

## European integration, as an approximation of globalisation: a statistical analysis based on stratified entropy indexes of concentration

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**Abstract.** *The paper tries to document the process of economic concentration at EU level and demonstrate that it could be seen as an approximation of globalisation. The phenomenon of economic concentration across the EU countries is highlighted by calculating entropy indexes of concentration for several layers (local and regional, regional and national, national and European), two by two, in a successive manner. By using Eurostat data, the values of entropy indexes document an increase of economic concentration from layer to layer, local to regional, regional to national and national to European level and suggest that the European economy could be seen as a globalized and stratified one, built from several economic layers and based on an increasing economic concentration from lower to higher layer.*

**Keywords:** economic concentration, globalisation, European integration.

**JEL Classification:** F01, F15, F62, O52

## 1. Introduction

Economic concentration across EU countries is a preferred topic for European researchers due to the relevance of their possible findings for the EU policies related to European Single Market and convergence of regions and European territories, social, economic and territorial cohesion.

Several authors discussed on the European integration process as an approximation of an advanced globalisation and a European model of globalisation was developed.

The focus of the paper is to prove, by using stratified statistical indicators, that concentration of economic activities across the EU countries, from local to community level, could be seen as a factor European globalisation process. The conceptual aspects of the paper are based on the theme of a European model of globalisation and on the fact that the globalisation is a phenomenon of concentration of national economies.

The paper is organised as follows: after a section dedicated to literature review on the concept of economic concentration, conceptual considerations on European globalisation are exposed in the next section, then data and methodology of the study are described in a special section, then the main findings of the study are exposed and conclusions are summarized in the final section.

## 2. Literature review on the concept of economic concentration

Concentration of economic activity across Europe was studied and analyzed by several authors in relation to specialisation as faces of the same coin and opposite phenomena (Aiginger, 1999; Aiginger and Leitner, 2002; Hallet, 2000; Aiginger and Davies, 2004). The interest of European researchers to these topics was generated by their concern to explain the process of European integration, competitiveness in the European Union and to suggest policy measures generally, and especially, for building the European Single Market. According to Aiginger (1999) there are at least two reasons for this interest. Firstly, the main channel by which integration enhances efficiency and competitiveness are decisions of firms regarding their optimal size and location, without the former national boundaries. The utilisation of scale economies and a deeper division of labour were expected to become the driving forces of Europe's increased competitiveness in the Single Market Program. On a theoretical level, integration is modelled as a decrease in transport costs (including proper transport costs, distribution cost, transaction costs etc.). The deepening of integration needs structural changes generating the increase of specialisation. High wage countries have to move into productivity and research intensive industries on order to ensure further growth in production and employment. Low wage countries specialise in labour intensive activities. Secondly, the specialisation of countries in narrow product groups may increase demand risk for individual countries and possibly making countries and regions more vulnerable to "asymmetric shocks". These disturbances would endanger stability within a common currency area. The heterogeneity of countries

within European Union is still large, productivity increases were expected to come from increasing economies of scale and globalisation was expected to affect low-income country specifically. The contribution of economic structure allows a detailed assessment of the probable impact of these facts.

Krugman (1991) is considered a starting point of the literature on regional concentration. He measured regional concentration by calculating a locational Gini coefficient and compared the regional market shares for one industry with the employment structure of manufacturing.

Karsten (1996) develops the idea of an inverted u-shaped relation between economic concentration and per capita GNP. He delivered evidence that the share of the population in the capital city and in urban areas are largest for middle income countries and explained the more dispersed structure of Europe vs. developing countries by dispersion of the skills and the historical fact of dispersed production at the start of the industrial revolution.

Concentration was defined in relation with agglomeration in several studies. For example, according to Brülhart (1998) the concentration analyzes the location in the space of some defined well sectors (for example, industrial activities), while agglomeration analyzes the spatial location of a bigger part of economic activity as manufacturing in general. In other words, when empirical studies prove the existence of the agglomeration there is also some concentration. On the other hand, he can have some geographical concentration without agglomeration. For Hallet (2000) the concentration and the agglomeration are very different from the specialisation.

Rossi-Hansberg (2005) proposed a model with two industries, a continuum of regions, iceberg type transport costs and agglomeration effects via production externalities and demonstrated the implications that specialisation and concentration do go in opposite directions when transport costs changes. Lower transport costs imply higher specialisation and lower concentration.

Earlier theoretical and empirical studies assumed that specialisation and concentration are closely related or even equivalent phenomena. Aiginger and Rossi-Hansberg (2006) argued that they are not, and that understanding the differences between them is important to enhance our understanding of the distribution of economic activity in space.

### 3. Conceptual considerations on European globalisation and study assumptions

The present paper is concentrated on the phenomenon of economic concentration and its consequences in the contemporary process of globalization, with focus on the European economy. Therefore, we investigate the main theoretical approaches related to globalisation, European integration and economic concentration.

According to Friedman (2001), globalisation is "the expression of a world's system integrating itself on a highest level and permanently open to integration".

Economic globalisation is the process of increasing economic integration between countries, leading to the emergence of a global marketplace or a single world market (Riley, 2005).

The process of globalisation is associated with *internationalisation* (a growth of international exchange, large and growing flows of trade and capital investment between countries), *liberalisation* (a process of removing state-imposing restrictions on movements between countries in order to create an open borderless world economy), *universalisation* (spreading various objects and experiences to people at all corners of the earth), *modernisation* (social structures of modernity-capitalism, rationalism, industrialism, bureaucratism and individualism - are spread the world over) and *respatialisation* (a reconfiguration of social geography with increased transplanetary connection between people)(Schulte, 2008).

The complex phenoment of globalisation has several features: interconnection between regional and national economies, as result of their trade with goods and services accross border, intense cross-border trade and capital flows, a process of market integration, emergence of institutions which regulate the cross-border economic exchange, cross-border interaction of a political and social nature (Pfister, 2012).

We have two starting points in our considerations to develop a possible theory of European globalisation.

One starting point in our considerations is the assumption that *European integration is an advanced approximation of globalization* (Dinu, 2004; Dinu et al., 2005). According to Professor Marin Dinu (2004), in an interpretative model, *the globalization is a problem of progressive integration of national economies aiming to create a coherent world economy*.

This opinion is in line with assertions of other authors. European integration is, at the same time a reaction to the process of globalization and its most advanced expression (Castells, 2000). The second part of the assertion suggests that the EU can be treated as an instance of globalization. *The EU - wheather conceived as a form of liberal market order or as hybrid form of multi-level polity- is a realisation of globalisation* (Rosamond, 2005).

This asertion is consistent with Ross's observation that "the unintended consequences of decision to deepen European integration after 1985 have promoted globalisation". The key decisions in the EU's history sponsoring globalization (creation of the singke-market programm in 1985) were caused less by globalisation the strategic choices to accelerate integration.

European integration can be seen as distinct west European effort to contain the consequences of globalisation. Rather than be forced to choose between national polity

for developing policies and the relative anarchy of globe, west Europeans invented a form of regional governance with polity-like features to extend the state and harden the boundary between themselves and the rest of the world (Wallace, 1996, p.17)

An European model of globalization has fourth key points (Dinu et al, 2005):

1. acceptance of liberalism principles in economies;
2. increase of transparency of European institutions;
3. harmonisation of trade globalization, aiming to reduce poverty;
4. protection of certain branches: agriculture, public health, natural resources, cultural diversity.

In the terms of European Commission, this model means a third way to globalization, a middle way, between protectionism and uncontrolled openness of economies. The EU appears as an effective arena of globalisation under so named phenomenon of "europenisation" and as a space of individual acts of Member States, in accordance with the global trends (Dinu et al, 2005).

Another starting point is the idea assumed by Săvoiu, Simăn and Crăciuneanu (2012), according to which, globalization is defined *as the most intense economic phenomenon of concentration of national macroeconomies. However, this also triggers the question regarding the parallel dynamics of two layers (global and national, national and regional, regional and local), and by generalization, of all structures interpreted and correlated as layers, two by two in a successive manner.*

According to the above considerations and in order to generate a simple frame for a statistical analysis, we assume that European economy is a globalized and stratified one, which integrates one by one, successive economic layers: local with regional, regional with national, national with European. The European layer integrates the national layers, a national layer (i.e. economy of a Member State) integrates its regional layers (economies of regions) and a regional layer integrates its local components (economies of local administrative territorial units).

In this vision, the phenomenon economic concentration is measured in each layer, based on the economic structure of the territorial units from the lower layer.

The assumption of the study is an increase in economic concentration from lower to higher layer.

#### 4. Measurements for economic concentration

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

For the purpose of the paper, we define economic concentration as the distributions of the shares of a territorial unit  $j$  in an individual industry  $i$ . Based on the hierarchical system dividing the European territory, Nomenclature of Territorial Units for Statistics (NUTS), we refer to the following territorial units: local (NUTS 3), regional (NUTS 2) and national (NUTS 0).

There are many standard statistical indices of economic concentration (dispersion) which might be used for the concept of concentration. In the statistical analysis of concentration, to the chronological data series of moments, structures of the local, regional, national and global economies are assigned specific structural energies ( $g_i^2$ ). For example, the Hirschman index in the simplified form is calculated by the squared shares of industries or countries (Săvoiu et al., 2012).

$$H = \sqrt{\sum_{i=1}^n g_i^2} \quad (1)$$

where:  $g_i$  is the share of an industry or a country in the overall output and  $n$  is the number of industries or countries.

Another instrument is the Gini-Struck index (Săvoiu et al., 2012):

$$G_{-S} = \sqrt{\frac{n \sum_{i=1}^n g_i^2 - 1}{n - 1}} \quad (2)$$

Other statistical indicators appropriate for the analysis of economic concentration are: *concentration ratio* and *standard deviation*.

*Concentration ratio* calculates the share of the largest  $n$  units in the total. It is easy to calculate and interpret, but as disadvantage, it makes use only of the information provided by the largest units, that the relative size of each unit within the group of large units is not accounted for, and that there is no good guide as to how  $n$  should be.

*Standard deviation* of the shares takes into account all available information, highly weighting positive and negative outliers. In the literature on the convergence of income, it is one of the most commonly used indicators. Sigma-convergence is reported if the standard deviation of per capita income or between productivity falls.

A special category of statistical measurement of concentration consists of *entropy indexes*. They 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. Brühlhart and Traeger (2005)'s study is also based on entropy indexes.

## 5. Data and methodology

For the purpose of the paper, we choose the entropy index of concentration because it uses a complete distribution of industry or country shares, not only the top entities.

We imagine the European economy as global economy consisting of several layers:

Layer 0 -European level;

Layer 1 -national level;

Layer 2 -regional level;

Layer 3 -local level.

In the structure of each layer  $i$  industries and  $j$  economies are included.

We use the following notations:

In each layer,  $X_{ij}$  -the output of industry  $i$  in the economy of a territorial unit  $j$ ,  $i=1, \dots, n$  and  $j=1, \dots, k$ .

$\sum_i X_{ij} = X_j$  -the total output of all industries in the economy of the territorial unit  $j$

$\sum_j X_{ij} = X_i$  -the total output of economy of the territorial unit  $j$ , in industry  $i$

For a given layer, for the industry  $i$ , the entropy index of concentration is calculated by:

$$CONC_i = -\sum_j \frac{X_{ij}}{X_i} \ln \frac{X_{ij}}{X_i} \quad (3) \quad (\text{Aiginger, 2004})$$

The value of  $CONC$  must lie between  $\ln(k)$  and 0.

For a given layer, the entropy index of concentration is calculated by weighting  $CONC_i$  with the share of industry  $i$  in the aggregate output of the layer ( $X$ ):

$$E\_CONC = \sum_i \frac{X_i}{X} \cdot CONC_i = -\sum_i \frac{X_i}{X} \cdot \sum_j \frac{X_{ij}}{X_i} \ln \frac{X_{ij}}{X_i} = -\sum_i \sum_j \frac{X_{ij}}{X} \ln \frac{X_{ij}}{X_i} \quad (3)$$

We will calculate  $E\_CONC$  for each layer: local, regional, national and European, considering that: the economy of region is built on the economies of the local territorial units, further, the economy of a State integrates the economies of its regions, and the European economy integrates the economies of its Member States.

At European level, we include all Member States, taking into account the economic structure of 12 branches according to NACE (REV.2) and the available data in EUROSTAT database. At national level, of Member States, we calculate  $E\_CONC$  based on the regional economies and their structure of 12 branches. At regional level, the

calculus was similarly, based on local economies (components of regional economies) and their structure of 12 branches.

For the output of branches and economies (at local, regional, national and European level) the values of the statistical indicator "Gross Added Value"(GVA) at market prices in Euro were used, extracted from EUROSTAT's REGIO data base, by NACE (rev.2) in the EU countries, at European level at NUTS 2 and NUTS 3 level, for the year 2011. Cipru, Malta and Luxembourg were excluded as they don't include regions (NUTS 2). Data from 270 territorial unit at NUTS 2 level and 1294 units at NUTS 3 level were computed.

## 6. Main findings

The entropy indexes of concentration were calculated, taking into consideration the economic layers two by two, as follows: in the layer 2, at NUTS 2 level, based on GVA of economic structures of territorial units NUTS 3; in the layer 1, at national level, based on GVA of economic structures of territorial units.

In the first column are displayed the values of entropy index of concentration in certain regions of Europe (NUTS 2), in the second column, the values for Member States and in the third column the value for the European Union.

As it is displayed in the Table 1, we notice that for the most European countries the entropy index of concentration has increasing values going from lower layers (regional) to higher layers (national and European).

From the regional to national level, respectively from layer 2 to layer 1, the concentration of economic activities is increasing for 14 EU countries of 19. For Germany, Ireland, Portugal, Slovenia and Finland the assumption that the concentration growth is related to the level of layer is not confirmed. Each country is an individual case. For the case of Germany, structured in 38 regional economies, data were available only for 3 branches: agriculture, industry and construction, therefore we appreciate the result to be not relevant for our study. In Ireland, only 2 regions are shaping the structure of the economy, very different as economic power. The GVA of is 4.64 times higher than those of Border, Midland and Western. Industry and Manufacturing are predominant in Southern and Eastern region and Industry and Trade are specific for Border, Midland and Western. The economy of Portugal is based on 8 regional units (NUTS 2), very different as concentration. For example, in Centro Region the value of entropy index is 2.15 and in Alentejo is only 1.15. Slovenia's economy is based on 2 regional economies, with almost same predominant branches: Industry and Wholesale and retail trade. In the region of Vzhodna Slovenija with 8 territorial units (NUTS 3) the entropy index is 1.78, and in Zahodna Slovenija region with 4 territorial units (NUTS 3) the entropy index is only 0.9.

Finland has 5 regions, very different as development. The GVA in Helsinki-Uusimaa regions is twice as in Länsi-Suomi, Etelä-Suomi, Pohjois- ja Itä-Suomi and of 61 times higher as in Åland.

**Table 1.** Entropy index of concentration across the European Union (2011)

Regional level (layer 2)		National level (layer 1)		European level (layer 0)
Hainaut (BE)	1,67	Belgium	2,10	2,2
Severozapaden (BG)	1,46	Bulgaria	1,46	
Severoychod (CZ)	1,28	Czech Republic	1,94	
Hovestaden (DK)	1,01	Denmark	1,48	
Oberbayern (DE)	2,45	Germany	1,09	
-	-	Estonia	1,11	
Southern and Eastern	1,25	Ireland	0,45	
Kentriki Makedonia (EL)	1,2	Greece	1,80	
Cataluna	0,88	Spain	2,39	
Ile de France	1,79	France	2,62	
Toscana	2,06	Italy	2,49	
-	-	Latvia	1,39	
-	-	Lithuania	1,8	
Dél-Dunántúl (HU)	1,06	Hungary	1,51	
Groningen (NL)	0,48	Netherlands	2,14	
-	-	Austria	3,22	
-	-	Poland	2,53	
Centro (PT)	2,15	Portugal	1,43	
Nord Vest (RO)	1,62	Romania	1,94	
Vzhodna Slovenija	1,78	Slovenia	0,64	
Západné Slovensko	1,08	Slovakia	1,33	
Pohjois-ja Itä Suomi	1,76	Finland	1,32	
Ostra Mellansverige	1,55	Sweden	1,82	
Eastern Scotland	1,62	United Kingdom	3,18	

**Note:** Malta, Cyprus were excluded as they are not structured in regional economies. Estonia, Latvia and Lithuania have only NUTS 3 territorial units. For Austria and Poland data were available only for 4, respectively 3 economic branches.

**Source:** author's computations based on Eurostat data.

From national to European community level, respectively from layer 1 to layer 0, the concentration increases in 18 EU countries and in 6 countries concentration is not related to the level of layer. This is the case of Spain, France, Italy, Austria, Poland and United Kingdom. In these countries the entropy index of economic concentration has higher values as the European level. Austria registered the highest level of 3,22 of the whole EU, but this result is not relevant due to the fact that data on GVA were available only for 4 branches of 12. A special case is United Kingdom which recorded a high value of 3.18 comparing with 2.2 at European level. The economy of UK is based on 37 regional economies (NUTS 2 level). The Gini coefficient illustrating the concentration of GVA between the 37 regions has the value of 0.15 showing a low concentration. Higher values of GVA are registered in the following branches: Industry and Wholesale and retail trade, transport, accommodation and food services. Industry is located in Gloucestershire, Wiltshire and Bristol/Bath area, East Anglia and West Midlands, Derbyshire and Nottinghamshire and West Yorkshire and trade in Greater Manchester,

Inner and Outer London, Berkshire, Buckinghamshire and Oxfordshire, Surrey, East and West Sussex and Gloucestershire, Wiltshire and Bristol/Bath area. Countries as Spain, Italy, France and Poland have a higher number of regions (19 in Spain, 26 in France, 22 in Italy, 16 in Poland). The entropy index of economic concentration in these countries has higher values due to the fragmentation of their economies in a higher number of territorial units.

## 7. Conclusions

The paper documents a process of increasing of economic concentration from bottom (local level) to top (over-national, European level) through the values of the entropy index of concentration, calculated for each layer.

We found that there is a direct relationship between the number of regional structures composing the national economies and the economic concentration at national level. As the number of regions is higher, the level of concentration is higher.

The paper intended to verify the above exposed theory of economic stratification according to which the level of economic concentration increases from a lower to a higher layer. In 6 cases of 24, the theory is not illustrated or in 6 cases the assumption of the study is not confirmed. There is an explanation of this fact. The more developed countries are tempted to attract very successful industries. More the countries are going to have similar levels of wealth; the more concentration is going to be weak. On the other hand, important differences of economic output, and that is the case of European Union, are going to determine a greater concentration of economic activities.

We found also that, as the number of the regional structures composing the national economies increases, the concentration at national level increases as well.

On the other hand, the paper offers an answer to the question: "do economic structures converge in the EU?" The answer is: mainly, yes. The findings of the paper suggest that the economic structures are more geographically concentrated going from small to vast territorial units.

This conclusion is relevant for European policy makers, since integration and globalisation are currently reshaping the industrial structures and the question that it is done in a balanced or asymmetric way remains an important policy issue (Aiginger, 1999).

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