

REGIONAL SPECIALISATION AND GEOGRAPHIC CONCENTRATION OF INDUSTRIES IN ROMANIA¹

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Abstract

There are many studies in the regional economics literature which have approached the issues of regional specialisation and industrial concentration. Regional specialisation depicts the distribution of the sectoral shares in one region, usually compared to the rest of the country, while geographic concentration of a specific industry reflects the distribution of its regional shares. In order to explore the main characteristics and the interaction between regional specialisation and sectoral concentration in Romania and to achieve a better understanding of the topic, we have used “traditional” statistical measures like the Herfindahl Index and Krugman Dissimilarity Index. Concentration of industries and specialisation of regions were measured for the 1996-2005 period on the basis of the Gross Value Added and employment data, by branch and by region, provided by Romanian official statistics.

JEL classification : R11, R12.

Keywords: specialisation, concentration, region, Romania.

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1. Introduction

Many studies in the regional economics literature have approached the issues of both industrial specialisation of regions/countries and geographic concentration of industries, considered by many as “two sides of the same coin”.

This topic is becoming increasingly important for Romania since the transition to the market economy has already radically reshaped the industrial structure and, following the recent accession to the EU, further changes are expected in order to adjust to the new enlarged economic environment. Moreover, the ongoing international evolution viz. integration, globalization, new technological opportunities and changing demand are currently bringing about new challenges and the need for countries and industries to adapt more rapidly.

The aim of our research is to investigate whether economic activities in Romania are becoming more geographically dispersed or not and whether the economic structure of the regions is converging or is becoming more different. For this purpose we will employ different statistical measures of both regional specialisation and geographic concentration, in an attempt to capture various sides of these phenomena.

The paper is structured as follows. In the next section we provide a short overview of the relevant literature, with reference first of all to the main theoretical contributions and then briefly discuss the empirical studies concerning specialisation patterns in European countries and in Romania as well. Section Three describes the methodology used to work on data. Sections Four and Five move on to provide our basic empirical results on economic specialisation of regions and geographic concentration of economic activities. We present evidence showing that these two processes are developing at different speeds and, sometimes, in opposite directions. Section Six provides concluding comments.

2. Theory and empirical evidence on specialisation and concentration

The models and empirical studies which focus on regional specialisation and industrial concentration mainly originate in trade theory and location theory, dating back to the 19th and then 20th century.

As emphasized by the existing literature, *the definitions of regional specialisation and geographic concentration* are reflected in a matrix based on the production structures, by industry and by region (Aiginger, 1999). They both describe the same reality but approach it from different perspectives.

Regional specialisation expresses the regional perspective and depicts the distribution of the sectoral shares in its overall economy, usually compared to the rest of the country. A region is considered to be highly specialised if a small number of industries have a large combined share in the economy of that region.

Geographic concentration of a specific industry reflects the distribution of its regional shares. A highly concentrated industry will have a very large part located in a small number of regions.

One of the main strands of the literature dedicated to regional specialisation refers to the mechanisms of this process, usually described by Ricardo's comparative advantage theory (1817) and Heckscher-Ohlin's factor endowment theory (Heckscher, 1919, Ohlin, 1933). In another register the Keynesian approaches to growth theory predict less specialisation as a result of income convergence through the equalization of factor productivity (Armstrong and Taylor, 2000). Moreover, the models based on product differentiation and economies of scale have demonstrated an increasing emphasis on intra-industry trade (world trade in similar products) rather than on inter-industry trade (world trade in different products), as predicted by traditional trade theories (Marshall (1920), as described by Krugman (1991)).

Another category of models deals with the determinants of location and specialisation. Of special interest are the mobile factors, considered the engine of the agglomeration process. The improvement of the factor endowment in the destination region increases its attraction as a location for other manufacturing activities leading to a cumulative process. The location choice of the mobile factors is determined by the so-called centripetal and centrifugal forces (Krugman, 1998). Thus, the centripetal forces include the increasing returns to scale, localization and urbanisation economies, home market and price index effects. The centrifugal forces refer to the scarcity of immobile factors, congestion costs and the competition effects. Further on Fujita, Krugman and Venables (1999) employ the terms of agglomerating forces (e.g. economies of scale, forward/backward linkages) and degglomerating forces (e.g. trade costs and factor prices differences). The core-periphery model makes the distinction between good market access ("core" regions) and more distant markets ("periphery regions"). On its turn, the new growth theory suggests more specialisation due to the self-reinforcing effects of externalities for technology or human capital.

The size of the regions has also been taken into consideration in relation to the level of productive specialisation, the existence being assumed *a priori* of an inverse relationship between these two variables. Ezcurra *et al.* (2006) discuss the idea that larger regions have a lower level of specialisation than smaller regions owing to the more heterogeneous population and variations in physical factors. However, when the role played by agglomeration economies is taken into consideration the increase in the level of specialisation in larger regions can be also demonstrated (Fujita *et al.*, 1999, Fujita and Thisse, 2002).

Regional specialisation is usually analysed in connection with industrial concentration, the latter being focused on "the distribution in the geographical dimension" (Aiginger, 1999, p.15). As pointed out by Aiginger and Rossi-Hansberg (2006), in fact specialisation and concentration might be seen as the two sides of the same coin

and, from a statistical viewpoint, they can be addressed as two perspectives which derive from a matrix with the columns referring to countries (or regions) and the rows to industries. The specialisation perspective can be analysed when the columns are considered, while concentration can be interpreted by each row. Aiginger and Davies (2004) have demonstrated by means of a mathematical model a preliminarily intuitive finding, namely that “if inequalities tend to increase down the columns, so they should also increase along the rows” (p. 7).

Although the bulk of the literature on specialisation and concentration implicitly or explicitly treats these two phenomena as interrelated, there are some empirical outcomes suggesting they should rather be considered as independent processes since they “might not in all cases move in the same direction, and are probably going to take place at different speeds” (Dalum *et al.*, 1998, p. 2). Considering specialisation and concentration, Aiginger and Davies (2004) argue that these are two perspectives to be derived from a matrix with the columns referring to countries, and the rows to industries. In such cases, specialisation is observed by reading down each column, whilst concentration is observed by reading along each row. Aiginger and Davies explore the intuition of inequalities that tend to increase down the columns, so they should also increase along the rows. They consider the hypothetical symmetric case—all countries and that all industries were equally sized, and then allowing for asymmetries, which is the general case. An exact statistical relation was derived between specialisation and concentration using the entropy index, and based on that, the paper shows that the intuition of a parallel movement is only correct if countries and industries are equally sized. The main finding of the paper is that greater specialisation in the structures of individual countries does not necessarily mean that industries will become more geographically concentrated. The conclusion relies on data from nine of the EU members between 1985-1998, in which case empirically specialisation of countries has increased and the concentration of industries has decreased.

Furthermore, the model in Rossi-Hansberg (2005) was used for empirically proving that *specialisation and concentration may even go in opposite directions* when transport costs change. More specifically, as transport costs decline, the degree of concentration tends to increase, while the level of specialisation decreases (Aiginger and Rossi-Hansberg, 2006).

Based on the framework outlined by the corresponding models and theories, the empirical studies undertaken in Europe with regard to productive specialisation dynamics until the beginning of the 2000s display several characteristic features such as (Hallet, 2000): most studies use national data (i.e. at country level); time periods vary between 10 and 25 years; the most frequently analysed variables are production, employment or trade in the manufacturing sector; the indicators propose either a sectoral perspective (“concentration”) or a geographical perspective (“specialisation”); most of the statistical analyses explain the results by specific industry characteristics

(factors, scale, R&D intensities, etc.) or country characteristics (centrality, income, etc.).

Thus, Molle (1996) has analysed the sectorial specialisation based on employment data in 96 regions at NUTS1 and NUTS2 level between 1950 and 1990, pointing out the convergence of productive regional structures over time, with a higher specialisation in 1990 for the peripheral regions. Hallet (2002) has also focused on regional specialisation, employing data on value added for 119 NUTS1 and NUTS2 regions between 1980 and 1995. The results indicate a diminishing specialisation as a consequence of the tendency of the analysed regions' productive structures to shift towards the European average. Cornett (2002) proposes an alternative concept of cohesion based on an outline of patterns of interregional specialisation measured by intra-industry trade between countries (1988-1998). From this perspective he discusses the EU policy toward subsequent enlargements and their impacts on the EU's internal balance. Aiginger (1999) also underlines the rising policy concern with the question of specialisation, pointing out that "it is of high political importance whether the deepening of the integration process will shift activities towards the core, leaving the periphery slow growing industries, or not. It is of high policy concern whether increasing specialisation of countries yields industry structure, which increases the danger of asymmetric shocks; these are demand shocks affecting countries differently, which have a common currency" (p. 20).

As regards the competitiveness objective as one of the pillars of the EU's cohesion policy, Aiginger (1999) highlights a twofold significance of specialisation and concentration to this issue. First, firms' decisions regarding their optimal size and location, without former national boundaries, represent an important way of enhancing efficiency and competitiveness via integration. Second, there is a growing policy concern that countries' specialisation in narrow groups of products might increase the demand risk for individual countries.

In connection with this conclusion, many questions have been raised about the distribution patterns of welfare benefits among the European regions. A commonly held idea is that the integration process could entail an increased instability of regional development and rising divergence of regional incomes (Krieger-Boden, 2002). In other words, the European integration will determine the emergence of winner and loser regions. However, some authors support the distinction between absolute and relative winners (and losers) (e.g. Nijkamp, 1997) and the need to act accordingly when regional policy at European and country level is elaborated.

As regards the case of *Romania*, various studies on regional specialisation and industrial concentration have been undertaken both in international and national contexts. For example, Traistaru, Nijkamp and Longhi (2002) have focused on regional specialisation and location of industrial activity in several accession countries (Romania, Bulgaria, Slovenia, Hungary and Estonia). They aimed to identify and explain

the effects of economic integration on the patterns of regional specialisation considering the increasing integration of the Central and East European countries with the EU as a result of trade and FDI growth. The emphasis was put on the relationship between specialisation and polarisation, the scope of the relocation of manufacturing activities, the correlation between regional specialisation and growth. The conclusions revealed both features specific to each country for various sub-periods and general findings like those referring to the existence of a negative correlation between regional specialisation and regional GDP per capita and unemployment rates and the association of lower growth of regional GDP per capita with higher unemployment rates, confirmed for all countries.

The question of regional specialisation has been analysed in the national context too, mainly addressing the influence of transition, restructuring and privatisation on this process. Studies like those performed by Russu (2001), Mitrut and Constantin (2006), Andrei *et al.* (2007), highlighted structural changes of a lower importance to most industries in the first ten years. The main factors which determined significant changes refer to the removal of the Council of Mutual Economic Assistance (COMECON) and its corresponding market and the openness of foreign trade towards the EU countries as well as temporary action-based factors, including political (e.g. the war in the former Yugoslavia) and economic (e.g. the raise of oil price) ones (Russu, 2001).

3. The methodological background

Most of the Romanian empirical studies carried out in this field employ indices like the Herfindahl Index, Krugman Dissimilarity Index, Gini Index and others, each one having some advantages and limits. In order to continue this analysis by approaching both sides simultaneously so as to check the correspondence between them, as revealed by the mainstream of empirical studies, we used the traditional indicators of specialisation and concentration. We have chosen an absolute measure – the Herfindahl Index – and a relative one – the Krugman Dissimilarity Index. Static and dynamic analysis have been combined by means of comparing the same indicator for different years.

Concentration of industries and specialisation of regions have been measured on the basis of the Gross Value Added and the number of employed population, both very popular in most empirical studies on this topic. Industry and regional data sets for this study were provided by Romanian official statistics (Territorial Yearbooks). The common sectoral classification available for the entire time span is limited to nine economic branches.

Due to the limited availability of comparable regional data we had to restrict our research to a ten-year period, divided into two equal time intervals: a period

of prevalent economic decline (1996-2000) and one of sustained economic growth (2001-2005).

The first statistical measure that we employed is the *Herfindahl-Hirschman Index*, probably the most commonly used indicator of concentration/specialisation:

$$H_j^C = \sum_{i=1}^n (g_{ij}^C)^2 \quad \text{and} \quad H_i^S = \sum_{j=1}^m (g_{ij}^S)^2$$

where:

$$g_{ij}^C = \frac{x_{ij}}{\sum_{i=1}^n x_{ij}} = \frac{x_{ij}}{x_j} \quad \text{and} \quad g_{ij}^S = \frac{x_{ij}}{\sum_{j=1}^m x_{ij}} = \frac{x_{ij}}{x_i}$$

H_j^C - the Herfindahl index for concentration

H_i^S - the Herfindahl index for specialisation

i - region; j - branch

x - Gross Value Added or employment;

x_{ij} - Gross Value Added or employment in branch j in region i ;

x_j - total Gross Value Added or employment in branch j ;

x_i - total Gross Value Added or employment in region i ;

g_{ij}^C - the share of region i in the total national value of branch j ;

g_{ij}^S - the share of branch j in the total value of region i .

The Herfindahl index increases with the degree of concentration/specialisation, reaching its upper limit of 1 when the branch j is concentrated in one region or the region i is specialised in only one branch. The lowest level of concentration is $1/n$ i.e. all regions have equal shares in branch j , while the lowest specialisation is $1/m$ i.e. all branches have equal shares in region i . This means that the lower-bound of the Herfindahl Index is sensitive to the number of observations, limiting direct comparisons (e.g. to countries having exactly the same number of regions), which is its main shortcoming. Another limit of the indicator is due to the fact that the Herfindahl index is an absolute measure and big regions having larger shares mainly influence the changes in the concentration/specialisation (the index is biased towards the larger regions).

The second indicator is the well-known *Krugman Dissimilarity Index* used for measuring either concentration (K_j^C) or specialisation (K_i^S):

$$K_j^C = \sum_{i=1}^n |g_{ij}^C - g_i|$$

and

$$K_i^S = \sum_{j=1}^m |g_{ij}^S - g_j|$$

where,

$$g_i = \frac{X_i}{X}, \quad g_j = \frac{X_j}{X}$$

and X stands for the total (national) Gross Value Added or employment.

It is a relative measure of specialisation/concentration which is employed for comparing one branch/region with the overall economy. A slightly different form of the index may be used to compare two countries/regions. Its values range from 0 (identical territorial/sectoral structures) to 2 (totally different structures).

4. Results

4.1. Sectoral specialisation of the Romanian regions

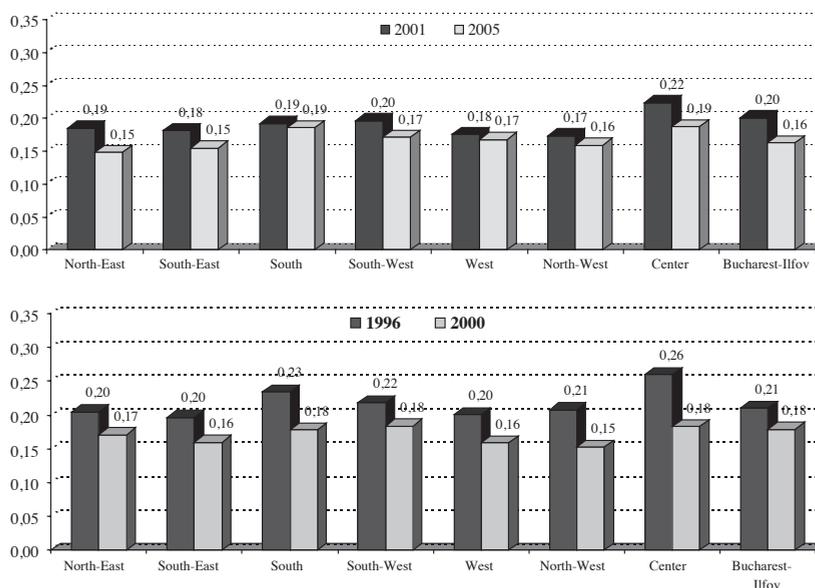
The analysis of the Herfindahl index points to a clear decrease in the level of sectoral specialisation in 2005 against 1996, for all Romanian regions, irrespective of the variable used: Gross Value Added (Table 1 and Figure 1) or employment (Table 2 and Figure 2). This should be considered a positive evolution from the point of view of the economic vulnerability usually associated with a high degree of specialisation (e.g. the mining industry in Southern Romania). Developed regions tend to have a lower level of specialisation and we should note that recent EU studies found a rather stable economic specialisation in production (based upon broad economic sectors) and a decline of specialisation in employment (Marelli, 2006).

Table 1. Statistical measures of specialisation based on Gross Value Added data

Region	Herfindahl Index				Krugman Dissimilarity Index			
	1996	2000	2001	2005	1996	2000	2001	2005
North-East	0.2044	0.1712	0.1854	0.1484	0.1319	0.2570	0.1676	0.1574
South-East	0.1966	0.1599	0.1817	0.1549	0.1007	0.1207	0.1134	0.1068
South	0.2346	0.1783	0.1923	0.1860	0.1412	0.1707	0.1678	0.1844
South-West	0.2181	0.1842	0.1969	0.1712	0.1158	0.2338	0.2270	0.1754
West	0.2010	0.1586	0.1760	0.1675	0.1098	0.0479	0.0969	0.0688
North-West	0.2076	0.1528	0.1736	0.1594	0.1303	0.1205	0.0686	0.0685
Center	0.2598	0.1829	0.2242	0.1870	0.1637	0.1433	0.1921	0.1387
Bucharest-Ilfov	0.2105	0.1791	0.2006	0.1625	0.4191	0.4263	0.4676	0.3726

Source: author's calculations

The highest levels of specialisation in production were in 2005 in the central and southern regions (industry), while the degree of specialisation in employment had bigger values for all regions, reaching its maximum in the north-eastern and south-western regions (agriculture) and minimum in Bucharest-Ilfov (Tables 1 and 2).

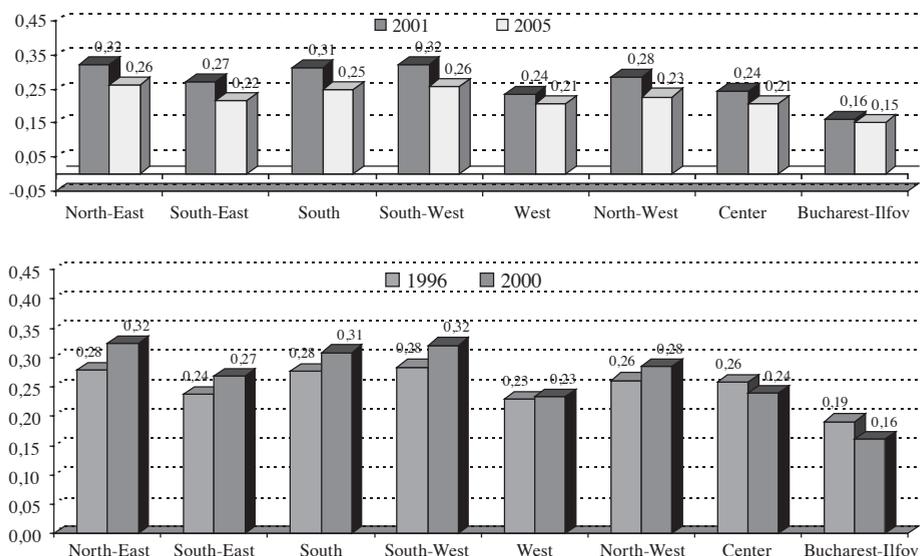
Figure 1. The Herfindahl Index of specialisation based on Gross Value Added data

As the level of specialisation declined, the Krugman Dissimilarity Index diminished in some regions and amplified in many others, proving an increasing divergence in sectoral structures among the regions. Except for Bucharest-Ilfov, the Krugman Index was relatively low in Romania in 2005 when compared to Poland (0.508) or Lithuania (0.328), but is much higher than in the EU15, where it is below 0.150 for most of the countries, reaching a minimum of 0.063 in Austria and 0.064 in Germany (Marelli (2006), based on regional employment data).

Table 2. Statistical measures of specialisation based on employment data

Region	Herfindahl Index				Krugman Dissimilarity Index			
	1996	2000	2001	2005	1996	2000	2001	2005
North-East	0.2785	0.3234	0.3221	0.2600	0.1732	0.2031	0.1945	0.2389
South-East	0.2369	0.2682	0.2693	0.2160	0.1588	0.1008	0.1151	0.0973
South	0.2768	0.3089	0.3116	0.2486	0.1184	0.1405	0.1478	0.1505
South-West	0.2841	0.3210	0.3202	0.2589	0.1877	0.1938	0.1914	0.2046
West	0.2288	0.2331	0.2364	0.2071	0.1009	0.1193	0.1213	0.1414
North-West	0.2610	0.2849	0.2835	0.2275	0.0969	0.0988	0.0828	0.0912
Center	0.2580	0.2393	0.2440	0.2069	0.1870	0.1843	0.1860	0.1583
Bucharest-Ilfov	0.1907	0.1613	0.1631	0.1519	0.6023	0.7050	0.6959	0.6133

Source: author's calculations

Figure 2. The Herfindahl Index of specialisation based on employment data

The Herfindahl Index and the Krugman Dissimilarity Index of specialisation both showed significantly higher values when computed out of employment data, but their time tendency is mostly the same (Table 2). The Bucharest-Ilfov region displays a sectoral structure markedly different from all other regions.

4.2. Geographic concentration of economic activities in Romania

The Herfindahl Index for concentration shows lower values than the specialisation index and little variation in respect to the data employed. One possible explanation is that we used rather broad economic sectors because of the unavailability of a finer regional disaggregation of branches.

Another difference regards the lack of a clear tendency in results. Most of the regions recorded increases in concentration, but there were also a few branches, such as industry, reducing their level of regional concentration.

From the production point of view, the most concentrated sector in 2005 was constructions (Bucharest-Ilfov), while the biggest concentration in employment was recorded for real estate transactions and other services (Bucharest-Ilfov), closely followed by agriculture (North-East and South-East).

The increase in the degree of concentration in most of the main branches was accompanied by a rise in their regional dissimilarities, as the Krugman Index points out. There is a relatively strong concordance between the results of the Herfindahl and Krugman indices.

Table 3. Statistical measures of concentration based on Gross Value Added data

	Herfindahl Index				Krugman Dissimilarity Index			
	1996	2000	2001	2005	1996	2000	2001	2005
Agriculture¹	0,1418	0,1435	0,1433	0,1434	0,3894	0,3927	0,4053	0,3894
Industry²	0,1301	0,1286	0,1293	0,1287	0,1934	0,1475	0,1321	0,1446
Construction	0,1348	0,1364	0,1338	0,1631	0,1675	0,1131	0,1037	0,2161
Trade³	0,1361	0,1618	0,1623	0,1593	0,0774	0,1884	0,1839	0,1665
Transport and communications	0,1407	0,1464	0,1458	0,1517	0,1117	0,0984	0,1044	0,1650
Real estate transactions and other services	0,1527	0,1841	0,2161	0,1516	0,1512	0,2969	0,3886	0,1412
Public administration and defense	0,1304	0,1991	0,1483	0,1504	0,2518	0,3547	0,1415	0,1408
Education	0,1317	0,1295	0,1302	0,1309	0,2200	0,2096	0,2082	0,1906
Health and social assistance	0,1280	0,1276	0,1272	0,1293	0,1897	0,1502	0,1541	0,1315

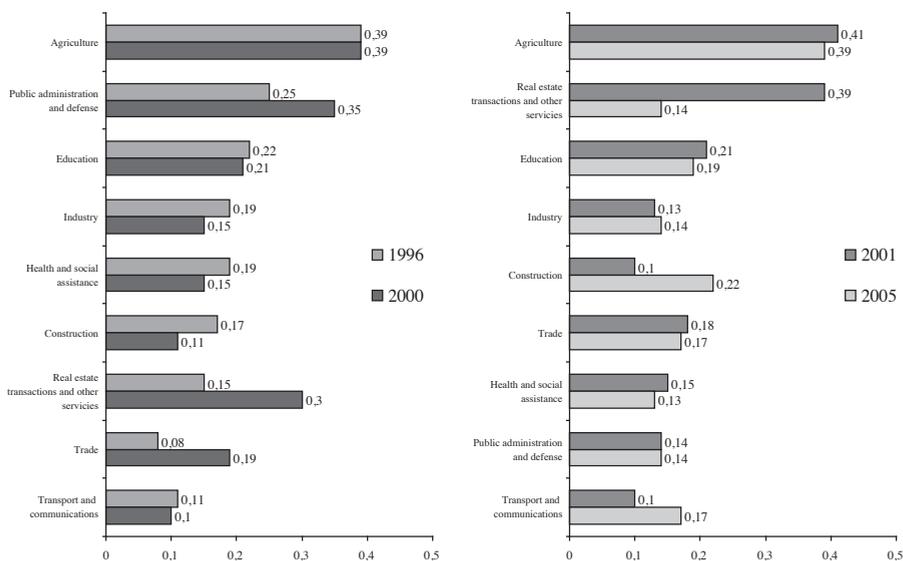
Source: author's calculations

1) including hunting and forestry, fishery and fish-farming

2) including electric and thermal energy, gas and water.

3) including hotels and restaurants

Figure 3. The Krugman Index of concentration based on Gross Value Added data



The higher degree of concentration may be connected to the recent increase in foreign investments in Romania. Romania attracted foreign direct investments worth €7 billion in 2007, and over €8 billion in 2006. Ford recently made significant investments in Romania, while Germany's Daimler is also considering a possible relocation to Romania. The search for a country with lower production costs is not however limited to the auto industry. The central region (Cluj county) had the chance to benefit from massive Nokia investment in a new plant, as a result of production relocation from Germany. The southern region (Arges county) is a very good investment area for IT because it is the only county in the south oriented in this direction (the others are agriculture, cars and oil) and has informatics high schools. Also, massive investments were made in the northern part of the country, in Moldova, in Iasi, which is a very big IT center.

Table 4. Statistical measures of concentration based on employment data

	Herfindahl Index				Krugman Dissimilarity Index			
	1996	2000	2001	2005	1996	2000	2001	2005
Agriculture¹	0.1477	0.1489	0.1488	0.1482	0.2721	0.2823	0.2838	0.2773
Industry²	0.1299	0.1287	0.1289	0.1279	0.1180	0.1112	0.1069	0.1251
Construction	0.1306	0.1298	0.1301	0.1476	0.1964	0.1717	0.1700	0.2953
Trade³	0.1286	0.1282	0.1293	0.1311	0.1384	0.1403	0.1326	0.1664
Transport and communications	0.1322	0.1323	0.1348	0.1386	0.1969	0.2068	0.2372	0.2557
Real estate transactions and other services	0.1694	0.1652	0.1694	0.1767	0.3943	0.3794	0.3988	0.4298
Public administration and defense	0.1306	0.1318	0.1297	0.1330	0.1275	0.1643	0.1369	0.1643
Education	0.1300	0.1293	0.1296	0.1304	0.0879	0.0866	0.0897	0.1119
Health and social assistance	0.1290	0.1278	0.1275	0.1286	0.0514	0.0684	0.0584	0.0703

Source: author's calculations

1) including hunting and forestry, fishery and fish-farming

2) including electric and thermal energy, gas and water.

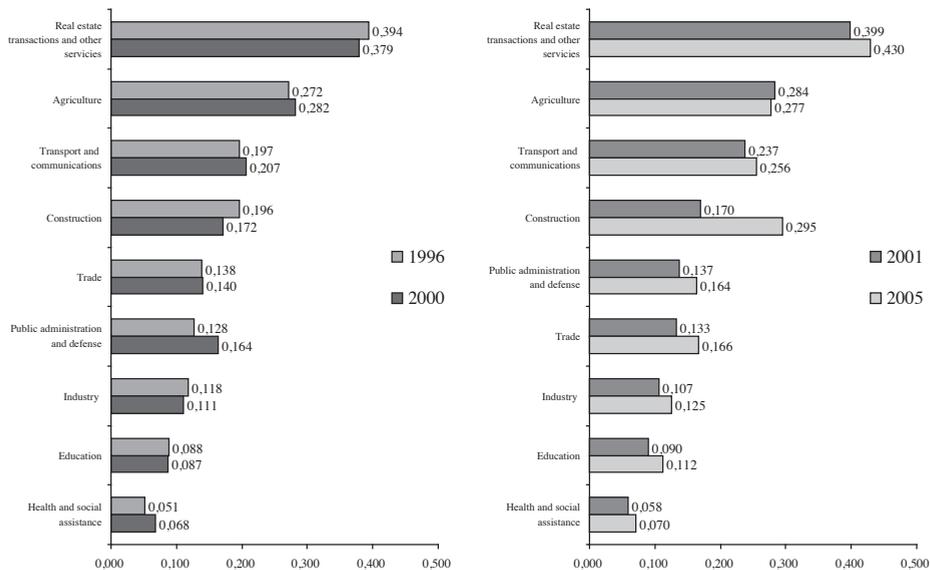
3) including hotels and restaurants

The coefficient of structural changes shows little average movement in the territorial distribution of the branches, but our broad disaggregation of branches may hide stronger internal movements within each branch.

Although Romanians seem to be open to mobility, flows of internal migration display rather low levels in recent years. Almost half of the individuals who migrated to urban localities after 2002 changed their locality of residence in order to attend

school, especially higher education institutions which are located in urban areas and only 13% of them migrated to urban localities owing to the fact that they had found a job.

Figure 4. The Krugman Index of concentration based on employment data



5. Final remarks

In this paper we have explored the main characteristics and the interaction between regional specialisation and sectorial concentration. Two common statistical measures of specialisation and concentration were employed based on both Gross Value Added and employment data for selected years in order to highlight the different aspects of these phenomena and to compare the results.

The major findings of the study are that during 1996-2005 the structural changes within regions were significant, important reallocations of employment took place in order to adapt to the changing economic environment and Romanian regions become less specialised while the industries become slightly more concentrated. These outcomes of our research support the theories stating that divergent evolutions of specialisation and concentration are possible (e.g. the Rossi-Hansberg model), but we shall have to check the robustness of such findings over a longer period of time.

These results show that Romania, as a transition country with an economic structure coming from the former centrally planned economy and unable to adjust to a market-oriented structure in a short period of time, first despecialised as a result of

restructuring and privatisation measures. They led to production diminishing in key sectors accompanied by replacement of the big state industrial enterprises by small and medium firms, more flexible and able to adapt to the requirements of the market economy. Under these circumstances, while Romania will develop new, efficient and effective structures, it may be possible to respecialise in the future depending on the comparative advantages it may find in the European integrated market.

In terms of economic policy, these conclusions provide useful information to be considered when decisions relating to investment funds allocation or employment policies are adopted.

Further research will be needed in order to explore the driving forces of specialisation and concentration in Romania and to deepen the analysis, both in absolute and relative terms, and not only at national scale, but also at the EU level. The emphasis will be put especially on the influence of the location factors in the new context of the integrated EU.

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