



## THE CONCEPTS OF SPECIALISATION AND SPATIAL CONCENTRATION AND THE PROCESS OF ECONOMIC INTEGRATION: THEORETICAL RELEVANCE AND STATISTICAL MEASURES. THE CASE OF ROMANIA'S REGIONS

**Ion Lucian Ceapraz**

Laboratoire d'Economie et de Gestion (LEG)

UMR-CNRS 5118,

Université de Bourgogne,

Pôle d'Economie et de Gestion,

B.P. 26 611, Dijon Cedex, France

Email: [ceaprazlucian@yahoo.com](mailto:ceaprazlucian@yahoo.com)

**Biographical notes:** Ion Lucian Ceapraz is a PhD student within the Laboratory of Economics and Business within the University of Burgundy at Dijon, France. His doctoral dissertation provides insights on the regional development in Romania before and after 1989 through the concepts of specialization and spatial concentration. His primary focus in research concerns fields like: urban labour markets in Eastern Europe' countries, metropolization processes in Eastern Europe, localization of economic and residential activities, spatial configuration of housing and industries, economic mutations and enlargement process within the regional context.

**Abstract.** The issues of specialisation and spatial concentration are important to economic policy and to the competitiveness of the European Union for several reasons. The literature on trade theory concerning economic integration provides different perspectives on the evolution of specialisation and spatial concentration. Both issues have been analysed in the theoretical literature as related economic concepts, but additional empirical research is needed for a better understanding of these phenomena. The purpose of the paper is both methodological and descriptive. First, we display the theoretical literature on trade, which emphasises the role played by economic integration at national level. Second, we try to see which of the trade theories best explains the regional structure of employment in terms of specialisation and spatial concentration. We apply our methodology to a specific case: Romania's development regions and their employment structure. Therefore, regional specialisation and geographical concentration are defined in relation to production structures.

**Keywords:** specialisation, spatial concentration, trade theories, economic integration, Romania's development regions.

**JEL Classification:** R12, R23, P25, P33.

## 1. Theoretical background

Even today the economic theory does not offer universal explanations concerning the phenomena of specialization and concentration. There are various models which are based on the traditional theory of trade, the new trade theory and the new economic geography. These models make different propositions according to the diverse hypotheses taken into account (von Schutz, Stierle, 2003).

The purpose of this paper is to highlight the concepts of specialization and spatial concentration which are interrelated and complementary from the perspective of economic geography and trade integration of the former Eastern Europe's countries.

This paper is structured in four parts. To study the fundamental theories of the trade it is necessary to define exactly the notions of specialization and concentration.

*The first part* is dedicated to the brief presentation of the various theories concerning the international trade and the economic geography, each presenting peculiarities which end in different propositions. Also, we explain the concepts of specialization and concentration by emphasizing their basic definitions and the differences and common points which characterize them. In the theoretical literature both concepts are sometimes used in a close direction while at the empirical level they have different senses. Indeed, to know why a country or a region specializes in a precise activity or why such a particular branch of industry is especially localized in a particular place implies different mechanisms.

*Secondly*, we propose a brief descriptive analysis concerning the evolution of the former Eastern Europe's countries and the main theories and empirical analysis attached to the economic effects of the integration on their territorial and sector-based dynamics.

*Thirdly*, we are going to focus on the theoretical frame best adapted to our analysis of the Romanian's regions of development.

*Finally*, we give some statistical results concerning the specialization and spatial concentration in Romania's regions.

### *1.1. Definitions and theoretical relevance*

The first theories which explain the specialization put in foreground the comparative advantages. Therefore, countries are going to specialize in the products by using the endowments which are the most plentiful. On the other hand, the theories of localization take into account the process of agglomeration and dispersion. So, the economies of scale and 'backward' and 'forward linkages' are going to facilitate the concentration while the congestion, the weak costs of the immobile factors (in the suburbs) and the costs of transport are going to facilitate the dispersion (Aigner, Rossi-Hansberg, 2006).

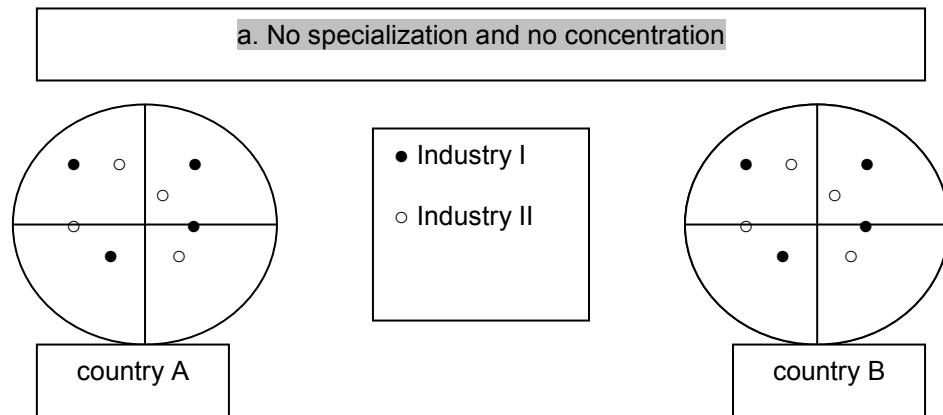
The specialization and the concentration were treated as connected processes and even identical. If at the theoretical level their connection depends on theories which we take into account, at the empirical level the analysis of the diverse economic activities use the same data for the specialization and the concentration. Most of the empirical studies treat both processes as parallels, that is the dynamics of the specialization is always accompanied with the same dynamics of the concentration.

However, it is necessary to make the difference between the sectorial concentration and the spatial concentration. There are always ambiguities arising from the fact that the sectorial concentration is synonymous with the specialization. For our case the comparisons are made between the specialization and the geographical concentration.

Statistically, after Aigner (2004) "the specialization and the spatial concentration can be two perspectives derived from the same matrix where columns are represented by countries (regions), and lines by the industries". The specialization can be observed by reading every column while the concentration can be interpreted by reading every line (Aigner, 2004).

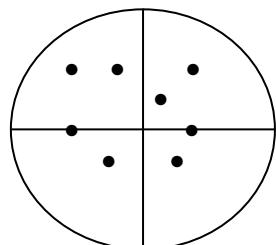
Other authors see distinctions between the specialization and the spatial concentration. Besides, they also introduce the concept of agglomeration. So, the concentration and the agglomeration are seen as opposite to the specialization and make reference to the question of how the economic activity is distributed in the space.

The concentration and the agglomeration are both concerned if the economic activity is or not in some specific localizations (city, region, country). According to Brulhart (1998), the concentration analyzes the location in the space of some defined well sectors (for example industrial activities) while the agglomeration analyzes the spatial location of a bigger part of the economic activity as the manufacturing in general<sup>1</sup>. In other words, when the empirical studies prove the existence of the agglomeration there is also some concentration. On the other hand, he can have some geographical concentration without agglomeration (see figure 1). For Hallet (2000), for example the concentration and the agglomeration are very different from the specialization. The specialization compares if the weight of a region in the production of the good is relatively important or not with regard to the weights of the other locations in the same production. For a better understanding we can relate to the figure 1a where countries A and B are not specialized while in the figure 1b they are. More, in the figure 1b the specialization coincides with the concentration because of the equal sizes of both countries. On the other hand, in the figure 1b the concentration and the specialization do not coincide.



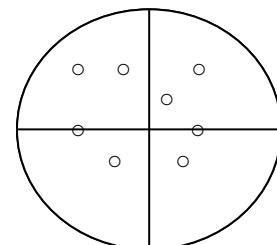
<sup>1</sup> See the figure 1b and 1d. In the figure 1b there is some concentration of both industries (I in the country A and II in the country B) while in the figure 1d there is an agglomeration of industrial activity (most of the activities of type I and II are located in the country A).

b. Specialization ; concentration at national level



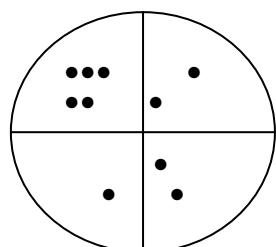
country A

- Industry I
- Industry II



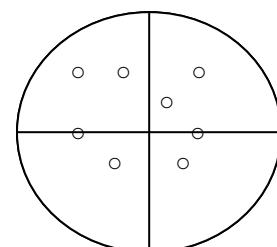
country B

c. Specialization; concentration of industry I at regional level



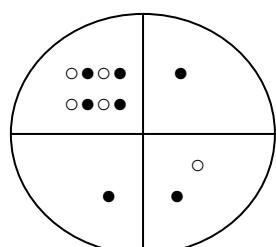
country A

- Industry I
- Industry II



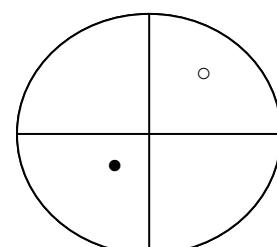
country B

d. Concentration and agglomeration

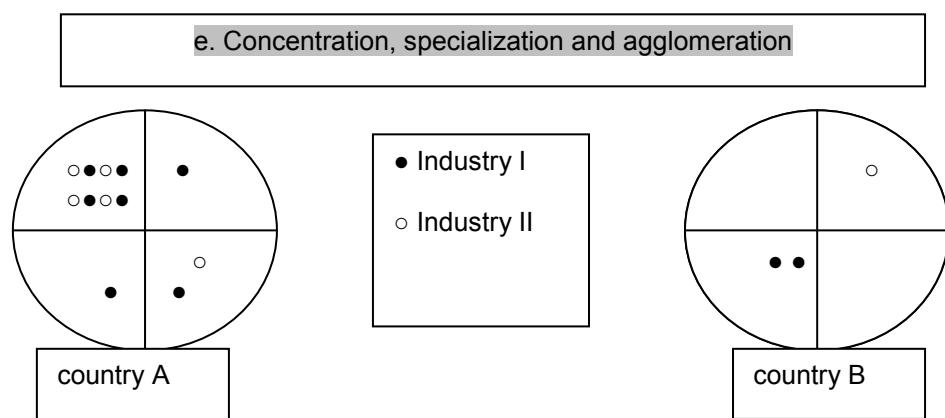


country A

- Industry I
- Industry II



country B



**Figure 1. The concentration, the specialization and the agglomeration**  
(after Brakman *et al.*, 2001)

### 1.2. The context of evolution of the specialization and of the concentration

The phenomenon of the regional specialization generated a considerable interest among the economists, the geographers and the historians. Since Adam Smith's major work (*Wealth of nations*, 1776) the specialization was connected with the regional development and the economic growth (Dunn *et al.*, 1960).

With the work of D. Ricardo, *One the Principles of political economy and taxation* (1821) the economists really begin to develop theories of the national specialization and of the interregional trade (Ohlin, 1967, Krugman, 1991b). Since Heckscher and Ohlin, the theories of the trade undertook to introduce little by little a spatial dimension into the development of trade. So, in the classic theories of trade, the specialization becomes intra-branch.

While the specialization was more attached to the evolution of the international trade' theory, the industrial concentration will be the privilege of the theorists regarding the localization of the 19th century (Aigner, Rossi-Hansberg, 2006).

## 2. Theories

### 2.1. The Traditional Theory of Trade

The traditional theories of trade explain the gains of exchange between the various countries when every country has a comparative advantage. Whether it is the differentials of work'

productivity in the case of Ricardo (1821) or the relative factorial endowments of Heckscher and Ohlin, these theories constitute simple criteria to estimate the specialization. These theories knew several improvements by the introduction of explanatory factors as the technological gap, the expenses in R&D and the differentials of qualification of the workers.

## 2.2. *The Theory of Comparative Advantage*

The theory of comparative advantage used to be the most important concept in the theory of international trade. It is not any more the case today. The original idea of comparative advantage dates back to the 19th century.

The original logic that trade can bring advantages for the countries which are doing it is based on the concept of absolute advantage described for the first time by Adam Smith in *Wealth of Nations* (1776). The model, which describes the theory, is sometimes called the Ricardian model but the original description of the idea can be found in *Essay on the external corn trade* of Robert Torrens (1815). Ricardo only formalized the idea in a numerical example of his book *On the principles of political economy and taxation* (1821). Then the idea is going to appear again in James Mill's book, *Elements of political economy* (1821) and in the publication of J.S. Mill, *Principles of political economy* (1848). Concerning Ricardo's model, he imagines two countries which produce goods by using working force as the only factor of production. Nevertheless, the author supposes levels of different productivity for the countries in cause. So the specialization of a country in all types of goods cannot guarantee the growth of the world production. Ricardo shows the fact that the specialization must be realized for the good the country possesses a comparative advantage of production. To identify the good which produces the comparative advantage it is necessary to compare the production costs of every country. These production costs are not the monetary costs nor the costs of the resources but the costs of opportunities. A country possesses a comparative advantage in the production of the good if it can produce the good with a cost of opportunity lower than the other country. The cost of opportunity of the good is defined as the quantity of another good which must be exchanged in order to produce a unit more of the first good.

## 2.3. *The New Theories of International Trade*

Changes took place when Ricardo's traditional theories and Heckscher-Ohlin gave up the place to the New Theories of Trade introduced by Elhanan Helpman and Paul Krugman

(1985). The preceding passage on the classic theories of trade was based on the comparative advantages (in terms of endowments of production and the specific sector-based inputs working under a perfect competition) and the intra-industry trade accompanied by the differentiation of products and the monopolistic competition. This time in the New Theories of Trade, Krugman developed a model where countries begin exchanges even if there is no comparative advantage at all. In this model, most of the trade between countries develop if countries have a similar level of development (endowments) in factors and concerns the same category of products (intra-industry trade). It is what the New Theory of Trade tries to explain and where the emphasis is on economies of scale, differentiation of the product and imperfect competition (Aigner, 2004). So the increasing returns and the differentiation of products can offer us important information on the specialization and the concentration. According to Aigner (2004), the first category of models of the New Theory of Trade considers that the costs of firms decrease when the size of the local industry is reduced, all this in a frame dominated by the perfect competition and constant internal costs. In this case the regional concentration is built from the external economies of scale to firms.

The commercial streams between various countries are going to give birth to the «international economies of scale» (Aigner, 1999) and to a specialization not only inter-industry but also intra-industry (Brulhart, 1996, Aigner, 1999).

At the level of the concentration the more developed countries are going to attract the very successful industries. Indeed, more the countries are going to have similar levels of wealth, the more the concentration is going to be weak. On the other hand, important differences of incomes are going to determine a greater concentration of the activities.

#### *2.4. The New Economic Geography*

The New Economic Geography takes into account the strengths of agglomeration and dispersal. Economies of scale play a very important role in the New Economic Geography and the various regions or locations pass this time in the centre of interest. Moreover, at the level of regions or locations, the economic geography is rather interested in the structure and in the weight of production than in trade. Also the specialization is not any more a cause of the comparative advantages but the effect of the differences in the size of markets and in the concentration of demand. The history can play an important role and the combination of

transport costs and scale economies can determine countries to be net exporters of a product when the commercial streams are intensifying and the increasing returns develop.

The New Economy Geographique and its pioneers Krugman (1991b, 1995), Porter (1996), Fujita, Krugman and Venables (2001) brought new concepts and models to explain the uneven distribution of economic activities in space.

Therefore, the agglomeration of companies and households results from a complex game of the externalities as a result of the increasing returns within the framework of a monopolistic competition. It shows that the size of the market influences positively the concentration of the industries. This grouping is going to have a beneficial effect on the population which on its turn is going to act on the agglomeration of companies.

While the New Geographical Economy describes the externalities which are transmitted on at the level of markets, the interactions beyond market prevail in the other theories on the agglomeration. The effects of overflowing in human resources ('spillovers') and the technical and organizational knowledge can be a result of the effect of urbanization (the size and the urban variety) or of the effect of location (the specific interactions of the sector (Lucas, 1988, Henderson, 1988, Fujita and Thisse, 2004).

### **3. The impact of economic integration' enlargement on the specialization/spatial concentration of Eastern Europe' countries**

The transition of the Eastern Europe's countries towards the market economy had determined the liberalization of their international trade and their opening to foreign capital. The changes which resulted from it in the volume, the structure and the direction of their trade as well as in the streams of the capital were considerable. The introduction of the competition and the opening of markets entailed changes in the structures of production and in the location of economic activities. The disappearance of a planned and autarkic economy within Comecon<sup>2</sup> with a strong regional specialization and a centralized division of labour entailed a profound

---

<sup>2</sup> The Council for Mutual Economic Assistance (COMECON, 1949 – 1991), was an economic organization of communist states and a kind of Eastern Bloc equivalent to—but more geographically inclusive than—the European Economic Community (Wikipedia, 2007).

reorientation of the international exchanges of the Eastern Europe' countries with differences marked according to regions.

According to Dupuch *et al.* (2004), there are two types of scenarios which concern the enlargement. The first one concerns the ascendancy of the intra-industry trade who results from a weak specialization of the productive structures and from the workforce. The second scenario shares the experience of the United States and shows itself within the framework of the New Economic Geography. This one argues an integration followed by a growth of the specialization which results from comparative advantages inter-industry. The member states of this process are going to specialize in a small number of activities.

The first debates on the connections between the liberalization of trade and the growth were dominated by the neo-classic theories based on the perfect competition and the constant returns. These models foresee a convergence of incomes and growth rates for countries in cause. Afterwards, the models of the new theory of trade with their model of centre-periphery turn out to be relevant for the integration of Eastern Europe' countries. The current situation of the already integrated countries or becoming integrated can be characterized as a stage of "intermediate commercial costs" (Traistaru *et al.*, 2005). A new integration can bring a relocation of the industrial sector towards these countries because of the considerations connected to the costs of factors (Hallet, 1998).

### *3.1. The theoretical framework for the regional development in Romania*

The point of departure on the analysis of the specialization and the regional concentration in Romania is supplied by the East European space because all the countries belonging to this area underwent a reorientation of trade from East to West after the end of Comecon (Maurel, Cheikbossian, 1997). The progressive integration of these countries resulted from a change of the productive structures and from the regional specialization (Traistaru *et al.*, 2004). Romania as all the other Eastern Europe' countries underwent major changes concerning its commercial stream. Most of these countries have an intra-industry trade with the EU but the peripheral regions (Romania, Bulgaria) constitute still an exception with an inter-industry type trade. Strong differences of specialization persist between these countries, with a 'centre-periphery' scheme which appears at the theoretical level, in spite of the absence of the intra-national mobility of the workforce. So, the 'centre' converges on the standards of the EU with

a development of the intra-industry trade and an increasing specialization and a 'periphery' still depends on the comparative advantages in extensive workforce industries.

Catin, van Huffel (2004) show that the relation between the liberalization and the specialization /concentration in developing countries can be better pointed out if we take into account two different processes: an endogenous economic opening characterized by the economic development in the historic context and, an economic opening of exogenous type organized by the commercial liberalization. It is in fact what we can observe also in the case of Romania before and after 1989 when the effects of the impact of the regional and international integration differ according to periods.

Because most of the measures of specialization / concentration presented in the third part are calculated from 1992, it is obvious that we are going to focus on the second period, qualified as exogenous and dependent on the frame of the European Union. The integration within the framework of the European Union represents for all the Romanian regions of development an "exogenous shock" (Catin, van Huffel, 2004).

In the first place, the effects are different: from the concentration to the dispersal. That is, all this process is depending on the development of every region at the time of the opening and of its geographical position (centre or suburb).

Secondly, at the imminent moment of the enlargement, it is the geographical position and the regional comparative advantages that turn out to be very important and which constitute the "initial conditions" (Catin, van Huffel, 2004). For example, the central region of Bucharest-Ilfov which presents an access privileged to the international markets will see its concentration strengthening by the opening. Because one of the most important "initial condition» at the regional level is the rate of urbanization, the central region of Bucharest-Ilfov can have an enormous advantage concerning the concentration of the activities seeing its primacy in Romania. Within the framework of the peripheral regions (the West region and the Northwest region) which already border countries of the EU, the intensification of the commercial streams in these regions can have an effect of slowing down the spatial concentration (Catin, van Huffel, 2004).

Thirdly, the opening can be characterized by an increasing concentration in particular activities in the central region and a relocation of the other activities in the peripheral regions. According to Fujita, Krugman and Venables (1999) the commercial liberalization drives every region to specialize in a single activity. This effect incites to agglomeration of the firms of the same sector and the dispersion of the others, in relation with the competition and the immobile factors (Catin, van Huffel, 2004). Thus, according to every activity taken into account, the opening can have different effects: regions which converge in terms of incomes and total employment but, which diverge in terms of productive specializations (Catin, van Huffel, 2004).

### *3.2. Why regional employment?*

The revival of the concept of regionalism in the context of globalization led to an analytical renewal. Compared to the concepts of the fifties, “prototypes of the theories of the customs unions” (Hugon, 2001), regional integration does not relate only to trade. It also relates to the flows of capital, the employment, the installation of a common institutional environment or the coordination of the policies which allow the convergence of the economies (Hugon, 2001). Several concepts emerged beside the old ones, opposing planned integration to integration by the market or to the integration generated by the economic actors. According to an industrial, territorial and geographical conception, productive integration is the result of the relations in a regional space between the national firms, transnational and international. It leads to a regional division of work and to the space concentration and agglomeration. Thus, the analysis of the structures of employment constitutes a fundamental element of our work.

## **4. The concepts of specialization and concentration**

The specialization and the regional concentration constitute major constraints for the competitiveness and the European integration of the Romanian regions. The economic integration is progressive and differentiated at the regional level. From the structures of employment observed at the regional level it is possible to calculate the various indicators of specialization and concentration. Then, we can draw conclusions and make predictions concerning the effects of the integration at the regional level.

#### *4.1. The regional specialization*

The phenomena of specialization are profoundly different according to the degree of regional or national analysis. In the European case, certain studies show that the specialization is more marked at the regional level than at the national level. The growth of a region depends widely on the complexity of the productive structures. In other words, we can characterize regions as more or less specialized in certain activities or more or less diversified.

The regional specialization is defined as the distribution of the weight of a sector (industry)  $i$  in the total economic activity of a region specific (district)  $j$  (Aigner, 1999). A region  $j$  is considered specialized in a specific industry  $i$  if this industry has a big weight among the employment in the branch of industry of the region  $j$ . The industrial structure of a region  $j$  "is strongly specialized" if a reduced number of industries has a big weight in the whole of the industries.

The specialization of a region (or city) is also defined by the concentration (grouping) of the activities of this zone in one or several industries. When we invert the roles played by the geographical divisions we can easily pass from an indicator of geographical concentration of an industry towards an indicator of local specialization.

As in the case of the concentration it is necessary to differentiate between the relative specialization (the Gini index) and the absolute specialization (the Herfindahl index).

#### *4.2. The spatial concentration*

After Arbia (2001), the majority of empirical work which relates to the economic concentration of the activities is still based on calculations of basic statistical measurements where the geographical properties of the data do not play any role.

It is what we called studies on the space concentration based to a-spatial measures. The spatial concentration is an a-spatial concept of variability and most obvious of the examples is the calculation of the coefficient of localization of Gini or the more complex index of Ellison and

Glaeser (Arbia, 2001). The use of the coefficient of Gini is sometimes problematic in the sense that the index is not comparable at the level of industries where the size of the firms varies, that is the coefficient is inappropriate to make the difference between the geographical concentration and the industrial concentration. The geographical concentration measures the geographical distribution of a sector in a territory. Thus, the industrial concentration represents the productive structure of an industry between different manufacturing units composing analyzed industry (Puech, 2003). Concerning the geographical concentration there are several types which one can use in our analysis. In the direction of Puech (2003), Haaland *et al.*, (1998) and Brulhart, Traeger (2003) we can apply to the analysis the following measures of concentration:

- the absolute concentration which represents the space distribution of the activities of an industry without external reference: it analyzes the distribution of the activities of an industry between the various selected geographical areas;
- the relative concentration analyzes the distribution of the activities of an industry compared to the average of the distribution of the whole of the activities;
- The geographical concentration is defined like the distribution of the weights of the areas (districts) in a specific sector of the economic activity (industry)  $i$ . A specific industry  $i$  is considered "concentrated" if a great part of the production is carried out in a reduced number of regions.

#### *4.3. Measures or indices borrowed from other fields*

The majority of the indices which measure specialization and the concentration come from the other fields of research. Two of more used indices, the index of Gini and the index of Herfindahl were used at the beginning in the studies which measure the inequalities of the incomes between the individuals, respectively the demographic inequalities. While the index of Gini is applied more in the space economy, the index of Herfindahl is especially used in the studies of industrial organization to show the existence of the predominance of the firms in certain sectors.

Secondly, specialization and the geographical concentration can be evaluated by using absolute and relative measurements. There are many indicators proposed in the literature, each one presenting advantages and disadvantages. For our analysis we selected an absolute

measurement (the Herfindahl index) and a relative measurement (the Gini index and the Krugman dissimilarity index).

#### 4.3.1. The Gini index

After Krugman (1991b), the index of Gini became a standard measure for the studies relating to geographical specialization. The index of Gini is most known and it gave rise to many derived coefficients (Lajugie *et al.*, 1985, Krugman, 1991a, Brulhart, 2001, Combes *et al.*, 2006). In the economic field, it very much used to measure the economic degree of concentration for different locations. It expresses the correspondence between the percentage of the distribution of industrial employment in certain space units and the percentage of the distribution of national employment within the framework of the same space units.

The index of Gini for specialization measures the sum of the differences concerning the rates of specialization by the addition of the weights' differences of each region and of the weights of the arithmetic mean obtained after the decreasing classification of the specialization' rates of each sector  $i$ . The index takes values between zero and one. An index which approaches zero indicates that the distribution of the production of a sector  $i$  corresponds to the national distribution. Also if an index takes values close to 1 it means that a region is completely specialized in an industry.

After Beine, Coulombe (2004) the Gini index for regional specialization is a relative measure and its evolution might capture the degree of heterogeneity across the regions of a country. In this case it captures the gap between the industrial structure of a region  $j$  and the average of the industrial base of the other regions.

*Gini index for regional specialization:*

$$\text{GINI}_j^S = \frac{2}{n^2 \bar{R}} \sum_{i=1}^n \Lambda_i |R_i - \bar{R}| \quad (1)$$

where :

$n$  = the number of industrial sectors;

$$R_i = \frac{s_{ij}^s}{s_i} \quad (\text{for every industrial sector of the region } j);$$

$$\bar{R} = \frac{1}{N} \sum_{i=1}^n R_i \text{ (the mean of } R_i \text{ for the industries) ;}$$

$\Delta i$  = indicates the position of the sector  $i$  in ranking of  $R_i$  in descending order;

$E$  = employment;

$S$  = weight of employment;

$I$  = industrial sectors with  $i = 1, 2, \dots, n$  ;

$J$  = region,  $j = 1, 2, \dots, m$  ;

$s_{ij}^s$  = the weight of the employment in the industry  $i$  of the region  $j$  in the total employment of the region  $j$  ;

$$s_{ij}^s = \frac{E_{ij}}{E_j} = \frac{E_{ij}}{\sum_i E_{ij}} ;$$

$s_i$  = the weight of the employment of the industry  $i$  in the total employment in all regions;

$$s_i = \frac{E_i}{E} = \frac{\sum_j E_{ij}}{\sum_i \sum_j E_{ij}} ;$$

$E_{ij}$  = employment of sector  $i$  from the region  $j$ ;

$E_j$  = total employment in the sector  $i$  in all regions

$E_j$  = the total employment of the region  $j$ ;

$E$  = total employment from all the regions.

In this case the Gini index for the concentration measures the sum of the differences of the concentration' rates by the addition of the differences of the weights of each sector and the weights of the arithmetic mean obtained after the decreasing classification of each region concentration rates. The index takes values between zero and one. An index which approaches zero value indicates that the distribution of the concentration in a region  $j$  corresponds to the national distribution. Also if an index takes values close to 1 that means that a region presents a strong concentration in a specific sector.

*Gini index for spatial concentration:*

$$GINI_i^c = \frac{2}{m^2 \bar{C}} \sum_{j=1}^m \Lambda_j |C_j - \bar{C}| \quad (2)$$

where :

$m$  = the number of regions;

$$C_j = \frac{s_{ij}^c}{s_j} ; \text{(for every region in the industry } i\text{)}$$

$$\bar{C} = \frac{1}{m} \sum_{j=1}^m C_j \text{ (the mean for } C_j \text{ for the regions)} ;$$

$\Lambda_j$  = indicates the position of the region  $j$  in the ranking of  $C_j$  in descending order;

$s_{ij}^c$  = the weight of employment in the sector  $i$  from the region  $j$  in the total employment of the sector  $i$  ;

$$s_{ij}^c = \frac{E_{ij}}{E_i} = \frac{E_{ij}}{\sum_j E_{ij}} ;$$

$s_j$  = the weight of the employment of the region  $j$  from the total employment ;

$$s_j = \frac{E_j}{E} = \frac{\sum_i E_{ij}}{\sum_i \sum_j E_{ij}} ;$$

$E_{ij}$  = employment of sector  $i$  from the region  $j$ ;

$E_j$  = total employment in the sector  $i$  in all regions;

$E_j$  = the total employment of the region  $j$ ;

$E$  = total employment from all the regions.

#### 4.3.2. The Herfindahl index

The Herfindahl index of regional specialization is an absolute measure and it sums up the squares of industry shares in the total activity in the region. It could take values between zero and one. Its evolution might reveal to what extent a given region is becoming more

specialized or diversified regardless of how the economic structure of the country as a whole is evolving (Beine, Coulombe, 2004).

*Herfindahl index for regional specialization:*

$$H_j^S = \sum_i s_{ij}^S^2 \quad (3)$$

where :

$s_{ij}^s$  = the weight of the employment in the industry i of the region j of the total employment of the region j ;

$$s_{ij}^s = \frac{E_{ij}}{E_j} = \frac{E_{ij}}{\sum_i E_{ij}} ;$$

$E_{ij}$  = the employment of sector i from the region j ;

$E_j$  = the total employment of the region j.

The Herfindahl index of spatial concentration is a measure of absolute concentration and is calculated as the sum of the region' shares in national employment in the particular industry.

*Herfindahl index for spatial concentration:*

$$H_i^C = \sum_j s_{ij}^C^2 \quad (4)$$

where :

$s_{ij}^c$  = the weight of employment in the sector i from the region j in the total employment of the sector i ;

$$s_{ij}^c = \frac{E_{ij}}{E_i} = \frac{E_{ij}}{\sum_j E_{ij}} ;$$

$E_{ij}$  = employment of sector i from the region j;

$E_i$  = total employment in the sector i in all regions.

#### 4.4. Statistical results

##### 4.4.1. Gini index and Herfindahl index for specialization

The goal of this paragraph is to evaluate the dynamics of the specialization and the diversification of the Romanian regions. Relative and absolute measurements of calculation characterize economic specialization and they are compared between them. Relative regional specialization between 1992- 2003 at level NUTS is shown in table 1 (calculated for 14 branches of industry and the eight Romanian areas of development). Also absolute specialization was calculated on 14 branches of industry for all the areas (table 2). The values of the Gini index define the areas as very specialized in 1992 (the values ranging between 0,100 and 0, 384) with a tendency of increase in specialization in 2003 (the values ranging between 0,177 and 0,722). In 1992 the greatest relative specialization is found in the area of Bucharest-Ilfov with an index of specialization of 0,384 followed by the area of South-west (0, 233) and the area of the West (0, 228). In 2003 the area of Bucharest-Ilfov keeps its first position for the regional specialization (0, 722), followed by the South-Western area with a strong growth of specialization (0, 346) and the area of the North-West (0,221). Between 1992-2003 there is a growth of relative specialization in seven of the eight areas. The strongest growth of specialization between 1992-2003 was recorded in the area of Bucharest-Ilfov (more than 88%). The other areas which had important growth rates are the area of the North-East (77%), the area of South (66%) and the area of South-West (48%). It is difficult to give exact explanations concerning the expansion of specialization in each area. The increase in specialization in almost all the areas is mainly a consequence of the changes of the industrial structure specific to each area and before and a cause of the conditions of the economic transition and imminent European integration. A brief description of the major changes in the industrial structure of the Romanian areas of development is presented below.

*Relative specialization versus absolute specialization.* In the case of specialization our measures like Gini and Herfindahl quantify differently the employment. As shown by Haaland *et al.* (1998) and Midelfart-Knarvik *et al.*(2000), while Gini relative measures give more importance to small regions, Herfindahl absolute measures emphasize the importance of large regions. That's why our results from the Table 1 and Table 2 are quite different and even opposed as hierarchy in the case of Bucharest-Ilfov region or the Nord-East region.

Another reason of this difference is linked with the fact that our indicators (Gini, Herfindahl) measure a global specialization without making clear in what sector the regions specialize mostly.

**Table 1. Gini regional specialization index**

Regions	Gini regional specialization index (8 regions)			
	1992	rank 1992	2003	rank 2003
Nord-East	0,100	8	0,177	8
South-East	0,178	6	0,207	4
South	0,116	7	0,193	7
South-West	0,233	2	0,346	2
West	0,228	3	0,203	6
North-West	0,215	4	0,221	3
Centre	0,193	5	0,204	5
Bucharest-Ilfov	0,384	1	0,722	1

**Source:** Own calculations based on data from the National Institute of Statistics, 2006

**Table 2. Herfindahl regional specialization index**

Regions	Herfindahl regional specialization index (8 regions)			
	1992	rank 1992	2003	rank 2003
Nord-East	0,256050	1	0,256444	1
South-East	0,209807	6	0,205571	5
South	0,240756	2	0,238907	3
South-West	0,232044	3	0,246494	2
West	0,178810	7	0,171201	7
North-West	0,221119	5	0,220789	4
Centre	0,225441	4	0,187850	6
Bucharest-Ilfov	0,166543	8	0,123535	8

**Source:** Own calculations based on data from the National Institute of Statistics, 2006.

#### 4.4.2. Statistical results. Gini index and Herfindahl index for concentration

Gini index of concentration. Concerning the evolution of economic sectors the measure of Gini index shows us a regional concentration dominated in 2003 by the industrial sector “Mining and quarrying”, the tertiary sector “Financial intermediations” and the 3<sup>rd</sup> most concentrated sector “Agriculture, hunting and sylviculture”. We can observe in the Table 3 that the sector “Mining and quarrying” continue to preserve the 1<sup>st</sup> position since 1992. The tertiary sector “Financial intermediations” ranked in 10<sup>th</sup> position in 1992 arrives in second place in 2003 because of its strong concentration in few urban centres. Other sectors with an important concentration in 2003 are “Real estate and other services” (4<sup>th</sup> position), “Education” (5<sup>th</sup> position), “Constructions” (6<sup>th</sup> position), etc.

**Table 3. Gini index of regional concentration**

Sectors	Gini index of regional concentration (13 sectors)			
	1992	rank 1992	2003	rank 2003
Agriculture, hunting, sylviculture	0,498	2	0,368	3
Mining and quarrying	0,637	1	0,620	1
Manufacturing	0,181	8	0,145	12
Electric and thermal energy, gas and water	0,175	9	0,147	11
Constructions	0,237	4	0,265	6
Trade	0,214	5	0,165	10
Hotels and restaurants	0,184	7	0,264	7
Transport, storage and communications	0,210	6	0,244	8
Financial intermediations	0,153	10	0,394	2
Real estate and other services	0,325	3	0,356	4
Public administration and defence	0,111	12	0,171	9
Education	0,114	10	0,278	5
Health and social assistance	0,097	13	0,056	13

**Source :** Own calculations based on data from the National Institute of Statistics, 2006.

Herfindahl index of concentration. The estimations of Herfindahl index of concentration give us a rather different picture of spatial concentration compared to the Gini (table 4). The most

concentrated sector in 2003 is “Real estate and other services” followed by the “Financial intermediations” and “Mining and quarrying”. The “Financial intermediations” used to be less concentrated sector in 1992 with a spectacular drop in 2<sup>nd</sup> place in 2003. We observe that the “Agriculture, hunting and sylviculture continue to be still a concentrated sector in 2003 with little change from 1992.

**Table 4. Herfindahl index of regional concentration**

Sectors	Herfindahl index of regional concentration (13 sectors)			
	1992	rank 1992	2003	rank 2003
Agriculture, hunting, sylviculture	0,147	3	0,145	4
Mining and quarrying	0,142	4	0,158	3
Manufacturing	0,128	8	0,130	5
Electric and thermal energy, gas and water	0,173	1	0,120	12
Constructions	0,135	5	0,126	7
Trade	0,132	6	0,125	8
Hotels and restaurants	0,126	9	0,122	10
Transport, storage and communications	0,129	7	0,129	6
Financial intermediations	0,115	13	0,164	2
Real estate and other services	0,152	2	0,167	1
Public administration and defence	0,119	12	0,113	13
Education	0,124	10	0,125	9
Health and social assistance	0,122	11	0,122	11

**Source :** Own calculations based on data from the National Institute of Statistics, 2006.

*Relative concentration versus absolute concentration.* In the case of concentration because of the less heterogeneity between sectors our relative (Gini) and absolute indicators (Herfindahl) have more similar results as hierarchy. Nevertheless the same notices can be observed like in the case of the specialization: relative measures give more weight to small sectors while the absolute indicators to the larger ones. Likewise, our indicators for the concentration measure the global concentration of sectors without specifying a particular region where this concentration is occurring.

## 5. Conclusions

Our results show us big differences between relative and absolute indicators. As shown before this is due to the size and importance attributed to the sector/region by the relative/absolute measures.

*For specialization*, according to Gini index we register an increase of relative specialization in all regions except one (West region). In the same manner, according to Herfindahl we have a decrease of absolute specialization in all regions except two (the Nord-East which maintains the same level of absolute specialization in 1992 as well as 2003 and the South-West region which had an increase of specialization).

*For the concentration*, according to Gini index we observe an increase of relative concentration for 7 sectors (Constructions, Hotels and restaurants, Transport, storage and communications, Financial intermediations, Real estate and other services, Public administration and defence, Education, Health and social assistance) and a decrease for 6 sectors (Agriculture, hunting, sylviculture, Mining and quarrying, Manufacturing, Electric and thermal energy, gas and water). In the same direction, according to Herfindahl index we notice an increase of absolute concentration for 5 sectors (Mining and quarrying, Manufacturing, Financial intermediations, Real estate and other services), a decrease for 6 sectors (Agriculture, hunting, sylviculture, Electric and thermal energy, gas and water, Constructions, Trade, Hotels and restaurants) and a constant trend for 2 sectors (Transport, storage and communications, Health and social assistance).

Thereby, our results depend in general on the distributional indicator chosen, on the degree of disaggregation, on the chosen activity variable and on the chosen measure (relative or absolute). Likewise in this particular study, these indicators are a-spatial: *i*) the concentration is measured globally (no region is figure out) and is not spatialized, *.ii*) the specialisation is based on regions and is globalized (no particular industry is taken in consideration).

From the perspective of economic geography both concepts are useful and emphasize the degree of integration at regional level.

## Bibliography

- Aigner, K., "Do Industrial Structures Converge? A survey on the empirical literature on specialisation and concentration of industries", *WIFO working paper* No. 116, 1999.
- Aigner, K., "Industrial specialisation and geographic concentration: two sides of the same coin?", *Journal of Applied Economics*, Vol.VII, No. 2, 2004.
- Aigner, K., Rossi-Hansberg, E., "Specialization and concentration: A note on theory and evidence", *Empirica*, Vol. 44, No. 4, 2006.
- Arbia, G., "The role of special effects in the empirical analysis of regional concentration", *The Journal of Geographical Systems*, 3, 2001.
- Beine, M., Coulombe, S., "Economic integration and regional industrial specialization patterns: new evidence from the Canadian-U.S. FTA experience", paper prepared for the Meeting of Canadian Economics Association, 2004.
- Brakman, S., Garretsen, H., van Marrewijk, C., *An Introduction to Geographical Economics*, Cambridge University Press, 2001.
- Brulhart, M., "Commerce et spécialisation géographique dans l'Union Européenne", *Économie Internationale*, 65(1), 1996.
- Brulhart, M., "Trading Places: Industrial Specialisation in the European Union", *Journal of Common Market Studies*, 36(3), 1998.
- Brulhart, M., "Evolving geographical concentration of European manufacturing industries", *Weltwirtschaftliches Archives*, vol. 137, n°2, 2001.
- Brulhart, M., Traeger, R., "An Account of Geographic Concentration Patterns in Europe", Institute for International Integration Studies (IIIS), *Research paper* No. 03/11, 2003.
- Catin, M., van Huffel, C., "L'impact de l'ouverture économique sur la concentration spatiale des pays en développement", *Révue Région et développement*, n°20, 2004.
- Combes, P.P., Mayer, T., Thisse, J.F., "Chapitre 10 : Mesurer la concentration spatiale", document Université Paris 1, équipe TEAM Paris, 2006.
- Dunn, E.S., Lampard, E.E., Muth, R.F., Perloff, H.S., *Regions, Resources and Economic Growth*, Lincoln: University of Nebraska Press, 1960.
- Dupuch, S., Jennequin, H., Mouhoud, E.M., "EU enlargement: what does it change for the european economic geography?", working paper Université de Paris XIII et CEPN n° 04, 2004.

Fujita, M., Krugman, P., Venables A. J., *The Spatial Economy: Cities, Regions and International Trade*, Cambridge, MIT Press, 1999

Fujita, M., Thisse, J.F., *Economies of Agglomeration: Cities, Industrial Location and Regional Growth*, Cambridge, Cambridge University Press, 2004.

Haaland, J.I., Kind, H.J., Midelfart-Knarvik, K.H. et Torstensson, J., "What determines the economic geography of Europe?", Centre for Economic Policy Research, *Discussion paper* No. 2072, 1998.

Hallet, M., "The regional impact of the single currency", Paper presented at the 38th Congress of the European Regional Science Association, Vienna, 1998.

Hallet, M., "Regional specialisation and concentration in the EU", *Economic papers*, 141, European Commision, Brussels, 2000.

Helpman, E., Krugman, P., *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy*, MIT Press, Cambridge, Massachussets, 1985.

Henderson, J. V., *Urban Development Theory, Fact and Illusion*, New York, Oxford University Press, 1988.

Hugon, H., "Le renouvellement des théories et de l'intégration régionale", CERED, Université de Paris X-Nanterre, 2001.

Krugman, P., "Increasing returns and economic geography", *Journal of Political Economy*, 99, 1991a.

Krugman, P., *Geography and Trade*, Cambridge, MIT Press, 1991b.

Krugman, P., *Development, Geography and Economic Theory*, Cambridge, MIT press, 1995.  
Lucas, R., "On the mechanics of economic development", *Journal of Monetary Economics*, 22, 1988.

Lajugie, J., Delfaud, P., Lacour, C., *Espace régional et aménagement du territoire*, Paris : Dalloz, 1985.

Maurel, M., Cheikbossian, G., "The new geography of Eastern European trade", *CEPR discussion paper* No. 1580, 1997.

Mill, J., Elements of political economy, document internet, 1821.

Mill, J.S., Principles of political economy, document internet, 1848.

Ohlin, B., *Interregional and International Trade*, Harvard Economic Studies, 1967.

Porter, M., 1996, "Competitive advantage, agglomeration economies and regional policy", *International Regional Science Review*, No. 19, 1996.

Puech, F., "Concentration géographique des industries : mesures et enjeux", Thèse de doctorat, Université de Paris I- Pantheon Sorbonne, 2003.

Ricardo, D., *On the Principles of Political Economy and Taxation*, London: John Murray, 1821.

Smith, A., *An Inquiry into the Nature and Causes of the Wealth of Nations*, 2 Vols., Everyman's Library (London: Dent & Sons, 1904), 1776.

Torrens, R., "An Essay on the External Corn Trade", document internet, 1815.

Traistaru, I., Nijkamp, P., Resmini, L., (eds.), *The Emerging Economic Geography in EU Accession Countries*, Ashgate, Aldershot, 2004.

Traistaru, I., Nijkamp, P., Longhi, S., "Economic integration, specialization of regions and concentration of industries in EU accession countries", *Journal of International Business and Economy*, vol. 6(1), 2005.

Von Schutz, U., Stierle, M., "Regional specialisation and sectoral concentration: an empirical analysis for the enlarged EU", document of European Regional Science Association, 2003.