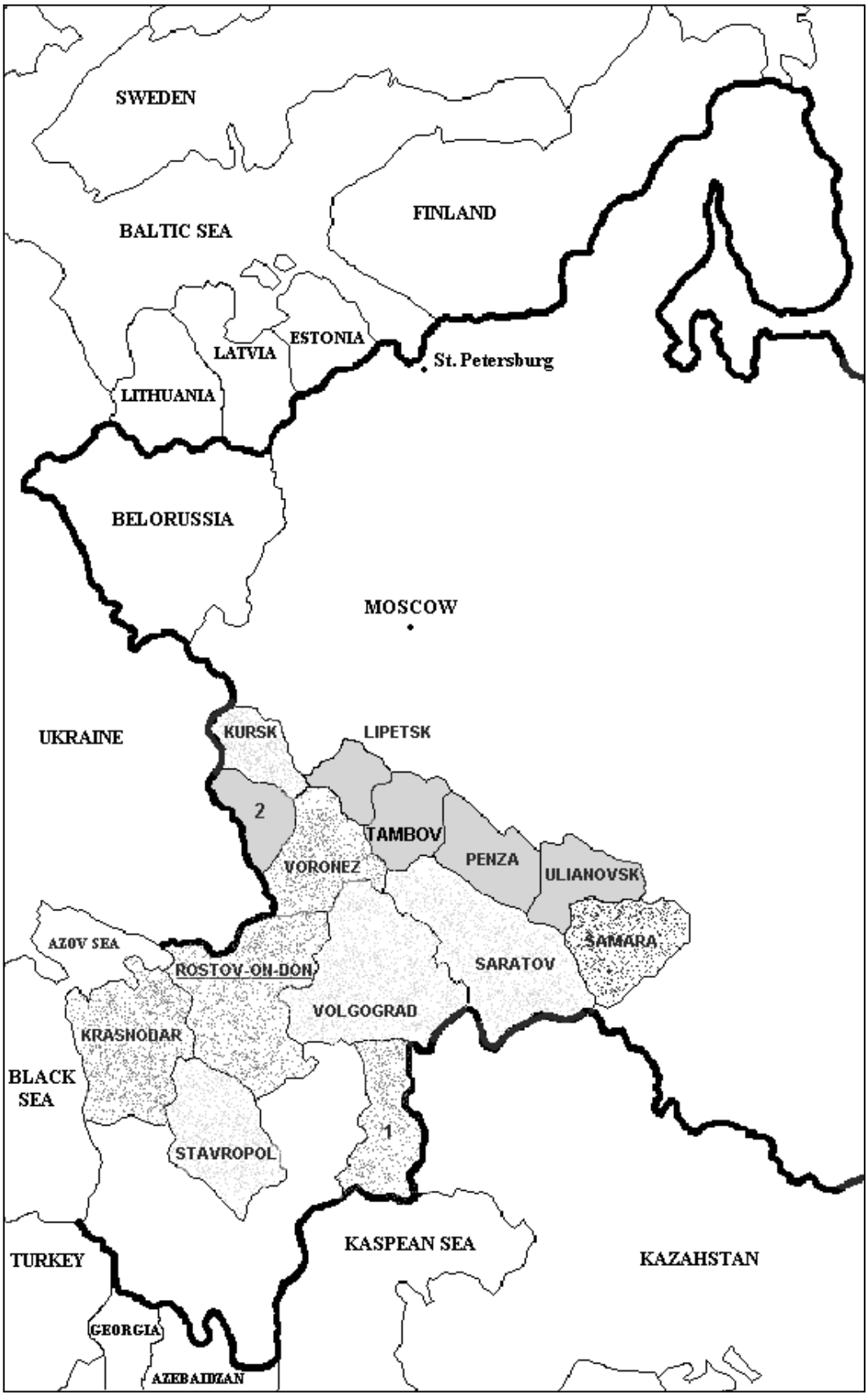


FIGURE 1

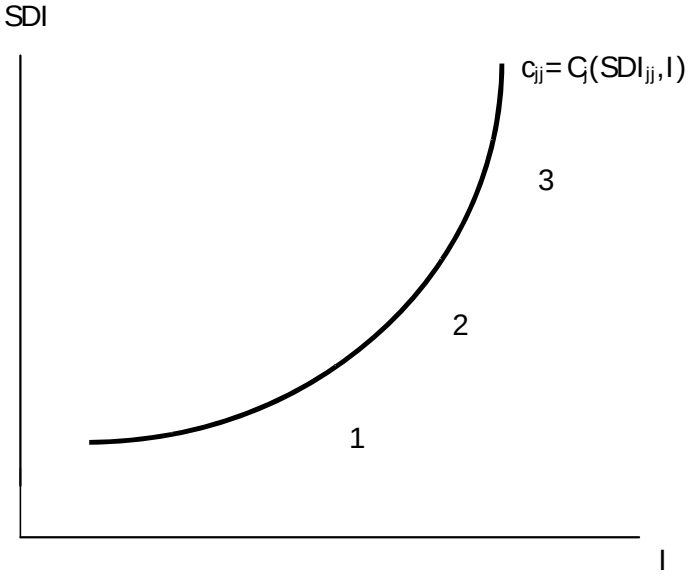


FIGURE 2

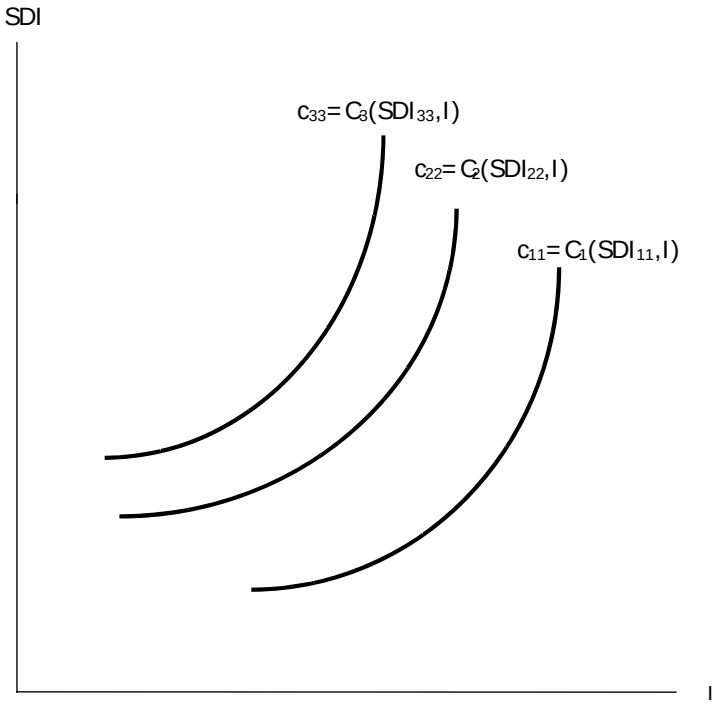
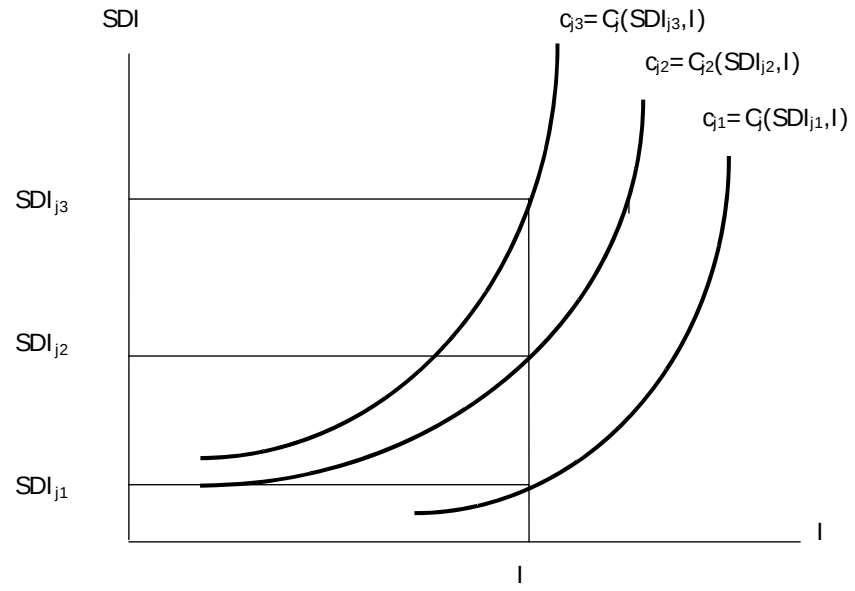


FIGURE 3



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