

## THE CLUSTERING POTENTIAL IN TRANSYLVANIA BASED ON THE CONCENTRATION OF ECONOMIC ACTIVITIES AND REGIONAL SPECIALIZATION

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**ABSTRACT. – The Clustering Potential in Transylvania Based on the Concentration of Economic Activities and Regional Specialization.** In our days clusters and cluster policies have begun to play an increasingly important role in the economic and political environment alike, being mentioned more and more often in relation to new development policies as an easy solution for the complex problems of the economy. For pointing out the “raison d’être” of these approaches, we intend to analyze the specialization and the spatial concentration of economic activities based on a very straight-forward approach for pointing out the intensifying activities of the economy both from a territorial as well as from a sectoral point of view. The topic is all the more important since much of the financial support and state aid going into the economy in the last years has been channeled in the form of financial grants given to specific structures like clusters or competitiveness poles and the tendency does not look like it is about to change. That is why in the present paper we would like to analyze the specialization of the counties in Transylvania and the concentration of the certain industries and try to find a correlation with the clusters which have emerged in the past years.

*Keywords: clusters, concentration, specialization, development.*

### 1. INTRODUCTION

Since the elaboration of the economic cluster theories, the concept and its interpretations have undergone numerous transformations, attracting a series of admirers along the years, but especially in the last period many skeptics started to appear.

All over the world there is a wide variety of cluster definitions, each one adding a few different elements, trying to better describe the multitude of connections and relations which make up a cluster in the real sense of the word. But probably none of them sums up the idea better than the one from Lefebvre (Ecole des Mines de Paris) who says that “There is no real adequate definition for a cluster. In reality, there are very different types of clusters to be found, involving different types of partners from industry, research, education, policy, (...). The two most famous examples of clusters, Silicon Valley and the Italian districts, are extremely different in their nature and ways of bringing the actors together” (Committee of Regions 2010, p.11).

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Although even the name has suffered a series of changes (competitiveness pole, industrial agglomeration, etc) – depending on the reasons for using the term – the basic concept has essentially remained the same, representing the close cooperation between companies, research institutions and other stakeholders in a geographically delimited area. Since we would not like to go into detail regarding the definition of the concept, we will consider the above description as a guideline when using the term further in the paper. Even so, we have to point out that because of this fuzziness we sometimes come face to face with the barriers imposed by the vague character of the cluster concept when trying to underline certain characteristics, although this does not seem to deter decision makers when supporting certain “privileged” economic sectors.

At this stage, probably the best starting point would be to accept the fact that these structures DO exist, the object of the analysis being to identify the causes of the phenomenon, its characteristics as well as the factors capable of influencing the clustering process. The New Economic Geography does offer us some explanations on why these clusters - which are so hard to describe statistically - have become an essential part of our thinking in relation to regional development, one of the main elements in this sense being the relation between scale economies, transport costs and the positive externalities of the market (Möller and Litzel, 2008). The New Economic Geography can also give explanations regarding the advantages of settling in the proximity of companies within the same industry (Benedek, 2004) based on models of monopolistic competition, trying to explain the clustering phenomenon through the interaction of companies and consumers, the existence of scale economies as well as transport costs (Dixit and Stiglitz 1977, Ethier 1982). Krugman’s center-periphery model, with its subsequent modifications and extensions represents an important step in analyzing the concentration of production activities (under ideal conditions), using a series of simplifications regarding labor, the number of industries, number of companies, transport costs and of course perfect competition (Sternberg, 2001 ap. Benedek, 2004). As a result, according to the authors, the interactions between the right geographical location, production and consumption can lead to the development of a self-sustaining process of the concentration of production.

In the approach of Dixit and Stiglitz, one of the major advantages of agglomeration economies is the variety of inputs found within a reasonable distance and with negligible transport costs, leading to an increased productivity. But diversity without a certain degree of specialization is of little help when trying to increase the chances of beneficial interactions. Therefore there is a strong need for the diversity of inputs corresponding to the activity of the companies, in close connection with the functional specialization at regional or local level. This approach represents a distancing from traditional approaches, abandoning the concept of clear-cut borders among industries, these being penetrated more and more by complex linkages between suppliers and consumers.

A series of empirical studies have shown that in the last years the specialization of regions measured by the spatial concentration of production activities - using conventional classifications of the economic sectors - has entered a phase of decline (Haas and Südekum, 2005; Möller and Tassinopoulos, 2001). Seen as an isolated phenomenon, this could mean a greater geographic dispersion of horizontally interlinked companies

and could also be used as a counter-argument in the face of the clustering phenomenon. On the other hand, if we consider the inter-sectoral specialization, the situation changes somewhat in the sense that the place of industrial specialization is slowly being overtaken by the increasing importance of functional specialization (Duranton and Puga, 2005), the advantages being related to three main elements: the presence of common inputs, the concentration of the specialized workforce and the spillover effects of knowledge.

In the end the real problem is also related to the fact that economic spaces are usually the result of hystorical events and processes of economic growth and decline, with a strong influence on the complexity of the value chains, their need for new technologies, etc. Moreover, within the Eastern parts of Europe we also have to consider the long lasting effects of a socialist economic system, path dependency having a strong influence in this area. All these characteristics make the economic structures function in the form of organic structures, having totally different characteristics based on geographic localization as well as the sector of activity. This in turn makes it difficult to develop empirical methods for identifying different types of clusters, although in the following chapters we will attempt to use a method for identifying agglomerations with a high clustering potential, event though at the moment we are missing data regarding the connections between the companies, RDI institutions and public authorities.

## **2. ASPECTS RELATED TO SPECIALIZATION AND THE CONCENTRATION OF ECONOMIC ACTIVITIES**

A series of studies in the field have approached the subject of industrial specialization and the spatial concentration of industries, considering the two phenomena as strongly interrelated, regional specialization representing the territorial perspective, describing the distribution of economic activities in delimited area within the analyzed territory, whereas the geographic concentration of an economic activity represents the share of the sector within the regional economy. According to some authors, these aspects are of key importance in the case of industrial policies as well, areas with a high degree of specialization being much more vulnerable in the event of economic shocks hitting the dominant sectors. At the same time, regional specialization is related to the fact that the respective area has got advantages in the production of different goods or services and makes better use - in comparison with other regions - of the production capacities in the respective sector. This spatial concentration of an economic activity furthermore implies that the production of certain goods is distributed unequally compared to other factors, such as the number of the population.

The effects of regional specialization are underlined by a series of growth models, including the classic center-periphery model (Myrdal, 1957 or Friedmann, 1977), the growth poles model (Perroux, 1969) etc, applied to different territorial levels (global, national, regional, local) supporting a convergence or a divergence in the level of development as a result of interconnected factors (Armstrong, 2000).

Apart from these we can find a series of other attempts aiming to compare results obtained from studies undertaken in different countries, suggesting a series of changes and amendments to indicators in order to be able to measure concentration,

considering the size of firms, their number or the size of the respective areas in the same way. Although the majority of the literature on specialization and concentration treats the two phenomena as interconnected, there are a series of results showing that usually they either do not lead to the same conclusions or, that they show up with a different speed and intensity. Therefore we propose to analyze the phenomenon in detail, hoping to point out relevant aspects related to the relation between the specialization of the counties, the concentration of industries and the clustering potential in Transylvania, based on the number of companies in the respective sectors.

In the following sections we will present an analysis on concentration and specialization, attempting to offer an overview on the role they have on the clustering process by making use of a hybrid method of analysis obtained from the combination of two approaches. The first one originates from the authors Goschin, Constantin, Roman and Ileanu who have measured specialization and concentration within the Romanian regions in the 1996 - 2007 period for the 9 main sectors of the economy, concluding that specialization has been constantly declining during the analyzed period, whereas the level of concentration has shown a slight increase. The other approach we will use has been derived from the authors Möller and Litzel who have analyzed the specialization and concentration of the economic sectors in Bavaria, in the first phase for all branches of the regional economy (all NACE two digit divisions), than for the 9 main industries and finally for the industries related to the 9 regional clusters existing in the area. Their main conclusion was that the differences in specialization have been much more evident in the case of industries related to the activities of the clusters but differences have also been significant in the case of the 9 main industries in the area.

So in other words, a certain area (county or region) can be considered as specialized if a relatively low number of industries account for a relatively large part of the economic activity in the area. Concentration on the other hand reflects the distribution of a certain economic sector between the analyzed territorial units. A highly concentrated sector will be present in just a few of the delimited areas, even though the number of companies can be much lower compared to the number of companies operating in other sectors of the economy. To be able to explore the specific characteristics of concentration in detail we will make use of three main indicators which will help us get a better overview on the economic sectors, although without insisting on the dynamics and the speed of the process<sup>2</sup>.

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<sup>2</sup> **Methodological note** - for measuring concentration and specialization we will use the following:

$$a_{ir} = \frac{x_{ir}}{x_r} = \frac{x_{ir}}{\sum_{i=1}^n x_{ir}} \quad (1.) \text{ and} \quad A_{ir} = \frac{x_{ir}}{x_i} = \frac{x_{ir}}{\sum_{r=1}^n x_{ir}} \quad (2.)$$

where:

$x_{ir}$  represents the number of companies in sector "i" within "r" county,

$x_i$  represents the number of companies in sector "i" in all counties combined,

$x_r$  represents the total number of companies within "r" county,

$x$  represents the total number of companies in all counties combined

$a_{ir}$  represents the level of concentration: the share of "r" county in the total number of companies active in sector "i"

Even if the above indices are generally used as a basis for calculating more complex indicators – like the Hirschman-Herfindahl index, the Krugman dissimilarity index or the Gini coefficient – they still offer valuable information for analyzing the general conditions related to the spatial distribution of economic activities as well as for describing spatial inequalities.

### 3. THE SPECIALIZATION OF THE COUNTIES IN TRANSYLVANIA BASED ON THE NUMBER OF COMPANIES

In the first phase we will calculate and analyze the rate of specialization within the counties of Transylvania using the Krugman and Herfindahl indices<sup>3</sup>. There is also a third method for measuring specialization by somewhat modifying the Gini coefficient. The latter in the modified version measures the degree of inequality in the distribution of companies related to a certain economic sector and an area of reference. The coefficient is calculated in relation to the Lorenz curve in which the cumulated number of companies from the different sectors is compared to the total number of companies in the analyzed area<sup>4</sup>. If the distribution of companies were equal in all sectors of the economy, the Lorenz curve and the 45 degree diagonal would overlap and the value of the Gini coefficient would be equal to null. On the other hand, if all companies were active in one single sector, the Lorenz curve would coincide with the horizontal axis and the vertical axis on the left side of the chart, the value of the index reaching its maximum value of 100.

In the following we have used three different approaches, first calculating the respective indices for all 88 of the two digit NACE divisions. In the second phase we have calculated the same indices for broader fields of activity obtained by grouping certain

$A_{ir}$  represents the level of specialization: the share of companies operating in sector “i” compared to the total number of companies in “r” county

<sup>3</sup> **Methodological note** - the formulas for calculating the Krugman and Herfindahl indices for specialization are:  $SPEC_r^K = \sum_i |a_{ir} - A_i|$  (3.) and  $SPEC_r^H = \sum_i a_{ir}^2$  (4.)

<sup>4</sup> **Methodological note** - the modified Gini index is calculated starting from the formula:

$$B_{ir} = \frac{A_{ir}}{a_r} - \frac{a_{ir}}{A_i} \quad (5.)$$

from where we obtain pairs according to the share of the sectors in relation to the total number of companies in the respective county ( $a_{ir}$ ) and the share of the sector compared to the total number of companies present in the analyzed territory - in our case Transylvania ( $A_i$ ). After being sorted in ascending order, these values can be cumulated as follows:

$$\tilde{s} = \sum_{i=1}^j \tilde{a}_{ir} \quad (6.) \quad \text{and} \quad \tilde{S} = \sum_{i=1}^j \tilde{A}_i \quad (7.)$$

where, if represented on a graphic we can obtain a shape similar to the Lorenz Curve. In conclusion the modified Gini coefficient for measuring specialization can be calculated as follows:

$$SPEC_r^G = 1 - \sum_{i=1}^j (\tilde{s}_{i-1,r} - \tilde{s}_{ir}) \tilde{A}_i \quad \text{where} \quad \tilde{s}_{0r} = 0 \quad (8.)$$

sectors which we considered to be closely related (i.e. the forestry, wood processing, furniture industry, etc.) forming thus 21 major areas. Furthermore, in order to increase the relevance of the analysis in relation to the clustering processes in Transylvania we have also identified 29 economic sectors which we have believed to be closely related to the activities of the 16 existing and functional clusters identified (Table 1.).

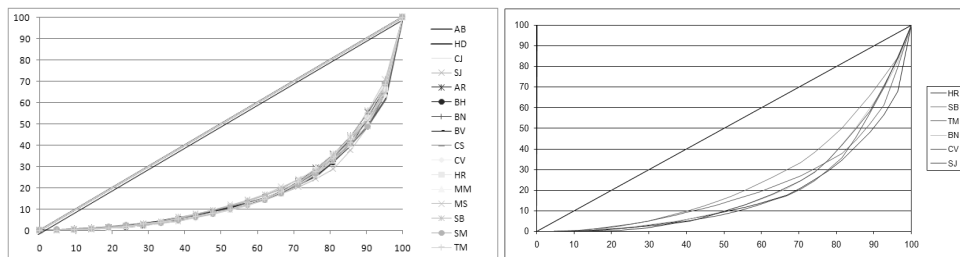
### The clusters in Transylvania

**Table 1**

| Nr. | Cluster   | Field                       | Localization          |
|-----|---|-----------------------------|-----------------------|
| 1   | ICT Regional Cluster                                  | ITC                         | TM, Timișoara         |
| 2   | Polaris   | ITC                         | CJ, Cluj-Napoca       |
| 3   | Cluj IT   | ITC                         | CJ, Cluj-Napoca       |
| 4   | ETREC   | Electric equipment          | BV, Săcele            |
| 5   | Automotivest  | Automotive                  | TM, Timișoara         |
| 6   | Transylvania Aeronautical Cluster                     | Aeronautics                 | BV, Brașov            |
| 7   | Regiofa   | Furniture, wood industry    | HR, Odorheiu Secuiesc |
| 8   | ProWood   | Wood industry and energy    | CV, Sfântu Gheorghe   |
| 9   | Green Energy  | Biomass, energy             | CV, Sfântu Gheorghe   |
| 10  | Cluster Mobilier Transilvan                           | Furniture industry          | CJ, Cluj-Napoca       |
| 11  | Agrofood Regional Cluster                             | Food industry               | CV, Sfântu Gheorghe   |
| 12  | Agrofood Cluster                                      | Food industry               | AR, Arad              |
| 13  | Transylvania Textile and Fashion Cluster              | Textile and clothing        | CV, Sfântu Gheorghe   |
| 14  | Innovative Regional Cluster Packaging-Printing-Design | Print, packaging, publicity | CV, Sfântu Gheorghe   |
| 15  | ROSENC  | Renewable energies          | TM, Timișoara         |
| 16  | TREC  | Renewable energies          | CJ, Cluj-Napoca       |

**Source:** the author based on data from the Competitiveness SOP MA and the Romanian Cluster Association

Analyzing the Lorenz curves related to the classifications mentioned above we can immediately observe that there are no significant differences neither in the case of the 88 economic sectors, nor in the case of the 21 major fields of activity. Although there is a certain inequality in the importance of the different sectors within counties, these differences are of largely the same size, being unable to differentiate them with the help of the Lorenz curve only.



Lorenz Curves for the 21 major fields of activity      Lorenz curves for the 27 industries related to the activities of the clusters in Transylvania

**Fig. 1.** Differences of the Lorenz Curve measuring the specialization of the counties.

**Source:** the author, based on data from the Research Center for Interethnic Relations, 2009

On the other hand, we can draw a series of conclusions regarding the specialization of the counties of Transylvania according to the Gini coefficient. As in the case of the aforementioned studies, it has been expected that that the results regarding the 88 NACE divisions would be similar in the case of all counties. What is surprising though is the fact that in contrast to the expectations, the differences have been even more significant than in the case of the 21 major groups of activities. We can say this based on the fact that theoretically the grouping of certain activities in larger sections should have resulted in a differentiation of the counties regarding specialization, given the functional relations between the companies within the interconnected sectors (i.e. a county might not stand out in the case of wood processing alone, but the specialization might be significant if we consider a larger array of activities like forestry, wood industry, the furniture industry, etc.).

In the case of the 88 NACE divisions a more prominent differentiation is apparent in the case of Sălaj and Hunedoara counties, the latter showing a specialization (apart from trade and construction) in transport, tourism and financial services. Also, a slight differentiation can also be shown in the case of Sălaj County, where the share of companies active in agriculture and transport show a somewhat larger share.

On the other hand, if we consider the 27 sectors related to the clusters operating in the area, the situation changes somewhat, since we can immediately see an inequality in the case of Bistrița Năsăud, Covasna, Harghita and Sălaj counties, these being much more significant than in the case the other two approaches. We can see that in the case of the first three there is a strong presence of companies active in the field of wood processing, forestry and manufacturing of wood products, the food industry being also very important in Covasna County. On the other hand agriculture and related services are once again mostly relevant in Sălaj County, although the food industry has a much smaller importance (which suggests that the agricultural products are being processed in other parts of the country). In an overview, we can observe that these counties are usually specializing in sectors with a low added value, like the ones mentioned above and others like textiles and the clothing industry.

In contrast, we can find that in counties considered more developed and where the regional economy also shows a greater stability in the case of the above mentioned indicator, we can find sectors like architectural and planning services, construction and activities and services related to the IT industry (i.e. Cluj, Timiș counties) in the first places. Even so, in Timiș County we can remark the significant share of the agricultural sector, which is very much in contrast with the other dominant ones like IT services and the automotive industry.

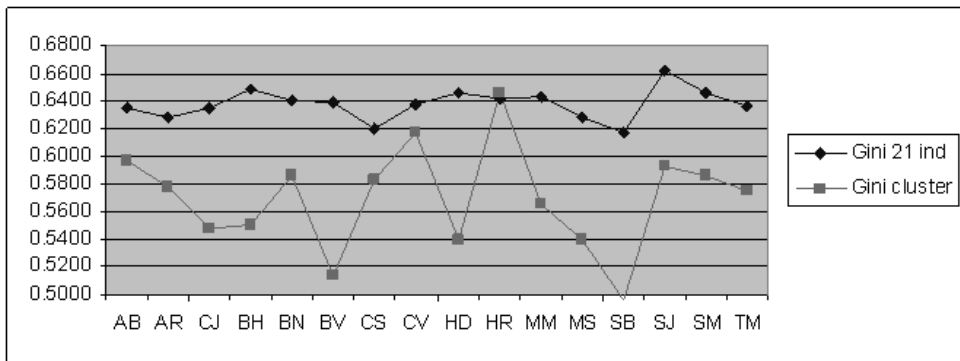
**Values of the Gini coefficient calculated for the 21 major areas of activity and the 27 sectors related to the activities of the clusters in Transylvania for the year 2009**

**Table 2**

|                       | AB    | AR    | CJ    | BH    | BN    | BV    | CS    | CV    | HD    | HR    | MM    | MS    | SB    | SJ    | SM    | TM    |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Gini Major industries | 0.635 | 0.629 | 0.636 | 0.649 | 0.641 | 0.639 | 0.621 | 0.638 | 0.646 | 0.641 | 0.643 | 0.628 | 0.617 | 0.662 | 0.646 | 0.636 |
| Gini clusters         | 0.597 | 0.578 | 0.548 | 0.551 | 0.586 | 0.514 | 0.583 | 0.618 | 0.540 | 0.645 | 0.566 | 0.539 | 0.496 | 0.593 | 0.586 | 0.575 |

**Source:** the author based on own calculations

As an intermediate conclusion, based on the values of the Gini coefficient and the analysis of the Lorenz Curve, we can state that there is a strong economic basis for the existence of the IT clusters in Cluj and Timiș counties, for the textile and wood clusters in Covasna and Harghita counties as well as the automotive industry in Timiș County. In the case of the other clusters - mainly because of the vast array of sectors they cover - it is very hard to draw relevant conclusions in this sense (i.e. the field of renewable energies).

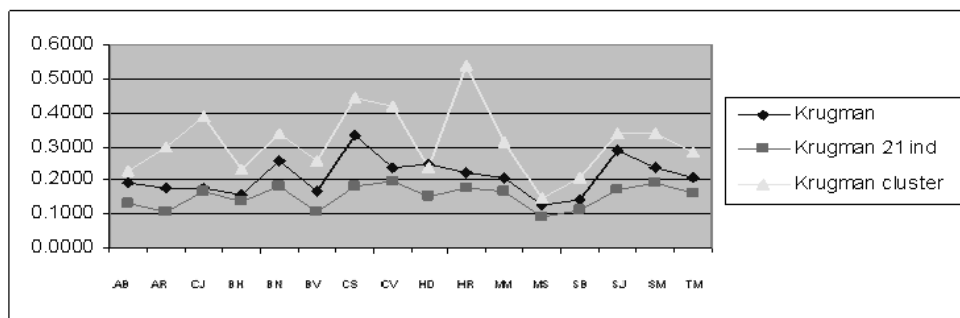


**Fig. 2.** The Gini coefficient calculated for the 21 major groups of activity and the industries related to the clusters in Transylvania.

**Source:** the author, based on data from the Research Center for Interethnic Relations, 2009



Moving on, if we analyze the Krugman dissimilarity index we can see that the values are the most prominent in the case of industries related to activities of the clusters and are the least significant if we analyze the economic sectors grouped into the 21 larger fields of activity.



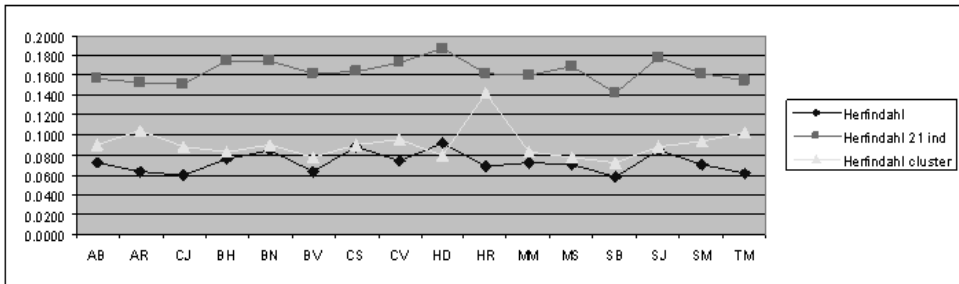
**Fig. 3.** The Krugman dissimilarity index calculated for the 88 NACE divisions, the 21 major groups of activity and the 27 industries related to the clusters.

**Source:** the author, based on data from the Research Center for Interethnic Relations, 2009

In figure 3 one notices that the Krugman index, calculated for the 27 sectors - even though the amplitude of the values is somewhat more evident - does not show significant differences in the classification of the counties apart from a few exceptions like Cluj, Covasna and Harghita counties. These extreme values can also be attributed to the change in hierarchy regarding the dominant industries, as in the case of Cluj where, by omitting sectors irrelevant from the point of view of clusters other fields have come forward like architecture, engineering or IT services (taking the place of companies in the field of trade, general services, etc), keeping in mind that the agriculture has still remained in second place. The most prominent change however can be observed in the case of Harghita County where, after omitting sectors like tourism, transports, real-estate transactions, health and trade, others have come forward like agriculture, construction, forestry and wood processing as well as the food industry.

As a conclusion we can say that the Gini and Krugman indices give similar results in the case of the counties, even if their amplitude is somewhat more significant in the case of the Krugman index, being thus considered as more appropriate for emphasizing the differences in specialization.

The Herfindahl index on the other hand shows a more modest variation, rarely changing the situation presented by the other two indices, a conclusion supported even by Möller and Litzel, showing that in the case of Bavaria the correlation between the Krugman and Gini indices has continuously been above 0.98. The Herfindahl index however shows a correlation with the Krugman index only in the case of all 88 NACE divisions but neither in the case of the 27 sectors related to clusters, nor in the 21 major groups of activity.



**Fig. 4.** The Herfindahl index calculated for the 88 NACE divisions, the 21 major groups of activity and the 27 industries related to the clusters.

**Source:** the author, based on data from the Research Center for Interethnic Relations, 2009

Comparing the results with those obtained by the authors Goschin, Constantin, Roman and Ileanu (2009), we have to point out that the researchers have analyzed major areas of the economy – 9 in total – at regional level for the whole country and they have calculated the respective indices for the years 1996, 2000, 2005 and 2007. In their analyses the more developed regions have not only shown a lower level of specialization but they have also witnessed a more accelerated decrease in the case of the Krugman index - in accordance with the European tendencies in the last years. According to the Krugman index the rate of specialization has been relatively low compared to other countries like Poland (0.508) or Lithuania (0.328) but still significantly higher than in the countries of Western Europe like Germany (0.064) or Austria (0.063). This phenomenon is also evident in the case of the county level analysis, since we can observe higher values in the case of the less developed counties, the smallest ones being present in areas with a more stable economic structure like Cluj, Sibiu or Timiș counties.

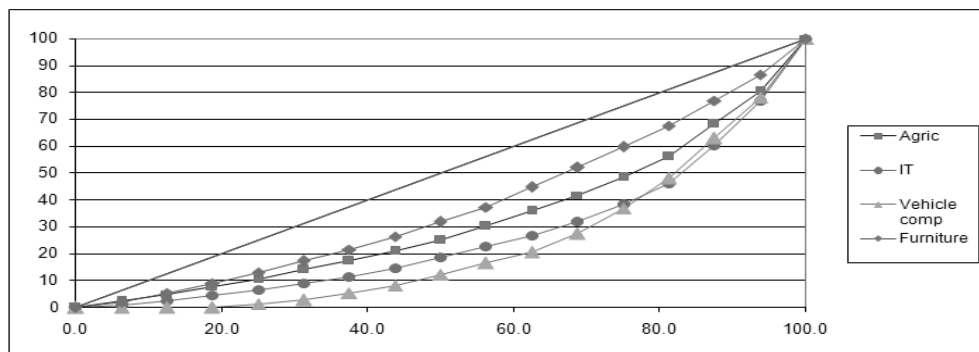
#### 4. THE CONCENTRATION OF ECONOMIC ACTIVITIES

Based on the method presented above for measuring the level of specialization, with small adjustments we can transform the respective formulas in a way to be able to express the concentration level of economic activities. Thus it is not possible to talk about concentration when the share of a certain sector is equal within each and every territorial unit, whilst the highest level of concentration can be reached when a sector is present in only one of the analyzed territories<sup>5</sup>.

<sup>5</sup> **Methodological note** - for calculating the concentration according to the Krugman and Herfindahl indices we will be using the following formulas:

$$CONC_r^K = \sum_i |A_{ir} - a_i| \quad (9.) \quad \text{and} \quad CONC_r^H = \sum_i A_{ir}^2 \quad (10.)$$

The same approach has been used in the case of the Lorenz curve, the goal being to observe the differences in concentration of the respective economic sectors compared to a perfectly even distribution.

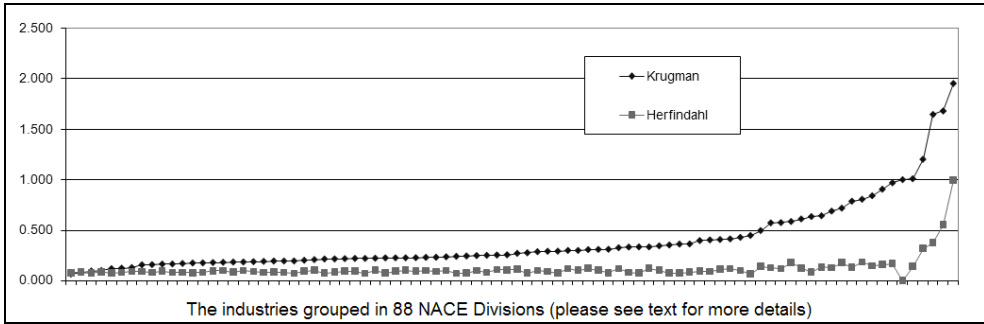


**Fig. 5.** Differences of the Lorenz curve in the case of agriculture, IT, automotive and furniture industries.

**Source:** the author, based on data from the Research Center for Interethnic Relations, 2009

Considering the extreme values, in the case of concentration we can observe a significant difference between the sectors of the economy, these being best illustrated by the Lorenz curve presented in Figure 5. Here we can see for example that the ones related to the production of automotive parts or the IT industry have a much more pronounced tendency to concentrate than the furniture industry or agriculture, the latter ones being divided more uniformly between the counties of Transylvania, at least according to the number of active companies.

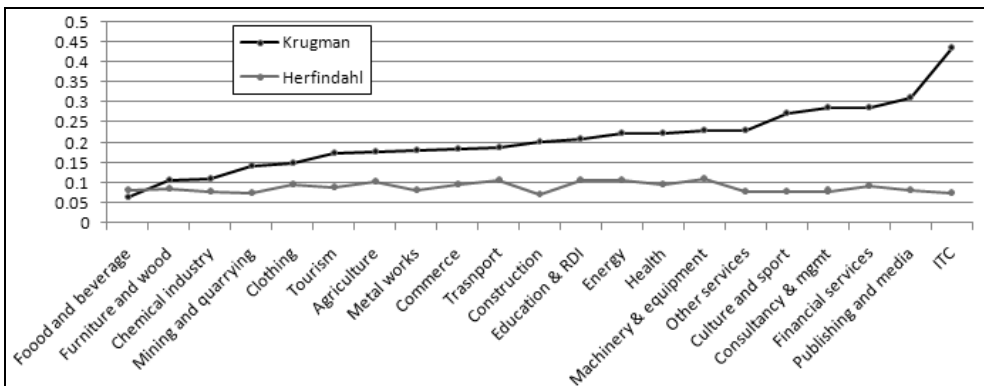
If we come back to the initial approach and calculate the Krugman and Herfindahl indices for all 88 NACE divisions, for the wider areas of activity and finally for the 27 sectors related to the activities of the regional clusters, the differences in this case are much more visible. This means that although in the last period counties have been moving towards a lower rate of specialization, the disparities have become more and more significant in the case of concentration. Observing the phenomenon in greater detail, we can say that in the case of all NACE divisions there are major changes regarding the importance of certain activities, although, given the very small differences in the values, in most cases we can neglect them. On the other hand, regarding the outstanding values we can point out a significant difference especially in the case of industries which are not really relevant from the point of view of clusters - like mining, associative activities, libraries, etc. What is important though is the fact that according to the Krugman index the activities related to wood processing and the manufacturing of wooden products, automotive components, pharmaceuticals, tourism and IT services also have a much higher tendency to concentrate than others. Moreover, activities related to the IT sector (information services, IT services as well as electrical equipment and production of computers) show even higher values for concentration, mainly because of the fact that IT companies tend to settle in larger cities with high numbers of companies.



**Fig. 6.** The Krugman and Herfindahl indices calculated for the 88 NACE divisions

**Source:** the author, based on data from the Research Center for Interethnic Relations, 2009

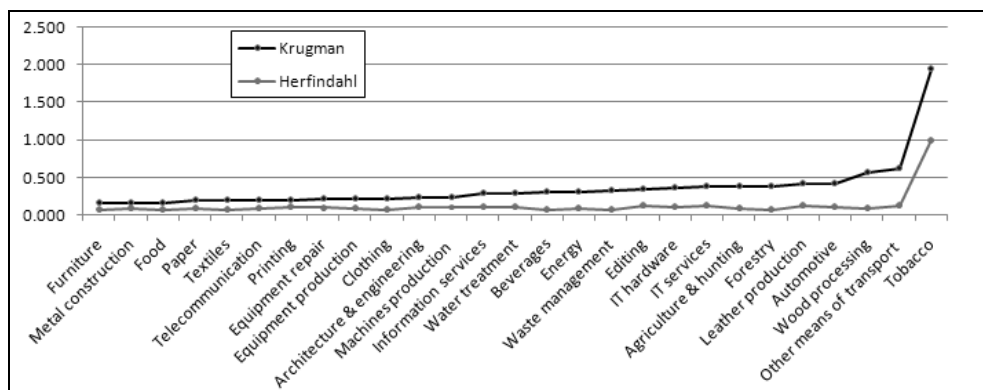
If we focus on the analysis of the 21 major groups of economic activity, one may remark a significant difference in the hierarchy imposed by the two indices, but no major differences compared to the results presented above. According to the Krugman dissimilarity index, the furniture and wood industries continue to show considerable levels of concentration, followed by the sectors related to metal works, textiles and clothing, the most uniformly distributed ones being trade, construction and tourism. In the case of the Herfindahl index on the other hand, we can observe the same anomalies as in the case of the 88 NACE divisions, namely that the furniture industry, wood processing migrate to the second to last place along with the textile and clothing industries whilst the most concentrated sectors remain those related to the IT industry.



**Fig. 7.** The Krugman and Herfindahl indices calculated for the 21 major groups of economic activity

**Source:** the author, based on data from the Research Center for Interethnic Relations, 2009

On the other hand, analyzing the same phenomenon in the case of the sectors related to the activities of the Transylvanian clusters, we can observe a flattening of differences regarding the hierarchy, although there is a significant overall increase in the case of the Krugman index compared to the previous situation - meaning that these industries all have a much higher tendency to concentrate in space than the major groups or the 88 NACE divisions as a whole. The most interesting part in this sense is the extreme value seen on figure 8 where the Herfindahl index reaches its maximum value of 1 in the case of the tobacco industry concentrated in only one county, although since then the factory in Sfântu Gheorghe has been closed down.



**Fig. 8.** The Krugman and Herfindahl indices calculated for the 27 sectors related to the activities of clusters in Transylvania

**Source:** the author, based on data from the Research Center for Interethnic Relations, 2009

## 5. CONCLUSIONS

In the present analysis we have tried to utilize a conventional method for obtaining new results related to the concentration of economic activities as well as the specialization tendencies in Transylvania, correlating the results with the presence or the lack of clusters in the respective sectors or - from a territorial perspective - in the analyzed counties.

Regarding specialization, one can say that the phenomenon is not that widespread in Transylvanian counties, especially in the case of the 88 NACE divisions. From the figures of the Lorenz curve we can observe the overlapping of almost all counties, some anomalies being present only in the case of Sălaj and Hunedoara due to a somewhat higher share of companies working in agriculture, trade and transport. Regarding the Krugman and Herfindahl indices, the two have pointed out the same counties along with others like Caraș-Severin, Bistrița Năsăud, Satu Mare, Covasna and Harghita, all of them having less diversified economic structures and thus being much more vulnerable in the face of economic changes. These counties are also considered the least developed ones based on the value of the GDP / capita. In the case of more developed areas we

can observe a greater diversity of the economy (and thus a low level of specialization), the only difference being the case of Timiș county where - in spite of the more developed character - we can see a significant share of the sectors related to agriculture, forestry and fishing. Regarding the Herfindahl index there are no major changes except for the case of Bihor county, which comes to a leading position due to the high share of companies in the field of construction, tourism and transport.

Also, despite thinking that grouping closely related economic sectors could lead to a greater differentiation between the counties (based on the functional relations between them), contrary to our expectations these differences have been much less significant than in the previous case, most probably meaning that the inter-sectoral relationships are much stronger than the ones formed within the same fields of activity.

If we consider the 27 economic sectors related to the activities of the Transylvanian clusters the situation changes somewhat in the sense that - even if at first glance Bistrița Năsăud, Covasna, Harghita and Sălaj come up once again - differences are much more significant than in the previous two cases. As a result, based on the values of the Gini index we can say that there is a strong economic basis for the existence of the IT clusters in Cluj and Timiș counties, for the textile and wood clusters in Covasna and Harghita counties as well as the automotive cluster in Timiș County. For the other clusters - because of the vast number of sectors they cover - it is very hard to draw relevant conclusions in this sense (i.e. the renewable energy sector).

As for the Krugman dissimilarity index we can observe more pronounced differences for industries related to the activities of clusters - differences being much smaller though in the case of sectors grouped into the 21 major fields of activity. In this case in Cluj county, after omitting some of the sectors not relevant from this point of view there has been a strong emphasis on sectors like architecture, engineering as well as IT services. The most visible change can be observed though in the case of Harghita County where, following the elimination of some sectors like tourism, transport, real-estate transactions, health services and trade, other sectors have emerged as dominant, like agriculture, construction, forestry and wood processing as well as the food industry.

The Herfindahl index on the other hand shows a more modest variation in the case of specialization, slightly changing in some places the hierarchy laid out by the other two indices. In this case, we consider that in the future a more extended analysis could reveal much more significant inequalities between the counties of Transylvania - with a more balanced economic structure - and the late mono-industrial centers from other parts of the country, more specialized, which can be a plus in the process of clustering (if these are not based on the exploitation of natural resources) but can significantly increase their vulnerability in the face of sudden changes within the economic environment.

Also, related to concentration we can observe a more prominent difference between the character of industries, with sectors showing a higher tendency of concentration standing out (i.e. automotive components or the IT industry), in contrast with more traditional sectors (like the furniture or the food industry). In this case we can see differences of a totally different scale than in the case of specialization, certain economic sectors having a much higher tendency to concentrate in space than others. Differences are also apparent in the hierarchy of the counties according to the Krugman and Herfindahl indices, the differences in values being quite small though, especially in the

case of all 88 NACE divisions. It is also important to mention that the activities related to wood processing, the production of automotive components, pharmaceuticals, tourism and IT services have a much higher rate of concentration according to the Krugman dissimilarity index, although based on the Herfindahl index these sectors will occupy inferior positions due to a flaw of the latter, namely the fact that it is greatly influenced by the size of the territorial units (here the total number of companies in the certain county). Also a significant difference can be seen in the case of the furniture industry and the manufacturing of wood products, their concentration in counties like Harghita and Covasna being overshadowed by the fact that these are much smaller in size, having a much smaller number of companies.

Regarding sectors arranged into major fields of economic activity we can still observe a considerable difference between the hierarchies generated by the two indices, although there are no major changes compared to the results obtained in the previous phase. According to the Krugman index the furniture industry and wood processing still show a more obvious level of concentration, being followed by the sector of metal works, the textile industry, clothing as well as IT services while the most equally distributed ones remain trade, construction and tourism. For the Herfindahl index on the other hand, we find the same differences as in the case of the 88 NACE divisions, namely that the most concentrated industries tend to be those related to IT, while the furniture industry along with wood processing and textiles occupy to the last places.

But in the case of industries related to the activities of the 16 clusters we can observe a flattening of the differences, although in the case of the Krugman index there is a visible increase in the values, meaning that these 27 industries have a much higher tendency for concentration than the ones not related to the above mentioned networks.

Finally, as regards the methods of analysis we can say that, in spite of the shortcomings and limitations we have managed to obtain relevant conclusions regarding the sectors of the economy where we can point out certain tendencies of concentration, the conclusions being supported in some cases even by the phenomenon of specialization in certain counties, especially the less developed ones with a less diversified economic structure.

As for the results, we can say that there is a strong economic basis to support the development of already existing clusters in the field of IT in Timiș and Cluj counties, the biomass, textile and wood clusters in Harghita and Covasna counties as well as the automotive cluster in Timiș county. For the clusters in the field of agro-food in Covasna and Arad, even if there is a certain specialization in agriculture, in the future there needs to be a higher emphasis on the food processing industry, otherwise these counties will simply remain suppliers of raw materials with a low added value. In the case of other clusters we could not identify a significant concentration or a specialization, most probably because of the large array of activities they cover as well as the fact that NACE divisions are not really suited for identifying functional relationships among companies. Furthermore there could also be high potential for tourism clusters and food clusters in some of the counties, but in most cases the large number of very small companies - in the absence of larger facilitators - makes it difficult to start up long term relations for cooperation.

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