



“ALEXANDRU IOAN CUZA” UNIVERSITY OF IASI
FACULTY OF ECONOMICS AND BUSINESS
ADMINISTRATION



Theories and Empirical Evidence on the Agglomeration Process and the Impact on the Regional Development in Central and Eastern Europe

- Summary of the PhD Thesis -

Scientific coordinator:

Prof. Univ. Dr. Gabriela Carmen Pascariu

PhD Student:

Dîrzu Mădălina - Ștefania
(Economics and International Affairs)

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Summary of the PhD Thesis

The PhD thesis entitled *Theories and Empirical Evidence on the Agglomeration Process and the Impact on the Regional Development in Central and Eastern Europe* contains 232 pages and consists of an introduction, four chapters, conclusions, appendices and a bibliography that includes more than 200 sources.

Due to the complexity of the subject, this scientific study requires an interdisciplinary approach, which should include concepts, methods and tools specific to various fields, such as: international economic relations, spatial economics, history, geography, econometrics and European studies.

The overall objective of the doctoral research is *to analyze the tendency of economic activities to agglomerate in certain regions and to study how these agglomerations influence the regional development, namely the convergence in Central and Eastern Europe (CEE) during the period 2000-2010.*

The general objectives of the research are:

- O1. To identify the meanings of the term “agglomeration” in economy;
- O2. To identify the agglomerations in regional development theories;
- O3. To assess the relative size of the theories on

agglomerations;

O4. To identify the methods and the instruments for measuring areas;

O5. To analyse comparatively Central and Eastern Europe vs. Western Europe regarding the study of the spatial distribution of agglomerations, competitiveness and relations between agglomerations and regional development for the economy sectors corresponding to the UE regions;

O6. To assess the impact of agglomerations on regional development in Central and Eastern Europe.

The questions to which the research will answer (research questions) are:

- What is the spatial distribution of the agglomerations formed in the various economic sectors in Central and Eastern Europe compared to Western Europe?
- What are the most appropriate indicators to describe the impact of agglomerations on the level of regional development?
- How do agglomerations contribute to the urban competitiveness of the EU regions?
- What types of agglomerations specific to which economic sectors have a positive impact on the regional development in Central and Eastern Europe compared to Western Europe?

- To what extent can agglomerations reduce the disparities between the regions of Central and Eastern Europe?

In order to pursue the goal that was set at the beginning and to accomplish the objectives, the methodological approach was built on two dimensions: a qualitative one that allows the analysis of the concept of “agglomeration” and of the related terms, and on the other hand, a quantitative one that is characterised by the application of *shift-share* (shifting – distribution) and *spatial auto-correlation* methods so as to obtain a preliminary analysis of the relationship between agglomerations and regional development, followed by a *panel data regression analysis*.

The PhD thesis is divided into four chapters, of which the first two chapters are of theoretical nature and the latter two chapters are of applied nature; the thesis ends with a series of general conclusions and a list of appendices.

Chapter I – The conceptual framework of the agglomeration process of economic activities

The first chapter of the thesis provides a clarification of the definition regarding the concept of *agglomeration*, from an economic point of view. Various manifestation hypostases are identified (cluster, territorial network, specialization, concentration) on which the literature offers a fairly diverse

range of information. Therefore, in this thesis, we have advocated the use of the term agglomeration or industrial concentration, which is a solution used in economy.

In addition, this chapter includes several views of the authors on the decisive factors which trigger the agglomeration of economic activities in specific regions, depending on factors such as climate, geographical location, road networks and even factors related to transportation costs, human capital, etc.

Finally, the first chapter ends with the analysis of the main theories that founded the literature concerning agglomerations. The first scientific approaches that represent the basis of the scientific literature on the agglomeration process had as a starting point the analysis of the issue of the *geographic location* of economic activities and localities, which explains the name of the new trend in economics – *the location theory*. Most of the location theories had as a starting point the existence of natural resources in the region, with the aim of minimizing the transportation costs and optimizing the costs of locating the specific activities where there are conditions which could help obtaining sources of high profit or income. In other words, the agglomeration processes are accentuated whenever we admit that, just as in the situation where a company's representatives can identify the locations at the lowest cost, it is likely that similar companies' representatives identify the same locations. Therefore, it is

likely that agglomerations of companies appear in locations that offer low prices and high demand.

Even though they are very important, the location theories failed to impose themselves in the main trend of economy and were absorbed by the so-called “regional science”. As a consequence, regional development theories developed and focused on the study of behaviour in the area of locating economic activities, demonstrating their tendency to cluster in space as agglomerations such as industrial parks, small or large towns, etc.

Chapter II – Economic agglomerations and regional development

In the second chapter, the role attributed to agglomerations as a regional development factor is analyzed. Therefore, the most important views on the process of economic growth, which aims at exploiting the potential created by agglomerations, are inventoried. Starting from the idea that the explanations for the formation of agglomerations are based on the existence of specific scale economies, known as *agglomeration economies*, the theory that encompasses all these attributes that are characteristic to agglomerations is the *new economic geography* (NEG), proposed and promoted by Paul Krugman (1991). The theory assumes that a region is

more advanced than other regions because of its ability to agglomerate new businesses and skilled labour and because of its effective exploitation of scale economies and their variety.

Another theory that attempted to identify why economic activities are concentrated in a certain area and not in another one was *the endogenous growth theory*. According to this view, when individuals or businesses accumulate new capital, they indirectly contribute to the productivity of the capital held by third parties. Such situations may occur when investing in physical and human capital. When the endogenous growth theory is applied at the regional level, one can notice that increasing returns of scale are a feature of agglomeration economies.

Similarly, the economist Alfred Marshall found that the concentration of similar businesses attracts, develops, and benefits of a skilled workforce. The result is the generation of intra-industrial mechanisms of information circulation in the neighbouring businesses, which ultimately leads to the accumulation of new capital by individuals and businesses. This approach of Marshall's was later extended by Arrow and Romer by the inclusion of the information flow, which led to the implementation of MAR model (Marshall – Arrow – Romer).

While MAR model is oriented to the externalities that may result from the agglomeration of companies in a certain

economic sector, Jane Jacobs's model highlights the benefits of inter-industrial agglomerations, trying to explain that the diversity of the existing branches in a region leads to a variety of knowledge, which facilitates economic growth.

Even if both MAR model and Jacobsian model admit the benefits of agglomeration either at an intra-industrial level or at an inter-industrial level, Porter's model emphasizes the importance of competitive agglomerations, explaining their impact on the competition in three ways: by increasing the productivity of companies in the region, by facilitating innovation, and by the creation of new companies to expand and strengthen the agglomeration so that it should become a source of prosperity.

Subsequently, this chapter presents different measurement methods, which are mainly destined to quantify the degree of agglomeration at a spatial level. In this regard, the literature suggests several methods of measurement such as the location coefficient, Hirschman-Herfindahl index, Gini's coefficient, Ellison and Glaeser's index and Krugman's index; among all these variants, the location coefficient is most often used.

Finally, the second chapter concludes by assessing the current state of the empirical research on agglomeration processes and their impact on the economic development in the EU. Overall, the existing empirical evidence does not seem to

be exhaustive or conclusive. In particular, both the use of various measurements to express the degree of agglomeration and the use of information at different spatial scales make the comparison of the results of these contributions difficult in order to reach concrete conclusions. The only book that analyzes NUTS2 regions (Bosker, 2007), which is also the aim of this scientific approach, uses a type of agglomeration measurement which is not ideal. In addition, according to the information we hold, the case of the regions of Central and Eastern Europe has not been thoroughly studied yet.

Chapter III – Economic agglomerations as instrument of regional development in the European Union

The third chapter is dedicated to the comparative analysis of Central Europe and Eastern vs. Western Europe regarding the analysis of spatial distribution of the agglomerations, the competitiveness and the relations between agglomerations and regional development for the economy sectors corresponding to the EU regions.

In this research, the variable of interest is the number of employees and it is used to calculate the location coefficient in order to illustrate the spatial distribution of economic agglomerations in 271 regions (NUTS2) of the European Union during the period 2000-2010. We chose to analyze this period because of the amount of the available data it contains.

The data regarding the working population at the NUTS2 level come from the European Union statistics (Eurostat) and from the European Regional databases provided by Cambridge Econometrics. In addition, the data on the number of employees were collected for all economic sectors corresponding to the NACE Rev.1 coding system; the entire data set corresponds to the level of aggregation proposed by Cambridge Econometrics, as it is shown in Table III.1:

Table III.1. Aggregation of economic sectors proposed by Cambridge Econometrics according to NACE rev. 1

No.crt. (sector code)	NACE rev.1 code	<i>Name</i>
1	A	<i>Agriculture, hunting and forestry</i>
	B	<i>Fishing</i>
2	CA	<i>Extraction of energy products</i>
	CB	<i>Mining and quarrying of non-energy products</i>
	E	<i>Water supply; sewerage, waste management and decontamination activities</i>
3	DA	<i>Food, beverage and tobacco industry, manufacture of beverage and tobacco</i>

4	DB	<i>Manufacture of textiles</i>
	DC	<i>Manufacture of leather and leather products</i>
5	DF	<i>Manufacture of coke, of refined petroleum products and of nuclear fuel</i>
	DG	<i>Manufacture of substances, chemicals, synthetic and artificial fibres</i>
	DH	<i>Manufacture of rubber and plastic products</i>
6	DL	<i>Industry of electrical and optical equipment</i>
7	DM	<i>Transportation industry</i>
8	DD	<i>Manufacture of wood and wood products</i>
	DE	<i>Manufacture of cellulose, paper and paper products; publishing and printing publications</i>
	DI	<i>Manufacture of other non-metallic mineral products</i>
	DJ	<i>Metallurgy and metal products</i>

	DK	<i>Manufacture of machinery and equipment</i>
	DN	<i>Other industrial activities</i>
9	F	<i>Construction</i>
10	G	<i>Wholesale and retail trade; repair of motor vehicles and motorcycles and of personal and household goods</i>
11	H	<i>Hotels and restaurants</i>
12	I	<i>Transport, storage and communications</i>
13	J	<i>Financial intermediation</i>
14	K	<i>Real estate, renting and service provided by businesses for businesses</i>
15	L	<i>Public administration and defence; social insurance of the public system</i>
	M	<i>Education</i>
	N	<i>Health and social assistance</i>
	O	<i>Other activities of community, social and personal service</i>
	P	<i>Activities of staff employed in private households</i>

	Q	<i>Activities of extraterritorial organizations and bodies</i>
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Source: Cambridge Econometrics

Thus, by means of quantifying the agglomerations using the location coefficient for the 15 economic sectors and by means of applying the *shift-share* (shifting – distribution) and *spatial autocorrelation* methods, we managed to obtain a preliminary analysis of the relationship between agglomerations and regional development, namely competitiveness during the period 2000-2010.

Thus, in terms of spatial distribution of agglomerations, we can state that there are still significant differences between the economic agglomerations formed in various areas in Central and Eastern Europe and Western Europe, suggesting that the regions of the former socialist countries have failed to correct the structural distortions caused by the neglect of the important areas of activity and to create a relatively smooth development of the areas that require a higher level of technology.

By applying spatial autocorrelation, it has been noted that there is a positive spatial autocorrelation between GDP / capita and the agglomerations formed in all sectors across the European Union, which confirms the spatial correlations between different neighbouring regions. Thus, physical proximity understood as geographical proximity appears to be

a prerequisite for the synergy of the economic processes, yet an essential one for the emergence of competitive cluster-type agglomerations. However, these spatial correlations seem to manifest positive influences, especially in the developed regions of Western Europe, and not so much in the territorial units in Central and Eastern Europe, which could lead to an increase in regional disparities between the East and the West.

Last but not least, by using the shift-share method, the results show that, for the European Union, the regions of Western Europe have a significant competitive advantage in the agglomerations formed in the tertiary sector, while the regions of Central and Eastern Europe have a major competitive advantage, particularly in the case of agglomerations in the industrial sector.

Chapter IV – Measurement of the impact of economic agglomerations on regional development in Central and Eastern Europe (CEE)

The fourth chapter attempts to conduct the empirical analysis of the research in the 54 regions of Central and Eastern Europe. To this end, four econometric models are tested, and the period under analysis is 2000-2010.

The empirical research in this chapter is based on the *regression analysis of panel data* which allows the development of some models which can be divided into two categories:

- *Pooled regression* models (*common, globalized, bulk* regression), where the bi-dimensional component of panel data is not important (transverse *component* and *time* component) and where they are treated “in bulk”;
- *Fixed Effects Models*, setting the effect of the cross (transverse) component.

The variables included in the model are:

- the dependent variable: the *regional development* calculated from the GDPs of the CEE regions aggregated by the arithmetic average for the periods under discussion.
- independent variables: the natural logarithm of GDP / capita at the beginning of the period, the percentage of GDP allocated to research and development, the real value of expenditure on research and development, the percentage of the population with higher education of the total population, the population density in the region, the percentage of human resources involved in science and technology, the regional location coefficient, the sectoral – regional location coefficients.

We also used a dummy variable in the models to test Williamson’s hypothesis, which show that economic

agglomerations have a different effect on the economic growth according to the GDP / capita. Thus, for the *countries whose economies are less developed*, the economic agglomeration may be an important factor for the economic growth, while for *countries whose economies are developed* the economic agglomeration does not hold such an important place. By applying the four types of econometric models, we have found that agglomerations in general as well as the agglomerations specific to certain economic sectors have a different impact on the regional development in Central and Eastern Europe.

In general, *the economic agglomeration*, when measured by *the regional location coefficient*, has a positive effect on the economic growth, according to the first model, that is the *Fixed Effects Model*.

The most interesting cases that resulted following the tests on Williamson's hypothesis are those where *the importance of activity sectors change radically for more developed economies as compared to less developed economies* (this is the case for sectors such as: *the transportation industry, constructions, repairs on motor vehicles and motorcycles and on personal and household goods; financial intermediation and non-market services*).

Conclusions

This scientific approach has managed to:

O1. *Identify the meanings of the term “agglomeration” in economics*

In the literature, there is no such thing as a unique definition of agglomerations from an economic perspective or of the related concepts. Thus, concepts such as cluster, regional network, concentration or specialization are often used in order to describe the same reality, even if similar terms have slightly different characteristics. For these reasons, we chose to use the term agglomeration or industrial concentration in this thesis; this solution is used in economics.

O2. *Identify agglomerations in regional development theories*

After exploring the semantic field of the term “agglomeration”, the next natural step was to identify the meanings of the term “agglomeration” in the economy theories. Early theories that were the basis of the literature concerning the agglomeration process were the location theories, which were later absorbed by the “regional science”. This represented a shift from the location theories to the regional development theories, the latter showing that the criteria taken into account in deciding on the location of the economic activities have been adapted and transformed so that, at present, the emphasis falls on innovation, knowledge and skilled labour which are benefits

coming from the value circuit developed inside agglomerations.

O3. *Evaluate the relative size of the theories concerning agglomerations*

The basic theory which provides the essential data for understanding the economy based on agglomerations is the *new economic geography* (NEG), founded by Paul Krugman. According to this theory, a region is more developed than another one because it can agglomerate new businesses with skilled labour and because it effectively exploits economies of scale and their diversity.

Another theory that attempted to identify why economic activities tend to be located in one place rather than another in order to make a profit was the *theory of endogenous growth*. According to this approach, when individuals or businesses accumulate new capital, they influence in a positive yet indirect way the productivity of the capital held by third parties.

According to these theories, MAR model and Jacobsian model acknowledge the benefits of agglomerations either at an intra-industrial level or at an inter-industrial level. In addition, Porter's model emphasizes that the agglomeration process, as a result of the economic activity caused by the merging of powerful industries, can generate beneficial effect at the regional level, provided that there are competitive advantages thanks to superior cluster-type agglomerations.

O4. *Identify the methods and instruments for measuring agglomerations*

In order to successfully conduct the analysis of the relationship between agglomerations and regional development, it is necessary to quantify it. Here are some examples used in identifying agglomerations in the spatial distribution of economic sectors: as the location coefficient, Hirschman-Herfindahl index, Gini's coefficient, Ellison and Glaeser's index and Krugman's index. In this thesis, we used the location coefficient in order to measure the agglomeration level of economic sectors at a regional level due to its computational speed, to the relatively accessible data on the employed population and to the possibility of its application to different geographic scales.

O5. *Analyze comparatively Central and Eastern Europe vs. Western Europe regarding the study of the spatial distribution of agglomerations, the competitiveness and the relations between agglomerations and regional development for the economy sectors of the EU regions.*

The results obtained following the application of *shift-share* and *spatial autocorrelation* methods are perfectly consistent with economic theories, which say that the regions which are less developed economically in Central and Eastern Europe are characterized by a high concentration of employment in sectors characterized by a low level of

technology, while developed regions in Western Europe are characterized by high concentration of workforce in areas characterized by a high technological level.

O6. Evaluate the impact of agglomerations on regional development in Central and Eastern Europe

To achieve this, we used four categories of *pooled regression models* and *crossed fix effects models*, of which the more important are those in the latter category.

The most interesting cases are those where *the importance of activity sectors changes radically for more developed regions compared to the less developed regions*. This suggests a different structure of developed economies compared to less developed economies and a change in strategic sectors. Economic agglomerations in sectors such as transportation and construction, which are considered to be factors of economic growth in less developed economies, become slowing down factors for developed economies; at the same time, economic agglomerations in sectors such as trading and financial intermediation are factors of growth in advanced economies and slowing down factors in less advanced economies.

Actual expenditure and *percentage expenditure* on research and development prove to have a negative impact on

regional development according to *crossed fix effects models*, which was also confirmed by the *pooled regression models*.

The percentage of employees in the field of technology has a positive impact on regional development, according to the two fixed effect models. The first *crossed fix effects models* showed the existence of the same positive effect in the case of *the percentage of graduates from higher education* on regional development.

The convergence process is more likely to indicate the transition to a phase of convergence rather than the convergence itself, despite the fact that it takes place at all regions in Central and Eastern Europe, and it has *very low* values, close to 0, which are *negative* for the coefficient corresponding to the β convergence and which resulted from the two classes of *crossed fix effects models*, being also confirmed by the *pooled regression models*.

In conclusion, personal contributions can be summarized as follows:

- From a theoretical point of view

We have identified and analyzed the concepts and typologies in which we find agglomerations today, demonstrating their importance for the economy. At the same

time, we have identified the main theoretical approaches that addressed the phenomenon of agglomeration, which allowed us to classify, from a historical and spatial perspective, experts' interest in elaborating the theories concerning agglomerations.

- From a practical point of view

The research presented in this thesis represents the first empirical investigation on the influence of agglomerations at a NUTS2 level on the regional development in the regions of Central and Eastern Europe.