

HOW DOES SECTOR CONCENTRATION EVOLVE AT COUNTRY AND REGION LEVELS? THE EUROPEAN CASE

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Abstract

This paper analyzes the evolution of the three main economic sectors – agriculture, industry and services – at the level of European countries and regions. We base our analysis on the Theil index constructed using European gross value added data for 23 EU countries and compare it to regional data for a ten-year period (from 1995 to 2004). Our results show that the most difficult challenges posed by the unequal concentration in the main sectors appear at the wider region not the country level. It will therefore be necessary to devise new regional policies that take into account these disparities.

Keywords: •sectors analysis, •spatial concentration, •European regions, •Theil index, •integration

JEL Classification: R11, R12, F15

Rezumat

În acest articol analizăm evoluția celor trei mari sectoare economice – agricultură, industrie și servicii - la diferite nivele teritoriale, în contextul Uniunii Europene. Folosim în acest scop indicele Theil, care masoară valoarea brută adăugată în cazul a 23 de țări membre ale Uniunii Europene, în perioada 1995-2004. Datele obținute la nivel de țară sunt apoi comparate cu cele obținute la nivelul a trei regiuni europene. Rezultatele finale sugerează că problemele importante legate de inegalitate în repartizarea teritorială a celor trei sectoare economice se manifestă la nivel regional pan-european, și nu la nivel de țară. Se impune deci, ca măsurile de politică economică și socială promovate în context european să fie reformulate pentru a ține seama de importanța problematicii de ordin regional.

Cuvinte cheie: • Analiză sectorială • Concentrare geografică • Regiuni europene • Indicele Theil • Integrare

Clasificare JEL: R11, R12, F15

Introduction

Fifty years after the Rome Treaty was signed, Europe offers the best example of international economic integration: EU has continued its enlargement and the process of production factors liberalization. Thus, the economic research has to take these changes into account: analyzing the exploitation of exogenously distributed resources is no longer enough as productive resources can be moved. A new perspective needs therefore to be added to the analysis of the spatial concentration of activities in different European countries and regions¹.

In order to characterize the structure of economic activities in Europe, our study will be based on entropy indexes resulting from European sector data at country and region level. First, we will introduce the data sample, and will account for the indicators and for the methodology we use to build them. Secondly, we will present and dwell on our main results.

1. Data and measurement

The geographic concentration² of a sector is measured by the regions' and countries' shares in its overall activity. A given sector has a strong geographic concentration if an important share of its output comes from few countries or regions (Aiginger, 1999, WIFO, 1999, Longhi et al., 2005).

Several types of indicators – standard or more sophisticated – can be used to describe the concentration of activities. As these indicators are very numerous, for simplicity reasons, we have chosen to use in this paper entropy indexes only; they allow a comparison between sectors concentration at different spatial levels.

We will take into account 23 members of EU and their NUTS 3 regions and will use the Eurostat – Regio database. Several EU members have been excluded from our study either because they have become EU members only recently (Romania and Bulgaria) or because they form only one region at NUTS 3 level (Luxemburg and Cyprus). The latter choice is justified by the fact that we analyse the disparities between both countries and regions inside each country.

At NUTS 3 level, we will be dealing with 1180 regions within the 23 European countries. We haven't taken into consideration the NUTS 3 ultra peripheral regions situated outside the European continent, i.e. the four overseas

French departments (French Guiana, Guadeloupe, Martinique and Reunion), the two independent Portuguese regions (Azores and Madeira) and the Autonomous Community of the Canary Islands.

Even if the geographic disaggregation is very complex and allows us to take into account a high number of regions, data are available for only three sectors: industry, agriculture and services. Working on several sectors may be interesting, but it is not possible in the case of NUTS 3 regions. For a more complex sector analysis it would be necessary to choose a NUTS 1 or NUTS 2 geographic level. Therefore, we had to make a choice between, on the one hand, a large geographical disaggregation and more aggregated sectors levels and, on the other hand, a low level of spatial disaggregation and a more detailed sector decomposition. Studying the sectors geographic distribution at NUTS 3 level represents one of the original issues of our study. Indeed, very few empirical studies have been concerned with this aspect so far.

We will base our analysis on production data which are more relevant for characterizing a country's or region's economic structure than trade data, which offer merely an approximate estimation of the concentration issues and can be considered only as "second best" indicators (Brühlhart, 2000). More precisely, the evolution of the production activities geographic concentration will be analyzed on the basis of a sample which will take into account only gross value added data. Long-term data is necessary to study this evolution.

Therefore, in order to achieve our aim while working on homogenous data both at the level of calculation methodology and statistical units, we have dealt with the whole of gross value

added European data available between 1995 and 2004 at NUTS 3 level.

Entropy indexes will be used to study the spatial concentration of the three main economic sectors between 1995 and 2004. The main advantage in using these indexes is that they can be decomposed and thus can illustrate the sector concentration at country level and within countries.

The entropy indexes we use imply that the number of sectors (j) varies between 1 and N_S ($j = 1..N_S$) and that the number of regions (i) within a country varies between 1 and N_R ($i = 1..N_R$). We also consider that the number of analyzed countries (k) varies between 1 and N_P ($k = 1..N_P$). Moreover, the indexes will be built according to Brühlhart and Traeger (2005) and Combes et al. (2006), but we will also underline in an original manner their decomposition. This feature of the entropy indexes is based on the fact that

the whole variance of a two-index variable can be decomposed into a “within” variance and a “between” variance. We can thus decompose the degree of sector concentration in Europe into a country concentration degree and a region concentration degree, proper to each country, which can be written:

$$I^{entropy} = I_{between}^{entropy} + I_{within}^{entropy} \tag{1}$$

Generally speaking, this decomposition has only been applied to the Theil index, which is a particular case of the general entropy index, since, according to the general definition of the entropy index, the weighting coefficients of the “within” entropy depend on the “between” entropy and this may bias the issue. This is the reason why we will use the most common and the simplest form of the entropy index which is the Theil index.

According to the approach used by Combes et al. (2006), the Theil index can be written in terms of concentration as follows:

$$I_i^{Conc_Theil} = \sum_{i=1}^{N_R} I_{ij}^{Absolute_conc} \log\left(\frac{I_{ij}^{Absolute_conc}}{I_i}\right) \tag{2}$$

where

$$I_{ij}^{Absolute_conc} = \frac{X_{ij}}{\sum_i X_{ij}} = \frac{X_{ij}}{X_{\cdot j}}$$

$$I_i = \frac{\sum_j X_{ij}}{\sum_i \sum_j X_{ij}} = \frac{X_{i\cdot}}{X_{\cdot\cdot}}$$

The index $I_{ij}^{Absolute_conc}$ represents the concentration ratio expressed in absolute terms and shows the production share of the sector j of the region i (X_{ij}) compared to the total

production of this given sector ($X_{j\cdot}$). The index I_i represents a region i ' share in the total activity of the whole countries and regions which are analysed.

The Theil concentration index used in our approach can be decomposed in order to take into account the variance between and within groups. Consequently, we can identify the

“between” component and the “within” component of the Theil index.

- the “between” component of the Theil index is the share of inequalities caused by the international inequalities:

$$I_{between}^{Conc_Theil} = I_{between}^{entropy} = \sum_{k=1}^{N_p} I_{kj} \log \frac{I_{kj}}{I_k}, \tag{3}$$

where I_{kj} and I_k ($I_{kj} = \frac{X_{kj}}{X_{\cdot j}}$, $X_{kj} = \sum_{i \in k} X_{ij}$ and $I_k = \frac{\sum_{j=1}^{N_s} X_{kj}}{X_{\cdot \cdot}}$)

$$\tag{4}$$

represent the shares of the country k in the total production of the sector j and in the total activity of the whole of the countries respectively.

- the “within” component of the entropy index results from the national Theil indexes weighted by the countries sector share in the total activity:

$$I_{within}^{Conc_Theil} = I_{within}^{entropy} = \sum_{k=1}^{N_p} I_k I_{ki} = \sum_{k=1}^{N_p} I_k \left(\sum_{i \in k} I_{ij}^{Absolute_conc} \log \frac{I_{ij}^{Absolute_conc}}{I_j} \right) \tag{5}$$

where I_k is the share of inequalities caused by international disparities while I_{ki} is the share of inequalities caused by interregional inequalities.

2. Spatial concentration of sectors in Europe: some evidence

The entropy indexes have been long applied to income data only. But they were also used by Aiginger and Pfaffermayr (2004) in analysing the geographic concentration of several sectors at the level of European countries. According to their results, sectors concentration appears to have diminished in the 1990s (2% to 5%), while on the contrary European countries specialization rose. This has been confirmed by Aiginger and Davies

(2004)’s study. Their results are obtained by decomposing the entropy indexes related to concentration and to specialization and by showing that the two processes have a similar evolution only if the countries and/or the industries have a similar size.

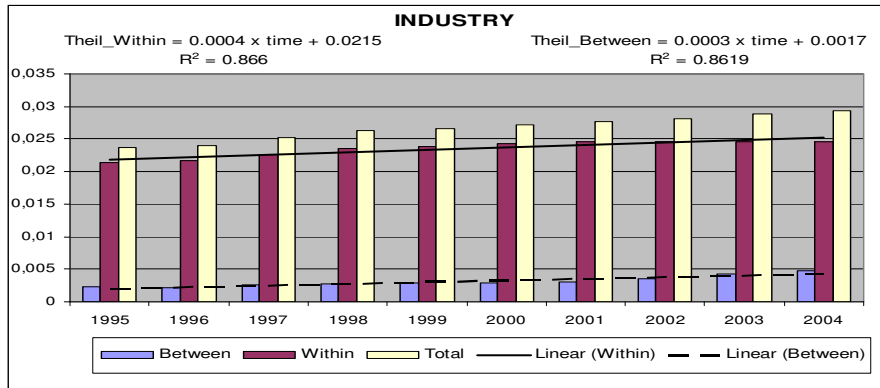
Brühlhart and Traeger (2005)’s study is also based on entropy indexes. But in order to avoid the “modifiable areal unit problem (MAUP)”, they chose to calculate their indexes on the basis of economic activity of “basic units” defined as a square kilometre of land area. Therefore, unlike the two previously mentioned studies, they distinguished between “topographic concentration” (which represents the degree to which sectors are concentrated relative to physical space, without any other weighting) and “relative

concentration” (which measures the degree to which sectors are concentrated relative to the geographic distribution of aggregate activity). Using employment data for eight sectors, they showed that between the 1970 and 2000 in the 236 NUTS 2 or NUTS 3 regions belonging to 17 European countries, the “relative concentration” rose while the “topographic concentration” fell down. The short-term variations of the European regional concentration are widely influenced by the variations of concentration between countries, while not showing very important long-term variations. The “within” concentration remained stable over time. It is therefore difficult to assess whether disparities between sectors over time are really caused by the change in firms locations or by changes in these sectors’ production structure (Combes et al., 2006).

Brühlhart and Traeger (2005) used the entropy index decomposition properties when analysing the spatial concentration of industries. Their aim was to identify the evolution of this index between countries and within the European countries between 1980 and 1995, using a sample of NUTS 2 regions. In the industry sector, the concentration between the countries’ regions is higher than the level of concentration between the different countries. Moreover, over time, the former goes down while the

latter goes up. Given this observation, it is possible to consider a growing specialization of the European countries.

In our analysis, we will also calculate Theil³ indexes in order to show the impact of both national and regional scale on the evolution of concentration. We will estimate the trend of these indexes and will compare their coefficients in order to assess the dynamics of the relative concentration, defined as the ratio of the “within” and “between” components of the total entropy. The results obtained by using the Theil index in the analysis of the sector concentration on different spatial levels will be summed up in the following graphs. These graphs are built on the basis of the total Theil indexes where we distinguish the “between” level (between countries) and the “within” level (between regions within each country). The “between” component of the total entropy is measured by the Theil index presented here above; it has been calculated for each country whereas the “within” component has been calculated according to the average weighted by the share of the country in the total activity, which involves Theil indexes for each country. By means of this distinction, we can assess whether sectors are more concentrated either on the region or country level. We begin our presentation with the industry sector.



Graph 1 Disparities in industry's spatial distribution Source: Eurostat-Regio, own computations

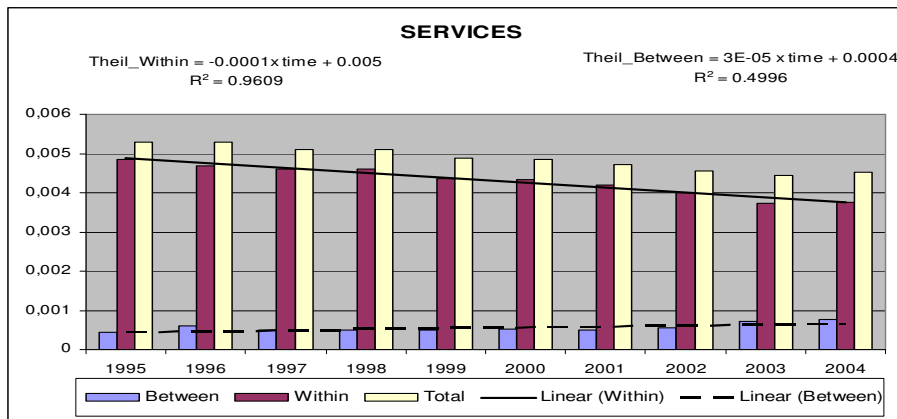
Between 1995 and 2004 the concentration of the industry sector grows. This raise is due to an industry concentration increase both in the European countries and in the regions within each country. However, it is at regions' level that the rise appears to be more significant. According to the given trend coefficients (0.0004 and 0.0003 respectively), this tendency seems to become more pronounced over time. If the growth of the "within" concentration is more significant than the "between" concentration for the given period, it follows that the "relative" concentration becomes more important and that the gap between the two components ("between" and "within") deepens.

The fact that the concentration of industries within countries' regions is higher than between countries joins the conclusions of Brühlhart and Traeger (2005)'s study. Nevertheless, their conclusions also show that in the industry sector, the concentration between regions decreases over time in favor of the concentration at country level, which hasn't been proved by our

analysis. We therefore consider that the "between" and "within" concentrations have a growing trend, but that the former grows less rapidly than the latter. This suggests that there is no tendency for convergence between the two types of concentration.

Hallet (2000) and Amiti (1999) have also shown the geographic concentration's growth for the European countries and have pointed out that this phenomenon can be accounted for by the intensification of the European integration⁴. Moreover, the significant growth of the industry's territorial concentration put forward in our analysis may be linked to the fact that eight Central and Eastern Europe countries are part of our sample. These countries underwent an important change of their production sector during the transition to the market economy, which involved significant foreign direct investment flows especially in the industrial sector (Dupuch, 2004, Oros, 2007, Romocea Turcu, 2008).

We will now focus on the services sector that has witnessed an important development these last years.



Graph 2 Disparities in services spatial distribution Source: Eurostat-Regio, own computations

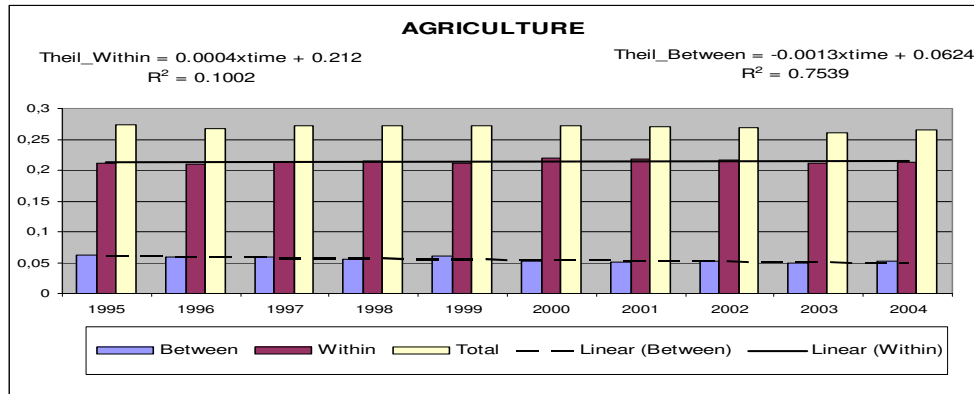
The Theil index's evolution shows that services concentration ("total" component) diminishes in Europe over the analyzed period. This is due to the fall of the services concentration in the regions within each country, since this sector's concentration at the countries level remains relatively stable, or even grows slightly. Consequently, the "relative" concentration ("within" component / "between" component) falls.

The general tendency to tertiarisation and to urbanization reinforcement in developed countries can account for this sector's high concentration at country level. However, at regions level, services concentration decreased considerably during the given period. This can be explained by the fact that, under the impact of the public authorities' decisions and of different market mechanisms, the distribution of services within countries has to cover the whole territory. For instance, a homogeneous distribution of the public

administration's services in the territory can be a consequence of the fact the public authorities want to maintain a minimum of administration in the outlying areas. Therefore, the location of this type of sectors depends exclusively on the public will. On the contrary, other sectors' location can be influenced mainly by economic reasons (for instance the hotels and restaurants sector).

Furthermore, services' deconcentration at region level can be due to the fact that larger regions of the European countries tend to have a less significant share in the production of this sector, being overtaken by smaller but more attractive regions. In the same way, as Dupuch and Mouhoud (2004) show, we can also suggest that there is a tendency to dispersion in the households' services which is beneficial to regions having natural resources.

We will now focus on the agricultural sector.



Graph 3 Disparities in agriculture’s spatial distribution Source: Eurostat - Regio, own computations

For the analyzed period, the “between” component of the index corresponding to the agricultural sector falls down, while the “within” component slightly rises. It follows that the concentration of this sector decreases between countries and becomes more important at the level of each country’s regions on account of the general stabilization of agriculture location disparities in Europe. Nevertheless, this sector territorial location depends on the spatial distribution of the resources used.

The agriculture depends on soil constraints and will therefore be less influenced by agglomeration effects. Moreover, the fact that this sector has a fixed geographic location explains why it can only develop in regions with an important agricultural potential. Daniel (2003) confirms that the agricultural production tends to concentrate in the same basins, especially when we take into account all the products of the sector and not each product on its own. Besides, the agricultural subsidies system triggers a certain stability of the agricultural production localization.

From another point of view, the relative deconcentration of the agricultural sector at country level reflects a general tendency in the

developed countries: the production structures undergo a growing tertiarization while the agricultural sector, whose development depends mainly on public subsidies, is relatively left behind.

After having analyzed the overall spatial location of the three sectors, we can notice the following:

- the geographic concentration of the industrial sector is reinforced.
- the services undergo significant deconcentration at all spatial levels.
- the agriculture’s territorial concentration remains rather stable.

Nevertheless, the degree of concentration is very different between the three sectors (as shown by the scale of the three graphs): agriculture is the most concentrated sector (0.27), followed by industry (0.029) and services (0.005). What is more important is that for all three sectors, it appears that the spatial concentration is more significant in the regions than in the countries.

Conclusion

In this paper, we have studied sectoral concentration in Europe on the basis of entropy indexes and we have

shown that the three analyzed sectors – agriculture, industry and services – are more concentrated at region rather than country level: the “within” component holds indeed a more important share in the overall disparities. Consequently, sectors concentration disparities between regions within countries mainly account for the overall extent of the European sectoral location inequalities.

Our results are however strongly dependent upon our data, that is the level of sector aggregation and the size heterogeneity between countries, on the one hand, and the NUTS 3 regions, on the other hand. Nevertheless, our results show beyond doubt that sectoral location disparities in Europe represent a

regional rather than a country issue. It follows that a new perspective must be adopted, that should put together the economic cohesion policies between countries and regions. Our results show that it is necessary to pay more attention to regional issues and to develop an active regional policy within each country but also at the level of Europe.

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End notes

- ¹ The term “region” is used only to designate the territorial division proper to Europe. The official division of EU for regional statistics is represented by the NUTS System (Nomenclature of Territorial Units for Statistics).
- ² The sectoral geographic concentration as we analyse it here is different from the “concentration” used in industrial economics, where it represents the shares of the firms in a given industry or sector.
- ³ All computations for regions and countries are available upon request.
- ⁴ The significant increase of the European industry’s geographical concentration can be analysed using specific elements of the new trade theory and the new economic geography.

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