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Specialisation and Concentration Patterns in the Romanian Economy

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Abstract

The economic specialisation of the regions and the spatial concentration of the economic activities are reflecting the same reality from two different perspectives. Our research is an attempt to capture the main patterns and the evolution of regional specialisation and sectoral concentration in the Romanian economy for selected years during 1996-2007 period, on the basis of the Gross Value Added and employment data, by branch and by region. We employed standard statistical measures of specialisation and concentration, combined with methods envisaging the amplitude and the speed of structural changes in order to highlight the various sides of these two complex phenomena.

Key words: specialisation, concentration, region, employment, Gross Value Added, Romania

JEL classification: R11, R12

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 to be two closely interrelated phenomena. The definitions of both regional specialisation and geographic concentration of industries are based on the same production structures, reflecting the same reality. Regional specialisation expresses the territorial perspective and depicts the distribution of the shares of the economic activities in a certain region, usually compared to the rest of the country, while geographic concentration of a specific economic activity reflects the distribution of its regional shares.

This topic is increasingly important to the economic policy and to the competitiveness: while the exploitation of the scale economies and of the specific endowments of the regions increases productivity, a highly specialised region is more vulnerable to the economic shocks in its leading sector. Structural shifts in the economy should be of high policy concern for Romania, as well. The transition of Romania to the market economy had already reshaped its economic structure, but the ongoing evolution of the global economy is currently bringing about new challenges and the need to adapt more rapidly.

The objective of this study is to contribute to the existing research by providing new empirical results on specialisation and concentration in the Romanian economy, from various perspectives highlighted by different statistical measures available.

The paper is organised as follows. Section 2 gives an overview of the relevant literature on this topic, while section 3 briefly describes the statistical indicators we selected for the measurement of concentration and specialisation in Romania. Sections 4 and 5 discuss the results, showing that the economic specialisation of the Romanian regions constantly decreased, while the degree of regional concentration of the main economic branches generally increased in

the 1996-2007 period. The paper concludes with a summary of the main findings and directions for future research.

2. Theory and empirical evidence on specialisation and concentration

The industrial specialisation of regions is usually addressed in connection with the geographical concentration of industries, as “two sides of the same coin” (Aiginger and Rossi-Hansberg, 2006).

Regional specialisation describes the distribution of the sectoral shares in its overall economy compared to the whole country, whereas the geographical concentration of a specific industry reflects the distribution of its regional shares.

One of the main streams of the literature dedicated to regional specialisation refers to the mechanisms of this process, as described by Ricardo’s comparative advantage theory (1817) and Heckscher-Ohlin’s factor endowment theory (Heckscher, 1919, Ohlin, 1933). Then, neoclassical models and new models of trade also demonstrate how regional specialisation allows economies to benefit from their resource endowments (Krugman, 1991, Fujita, Krugman and Venables, 1999, Armstrong and Taylor, 2000).

Another category of models deals with the determinants of location and specialisation. Of a 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 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.

The size of the regions has been also taken into consideration in relation with the level of productive specialisation, being a priori assumed the existence of an inverse relationship between these two variables. Ezcurra et. al. (2006) discusses the idea that larger regions have a lower level of specialisation than the smaller regions owing to the more heterogeneous population and variations in physical factors. Though, 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).

The consequences of regional specialisation are highlighted by a series of growth models, including the classical core-periphery model (Myrdal, 1957 and Friedmann, 1977), growth pole model (Perroux, 1969), cumulative causation model (Dixon and Thirlwall, 1975), etc., applied at shifting scales (global, national, regional, local) and supporting either convergence or divergence in development level as a result of various inter-related, sometimes competing factors (Armstrong, 1994). 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)).

As mentioned before, 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).

The last two decades are characterised by special concerns with the development of special models and techniques and the adaptation of the existing ones for examining the particular aspects revealed by industrial concentration. Thus, Ellison and Glaeser (1997) propose

a model able to motivate new indices of geographical concentration and co-agglomeration. They take into consideration localized industry-specific spillovers, natural advantages and pure random chance so that the resulted indices are able to reflect the differences in size distribution of plants and size of geographical areas. In their view location spillovers refer to both physical spillovers (as defined by Krugman (1991), who considers that the presence of one firm diminishes the transportation costs for another one) and intellectual spillovers (as defined by Glaeser et al., 1992). Subsequently, the authors demonstrate that by means of these indices “comparisons of the degree of geographical concentration across industries can be made with confidence” (p.889).

Other authors have deepened various existing techniques in order to open new directions of investigation and broaden the “classical” conclusions in the field.

For example, Acar and Sankaran (1999) have focused on “the trend towards specializing the Herfindahl index for measuring industry concentration and entropy measure for expressing firm diversity” (p.969). By decomposing both Herfindahl index and entropy they argue that the advantage of entropy measures with regard to decomposability is also shared by Herfindahl index, which proves to be even more versatile in terms of inversion than the entropy measure.

In another register, by comparing the results obtained for two different countries – United States and New Zealand - Micheline and Pickford (1995) have demonstrated that the high correlation between concentration ratio and Herfindahl index may be biased upward when estimated Herfindahl index is used. As a result, they propose a new family of Herfindahl indices estimators which is derived from the upper and lower limits rather than generalized assumptions about firm size distribution.

Although the bulk of the literature on specialization and concentration implicitly or explicitly treated the two phenomena as interrelated, there are some empirical outcomes suggesting they would 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). Furthermore, the model in Rossi-Hansberg (2005) was used for empirically proving that specialization and concentration may even go in opposite directions when transport costs change. More specifically, as transport costs lower the degree of concentration tend to increase, while the level of specialization decreases (Aiginger and Rossi-Hansberg, 2006).

Starting from these overall considerations this paper proposes an insight into regional specialisation and industrial concentration issues in Romania.

3. Statistical measures for specialisation and concentration

As emphasized by the existing literature, the definitions of both regional specialisation and geographic concentration of industries are based on the same production structures, reflecting the same reality (Aiginger, 1999). Specialisation of a certain region expresses the distribution of the shares of economic branches in its overall economy, usually compared to the rest of the country. A region is considered to be highly specialized if a small number of industries have a large combined share in the economy of that region. Geographic concentration of a specific sector reflects the distribution of its shares by region. A highly concentrated sector will have a very large part located in a small number of regions.

In order to explore the main patterns and the interaction between specialisation and concentration in the Romanian economy, we had to select the statistical indicators and the variables that give data for the quantification of the trends. We combined standard statistical measures with indicators of the amplitude and the speed of structural changes and we also

combined static and dynamic analysis, by computing the same indicator for different years and by using indicators that explicitly consider time variation. As regards the variables to be addressed for measurements, we have chosen Gross Value Added and the number of employed population, both very popular in most of the empirical studies on this topic.

The first step in any concentration and specialisation empirical analysis consists of computing the *concentration and specialisation ratios*:

$$g_{ij}^C = \frac{E_{ij}}{\sum_{i=1}^n E_{ij}} = \frac{E_{ij}}{E_j} \quad \text{and} \quad g_{ij}^S = \frac{E_{ij}}{\sum_{j=1}^m E_{ij}} = \frac{E_{ij}}{E_i},$$

where:

g_{ij}^C - the concentration ratio: the share of the region/county i in the total national employment or Gross Value Added of industry j;

g_{ij}^S - the specialisation ratio: the share of the industry j in the total employment or Gross Value Added of region/county i;

E_{ij} - employment or Gross Value Added in industry j in the region/county i;

E_j - national employment or Gross Value Added in industry j;

E_i - total employment or Gross Value Added in the region i;

i – region/county; j- industry.

Although these ratios are used mainly as a basis for many of the more complex and sophisticated measures of concentration and specialisation, they can by themselves offer valuable information by depicting the general image of the spatial distribution of industries and by detecting spatial irregularities.

The first synthetic statistical indicator that we employed in this study is the *Herfindahl-Hirschman Index*, an absolute measure of concentration/specialisation which is probably the most commonly used:

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

where: $g_{ij}^C = \frac{X_{ij}}{\sum_{i=1}^n X_{ij}} = \frac{X_{ij}}{X_j}$ and $g_{ij}^S = \frac{X_{ij}}{\sum_{j=1}^m X_{ij}} = \frac{X_{ij}}{X_i}$

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 is increasing with the degree of concentration/specialization, reaching its upper limit of 1 when the branch j is concentrated in one region or the region i is specialized in only one branch.

The main weakness of the Herfindahl index is the sensitivity of its lower limit to the number of observations: the lowest level of concentration is 1/n (when all regions have equal shares in branch j), while the lowest specialisation is 1/m (when all branches have equal shares in region i).

As an absolute measure, this indicator has another important shortcoming: big regions, because of their larger shares, heavily influence the changes in the concentration/specialisation (the index is biased towards the larger regions).

When computed out of county level data, the Herfindahl Index ranges between 0.0238 and 1 in Romania. We also have to note that the results are very much dependent on the fineness of the industrial classification employed.

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

$$K_j^C = \sum_{i=1}^n |g_{ij}^C - g_i| \text{ and } K_i^S = \sum_{j=1}^m |g_{ij}^S - g_j|, \text{ where } g_i = \frac{X_i}{X}, g_j = \frac{X_j}{X}$$

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

The Krugman Index is a relative measure of specialisation/concentration which compares 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 (when all territorial/sectoral structures are identical) to 2 (for totally different structures).

The third indicator, the **Lilien Index** captures the speed of the sectoral employment reallocation in the economy, as the main factor of differences in specialisation (Lilien, 1982). The Lilien Index is calculated for each region i as:

$$L_i^S = \sqrt{\sum_{j=1}^m \frac{X_{ij}}{X_i} (\Delta \log X_{ij} - \Delta \log X_i)^2}, \text{ where:}$$

$\frac{X_{ij}}{X_i}$ - the share of branch j in the total employment of region i;

X_{ij} - employment in branch j in region i;

X_i - total employment in region i;

Δ - the first difference operator

Based on his index, Lilien (1982) found that a large part of the time-series variation in the U.S. unemployment since World War II can be considered the result of employment reallocation shocks in the economy. The outcome is partly contested by some authors considering that it is the potential correlation between this index and the effects of aggregate cyclical disturbances that have to be taken into account. Nevertheless, the Lilien Index is still considered to be a useful measure of the speed of structural changes. The higher the value of this indicator, the faster the structural changes and the bigger the reallocations of employment between branches. It also

indicates the ability of an economy to flexibly react and quickly adapt to changes in aggregate demand.

The fourth indicator is a *clustering index of concentration* originating in the gravity models. It measures the spatial dispersion of the economic activities by summing up the distance-weighted data of all the pairs of regions:

$$C_j^C = \frac{\sum_i \sum_k \left(\frac{X_{ij} X_{kj}}{d_{ik}} \right)}{\sum_i \sum_k \left(\frac{X_i X_k}{d_{ik}} \right)} \text{ with } i \neq k,$$

where:

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

X_{kj} - Gross Value Added or employment in branch j in region k;

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

X_k - total Gross Value Added or employment in region k;

d_{ik} - the geographic distance between capitals of regions i and k.

This indicator increases with the degree of concentration, indicating if similar economic activities take place in geographically low distanced regions.

The last indicator employed in our research is the *coefficient of absolute structural changes*, used for measuring the average change in sectoral or territorial shares recorded in different units of time:

$$\tau_{g_1-g_0} = \sqrt{\frac{\sum_{i=1}^n (g_{1i} - g_{0i})^2}{n}},$$

where g_{1i} and g_{0i} are the sectoral or regional shares i in two time periods 1 and 0.

The indicator increases with the intensity of the time changes in either specialisation or concentration. We also used it for comparing concentration and specialisation ratios computed out of different data sets (Appendix 1).

The selected statistical indicators of concentration and specialisation have been calculated using data on Gross Value Added and the number of employed population. Sectoral and regional data sets for this study were provided by Romanian official statistics, the common sectorial classification available for the entire time span consisting of nine main economic branches. Comparable regional data were available only starting with the year 1996, therefore the entire time span envisaged by our research was 1996-2007, divided into a period of prevalent economic decline (until 2000), followed by sustained economic growth. The results will be discussed in the following two sections.

4. The economic specialisation of the Romanian regions

The Herfindahl index for specialisation clearly shows a decrease in the level of economic specialisation for all Romanian regions and for the entire period (Table 1). Although the results

slightly differ depending on the variable used for measurements (Gross Value Added data yields smaller values of the index compared to employment data) this trend is followed by all regions.

As a high degree of specialisation entails economic vulnerability (e.g. the mining industry in Southern Romania) and is usually associated with a lower level of development, this a positive trend for Romania. Developed regions generally display smaller and further declining degrees of specialisation as revealed by recent EU studies (Marelli, 2006). The most developed region in Romania – Bucharest-Ilfov – has by far the smallest degree of specialisation in all selected years, if computed out of employment data (Table 1).

Table 1. The Herfindahl Index for the specialisation of the regions

| | Herfindahl Index based on Gross Value Added data | | | | Herfindahl Index based on employment data | | | |
|-----------|--|--------|--------|--------|--|--------|--------|--------|
| | 1996 | 2000 | 2005 | 2007 | 1996 | 2000 | 2005 | 2007 |
| NE | 0.2044 | 0.1712 | 0.1484 | 0.1418 | 0.2785 | 0.3234 | 0.2600 | 0.2304 |
| SE | 0.1966 | 0.1599 | 0.1549 | 0.1550 | 0.2369 | 0.2682 | 0.2160 | 0.1921 |
| S | 0.2346 | 0.1783 | 0.1860 | 0.1991 | 0.2768 | 0.3089 | 0.2486 | 0.2202 |
| SV | 0.2181 | 0.1842 | 0.1712 | 0.1730 | 0.2841 | 0.3210 | 0.2589 | 0.2258 |
| V | 0.2010 | 0.1586 | 0.1675 | 0.1716 | 0.2288 | 0.2331 | 0.2071 | 0.1903 |
| NV | 0.2076 | 0.1528 | 0.1594 | 0.1633 | 0.2610 | 0.2849 | 0.2275 | 0.1998 |
| C | 0.2598 | 0.1829 | 0.1870 | 0.1865 | 0.2580 | 0.2393 | 0.2069 | 0.1890 |
| BI | 0.2105 | 0.1791 | 0.1625 | 0.1733 | 0.1907 | 0.1613 | 0.1519 | 0.1565 |

Specialisation in 2007 reaches its peak in the South region (specialised in industry), when measured out of GVA data, but its highest value is to be found in the North-East region (agriculture) when based on employment data (Table 1).

Table 2. The Krugman Dissimilarity Index for the specialisation of the regions

| | Krugman Dissimilarity Index based on Gross Value Added data | | | | Krugman Dissimilarity Index based on employment data | | | |
|-----------|---|--------|--------|--------|---|--------|--------|--------|
| | 1996 | 2000 | 2005 | 2007 | 1996 | 2000 | 2005 | 2007 |
| NE | 0.1319 | 0.2570 | 0.1574 | 0.1843 | 0.1732 | 0.2031 | 0.2389 | 0.2505 |
| SE | 0.1007 | 0.1207 | 0.1068 | 0.0885 | 0.1588 | 0.1008 | 0.0973 | 0.0944 |
| S | 0.1412 | 0.1707 | 0.1844 | 0.2292 | 0.1184 | 0.1405 | 0.1505 | 0.1662 |
| SV | 0.1158 | 0.2338 | 0.1754 | 0.1856 | 0.1877 | 0.1938 | 0.2046 | 0.1961 |
| V | 0.1098 | 0.0479 | 0.0688 | 0.0698 | 0.1009 | 0.1193 | 0.1414 | 0.1440 |
| NV | 0.1303 | 0.1205 | 0.0685 | 0.0831 | 0.0969 | 0.0988 | 0.0912 | 0.0924 |
| C | 0.1637 | 0.1433 | 0.1387 | 0.1726 | 0.1870 | 0.1843 | 0.1583 | 0.1623 |
| BI | 0.4191 | 0.4263 | 0.3726 | 0.3725 | 0.6023 | 0.7050 | 0.6133 | 0.6060 |

Despite the decrease in the level of specialisation, the dissimilarities between the economic structures of the regions were significant (Table 2). The Krugman Dissimilarity Index diminished in some regions and amplified in many others illustrating the divergence among the regions as regards their sectoral structures.

Except for Bucharest-Ilfov, Krugman Index was relatively low in Romania in 2007 when compared to Poland (0.508) or Lithuania (0.328), but is much higher than in EU15, where it is below 0.150 for most of the countries, reaching a minimum of 0.063 in Austria and 0.064 in Deutschland (Marelli (2006), based on regional employment data).

The Herfindahl Index and the Krugman Dissimilarity Index of specialisation both showed significantly higher values when computed out of employment data, but the trend is similar irrespective of the variable employed (Tables 1 and 2). The regional variation of the Herfindahl Index is much smaller compared to the Krugman Dissimilarity Index (Appendix 3). For both indices, Bucharest-Ilfov region displays the strongest distance to the other regions: the smallest degree of specialisation and a structure of economic activities very different from all other regions. These results are in line with its privileged position as the most developed region in Romania, concentrating a big part of the national wealth.

Table 3. Regional changes in specialisation

| | Coefficient of structural changes based on Gross Value Added data (pp*) | | | Coefficient of structural changes based on employment data (pp*) | | |
|-----------|---|-----------|-----------|--|-----------|-----------|
| | 1996-2000 | 2001-2005 | 2005-2007 | 1996-2000 | 2001-2005 | 2005-2007 |
| NE | 3.39 | 3.40 | 1.82 | 3.42 | 2.80 | 1.56 |
| SE | 4.70 | 2.69 | 1.33 | 2.39 | 3.35 | 1.63 |
| S | 5.10 | 3.49 | 1.22 | 3.74 | 3.20 | 1.58 |
| SV | 4.60 | 3.54 | 0.99 | 3.20 | 3.00 | 1.75 |
| V | 6.54 | 2.92 | 1.20 | 2.23 | 3.23 | 1.37 |
| NV | 7.41 | 2.30 | 0.78 | 3.05 | 3.60 | 1.78 |
| C | 5.83 | 2.91 | 0.90 | 2.97 | 2.90 | 1.56 |
| BI | 9.70 | 3.79 | 1.99 | 2.78 | 3.07 | 2.45 |

* *percentage points*

The values of the coefficient of absolute structural changes (Table 3) had a relatively small variation from a region to another in the last two time periods envisaged. There was a slightly reduction of its values during the interval 2001-2005, a period of sustained economic growth, compared to the previous interval of economic decline, for all regions, irrespective of the data employed. The decline in the intensity of structural changes by region was even stronger in 2005-2007 period, mainly as a statistical effect of the shorter time span. In 2005-2007 period, the economic sectors changed their shares in a region on average by 0.78-1.82 percentage points based on production data and by 1.37-2.45 percentage points based on employment data.

The Bucharest-Ilfov region experienced the strongest changes in all time periods.

Table 4. The speed of changes in specialisation

| | The Lilien Index | | |
|-----------|------------------|-----------|-----------|
| | 1996-2000 | 2001-2005 | 2005-2007 |
| NE | 0.1887 | 0.1887 | 0.1393 |
| SE | 0.1643 | 0.2079 | 0.1281 |
| S | 0.1986 | 0.2070 | 0.1183 |
| SV | 0.1928 | 0.1836 | 0.1351 |

| | | | |
|-----------|--------|--------|--------|
| V | 0.1490 | 0.2019 | 0.1167 |
| NV | 0.1683 | 0.2178 | 0.1487 |
| C | 0.1678 | 0.2139 | 0.1315 |
| BI | 0.1855 | 0.2456 | 0.1958 |

The Lilien Index (Table 4) points to significant structural changes and reallocation of employment between sectors, thus proving that the economy is adapting to changes in the aggregate demand. Similar to the previous indicator, it reveals a decrease in the magnitude of structural changes. Nevertheless we should keep in mind that it only partially shows the region's ability to change, since the shift of resources that occurs within the framework of each sector cannot be captured by the Lilien Index.

5. Regional concentration of economic activities in Romania

The Herfindahl Index for concentration (Table 5) shows lower values than the specialisation Herfindahl Index and relatively little variation in respect to the data employed (GVA or employment data), possibly as a result of using broad economic sectors, because a finer regional disaggregation of branches was not available.

Opposite to the declining trend of specialisation, concentration of economic activities was bigger in 2007 compared to 1996 in all branches, except for education, where it felt slightly. As expected, health and social assistance is at the lower margin of concentration in production. Industry, as a whole, also has a small value of the indicator, but the degree of concentration is certainly bigger for most of its branches, as industries usually have high economies of scale, which determines their concentration in fewer locations.

Table 5. The Herfindahl Index for concentration

| | Herfindahl Index based on Gross Value Added data | | | | Herfindahl Index based on employed population data | | | |
|--|--|--------|--------|--------|--|--------|--------|--------|
| | 1996 | 2000 | 2005 | 2007 | 1996 | 2000 | 2005 | 2007 |
| Agriculture ¹⁾ | 0.1418 | 0.1435 | 0.1434 | 0.1434 | 0.1477 | 0.1489 | 0.1482 | 0.1484 |
| Industry ²⁾ | 0.1301 | 0.1286 | 0.1287 | 0.1309 | 0.1299 | 0.1287 | 0.1279 | 0.1281 |
| Construction | 0.1348 | 0.1364 | 0.1631 | 0.1502 | 0.1306 | 0.1298 | 0.1476 | 0.1427 |
| Trade ³⁾ | 0.1361 | 0.1618 | 0.1593 | 0.1582 | 0.1286 | 0.1282 | 0.1311 | 0.1329 |
| Transport and communications | 0.1407 | 0.1464 | 0.1517 | 0.1780 | 0.1322 | 0.1323 | 0.1386 | 0.1374 |
| Real estate transactions and other services | 0.1527 | 0.1841 | 0.1516 | 0.1627 | 0.1694 | 0.1652 | 0.1767 | 0.1952 |
| Public administration and defence | 0.1304 | 0.1991 | 0.1504 | 0.1490 | 0.1306 | 0.1318 | 0.1330 | 0.1323 |
| Education | 0.1317 | 0.1295 | 0.1309 | 0.1314 | 0.1300 | 0.1293 | 0.1304 | 0.1298 |
| Health and social assistance | 0.1280 | 0.1276 | 0.1293 | 0.1296 | 0.1290 | 0.1278 | 0.1286 | 0.1281 |

¹⁾ including hunting and sylviculture, fishery and pisciculture

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

³⁾ including hotels and restaurants

From the production point of view, in 2007 transport and communications was the most concentrated sector (in Bucharest-Ilfov), while the biggest concentration in employment was recorded for real estate transactions and other services (Bucharest-Ilfov).

Table 6. The Krugman Dissimilarity Index for concentration

| | Krugman Dissimilarity Index based on Gross Value Added data | | | | Krugman Dissimilarity Index based on employed population data | | | |
|--|---|--------|--------|-------|---|--------|--------|--------|
| | 1996 | 2000 | 2005 | 2007 | 1996 | 2000 | 2005 | 2007 |
| Agriculture ¹⁾ | 0.3894 | 0.3927 | 0.3894 | 0.420 | 0.2721 | 0.2823 | 0.2773 | 0.2785 |
| Industry ²⁾ | 0.1934 | 0.1475 | 0.1446 | 0.188 | 0.1180 | 0.1112 | 0.1251 | 0.1368 |
| Construction | 0.1675 | 0.1131 | 0.2161 | 0.144 | 0.1964 | 0.1717 | 0.2953 | 0.2598 |
| Trade ³⁾ | 0.0774 | 0.1884 | 0.1665 | 0.142 | 0.1384 | 0.1403 | 0.1664 | 0.1843 |
| Transport and communications | 0.1117 | 0.0984 | 0.1650 | 0.233 | 0.1969 | 0.2068 | 0.2557 | 0.2251 |
| Real estate transactions and other services | 0.1512 | 0.2969 | 0.1412 | 0.165 | 0.3943 | 0.3794 | 0.4298 | 0.5030 |
| Public administration and defence | 0.2518 | 0.3547 | 0.1408 | 0.137 | 0.1275 | 0.1643 | 0.1643 | 0.1563 |
| Education | 0.2200 | 0.2096 | 0.1906 | 0.213 | 0.0879 | 0.0866 | 0.1119 | 0.1085 |
| Health and social assistance | 0.1897 | 0.1502 | 0.1315 | 0.149 | 0.0514 | 0.0684 | 0.0703 | 0.0723 |

¹⁾ including hunting and sylviculture, fishery and pisciculture

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

³⁾ including hotels and restaurants

The increase in the degree of concentration was accompanied by a rise in the regional dissimilarities for most of the main economic branches, as Krugman Index points out (Table 6). The biggest dissimilarities were displayed by agriculture (dependent on the natural factors endowment) when using GVA data, and real estate (heavily concentrated in Bucharest-Ilfov) when employment data are used.

There is a relatively strong concordance between the results of Herfindahl and Krugman indices, but the variation of the Herfindahl Index by economic sector is much smaller compared to the Krugman Dissimilarity Index (Appendix 2).

Table 7. Structural changes by branch

| | Coefficient of structural changes based on Gross Value Added data (pp*) | | | Coefficient of structural changes based on employed population data (pp*) | | |
|---------------------------------|---|---------------|---------------|---|---------------|---------------|
| | 1996- 2000 | 2001- 2005 | 2005- 2007 | 1996- 2000 | 2001- 2005 | 2005- 2007 |
| Agriculture ¹⁾ | 1.16 | 1.34 | 0.53 | 0.12 | 0.28 | 0.03 |
| Industry ²⁾ | 1.16 | 1.42 | 0.90 | 0.96 | 0.67 | 0.32 |
| Construction | 1.49 | 3.91 | 1.38 | 3.22 | 0.76 | 0.77 |
| Trade ³⁾ | 3.39 | 0.60 | 0.27 | 0.71 | 1.31 | 0.48 |
| Transport and communications | 1.63 | 1.34 | 2.60 | 0.91 | 1.83 | 0.56 |
| Real estate transactions | 3.60 | 5.02 | 1.22 | 0.89 | 0.90 | 1.47 |

| | | | | | | |
|-----------------------------------|-------|------|------|------|------|------|
| and other services | | | | | | |
| Public administration and defence | 11.24 | 0.41 | 0.33 | 0.81 | 1.05 | 0.26 |
| Education | 0.78 | 0.82 | 0.32 | 0.58 | 0.33 | 0.27 |
| Health and social assistance | 1.31 | 0.89 | 0.29 | 1.12 | 0.93 | 0.31 |

* in percentage points

¹⁾ including hunting and silviculture, fishery and pisciculture

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

³⁾ including hotels and restaurants

The coefficient of structural changes shows little movement in the territorial distribution of the economic branches, but our broad disaggregation of sectors may hide stronger internal changes within each one (Table 7).

Table 8. Clustering measures of concentration

| | Clustering Index based on Gross Value Added data | | | | Clustering Index based on employed population data | | | |
|---|--|-------|-------|-------|--|-------|-------|-------|
| | 1996 | 2000 | 2005 | 2007 | 1996 | 2000 | 2005 | 2007 |
| Agriculture ¹⁾ | 0.072 | 0.054 | 0.054 | 0.055 | 0.083 | 0.082 | 0.070 | 0.066 |
| Industry ²⁾ | 0.089 | 0.070 | 0.072 | 0.074 | 0.107 | 0.106 | 0.091 | 0.085 |
| Construction | 0.086 | 0.070 | 0.071 | 0.070 | 0.105 | 0.106 | 0.094 | 0.087 |
| Trade ³⁾ | 0.088 | 0.073 | 0.072 | 0.071 | 0.103 | 0.108 | 0.092 | 0.087 |
| Transport and communications | 0.089 | 0.072 | 0.070 | 0.071 | 0.101 | 0.108 | 0.094 | 0.089 |
| Real estate transactions and other services | 0.094 | 0.071 | 0.072 | 0.072 | 0.120 | 0.116 | 0.101 | 0.092 |
| Public administration and defence | 0.080 | 0.075 | 0.073 | 0.072 | 0.111 | 0.113 | 0.096 | 0.089 |
| Education | 0.079 | 0.064 | 0.064 | 0.063 | 0.099 | 0.100 | 0.085 | 0.080 |
| Health and social assistance | 0.082 | 0.065 | 0.066 | 0.066 | 0.100 | 0.100 | 0.087 | 0.082 |

¹⁾ including hunting and silviculture, fishery and pisciculture

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

³⁾ including hotels and restaurants

Not surprisingly, the clustering index (Table 8) displays its highest value in industry, as it is less spatially dispersed, exploiting the advantages of the economies of scale, while the agriculture and its production is more evenly dispersed.

All the previous statistical indicators of concentration and specialisation showed significant dissimilarities depending on the data employed: Gross Value Added or employment data. As the concentration and specialisation ratios are the basis for most of the synthetic indicators, we measured the average distance between their values computed out of GVA data against employment data and found out that the differences are important (Appendix 1), therefore the variables should be carefully considered when comparing the results coming from different studies on concentration and specialisation.

6. Concluding comments

In this paper we have explored the main characteristics and the interaction between regional specialisation and sectoral concentration in Romanian economy during 1996-2007 period using various statistical indicators. Production and employment data are the most popular data choices for the measurement of concentration and specialisation. We used both of them and found out important differences in the level of resulting values of the statistical indicators and in their regional and sectoral hierarchies as well. The values of the concentration and specialisation measures are also very sensitive to the level of disaggregation of the data. For instance, concentration increases with the number of sectors envisaged.

We found a low and decreasing degree of economic specialisation for all the regions, while the concentration level is slightly increasing for most of the economic sectors, in contradiction with the “traditional” theories which predict similar, if not identical, evolutions of concentration and specialisation. Even if concentration and specialisation are two different ways to look at the same data, given the unequal size of the regions/sectors and the fact that the synthetic indicators computed reflect the entire distribution of shares, concentration and specialisation may go in opposite directions. The outcomes of our research are in line with the new theories stating that divergent evolutions of specialisation and concentration are possible (e.g. the Rossi-Hansberg model), although the robustness these results still has to be checked on a longer period of time and a finer disaggregation of data.

Important dissimilarities exist as regards the sectoral structures of the regions and the territorial distributions of the economic sectors, as well.

Another major finding of the study is that the speed of structural changes within regions was significant; important reallocations of employment took place in order to adapt to the changing economic environment.

Further research will be needed in order to explore the driving forces of specialisation and concentration in Romania. There is also a need to deepen the analysis, both in absolute and relative terms, by using a finer territorial and sectoral disaggregation which will bring more information.

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Appendix 1.

Average differences in the values of specialisation ratios depending on the data (Gross Value Added against employment data)

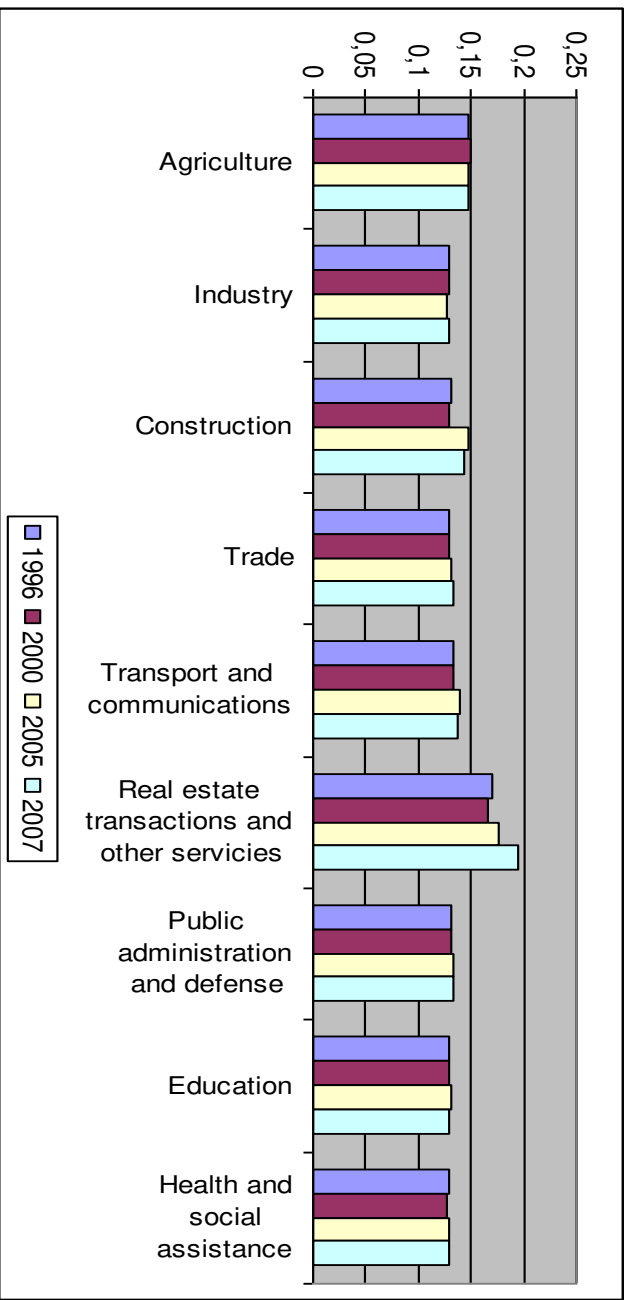
| | 1996 | 2000 | 2005 | 2007 |
|-----------|----------|----------|----------|----------|
| NE | 0.071834 | 0.122581 | 0.110759 | 0.103202 |
| SE | 0.066161 | 0.115035 | 0.091655 | 0.084518 |
| S | 0.063294 | 0.128728 | 0.106909 | 0.103046 |
| SV | 0.080508 | 0.140942 | 0.11597 | 0.107766 |
| V | 0.03053 | 0.099805 | 0.075259 | 0.074056 |
| NV | 0.054316 | 0.129365 | 0.095651 | 0.086891 |
| C | 0.040757 | 0.089038 | 0.072832 | 0.065679 |
| BI | 0.034053 | 0.082352 | 0.040819 | 0.04546 |

Average differences in the values of concentration ratios depending on the data (Gross Value Added against employment data)

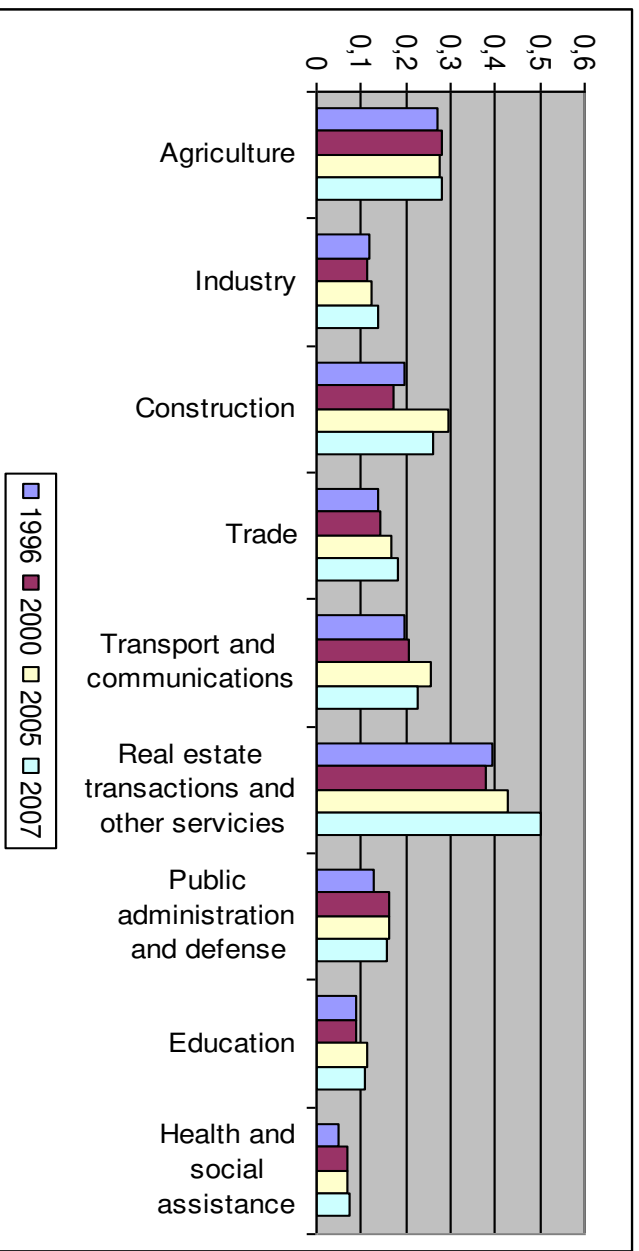
| | 1996 | 2000 | 2005 | 2007 |
|--|----------|----------|----------|----------|
| Agriculture | 0.020482 | 0.06552 | 0.018082 | 0.02005 |
| Industry | 0.014831 | 0.047787 | 0.020749 | 0.024712 |
| Construction | 0.012229 | 0.049696 | 0.017531 | 0.012438 |
| Trade | 0.028271 | 0.037162 | 0.041087 | 0.035919 |
| Transport and communications | 0.034124 | 0.066151 | 0.022524 | 0.047896 |
| Real estate transactions and other services | 0.019951 | 0.036997 | 0.026461 | 0.02746 |
| Public administration and defense | 0.033389 | 0.033965 | 0.026637 | 0.027267 |
| Education | 0.006448 | 0.012396 | 0.005221 | 0.006074 |
| Health and social assistance | 0.004322 | 0.006841 | 0.009046 | 0.010184 |

Appendix 2. Concentration measures based on employment data

The Herfindahl Index

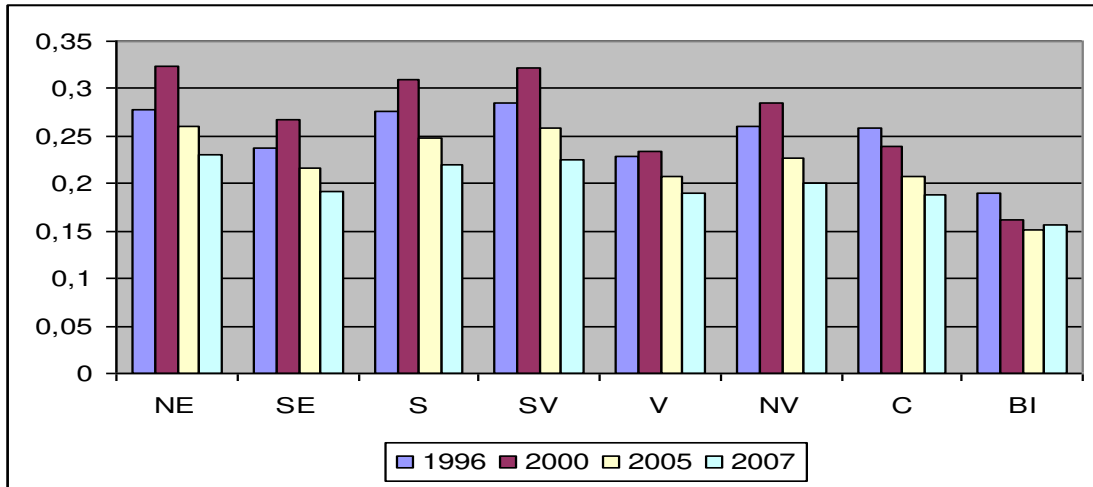


The Krugman Index



Appendix 3. Specialisation measures based on employment data

The Herfindahl Index



The Krugman Index

