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Three Essays in Regional Economics:

The Case of Romania

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Abstract

Chapter 1 derives an econometric specification which relates the income levels of a particular location with a weighted sum of the volume of economic activities of the surrounding locations (market access). Then, empirically, we estimate this econometric specification for a sample of 42 Romanian regions in the year 2006. The results show that market access is statistically significant and quantitatively important in explaining cross-county variation in Romanian per capita GDP levels.

Chapter 2 looks at the link between human capital and geographical location in Romania. The results show that the percentage of individuals with medium and high educational levels is affected positively by the regions´ market access even after looking for third variables that might be affecting regional educational levels and which work through accumulation incentives.

Chapter 3 focuses on the analysis of the growth dynamics in the Romanian economic over the period 1995-2008 and the link between them and the economic geography of the country. The results of our analysis point out that a catching-up process across Romanian counties is not taken place and that the economic geography of the country is shaping the growth dynamics observed over the course of the years analyzed in this chapter.

Resumen

El capítulo 1 deriva una especificación econométrica que relaciona los niveles de renta en una localización con una media ponderada por la distancia del volumen de actividad económica de las localizaciones colindantes (market access en su denominación anglosajona). Empíricamente, se estima esta especificación econométrica para la muestra de las 42 regiones rumanas en el año 2006. Los resultados demuestran que el market access es estadísticamente significativo y cuantitativamente importante a la hora de explicar las diferencias regionales en los niveles de PIB per cápita en Rumanía.

El capítulo 2 analiza la relación entre capital humano y localización geográfica en Rumanía. Los resultados muestran que el porcentaje de

individuos con niveles educativos medios y altos depende positivamente del market access de las regiones incluso después de controlar por otras variables que pueden influir en los niveles educativos.

El capítulo 3 se centra en el análisis de la dinámica de crecimiento de las regiones rumanas en el período 1995-2008 y en el link entre esta dinámica y la geografía económica del país. Los resultados del análisis muestran que no existe un proceso de convergencia entre las regiones rumanas y por otro lado que la geografía económica del país tiene un efecto importante a la hora de explicar la dinámica de crecimiento observada en el período analizado en este capítulo.

Resumo

O capítulo 1 deriva unha especificación econométrica que relaciona os niveis de renda nunha localización con unha media ponderada pola distancia do volume de actividade económica nas localizacións lindantes (market access na súa denominación anglosaxona). Empiricamente, estimase esta especificación econométrica para a mostra das 42 rexións romanesas no ano 2006. Os resultados demostran que o market access e estatisticamente significativo e cuantitativamente importante a hora de explicar as diferenzas rexionais nos niveis de renda per cápita en Romanía.

O capítulo 2 analiza a relación entre capital humano e localización xeográfica en Romanía. Os resultados mostran que o porcentaxe de individuos con niveis educativos medios e altos depende positivamente do market access das rexións incluso despois de controlar por outras variables que poden influír nos niveis educativos.

O capítulo 3 centrase na análise da dinámica de crecemento das rexións romanesas no período 1995-2008 e no enlace entre esta dinámica e a xeografía económica do país. Os resultados da análise mostran que no existe un proceso de converxencia entre as rexións romanesas e por outro lado que a xeografía económica do país ten un efecto importante a hora de explicar a dinámica de crecemento observada no período analizado neste capítulo.

I. Introducción

El objetivo de la presente tesis doctoral es triple: a) Analizar en que medida la ecuación nominal de salarios que constituye una de las ecuaciones estructurales mas importantes en términos de aplicabilidad empírica de los modelos centro-periferia de *Nueva Geografía Económica* se verifica en el caso de las disparidades observadas en los niveles de renta entre las diferentes regiones (condados) rumanas, b) Analizar en que medida las predicciones teóricas mas recientes de los modelos centro-periferia de *Nueva Geografía Económica* que vinculan la localización geográfica con la acumulación de capital humano se verifican para el caso de Rumanía y c) analizar en que medida los patrones de crecimiento regional observados en las regiones rumanas pueden vincularse a la geografía económica del país.

La investigación que se presenta en esta tesis doctoral se inicia (capítulo 1) con un análisis de la evolución de las disparidades de renta en las regiones rumanas y su explicación a través de una de las ecuaciones que ha sido el *caballo de batalla* de muchas investigaciones empíricas en el campo de los modelos centro-periferia de *Nueva Geografía Económica*; la ecuación nominal de salarios la cual vincula el salario en cada localización con su *market access* (media ponderada por la distancia del volumen de actividad económica de las localizaciones colindantes). La evolución favorable de la economía Rumana en los últimos años y especialmente después del 2004 ha permitido una mejoría notable de los niveles de desarrollo de las distintas regiones que componen el país. No obstante, este desarrollo ha sido bastante desigual, siendo los elementos más importantes que lo describen los siguientes: a) un elevado grado de disparidad en los niveles de renta entre las distintas regiones rumanas y

además con una tendencia creciente. Los datos para el 2006 reflejan que el ratio entre el PIB per cápita de la región más rica (Bucharest) y la media del país es superior a 5. Incluso excluyendo de los cálculos la capital del país el ratio es superior a 3. Si hacemos la comparación entre la región mas rica y la mas pobre el ratio se dispara a 18.30 (incluyendo Bucharest) y 9.59 respectivamente (sin Bucharest), b) Los niveles de desarrollo en Rumania muestran un fuerte patrón *centro-periferia*. La distribución espacial de los niveles de renta en Rumanía muestra que lo que en el lenguaje de los modelos de *Nueva Geografía Económica* se denomina *centro* estaría representado principalmente por las regiones del oeste y noroeste del país mientras que la *periferia* estaría representada por las regiones del noreste y sureste. Otra forma alternativa de ver este patrón *centro-periferia* es mediante un gráfico que recoja la relación entre el PIB per cápita de cada una de las regiones y su distancia a Timisoara (ciudad localizada en el oeste del país). Los datos reflejan que a medida que nos movemos cada vez más lejos de Timisoara el nivel de renta de las regiones es cada vez menor.

El siguiente paso en nuestra tesis doctoral (capítulo 2) ha sido analizar en que medida las predicciones teóricas mas recientes de los modelos centro-periferia de *Nueva Geografía Económica* que vinculan la localización geográfica con la acumulación de capital humano se verifican para el caso de Rumanía. Los niveles de capital humano en Rumania, al igual que lo que ocurre con la distribución de los niveles de renta, también muestran una distribución espacial bastante desigual. Los porcentajes más elevados de población con estudios secundarios y terciarios se alcanzan en lo que de acuerdo a la denominación típica de los modelos de *Nueva Geografía Económica* es el centro económico de Rumanía: Bucharest, Iasi, Timisoara, Cluj-Napoca, Constanta, Brasov y

Craiova que es donde se localizan las universidades mas importantes del país. Si comparamos los datos de la educación secundaria en estas regiones con la media del país se ve que los resultados están bastante por encima de la media. En el otro extremo, las regiones rumanas que están localizadas lejos de esto polos de crecimiento, en lo que podría denominarse la *periferia económica* Neamţ, Mureş, Tulcea, Satu Mare, Botosani, Vaslui, Olt, Teleorman tienen cifras de educación superior por debajo de la media del país. Además, en la distribución espacial de los niveles de capital humano se muestra también un fuerte gradiente centro-periferia que se puede observar fácilmente en un gráfico relacionando los niveles de educación superior con la distancia a Timisoara. Los datos muestran que cuando más lejos nos encontremos de Timiosara menores serán los niveles de educación secundaria y terciaria.

Finalmente en el capítulo 3 se analiza la dinámica de crecimiento de las regiones rumanas a lo largo del período 1995-2008 y se estudia en que medida esta dinámica de crecimiento se puede relacionar con la geografía económica de Rumania. El patrón de crecimiento de Rumanía a lo largo de este período permite diferenciar claramente entre un período de recesión 1995-2000 y un período de fuerte crecimiento entre 2000 y 2008. Nuevamente la dinámica de crecimiento apoya la tesis de los modelos de *Nueva Geografía Económica* donde las regiones con un mayor nivel de desarrollo y de densidad de actividad económica son las regiones ganadoras en este proceso y por tanto las predicciones de los modelos neoclásicos de crecimiento (convergencia entre los niveles de renta) no se verifican para el caso de Rumanía en el período de tiempo analizado.

II. Metodología: Marco Teórico

El marco teórico para el análisis realizado a lo largo de esta tesis doctoral se basa por un lado en el uso de modelos de *Nueva Geografía Económica* (capítulo 1 y 2) y por otro en los modelos neoclásicos de crecimiento económico (capítulo 3).

En relación a los capítulos 1 y 2 existen muchos elementos que pueden justificar el porque los niveles de desarrollo o los niveles de capital humano varían de unas regiones a otras. Desde el punto de vista de las teorías del crecimiento económico (Barro and Sala-i-Martin, 1991, 1995) muestran que diferencias en los niveles de ahorro, niveles de inversión, gasto en I+D, dificultades en la transmisión de tecnología etc. pueden explicar por qué las regiones no converjan. Las teorías tradicionales de desarrollo económico por otro lado ponen más énfasis en los factores de geografía de primera naturaleza (geografía física) que en los factores de segunda naturaleza (geografía económica). Factores como acceso a ríos navegables, puertos, aeropuertos, recursos naturales, horas de sol, etc. estarían en la base de estos modelos (véase Hall and Jones, 1999). Dentro de las teorías de la economía urbana se enfatizan factores como las economías externas de escala que surgen de poner los recursos relevantes en proximidad espacial, por ejemplo en la misma ciudad, lo cual aumentaría la productividad de las empresas y de los trabajadores (Marshall, 1920; Henderson, 1986; Duranton and Puga, 2004).

Nuestro marco teórico (capítulos 1 y 2) se centra en la rama de la economía espacial que se conoce como *Nueva Geografía Económica* (NGE) o *Economía Geográfica* (Krugman, 1991; Brakman et al., 2009). La NGE nos proporciona una nueva explicación de la aglomeración de las actividades económicas y de la acumulación de capital humano usando

modelos de equilibrio general con fundamentación microeconómica y a diferencia de las teorías de crecimiento económico tienen en cuenta los aspectos geográficos, concretamente los aspectos de geografía económica y por tanto la estructura geográfica de la producción, niveles de renta y capital humano puede ser analizada explícitamente.

En el capítulo 3 metodológicamente nos centramos en la literatura empírica que se deriva de los modelos de crecimiento neoclásico (Barro and Sala-i-Martin, 1991, 1995) pero incorporamos a nuestro análisis componentes de geografía económica para ver en que medida éstos están en la base de los distintos patrones de crecimiento observados en el período analizado en esta tesis doctoral.

En el capitulo 1 a partir del desarrollo de un modelo centro-periferia multi-región de N*ueva Geografía Económica* (basado en Breinlich, 2006) se deriva una especificación econométrica que relaciona los niveles de renta en una localización con una media ponderada por la distancia del volumen de actividad económica de las localizaciones colindantes (market access en su denominación anglosajona). En el capítulo 2 se utiliza un modelo centro-periferia multi-región de *Nueva Geografía Económica* con acumulación endógena de capital humano (basado en Redding y Schott, 2003) para explicar la relación entre la localización geográfica de cada una de las localizaciones y los diferentes niveles educativos. Finalmente en el capítulo 3 se utilizan las ecuaciones estructurales que se derivan de un modelo neoclásico de crecimiento económico (basado en Barro and Sala-i-Martin, 1991, 1995) para explicar las relación entre las tasas de crecimiento y los niveles iniciales de renta. Adicionalmente se incorporan consideraciones de geografía económica para ver en que medida factores como el market access o

cambios en éste están condicionando los patrones de crecimiento de las distintas regiones.

III. Metodología: Estimación Empírica

En relación a la estimación empírica de los diferentes modelos propuestos, en el capítulo 1 se estima econométricamente la relación entre los niveles de renta en el año 2006 para las 42 regiones rumanas (condados) y nuestra variable clave de geografía económica que es el market access. Se completa este modelo de base con; a) un modelo ampliado donde se recogen diferentes variables de control para desenredar el efecto que el market access tiene en los niveles de renta y b) un modelo espacial para controlar por los posibles problemas de autocorrelación espacial. Las estimaciones se realizan por mínimos cuadrados ordinarios (MCO) y también se recurre a la estimación mediante el uso de variables instrumentales para controlar por los posibles problemas de endogeneidad entre el market access y nuestra variable dependiente.

En el capítulo 2 se estima empíricamente la ecuación estructural que se deriva de la adaptación del modelo de Redding y Schott (2003) al contexto rumano. Procedemos al igual que en el capítulo anterior con la estimación de una ecuación de base que relaciona el nivel de acumulación de capital humano (porcentaje de población con estudios primarios, secundarios y terciarios en el año 2006) de las 42 regiones rumanas con el market access y después se hace una extensión de esta ecuación de base tanto mediante la incorporación de variables de control como mediante la redefinición de nuestra variable dependiente incorporado por un lado los años medios de educación en cada una de

las regiones y por otro mediante la ordenación de los niveles educativos en bajos, medios y altos y estimando un modelo probit ordenado. Las estimaciones las realizamos mediante mínimos cuadrados ordinarios (MCO) y también mediante el uso de variables instrumentales para controlar por los posibles problemas de endogeneidad. El capítulo contiene un análisis muy extensivo mediante el uso de diferentes instrumentos basados en la literatura reciente de la *Nueva Geografía Económica* (Combes et al., 2010).

En el capítulo 3 se realiza un análisis de los diferentes patrones de crecimiento de las regiones rumanas a lo largo del período 1995-2008. Una parte del capítulo sigue la metodología de Rodriguez-Pose y Vilalta Bufi (2005) para una clasificación de las regiones en diferentes tipos (regiones ganadoras, regiones perdedoras, regiones de convergencia y regiones con dinámica de retraso) teniendo en cuenta la desviación de cada región a la media de crecimiento de cada período analizado y al nivel de PIB inicial del período y posteriormente se estima econométricamente la relación entre las tasas de crecimiento de los diferentes períodos analizados 1995-2008, 1995-2000, 2000-2004 y 2004-2008, el nivel de renta inicial del período y el market access. De esta manera podemos comprobar en que medida los patrones de crecimiento se caracterizan por la verificación de las hipótesis de los modelos neoclásicos de crecimiento económico y en que medida la geografía económica desempeña un papel importante a la hora de explicar la dinámica de crecimiento observada a lo largo de los períodos analizados.

Chapter 1: Economic Remoteness and Wage Disparities in Romania[1]

Abstract

This chapter looks at the link between per capita GDP disparities and market access for the Romanian regions. In first place, we derive an econometric specification which relates the income levels of a particular location with a weighted sum of the volume of economic activities of the surrounding locations (market access). Then, empirically, we estimate this econometric specification for a sample of 42 Romanian regions in the year 2006. The results show that market access is statistically significant and quantitatively important in explaining cross-county variation in Romanian per capita GDP levels. Moreover, our results are robust to the inclusion of control variables thought to be important in explaining Romanian income levels as it is the case with human capital and innovation levels. After controlling for these variables, market access remains still positive and statistically significant although its influence on per capita GDP levels decreases around 25%. Finally some policy conclusions are also drawn.

Key Words: Economic Remoteness, Market Access, Wage Disparities, Romania

JEL Classification: R11, R12, R13, R14, F12, F23

[1] A version of this chapter has been published as : Lopez-Rodríguez, J., Faiña A. and C. Bolea-Gabriel (2011) Economic Remoteness and Wage Disparities in Romania, **Tijdschrift voor economische en sociale geografie**, Vol(102) 5, pp. 594–606 and as Lopez-Rodríguez, J., Faiña A. and C. Bolea-Gabriel (2011) Economic Remoteness and Wage Disparities in Romania, **Regional Economics Application Laboratory, University of Illinois at Urbana Champaign, REAL-10-T-8, 2010**

1.1. Introduction

The favourable evolution of the Romanian economy in recent years and especially after its take off in 2004 has allowed an important improvement of the development levels among its regions although this development was quite uneven. The Romanian accession to the European Union (EU) meant that it has had to reorganize its territory in order to have a more efficient EU fund absorption. From the 42 existing counties, Romania has created 8 economic regions[2] although without legal personality. The counties belonging to the Northeast (1) and Southeast Economic Regions (2) are far removed from the main European markets and experience severe underdevelopment problems. Moreover, their sectoral structure is heavily based on agriculture. On the other hand, the counties belonging to the West (5), Northwest (6) and Center (7) Economic regions benefit from a better location with respect to the main European markets having more potential to attract investors.

Table 1 shows the values of Gross Domestic Product per capita (GDPpc) for the 42 Romanian counties in 2006. The results show quite clearly the dominance of the nation's capital (Bucharest). Per capita GDP in Romania is more than five times higher than the national average. Comparing Bucharest with the poorest county (Giurgiu) the data show overwhelming differences (per capita GDPpc in Bucharest is more than 18 times higher than that of Giurgiu.

If we exclude from the calculations the distortion generated by the capital values, the results still show that in Romania there is a strong regional contrast in terms of per capita GDP. Thus, table 1.1 shows that

[2] We are going to use the word/s *region/s* throughout the chapters of this thesis which are more common in the regional economics literature; however it is important to bear in mind that in the case of Romania the regions we are referring to here are called Romanian counties.

the richest city after Bucharest, Timisoara, has a per capita GDP which is over three times higher than the national average.

Table 1.1: GDPpc and Gross Wages: Romania (2006)

County	GDPpc
Bacău	2300
Botoşani	910
Iaşi	3900
Neamt	1430
Suceava	1781
Vaslui	814
Brăila	1048
Buzău	1297
Constanţa	2715
Galaţi	1848
Tulcea	690
Vrancea	954
Arges	2723
Călăraşi	653
Dambovita	1560
Giurgiu	589
Ialomita	840
Prahova	3040
Teleorman	974
Dolj	1850
Gorj	2000
Calculation including the capital (Bucharest)	
Average	1948
Max.	10780
Min	589
Ratio max./med	5.53
Ratio max./min.	18.30

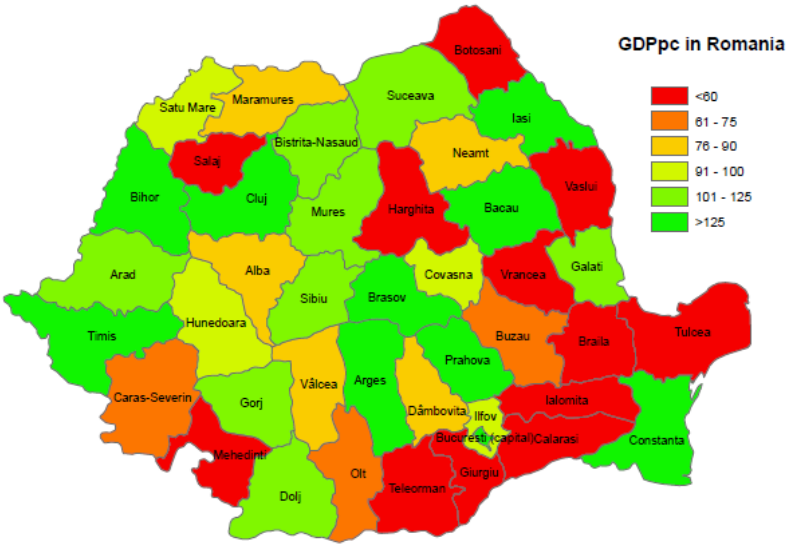
County	GDPpc
Mehedinti	788
Olt	1146
Valcea	1382
Arad	2012
Caras – Severin	1102
Hunedoara	1672
Timiş	5651
Bihor	2328
Bistriţa-Năsaud	1820
Cluj	3050
Maramures	1440
Satu Mare	1670
Salaj	735
Alba	1350
Braşov	2718
Covasna	1590
Harghita	1037
Mureş	2154
Sibiu	1801
Ilfov	1671
Bucureşti	10780
Calculation without the capital (Bucharest)	
Average	1691
Max.	5651
Min	589
Ratio max./med	3.34
Ratio max./min.	9.59

Source: Own elaboration based on INSSE figures

Moreover, map 1.1 clearly shows that the Romanian disparities show a well-defined "center-periphery" gradient in the sense that in the spatial distribution of the Romanian income (excluding Bucharest), the so called "economic center" would be represented by the regions located mainly in the West and Northwest parts of the country whereas the so called "economic periphery" would be represented by the regions located mainly in the Northeast and Southeast parts of the country. Another

alternative way of looking at the "center-periphery" gradient in Romania is by plotting GDPpc against distance to Timisoara (Figure 1.1). The results show that as we move further away from Timisoara, per capita GDP figures (on average) decreases.

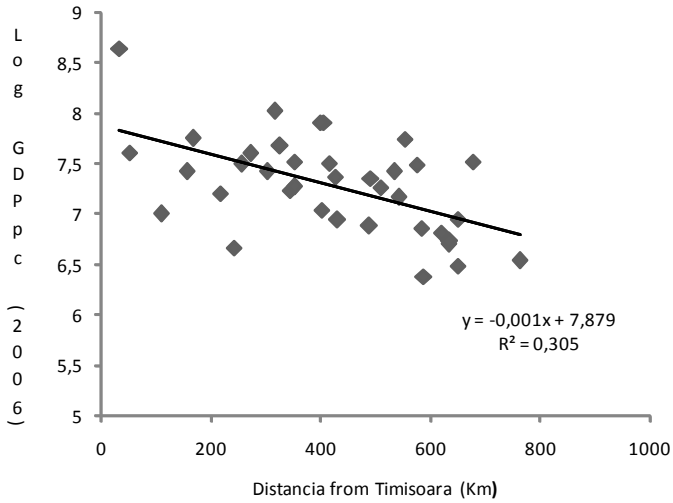
Map 1.1: GDP per Capita in Romanian Regions



(Index, Average 2006 GDPpc Romania=100)

Source: Own elaboration based on INSSE figures

Figure 1.1: GDPpc and Distance from Timisoara (Romania 2006)



(Data on Bucharest is excluded from the computations)

Source: Own elaboration based on INSSE figures

At a theoretical level there are many factors that explain why different regions within a territory do not converge. From the standpoint of economic growth theories (Barro and Sala-i-Martin, 1991, 1995) show that differences in savings rates, investment rates, skilled human capital and difficulties in technology transmission could explain this lack of convergence. Traditional theories of economic development put more emphasis on first nature geography factors, i.e. the natural advantages of different locations (access to navigable rivers, ports, airports, allocation of oil, hours of sunshine, etc.) (See Hall and Jones, 1999). Urban economics theories emphasize the external economies of scale that arise from placing relevant resources in spatial proximity, for instance in the same city, which improves productivity of firms and workers in local environments (Marshall, 1920; Henderson, 1986; Duranton and Puga, 2004).

But since the early nineties, thanks to the seminal work of Krugman (1991) which gave rise to the so called New Economic Geography, a new explanation of the phenomenon of agglomeration of economic activities in space was given by using general equilibrium models grounded in microeconomic decisions where the key ingredients are the existence of increasing returns at the firm level and transportation costs. Krugman (1991) model lead to an explanation of the agglomeration of economic activities based on the so-called second nature geography factors. This means that what is really important for seeing agglomeration dynamics is how far a location is from its consumer markets and from its input suppliers. This explanation has reached an important theoretical consolidation and can be considered a more satisfactory way of explaining the agglomeration of economic activities than the explanations based on arguments of the first nature geography. At

empirical level, Krugman (1991) model has triggered a plethora of contributions for different geographical scenarios: On the one hand it can be mentioned the contributions looking at income differences for cross country samples or cross regional samples involving different countries (Redding and Venables, 2004; Breinlich, 2006; Head and Mayer, 2006; and Lopez-Rodriguez and Faiña, 2007, and Lopez-Rodriguez et al. 2011). On the other hand, there are the contributions looking at cross regional income differences carried out at single country level (Hanson, 2005; Roos, 2001; De Bruyne, 2003; Mion, 2004; Pires, 2006). However, to the best of our knowledge, there are no studies at country level of the forces put at work in Krugman´s (1991) model for any Central and Eastern European country.

This chapter tries to fill in this gap by applying Krugman´s (1991) model to the regions in a national setting such as the case of Romania. We first derive an econometric specification which relates the income levels of a particular location with a weighted sum of the volume of economic activities of the surrounding locations (market access). Then, empirically, we estimate this econometric specification for a sample of 42 Romanian regions in the year 2006. The results of the estimations show that market access play an important role in explaining cross-county wage disparities observed in Romania. Moreover, the results of our estimations are also robust to the inclusion of control variables considered important in the explanations of wage disparities across Romanian counties such as human capital and innovation. The results therefore suggest that those Romanian counties located in the economic periphery of the country suffer from their remoteness in order to catch-up in terms of wages and development levels with the more advance ones. An obvious policy implication in this regard will be the need of implementing policy actions

to reduce transport costs directly via improvements in infrastructure (e.g. roads, ports, etc.) which in the case of Romania are still very much lagging behind.

The remaining part of the chapter is structured as follows: Section 2 introduces the theoretical framework from which the econometric specifications are derived and are used in the subsequent sections. Section 3 contains the econometric specifications which will be estimated using Romanian data. Section 4 provides information about data sources and the main variables of our analysis. Section 5 presents the results of the estimations and finally, section 6 contains a summary of the main contributions of the chapter and draws some policy conclusions.

1.2. Theoretical Framework

Our theoretical framework is a reduced form of a standard New Economic Geography model [3] (multiregional version of Krugman (1991) model) which incorporates the key ingredients to obtain the so called nominal wage equation which will constitute the workhorse of our empirical estimation.

We consider a world with R regions $(j = 1,2,\ldots,R)$, and we focus on the manufacturing sector, composed of firms that produce a great number of varieties of a differentiated good (M) under increasing returns to scale and monopolistic competition. Transportation costs of differentiated goods are in the form of iceberg costs so in order to receive 1 unit of the differentiated good in location j from location i, $T_{i,j} > 1$ units must be shipped, so $T_{i,j} = 1$ means that the trade is

[3] Other related NEG models can be seen in Fujita et al. (1999)

costless, while $T_{i,j}-1$ measures the proportion of output lost in shipping from i to j. The manufacturing sector can produce in different locations

On the demand side, the final consumers´ demand in location j can be obtained by the utility maximization of the following CES function:

$$\max_{m_{i,j}(z)} D_j \tag{1.1}$$

Where M_j represents the consumption of the differentiated good in location j. D is an aggregate of the different industrial varieties defined by a CES function à la Dixit and Stiglitz (1977):

$$M_j = \left[\sum_{i=1}^{R} \int_0^{n_i} m_{i,j}(z)^{\sigma-1/\sigma} dz \right]^{\sigma/\sigma-1} \tag{1.2}$$

where $m_{i,j}(z)$ represents the consumption of each variety z in location j and which is produced in location i, n_i is the number of varieties produced on location i, σ is the elasticity of substitution between any two varieties where $\sigma > 1$. If varieties are homogenous, σ goes to infinite and if varieties are very different, σ takes a value close to 1.

Consumers maximize their utility (function 1.1) subject the following budget constraint:

$$\sum_{i=1}^{R} n_i x_{ij}^D p_{ij} = Y_j \tag{1.3}$$

Solving the consumer optimization problem, we obtain the final demand in location j of each variety produced in location i.

$$x_{ij}^M = p_{ij}^{-\sigma} \left[\sum_{n=1}^{R} n_n p_{nj}^{1-\sigma} \right]^{-1} Y_j \tag{1.4}$$

where p_{ij} ($p_{ij} = p_i T_{ij}$), is the price of varieties produce at location i and sold at j and Y_j represents the total income of location j.

Let us define a price index for manufacturing goods as $P_j = \left[\sum_{n=1}^{R} n_n p_{nj}^{1-\sigma}\right]^{\frac{1}{1-\sigma}}$ (for the derivation and discussion of this equation, we refer to appendix A to chapter 1).

This Industrial Price Index of location j measures the minimum cost of buying 1 unit of the differentiated good M so it can be interpreted as an expenditure function. If we rewrite the expenditure on consumption as $E_j = Y_j$, the final demand at location j can be given by $x_{ij}^{consM} = p_{ij}^{-\sigma} P_j^{\sigma-1} E_j$. However, in order for x_{ij}^{consM} units to arrive to location j, $T_{i,j} x_{ij}^{consM}$ units must be shipped. As a result, the effective demand facing a firm in i from j is given by expression:

$$x_{ij}^{M} = T_{ij} p_{ij}^{-\sigma} P_j^{\sigma-1} E_j = p_i^{-\sigma} T_{ij}^{1-\sigma} P_j^{\sigma-1} E_j \qquad (1.5)$$

Turning to the supply side, a representative country firm maximizes the following profit function:

$$\prod_i = \sum_{j=1}^{R} \frac{p_{ij} x_{ij}^{M}}{T_{i,j}} - w_i^{M} (F + c x_i^{M}) \qquad (1.6)$$

The technology of the increasing returns to scale sector is given by the usual linear cost function: $l_{Mij} = F + c x_{ij}^{M}$, where l_{Mij} represents the industrial labour force needed to manufacture 1 unit at location i and sell it at location j, F are the fixed costs units which are needed for manufacturing the industrial good, c is the unit variable cost and x_{ij}^{M} is the quantity of each variety demanded at location j and produced at location i ($x_i^{M} \equiv \sum_j x_{ij}^{M}$) represents the total output produced by the

firm at location i and sold at different j locations) and w_i^M is the nominal wage paid to the manufacturing sector workers at location i.

Increasing returns to scale, consumers´ love of variety and the existence of a limited number of potential varieties of the manufacturing good mean that each variety is going to be produced by a single firm at single location. In this way, the number of manufacturing firms coincides with the number of varieties. Each firm maximizes is own profit behaving as a monopolist of its own variety of the differentiated good. First order conditions for profit maximization lead us to the standard result that prices are a mark-up over marginal costs.

$$p_i = \frac{\sigma}{\sigma - 1} w_i^M c \tag{1.7}$$

where $\frac{\sigma}{\sigma - 1}$ represents the Marshall-Lerner Price-cost ratio. The higher the ratio, the higher the monopolistic power of the firm. Krugman (1991) interprets σ as an inverse measure of the scale economies due to its interpretation as a direct measure of the price distortion and as an indirect measure of the market distortion due to the monopoly power. Since $\frac{\sigma}{\sigma - 1}$ is higher than 1, Krugman (1991) interprets this result as a proof of increasing returns to scale. Substituting this pricing rule into the profit function, we obtain the following expression for the equilibrium profit function:

$$\prod_i = \left(w_i^M \right) \left[\frac{c x_i^M}{\sigma - 1} - F \right] \tag{1.8}$$

Free entry, which assures that long-run profits will be zero, implies that no firm will have incentives to move from one location to another. This implies that equilibrium output is the following one:

$$x_i^M = \overline{x} = \frac{F(\sigma - 1)}{c} \tag{1.9}$$

The price needed to sell this many units is given by $P_i^{\sigma} = \frac{1}{\overline{x}} \sum_{j=1}^{R} E_j P_j^{\sigma-1} T_{i,j}^{1-\sigma}$. Combining this expression with the fact that prices are a constant mark-up over marginal costs in equilibrium, we obtain the following zero-profit condition:

$$w_i^M = \left(\frac{\sigma - 1}{\sigma c} \right) \left[\frac{1}{\overline{x}} \sum_{j=1}^{R} E_j P_j^{\sigma-1} T_{i,j}^{1-\sigma} \right]^{1/\sigma} \tag{1.10}$$

This equation is called nominal wage equation which constitutes the key relationship to be tested in the empirical part of this work. According to equation (10), the nominal wage level in each location depends on a weighted sum of the purchasing capacities of the different locations where the weighted scheme is a decreasing function of the distance between locations. In the New Economic Geography literature, the expression on the right hand side of equation (1.10) has been labelled with different names market access (Redding and Venables, 2004) and real market potential (see Head and Mayer, 2004)[4].

We will refer to this expression as market access and will be labelled as MA. The meaning of this equation is that access advantages raise local factor prices. More precisely, production sites with good access to major markets because of its relatively low trade costs tend to reward their production factors with higher wages.

[4] This expression is semantically analogous to the one employed by Harris (1954) but the term real refers to the fact that price difference between different locations are taken into account. The concept of nominal market potential of Head and Mayer (2004) is a concept similar to the Harris (1954) market potential

If we normalize the way we measure production, choosing the units such as that $c = \frac{(\sigma - 1)}{\sigma}$, $F = \frac{1}{\sigma}$, and defining the market access of location i as $MA_i = \sum_{j=1}^{R} E_j P_j^{\sigma-1} T_{i,j}^{1-\sigma}$, we can rewrite the nominal wage equation as:

$$w_i^M = \left[MA_i \right]^{1/\sigma} \tag{1.11}$$

This simplification of the nominal wage equation is very similar to the Harris (1954) market potential function in the sense that economic activity is more important in those regions which are close to large markets.

1.3. Econometric Specification

Taking logarithms in expression (1.11), the estimated nominal wage equation expressed in per capita terms is based on the estimation of the following expression:

$$\log(w_i) = \theta + \sigma^{-1} \log\left[MA_i \right] + \eta_i \tag{1.12}$$

Where η_i is the error term and the other variables are as defined in the previous sections. This equation relates the per capita nominal wage in county i with income in other counties, weighted by distance and price. Therefore, in accordance with the predictions of the theory, the higher the levels of income and price levels and the lower the distance between locations, the higher will be the level of local wages. This specification captures the notion of a spatial wage structure and allows us to verify the direct relationship between the nominal wage of a location and its market access which is an important condition to observe agglomeration dynamics.

However equation (1.12) is a restricted specification to analyze the potential effects market access has on wages as we cannot say whether the regression captures causality or simply captures correlations with omitted variables such as human capital, innovation and so on. To address these potential impacts and control for the possibility of other shocks that are affecting the dependent variable and are correlated with market access, we also estimate an alternative specification that explicitly takes into account the above considerations. Therefore we expand our baseline estimation (eq. 1.12) to allow for the inclusion of control variables which may be affecting cross-county wage levels by estimating the following equation:

$$Lnw_i = \theta + \sigma^{-1} \ln MA_i + \sum_{n=1}^{N} \gamma_{i,n} X_{i,n} + \eta_i \qquad (1.13)$$

where X_{in} is a vector of control variables and $\gamma_{i,n}$ the corresponding coefficient.

1.4. Data Source and Construction of variables

The data for this chapter refers to the year 2006 and was taken from different sources, National Statistical Institute of Romania (INSEE), the statistical office of the European Union (EUROSTAT) and data from various ministries of the Romanian Government.

First, the dependent variable of the model was approximated by using 2006 data on per capita GDP at county level. These data come from the Romanian National Statistical Institute.

Second, with respect to the independent variables, our main variable of interest is market access. This variable was built using 2006 data as a distance-weighted sum of the volume of economic activity in the

surrounding regions. We proxy each county´s volume of economic activity by its total gross domestic product. With respect to the calculation of the discount factor (distance between regions) it is based on the distances measured in Km between the capital cities of the 42 counties in which Romania is divided. Data on distances between capital cities was obtained from the website www.travelworld.ro. The calculation of the internal distance within each county is approximated by a function that is proportional to the square root of each county´s area. The expression used for calculation is $0.66\sqrt{\frac{Area}{\pi}}$ where "Area" represents the size of the county expressed in km2. This expression gives the average distance between two points on a circular location (see Head and Mayer, 2000; Nitsch, 2000; and Crozet, 2004; for a discussion of this measure of internal distance).

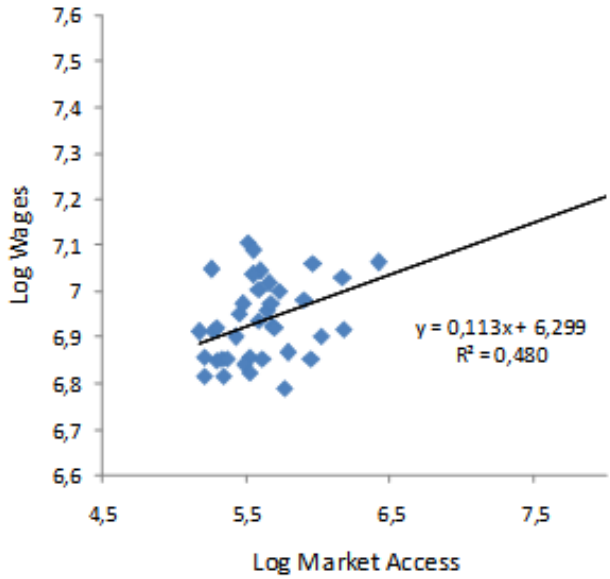
The other independent variables refer to innovation and human capital which in the model act as control variables. The reason for using these controls is based on the fact that they might be affecting our dependent variable through our market access measure. Innovation at county level is proxy by the county share on R&D expenditure (measured as the percentage of the county Gross Domestic Product). With respect to the human capital variable we consider the percentage of each Romanian county´s population that has attained secondary and tertiary education. Data for all the control refers also to the year 2006 and was obtained from the Romanian National Statistical Institute (INSEE).

1.5. Empirical Results

1.5.1. Market Access and Wages: Preliminary Analysis

In this section we present and discuss a series of graphs which give a first visual approach to the empirical estimates carried out in the next section. Figure 1.2 plots log regional per capita GDP levels on log market access. This preliminary approach shows a positive effect of market access shaping regional per capita GDP levels which is in line with the theoretical propositions derived from the model proposed in section 2 of the chapter.

Figure 1.2: Wages and Market Access (Romania, 2006)



Source: Own elaboration based on INSSE figures

In the composition of the Romanian market access, it is actually instructive to further split it up into two components, the domestic component and the foreign component. The domestic market access (DMA) of a Romanian county refers to the contribution made to total market access (TMA) by the county itself and the foreign market access

(FMA) of a Romanian county is the contribution made to total market access (TMA) by the surrounding Romanian counties. Therefore, the analysis of these two components of the TMA allows us to clarify the relative importance of each market access component and therefore we can estimate which has more impact in shaping per capita GDP at county level. Table 1.2 provides some information on the average composition of market access for the 42 Romanian counties by breaking down total market access (TMA) into its two components, the domestic component (DMA) and the foreign component (FMA).

Table 1.2: Summary Statistics on Market Access: Romania (2006)

County	DMA	TMA	DMP/ TMA	County	DMP	FMP	DMP/ TMA
Bacău	54	233	19%	**Mehedinti**	9	183	5%
Botoşani	16	183	8%	**Olt**	20	272	7%
Iaşi	115	169	41%	**Vâlcea**	20	279	7%
Neamţ	27	224	11%	**Arad**	29	204	13%
Suceava	35	173	17%	**Caras-Severin**	11	173	6%
Vaslui	14	229	6%	**Hunedoara**	26	212	11%
Brăila	15	260	5%	**Timiş**	110	149	43%
Buzău	22	364	6%	**Bihor**	44	166	21%
Constanţa	63	186	25%	**Bistriţa-Năsaud**	21	193	10%
Galaţi	46	222	17%	**Cluj**	70	187	27%
Tulcea	5	190	3%	**Maramures**	25	158	13%
Vrancea	14	278	5%	**Satu Mare**	25	152	14%
Arges	59	331	15%	**Salaj**	8	192	4%
Călăraşi	8	312	2%	**Alba**	18	209	8%
Dambovita	35	444	7%	**Braşov**	60	308	16%
Giurgiu	8	476	2%	**Covasna**	15	307	5%
Ialomita	10	319	3%	**Harghita**	11	241	4%
Prahova	99	516	16%	**Mureş**	40	227	15%
Teleorman	15	397	4%	**Sibiu**	28	280	9%
Dolj	42	227	16%	**Ilfov**	33	5633	1%
Gorj	28	203	12%	**Bucureşti**	3631	552	87%

TMA: Total Market Access DMA: Domestic Market Access TMA: Foreign Market Access

Source: Own elaboration

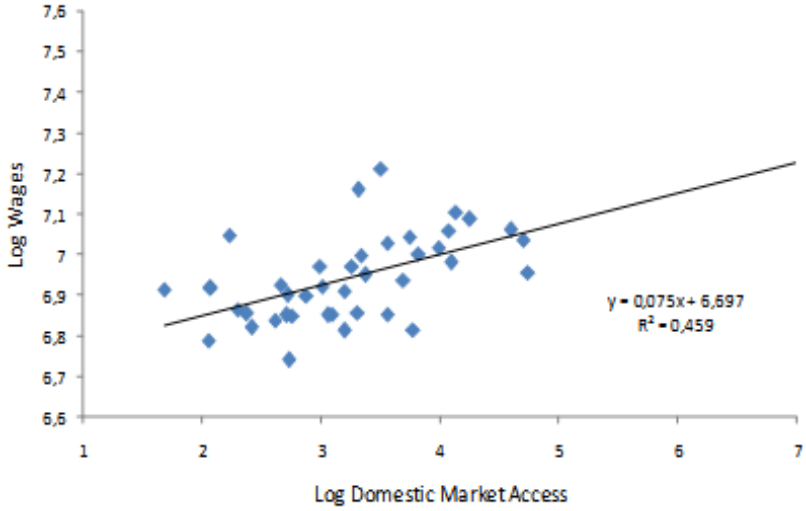
It can be seen that overall the foreign component of market access dominates the domestic component. However, excluding Bucharest, it is worth remarking the relative importance of the domestic component in

the Romanian most dynamic counties with percentages over total market access above 20% such as the cases of Iasi, Constanta, Timis, Cluj, Bihor and Bacau. Within this set of regions Iaşi county, located in the so-called Region 1-Northeast, and Timis county, Region 5-West, stand over the others with a domestic contribution to total market access above 40%. The reason behind these high values of the domestic component lies in the fact that these counties are important growth poles within the country with an important weight in both population and GDP. Timiş county, geographically situated in the west on the border with Serbia and Hungary, has a better access than other Romanian counties to the main central European markets. In fact within a 500 km radius there are four European capitals. Moreover, the county belongs to the euro-region DKMT (Danube, Cris, Mures-Tisa) jointly with other counties from Serbia and Hungary. The other case is Iasi, Romanian's most populous county with nearly 800,000 inhabitants, the ancient capital of the country (before unification) and the largest cultural center of eastern Romania. It works as a growth pole in the Region 1- Northeast. Cluj-Napoca is also an important pole of economic growth in Region 6-North West with a history marked by multiculturalism, along with the Region 7-Center, and the domination of the Austro-Hungarian Empire. These facts have made possible that Hungarian, German and Austrian investments in these regions are higher than the national average. Representative sectors in these counties are the pharmaceutical, the chemical and the high tech ones.

Figures 1.3 and 1.4 give a first approximation to the importance the domestic and foreign components of market access represent in relation to per capita GDP levels in each county. As it is shown in figure 1.4 the two components have a positive effect on per capita GDP levels observed

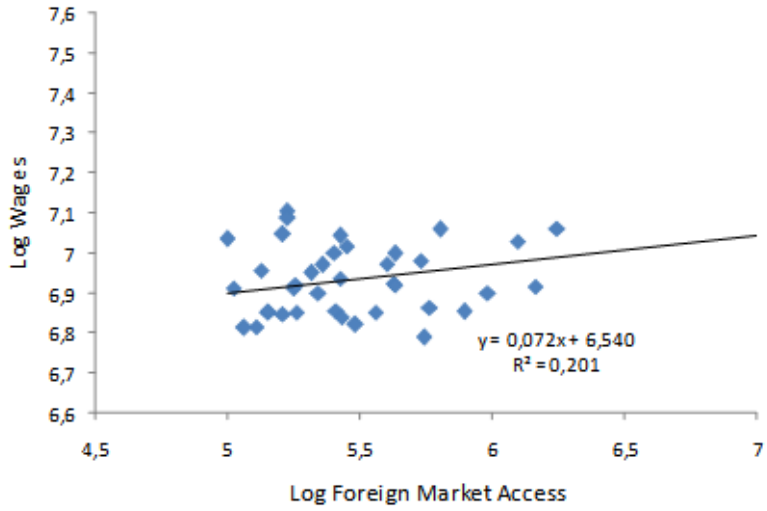
in each county but the important weight the domestic component of market access has in explaining income levels is clearly seen by the better fit of the regression.

Figure 1.3: Wages and Domestic Market Access (Romania, 2006)



Source: Own elaboration based on INSSE figures

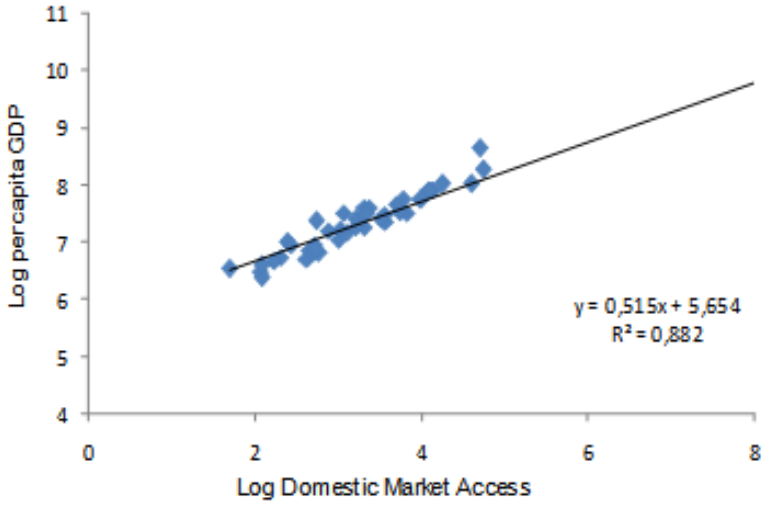
Figure 1.4: Wages and Foreign Market Access (Romania, 2006)



Source: Own elaboration based on INSSE figures

The above figures show a positive relationship between income levels, per capita GDP figures and market access for the Romanian regions. The rationale behind these effects of market access on income levels is based on the direct trade cost savings that accrue to central locations.

Figure 1.5: GDP per capita and Domestic Market Access (Romania, 2006)



Source: Own elaboration based on INSSE figures

The above figures show a positive relationship between income levels, either approximated by wages or per capita GDP figures, and market access for the Romanian regions. The rationale behind these effects of market access on income levels is based on the direct trade cost savings that accrue to central locations.

1.5.2. Baseline Estimations: OLS Estimations

Table 1.3 presents the results of different estimations of equation 1.6 for the 42 Romanian counties in the year 2006. In column 1 we regress per capita GDP levels on total market access (foreign plus domestic) using OLS.

Table 1.3: Market Access and Romanian Income: Baseline Estimations (Romanian Regions, 2006)

Dependent Variable	Log Wages 2006					
Regressors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Constant	6.29** (0.11)	6.26** (0.13)	6.69** (0.04)	6.54** (0.13)	6.38** (0.23)	6.28** (0.13)
Log MA2006	0.11** (0.02)	0.12** (0.02)				
Log DMA2006			0.07** (0.01)			
Log FMA2006				0.07** (0.02)		
Log MA2006					0.09** (0.04)	0.12** (0.02)
Estimation	OLS	IV	OLS	OLS	IV	IV
Inst. variables First stage R2		0.66			0.22	0.73
First Stage (t-statistic)		8.60			3.51	3.29(av.d) /8.29(size)
Hansen J Statistic		Exactly identified			Exactly identified	3.11
R2	0.48	0.47	0.40	0.20	0.47	0.48
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.00
Number observations	42	42	42	42	42	42

Note: Table displays coefficients and Huber-White heterocedasticity robust standard errors in parenthesis;** denotes statistical significance at 5% level ,* denotes statistical significance at 10% level; "First stage" R2 is the R2 from regressing market access on the instruments set, Instruments: region Size Column (2), Average Distance (5) and Average Distance and region Size (6)

Source: Own elaboration

The estimated coefficient on market access is positive and statistically significant at 5% level and the R2 of the regression is 0.48. This first result is in line with the theoretical expectations, showing that doubling a county market access would increase its income by 11%. As a robustness test, column (3) enters log domestic market access[5] and column (5) enters log foreign market access[6] as separate terms in the regression

[5] The Domestic Market Access (DMA) of a region "i" refers to the contribution made to total market access (MA) by the region itself.

[6] The Foreign Market Access (FMA) of a region "i" refers to the contribution made to total market access (MA) by the regions surrounding region "i".

equation. Theory tells us that this regression is misspecified, and we see that the R2 is lower than with the correct specification (column (1)). However, both terms are positively signed and statistically significant at the 5% level.

However, the use of market access as the only regressor brings the problem of reverse causality in the sense that in its computation we include the Gross Domestic Product of each Romanian county which in turn is increasing in per capita GDP as captured by the dependent variable, log per capita GDP. This endogeneity problem can cause inconsistent and biased estimates. In order to address this issue, we use instrumental variables to estimate the effect of market access on income levels.

A. Instrumental Variables

One concern that arises in the estimation of the effect of market access on income levels is that there is a third variable that explains variations in both, market access and income. As a way to deal with this concern, we use instrumental variables. These variables need to generate a variation in income levels only through their impact on market access. Based on these premises, following other studies carried out on spatial economic issues linked to the nature of this research (Breinlich, 2006; Lopez-Rodriguez et al., 2007; and Redding and Venables, 2004), and considering the specific features of Romania´s spatial structure we have isolated variations in market access that can be assumed to be exogenous to the different kind of shocks that could be affecting market access. Geographical variables are the most suitable candidates for such instrumental variables estimation due to their exogeneity with respect to market access. Therefore, we instrument market access with a different set of instruments: In column 2 we instrument market access with the

county's size expressed in km2. This instrument captures the advantage of large regional markets in the composition of the domestic component of market access. In column 5 we instrument market access with the average distance of each county to the surrounding ones. This instrument captures the market access advantages of locations close to the economic centre of Romania. In column 6 we instrument market access with average distance and with county´s size. We chose to estimate a cross-sectional instrumental variable model (columns 2, 5 and 6) instead of a panel data one for two reasons: First, there is neither enough data on Romanian regions nor reliability of the data to build up a panel and second our potential instruments, area of the region and the average distances, are time invariant variables.

Following the theory on IV estimation, the instruments proposed need to pass two tests: the "first stage" restriction, which tests whether the variation in the instrument is correlated to the variation in the endogenous variable –in this case, market access–, and the exclusion restriction, which cannot be tested empirically.

Formally, we can represent the Two –Stage Least Square estimation we are going to implement in the following way:

$$\ln \hat{MA}_i = \theta + \beta Z_i + \sum_{n=1}^{N} \gamma_n X_{i,n} + \varepsilon_i \qquad (1.14)$$

$$Lnw_i = \theta + \sigma^{-1} \ln \hat{MA}_i + \sum_{n=1}^{N} \gamma_n X_{i,n} + \eta_i \qquad (1.15)$$

Where MA is the endogenous regressor, on the outcome *Lnw* and *Z* is the instrument set we are going to use. In the same way, we can represent the aforementioned restrictions:

- First Stage Restriction: $\beta \neq 0$
- Exclusion Restriction: $\mathrm{cov}(Z_i, \eta_i) = 0$

The instrument "total area of each county expressed in km2" is significant in the first stage and explains 66% of the variation in Romania´s regional market access. The instrument "average distance of each county to the surrounding ones" is also significant but its explanatory power on market access decreases to 22%. The use of both instruments together is also significant and the explanatory power increases to 73%. The F-test of the null hypothesis that the coefficients on the excluded instruments are equal to zero is 0.00. However, as a rule of thumb, when there is a single endogenous regressor, a first stage F-statistic less than 10 indicates that the instruments are weak (see Stock and Watson, 2007). The heart of this problem lies in the fact that we only have 42 cross-sectional observations for Romania which can be rather problematic when drawing harsh conclusions based on inference. Since the instruments represent quite distinct source of information and are uncorrelated, we can trust them to be reliable instruments[7]. Moreover, the test of the model's overidentifying restrictions cannot reject the exogeneity of these variables (see column 6). In the second-stage wage equation, we again find positive and highly statistically significant effects of market access on Romanian per capita GDP, with the IV estimate of the market access coefficients close to those estimated using OLS. The intuitive interpretation of the results presented in Table 3 suggests that high market access counties have a better access to consumer markets. Therefore as manufacturing firms have to sell their output in different locations incurring in transportation cost, the added value that remains

[7] The goodness of the instruments is proved with the Sargan test, which contrasts the null hypothesis that a group of s instruments of q regressors are valid. This is a χ^2 test with (s–q) degress of freedom that rejects the null when at least one of the instruments is correlated with the error term (Sargan, 1964). In our case, the null hypothesis is not rejected at 5%, validating the use of the instruments.

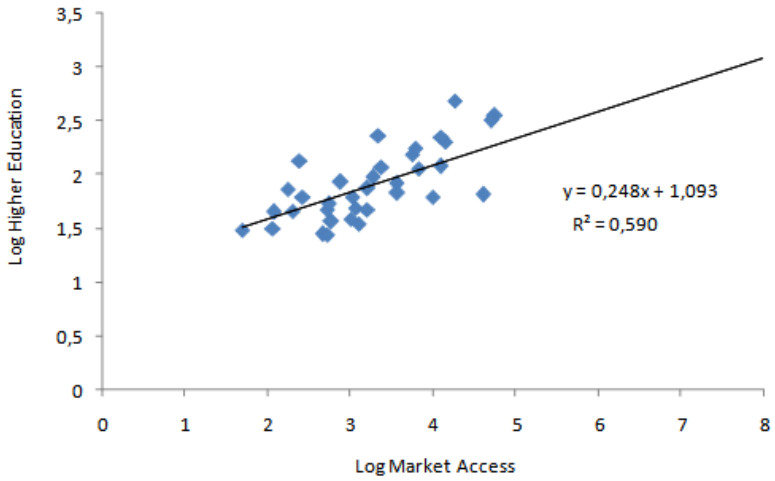
to pay local factors of production, among them labour, is higher in central locations (high market access) than in remote ones.

B. Robustness Checks

The above analysis shows a positive relationship between wage levels and market access. However these positive relationships may be due to third variables that are affecting regional income levels through the market access and which might be working through the incentives centrality provides in terms of benefiting higher levels of human capital, innovations and so on. In fact, high market access provides more long-run incentives for invest in human capital by increasing the premium for skilled labour. As Redding and Schott (2003) argue, this will be the case if intermediate and trade cost intensive goods are also relatively intensive in that production factor. Indeed, stocks of human capital are highly correlated with market access in the Romanian regions under study here, at least for the period for which data are available (2006). Innovative activity is also affected by spatial proximity and geography. The interaction of high market access in dense and central Romanian regions which makes them large and profitable markets for innovation, together with increasing returns to innovation and localization of the knowledge spillovers, seem to explain the pattern of high concentration of innovative activities in the so called “economic center” of Romania such as the capital, Bucharest, with a significant weight in sectors such as the pharmaceutical (over 90%) and other regions, Iasi and Cluj Napoca which have the monopoly of production of certain drugs. Other growth poles where innovative activities are important are the cities of Timisoara, Constanta, Galati, Craiova and Ploiesti that have focused on the chemical industry.

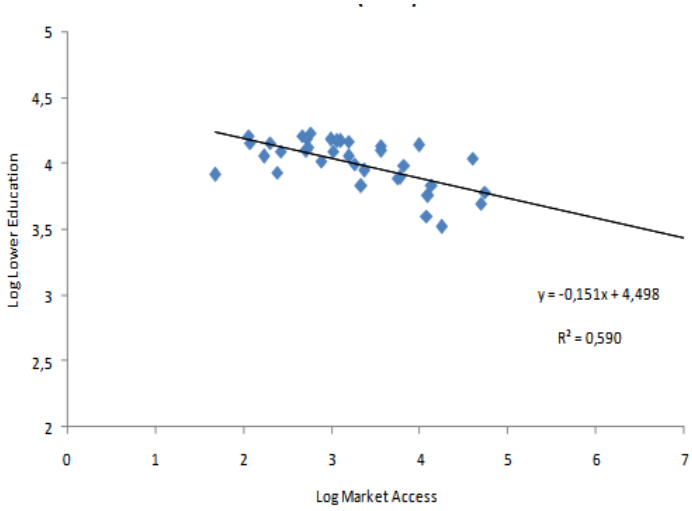
The next panel contains 3 figures (figure 1.6 to figure 1.8). The first two figures of the panel plot the percentage of individuals with secondary and tertiary education in each Romanian county (log Higher Education, Figure 1.6) and the percentage of individuals with primary educational attainment levels (log Lower Education, Figure 1.7) against market access, where the second panel (Figure 1.8) does the same for the expenditure on R&D activities. As is already apparent in the figures, market access shows a positive correlation with high and intermediate levels of education and the expenditure on R&D activities and a negative correlation with primary education. Although naturally there are a large number of alternative determinants of human capital accumulation and the size of R&D activities, this finding is at least supportive of a potential long-run impact of market access.

Figure 1.6: Secondary and Tertiary Education and Market Access (Romania, 2006)



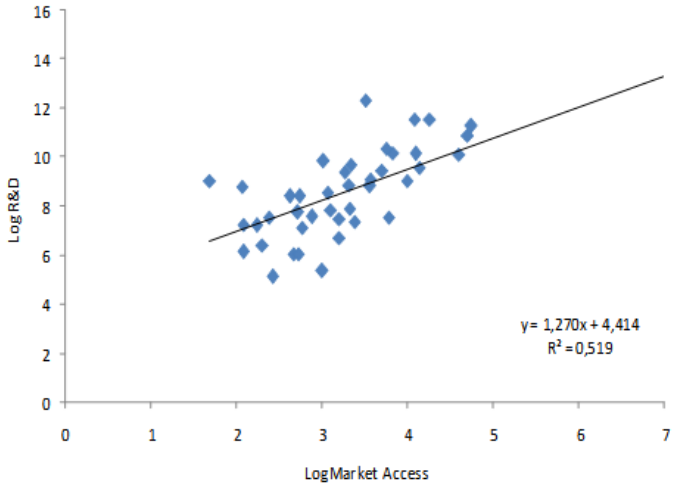
Source: Own elaboration based on INSSE figures

Figure 1.7: Primary Education and Market Access (Romania, 2006)



Source: Own elaboration based on INSSE figures

Figure 1.8: R&D Expenditure and Market Access (Romania, 2006)



Source: Own elaboration based on INSSE figures

As is already apparent in the figures and confirmed in the regression results reported in Table 1.4, market access shows a significantly positive correlation, high and intermediate levels of education and with R&D expenditures.

While a more detailed investigation of the role of market access in affecting human capital formation and the size of R&D activities is beyond the scope of this chapter, we will try to answer a related question. Therefore, assuming that a significant portion of the advantages of centrality operates through accumulation incentives, what is the importance of the direct trade cost advantage central to the theoretical part of this chapter? A straightforward way of testing this is by including human capital and the size of R&D activities as additional repressors in the baseline specification estimated earlier.

Table 1.4: Market Access, Human Capital and R&D Expenditure (Romanian regions, 2006)

Dep. Variable:	Log (Higher Education)	Log (Lower Education)	Log (R&D Expenditure)
Regressors			
Constant	1.09** (0,16)	4,49** (0.07)	4.41** (0,6)
Log MA2006	0,25** (0.03)	-0,15** (0.02)	1.27** (0,19)
Estimation	**OLS**	**OLS**	**OLS**
R2	0,59	0,59	0,52
N. observations	42	42	42

Notes: Table displays coefficients and Huber-White heterocedasticity robust standard errors in parenthesis; MA2006 refers to the market access index for the year 2006 computed using gross domestic product as a proxy for the volume of economic activity
** indicates coefficient significant at 5% level * significant 10% level

Source: Own elaboration

The next table, table 1.5, presents our preferred specification of the relationship between market access and per capita GDP levels where we use as control variables the ones mentioned above which could be affecting per capita GDP levels through the market access (equation 1.13). Therefore we control for cross-county variation in the levels of human capital and for the size of R&D expenditures. The first control variable, human capital, is measured (in logs) as the 2006 percentage of individuals with secondary and tertiary education in each Romanian

region (labelled as log Higher Education). The second control variable, size of R&D expenditure gathers 2006 regional expenditures on R&D activities (also measured in logs).

Table 1.5: Market Access and Regional Income: Extended Estimations (Romanian Regions, 2006)

Dependent Variable	Log Wages 2006			
Regressors	(1)	(2)	(3)	(4)
Constant	6.10** (0.10)	6.10** (0.19)	6.10** (0.19)	6.13** (0.11)
Log MA2006	0.11** (0.02)	0.11** (0.03)	0.09** (0.02)	0.09** (0.02)
Log Higher Education 2006	0.11** (0.02)	0.11** (0.02)	0.07** (0.03)	0.07** (0.03)
Log R&D Expenditure 2006			0.02** (0.001)	0.01** (0.001)
Estimation	OLS	IV	OLS	IV
Inst. Variables First stage R2		0.73		0.73
First Stage (t-statistic)		3.29 (av.d) /8.29 (size)		3.29 (av.d) /8.29 (size)
Tests		Value		p-value
Jarque-Bera Normality test		0.610		0.987
Breusch-Pagan		2.114		0.549
Koenker-Bassett		1.540		0.672
White		13.548		0.139
Moran's I (error)		0.981		0.326
Lagrange Multiplier (lag)		1.099		0.294
Lagrange Multiplier (error)		0.309		0.578
R2	0.65	0.66	0.69	0.69
Prob (F-statistic)	0.00	0.00	0.00	0.00
Number observations	42	42	42	42

Note: Table displays coefficients and Huber-White heterocedasticity robust standard errors in parenthesis, ;** denotes statistical significance at 5% level ,* denotes statistical significance at 10% level; "First stage" R2 is the R2 from regressing market access on the instruments set, Instruments: Average Distance to other regions and region´s size

Source: Own elaboration

Columns 1 to 4 contain a summary of the estimation of equation 1.13. In Colum 1 we regress (OLS estimation) county per capita GDP levels on the total market access and controlling for human capital. The results of the

estimation show that the coefficients are in line with the expectations and the coefficient of our main variable of interest, market access, is positive and statistically significant. Moreover its value is the same as in the baseline estimation, column 1 Table 1.3. On the contrary, the explanatory power of the regression has increased seventeen percentage points from the baseline estimations (0.48% to 0.65%). In column 3 we add as an additional control variable to the estimation in column 1 the size of R&D expenditures (OLS estimation). Even in this case, with the inclusion of both controls, the estimation still reports a positive and statistically significant market access coefficient. However, the value of the market access coefficient declines around 25% moving from 0.12 (column 6, Table 1.3) to 0.07. Still in this case if we double the market access, county per capita GDP would increase by 7% after controlling for human capital and for the size of R&D expenditures. The explanatory power of the regression increases around 43%, (from 0.48% to 0.69%).

In order to address the potential reverse causality problem of market access, as we did in the earlier estimations (Table 1.3), we instrument total market access with each county average distance to other counties and with county size. Columns 2 and 4 of table 1.4 report the results using IV estimates. As we can see from the estimations, the results back the ones obtained in the OLS estimations with no changes in the coefficient estimates.

Although these results show some variability in the estimated coefficient on market access (with respect to the baseline estimations), it always retains both economic and statistical significance. This provides evidence that the estimated market access effects are not being driven by unmodelled (third) variables correlated with both market access and county per capita GDP. In the light of these results, it seems likely that

access to sources of demand is indeed an important factor in shaping the regional wage structure in Romania.

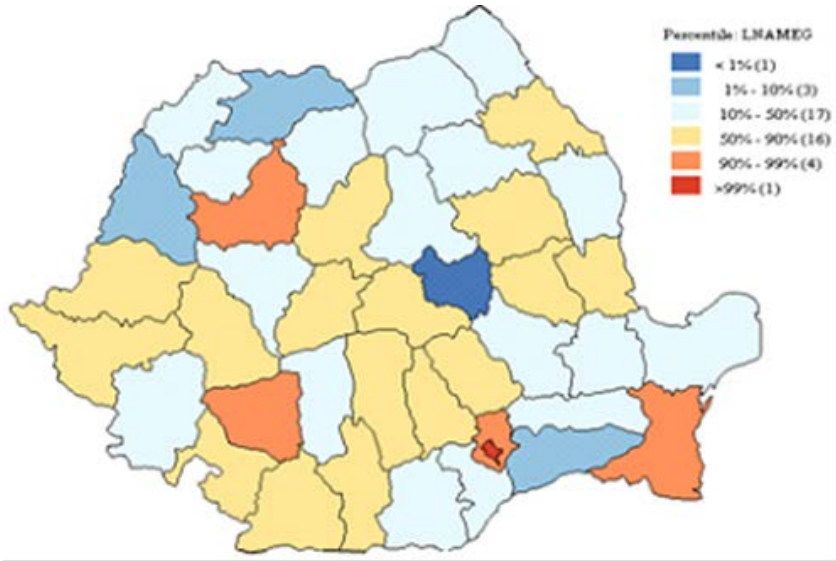
C. Spatial Dimension

Another additional goal of this section is to shed further light on the analysis derived from equation (1.12 and 1.13) by broadening the empirical analysis by considering the spatial dimension. In this sense, the geographic dimension of the dependent variable is explored by using an exploratory spatial data analysis (ESDA) approach. This analysis will help with the identification of the type of spatial pattern present in the distribution of per capita GDP levels across the Romanian counties. All computations were carried out by using SpaceStat 1.91 (Anselin, 2002), GeoDA (Anselin, 2003) and ArcView GIS 3.2 (ESRI, 1999) software packages. First, we test global spatial autocorrelation for the initial per capita GDP levels by using Moran's I statistic (Cliff and Ord, 1981), $I = \frac{N}{S_0}\frac{z'Wz}{z'z}$, where N is the number of Romanian counties, $S_0 = \sum_i \sum_j w_{ij}$, z_{it} is the log of wages in county *i* at time *t*=2006 in deviation from the mean, *W* was defined expressing for each county (row) those counties (columns) that belong to its neighborhood. Formally, w_{ij}=1 if county *i* and *j* are neighbors, and w_{ij} =0 otherwise. This simple contiguity matrix ensures that interactions between counties with common borders are considered [8]. For ease of economic interpretation, a row-standardized form of the *W* matrix was used. Thus, the spatial lags terms represent weighted averages of neighboring values.

[8] Other alternative definitions for the spatial weights matrix were considered. Specifically, defining their elements as the inverse of the distances, and considering the median of the great circle distance distribution, the lower quartile, the upper quartile and the maximum distance. These matrices generated results very similar to those presented in this paper.

The value of *I* for the log of per capita GDP (LNAMEG) is 0.2089. The expected value for this statistic under the null hypothesis of no spatial correlation is E[I]=-0.0244. It appears that LNAMEG is spatially correlated since the statistic is significant with p=0.0140. This initial result therefore reveals the existence of a pattern of positive spatial dependence in the distribution of county wages in Romania. Map 2 shows the spatial distribution of county wages in Romania in 2006. Figure 3 provides a view that there is spatial autocorrelation in this year through the Moran scatterplot [9].

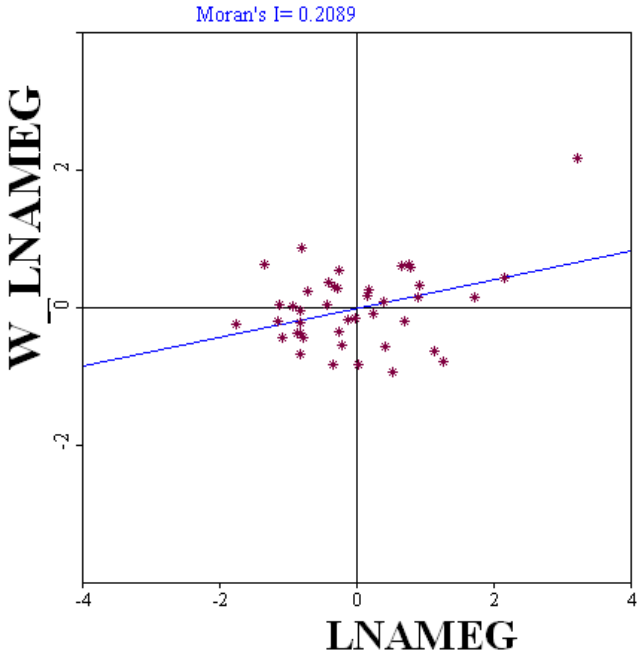
Map 1.2: Spatial percentile distribution for the log of Wages in 2006, (LnAMEG)



Source: Own elaboration based on INSEE data

[9] The Moran scatterplot displays the spatial lag *W log(GDPpc)* against *log(GDPpc)*, both standardized. The four quadrants of the scatterplot identify the four different types of local spatial association between a province and its neighbours (Anselin, 1996): quadrants I (*High* income-*High* spatial lag) and III (*Low* income -*Low* spatial lag) correspond to positive spatial autocorrelation while quadrants II (*Low* income -*High* spatial lag) and IV (*High* income -*Low* spatial lag) refer to negative spatial dependence.

Figure 1.9: Moran scatterplot for the log of Wages in 2006



Source: Own elaboration based on INSEE data

Starting from model 4 in table 1.5 different diagnostics for spatial dependence were carried out. The results of these diagnostics are presented in table 1.5. It is important to mention that no problems were revealed with respect to a lack of normality (residuals from this regression are normally distributed, since the Jarque-Bera test does not reject the null hypothesis of normality), and there is no evidence of the existence of heteroskedasticity (Breusch-Pagan, Koenker-Bassett test, White). The value of the Morans' I for the residuals is 0.98 and the null hypothesis of no spatial correlation is not rejected (p-value 0.326); it becomes clear that there would be no evidence for the adoption of a spatial model (The Lagrangre Multiplier (error) test and the Lagrange Multiplier (lag) test are not significant).

1.6. Final Remarks and Conclusions

In this chapter we have built a New Economic Geography model an estimate an econometric specification which relates the levels of per capita GDP levels paid in each location with an index of the degree of accessibility to consumer markets in that location. The estimations have being performed for a sample of 42 Romanian regions for the year 2006. The chapter reports two main results: From our baseline estimations we have shown that market access play an important role in shaping the spatial wage structure observed in Romania. This first result has to be interpreted with caution insofar as the instruments for market access are weak. Turning to our preferred specification, our results also point to the fact that there are (at least) two important channels through which market access might be affecting the Romanian spatial wage structure which are human capital levels and regional innovation sizes. Therefore, these results emphasize the role of market access in avoiding Romanian wage differences to be bid away and so in acting as a penalty for the economic catching up of the poorest Romanian regions towards the more developed ones. This result has a clear implication in policy terms: as regions cannot change their location, i.e. regions cannot move, an obvious policy implication in this regard will be the need of implementing policy actions to reduce transport costs directly via improvements in infrastructure (e.g. roads, ports, etc.) which in the case of Romania are still very much lagging behind.

In addition, our results propose that regional human capital levels and the size of regional innovation activities may be hampered as well by market access and therefore be also affecting income levels. Therefore, due to this lack of a natural tendency for a favorable evolution of these two variables in the Romanian low market access regions, there is a need

for policy measures to partially offset the penalties impose by economic remoteness regarding human capital and innovation. As a matter of example the policy priorities in Romania should be focused on creating economic incentives for developing entrepreneurship, promoting effective regional innovation systems involving firms, research centers and universities which will allow the growth of the global stock of knowledge, fomenting long life learning (in Romania only two people in a hundred are involved in long life learning), favoring the acquisition of IT equipment in firms (the percentage of IT equipment spending in relation to GDP in Romania is ten times smaller compared with the EU-25). Regarding these policy priorities, Romanian own policies will be benefited by its EU membership especially through the EU Regional Policy which will channel an important part of its funds (as far as structural funds is concerned) via improvements in infrastructure, human capital and aids to the productive sectors. At this respect, how efficient and how well Romanian regional authorities will manage and spend the EU funds will be very important to the future of regions lagging behind.

This research is open for further analysis. Perhaps one of the first straightforward research avenues is to perform a panel data exercise as new data on Romanian regions becomes available. Panel data regressions have the advantage that time and regional fixed effects can be introduce in the analysis as well as possibilities for first differencing. This type of analysis (Fixed effects and first differences) will eliminate or significantly reduce problems arising from heterogeneity of regions and also will remove the influence of regional outliers (such as the case of the capital, Bucharest). Another important research avenue to analyze in future extensions of this chapter is to consider other hypotheses that can compete in explaining the spatial wage structure observed in Romania. In

this respect the recent and converging debate on the interplay of human capital externalities theories and urban wage premium theories suggested in Halfdanarson et al. (2008) seems a worthwhile undertaking[10]. Very recently the collection of reliable micro-data on workers individual features in some countries has allowed performing very fine econometric studies to estimate the effect of individual skills in existing spatial wage disparities. Using French micro-data Combes et al. (2008) show that spatial sorting by skills is very important in explaining spatial wage disparities. In Spain, Puga and De la Roca (2010) have exploited a micro data base (based on Spanish social security records which traces over time the working places and the salaries for a very large sample of individuals) to analyze the dynamic effects in wages of working in dense cities. Once this kind of micro data becomes available for more countries (among them Romania) it would really interesting to enlarge the geographical focus of this type of studies and test for the robustness of the aforementioned studies. Finally, it will also be important to seek alternative channels that may be affecting per capita GDP levels in addition to human capital and innovation.

[10] We thank to a referee for point out this possibilities for future extensions of this research

Chapter 2: Economic Geography, Human Capital and Policy Implications in Romanian counties[11]

Abstract

This chapter looks at the link between human capital and geographical location for the Romanian regions based on the theoretical model developed in Redding and Schott´s (2003) chapter. Using 2006 data on the different educational attainment levels for the 42 Romanian regions, it identifies that the percentage of individuals with medium and high educational levels is affected positively by the regions´ market access. Doubling market access would increase the percentage of individuals with medium and high educational levels between 22-25%. We also disentangle the effects market access can have on higher educational attainment levels by looking for third variables that might be affecting regional educational levels and which work through accumulation incentives. Some policy implications to overcome the costs remoteness imposes on human capital accumulation in Romania are also drawn.

Key Words: Geographical location, Market Access, Human Capital, Romania

JEL Classification: R11, R12, R13, R14, F12, F23

[11] A version of this chapter has been published as a working paper N.522/2010 of the Colección de Documentos de Trabajo de la Fundación de las Cajas de Ahorros (FUNCAS) and as Lopez-Rodríguez, J., Faiña A. and C. Bolea-Gabriel (2011) The Effects of Economic Geography on Education in Romania, **Theoretical and Applied Economics**, Vol XVIII, 2(555), pp. 101-110.

2.1. Introduction

Human capital can broadly be defined as "...*the productive resources that focus on work resources, skills and knowledge*" (OECD) or "*human skills and capabilities generated by investments in education and health*" (WHO). From these definitions it is clear that human capital must play an important role in the economic development of countries and regions. In fact, aggregate human capital at national or regional level has been a recurrent variable in economic growth models (Barro, 1991, 1997; Barro and Lee, 1994; Benhabib and Spiegel, 1994; Englander and Gurney, 1994; Hanushek and Kim, 1995; Islam, 1995). However, despite of the wide scholarly agreement of its impact on economic growth there is little consensus on the exact contributions of the different measures and indicators of human capital to economic development (Levine and Renelt, 1992; Rodriguez-Pose and Vilalta-Buffi, 2005). Another important issue related to human capital and economic development and far less studied is the role the economic geography of a country or a region plays with respect to this relationship. At this point the fairly new branch of the spatial economics known as New Economic Geography (NEG) (Krugman 1991, 1992) has emerged as a new theory which emphasizes the role *second nature geography* variables or economic geography variables play with respect to the spatial distribution of income and human capital across countries or regions as oppose to the role played by *first nature geography* [12] variables (Hall and Jones, 1999).

[12] By first nature geography we refer to the physical geography of a country (natural endowments, climate conditions, access to ports, airports, navigable rivers and so). Second nature geography refers to the economic geography, i.e. how far a country or region is from its consumer markets and from its input suppliers.

The emphasis of a large number of empirical studies in the NEG literature has been put on the effects economic geography have on either cross-country or cross-regional per capita income differences. This has been done by testing the well-known theoretical proposition that arises in standard core-periphery NEG models which is refer to as the nominal wage equation (Brakman et al., 2004; Breinlich, 2006; Hanson, 2005; Overman et. al., 2003; Redding and Venables, 2004; Lopez-Rodriguez and Faiña, 2007). However, recent theoretical developments within the NEG literature (Redding and Schott, 2003) has allowed to extend the empirical investigations to the analysis of the effects geographical location have on human capital accumulation.

Redding and Schott´s (2003) pioneering paper extend a standard two-sector New Economic Geography model to demonstrate that being located on the economic periphery can reduce the return to skills, thereby reducing incentives for investment in human capital accumulation. To our Knowledge, the only empirical investigations of Redding and Schott´s (2003) paper were carried out by Lopez-Rodriguez et al. (2007) for a cross-regional setting of 205 NUTS2 regions in the European Union and by Can Karahasan and Lopez-Bazo (2011) for the Spanish provinces. Lopez-Rodriguez et al. (2007) paper provides evidence that in the case of the European Union (EU) there is a spatial educational attainment structure, i.e., educational levels are higher in regions located in the economic center of the EU than in the regions located in the economic periphery. Can Karahasan and Lopez-Bazo (2011) results for the Spanish provinces indicate that the estimated impact of market access vanishes and becomes non-significant once we control for the industrial mix and the spatial dependence in the distribution of human capital. These results jointly with those which relate the effects that

economic geography has on cross-country and cross-regional per capita income can be considered as an additional prove of the penalty remoteness imposes for economic development and therefore for the convergence of countries and regions. However, much more empirical studies on the relationship between human capital and location are needed. So far, there is only one paper at country level on the forces put at work in Redding and Schott´s (2003) paper.

This chapter tries to fill in this gap by applying Redding and Schott´s (2003) framework to the regions in a national setting such as the case of Romania. The chapter stresses, for the case of the 42 Romanian regions, the importance of geographical location in human capital accumulation, showing that the percentage of individuals with medium and high educational attainment levels depends positively on the region´s market access whereas the opposite occurs for low educational attainment levels.

The rest of the chapter is structured as follows: section 2 contains the theoretical framework in which the relationship between human capital accumulation and geographical location is established. Section 3 presents the econometric approach and data. Section 4 discusses the econometric results on the link between educational attainment levels and remoteness. Finally section 5 presents the main conclusions and some policy implications.

2.2. Theoretical framework

The theoretical framework presented in this chapter is a short version of the Redding and Schott (2003) New Economic Geography model (NEG henceforth). The difference of our model with Redding and Schott´s

(2003) model is in the modelling of the role played by intermediate goods. Contrary to Redding and Schott´s (2003) model we assume that the production of manufactured goods is carried out without using intermediates in the production of final output. The difference of this model with respect to standard two-sector NEG models such as Fujita et al. (1999) or Krugman (1991) is based on the introduction of endogenous human capital accumulation. To account for this new feature we consider a world in which we have R locations $i \in \{1,....,R\}$ and each location have a mass of consumers Li. We assume that consumers are endowed with one unit of labour which is offered inelastically with zero disutility and that consumers choose endogenously whether to invest or not in becoming skilled. In the decision of becoming skilled a worker has to compare the costs of education to acquire those skills with the future benefits of been skilled, which for the purposes of this chapter can be summarized in the higher wages skilled workers perceive. Therefore, the critical part of the model is constructed over the individuals' human capital investment choice, which is formulated as:

$$w_i^s - w_i^u \geq \frac{h_i}{a(z)} w_i^u \tag{2.1}$$

Where w_i^s and w_i^u represents the wage level of skilled and unskilled workers respectively. The gap in the left-hand side of (2.1) is the wage premium, which should be higher than the cost of education defined in the right-hand side so that individuals have incentives to invest in education. The cost of education comprises two components: $a(z)$ represents individuals' ability to become skilled, which lowers the cost of education, and h_i which accounts for the institutional environment and the public provision of education defined as an inverse

measure, i.e., increasing h_i raises the cost of private education. From equation (2.1), Redding and Schott (2003) derived a skill indifference condition:

$$a^*_i = \frac{h_i}{\left(w_i^s / w_i^u - 1 \right)} \tag{2.2}$$

Hence, a_i^* represents a critical level of ability at which individuals are indifferent to becoming skilled or remaining unskilled. As the relative wages of skilled workers increase, the cut-off for this critical level of ability falls. In turn, this means that the number of individuals with an economic incentive for becoming skilled increases. Therefore, it is the magnitude of the relative wage that determines the individuals' decision to invest in human capital.

In the same way as in standard models of NEG, this model assumes homothetic utility functions and the same preferences for all consumers, which are defined for the consumption of a homogeneous agricultural good and a set of differentiated manufactured goods. Focusing on the agriculture and manufacturing equilibrium conditions of the model, it is easily to endogenized human capital accumulation as a function of the geographical location of the regions.

The agricultural sector produces a homogeneous good under conditions of constant returns to scale. The production function can be given by the following expression:

$$Y_i = \theta_i^Y (S_i^Y)^{\phi} (L_i^Y)^{1-\phi}, \quad 0 < \phi < 1 \tag{2.3}$$

Y_i represents the output of the agricultural sector. In this sector the output is produced using a ϕ share of skilled workers and a $1-\phi$ share of unskilled workers. θ_i is a parameter representing the agricultural productivity in each location.

The manufacturing sector produces differentiated goods according to a technology which presents increasing returns to scale and where the production of each variety requires only primary factors of production (skilled and unskilled labour). The profit function of a typical firm at location i can be given by the following expression:

$$\prod_i = \sum_{j=1}^{R} \frac{P_{ij}^M x_{ij}}{T_{ij}^M} - (w_i^S)^{\alpha} (w_i^U)^{1-\alpha} c_i (F + x_i) \qquad (2.4)$$

Where P_{ij}^M is the price at location j of one unit produced at location i, w_i^S is the wage of skilled workers with a share (α) in the total costs, w_i^U is the wage of unskilled workers with a share ($1-\alpha$) in the total costs, c_i is a marginal input specific to each location representing a technology index. F is a fixed cost of production and $x_i = \sum_{j=1}^{R} x_{ij}$ is the total output produced by the company for all markets it serves. Manufactured goods are traded between different locations incurring iceberg transportations costs, in other words a fraction of the good carried from location i to location j is melt in transit, so that for one unit to reach location j $T_{ij}^M > 1$ units must be sent from i location. Regarding to the producer's equilibrium, the agricultural sector operates under a scheme of perfect competition which implies that price must be equal to the marginal costs of production:

$$P_i^Y = 1 = \frac{1}{\theta_i^Y}(w_i^S)^{\phi}(w_i^U)^{1-\phi} \quad (2.5)$$

As we choose the output of agricultural good as numeraire, we assign a price equal to 1 so that $P_i^Y = 1$ for all goods produced in different i locations.

Once we solve for the first order conditions of profit maximization, the expression in the manufacturing sector implies:

$$(w_i^S)^{\alpha}(w_i^U)^{1-\alpha} = \xi c_i^{-1}(MA_i)^{\frac{1}{\sigma}} \quad (2.6)$$

where $\xi = \frac{\sigma - 1}{\sigma}$ is a constant, c_i is the parameter that reflects differences in technology between locations, $MA_i = \sum_{j=1}^{R}(T_{ij}^M)^{1-\sigma}E_j G_j^{\sigma-1}$ is the market access at location i, σ the elasticity of substitution between varieties of manufactured goods, E_j represents the total expenditure on manufacturing goods at location j and G_j is the price index for them. The expression (2.6) is another way of conceiving the nominal wage equation from standard core-periphery NEG models. The wage equation in (2.6) "pins down the maximum wages of skilled and unskilled workers that a firm in country i can afford to pay, given demand for its products (…), and given the cost of intermediate inputs (…)" (Redding and Schott, 2003 p. 523).

Combining the zero profit conditions of the constant returns to scale sector (agriculture) and of manufacturing with the skill indifference condition in (2.2), Redding and Schott (2003) are able to characterize the equilibrium relationship between geographical location and endogenous

human capital investments. Taking logarithms and totally differentiating expressions (2.5) and (2.6) an expression that relates geographical location with endogenous human capital investments can be obtained.

$$0 = \phi \frac{dw_i^S}{w_i^S} + (1-\phi)\frac{dw_i^U}{w_i^U} \tag{2.7}$$

$$\alpha \frac{dw_i^S}{w_i^S} + (1-\alpha)\frac{dw_i^U}{w_i^U} = \frac{1}{\sigma}\frac{dMA_i}{MA_i} \tag{2.8}$$

Considering equations (2.7) and (2.8) one can show that, if we make a shock so that the equilibrium value of market access decreases (MA_i), if the manufacturing sector is relatively skilled labour intense with respect to the agricultural sector, the new equilibrium is characterized by relatively lower wages of skilled workers. Therefore, this new equilibrium implies a higher critical level in terms of skills above which individuals prefer to invest in education and become skilled and thus we will have a lower supply of skilled workers[13].

From the zero profit condition in the agriculture sector (Eq. 2.5) we can express the derivative of the wage of unskilled workers as follows:

$$\frac{dw_i^U}{w_i^U} = -\frac{\phi}{(1-\phi)}\frac{dw_i^S}{w_i^S} \tag{2.9}$$

If we now substitute expression (2.9) into the zero profit condition of the manufacturing sector we get the following expression. (Renamed $(1-\alpha) = \beta$)

[13] This conclusion is based on the fact that the number of individuals with higher and higher levels of skills decreases as we seek them into a given population set.

$$(\alpha - \frac{\beta\varphi}{1-\varphi})\frac{dw_i^S}{w_i^S} = -\left[\frac{1}{\sigma}\right]\gamma \qquad (2.10)$$

Knowing that: $(\alpha - \frac{\beta\varphi}{1-\varphi}) > 0 \iff \frac{\alpha}{\beta} > \frac{\varphi}{1-\varphi}$

so $\frac{dw_i^U}{w_i^U} > 0$; $\frac{dw_i^S}{w_i^S} < 0$; $\frac{d\left(w_i^S / w_i^U\right)}{w_i^S / w_i^U} < 0$

From these expressions it can be deduced that if a region becomes remote (in the sense that market access fall) and assuming that manufacturing production is skill intensive, then the new equilibrium will be characterized by a lower relative wage of skilled workers[14]. Returning to the critical level of ability, this decline in the relative wages of skilled workers means a lower incentive to invest in human capital. Accordingly, the number of skilled workers can also be expected to fall in that region.

This is the argument underpinning the connection between the spatial distribution of human capital and market access, as the relative wages of skilled workers are predicted to be lower in the remote regions and, hence, the critical level of ability (a_i^*) to be higher, which means a lower incentive to accumulate human capital. The intuitive idea is that an increase in remoteness (a negative shock in the equilibrium value of market access in equation 2.8) causes higher transport costs to firms in selling their products, which has the same effect as a reduction in the relative price of the manufactured goods. Therefore if manufacturing

[14] A fall in *market access* with the initial equilibrium market prices results in a decrease in the size of the manufacturing sector and, thus, in an excess of skilled labour. Hence, the nominal skilled wage is lower and the nominal unskilled wage is higher in the new equilibrium

goods compare with agricultural ones are relatively skill-intense, firms will have less valued added left to remunerate their skilled workers in the economic peripheral locations (low market access locations according to the variables of the model). This reduction in the amount of valued added generated by the manufacturing sector will be translated into a relatively lower salary to the skilled labour in these regions. This lower salary will reduce the incentives to invest in becoming skilled and therefore this incentives shrinking will lead to a lower proportion of skilled labour in peripheral regions compare with more central locations. In this sense, economic remoteness will mean a penalty for human capital investments and also for the economic development of those locations.

2.3. Econometric Approach and Data

In this section we present the econometric approach we will use in the empirical estimations carried out in the next section of the chapter. The theoretical propositions arising from the model[15] can be estimating by running the following regression equation:

$$Ln(EA_i) = \alpha_0 + \alpha_1 \ln(MA_i) + \varepsilon_i \qquad (2.11)$$

EA_i represents the educational attainment level in region "i", MA_i represents the market access for region i and ε_i represents the error term. Equation (2.11) allows us to check if there is a spatial educational attainment structure in Romania, i.e. , namely whether there is a positive correlation between secondary and tertiary educational attainment

[15] The theoretical model in Redding and Schott (2003) includes both market and supply access, although their empirical application only considers the impact of market access, given that it is considerably more cumbersome to measure supply access, and because of the likelihood of a high correlation between both measures. The same approach is adopted elsewhere in the literature

levels and market access or alternatively if those regions which have a high market access index are also the regions with relatively high levels of education. We begin by examining how much of the variation in cross regional human capital can be explained when only including information on market access. This provides the basis for our baseline estimation where we assume that the error term is uncorrelated with the explanatory variables. Considering that this assumption can be violated and therefore the coefficient estimates be biased and inconsistent, we also present estimates using instrumental variables regression.

In order to control for the effects of outlying observations, we also estimate this alternative specification:

$$Ln(EA_i) = \alpha_0 + \alpha_1 \ln MA_i + \sum_{n=1}^{N} \gamma_n X_{i,n} + \varepsilon_i \qquad (2.12)$$

Where X_{in} is a control variable and γ_{in} is the correspondent coefficient.

To complement the estimations of different equations for different educational attainment levels, we also report the results of two alternative estimations based on transformations in the definition of the dependent variable. The first transformation of the dependent variable consists of ranking Romanian regions given the values 1 if low educational attainment is the highest share of educational attainment for a particular region and 2 if it is medium and high and then estimate and ordered probit model. The second transformation consists of estimating a single equation where the dependent variable is the average years of schooling in each region instead of educational attainments.

The dependent variable in the regression equation is the logarithm of educational attainment levels. We define two different types of

educational attainment levels. In first place we consider the percentage of each Romanian region´s population that has attained secondary and tertiary education which will be labelled in the econometric estimations as *log Higher Education.* In second place we define a new educational attainment level variable which takes in the percentage of each Romanian region´s population that has attained primary education which is labelled in the estimations as *log Lower Education*. The former definition of the dependent variable, according to the model´s prediction, is a direct way to test for the validity of the forces put at work in the model whereas the latter definition of the dependent variable will constitute and indirect way to test model´s prediction. Both higher and lower educational attainment levels data are taken from the Romanian National Statistical Institute (INSSE) and refer to the year 2006.

The variable on the right hand side of expression (#2.11) is the regions´ market access. Taking into account that the market access of a region "i" is a distance-weighted sum of the volume of economic activity in the surrounding regions, we build a market access variable which takes as a proxy for the volume of economic activity the total gross domestic product in each region. For the calculation of the discount factor included in the market access variable, we use the distances measured in Kms between the capital cities of each Romanian region. Data on each region gross domestic product is taken from INSSE and refers to 2006 and the data for the distances between capital cities comes from the website www.travelworld.ro

For the calculation of the internal distance within each region, it is approximated by a function that is proportional to the square root of each region´s area. The expression used for calculation is $0.66\sqrt{\frac{Area}{\pi}}$

where "Area" represents the size of the region expressed in km2. This expression gives the average distance between two points on a circular location (see Crozet, 2004; Head and Mayer, 2000; Nitsch, 2000 for a discussion of this measure of internal distance).

Regarding the market access measure, we have followed the approach taken by the vast majority of the studies in this type of related literature and which used only domestic markets in their market access computations (Hanson, 2005 for the case of US; Pires, 2006 for Spanish provinces; Mion, 2004 for the Italian provinces; Roos, 2001 for the German lander; Lopez-Rodriguez and Nakamura, 2011 for the Japanese Prefectures[16]).

2.4. Empirical Analysis

Table 2.1 records 2006 data on the percentage of each Romanian region´s population that has attained primary education (labelled in table 2.1 as lower education) or secondary and tertiary education (labelled in table 2.1 as higher education). As it can be seen from table 2.1, the educational attainment levels across Romanian regions vary greatly. The highest percentages of higher education are reach in the so called *economic centers* of Romania; Bucharest, Iasi, Timisoara, Cluj-Napoca, Constanta, Brasov and Craiova where also the country's main universities are located. The percentages figures on higher education in these regions are well above the Country´s average (8.55%) being Bucharest the region which ranks at the top (18.19%). On the other site, the Romanian regions located far from the above poles of growth in the

[16] However an alternative measure of market access was built considering not only the internal market but also the distance to markets outside Romania. We thank to a referee for pointing out about this fact.

so called *Romanian economic periphery* such as Neamţ Mureş, Tulcea, Satu Mare, Botosani, Vaslui, Olt, Teleorman have figures on higher education below the country's average (6.97%).

Table 2.1: Educational Attainment Levels in Romania (2006)

Region	Lower Education	Higher Education	Region	Lower Education	Higher Education
Bacău	10,07	5,95	**Mehedinti**	8,75	6,43
Botoşani	10,44	4,77	**Olt**	9,28	4,88
Iaşi	9,91	12,74	**Vâlcea**	8,85	5,97
Neamţ	9,50	1,97	**Arad**	8,48	7,87
Suceava	11,25	6,79	**Caras-Severin**	8,68	8,37
Vaslui	10,66	6,12	**Hunedoara**	8,59	7,19
Brăila	8,00	5,32	**Timiş**	8,25	12,17
Buzău	8,62	4,67	**Bihor**	9,12	9,43
Constanţa	8,55	9,97	**Bistriţa-Năsaud**	9,93	5,40
Galaţi	9,12	7,81	**Cluj**	7,46	14,67
Tulcea	4,45	4,40	**Maramures**	8,80	6,49
Vrancea	8,69	4,24	**Satu Mare**	9,68	5,32
Arges	4,58	7,98	**Salaj**	9,25	5,21
Călăraşi	9,09	4,46	**Alba**	8,58	6,88
Dambovita	9,32	6,19	**Braşov**	7,76	10,41
Giurgiu	8,92	2,80	**Covasna**	8,97	5,59
Ialomita	9,22	5,25	**Harghita**	8,95	6,01
Prahova	7,99	6,10	**Mureş**	8,85	3,95
Teleorman	8,10	4,22	**Sibiu**	9,06	10,63
Dolj	8,46	8,91	**Ilfov**	0,90	3,02
Gorj	9,95	8,03	**Bucureşti**	5,91	18,19

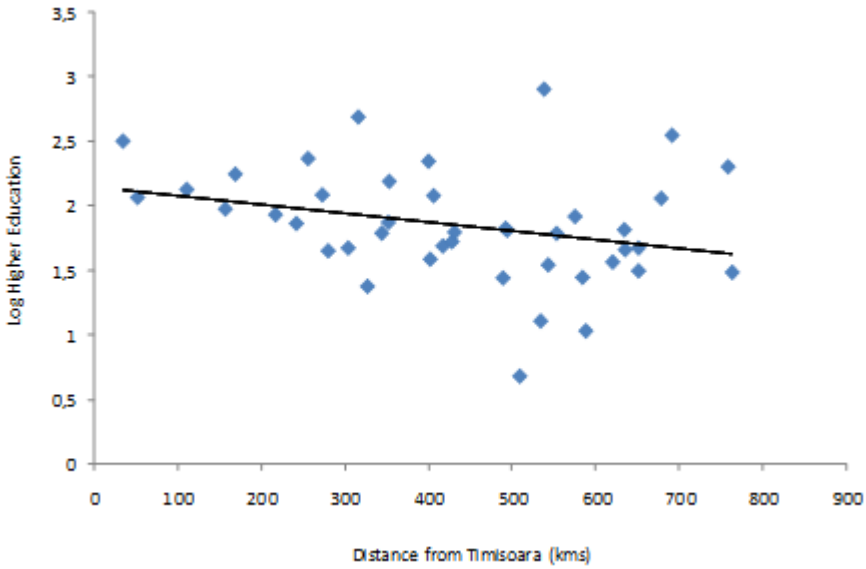
Computations including Bucaresti			Computations excluding Bucaresti		
Average Ed. A.	8,55	6,97	**Average Ed. A.**	8,61	6,70
Minimum Ed. A.	0,90	1,97	**Minimum Ed. A.**	0,90	1,97
Maximum Ed. A.	11,25	18,19	**Maximum Ed. A.**	11,25	14,67
Ratio max/av	1,32	2,61	**Ratio max/av**	1,31	2,19
Ratio max/min	12,49	9,23	**Ratio max/min**	12,49	7,44

Source: Authors´ Elaboration based on INSSE

Moreover, these figures on the spatial distribution of educational attainment levels across Romanian regions show a well-established core-periphery gradient, a pattern that is commonly observed when we refer to the analysis of the spatial distribution of incomes (poor regions

predominantly located in the so called "economic periphery" whereas rich ones are located in the so called "economic center"). Figure 2.1 illustrates this fact by plotting the percentage of population with higher education (in logs) in 2006 against distance from one of the Romanian economic centers (Timisoara).

Figure 2.1: Higher Education and Distance from Timisoara (Romania, 2006)

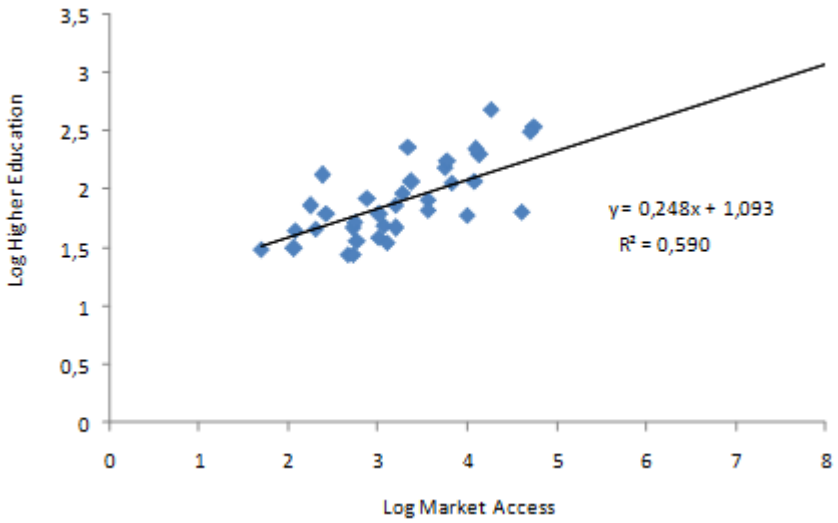


Source: Authors´ elaboration using data from INSSE

Before presenting the results of the econometric estimations carried out with 2006 data for the Romanian regions, we proceed presenting a couple of graphs which relate different levels of regional educational attainment in Romania and the corresponding regional market access. Figure 2.2 plots the percentage of individuals with secondary and tertiary education in each Romanian region (log Higher Education) against each Romanian region market access. As it can be seen in the graph the pairs of values (Higher Education, Market Access) are distributed along a

positive slope trend line indicating that higher market access regions have higher levels of secondary and tertiary education. The relationship *higher education-market access* is robust and not due to the influence of a few regions. Therefore, figure 2.2 corroborates, at least graphically, the theoretical predictions of the model.

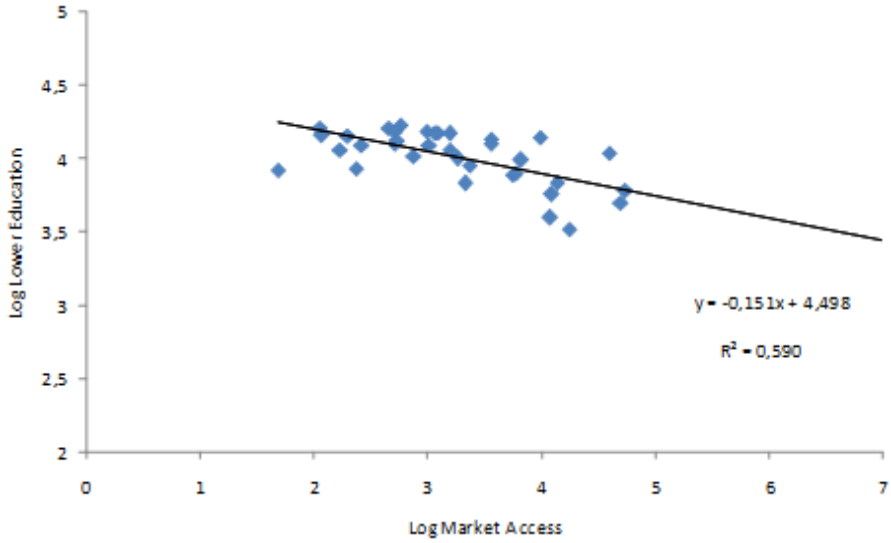
Figure 2.2: Secondary and Tertiary Education and Market Access (Romania, 2006)



Source: Authors´ elaboration using data from INSSE

Finally, an indirect way (graphically) to check for the validity of the theoretical predictions of the model is to plot primary educational attainment levels against market access and see how the set of points (primary education, market access) are distributed. This has been done in figure 2.3. The graph clearly shows that the set of points are distributed along a negative slope trend line, meaning that those regions with higher levels of market access have lower percentages of individuals with primary education or alternatively as the regions remoteness increases the incentives to become skilled diminish and therefore we found lower levels of individuals with higher education.

Figure 2.3: Primary Education and Market Access (Romania, 2006)



Source: Authors´ elaboration using data from INSSE

The previous descriptive analysis characterizes the relationship between different classifications of the educational attainment levels in Romania and market access. In this section we extend the analysis with a regression model. Taking into account our theoretical framework OLS and Instrumental Variables regressions of secondary and tertiary educational attainment levels for the year 2006 are conducted on the Romanian regions´ market access. Market access has been computed by using gross domestic product as the proxy of the volume of economic activity for each Romanian region and labelled in the table as MAGDP06.

Table 2.2: Market Access and Educational Levels: Baseline Estimations (Romania, 2006)

Dep. Variable	*log Higher Education*			*Log Lower Education*		*EAi,j*
Regress.	(1)	(2)	(3)	(4)	(5)	(6)
Constant	1.09* (0.16)	1.20** (0.16)	2.14** (0.16)	4.49** (0.07)	4.54** (0.09)	1.57** (0.10)
MAGDP06	0.25** (0.03)	0.22** (0.04)		-0.15** (0.02)	-0.17** (0.02)	0.11** (0.02)
Dist. Timisoara			-0.0007 (0.000)			
$D_{i,j}$						0.20** (0.06)
Est.	OLS	IV	OLS	OLS	IV	OLS
Inst. variables						
First stage R2		0.62			0.62	
R2	0.59	0.58	0.09	0.59	0.59	0.27
J-Statistic						
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.00
N.obs.	42	42	42	42	42	84

Note: Table displays coefficients and Huber-White heterocedasticity robust standard errors in parenthesis, ** indicates coefficient significant at 0.01 level, "First stage" R2 is the R2 from regressing market access on the instruments set, Instruments: Distance to Timisoara and region size

Source: Authors´ elaboration

Table 2.2 presents the results of estimating equation (2.11) on the sample of 42 regions in Romania for the year 2006[17]. In Column 1 we regress Log Higher Education on market access for the set of 42 Romanian regions. The results of the OLS estimation show that the coefficient of market access has the expected sign and is statistically significant at the 1% level. The results also show that doubling regions´ market access would increase secondary and tertiary education attainment levels by 25%. The null hypothesis that the coefficient on market access is equal to zero is easily rejected at conventional significance levels using a standard F-test, and the model explains over

[17] In these first set of results we have just focused our attention on the main theoretical predictions of the model (equations 2.5 and 2.6 and their implications in equations 2.7 and 2.8) and in light with them we have performed those regressions which constitute the closest counterpart to the model.

59% of the cross-regional variation in secondary and tertiary educational levels.

In column 4 we summarize the results of regressing the percentage of population with primary education (labelled as *Log Lower Education* in table 2.2) against market access. The results of the OLS estimation indicate that an increase in regional market access is negatively correlated with the percentage of population who has primary education. This result constitutes an indirect way of checking the theoretical predictions of the model.

A potential shortcoming of the previous analysis is the one referring to the endogeneity of the market access measure, i.e., good market access can be correlated with other determinants of the level of educational attainment of the Romanian regions and therefore cause inconsistent and biased estimates. To avoid problems of endogeneity between human capital levels and regional market access, the chapter presents instrumental variables estimates. IV estimation is based on the existence of a set of instruments that are strongly correlated with the original endogenous variables but asymptotically uncorrelated with the error term. Furthermore, they should also be variables that are not driven by an unobservable third variable the authors suspect might be jointly affecting market access and human capital levels. Once these instruments are identified, they are used to build a proxy for the explanatory endogenous variables which consists of their predicted values in a regression on both the instruments and the exogenous variables. However, it is difficult to find such instruments because most socioeconomic variables are endogenous as well. In this chapter after reviewing some of the most influential papers in the NEG literature

which deal with issues of market access endogeneity and which could be useful for our purposes (Breinlich, 2006; Combes et al.,2010; Redding and Venables, 2004) we adopt several approaches based on the aforementioned studies. Our first approach to the market access endogeneity (table 2.3) follows Breinlich (2006) and Redding and Venables (2004) and therefore we use geographic (accessibility) variables as instruments, since they are highly correlated with our market access variable but also non contemporary correlated with the errors. We instrument market access with distance from Timisoara and with the region size. The first instrument captures market access advantages of regions close to the geographic centre of Romania. The second instrument captures the advantage of large regional markets in the composition of domestic market access.

Columns 2 and 5 present the results for the corresponding instrumental variables estimation. Instruments are highly statistically significant and have the expected signs in the first stage. Distance to Timisoara and regions size explains 62% of regional market access. Since the instruments represent quite a distinct source of information and are uncorrelated, we can trust them to be reliable instruments. In the second-stage estimation we again find positive and highly statistically significant effects of market access on educational attainment levels although its effects are lower than in the OLS estimations. The market access coefficients change from 0.25 to 0.22 in the regression of log higher education against market access (column 2) and from -0.15 to -0.17 in the regression of log lower education against market access (column 5). For comparison purposes, column 3 reports the result of regressing log higher education against distances from Timisoara instead of using market access. The result provides evidence of the negative

correlation between secondary and tertiary educational attainment levels and regions distance from Timisoara.

The estimation of two different equations *log Lower Education* and *Log Higher Education* is based on the fact that the coefficient estimates are significantly different for the two equations. In order to check this fact we run this alternative regression:

$$Ln(EA_{i,j}) = \alpha_0 + \alpha_1 \ln(MA_{i,j}) + \alpha_2 D_{i,j} + \varepsilon_{i,j} \qquad (2.13)$$

Where $i = 1,2,.....42$ represents the 42 Romanian regions of our sample, $j = \{0,1\}$ stands for the level of educational attainment, being 0 if educational attainment is defined as lower education and 1 if educational attainment is defined as higher education, so $EA_{1,0}$ is the proportion of population in region 1 who has primary educational levels and $EA_{1,1}$ is the proportion of population in region 1 who has secondary and tertiary educational levels. $MAGDP06_{i,j} = MAGDP06_i$ for all $j = \{0,1\}$ is the market access of region $i = 1,2,.....42$ and $D_{i,j} = \{0,1\}$ is a variable that takes the value 0 if $j = \{1\}$ and 1 if $j = \{0\}$, $\varepsilon_{i,j}$ stands for the error term.

In this alternative specification our main parameter of interest is α_2 such that if α_2 is statistically different from cero, we can reject that the estimated coefficient α_1 is equal for the different equations and thus it confirms our approach to the problem. The results reported in column 6 of table 2.2 shows that α_2 is significantly different from cero, thus justifying the estimation of two different equations for the different levels of educational attainments.

However, the models given in table 2.2 are marked by outlying observations. The outlying regions do not correspond with the spatial educational attainment structure determined by the majority of the observations. Outliers will seriously affect the coefficient estimates, if they are influential leverage points, i.e. outlying observations with regard to our market access measure. We identify outliers as those observations for which Cook's distance is greater than 1. In order to control for the effects of the identified outlying observations, dummy variables for the outliers are introduced. The most significant outliers are the Romanian capital, Bucharest and the regions of Mureş, Buftea and Gorj.

The first column of table 2.3 reports results of regressing *log lower education* on *log market access* for the 42 Romanian regions after including dummies for the outlying observations. The estimated coefficient on market access is negative and statistically significant at the 1% level. The second column of Table 2.3 shows the results of the estimations of *log higher education* against *log market access.* The result is robust and the market access coefficient is again significant at the 1% level. The third column of table 2.3 indicates that market access retains a significant positive relationship with higher education even in the presence of variables thought to be important in cross regional development in Romania. The control variables, all referring to 2006 and available from the Romanian institute for national statistics (INSSE), we use consist of the expenditure in R&D expressed as percentage of regional gross domestic product, the share of ethnic minorities in the population of each region and the regional average gross monthly earnings. Regarding these controls, here the main issue incorporating only these three controls (average monthly earnings, expenditure in R&D and ethnic minorities) is based on the fact that we want to disentangle

the effects market access can have on higher educational attainment levels by looking for third variables that might be affecting regional educational levels and which work through accumulation incentives (average monthly earnings, expenditure in R&D and ethnic minorities fulfill this requirement). However a possibility for omitted variables bias could be present in the analysis[18] and therefore a fruitful research avenue in the future will be to discover new channels through which market access might be affecting educational attainment levels apart from the ones already mentioned in the chapter and therefore reduced the bias due to missing values. However at this stage there is neither enough data on Romanian regions nor reliability of the data to perform such analysis. The inclusion of our selected control variables into the model (column 3) reduces the magnitude of the market access coefficient from 0.30 to 0.13 although it remains statistically significant at conventional critical values. Among the controls, only the expenditure in R&D and ethnic minorities are statistically significant at the conventional critical levels.

[18] We thank a referee for pointing out about this fact.

Table 2.3: Market Access, Regional Dummies, Educational Levels and Average Years of Education
(Romania, 2006)

Dep. Variable	*Log Lower Education*	*log Higher Education*		*Average Years Education*	*Educational Levels*	*log Higher Education*	
Regress.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	4.53** (0.09)	0.92** (0.16)	-2.24 (3.65)	6.01** (0.35)		-4.39 (2.71)	-4.44 (2.28)
MAGDP06	-0.15** (0.02)	0.30** (0.05)	0.13** (0.06)	0.60** (0.10)	1.82** (0.57)		
MAGDP ROEU						0.135** (0.05)	0.133** (0.05)
R&D Expenditure			0.08** (0.03)			0.08** (0.02)	0.08** (0.02)
Average Montly Earnings			0.43 (0.54)			0.70* (0.30)	0.71** (0.30)
Ethnic minorities			0.004** (0.002)			0.003** (0.001)	0.003** (0.001)
Regional Dummies	yes	yes	yes	no	no	yes	yes
Est.	**IV**	**IV**	**IV**	**OLS**	**Ord. Probit**	**IV**	**IV**
Inst. variables							
First stage R2	0.62	0.62	0.70		0.71	0.92	0.95
R2	0.59	0.61	0.68	0.51	0.49	0.77	0.77
J-Statistic							
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N.obs.	42	42	42	42	42	42	42

Note: Table displays coefficients and Huber-White heterocedasticity robust standard errors in parenthesis, ** indicates coefficient significant at 0.01 level ,"First stage" R2 is the R2 from regressing market access on the instruments set, Instruments: Distance to Timisoara and region size (col, 1, 2 and 3), 1995 market access and terrain ruggedness (col 6) and 1995 market access and mean distance to the nearest commercial route (col 7)

Source: Authors´ elaboration

To complement our estimations columns 4 and 5 of table 2.3 summarize the results of two alternative estimations based on transformations in the definition of the dependent variable. In column 4 we transform Romanian regional educational attainment levels into average years of schooling and then we estimate a single equation using average years of

schooling as our dependent variable. This synthetic indicator for human capital levels has been used in many empirical studies see (Benhabid and Spiegel 1994, Temple 1999, Krueger and Lindahl 1999 and De la Fuente and Domenech 2001). To do the transformation of educational levels into average years of education we use information of the Romanian school system provided by the Ministry of Education, Research and Innovation. Romanian school system consists of the pre-university education system and the university education system. The pre-university education is broken down into 4 levels (preschool, primary, secondary level 1, secondary level 2). Primary education covers 4 courses and students are enrolled at the aged of 6 and finish at the age of 10. Secondary education is divided into two additional levels (level 1 and level 2) each of them of 4 years length; level 1 from 10 years old to 14 and level 2 from 14 to 18: Finally the higher education includes vocational training, usually three years, from 18 to 21 and university education which in Romania is on average 4 years length.

The results of the regressions show that the coefficient on market access is positive and statistically significant at the usual critical values, showing that an increase in a regions´ market access increases the average years of education of its population. Column 5 summarize the results of estimating an ordered probit model where the dependent variable was transformed into a binary variable given to it the values 1 or 2 according to the relative importance of the proportion of population who has low or medium or high educational levels. Therefore a region that has the highest proportion of population with low education is ranked 1, if the highest proportion is secondary and tertiary education is ranked 2. In ordered probit models, the sign of the coefficient shows the direction of the change in the probability of falling in the endpoint rankings, in our

case (Educational attainment level 1, lower education, or level 2, higher education) when market access changes. Probability of Educational Attainment level 1 changes in the opposite direction of the sign of the estimated coefficient and probability of educational attainment level 2 changes in the same direction. The coefficient reported in column 5 of table 2.3 is positive showing that the probability of having higher educational levels is higher in regions with high market access. The estimated coefficient is statistically significant at the conventional critical values[19].

Therefore the results reported in columns 4 and 5 can be taken as additional proofs that geographic location matters for determining educational levels across Romanian regions.

Taking into account that nowadays Romania is an open economy and thus dependent on the evolutions in other countries, in columns 6 and 7 we report the results of our extended estimations recalculating our market access measure (labeled in table 2.3 as MAGDP ROEU) to consider not only the internal market but also the distance to the markets outside the country (export markets). Therefore, in order to redo the market access computations we focus our attention on the main Romanian export markets. It does not come as a surprise that the EU countries represent the main export markets for Romania accounting for 68% of the total exports in 2006, being the most important partners, in decreasing order of exports share, Italy, Germany, France, Hungary and UK which account for 50% of the total Romanian exports. If we add to these countries the Romanian exports to Bulgaria, Austria, Holland, Spain, Greece and Poland the export share increases to 61%. Based on

[19] The statistic reported in ordered probit models to check the significance of the estimated coefficient is z-statistic instead of t-statistic from OLS.

these figures, we will take the situation in these 11 countries of the EU as an extra determinant of the Romanian market access. The way we do our extension of the market access measure is by adding to the previous county-computed market access (internal market access) the sum of the total gross domestic product in each of the former eleven main export countries weighted by the bilateral distance between the capital cities of each Romanian region and the capital of the country[20]. Data on each country gross domestic product is taken from Eurostat and refers to 2006 and the data for the distances between capital cities and countries'' capitals comes from the website www.travelworld.ro.

The results of the analysis carried out in columns 6 and 7 do not show any changes with respect to the elasticity of market access with regard to higher education when we take into consideration the influence export markets exert on market access. Again doubling the market access would increase the percentage of population with higher education by 13%. The most significant change relates to the effect of earnings on higher education which coefficient increases substantially in comparison with its estimation in column 3 and now it becomes statistically significant.

Additional robustness checks for market access endogeneity

Our second approach to the market access endogeneity follows Combes et al. (2010) and we use a combination of history and geology as sources of exogenous variation for market access. Historical values of the endogenous variable have frequently been used in the related literature on the grounds that the factors that played a role in the past are

[20] An alternative measure of market access could be built considering more markets outside Romania. This alternative measure/s can lead us to virtually take all the markets in the world and its computation could be very cumbersome. We thank to a referee for pointing out about this fact.

uncorrelated to the factors affecting current productivity shocks in the different regions. Breinlich (2006) and Combes et al. (2010), for example use lags of market access to instrument current market access in their estimates of regional GVA per capita in EU regions and local TFP in France respectively.

In our case, for Romania, the earliest and reliable regional GDP data (and also comparable with our 2006 data) to construct historical market access values, which is consistent with today's regional definition, is from the year 1995 and is provided by Romanian national statistical institute (INS, www.insse.ro)[21]. With these data, we have calculated the 1995 market access for each region as the sum of own GDP plus the GDP of other regions weighted by the inverse of the geodesic distance and we have used it as instrument for 2006 market access.

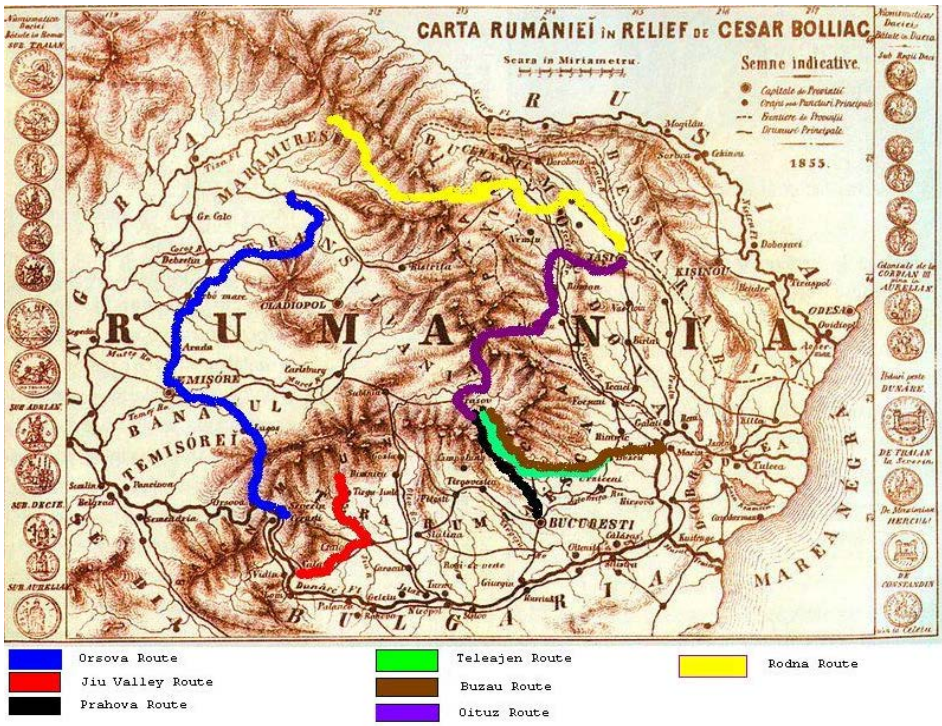
In addition to this approach using a lag of the endogenous variable, we have also followed Combes et al. (2010) and use instruments based on geology. The argument is that geology has determined settlement patterns and is thus related to market access but is no longer a factor influencing modern productivity differences across regions. Local terrain ruggedness is such a factor. It may affect population growth patterns and also reflects the suitability of areas for building roads. We use the information provided by the National Geographic Institute of Romania (http://www.acad.ro) on the differences in meters in elevation for each county and use them as an approach to the Romanian terrain

[21] Data for the period 1990-1992 is not available, due to lack of source of necessary data (Structural Inquiry in Enterprises). In the period 1993-1994, the data are calculated according to SEC 79 methodology. In the period 1995-2008 the data are calculated according to ESA 95 methodology and CANE Rev.1 and expressed in millions lei RON

ruggedness. These values therefore are capturing topographic heterogeneity and are used to instrument market access.

Settlement patterns over the past have also been determined by historic transport commercial routes. Thus we have also instrument current market access by using a map by Cesar Bolliac from 1853 (Figure 2.4) showing the principal commercial routes which were the precursors of the modern Romanian road network. Thus, being near these historical commercial routes strongly influenced the likelihood that a new road was built in this area. To construct the instrument, we digitalized the Cesar Bolliac map and calculated the mean distance from each location to the nearest of these routes.

Figure 2.4: Cesar Bolliac´s map of 1853 Comercial Routes in Romania



Source: Cesar Bolliac (1855)

Table 2.4: Romanian Higher Education as a function of market access: TSLS instrumental variable regression (2006)

Dep. Variable	*log Higher Education*							
Regress.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	1.16** (0.44)	1.09** (0.12)	1.14** (0.13)	1.12** (0.13)	0.41** (0.15)	-4.5 (2.61)	-4.5 (2.64)	-1.15 (0.70)
MAGDP06	0.23** (0.09)	0.25** (0.03)	0.23** (0.04)	0.24** (0.04)	0.24** (0.07)	0.12** (0.04)	0.12** (0.05)	0.21** (0.09)
R&D Expenditure						0.07** (0.02)	0.08** (0.02)	0.05** (0.02)
Average Monthly Earnings						0.73** (0.3)	0.74** (0.3)	0.23** (0.11)
Ethnic minorities						0.003* (0.001)	0.003* (0.001)	0.002 (0.002)
Regional Dummies	no	no	no	no	no	yes	yes	yes
Instruments								
1995 Market Access	yes			yes		yes	yes	
1853 commercial route mean distance		yes			yes			yes
Terrain Ruggedness			yes	yes	yes		yes	yes
First stage R2	0.90	0.25	0.19	0.93	0.40	0.95	0.96	0.71
First stage F-test	336.46	150.25	140.77	258.49	189.45	107.51	122.19	10.91
Hansen J Statistic (p-value)	Exactly identif	Exactly identif	Exactly identif	0.49	0.56	Exactly identif	0.47	0.52
N.obs.	42	42	42	42	42	42	42	42
R2	0.58	0.59	0.59	0.59	0.55	0.77	0.77	0.74

Note: Table displays coefficients and Huber-White heterocedasticity robust standard errors in parenthesis, ** indicates coefficient significant at 0.01 level, * denotes statistical significance at 10% level ,"First stage" R2 is the R2 from regressing market access on the instruments set, Instruments: 1995 market access (col 1 and col 6), 1853 commercial route mean distance (col 2), ruggedness index (col 3), 1995 market access and ruggedness index (col 4 and col 7), ruggedness index and 1853 commercial route mean distance (col 5 and 8)

Source: Authors´ elaboration

In table 2.4 we show again the results of addressing the potential endogeneity of market access by estimating equation (2.11) and (2.12) using two-stage least squares with the different instruments discussed above. The instruments need to be strongly correlated with the market access variable and they must influence productivity today only through current market access. The latter requires that the instruments are uncorrelated with the main equation residuals, a condition satisfied by the instruments proposed as they clearly are strictly exogenous. As for instrument relevance, first stage regression of the market access variable on all exogenous variables show that instruments provide a good fit in the first stage. They are always individually significant and of the expected sign; that is, the mean distance to the 1853 comercial routes and the local terrain ruggedness show a negative correlation with current market access, whereas the 1995 market access is positively correlated with current market access. The F-tests for joint significance of the included instruments show a high test statistic. In those estimations in which we have included more instruments than endogenous variables, the Hanson J test for overidentifying restrictions can be used to indicate whether the instruments are exogeneous assuming that a least one of the instruments is exogenous. In all specifications the hypotheses that the instruments are valid is not rejected. The fact that the instruments used are very different in nature provides credibility to the test as very similar instruments could lead to very similar parameters and thus pass the test even if they are endogenous.

The results of the estimations in columns 1 to 5 of table 2.4 can be confronted with those from the one-step approach based on OLS (column 1 of table 2.2) and with the IV approach (column 2 of table 2.2). They show that the elasticity of market access with regard to higher

education ranges from 0.23 to 0.25, being therefore almost the same than in the OLS and IV estimation of table 2.2 (0.25 for OLS and 0.22 for IV estimation). Therefore, these instrumental variable estimates confirm the OLS results and this suggests that endogeneity bias of market access is not a major issue. The results in columns 6, 7, and 8 of table 2.4 can be confronted with the results in column 3 of table 2.3.

The results show that the elasticity of market access with regard to higher education turns out 0.12 when 1995 market access is used as instrument (column 6) and when both the 1995 market access and the local terrain ruggedness are used as instruments (column 7). With 1853 commercial route distance and the local terrain ruggedness the elasticity of market access to higher education turns out to 0.21 (column 8), a value which is a bit lower (although quite close) to the values obtained in the majority of the estimations. Here, therefore, the results show again the same pattern (decrease in the magnitude of the market access coefficient) and in two of the estimations a very similar elasticity value for market access than the one obtained in table 2.3 (0.12 versus 0.13 of table 2.3). Most important in these last set of results (extended estimations) is that the estimate of the market access coefficient is positive and remains statistically significant at conventional critical values, but the results also show that including controls reduces the point estimate of market access from 0.30 to a value between 0.12 and 0.21 indicating that doubling the market access of a region leads on average to approximately between 12 and 21 percentage increase in the regions' percentage of population with higher education. The controls included in the regression are statistically significant at the conventional critical levels with the exception of ethnic minorities in column 8.

Overall, the results in table 2.4 are not only similar in magnitude to the corresponding results of table 2.3 but also to those from the one-step approach based on OLS (table 2.2).

2.5. Conclusions and Some Policy Implications

In this chapter we use 2006 data on Romanian regional educational attainment levels to look at the link between human capital accumulation and geographical location. The theoretical framework of the chapter, based on Redding and Schott (2003), presents a model which is an extension of the standard two-sector (agriculture and manufacturing) Fujita et al. (1999) economic geography model in which unskilled individuals are allowed to endogenously choose whether to invest in education. The main theoretical result of the model proves that relatively peripheral locations will experience a lower skill premium and therefore this reduces their incentives to educate their workers.

Consistent with the predictions of the model, our empirical findings emphasize the importance of economic geography in explaining the spatial structure of the Romanian regional human capital levels. The results of the bivariate regression of secondary and tertiary educational attainment levels against market access (regression of log higher education on log market access) show that the coefficient estimates of market access are positive and statistically significant. This result shows that high market access regions are endowed with higher levels of individuals with secondary and tertiary education which is in line with the theoretical predictions of the model. In particular the results show that if we double the market access of a region, the percentage of individuals with higher education would increase between 22-25%. Moreover

around 59% of the spatial variation in higher education is explained by the regions market access. The results of the bivariate regression prove to be robust to the inclusion of dummies and to the inclusion of other indicators important in cross-regional development in Romania such as regional expenses in R&D, the presence of ethnic minorities in the region´s population and the gross average monthly earnings. The results of the extended regressions (including dummies and other regional indicators) affect the coefficient estimates of market access reducing its magnitude from 0.30 to 0.13 although it remains statistically significant at conventional critical values. We also check indirectly the model´s prediction by regressing the percentage of individuals with primary education against market access (Log lower education on log market access). The results of the estimations show a statistically significant negative coefficient for market access which means that as the regions market access increases the percentage of individuals with low educational attainment levels decreases. This backs indirectly the results of the direct estimates. Finally we complement our estimations with two alternative estimations based on transformations in the definition of the dependent variable. In the first case we use average years of education as our dependent variable and in the second case the dependent variable was transformed into a binary variable given to it the values 1 or 2 according to the relative importance of the proportion of population who has low educational levels or medium or high educational levels. The results of these alternative regressions back again the main results found in the chapter.

One potential shortcoming of our analysis could be the clarification if the spatial educational structure observed in Romania is the result of skilled workers´ incentives to migrate to high market access regions, i.e., skilled

workers may be drawn to regions with good market access and therefore our empirical evidence would also be consistent with a quite different new economic geography model, where skilled workers migrate within each country[22]. Then the question that emerges is if migration to high market access regions within each country, based on the fact that industries agglomerate within a country in regions with good market access, generates an incentive for skilled workers to migrate to such regions. This aspect was studied by Crozet (2004) for a sample of European Union countries using data on internal annual migration flows. Crozet concludes that interregional migration flows are very weak because centripetal forces are very limited in geographic scope and barriers to migration are high enough to balance the centripetal forces. He observes very important migration costs reflecting that European workers have a very low degree of geographical mobility which explain the smallness of inter-regional migration flows. In Crozet words "…..*it seems very unlikely that a catastrophic core-periphery pattern will emerge within European Countries, or a fortiori on a greater scale*" (Crozet 2004, page 457). Migration trends in

Romania follow the common fact of a relatively high propensity to migrate for those who are highly skilled (almost 60% of migrants are high school or post high-school graduates[23] (Popescu, et al., 2008). However, regarding to destinations preferred by the migrants it is mainly to other EU countries rather than internal migrations within Romanian regions. Romanian migrants are mostly attracted by Italy and Spain, followed by Germany and Greece and also to non-EU countries such as Turkey and

[22] We want to thank an anonymous referee for pointing out this possible shortcoming of our analysis

[23] IER, Pais Nr. 1: Libera circulatie a persoanelor si serviciilor, 2005, site: http://www.ier.ro/PAIS/PAIS1/RO/Studiul1B.pdf

Israel. The data provided by the Romania´s Statistical Yearbook underline this idea showing that around 65% of the total number of Romanian highly skilled labor (scientists, researchers, university graduates) works in a foreign country. Additionally, looking at the migrant´s region of origin, those from Romanian developed areas are higher than those from the rest of the regions (in 2005 for example in Bucharest, North-West and West part of the country there were 6.985 official migrants compared to only 3.953 from the North-East, South-East, South-West and South (INS, 2007). Therefore, based on Crozet's (2004) findings and these facts about migration trends in Romania we can admit that internal migration flows within Romanian regions of highly skill workers from low market access regions (less developed regions) to high market access regions (central regions) have had little impact on the configuration of the spatial educational attainment structure observed in the analysis carried out in this chapter.

The results of our chapter have also important implications in policy terms for Romania. Based on the fact that remoteness hampers human capital accumulation which is considered a key engine to fuel economic growth and therefore to accelerate the development of countries and regions, an obvious policy implication is that remote locations in Romania need to get closer to the centers of economic activity. Though locations cannot move, is it possible to reduce the costs of remoteness? Perhaps most important in this regard will be the policy actions to reduce transport costs directly via improvements in infrastructure (e.g. roads, ports, etc.) which in the case of Romania are still lagging behind.

The recent accession of Romania to the European Union will mean that in the years to come it will receive big amounts of funding via Structural

Funds and Cohesion funds. An important policy priority therefore should be to channel part of these funds to tackle the infrastructural problems Romania is facing.

However, the Romanian accession to the European Union imposes also some challenges. With free movement of goods, people and capital, the risks of a "brain drain" of highly qualified people to other member states with better salaries is a fact that has been taken place ever since the Romanian access to the European Union. Moreover, other important issues that may hamper Romanian human capital accumulation in the short and medium term are among others the negative demographic trends characterized by low birth rates and high mortality rates, the overall health situation, the dropout rates which are relatively high, the low level of adult participation in lifelong learning, the large proportion of the population engaged in agriculture, particularly subsistence agriculture, the high unemployment above all long-term youth unemployment and the matching problems between the educational offer and what the job market really needs. Therefore, a clear strategy to overcome these problems establishing the right priorities with respect to the Romanian human resources is also needed. In this respect again an important role should be played by the European Union structural funds. As is stated in the current programming period (2007-2013), the Romanian strategy on human resources development wants to eliminate or reduce these weaknesses. Another important challenge refers to the management of the European funds. Good managerial practices must be set up in order for the European funds to deliver the expected results and to pursue the goals established at the 2005 March summit of the European Council "*Europe must renew the basis of economic competitiveness and to increase potential growth and productivity,*

strengthen social cohesion, placing greater emphasis on knowledge, innovation and optimization of human capital".

Chapter 3: Growth dynamics and Transition in the Romanian Economy: 1995-2008[24]

Abstract

This chapter focuses on the analysis of the growth dynamics in the Romanian economic over the period 1995-2008 and the link between them and the economic geography of the country in light of the transition process started in the early nineties. The analysis of the growth dynamics is carried out at different geographical scales and using different time spans. Regarding the time spans, we have first decided to perform the analysis for the whole period 1995-2008. However due to the fact that within this timeframe at least several periods with different growth dynamics can be distinguished we have broken down the whole period into three subperiods, 1995-2000, a period of recession in the Romanian economy, 2000-2004 and 2004-2008 two periods of expansion and high growth. Regarding the geographical scale we have followed a "top-down" approach starting the analysis by looking at the results at national level, then at the so called "economic regions level" and in a third stage at "county level". The analysis of the growth dynamics is followed by an econometric exercise which first tries to check for the (non)existence of convergence and then we have studied to which extend the economic geography of the country is a key ingredient in the observed growth dynamics. The results of our analysis point out that regardless of the period of study under consideration a catching-up process across Romanian counties is not taken place. Rather a divergence process is pretty much at work. Our second important conclusion is that the economic geography of the country is shaping the growth dynamics observed over the course of the years analyzed in this chapter.

Keywords: Convergence, Regional disparities, Growth dynamics, divergence, Economic Geography, Romania.

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3.1. Introduction

The process of European integration, beginning with the third stage of Economic and Monetary Union has intensified the coordination of the economic and sectorial policies of the EU Member States. The process of coordination has been done in order to harmonize national economic policy objectives to minimize the negative impact of economic policy measures taken by some EU member countries to other member countries and reduce the temptation for Member States to have an inadequate behaviour. In the case of Romania achieving real convergence was an essential goal for its integration into the European Union in 2007. The issue of convergence, both nominal and real, is very important not only from the policy perspective but also from the perspective of the theory of economic growth. From an economic policy point of view in the case of persistently large (or widening) gaps between poor and rich countries (regions), there could be a need for economic policy measures (domestic and international) to stimulate a catch-up process. The convergence issue is also relevant in the political context of European integration. The Article 2 of the Treaty of European Union stipulates itself that *"The Community shall have the task… to promote… a high degree of convergence of economic performance… the raising of the standard of living and quality of life, and economic and social cohesion and solidarity among Member States*." In a similar vein, article 130a stipulates that "*the Community shall aim at reducing disparities between the levels of development of the various regions, including rural areas*". Significant transfers have been provided for in the framework of the Structural and Cohesion Funds to support the process of economic convergence in the peripheral regions, i.e. regions with real per capita GDP significantly below the European Union average. From the

perspective of the economic growth theory, the reduction of existing gaps in developmental and income levels between countries and regions, in other words the convergence of regional incomes is postulated by the neo-classical model of growth. The idea of a transitional growth path to a steady state income, on which growth rates decline, is the fundamental theoretical ingredient of convergence analyses.

In this chapter we analyzed the growth dynamics in the Romanian economic over the period 1995-2008 and the link between the observed growth dynamics and the economic geography of the country. The analysis of the growth dynamics is carried out at different geographical scales and using different time spans. Regarding the time spans, we have first decided to perform the analysis for the whole period 1995-2008. However due to the fact that within this timeframe several periods with different growth dynamics can be distinguished we have broken down the whole period into three subperiods, 1995-2000, a period of recession in the Romanian economy, 2000-2004 and 2004-2008 two periods of expansion and high growth. Regarding the geographical scale we have followed a “top-down” approach starting the analysis by looking at the results at national level, then at the so called “economic regions level” and in a third stage at “county level”. The analysis of the growth dynamics is followed by an econometric exercise which first tries to check for the (non)existence of convergence and then we have studied to which extend the economic geography of the country is a key ingredient in the observed growth dynamics. The results on the one hand show that disparities across Romanian counties, regardless of the time period under analysis, have not been narrowing away. On the other hand we analyze which factors are behind the observed growth dynamics. At

this point our results show that the economic geography of Romania emerges as one of the key factors behind this divergence phenomenon.

The rest of the chapter is structured as follows: Section 2 briefly reviews the neo-classical growth model as it constitutes the theoretical framework on which the empirical section of the chapter is inspired. Section 3 presents a brief overview of the transition process in Romania. Section 4 offers a thorough analysis of the growth dynamics in Romania over the period 1995-2008. Section 5 analyzes in detail the regional growth in Romania by typology of region. Section 6 carries out an econometric exercise to link the economic Geography of the country with is growth performance over the period 1995-2008. Section 6 complements the analysis with a factor analysis and finally section 7 establishes the main conclusions of this chapter.

3.2. The Neo-Classical Model of Growth and the Convergence Hypothesis

3.2.1. The Neo-Classical Model of Growth

For most of the period since the end of the Second World War the analysis of economic growth has been dominated by debates which have swirled around the neo-classical growth model. The concept of convergence has its roots in this model generally referred to as the Solow model of growth and whose origin were the works of Robert Solow (1956) and Trevor Swan (1956). The basic neo-classical model describes a one-sector closed economy with a composite, single “Robinson Crusoe” agent (Household/producer) who owns the inputs and manages the production process.

The following discussion of this model is based on Chapter one of Barro and Sala-i-Martin´s (1995) book titled Economic Growth, chapter one of Sala-i-Martin´s (2000) book titled Apuntes de Crecimiento Económico, and Romer´s (1996) book titled Advanced in Macroeconomics.

In the simplest form of the neo-classical model, output Y at time t is a function of the variables physical capital $K(t)$ and labour $L(t)$, and the level of technology which is exogenous:

$$Y(t) = F\left(A(t), K(t), L(t)\right) \tag{3.1}$$

The central characteristics of the neo-classical model are the assumptions that (I) the level of technology is exogenously determined, (II) the production factors labour and capital each have diminishing marginal products, and (III) the production function shows constant returns to scale.

The level of technology $A(t)$ is considered as given, it is exogenously determined. In the long term, only a rise in technological level enables an increase in the steady state output. The assumption of a given technology to which every economy has free access is a strong simplification, given that technological progress is largely the result of research activities; however, there is some justification for this assumption. On a world-wide scale certain technological standards have been reached, to which an economy can find more and more easily access (for instance software that one can download from internet sites). In general, the argument of equal access to available technology, or fast technology diffusion, can be considered to be valid for highly open economies with a similar level of basic education of the population.

Technology is treated as labour augmenting: $Y = f\left(K, L * A(t)\right)$. It raises output in the same way as an increase in labour. (In this sense an innovation is Harrod neutral, i.e. the relative inputs shares $K * F_K / L * F_L$ are unchanged for a given capital/output ratio[25].

In the neoclassical model of growth a key assumption is that the marginal product of capital is positive, but it declines with raising capital. Hence, all other factors equal, any additional amount of capital yield a decreasing rate of return in the production function. This assumption is central to the neo-classical model of growth. Under this condition, capital accumulation does not make a constant contribution to income growth. The assumption of diminishing returns has been heavily challenged by new growth theory, which believes for instance human capital accumulation to yield constant returns, if not increasing ones- a possibility when considering knowledge spill-overs.

The condition of constant returns to scale implies that we can rewrite the production function in per capita terms, in its intensive form as it is also called:

$$y = f(k) \equiv F\left(\frac{K}{AL}, 1\right) = k^{\alpha} \qquad (3.2)$$

This is a function of capital per unit of effective labour.

3.2.2. Convergence in the Neo-Classical Model of Growth

3.2.2.1.Theoretical concept

The neo-classical model of growth postulates the convergence of regional incomes. Given the dynamics of this model of growth discussed

[25] An alternative assumption is that technological progress is Hicks neutral

in the previous section, one may expect that in a set of economies, which have the same steady state per capita income, and which differ only in their initial capital endowment per person and per capita income, initially poor economies will grow faster than rich economies to converge finally to the same per capita income. In the literature, the phenomenon that poorer economies on average will grow faster than richer ones (over the long term) has been termed as β - *convergence*. Such differential growth is necessary to reduce the intercountry variation of per capita income levels. A tendency for the dispersion of per capita incomes (as measured by their standard deviation) across a group of countries to fall over time has been labelled σ - convergence. Clearly, progress in σ -*convergence* is not only a function of the differential rates of growth between poorer and richer countries but also of the size of the initial income gap.

β - *convergence* is a necessary but not a sufficient condition for σ -*convergence*[26]. β -convergence implies the existence of a longer-term catch-up mechanism, i.e forces which work towards the narrowing of income differences across countries. These forces, however, can be offset by temporary shocks which adversely (or, positively) affect short-run growth performance. This is why the existence of β -*convergence* may not be fully reflected in changes of the dispersion of income levels[27]. The basic kind of convergence to a common steady state is referred to *as absolute convergence* (Barro and Sala-i-Martin, 1991, 1995; Sala-i-Martin, 1996; De la Fuente, 1995; Galor, 1996; Seidel, 1995). The assumption of a unique steady state will be only satisfied if all economies have the same fundamental parameters with respect to the saving rate s, population

[26] For a discussion of these convergence concepts see X. Sala-i-Martin (1996).
[27] See Barro (1997) and Henin and Le Pen (1995).

growth n, capital depreciation δ, and above all the same level of technology A[28], i.e if they all have the same production function. The only different is in the endowment of capital.

The view that economic growth is a complex function of a wide range of interrelated factors, over and above traditional factor inputs, has led some analysts to develop the idea of *conditional convergence.* This remains within the neo-classical framework but describes the tendency of countries to converge on their own long run equilibrium paths as a function of a number of preconditions or "conditioning variables", i.e. richer economies converge towards a high level of income, whereas poor economies converge towards a lower level income level (Ben-David, 1994). Differential growth rates then reflect the distance of countries from their own steady states[29]. This of course is a concept of convergence which has a completely different meaning from that of (absolute) β *-convergence.* In the case of groups of countries with broadly similar long-run equilibrium positions, there may be a tendency for (absolute) convergence within such groups (Convergence clubs) but not between them[30].

[28] Remember that $A(t)$ the level of technology in the neo-classical production function is often interpreted in the sense of comprising institutional infrastructure and hence the effectiveness of institutions and government systems as well.

[29] Mankiw (1995), pp.284.

[30] Baumol, (1986) comparing income levels in 1870 and 1979, identified a group of 16 advanced economies in such a convergence club. It is noteworthy that he found also some tentative evidence for club convergence among a group of the former centrally planned economies. A more restrictive form of the "club convergence" hypothesis is the requirement that countries are broadly similar both as regards their fundamental structural characteristics and their initial conditions, Galor (1996).

3.2.3.Methodologies of Convergence Analysis

Convergence studies can be placed in three broad categories: Cross-Section studies for absolute and conditional convergence, panel data analysis and Markov chain analysis. I sketch their main arguments and characteristics here.

3.2.3.1.Cross Section estimation of absolute convergence

Barro and Sala-i-Martin in their prominent paper titled "Convergence" (Journal of Political Economy, Vol. 100(2), April 1992, pp.223-249) estimate the absolute β -convergence on the basis of a univariate cross-country regression of per capita income growth between year t and $t+T$ ($1/T \log\left(y_{i,t+T} / y_{i,t} \right)$) on the initial level of per capita income ($y_{i,t}$).

The steady state income per capita of an economy is y_i^* , and x_i^* is the steady state growth rate of output, corresponding to the labour augmenting technological progress. So the specified equation to test β convergence would be:

$$1/T * \log\left[y_{i,t+T} / y_{i,t} \right] = x + \frac{(1-e^{-\beta * T})}{T} * \log\left[y_i^* / y_{i,t} \right] + u_{it,t+T} \qquad (3.3)$$

In practice, estimation is effected with the reduced form (Barro and Sala-i-Martin 1995:387, Sala-i-Martin 2000:202):

$$1/T * \log\left[y_{i,t+T} / y_{i,t} \right] = a + \frac{(1-e^{-\beta * T})}{T} * \log\left[y_{i,t} \right] + u_{it,t+T} \qquad (3.4)$$

In this specification one does not find the steady state y^* or the steady state growth rate x . Both are contained in the intercept a :

$$a = x + \frac{(1-e^{-\beta * T})}{T} * \log(y_i^*) \qquad (3.5)$$

We work with this reduced form because neither the steady state of an economy nor its steady state growth rate is known. This specification states absolute convergence as it considers a common intercept a for the set of economies that represents the steady state according to equation (3.4).

3.2.3.2.Cross Section estimation of conditional convergence

The available empirical evidence does not support the universal convergence hypothesis: there is no systematic tendency for poor economies to grow faster than richer ones. In fact, the dominant feature has been for diverging productivity levels and real per capita incomes between the group of advanced industrialized economies on the one hand and the developing countries on the other[31]. There are, of course, some significant exceptions, such as the East Asian growth rates. The general conclusion, however, is that countries do not tend to converge to the same balanced growth path, but rather settle on different ones. Such differences would lead to steady state differences. Conditional convergence is estimated on the basis of a multivariate regression analysis, with initial income and a set of "conditioning variables" X_i as proxies for the determinants of the long-term balanced growth path of the individual economies.

The equation to estimate is the following one:

$$1/T * \log\left[y_{i,t+T} / y_{i,t} \right] = a + \frac{(1 - e^{-\beta * T})}{T} * \log\left[y_{i,t} \right] + X_i + u_{it,t+T} \quad (3.6)$$

[31] For this empirical evidence see Pritchett (1997), Jones (1997), UNCTAD, Trade and Development Report, (1997), Sala-i-Martin (2000).

Conditional convergence exists if the coefficient on the initial income is negative. In other words, in case of conditional convergence there is a negative partial correlation between initial income per capita and subsequent growth.

3.2.3.3.Panel data estimation of convergence

Region-specific effects can be modelled by employing panel data estimation techniques. As a panel data estimation technique uses observations for several points in time, it is builds on a richer information set[32].

The general econometric specification of a panel data model is the following one:

$$1/T * \log\left[y_{i,t+T} / y_{i,t} \right] = a_i - \frac{1}{T}(1 - e^{-\beta * t}) * \log\left[y_{i,t} \right] + \psi_{t,t+T} + u_{it,t+T} \quad (3.7)$$

However in order to use OLS in the estimation, the coefficient $\frac{1}{T}(1 - e^{-\beta * t})$ is changed by a general coefficient b an the equation can be rewrite in the following way.

$$1/T * \log\left[y_{i,t+T} / y_{i,t} \right] = a_i - b * \log\left[y_{i,t} \right] + \psi_{t,t+T} + u_{it,t+T} \quad (3.8)$$

where the error term are composed of a_i, an unobserved individual effect which is constant over time, a time-specific factor $\psi_{t,t+T}$ which equally effects all individuals, and a random error $u_{it,t+T}$.

[32] Islam (1995) and Canova and Marcet (1995) show that cross-section analysis lead to a systematic downward bias of the convergence coefficient due this technique neglects unobservable factors and hence suffers an omitted variable bias.

The average growth rate between t and $t+T$ should be negatively related to the initial logarithm of the per capita income level $\log(y_{i,t})$. This relationship is represented by the common coefficient b. The region-specific fixed effect present over the whole sample period is captured with a_i. The term $\psi_{t,t+T}$ represents the time-specific effect affecting all individuals in period t, $t+T$. This specification of the model means that we estimate convergence through a two-way fixed effects model (see Hsiao 1986 and Baltagi 1995).

The speed of convergence β can be obtained from the following relationship between the coefficients of $\log(y_{i,t})$ in Eq. (7) and (8):

$$\beta = -\frac{1}{T}\ln(1-Tb) \tag{3.9}$$

The region-specific fixed effect a_i determines the region´s steady state income. This fixed effect is a concept similar to taking explanatory variables or country dummy variables in the conditional convergence analysis. The difference with the conditional convergence analysis is that panel data estimation allows for continuous individual conditional effects while the former assumes to identify groups of individual units. With the time-specific effect ψ_t global shocks are captured.

3.2.3.4. Markov Chain Models

Markov Chain models are a different approach to model convergence issues and growth dynamics. They have been employed by Quah (1996) Magrini (1995), Fingleton (1997, 1999) Durlauf and Quah (1998). The basic Markov Chain assumes that, given I income-level states, each region has a probability $p_i(t)$ of being in state i at time t, and given

state i at time t, a transition probability $m_{ij}(t)$ of being in state j at time $t+1$. By making the simplifying assumption that all transition probabilities are unchanging over time, that is, that $m_{ij}(t) = m_{ij}$ for all t, ordering these stationary probabilities as the $I-by-I$ transition matrix M and denoting $p_i(t)$ as the time-dependent elements of the $1-by-I$ row vector $p(t)$ then

$$p(t+1) = p(t) * M = P(0) * M^t \tag{3.10}$$

where M^t denotes the product of t identical M matrices. A consequence of Eq. (10) is the existence of an equilibrium probability $I-by-I$ row vector s where

$$s = s * M \tag{3.11}$$

This vector s is the ergodic probability vector[33] to which each of the rows of M^t tends as t tends to infinity and thus describes the stochastic equilibrium- in other words, the different output per capita level (state) probabilities to which the system converges under a single model for the transition probabilities.

Markov model implies that permanent interregional output per capita differences may characterize the system of EU regions at equilibrium which is quite unlike the equilibrium envisaged by basic neo-classical theory.

[33] Ergodicity is a property of a Markov Chain in which there is a finite mean recurrence time for each state, where the recurrence time is the time required for a first return to a state, and return is possible at any time. The ergodic probability vector is often referred to as the equilibrium distribution for the Markov chain but is preferred so as to distinguish it from the equilibrium of an economic system.

3.3. A brief overview of the transition process in Romania: Some Important facts

Michael Fairbanks in his book "*Changing the Mind of a Nation: Elements in a Process for Creating Prosperity*" (New York, 2000), says that transition is a sloppy process and can never occur in an easily described sequence. Despite this, people who want to construct their own transitions will have to have a schema that is shared and some sense of the components that are necessary to promote change, as well as a broad scope of skills and insights across many domains[34]. According to Fairbanks (2000) some potential steps that can be taken by the society undergoing a transition process are:

a) Decoding the current development strategy
b) Creating a sense of urgency
c) Understanding the range of strategic choices and be informed about them with analyses
d) Constructing a compelling vision for the country after transition
e) Creating new networks of relationships
f) Building productive coalitions
g) Developing and communicating short-term wins
h) Institutionalizing the changes
i) Evaluating and affirming the changes

The case of the Romanian transition can be considered as one of the most interesting cases from Eastern Europe, which began with an armed, social and economic revolution in December 1989. Since the beginning of the transition, it was clear that Romania´s road towards a functional

[34] Michael Fairbanks. "Changing the Mind of a Nation: Elements in a Process for Creating Prosperity," in Lawrence Harrison & Samuel P. Huntington, Culture Matters: How Values Shape Human Progress. New York: Basic Books, 2000.

economic market would not be easy. The lack of reforms, for instance in education, health care, private property, agriculture and industry join with the hyperinflation problems during the nineties was the usual scenario. Under these circumstances there was not point to talk about convergence. The rules of the game had to been imposed by the State and this was too weak to do it[35]. The main task and objectives of Romania was to obtain the appropriate institutions, but this challenge resulted to be a difficult one. New ways of doing politics, new politicians and new institutions were needed in order to promote coherent policies to reduce economic insecurity and social gaps and to encourage innovation and growth and increase the coordination and cooperation among the different market players. These factors were necessary conditions in order to establish the playground to support economic growth and therefore to reduce the economic differences across Romanian regions.

The Romanian transition process was more complicated than in the other Central and Eastern European countries. One of the main reasons was due to the fact that in the late 1980s, the Romanian economy was about to collapse, after 40 years of a strict central planning system which overemphasized the independence of its economy and overly relied on the heavy industry and the large and non-profitable infrastructure projects. One of the most "famous" cases is the industrial policy focus during the last decade of socialism in Romania which was basically to continue investing in heavy industry and other non-profitable industrial objectives. However, much less importance was given to the modernization and upgrading of existing technologies, which together

[35] Dinu, M., „ "*The way out from the alternative"*, *Ieşirea din alternativă*", *(Economie teoretică şi aplicată),* nr. 10, (Bucharest, 2006).

with a drastic decrease in technology imports, made many industrial companies being almost economically unfeasible after the transition. Therefore, the industrial sector became totally inefficient, extremely oversized and this partly explains the dramatic economic fall of the Romanian economy during the 90s[36]. Moreover, the lack of a true entrepreneurial capability, in Romania many people believe that anyone can be an entrepreneur, and the wrong political view[37] lead to a total disaster. The absence of a clear vision and integrated strategy for the country may partly explain why the results of the reforms have tended to be overwhelmingly disappointing. There is evidence showing that governments in Romania selected "off the shelf" reforms derived from one set of assumptions (implicit or explicit) and at the same time they selected other reforms based upon quite different or even directly contradictory premises. The political and administrative leaders made these selections hoping that all the changes would work well together but they did not and at the same time the interactions also have proven to be mostly negative. The slogan "We do not sell our country" was extremely famous in Romania during the 90s, however there were a lot of misleading interpretations in order to understand the theory and practice of the privatization processes. In Romania, the "private property of the state" found often a preferential legal status before the citizen's private property and it is well known the fact that the process of privatization in Romania was accompanied by deliberate firm bankruptcies with the future goal of buying these companies at very

[36] Birsan, M. *Integrare economică europeană*, ("*European economic integration"*), vol. III, *Mediul european a afacerilor*, Editura Fundaţiei pentru Studii Europene, (Cluj-Napoca, 2006).

[37] From this point of view, Romania offered a new example when the minister of economy himself guided the fired miners to use the received "compensation" in order to start their own business which of course was a complete failure.

cheap prices[38]. The Romanian governmental industrial strategy based on incremental techniques (1992-1996) and measures of bankruptcy and liquidation (1997-1999), were not successful in prioritizing the key sectors and the main activities of the economy. Thus, the overall volume of the manufacturing industry production recorded a constant decline. On top of these problems, throughout this period the government was forced to take additional measures in order to control the rampant inflation and reduce the fiscal deficit. The government was forced to decrease subsidies for key sectors of the economy such as in the agriculture sector and specially mining and industry sectors; the result was a rapid decrease in real wages (40% during the first 3 years of the transition). Moreover, in spite of the privatization measures taken in the public sector, very little growth was registered and instead the debt and the budget deficit of the country have continuously shown increasing rates.

The 2001-2002 National Human Development Report[39] (NHDR) for Romania made in the framework of the United Nation Development Program offers a very good contribution to the understanding of the transition processes, stressing the need for a more systemic and virtuous policy approach, a more adaptive capacity of the policy makers as well as a built-in capacity for managing change and complexity.

Based on the information provided in the report some key features from the economy, demography, health care and education system point of view are worth mentioning and summarizing in the Romanian transition process.

[38] Ion Pohoata I.*," The Paradigm of Neoinstititional Economics*, Econ Papers,Vol. 10(515), (Iasi, 2007).
[39] United Nation Development Program, Romania 2001-2002" A decade later: Understanding the transition process in Romania" (Bucharest, 2003).

3.3.1. Economy

a) By 1994, more than 80% of the arable land owned by co-operative farms was returned to their real owners;
b) There was an increase in exports, especially between 1992-1995 but there were continuous fluctuations thereafter;
c) The Industrial Production Index (IPI), decreased almost by 50% between 1990-1993, it showed some signs of recuperation by 1997, but in 1998 the IPI declined again;
d) The number of employees in the decade decreased by 44%, noticeably the great brunt of the impact being absorbed by the agricultural and construction sectors;
e) The share of GDP changed dramatically in a decade. Whereas the public sector contributed more than 80% in 1990, in 1999 it only contributed 38%. Similarly, the private sector's contribution to the GDP in 1990 was a mere 16%, while in 1999 it has grown to over two-thirds.
f) The transition in Romania was accompanied by an explosive increase in poverty. In 1989, an estimated 7% of the population was poor. By 1994, the poverty rate ranged, according to the methodology employed, between 22%-39%. A second wave of impoverishment began in 1997 and by 1999 the poverty rate had reached 42% (an increase of more than 60% over the 1995 rate), while extreme poverty doubled over the same period. Romania was the second poorest country in 2007 the year of his adhesion to the EU and in 2012 remains at the same position just after Bulgaria.
g) During the first years of transition, income inequality rose by approximately 50% above its 1989 level. The income differential between the richest 10% of households and the poorest 10%

continued to rise; the incomes of the top 5% on the average exceed those of the poorest by a factor of more than 15.

h) The minimum salary, intended as a basic guarantee of the dignity of labor and the welfare of the workers, has fallen dramatically from its 1989 level, and the proportion of those earning the minimum salary or close to it has increased sharply but even so is the second lowest on the EU member states once again after Bulgaria with just 167euros/month.

i) Over the past decade the labor market in Romania has shrunk and people have experienced for the first time in many years a sense of insecurity and uncertainty about employment prospects but the unemployment rate were and it still is below EU average. During 2000-2008 the unemployment rate was about 5-7%.

We have to understand that as central planning collapsed, a long process of de industrialization and economic restructuring started, which among its other effects, changed radically the spatial organization of economic activity in Eastern European countries. Old spatial organizations and divisions, organized along the so-called 'enterprise space' (Pickles and Smith, 1998), were soon – and very radically – transformed into new formations along new (and uneven) geographical lines, that resembled more traditional schemes of core-periphery. Transition was soon followed by increasing economic openness, with substantial shifts in trade partners and specializations and significant inflows of foreign investments, both of which contributed further to altering the economic geography of the countries concerned[40].

[40] Monastiriotis V., *Regional Growth Dynamics in Central and Eastern Europe*, LEQS papers, No.33/2011 (London, 2011).

3.3.2. Demography

a) From 1992 to 1999, the total population of Romania decreased from 24 million to 22.5 million, and furthermore until 2011. Nowadays the total population is about 19 millions. The most important causes seem to be a declining in the birthrates in combination with an increased death rate and external migration.
b) Between1993-1998, more than 120,000 Romanians emigrated and between 2000 and 2010 more than 3 million persons emigrated.
c) Only a slight increase in urban population can be noticed from 54% in 1991 to 55% in 1999. Related to the urban/rural ratio is the rate of internal migration the one which shows an increase from 11.3 in 1990 to 12.3 per thousand inhabitants in 1998.
d) The female/male population in Romania shows some slight but significant changes. In 1990, 50.7% of the Romanian population was female, while by 1999 this figure increased to 51.1% and to 52% in 2010.This trend can be explained mainly by an increase in the overall women's life expectancy.
e) The average family size in Romania has shrunk, as the number of smaller households (1-2 people) has grown while the larger households (3 to more than 6 people) have continued to decline.
f) In 1998 there were 40% more entrepreneurs and 40% more self-employed in Romania than in 1992, while the hired employees decreased by 25% in the same period.

3.3.3.Health care system

The health care reform in Romania has progressed, and has been relatively successful in tackling the challenges of primary care (for

example the SMURD[41] ambulance service) but not for the secondary and tertiary dimension, due to tight budget restrictions. Until 1991, almost exclusively administered by the Ministry of Health and Family, the State budget was the only financing source of the health care system. Beginning with 1992, the government adopted a series of policies meant to increase resources. As part of that effort, the Health Special Fund was established based on a 2% income tax, as well as on a small tax applied to tobacco and alcohol sales. Also, in 1993 the responsibility for equipping and maintaining the medical units was transferred from the central state to the local authorities' budgets. Beginning with 1998, the main source of finance for the public health care system is the Health Social Insurance National Fund. Contributions to this fund are equally paid by the employee and by the employer. People not earning a steady income (i.e., children, youth, retired and military conscripts) have free access to public health services.

3.3.4.Education system

The reform in the educational system has continued at a much slower pace, including attempts to decentralize financial matters and some decision-making areas. Nonetheless, school capacity in Romania is not being optimized adequately nor is it being given appropriate inputs and resources. Education holds a strategic position in any socio-economic system and/or process, as it can have tremendous long-term impact, both as means and as ends. Before the transition, the Romanian educational system was centralized under the authority of the Ministry

[41] SMURD is an emergency rescue service in Romania. SMURD is the Romanian acronym for "Serviciul Mobil de Urgenţă, Reanimare şi Descarcerare", that means Mobile Emergency Service for Resuscitation and Extrication. It has been created and coordinated since its creation in 1991 by Raed Arafat.

of Education and Research (formerly Ministry of National Education). Budgets, curriculum policies and regulations were all managed centrally and delivered to regional and local echelons for implementation. At the regional level, County school inspectorates had administrative oversight, as well as ensured teachers' training. Schools had very little autonomy in the decision-making process, much less teachers and other stakeholders (parents).

By 1992, key changes began to take place in the educational system of Romania. For example, obligatory education period was reduced to 8 years, the size of classes became smaller to ensure a better student/teacher ratio, new didactical and learning methodologies were introduced, and education in minority languages was allowed for the first time ever. The first real initiatives within the framework of a reform program took place between 1994-1995 with the (separated) financial assistance of the World Bank and the European Union's PHARE Program. The new Education Act came into force in September 1995 (which was later in 1997 further amended). Also, by 1995 the process of administrative decentralization had started and certain expenses, namely maintenance and reparations, were transferred to the local public authorities. Although the legal frame for the decentralization process is still not clear, in 1998, a new educational monitoring and evaluation system was created to measure students' performance. After 2007 the education system suffers another set of reform in order to accomplish the EU criteria.

By 1997, the educational system in Romania was still highly centralized, as it funded almost 75% of the expenses, while local budgets' contribution was only 14%. In 1999, supplementary responsibilities

referring to the pre-school education expenses were transferred to the local public authorities. The Ministry of Education and Research was still responsible for expenses related to salaries, textbooks, and other expenses related to special education. The national budget will remain the main source of finance in the immediate future, but local contributions are expected to increase. In 2000, over 10% of the state budget expenses and 8% of the local budget expenses were oriented towards the education system but these figures never came true. A new criterion to finance educational policy in Romania is also being developed. For example, in 2000 there was a new finance mechanism introduced to allow for more proportionality between budget and activities (i.e., number of pupils). Also, in the financing of public universities a new distinction between the "basic" and "complementary" financing has been introduced in 2000. Universities are now expected to invest in their own structure using partnership with other private and governmental economic agents.

The reform of the educational system in Romania remains a work in progress even in 2012 after the introduction of the so called "preparatory year" and the creation of the list of accredited universities.

However, there are still numerous obstacles and challenges to overcome, such as the emerging disparities in educational inputs and outputs within Romania. It is a complex process in which the reform initiatives coexist with old elements and practices, like in a puzzle. Similarly, the persistence, in different forms, of a diverse set of strategic purposes and objectives clearly is affecting the consistency and continuity of reform efforts. This is why the establishment of an efficient system, suitable for the new education realities of a transition country, with a more efficient

and professional management structure, represents a premise for an authentic reform.

Finally, we can still say that the process of transition in Romania is still an ongoing process. Romania is not a full market economy even after 22 years of democracy, but since the transition began some progress has been made although overcoming the industrial policies from the past, complete the transition from a centralized to a market economy, introduce competitiveness among market players and bringing substantive changes to the Romanian managers and enterprises have been and are still the greatest challenges during this process.

3.4. Growth dynamics in Romania: 1995-2008

The processes of transition from a central planning economy to a more market oriented economy and EU accession, the two dominant political and socio-economic processes that characterized the countries of Central and Eastern Europe (CEE) since the collapse of communism, have, over the last two decades, been followed by different growth dynamics which lead to interesting patterns of convergence, divergence and polarization. CEE economies, contrary to Western European countries which have had the historical framework to be aware of the importance of protecting institutions and building a solid institutional framework, have ignored the important role of the institutions in their processes of transition, generating a defective institutional framework, with high transaction costs, uncertain property rights, inflation problems in many cases, not clearly imposed laws, barriers in the way products enter on the market, etc. Moreover, the accession of CEE countries to the European Union in 2004 and 2007 intensified the processes of economic integration,

restructuring and national development, thus shrinking the evolutionary time during which the aforementioned processes were to take place. Economic transformations occurring globally and increased risk aversion contributed to a significant reduction of capital flows to Romania, increased pressures upon exchange rate[42].

Under the influence of these processes, the last twenty years have seen an important change in the old spatial economic structures and a sharp increase in regional disparities across many Central and Eastern European countries. Romania did not escape to such changes. The deindustrialization process in Romania was very important. The share of industry in Romania's GDP decreased from 46% in 1985 to less than 28% in 1999, however, its contribution to the export sector is still decisive. In 1997 and 1998 respectively, 97% of the value of exported goods in Romania was produced in the industry sector, while in 1999 the figure was 95%. Moreover, strong patterns of polarization and core-periphery structures emerged which were characterized by the concentration of economic activities around Bucharest-Ilfov, Timisoara and Cluj-Napoca, leaving other parts of the country, mainly in the North-East relatively underdeveloped. Therefore, the process of national convergence, stimulated by increasing openness and economic and political integration, has not been accompanied by a similar trend for cross-regional incomes equilibration.

Transition was soon followed by increasing economic openness, with substantial shifts in trade partners and specializations and significant inflows of foreign investments, both of which contributed further to

[42] Ungureanu D.M., Ruxandra D., Horia G., Florian B. – Romania´s real convergence to the European Union, volume 2, Econ papers, Bucharest, 2002.

altering the economic geography of the countries concerned among them it was also the case of Romania.

In order to analyze the growth dynamics of the Romanian economy during this twenty years[43] after the fall of its communism system in December 1989 we have broken down the whole period into 4 sub periods which are going to be analyze at three different levels, national level, *economic region*[44] level and county level.

a) 1995-2008 which constitutes our whole sample period
b) 1995-2000, this is a period mainly characterized by huge political instability, severe economic crises and also high inflation
c) 2000-2004 a period characterized by the recovery of the economy and subsequent high growth rates as a result of the reforms of the 90s combined with the positive effects coming from the rest of the countries in Europe.
d) 2004-2008 is a period characterized at the European level by a big enlargement of the European Union and unprecedented economic growth rates in Romania (average 8-10% annualy).

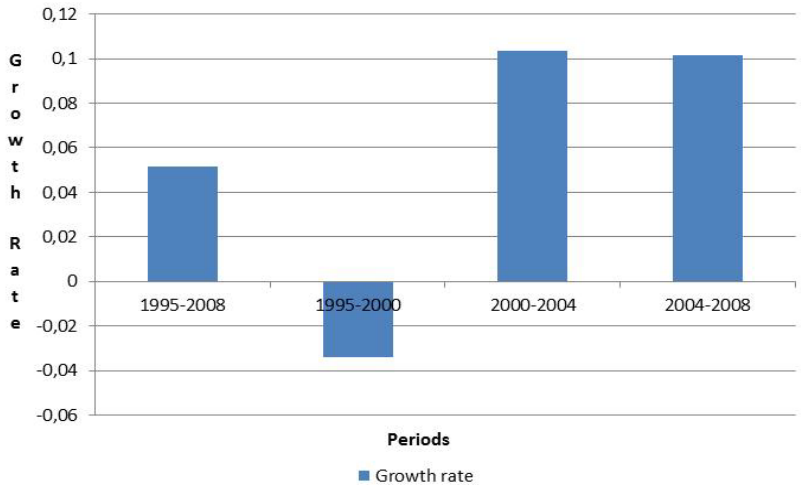
[43] 1990-1994 is a period characterized by the beginning of the privatization process, the launching of the first economic reforms and also a period of high hyperinflation. The lack of a set of reliable and comparable data in this period is the reason why it is not incorporated in our analysis.

[44] The development regions of Romania refer to the eight regional divisions created in Romania in 1998 in order to better co-ordinate regional development as Romania progressed towards accession to the European Union. The development regions correspond to NUTS II-level divisions in European Union member states. Despite becoming increasingly significant in regional development projects, Romania's development regions do not actually have an administrative status and do not have a legislative or executive council or government. Rather, they serve a function for allocating European Union PHARE funds for regional development, as well as for collection of regional statistics. They also co-ordinate a range of regional development projects and became members of the Committee of the Regions when Romania joined the EU on January 1, 2007.

3.4.1. Growth dynamics in Romania at the country level

Due to the lack of reliable and homogeneous data for Romania we start our analysis in the year 1995. A first image of what was the situation like in terms of growth rates since 1995 can be seen in figure 3.1 which breaks down the growth rates in Romania for different periods. Growth rates were computed in real terms (base year 1995) using data from the Romanian national statistical institute (INSSE) and Eurostat. Figure 3.1 shows that for the whole period of analysis (1995-2008) the average real per capita GDP growth rate was slightly above 5%. However if we split the whole period of the sample in the different sub periods we have already mentioned, we can see that the second half of the nineties, especially after 1996 which was the last year of economic growth of the 90s, is a period of a deep recession in Romania which elongates until the year 2000 with negative real per capita GDP growth rates of around -3.4%. Moreover, within this period, the years from 1997 to 2000 can be seen as belonging to a black period where the Romanian transition was full of political and institutional storms. If we focus only on the data of these years, the negative GDP growth rates of the Romanian economy were far worse off reaching -5.7%. From 2000 onwards, the situation in Romania changed drastically. Both 2000-2004 and 2004-2008 periods were periods of economic expansion with high per capita GDP growth rates (8-10% annually). These periods were also accompanied by the negotiation of the different chapters of EU membership that Romanian authorities agree with their European counterparts.

Figure 3.1: Average Growth Rate in Romania by periods: 1995-2008



Source: Own elaboration based on INSSE and Eurostat data

Table 3.1 provides us with detailed information on the real per capita GDP growth rates of the different periods shown in figure 3.1.

Table 3.1: Average growth rate in Romania by periods

Period	% Growth rate		Period	% Growth rate
1995-2008	5.18 %		**1996-2008**	4.85 %
1995-2000	-3.41 %		**1996-2000**	-5.70 %
2000-2004	10.34 %			
2004-2008	10.16 %			

Source: Own elaboration based on data from the Romania Statistical Institute

3.4.2. Growth dynamics at the Romanian economic region level

Our next step in the analysis of the growth dynamics across the different levels of aggregation-disaggregation of the Romanian economy goes one level down moving to the so called "Romanian economic development regions". Romania is divided into 8 economic development regions named on the grounds of their geographical location in the country: Northeast Region 1, Southeast Region 2, South Muntenia Region 3, Southwest Oltenia Region 4, West Region 5, Northwest Region 6, Center Region 7, and Bucharest and Ilfov Region 8.

Northeast Region 1 includes the following counties: Iasi, Botosani, Neamt, Suceava, Bacau and Vaslui. It has a total of 3.8 million inhabitants (about 14.6% of the total population of the country) and an area of 30,949 km2. Southeast Region 2 includes the counties of Vrancea, Galati, Braila, Tulcea, Buzau and Constanta with a total of 2.9 million inhabitants and about 35,770 km2. South Muntenia Region 3 is situated in the south includes 7 counties: Prahova, Dambovita, Arges, Ialomita, Calarasi, Giurgiu and Teleorman, it has a total population of 3.4 million inhabitants and a territory of more than 35,450 km2. The Southwest Oltenia Region 4 includes the county of Mehedinti, Gorj, Dolj, Olt and Valcea, the territory of these region is situated near the border between Bulgaria and Serbia is about 31,211 km2 and a population of 2.4 million inhabitants.

West Region 5 is one of the most developed in the country, the main county is Timis but other three are included: Arad, Hunedoara and Caras-Severin. The territory of this region represents over 14% of Romanian surface near the frontier with Serbia and Hungary. Northwest Region 6 represents 14.3% of national territory and about 12.6% of Romanians population. The counties included are Bihor, Cluj, Bistrita-Nasaud, Maramures, Satu Mare and Salaj.

The Center Region 7 includes Alba, Sibiu, Mures, Harghita, Covasna and Brasov county the hearth of Transylvania, the total population is 2.7 million inhabitants.

The smallest region is the Bucharest and Ilfov Region 8 that includes the capital Bucharest and the county that surrounds' him, it has about 1,821 km2 and 2.1 million inhabitants more than 10% of total population.

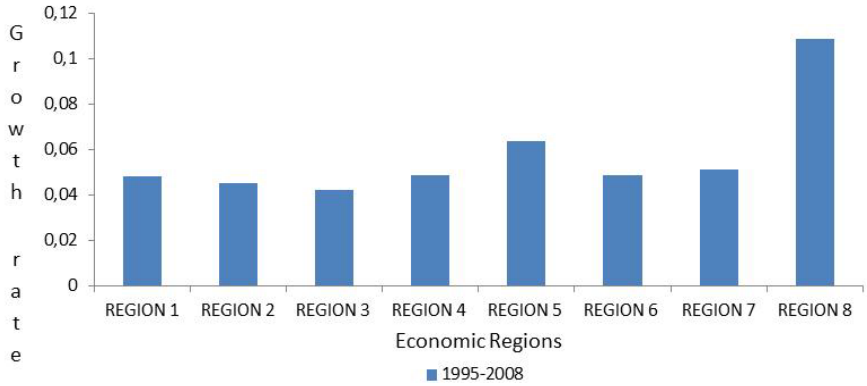
These 8 economic development regions are wrap up into four macro-regions; macro-region 1 (RO1) which includes Northwest Region 6 and Center Region 7, the macro-region 2 (RO2) which includes Northeast Region 1 and Southeast Region 2, the macro-region 3 (RO3) which includes South Muntenia Region 3 and Bucharest and Ilfov Region 8 and the macro-region 4 (RO4) which includes Southwest Oltenia Region 4 and West Region 5.

Our analysis of the growth dynamics for the Romanian economic development regions keeps the same structure than the analysis previously carried out at the country level, i.e, we divide the whole period of analysis into four sub periods, 1995-2008, 1995-2000, 2000-2004 and 2004-2008 using GDP data from the Romanian national statistical institute at 1995 prices and Eurostat data.

Figure 3.2 shows the 1995-2008 average real per capita GDP growth rates in the 8 Romanian economic regions. The most remarkable feature in this figure is the extraordinary performance of the Bucharest-Ilfov economic region which by far is the most developed region in the country with an average growth rate for the whole period over 10%. On the lower end of the scale are South Muntenia and North-East economic regions which are among the poorest economic regions in the country reaching during this period an average real per capita GDP growth rates slightly below 4.5%. If we exclude Bucharest Ilfov economic development region from our sample, which clearly acts as an outlier, the most developed economic regions in Romania are located in the Western and center parts of the county being form by the West, North-west and Center economic region (see also map 3.1). These regions are situated geographically close to Hungary (West economic region) and in some

parts of Transylvania (North-west and Center economic regions) and therefore are benefited by having high market access, a better infrastructural endowment than the rest of the regions in the country and also by being closer to the Western European markets than their counterparts in Romania. On average during 1995-2008 they grew at rates ranging between 5- 6.3% annually.

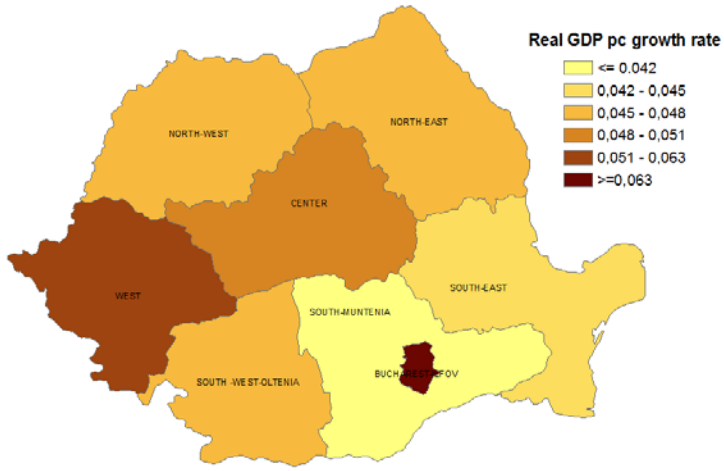
Figure 3.2: Average Growth Rate in Romania by periods: 1995-2008



Note: Region 1: North-East; Region 2: South-East; Region 3: South-Muntenia; Region 4: South –West Oltenia; Region 5: West; Region 6: North-West; Region 7: Center; Region 8: Bucharest-Ilfov

Source: Own elaboration based on INSSE and Eurostat data

Map 3.1: Real GDP per capita growth rate in Romanian economic regions 1995-2008

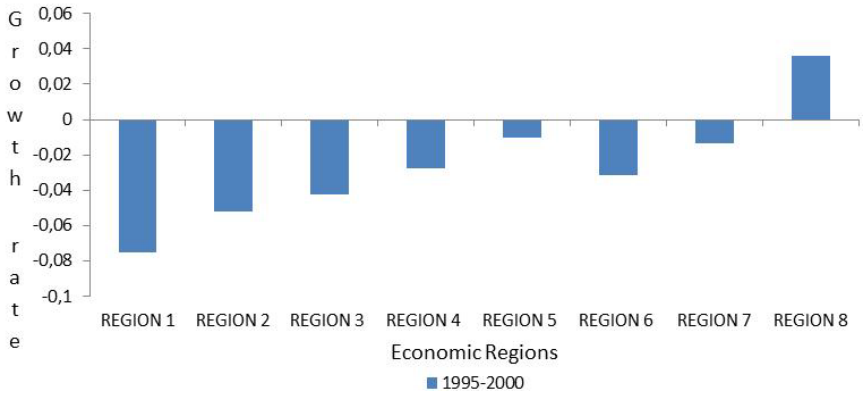


Source: Own elaboration based on INSSE and Eurostat data (GDP base year 1995)

If we analyze in more detail the different sub periods that form our sample at the Romanian economic region level we can see that during the first sub period 1995-2000, a period characterized by a deep economic fall and by the disastrous reforms carried out in the country between 1994-1996, Bucharest-Ilfov is the only economic region which emerge with positive growth rates achieving an average per capita GDP growth rate during this period of about 3%. Figure 3.3 and map 3.2 show the situation of the different economic regions during this period. As we can see all Romanian economic regions but Bucharest-Ilfov have negative growth rates. Among the looser regions their fall was very different ranging between -1% in the case of the West economic region and almost -8% in the North East region. Therefore it is quite clear that among the Romanian economic regions during this period took place a quite divergent process. This is a main characteristic of the Romanian regions in the road of convergence[45]. The 1995-2000 economic downturn is quite unequal even if we exclude the Bucharest-Ilfov region. West and Center economic regions fall around -1% and the North-East and South-East economic regions fall between -8 and -10.5% due to basically the crisis in the agriculture and industrial sectors.

[45] Iancu, A., *"Transition, Integration and Convergence - The Case of Romania",* "Working Papers of National Institute of Economic Research 101222, National Institute of Economic Research, (Bucharest, 2002).

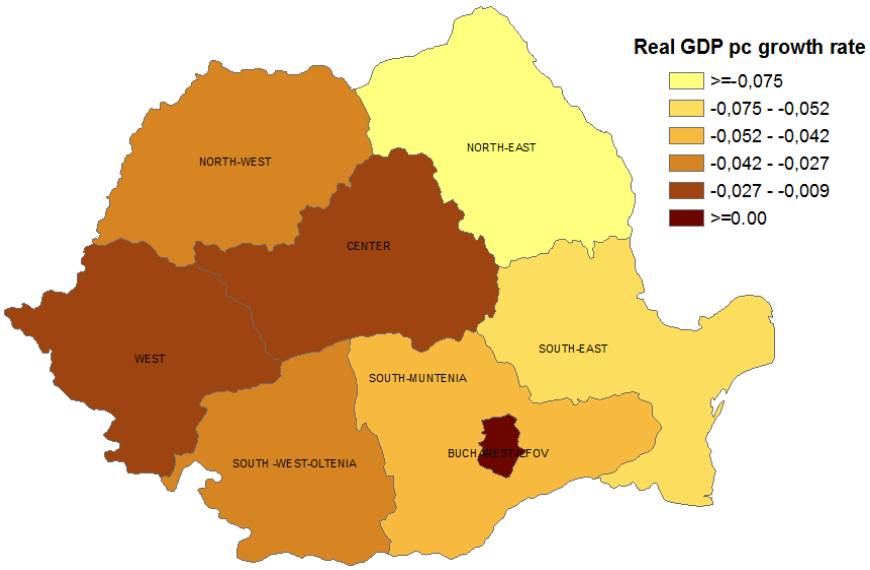
Figure 3.3: Average Growth Rate in Romania by periods: 1995-2000



Note: Region 1: North-East; Region 2: South-East; Region 3: South-Muntenia; Region 4: South –West Oltenia; Region 5: West; Region 6: North-West; Region 7: Center; Region 8: Bucharest-Ilfov

Source: Own elaboration based on INSSE and Eurostat data

Map 3.2: Real GDP per capita growth rate in Romanian economic regions 1995-2000



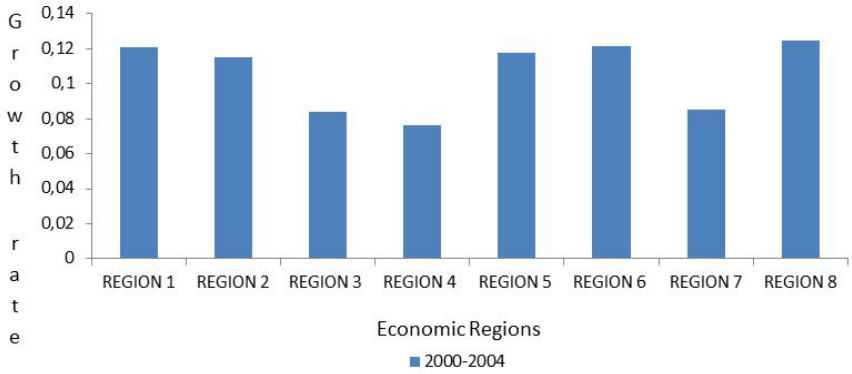
Source: Own elaboration based on INSSE and Eurostat data (GDP base year 1995)

The period 2000-2004 can be considered a period of prosperity in terms of economic growth although the growth rates among the Romanian economic regions vary greatly.

It ranges between 8% in the South of the county (South Muntenia and South –West economic regions) and up to 12% in the Bucharest Ilfov, West and North-West economic regions.

We see a spectacular uprising of the North-East and South-East economic regions which during the previous period had dramatically fallen. Figure 3.4 and map 3.3 show the results.

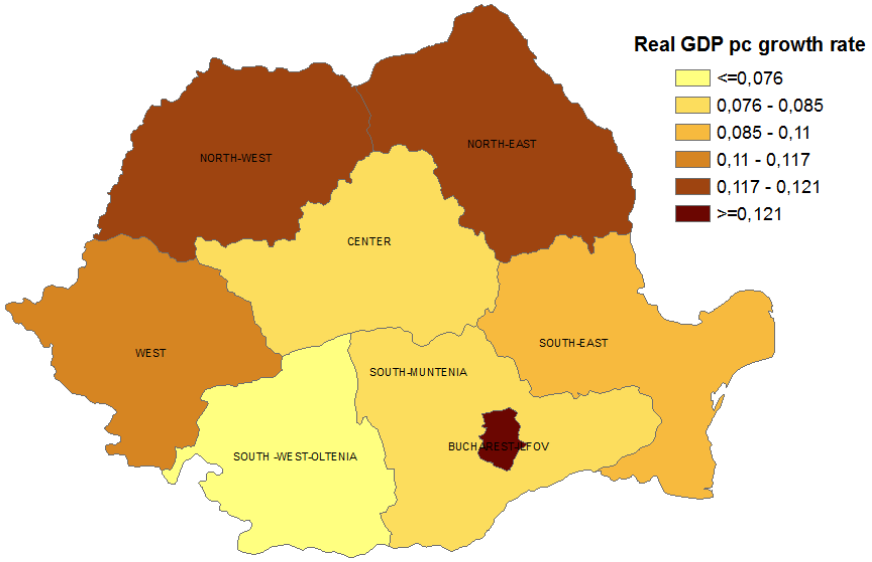
Figure 3.4: Average Growth Rate in Romania by periods: 2000-2004



Note: Region 1: North-East; Region 2: South-East; Region 3: South-Muntenia; Region 4: South –West Oltenia; Region 5: West; Region 6: North-West; Region 7: Center; Region 8: Bucharest-Ilfov

Source: Own elaboration based on INSSE and Eurostat data

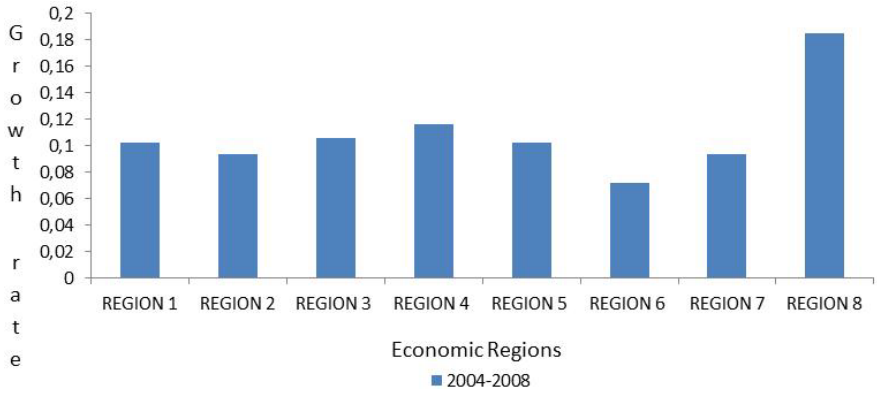
Map 3.3: Real GDP per capita growth rate in Romanian economic regions 2000-2004



Source: Own elaboration based on INSSE and Eurostat data (GDP base year 1995)

The period 2004-2008 is, as the previous one, characterised by high economic growth. Figure 3.5 and map 3.4 show that the Southern parts of the county grow much faster than the others. Again the Bucharest-Ilfov economic region is the one taking the lead. South Muntenia and Sowth-West economic regions have increased their growth rates from 7-8% in the period 2000-2004 to 9-10% between 2004-2008. West, North-West and Center economic regions had an economic slow down between 2004-2008 compared with the previous period.

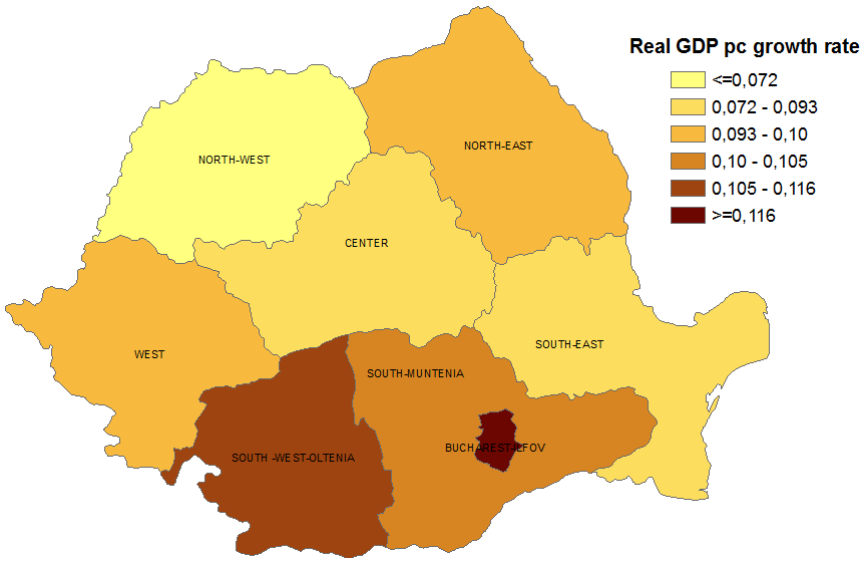
Figure 3.5: Average Growth Rate in Romania by periods: 2004-2008



Note: Region 1: North-East; Region 2: South-East; Region 3: South-Muntenia; Region 4: South –West Oltenia; Region 5: West; Region 6: North-West; Region 7: Center; Region 8: Bucharest-Ilfov

Source: Own elaboration based on INSSE and Eurostat data

Map 3.4: Real GDP per capita growth rate in Romanian economic regions 2004-2008

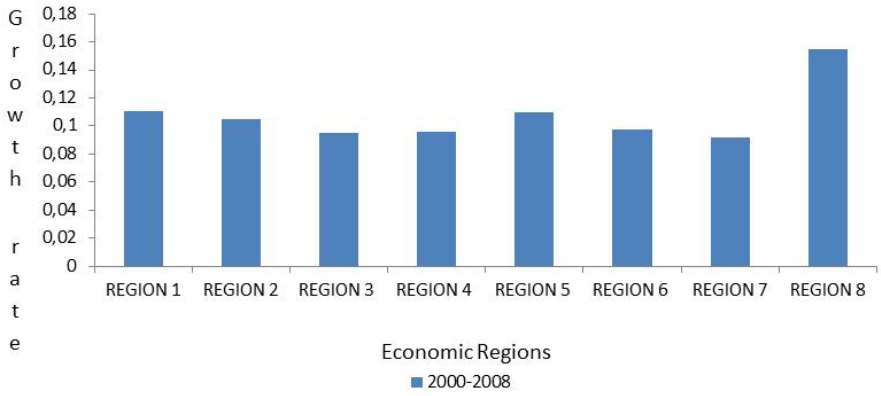


Source: Own elaboration based on INSSE and Eurostat data (GDP base year 1995)

Finally for this analysis at the Romanian economic region level we have merged together the two periods of economic boom 2000-2004 and 2004-2008. Bucharest-ilfov economic region is shown up as the leading

region with an average real per capita GDP growth rate of 15% followed by North-East, South-East and West economic regions with growth rates between 10-11%. The region with the lowest economic growth is the Center region. Figure 3.6 and map 3.5 show the results.

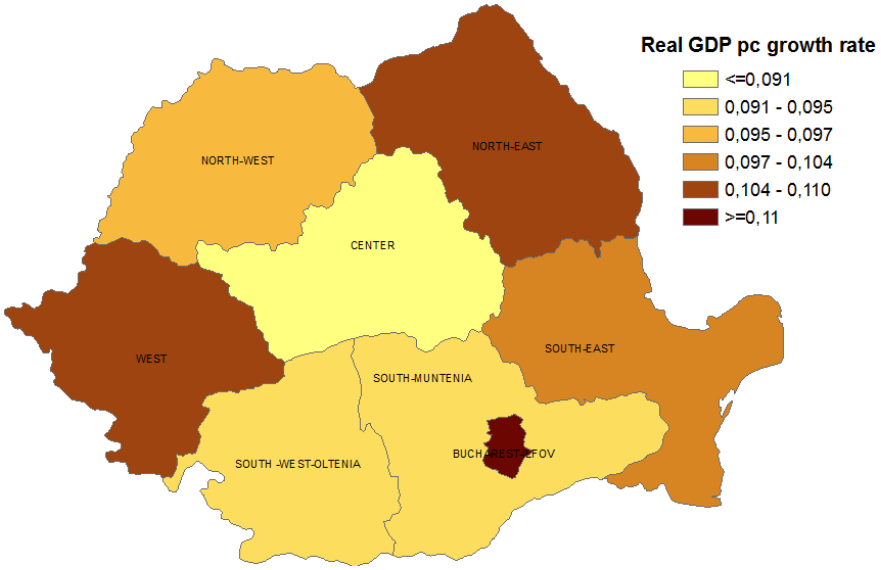
Figure 3.6: Average Growth Rate in Romania by periods: 2000-2008



Note: Region 1: North-East; Region 2: South-East; Region 3: South-Muntenia; Region 4: South –West Oltenia; Region 5: West; Region 6: North-West; Region 7: Center; Region 8: Bucharest-Ilfov

Source: Own elaboration based on INSSE and Eurostat data

Map 3.5: Real GDP per capita growth rate in Romanian economic regions 2000-2008



Source: Own elaboration based on INSSE and Eurostat data (GDP base year 1995)

Table 3.2 provides us with the growth figures for the Romanian economic regions across the different periods covered by the analysis carried out above. The table is divided in seven columns which represent the growth rates for the whole period of analysis 1995-2008 (column 1) and 1996-2008 (column 2[46]), the period of recession 1995-2000 (columns 3) and 1996-2000 (column 4[47]), and the periods of expansion 2000-2004 (column 5) 2004-2008 (column 6) and both periods of expansion merged (2000-2008). The most remarkable feature is the one refering to the Bucharest-Ilfov economic region which was the only region that during the years of recesion stood up with positive per capita GDP growth rates. Bucharest-Ilfov economic region was able to grow at an average rate of about 2,5% during the black years of the transition 1996-2000 but reached growth rate values around 15% during the years of the economic boom 2000-2008. Another important feature in this table is that during the years of economic boom growth rates across the Romanian economic regions were not as variable as they were during the years of recession. During the recesion some regions fall down just -1% (the West economic region for example) while others fall more than -7.5% as is the case with the North-East economic region.

[46] In column 2 we remove from the sample the last period of growth in the second half of the nineties (1996).

[47] Again these computations were carried out removing the data for the year 1996 and therefore all the years in this sub sample were years of recession and consequently the growth rates shown up more negative

Table 3.2: Average growth rate by regions and periods

Region	1995-2008	1996-2008	1995-2000	1996-2000	2000-2004	2004-2008	2000-2008
REGION 1	4.8%	3.6%	-7.5%	-10.6%	12.1%	10.2%	11.1%
REGION 2	4.5%	4.5%	-5.2%	-7.5%	11.5%	9.4%	10.4%
REGION 3	4.2%	4.2%	-4.2%	-6.5%	8.4%	10.6%	9.5%
REGION 4	4.9%	4.4%	-2.7%	-6.1%	7.6%	11.7%	9.6%
REGION 5	6.4%	6.2%	-1.0%	-3.5%	11.7%	10.2%	11.0%
REGION 6	4.9%	4.7%	-3.1%	-3.9%	12.2%	7.2%	9.7%
REGION 7	5.1%	4.8%	-1.3%	-3.8%	8.5%	9.3%	9.1%
REGION 8	10.9%	11.2%	3.6%	2.6%	12.4%	18.5%	15.5%

Note: Region 1: North-East; Region 2: South-East; Region 3: South-Muntenia; Region 4: South –West Oltenia; Region 5: West; Region 6: North-West; Region 7: Center; Region 8: Bucharest-Ilfov

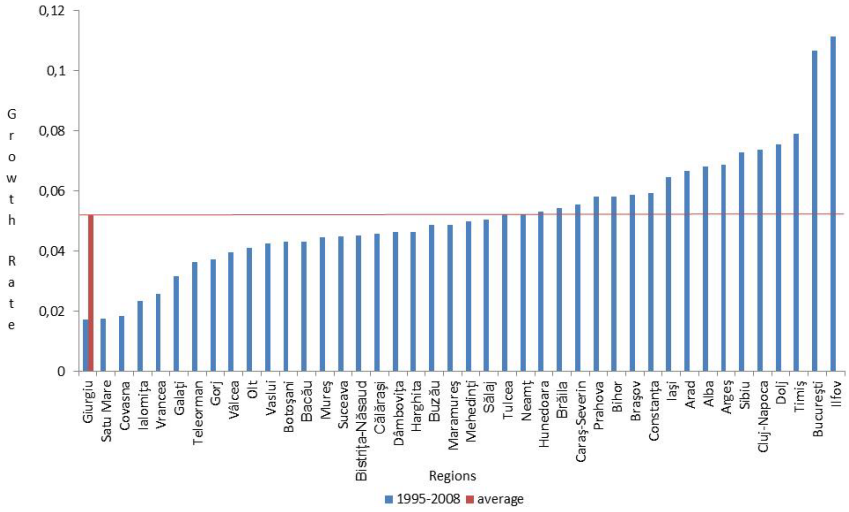
Source: Own elaboration based on INSSE and Eurostat data

3.4.3. Growth dynamics at the Romanian county level

In order to dig deeper into the Romanian growth dynamics this section goes another level down and we analyze the growth performance of the country at a county level.

Figure 3.7 plots the 1995-2008 average real per capita GDP growth rate at county level. During this period we can see that 23 counties are growing below the national average per capita GDP growth rate and 19 counties are growing above the average. Map 3.1 shows that the poorest regions are in the East, South-East and South parts of the country and the richest counties are in the West and North-West parts of Romania. The county of Covasna located in the center of the country with its high mountainous geography can be considered an exception.

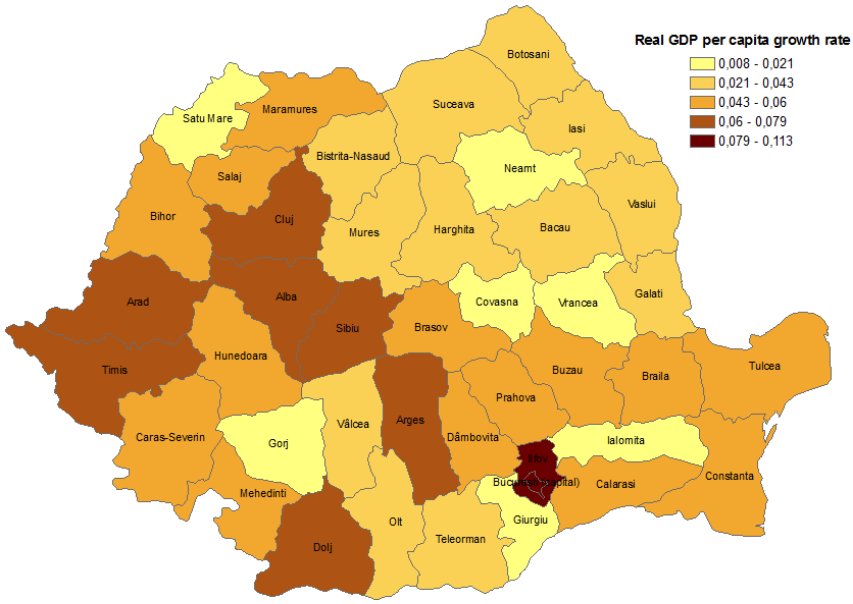
Figure 3.7: Average Growth Rate in Romanian counties: 2000-2008



Source: Own elaboration based on INSSE and Eurostat data

Map 3.6 shows very clearly the different growth paths across Romanian counties. Giurgiu, Ialomita and Gorj at the lower end of the growth scale can be seen as isolated counties in the sense that they are not sorrounded by other counties wich feature the same growth path. Only Covasna and Vrancea are neighbors within this group. At the upper end of the scale, the best performing counties are situated in the West part of the country and Transilvanya, with the exception of the capital Arges and Dolj. It is also worth to remark that the next group of counties which are above the lower end in terms of growth rates are place mainly in the North-East economic region with the exception of three counties from the Center economic region and another three counties from the South-Muntenia economic region.

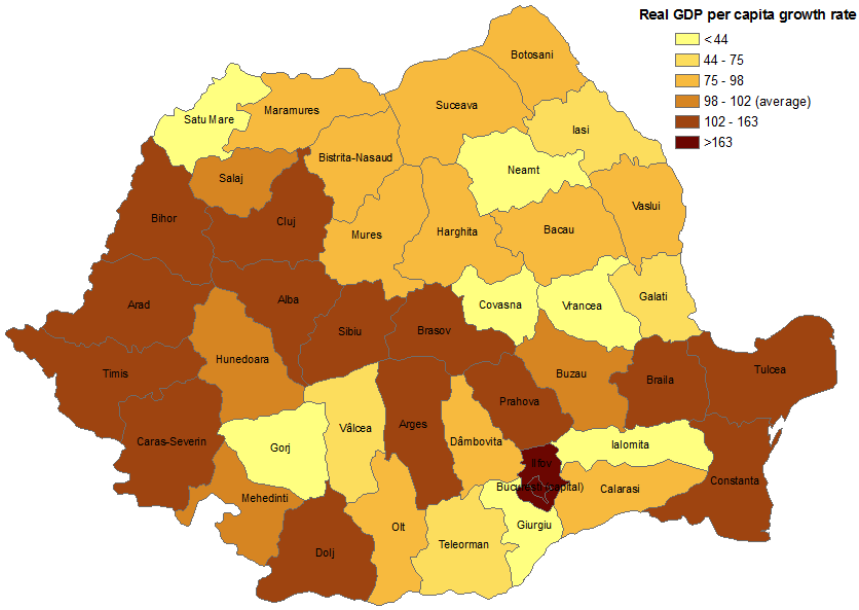
Map 3.6: Real GDP per capita growth rate in Romanian economic regions 1995-2008



Source: Own elaboration based on INSSE and Eurostat data

If we standardized the value of the national average per capita GDP growth rate to 100 and compute each county´s relative ratio to the national average a much clearer picture about those counties which perform better and worse than the national average and how are they spatially distributed can be obtained. The results of this transformation can be seen in map 3.7. From the map it can be seen that 18 counties plus the capital are situated above the national average and 23 counties are below this average. Among the highest disparities between neighboring counties in a spatial sense are the cases of the Bucharest-Ilfov county and Giurgiu and Ialomita counties. Giurgiu and Ialomita ratio is 44% whereas the Bucharest-Ilfov region ratio with the national average is situated 163% above it. Again the map shows that the Western parts of the country are emerging among the best performers.

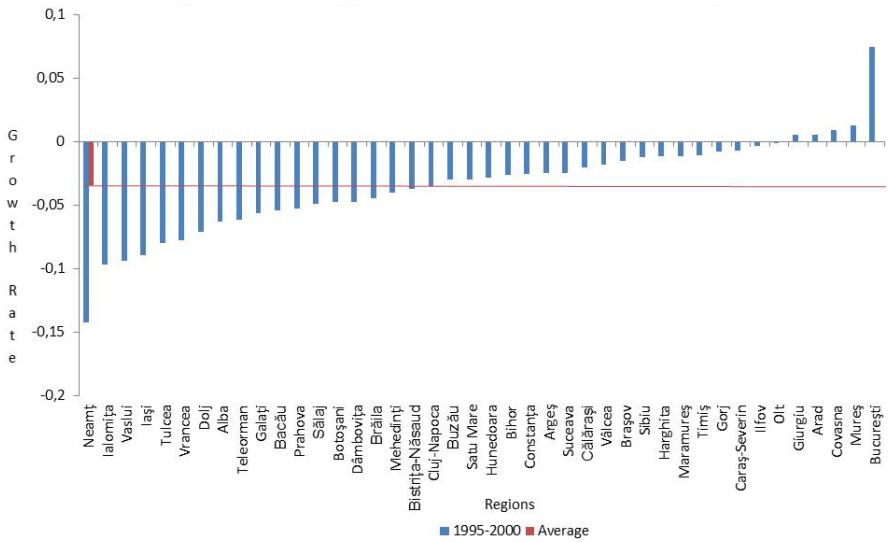
Map 3.7: Growth rate in Romanian economic regions 1995-2008 (average=100)



Source: Own elaboration based on INSSE and Eurostat data

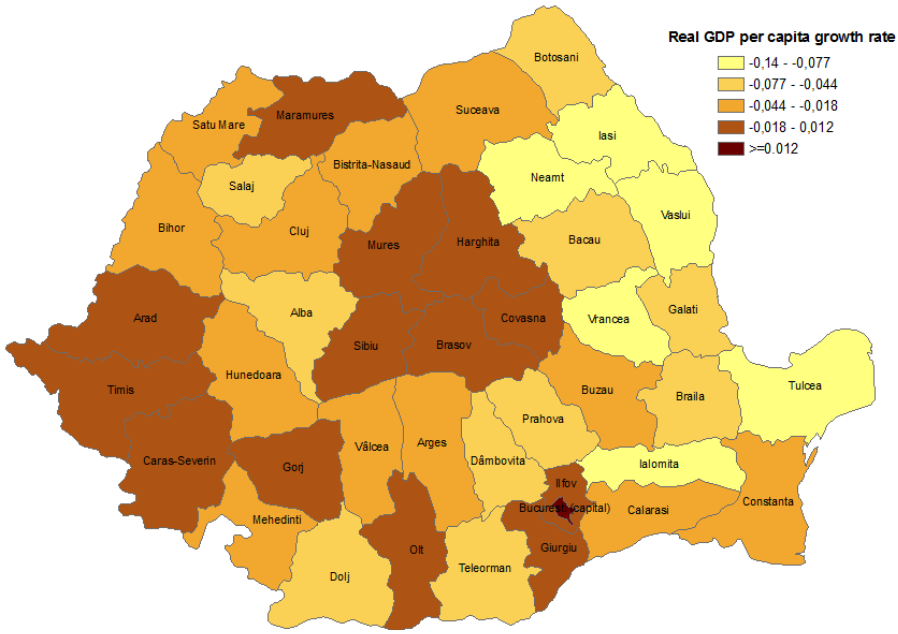
Figure 3.8 represents the average per capital GDP growth rate in Romanian regions in the years of the economic crisis of the 90s. 19 counties are situated below the national average per capita GDP growth rate, most of them from the Eastern and Southern parts of Romania. The most spectacular fall in growth was registered in the Neamt county (North-East) with almost a -20% per capita GDP growth rate. During this period only five counties have registered positive growth rates. Map 3.8 provides us with an image of the spatial distribution of counties according their respective growth rates.

Figure 3.8: Average Growth Rate in Romanian counties: 1995-2000



Source: Own elaboration based on INSSE and Eurostat data

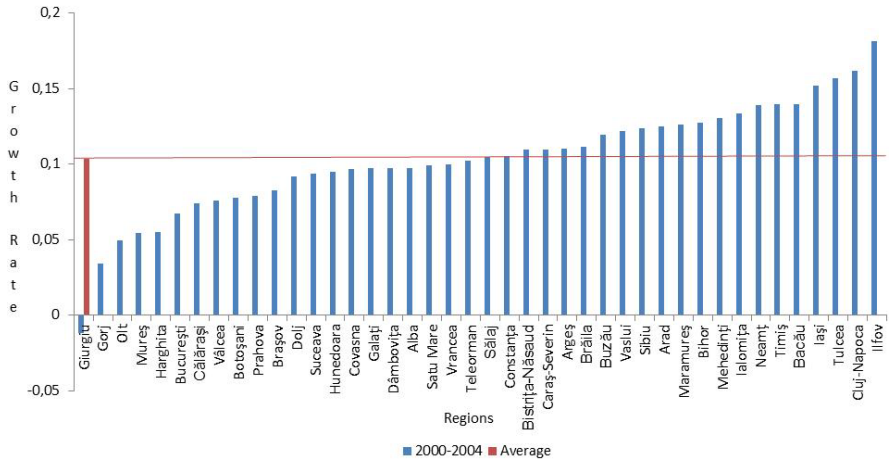
Map 3.8: Growth rate in Romanian economic regions 1995-2000



Source: Own elaboration based on INSSE and Eurostat data

After the economic crises in the last half of the nineties and the implementation of the economic reforms and new elections in 2000 a totally new economic landscape showed up for Romania. New economic activities were boosted and the growth rates in some counties reached values between 15 to 18%. This positive economic trend was in part helped by a European favorable economic climate. Under these circumstances during the period 2000-2004 (figure 3.9) 19 Romanian counties experienced a rapid economic growth above the national average and just 2 counties from the South experienced a growth rate just below 5%. One of the most relevant cases is the Giurgiu county which continued in recession until 2004. In the period 2004-2008 this position was taken by the Covasna county. Both counties are the poorest counties in Romania.

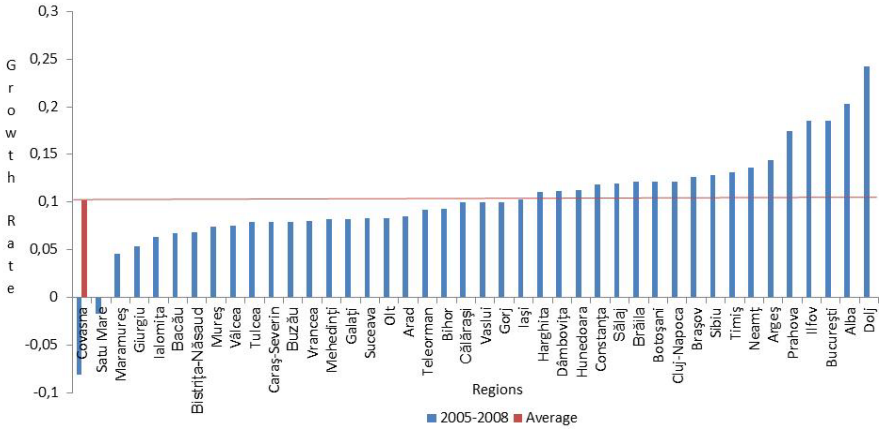
Figure 3.9: Average Growth Rate in Romanian counties: 2000-2004



Source: Own elaboration based on INSSE and Eurostat data

The economic boom in the first half of the 2000s continued in the period 2004-2008 although with a mild reduction in growth rates with respect to the previous period. However, even during this period some counties outperform their previous growth rate values such as Bucharest with a 20% growth rate two points above its average growth rate in 2000-2004. Again the countries from the West parts of Romania remain as the ones performing above the national average growing on the range 11-16% annualy (see figure 3.10).

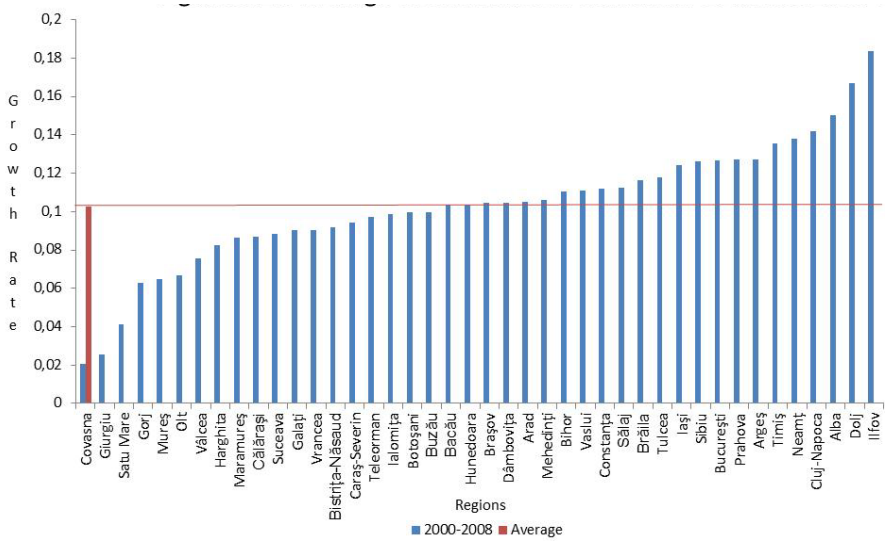
Figure 3.10: Average Growth Rate in Romanian counties: 2005-2008



Source: Own elaboration based on INSSE and Eurostat data

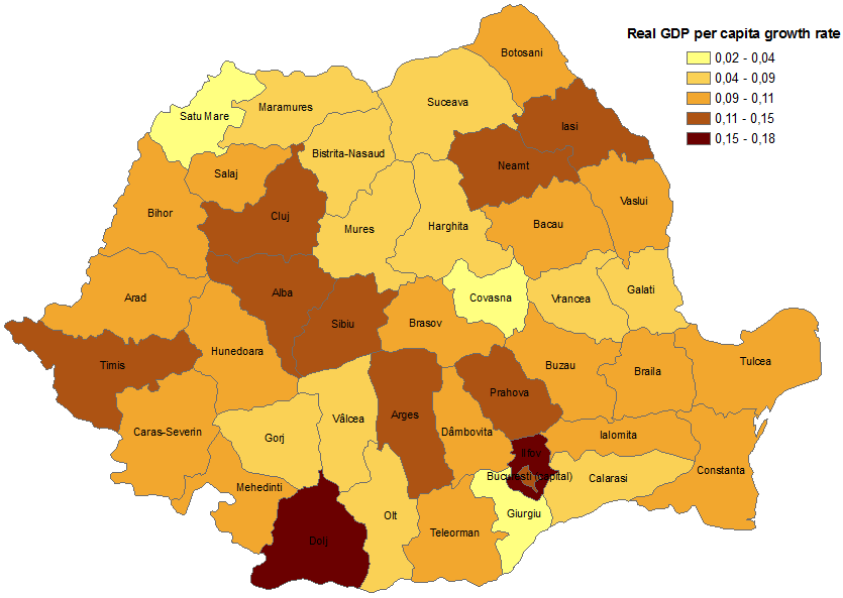
In order to wrap up some final conclusions on the economic boom from 2000 onwards we have merged in figure 3.11 the growth rates across Romanian counties for 2000-2008. It is worth remarking that many counties during this period have experienced growth rates well above the national average and the majority of the good performing counties are located in the West and Center parts of Romania (map 3.9). The capital once again highlights being the leader in terms of economic growth and the Covasna and Giurgiu counties experienced the lowest growth rates during this period.

Figure 3.11: Average Growth Rate in Romanian counties: 2000-2008



Source: Own elaboration based on INSSE and Eurostat data

Map 3.9: Growth rate in Romanian economic regions 2000-2008

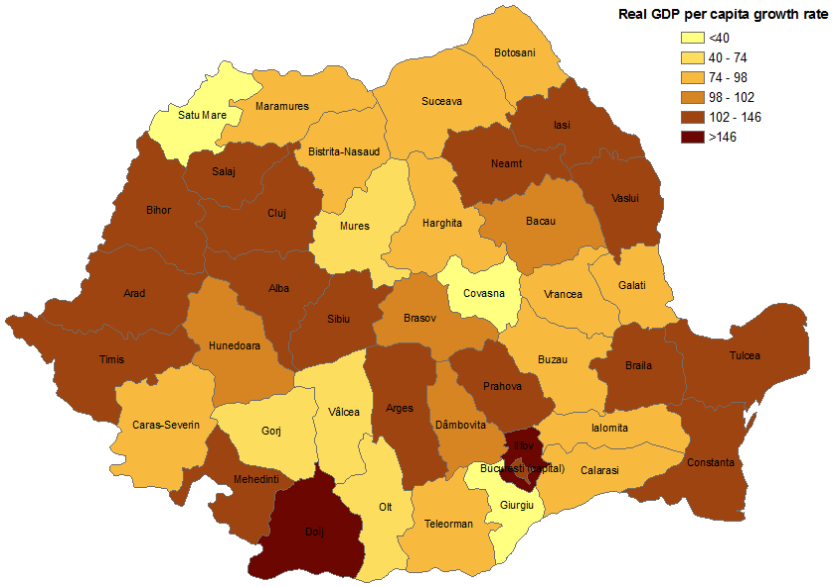


Source: Own elaboration based on INSSE and Eurostat data

Computing the county ratios of the per capita GDP growth rates with respect to the national average give a quite interesting picture (map

3.10). The Giurgiu, Covasna and Satu Mare counties are the counties located at the lower end of the index (below 40% with respect to the national average). On the upper end of the scale are Bucharest and Dolj county (above 146% of the national average). The West economic region jointly with North-West and Center economic regions were the leading regions that boost the Romanian economy during the 2000-2008 period due mainly to the high investments in the auto-motion electronic industry (Timis, Cluj, Sibiu and Bihor county).

Map 3.10: Growth rate in Romanian economic regions 2000-2008 (average=100)



Source: Own elaboration based on INSSE and Eurostat data

3.5. Regional growth in Romania by typology of region: 1995-2008

The previous sections in this chapter as well as the analysis carried out in chapter 2 of this PhD thesis have shown us that economic wealth and development levels are not evenly distributed across Romanian counties.

Strong regional disparities in GDP per capita and a core-periphery spatial structure in the distribution of both income levels and educational attainment levels has been a constant feature of Romania since the beginning of the nineties.

In this section of the chapter we analyze the performance of the Romanian counties in the period 1995-2008 grouping counties into four categories according to their relative performance with respect to the national average in terms of per capita GDP growth and initial per capita GDP levels[48]. Moreover we have also broken down the whole period of analysis into four sub periods in order to analyze in more detail what has been the situation like in each of them.

Figure 3.12 classifies Romanian counties according to their GDP per capita in 1995 and their economic performance during the period between 1995 and 2008. The reason for starting our analysis in 1995 is that before 1995 there was neither reliable data collected at county level for Romania nor a comparable and homogeneous set of data with the figures obtained in recent years. Data for the period 1990-1995 is not available, due to lack of source of necessary data (Structural Inquiry in Enterprises)[49].

The regional-county data in this analysis is measured in deviations from the national mean. With this transformation-standardization in our variables we are minimizing the typical problems that arise in this type of analysis and which refer basically to the spatial autocorrelation (see Armstrong, 1995; Rodríguez-Pose, 1999; Magrini, 1999).

[48] This analysis is inspired by the paper "Education, migration, and job satisfaction: the regional returns of human capital in the EU" written by Rodriguez-Pose and Vilalta-Bufi (2005) and published in the Journal of Economic Geography 5 (2005) pp. 545–566.

[49] INSSE – National institute of Statistic, Bucharest, Romania. (www.insse.ro)

In this way, all the variables used in this section indicate how well a county is doing relative to the Romania´s average. Any value above 1 indicates that a county is performing better than average, while values below 1 denote a below average performance.

Therefore, if we take the average Romanian GDP per capita in 1995 and its growth between 1995 and 2008 (figure 3.12) we can classify our counties into four groups:

1. Catching-up counties: counties with a low starting level of GDP per capita in 1995 with respect to the Romanian average, but with an above average economic performance for the period 1995-2008.
2. Winning counties: counties with both above national average 1995 GDP per capita and economic growth rate in the period 1995-2008.
3. Losing counties: counties with both below national average 1995 GDP per capita and economic growth rate in the period 1995-2008.
4. Falling behind counties: counties with an above national average 1995 level of GDP per capita, but with below average economic performance in the period 1995-2008.

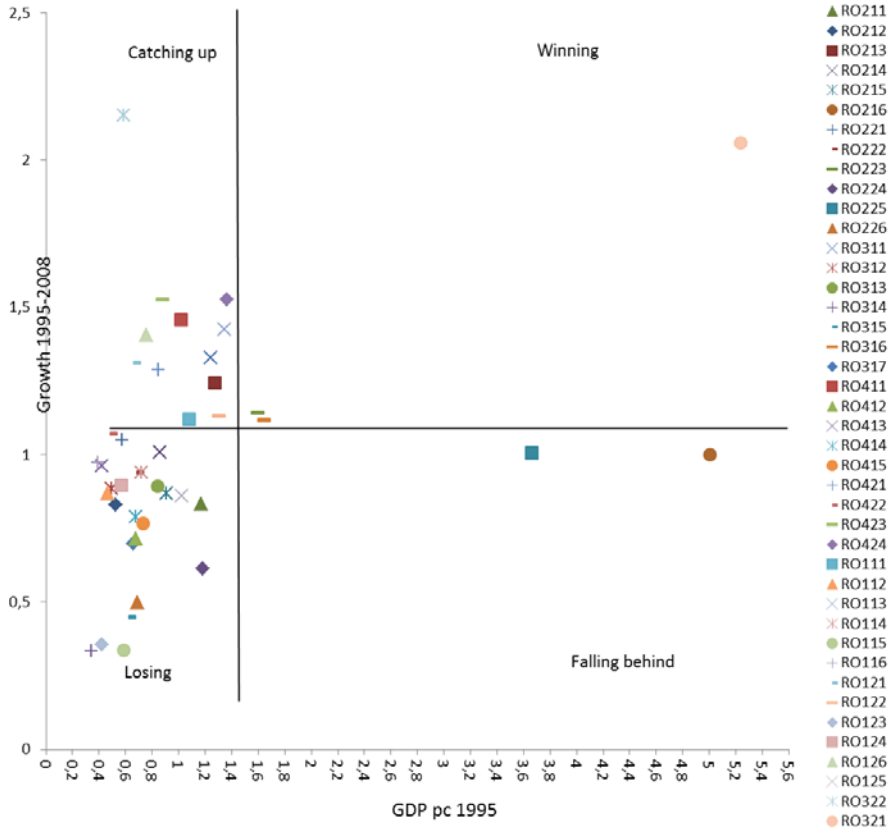
Therefore according to this classification, the first two categories of counties can be thought of dynamic counties whereas the other two categories (losing and falling behind counties) can be thought of less dynamic counties.

The results plotted in figure 3.12 confirm that, when regional GDP and economic performance are considered as deviations from the national mean, there is little evidence of convergence. Most Romanian counties tend to fall either in the winning or losing category, a factor that is in agreement with the recent findings of those authors that have identified greater polarization across regions in the Central and Eastern European

countries (Monastiriotis, 2011). In contrast, during this period only four regions are falling behind, and only a handful seems to be catching up.

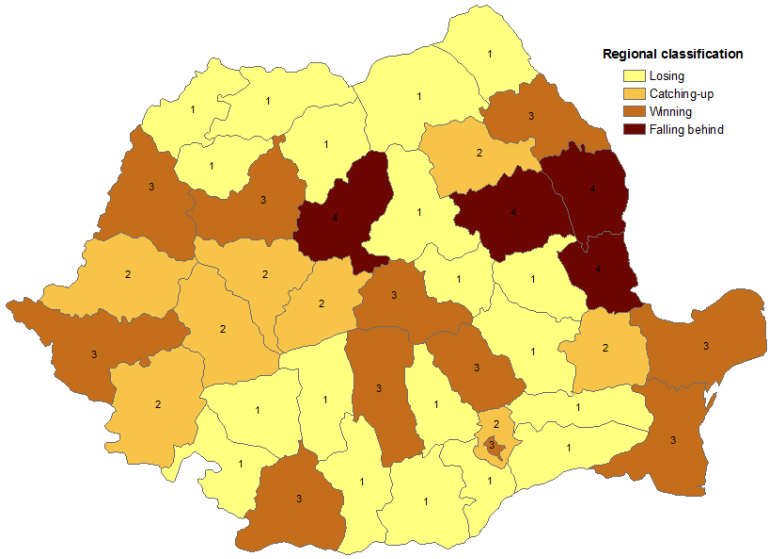
Map 3.11 helps us to explain the county grouping we have done in figure 3.12 based on the geographical location of each category within Romania. As we will see hereafter there are some geographic features which are common to the counties belonging to a particular group. Therefore based on the combined information of figure 3.12 and map 3.11 the following observations can be made:

Figure 3.12: Growth performance of Romanian counties: 1995-2008 (variables nationally standardized)



Source: Own elaboration based on INSSE and Eurostat data

Map 3.11: Growth rate in Romanian economic regions 1995-2008



Source: Own elaboration based on INSSE and Eurostat data

Romanian losing counties are situated around the Carpathian Mountains going from the North-North-West (near the Ukraine border) and the central parts of the country towards Center-South and reaching the Serbian border in the South-West part of the country; They form the largest group and consists of a series of industrial declining regions which were forced to an incredible industrialization process during the communism era but they remained with the legacy of a non-competitive industry in the nineties. These counties are: Satu Mare, Salaj, Maramures, Bistrita-Nasaud and Botosani, excepting the first one and the last one the other four counties are remote regions, with a mountain geography and therefore less developed.

Among the winning counties, we find Timis, Constanta, Bucharest-Ilfov, Cluj, Iasi and Dolj places were the industrial and services sector is highly developed as well as places home to some of the most important urban agglomerations such us the Romanian capital and Timis county.

The catching-up counties are always located near a winner county as the winner county acts like a center of economic activity for the surrounding locations. Only four counties belong to the falling behind category, they are located in the so called East region which is the most underdeveloped region of the country. The complete set of counties belonging to each category can be seen in the following table 3.3:

Table 3.3: Classification of Romanian counties: 1995-2008

Losing	Catching up	Winning	Falling behind
Botoşani	Neamţ	Iaşi	Bacău
Suceava	Brăila	Constanţa	Vaslui
Buzău	Arad	Tulcea	Galaţi
Vrancea	Caraş-Severin	Argeş	Mureş
Călăraşi	Hunedoara	Prahova	
Dâmboviţa	Alba	Dolj	
Giurgiu	Sibiu	Timiş	
Ialomiţa	Ilfov	Bihor	
Teleorman		Cluj	
Gorj		Braşov	
Mehedinţi		Bucureşti	
Olt			
Vâlcea			
Bistriţa-Năsaud			
Maramureş			
Satu Mare			
Sălaj			
Covasna			
Harghita			

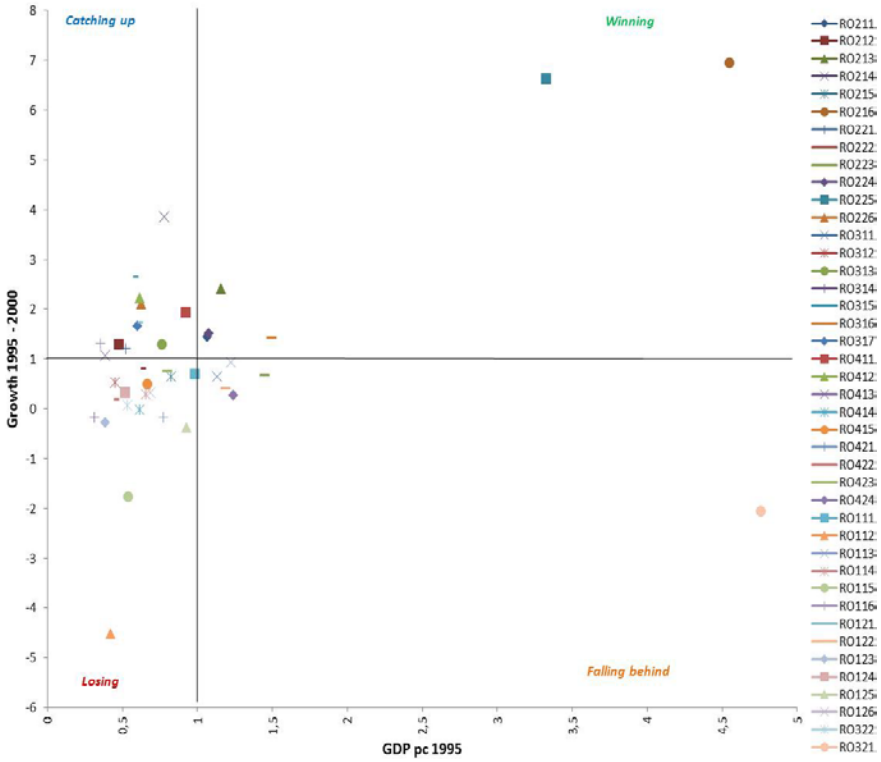
Source: Own elaboration based on INSSE and Eurostat data

In the remaining part of this section we are going to break down the whole period of analysis into a period of severe crisis (1995-2000) and two periods of high growth (2000-2004 and 2004-2008).

Figure 3.13 classifies again the Romanian counties according to their relative performance to the national mean in terms of their 1995 per capita GDP and their 1995-2000 growth rates. In this sub period, the main differences in terms of the number of counties belonging to each of

the groups with respect to the results we have seen previously are in the winning and catching up groups. The groups with the largest number of counties in the period 1995-2000 are those belonging to the losing category and the catching up category. Again no signs of convergence are shown by the data.

Figure 3.13: Growth performance of Romanian counties: 1995-2000 (variables nationally standardized)

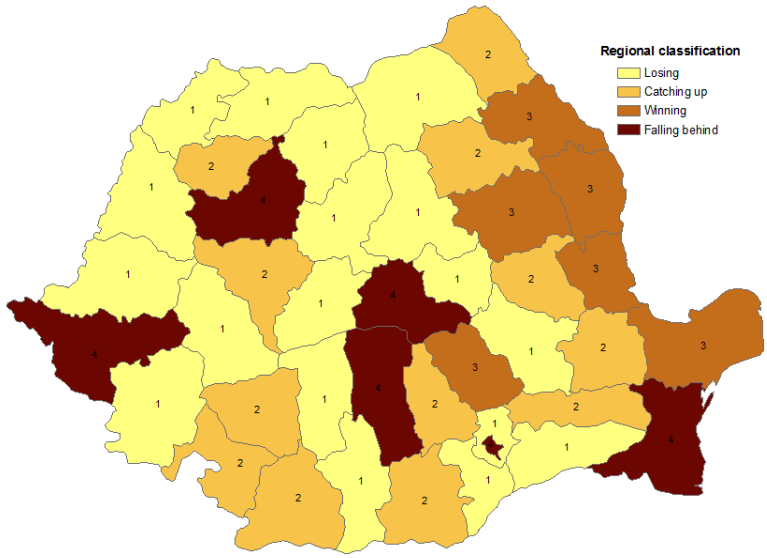


Source: Own elaboration based on INSSE and Eurostat data

If we take a look at the spatial distribution of the Romanian counties according to the classification we have already explained, map 3.12 shows that during this sub period the catching up group was further expanded to the East and South parts of the country and also the map points out to a favorable bias in terms of growth performance to the Eastern parts of Romania. During this period counties located in the

traditionally more developed parts of Romania such as Timis and Cluj were severely affected by the crisis and experience a serious fall in growth rates. Table 3.4 shows the counties that belong to each category.

Map 3.12: Growth rate in Romanian economic regions 1995-2000



Source: Own elaboration based on INSSE and Eurostat data

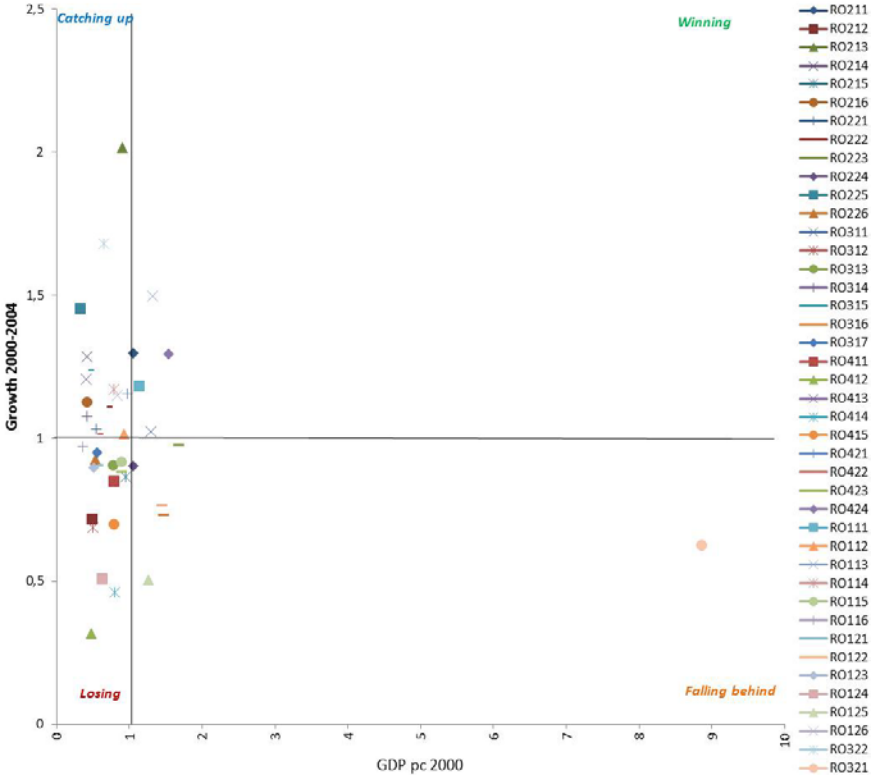
Table 3.4: Classification of Romanian counties: 1995-2000

Losing	Catching up	Winning	Falling behind
Suceava	Botoşani	Bacău	Constanţa
Buzău	Neamţ	Iaşi	Argeş
Călăraşi	Brăila	Vaslui	Timiş
Giurgiu	Vrancea	Galaţi	Cluj
Olt	Dâmboviţa	Tulcea	Braşov
Vâlcea	Ialomiţa	Prahova	Bucureşti
Arad	Teleorman		
Caraş-Severin	Dolj		
Hunedoara	Gorj		
Bihor	Mehedinţi		
Bistriţa-Năsaud	Sălaj		
Maramureş	Alba		
Satu Mare			
Covasna			
Harghita			
Mureş			
Sibiu			
Ilfov			

Source: Own elaboration based on INSSE and Eurostat data

The period 2000-2004, contrary to the previous one, is a period of recovery and economic expansion. Figure 3.14 shows again that during this period the groups with the largest number of counties are the losing and the catching up groups.

Figure 3.14: Growth performance of Romanian counties: 2000-2004 (variables nationally standardized)

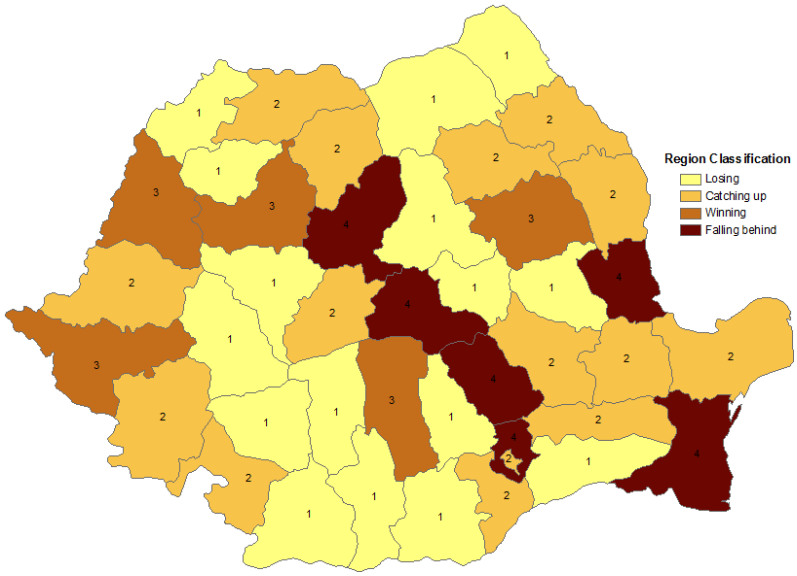


Source: Own elaboration based on INSSE and Eurostat data

However, looking at the spatial distribution of the counties depicted in map 3.13, we see a total different picture with respect to the previous period. The traditionally most developed counties in Romania, those located in the Center and West such as Timis, Bihor and Cluj are now falling into the winning category. They are the biggest counties in their respective regions with an outstanding economic activity. Investments in

the electronic industry made Cluj and Timis among the most powerful counties in Romania due in part to their strategic location, close to the border with Hungary and therefore to the Western markets. The number of falling behind counties is kept stable with respect to the previous period. The most important cases are those of Mures, Brasov and Constanta counties. However, the most relevant feature of map 3.13 is that around 70% of the "loosing counties" are situated in the mountain regions of the Carpathians with the only exceptions of Botosani county in the North-East region and Dolj, Olt, Teleorman and Ialomita counties in the South.

Map 3.13: Growth rate in Romanian economic regions 2000-2004



Source: Own elaboration based on INSSE and Eurostat data

Table 3.5 contains the counties that belong to each category.

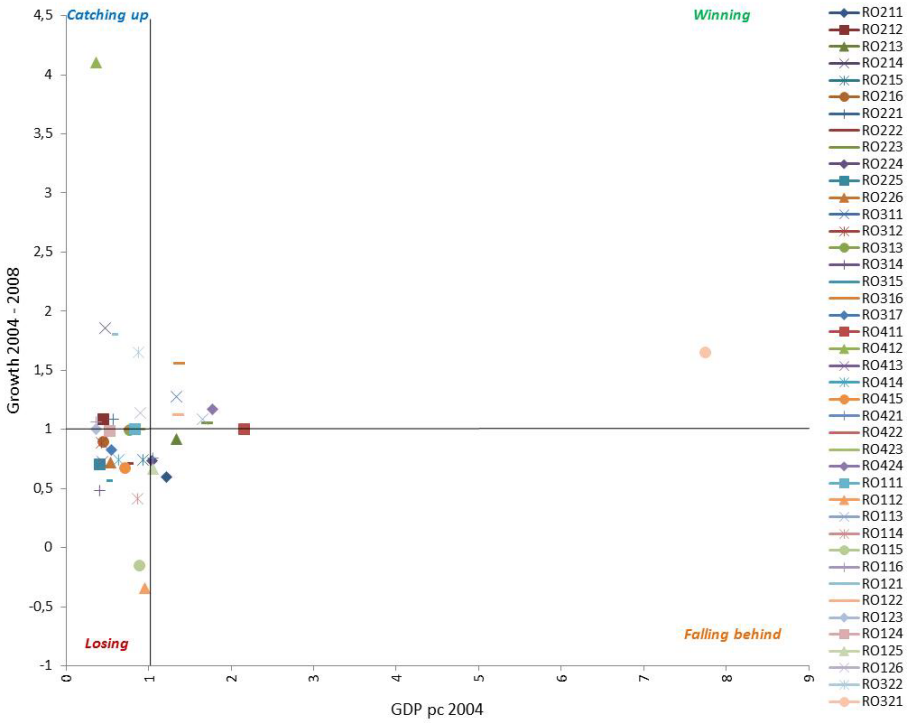
Table 3.5: Classification of Romanian counties: 2000-2004

Losing	Catching up	Winning	Falling behind
Botoşani	Iaşi	Bacău	Constanţa
Suceava	Neamţ	Argeş	Galaţi
Vrancea	Vaslui	Timiş	Prahova
Călăraşi	Brăila	Bihor	Braşov
Dâmboviţa	Buzău	Cluj	Mureş
Teleorman	Tulcea		Bucureşti
Dolj	Giurgiu		
Gorj	Ialomiţa		
Olt	Mehedinţi		
Vâlcea	Arad		
Hunedoara	Caraş-Severin		
Satu Mare	Bistriţa-Năsaud		
Sălaj	Maramureş		
Alba	Sibiu		
Covasna	Ilfov		
Harghita			

Source: Own elaboration based on INSSE and Eurostat data

The next period 2004-2008 is also a period of high economic growth. Comparing this period of growth with the previous one and looking at figure 3 the most relevant issues are on the one hand the increase in the number of counties that fall into the losing category from 16 to 19 and the reduction in the counties that fall into the falling behind category being represented this time by Mures and Galati. It seems that catching-up counties during the previous period such as Vaslui, Maramures, Buzau and Ialomita are during this period not strong enough to overcome the frontier towards the winning category and therefore they fall into the loosing category.

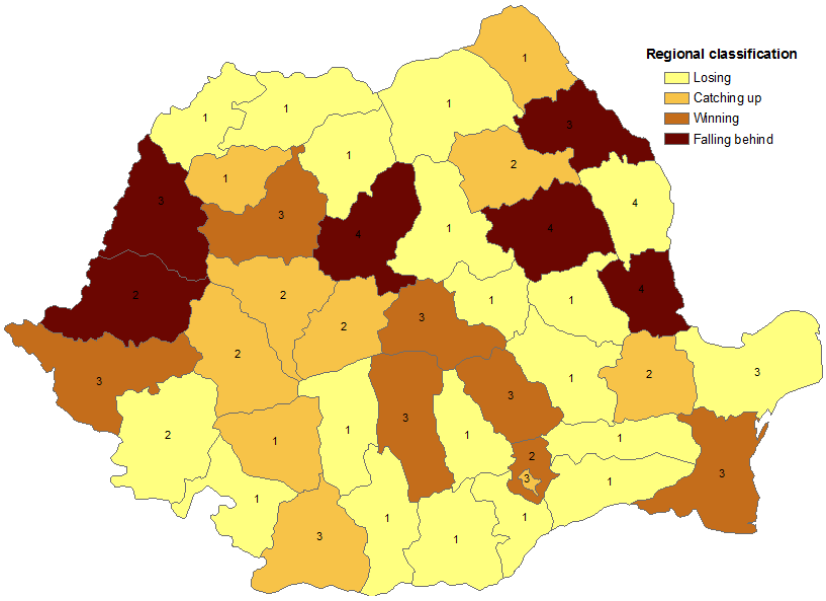
Figure 3.15: Growth performance of Romanian counties: 2004-2008 (variables nationally standardized)



Source: Own elaboration based on INSSE and Eurostat data

Map 3.14 shows quite clearly that as the Center economic region gets more and more developed a greater number of counties such as Alba and Hunedoara move from the previous loosing category to the catching-up category. Meanwhile the North-East economic region is the only region in Romania which during the 2004-2008 period does not have any winner county. 80% of the counties in this region are losing and falling behind counties.

Map 3.14: Growth rate in Romanian economic regions 2004-2008



Source: Own elaboration based on INSSE and Eurostat data

Table 3.6 contains the counties that belong to each category.

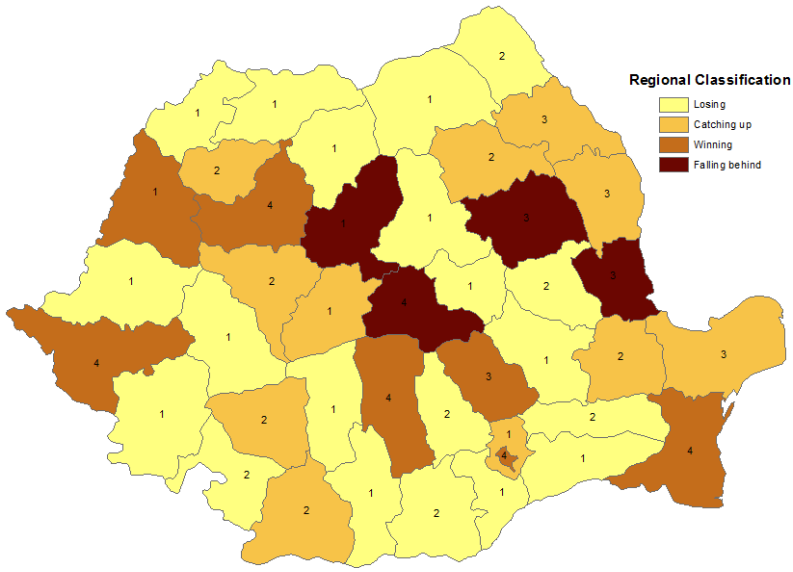
Table 3.6: Classification of Romanian counties: 2005-2008

Losing	Catching up	Winning	Falling behind
Vaslui	Botoşani	Constanţa	Bacău
Buzău	Neamţ	Argeş	Iaşi
Tulcea	Brăila	Prahova	Galaţi
Vrancea	Dolj	Timiş	Arad
Călăraşi	Gorj	Cluj	Bihor
Dâmboviţa	Hunedoara	Braşov	Mureş
Giurgiu	Sălaj	Bucureşti	
Ialomiţa	Alba		
Teleorman	Sibiu		
Mehedinţi	Ilfov		
Olt			
Vâlcea			
Caraş-Severin			
Bistriţa-Năsaud			
Maramureş			
Satu Mare			
Covasna			
Harghita			

Source: Own elaboration based on INSSE and Eurostat data

Merging together the two sub periods of economic growth map 3.15 shows the economic development of the so called West economic region and parts of the Center economic region with Timis, Cluj and Bihor being in the winning category and the underdeveloped South with Mehedinti, Valcea, Olt, Teleorman, Giurgiu, Dambovita, Calarasi and Ialomita counties falling into the loosing category. Ilvof, Arges and Prahova counties although geographically located in the South are highly industrialized and jointly with Timis, Cluj and Bihor are among the most developed counties. Constanta county is a different story. It is the only winner county at the Black Sea shores with an important commercial activity in opposition to its neighbor Tulcea county which is one of the poorest counties in Romania due to its geographical situation: 70% of Tulcea´s county is covered by the Danube Delta being this feature an important handicap for the settlement of major economic activities in the region. Moving to the Center and North-West economic regions we can see that all counties which fall into the loosing category are situated along the Carpathians Mountains which played an important role of isolation due to lack of infrastructure and therefore making difficult their access to other more developed parts of the country.

Map 3.15: Growth performance of Romanian economic regions 2000-2008



Source: Own elaboration based on INSSE and Eurostat data

3.6. Growth dynamics and Economic Geography in Romania: 1995-2008

In this section we will perform an econometric exercise to test for the pattern of divergence found in the analysis of the Romanian growth by typology of region. Taking into account our results in the two previous chapters of this PhD thesis and which basically refer to the importance of the so called second nature geography as a key variable to explain the spatial distribution of both income and educational attainment levels we will also test to which extend variations in regional market access over time have an impact on the growth rates observed across the different periods under scrutiny. Therefore, we will carry out OLS estimations regressing growth rates for three periods, 1995-2008, 1995-2000 and 2000-2008 against the initial level of GDP per capita in 1995, 1995 and 2000 respectively and the increase in regional market potential observed

over the period under analysis. The data for this analysis comes from the Romanian National Institute of Statistics located in Bucharest (NIS) which offers data on nominal GDP per capita (GDP p.c.) in the Romanian currency "new leu" (RON) at different levels of desegregation Nuts 1, Nuts 2 and Nuts 3[50] and data on annual inflation rates at country level. In our case and following the vast majority of European regional convergence analysis, we will use data for the 42 counties in which Romania is divided at Nuts 2 level. The reason why we have chosen 1995 as our initial year is due to problems with data availability and comparability. The Romanian National Institute of Statistics does not have data on GDP per capita for the years 1990-1994 at Nuts 2 level. However we could resort to use Eurostat data which is available since 1993 but these data is not computed using the same methodology since the data for the period 1993-1997 are calculated according to the ESA 79 methodology and from 1995 onwards according to the ESA 95 methodology. Therefore we have decided to start with the year 1995 in order to avoid comparability problems. Before carried out our estimations we have transformed our nominal per capita GDP figures into real values by building up a GDP deflator using the information on the annual inflation rates from the NIS database. Regarding the other key variable, the increase in the regional market access for the different periods of time, we have first computed the regional market potential for the years 1995, 2000 and 2008 by resorting to the, by now, well-known Harris´ (1954) market potential function. If we consider a world made up of n regions; i:1……..n, the Harris´ (1954) market potential in the ith

[50]Nomenclature of Territorial Units for Statistics is a geographical division of the European Union´s territory that subdivides each Member State into a whole number of regions at NUTS 1 level. Each of them is then subdivided into a number of regions at NUTS 2 level and these again are subdivided into a number of regions at NUTS 3 level.

region can be obtained as a weighted sum of the volume of economic activity in the surrounding locations where the weighed scheme is the inverse of the distance between locations. Mathematically, Mathematically, Harris´ (1954) market potential in its simplest formulation obeys to the following expression:

$$MP_i = \sum_{j=1}^{n} Y_j g(d_{ij}) \tag{3.12}$$

where MPi is the market potential on location i, Y_j is an index of purchasing capacity of location j (usually gross value added, gross domestic product or population), d_{ij} is the distance between two generic locations i and j and g(·) is a decreasing function. The market potential function can be understood as a measure of how far a location is from its consumer markets and therefore it can be used as a proxy for the demand potential that the whole population exerts over every location in the space. Therefore the higher is the market potential index of a location; the higher is its attraction power on production activities.

In our case we will compute market potentials for the years 1995, 2000 and 2008 proxying the volume of economic activity by the real Gross valued Added. In a second step we will compute the increase in regional market potentials over the period on which we run the estimations. Regarding the calculation of bilateral distances in the market potential function it is made on the basis of the road distances expressed in kilometres between the capital cities of each Nuts 2 region in which Romania is divided. For the calculation of the internal distance within each Nuts 2 region, it is approximated by a function that is proportional to the square root of each regions´ area. The expression used is $0.66\sqrt{\frac{Area}{\pi}}$ where area is each region area expressed in squared

kilometres (km2). This expression gives the average distance between two points on a circular location (see Crozet 2004, Head and Mayer, 2000 and Nitsch 2000) for a discussion of this measure of internal distance).

Therefore the model adopts the following form:

$$\log\left[y_{i,t+T} \Big/ y_{i,t} \right] = \alpha + \beta \log\left[y_{i,t} \right] + \gamma \log[\Delta MP_{i,t,t+T}] + u_{it,t+T} \quad (3.13)$$

The term on the left-hand side of the equation is the growth of per capita GDP from the base year *t* to the year *t*+T. Initial per capita GDP in region *i* is given by $y_{i,t}$, $\Delta MP_{i,t,t+T}$ represents the change in market potentials between the base year, t, and the year t+T and and $u_{i,t,t+T}$ is the disturbance term.

As in the previous section, all data are nationally standardized in order to minimize spatial autocorrelation problems. Thus, our variables are indices of how well a county region is doing with respect to its national average or how much market potential a county has in relation to the national average. Results will tell us to which extend variations in market potentials are affecting counties 'performance.

Table 3.7 presents the results of estimating equation (13) on the sample of 42 regions in Romania for the periods 1995-2008, 1995-2000 and 2000-2008. In Columns 1 we regress the average per capita GDP growth rate in the period 1995-2008 on the 1995 per capita GDP level. In column 2 we regress the average per capita GDP growth rate in the period 1995-2000 on the 1995 per capita GDP level and in column 3 we regress the average per capita GDP growth rate in the period 2000-2008 on the 2000 per capita GDP level. The results of these first set of estimations show that the coefficient of the initial level of GDP per capita in each period is

always positive and significant, signalling the process of regional divergence already highlighted in figures 3.12, 3.13 and 3.14. Columns 3 to 6 introduce the effect of the variation in the market potentials over time. The results of these last set of estimations show once again that even after controlling for the effects of changes in regional market potentials over time the initial level of per capita GDP levels is positive and statistically significant. Moreover our results also point out to the fact that regional changes in market potentials positively affect Romanian cross-regional growth rates. This result is consistent with a pattern of divergence in income levels among Romanian regions, pattern we have already seem in the previous section of this chapter.

Table 3.7: Regional Growth estimations

Dependent Variable	**per Cápita GDP Growth**					
	1995-2008	1995-2000	2000-2008	1995-2008	1995-2000	2000-2008
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.69** (0.06)	-0.25 (0.25)	0.94** (0.04)	0.56** (0.09)	-0.22 (0.26)	0.94** (0.095)
Log per cápita GDP 1995	0.29** (0.04)	1.44** (0.17)		0.52** (0.04)	1.42** (0.18)	
Log per cápita GDP 2000			0.026** (0.009)			0.034** (0.01)
Log inc MPGDP 1995-2008				0.11 (0.05)		
Log inc MPGDP 1995-2000					0.020** (0.009)	
Log inc MPGDP 2000-2008						0.094 (0.01)

Estimation	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**	**OLS**
R2	0.55	0.69	0.51	0.59		0.57
Prob (F-statistic)	0.00	0.00	0.00	0.00	0.00	0.00
Number observations	42	42	42	42	42	42

Note: Table displays coefficients for OLS estimations and Huber-White heterocedasticity robust standard errors in parenthesis. The dependent variable is the log of per capita GDP growth in the years 1995-2008, 1995-2000 and 2000-2008 (Columns 1, 2, 3, 4 and 6) . Log per capita GDP1995 and 2000, is the logs of per capita gross domestic product in the years 1995 and 2000, Log inc MPGDP1995-2008 , 1995-2000 and 2000-2008 are the increases in market potentials between 1995-2008 , 1995-2000 and 2000-2008 respectively. For data sources see text. * and ** signify statistical significance at the 5% and 1% levels

Source: Own elaboration based on INSSE and Eurostat data

3.7. Principal Component Analysis

So far the previous sections in this chapter have analyzed the evolution of the Romanian economy from 1995 onwards by taking into consideration per capita GDP figures. Although looking at GDP figures give us a flavor of the state of the Romanian economy this basic macroeconomic indicator is not enough in order to describe all the social and economic turmoil that Romania has been going through especially during the 90s. In this section besides the per capita GDP figures we are going to take into consideration other set of relevant socio-macroeconomic indicators in order to disentangle the main factors behind the growth dynamics we have described in the previous sections of the chapter.

The study of the distribution of economic activity in space and the estimation of local income levels are two major problems presented by the Regional Economy. Although the growth of the economic activity can approach the level of local development, in a strict sense it refers to the transformation of demographic, economic and social structures which usually accompanies growth. The multidisciplinary nature of this issue has led to the development of progressively more complex analysis that seeks to fit the new spatial economic systems and networks interactions (Nijkamp and Reggiani, 1998; Hewings et al., 2004; Capello and Nijkamp, 2004).

Among the difficulties that must save the studies on this subject, we should emphasize the choice of basic criteria from which to delimit the different frameworks, particularly when we find redundant information. At this point the so called Factor analysis or Principal Component Analysis (PCA) can be considered an appropriate tool since it eliminates

all the redundant information based on the variables available. The program offers the possibility to analyze the internal logic of the data structure and facilitates the preparation of composite and interpretable structural variables under a given theoretical background, in our case under the growth dynamics across Romanian counties between 1995 and 2008.

In particular, the use of a reduction technique or data integration in aggregates or factors characterizing a particular economic reality, which is what Principal Component Analysis (PCA) does, has been traditionally a privileged heuristic way of carry out descriptive studies of the regionalization technique. These methods allow us firstly to identify homogeneous and functional areas and, secondly, to establish a ranking of territories because of their varying socio-economic dynamism (Paelinck and Nijkamp, 1975).

The Principal Component Analysis, as well as other techniques for data reduction (factorial analysis in its various forms), are based on the idea of the existence of underlying dimensions that help explain a phenomenon as complex and multidimensional as is the local development[51]. At the same time the clusters technique (cluster analysis) is a fitting complement to the PCA that allows us to classify cases instead of variables. To be more accurate we use a clustering technique based on the inter-counties similarities which are translated in terms of variables as "proximity-difference" between the observations of each county, grouping the cases according to the minimization of the distances between variables. Therefore, what we are doing with these type of

[51] PCA – Principal Component Analysis presents similarities with the Factor Analysis, however, there are important differences, being the most important the fact that the PCA assumed that there is no variance of the variables themselves but the whole variance is common or shared

techniques is to study correlations between a large number of variables and group them into explanatory factors and characterize the reality of the Romanian socio-economic development between 1995-2008 based on the factors that can be interpreted and supporting our interpretation with local development theories (Aluja Banet, 1999).

Our factor analysis is based on the study of three different points in time; 1995 which is the first year in our sample and also the first year in our analysis, then the year 2000 which is the initial year of the Romanian recovery after the recession of the second half of the nineties and 2008 which is the last year of our sample and also the last year of the economic boom in Romania. The factor analysis is carried out using information on 19 socio-economic indicators at county level: number of internal migration flows from and out of each county (migrji,year,In and migrji,year,Out), real per capita GDP figures (Real GDP, year), unemployment rate (u, year), employment rate (Ocup Rate), labor force participation rate (Active Rate), number of inhabitants (Hab, year), population density (Hab Density), share of workers in agriculture (%Agriculture), industry (%Industry) and services sector (%Services), percentage of population with primary (% Ed P, year), secondary (% Ed S, year) and tertiary educational attainment levels (% Ed T, year), wages in agriculture (wia, tyear), industry (win, year) and services sector (wis, year) total wages (wi, tyear) and R&D investments as percentage of GDP (r&d, year).

Table 3.8: Total Variance Explained, 1995

Comp	Initial Elgenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Var	Cumulat %	Total	% of Var	Cumulat %	Total	% of Var	Cumulat %
1	7.090	37.316	37.316	7.090	37.316	37.316	6.622	34.854	34.854
2	4.393	23.119	60.435	4.393	23.119	60.435	3.996	21.032	55.886
3	1.918	10.094	70.529	1.918	10.094	70.529	1.845	9.709	65.595
4	1.306	6.873	77.402	1.306	6.873	77.402	1.694	8.916	74.511
5	1.127	5.93	83.331	1.127	5.93	83.331	1.676	8.82	83.331
6	0.824	4.339	87.67						
7	0.686	3.613	91.283						
8	0.543	2.859	94.142						
9	0.385	2.026	96.168						
10	0.222	1.166	97.334						
11	0.209	1.098	98.432						
12	0.116	0.612	99.044						
13	0.086	0.454	99.498						
14	0.047	0.248	99.746						
15	0.033	0.173	99.919						
16	0.010	0.051	99.97						
17	0.004	0.018	99.988						
18	0.002	0.012	100.000						
19	0.000	0	100.000						

Note: Extraction Method: Principal Component Analysis

Source: Own elaboration based on INSSE and Eurostat data

Table 3.8 shows the results for the first year 1995 and it can be seen that the program creates five factors or components extracted from our 19 indicators which jointly explain around 83.3% of total variance, although the first four already explain 77% of the total variance. We have to mention that these five factors are orthogonal and therefore problems such as multicollinearity do not exist. In order to interpret the mentioned factors we have to take a look at table 3.9 which contains the loadings of the variables (indicators) in the factors which have been extracted.

Table 3.9: Rotated component Matrix, 1995

	Component				
	1	2	3	4	5
migrji,1995,In	.975				
migrji,1995,Out	.974				
Real GDP, 1995	.958				
Hab, 1995	.945				
Hab.Density	.932				
r&d,1995	.930				
% Ed S, 1995	.702				
%Industry		-.958			
% Ed T, 1995		.889			
% Ed P, 1995		.888			
%Agriculture		.769			
%Services	.440	.687			
Ocup Rate		-.483		.452	.452
win,1995			.969		
wi,t1995			.815		
Active Rate				.809	-.882
wis,1995				.803	.613
u, 1995					
wia,t1995					

Note: Rotation Method: Varimax with Kaiser Normalization

Source: Own elaboration based on INSSE figures

Table 3.9 shows that the first factor (component) is made up of eight indicators: migration into the county, migration out of the county, Real GDP, number of habitants, density, R&D expenditure, percentage of population with secondary education attainment levels and percentage of workers in the tertiary sector. This information reveals that this factor could be termed as *agglomeration*. The second factor (component) is made up of the following indicators; share of workers in the agriculture, industry and tertiary sectors, percentage of population with primary education attainment levels and employment rate. This factor could be termed as *sectorial structure*

The next set of indicators which made up the third factor (component) are the following: total wages and wages in the industrial sector and

therefore this factor could be named as *relative labour costs*. As a conclusion for the analysis carried out for the year 1995 we have a map of total economic chaos, linked to the economy inheritance of the previous year and a complete fail in the implementation of economic reforms towards a well-functioning market economy.

Table 3.10: Total Variance Explained, 2000

Comp	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Var	Cumul %	Total	% of Var	Cumul %
1	7.357	38.721	38.721	6.803	35.806	35.806
2	3.211	16.899	55.620	2.863	15.070	50.875
3	1.763	9.278	64.898	2.149	11.311	62.186
4	1.502	7.904	72.802	1.735	9.130	71.316
5	1.400	7.366	80.168	1.682	8.852	80.168
6	.813	4.281	84.450			
7	.745	3.921	88.370			
8	.610	3.210	91.580			
9	.483	2.544	94.123			
10	.363	1.909	96.033			
11	.316	1.665	97.698			
12	.202	1.064	98.762			
13	.137	.724	99.486			
14	.036	.190	99.676			
15	.025	.130	99.806			
16	.019	.101	99.907			
17	.011	.058	99.965			
18	.007	.035	100.000			
19	.000	.000	100.000			

Source: Own elaboration based on INSSE figures

Table 3.10 contains the results for the year 2000. In this case the first four factors (components) explain more than 72% of the total variance (table 3.11).

Table 3.11: Rotated component Matrix, 2000

	Component				
	1	2	3	4	5
Real GDP, 2000	.950				
Hab, 2000	.948				
migrji,2000,Out	.935				
migrji,2000,In	.907				
r&d,2000	.903				
Hab.Density	.902				
% Ed T, 2000	.780				
wis,2000	.452		.437	.301	
%Industry		.943			
%Services	.465	-.697			
%Agriculture	-.369	-.688			
% Ed S, 2000	.400	.684		.404	
wia,t2000		-.571			
win,2000			.963		
wi,t2000	.421		.849		
u, 2000				.829	
% Ed P, 2000				.796	
Ocup Rate					.928
Active Rate					-.877

Source: Own elaboration based on INSSE figures

Although we have found that there are three indicators which load in two factors the weights are higher in the second factor, that is, they are more correlated with the second factor which we have termed before as sectorial structure. These results are coherent with the interpretation we have given to these factors in the previous analysis (year 1995). Therefore, the first factor (component) is made up of 8 indicators: Real GDP, number of habitants, migration into the county, migration out of the county, R&D expenditure, population density, and wages in the tertiary sector. In this case, the factor can be named in a similar way than before (*agglomeration*). The second factor includes the next indicators: % Industry, %services, %agriculture, %Ed S, 2000 and wia, t2000. This factor could be named as sectorial structure but it is important to

highlight that apart from the standard variables which help us to understand the structure of the economy, the variables wages in agriculture and the share of agriculture in total GDP seem to be highly correlated. This result reveals, on the one hand, the important weight assigned to agriculture in this economy and the corresponding labour costs associated to these activities.

The third factor (component) which includes wages in the secondary sector and total wages can be named as *industrial development.* The four factor (component) which includes total unemployment and % of population with primary education can be named as *school enrollment and labour hiring*. Finally the last factor includes occupation and active rates and can be labeled as *economic activity.*

So the landscape depicted for 2000 points out to the fact that the economic development in Romania could be mainly explained by two big factors. On the one hand, agglomeration explains to a largest extend the economic development across Romanian regions, which reinforces the results obtained in chapter 1. On the other hand, the second factor, which explains an important part of the variance of the economic development, is the sectorial structure. Indeed, we highlight the important weight associated to agriculture which is counteracting the economic progress. Therefore, although recognizing the importance of the agriculture sector in Romania, we emphasize the challenge faced by this sector to create more value added which will lead to a better factor remuneration in this sector (farmers, small producers, etc) and to a better competitive position in European market.

Finally, the analysis for the year 2008 is shown in tables 3.12 and 3.13. After more than eight years in a row of economic growth in Romania, the

results in table 3.12 show that the first factor (component) is again agglomeration. As it can be seen in table 3.13, this factor includes not only the same variables which we have identified previously but also the share of services over GDP. Although, the addition of the latter variable to the first factor could seem to be counterintuitive, the inclusion is meaningful. The explanation behind this result lies on the fact that the economic activity in Romania is highly concentrated in the capital of the country (Bucharest). In fact, there is a huge bias of concentration in services activities in the capital.

Table 3.12: Total Variance Explained, 2008

Comp	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Var	Cum %	Total	% of Var	Cum%
1	9.259	48.733	48.733	7.694	40.497	40.497
2	2.767	14.564	63.297	2.779	14.628	55.125
3	1.615	8.502	71.799	2.335	12.292	67.417
4	1.306	6.876	78.675	2.139	11.258	78.675
5	.941	4.952	83.627			
6	.771	4.060	87.686			
7	.679	3.572	91.258			
8	.509	2.678	93.937			
9	.460	2.423	96.360			
10	.274	1.443	97.803			
11	.198	1.040	98.843			
12	.089	.471	99.313			
13	.079	.418	99.732			
14	.021	.111	99.842			
15	.014	.075	99.917			
16	.012	.061	99.978			
17	.003	.015	99.993			
18	.001	.007	100.000			
19	.000	.000	100.000			

Source: Own elaboration based on INSSE figures

Now the results depict a totally different socioeconomic landscape. The new (components) variables make more “economic” sense to explain the situation of the Romanian economy in 2008 than the results for the previous years.

Table 3.13: Rotated component Matrix, 2008

	Component			
	1	2	3	4
migrji,2008,Out	.946			
migrji,2008,In	.920			
Hab, 2008	.917			
Real GDP, 2008	.906		.306	
Hab.Density	.872			
r&d,2008	.871		.318	
% Ed T, 2008	.741		.378	
wi,t2008	.733			.499
%Services	.721	-.540		
%Industry	-.591	.734		
%Agriculture		-.726		
% Ed S, 2008		.697		-.580
win,2008	.488	.505	-.308	.435
wis,2008	.362	.434		
u, 2008			-.694	
Active Rate		.327	.688	
Ocup Rate	.461	.410	.682	
wia,t2008				.824
% Ed P, 2008			-.477	-.642

Source: Own elaboration based on INSSE figures

The second factor can also be named as *sectorial structure*. This factor includes the same range of indicators than in the previous analysis additionally the remuneration of the factors associated to these activities (agriculture, industry…..). The third factor can be again labeled as *economic activity.*

Finally the last factor can be name as *school enrollment and labor hiring.*

We can wrap up this analysis by establishing three main conclusions: firstly agglomeration is playing the most important role in explaining the economic development in Romania in the period from 1995 to 2008. This effect is more and more important over the course of the years. In fact, a striking fact about economic activity in Romania is that it is highly concentrated around the capital, being this concentration much more pronounced in the service sector (the 2008 PCA have clearly shown this).

Secondly, the sectorial structure is the second factor in explaining the economic development. At this point the agriculture sector arises as a key sector. Nevertheless, it is necessary to mention that an improvement of the competitiveness and remuneration of labor force within this sector is still needed. Finally, the economy of Romania strongly needs not only get higher human capital levels but also match in a better way school education with labour demand, i.e higher education targeted to managerial duties, marketing, innovation, management for instance in the agriculture sector and to create technological platforms to support the agriculture activities.

3.8. Conclusions

In this chapter the growth dynamics of the Romanian economic over the period 1995-2008 have been studied and them a link between the economic geography of Romania and the observed patterns of growth has been established. Additionally we have also performed a principal component analysis in order to take into consideration other set of relevant socio-macroeconomic indicators and disentangle the main factors behind the growth dynamics of the Romanian economy. The analysis has been carried out at different geographical scales and time periods. For the analysis of the growth patterns we have started with an overview at national level and then we move into the analysis of the growth performance in the 8 economic development regions to end up in the last stage of disaggregation looking at the evolution of growth patterns at county level (42 counties). The time periods used in the analysis follow a natural classification based on the relative performance of the economy over them. Therefore we have distinguished for the

Romanian economy a period of recession 1995-2000 and two periods of expansion 2000-2004 and 2004-2008.

The results of growth regressions carried out for the different periods show that the coefficient of the initial level of GDP per capita in each period is always positive and significant, signaling a process of regional divergence and therefore giving support to the fact that disparities across Romanian counties, regardless of the time period under analysis, have not been narrowing away. Moreover our results also point out to the fact that regional changes in market potentials positively affect Romanian cross-regional growth rates and therefore the economic geography of Romania emerges as one of the key factors behind this divergence phenomenon. The attenuation of this divergence phenomenon within Romanian regions will need the right policy measures. The recent Romanian EU membership and the flow of EU structural funds towards Romanian regions will give a very good opportunity to overcome many of the structural problems the economy is facing.

Finally, the Principal Component Analysis performed in the last part of the chapter allowed us to establish three main conclusions: firstly agglomeration is playing the most important role in explaining the economic development in Romania in the period from 1995 to 2008. This effect is more and more important over the course of the years. In fact, a striking fact about economic activity in Romania is that it is highly concentrated around the capital, being this concentration much more pronounced in the service sector (the 2008 PCA have clearly shown this). Secondly, the sectorial structure is the second factor in explaining the economic development. At this point the agriculture sector arises as a

key sector. Nevertheless, it is necessary to mention that an improvement of the competitiveness and remuneration of labor force within this sector is still needed. Finally, the economy of Romania strongly needs not only get higher human capital levels but also match in a better way school education with labour demand, i.e higher education targeted to managerial duties, marketing, innovation, management for instance in the agriculture sector and to create technological platforms to support the agriculture activities.

Conclusions and Contributions of the Thesis

(CONCLUSIONES Y CONTRIBUCIONES DE LA TESIS DOCTORAL)

CONCLUSIONES DE LA TESIS DOCTORAL

Los resultados del capítulo 1 corroboran las predicciones teóricas de la ecuación nominal de salarios. Se demuestra que la geografía económica (market access) desempeña un papel fundamental en la explicación de las disparidades de renta observadas en Rumania. Aproximadamente, si se duplica el market access en una región esto tendría un impacto directo sobre los niveles de renta del orden del 9-11% Adicionalmente, nuestros resultados se muestran robustos a la inclusión de variables de control que son importantes en la explicación de los niveles de renta en Rumania como el capital humano y el porcentaje de gasto en actividades de investigación y desarrollo. Una vez que controlamos por estas variables, el market access sigue siendo positivo y estadísticamente significativo aunque su influencia sobre el nivel de renta se reduce en torno a un 25%.

Los resultados del capítulo 2 también apoyan las predicciones teóricas del modelo de Redding y Schott (2003). Los resultados de las regresiones identifican que el porcentaje de individuos con niveles educativos medios y altos está positivamente influenciado por el nivel de market access de cada una de las regiones. Si duplicamos el market access de las regiones tendría un impacto directo sobre el nivel de capital humano que se podría cuantificar en un aumento del porcentaje de individuos con niveles educativos medios y altos del entorno del 22-25%.

Los resultados del capitulo 3 muestran que no existe un proceso de convergencia entre las regiones rumanas (el coeficiente del nivel inicial de renta en cada uno de los períodos analizados es siempre positivo y significativo). Adicionalmente nuestros resultados ponen de manifiesto que los cambios regionales en los niveles de market access están

afectando de una manera positiva a las tasas de crecimiento en los diferentes períodos analizados y por tanto podemos decir que la geografía económica del país aparece como un elemento importante a la hora de explicar los factores que están detrás de la dinámica de divergencia observada.

Finalmente el análisis mediante componentes principales corrobora los resultados de los capítulos 1 y 2 poniendo de manifiesto la importancia de los efectos de la aglomeración y el capital humano para el desarrollo económico.

CONTRIBUCIONES DE LA TESIS DOCTORAL

1. *Economic Remoteness and Wage Disparities in Romania* (Jesus Lopez-Rodríguez, A. Faiña y Cosmin Bolea-Gabriel), **Tijdschrift voor economische en sociale geografie,** *Vol(102) 5, pp. 594–606, 2011* (esta publicación está basada en los resultados obtenidos en el capítulo 1).
2. *The Effects of Economic Geography on Education in Romania* (Jesus Lopez-Rodríguez, A. Faiña y Cosmin Bolea-Gabriel), **Theoretical and Applied Economics**, Vol XVIII, 2(555), pp. 101-110, 2011 (esta publicación está basada en los resultados obtenidos en el capítulo 2).
3. *Regional Dynamics in Romanian Counties: Convergence and Trade (*Jesus Lopez-Rodríguez *y Cosmin Bolea Gabriel),* in **International Trade** ISBN 979-953-307-940-9 (Editor Prof. Vito Bobek University of Applied Sciences, FH Joanneum, Graz, Austria), de próxima aparición Julio 2012. (esta publicación está basada en los resultados obtenidos en capítulo 3).

4. *Economic Remoteness and Wage Disparities in Romania, (*Jesus Lopez-Rodríguez, A. Faiña y Cosmin Bolea-Gabriel*)* **Regional Economics Application Laboratory, University of Illinois at Urbana Champaign, REAL-10-T-8, 2010** (esta publicación está basada en los resultados obtenidos en el capítulo 1).

5. *Human Capital, Geographical Location and Policy Implications: The Case of Romania , (*Jesus Lopez-Rodríguez, A. Faiña y Cosmin Bolea-Gabriel***), DT Funcas n.522, 2010.** (esta publicación está basada en los resultados obtenidos en el capítulo 2).

6. *Human Capital, Geographical location and Policy Implications: The case of Romania* (Jesus Lopez-Rodríguez, A. Faiña y Cosmin Bolea-Gabriel) enviado a **Tijdschrift voor economische en sociale geografie**.

References

REFERENCES

ALUJA BANET, T. (1999), *El análisis de componentes principales: una aproximación al data mining*. Barcelona, EUB.

ANSELIN, L. (2002), *SpaceStat Software for Spatial Data Analysis, Version 1.91*, Ann Arbor, TerraSeer Inc., Michigan.

ANSELIN, L. (2003), *GeoDa 0.9 User's Guide, Spatial Analysis Laboratory (SAL),* Department of Agricultural and Consumer Economics, University of Illinois Urbana-Champaign, IL.

BALTAGI, B.H. (1995), *Econometric Analysis of Panel Data*. Wiley, Chichester.

BARRO, R. (1991), Economic growth in a cross-section of countries. *Quarterly Journal of Economics*, 106, pp. 407–443.

BARRO, R. (1997), *Determinants of Economic Growth: a Cross-Country Empirical Study*. Cambridge, MA, MIT Press.

BARRO, R. and LEE, J. W. (1994), Sources of economic growth. *Carnegie-Rochester Conference Series on Public Policy*, 40, pp. 1–46.

BARRO, R. and SALA-I-MARTIN, X. (1991), Convergence Across States and Regions, *Brookings Papers on Economic Activity*, pp. 107-58

BARRO, R. and SALA-I-MARTIN, X. (1992), Convergence. *Journal of Political Economy*, 100(2), pp. 223-251.

BARRO, R. and SALA-I-MARTIN, X. (1995), *Economic Growth*, New York: McGraw-Hill.

BAUMOL, W. (1986), Productivity Growth. Convergence and Welfare: What the Long Run Data Show. *The American Economic Review*, 76(5), pp. 1072-1085.

BEN-DAVID, D. (1994), Convergence Clubs and Diverging Economies. *CEPR Discussion Paper*, 922, CEPR, London.

BENHABIB, J. and SPIEGEL, M. (1994), The role of human capital in economic development: evidence from aggregate cross-country data. *Journal of Monetary Economics*, 34, pp. 143–173.

BIRSAN, M. (2006), Integrare economică europeană, (European economic integration), Mediul european a afacerilor, Editura *Fundaţiei pentru Studii Europene*, volume III, pp.(?)

BOLLIAC, C. (1855), *A Relief Map of Romania*. Lithography, Bucharest. Whereupon.

BRAKMAN S., GARRETSEN H. and SCHRAMM M. (2004), The Spatial Distribution of Wages: Estimating the Helpman-Hanson Model for Germany. *Journal of Regional Science*, 44, pp. 437-66

BRAKMAN, S., GARRETSEN, H. and MARREWIJK VAN, CH. (2009), *The new introduction to Geographical Economics*. Cambridge University Press, UK.

BREINLICH, H. (2006), The Spatial Income Structure in the European Union: What Role for Economic Geography? *Journal of Economic Geography* 6, pp. 593–617

CAN KARAHASAN, B. and LOPEZ-BAZO, E. (2011), The Spatial Distribution of Human Capital: Can It Really Be Explained by Regional Differences in Market Access? *Institut de Recerca en Economia Aplicada Regional i Pública Document de Treball*, 2011/02, pp. 33.

CANOVA, F. and MARCET, A. (1995), The Poor Stay Poor: Non-Convergence Across Countries and Regions. *Centre for Economic Policy Research*, Discussion Paper 1265, CEPR, London.

CAPELLO, R. and NIJKAMP, P. (2004), *Urban Dynamics and Growth: Advances in Urban Economics*. Amsterdam, Elsevier.

CLIFF, A.D. and ORD, J.K. (1981), *Spatial Processes: Models and Applications*, Pion, London.

COMBES, P., DURANTON, G. and GOBILLON L. (2008), Spatial wage disparities: Sorting Matters! *Journal of Urban Economics,*63, pp. 723-742.

COMBES, P., DURANTON, G., GOBILLON L., and ROUX, S. (2010), Estimating agglomeration effects with history, geology and worker fixed effects. In Edward L. Glaeser (ed.), *The Economics of Agglomeration*. Cambridge, MA, National Bureau of Economic Research.

CROZET, M. (2004), Do Migrants Follow Market Potentials? An Estimation of a New Economic Geography Model. *Journal of Economic Geography*, 4, pp. 439-458.

DE BRUYNE, K. (2003), The Location of Economic Activity: Is There a Spatial Employment Structure in Belgium? Mimeo, KU Leuven

DE LA FUENTE, A. and DOMENECH, R. (2002), Educational Attainment in the OECD, 1960-1995. *CEPR Discussion Paper*, 3390, London.

DE LA FUENTE, A. (1995), The Empirics of Growth and Convergence. A Selective Review. *CEPR Discussion Paper*, 1275, London.

DINU, M. (2006), The way out from the alternative (Ieşirea din alternativă). *Economie teoretică şi aplicată*, 10, pp. 96-99.

DURANTON, G. and D. PUGA (2004), Micro-foundations of urban agglomeration economies, in HENDERSON J.V. and THISSE J.F. (eds.), *Handbook of Urban and Regional Economics*, 4, New York.

DURLAUF, S. and QUAH, D. (1998), The New Empirics of Economic Growth, *NBER Working Paper*, 6422, Cambridge.

ENGLANDER, A.S. and GURNEY, A. (1994), Medium-term determinants of OECD productivity. *OECD Economic Studies*, 22, pp. 49-109.

European Observatory on Demography and the Social Situation: http://ec.europa.eu/employment_social/social_situation/sso_en.htm

FINGLETON, B. (1997), Specification and Testing of Markov Chain Models: An Application to Convergence in the European Union. *Oxford Bulletin of Economics and Statistics*, 59(3), pp. 385-403.

FINGLETON, B. (1999), Estimates of Time Convergence: An Analysis of Regions of the European Union. *International Regional Science Review*, 22(1), pp. 5-34.

FUJITA, M., KRUGMAN, P. and VENABLES, A. (1999), *The Spatial Economy: Cities, Regions and International Trade*. MIT Press, Cambridge.

GALOR, O. (1996), Convergence: Inferences from Theoretical Models. *CEPR Discussion Paper*, 1350, London.

HALFDANARSON, D., HEUERMANN, D.F. and SÜDEKUM, J. (2008) Human Capital Externalities and the Urban wage Premium: Two Literatures and their Interrelations. *IZA Discussion Paper, 3493*.

HALL, R.E. and JONES, C.I. (1999), Why do some countries produce so much more output per worker than others? *Quarterly Journal of Economics* 114, pp. 83-116.

HANSON, G. (2005), Market potential, increasing returns and geographic concentration. *Journal of International Economics*, 67, pp. 1-24.

HANUSHEK, E.A. and KIM, D. (1995), *Schooling, labor force quality and economic growth*. Working Paper 5399, National Bureau of Economic Research, Cambridge, MA.

HEAD, K. and MAYER, T. (2000), Non-Europe: The Magnitude and Causes of Market Fragmentation in the EU. *Weltwirtschaftliches Archiv*, 136, pp.285-314.

HEAD, K. and MAYER, T. (2004), The Empirics of Agglomeration and Trade. *Handbook of Urban and Regional Economics*, 4, Chapter 59.

HEAD, K. and MAYER, T. (2006), Regional Wage and employment responses to Market Potential in the EU, *Regional Science and Urban Economics* 36, pp. 573-594.

HENDERSON, J.V. (1986), Efficiency of Resource Usage and City Size, *Journal of Urban Economics,* 19, pp. 47-70.

HENIN, P. and LE PEN, Y. (1995), Les épisodes de la convergence européene. *Revue Économique*, 46(3), pp. 667-677.

HEWINGS, G., NAZARA, S. and DRIDI, CH. (2004), Channels of Synthesis Forty Years on Integrated Analysis of Spacial Economic Systems, Journal of Geographical Systems, vol. 6 (1), pp. 7-25.

HSIAO, C. (1986), *Analysis of Panel Data*. Cambridge University Press.

IANCU, A. (2002), Transition, Integration and Convergence: The Case of Romania. *Working Papers of National Institute of Economic Research*, 101222, pp.27-40

IANCU, A., Convergenţă instituţională şi integrarea în UE, (Institutional Convergence and EU integration), 2008, Romanian Academy, National institute of Economic Reserach,pp.53-73

IER (2005), Libera circulaţie a persoanelor şi serviciilor. *European Institute from Romania*. http://www.ier.ro/PAIS/PAIS1/RO/Studiul1B.pdf

IER (2007), International migration, according to gender. *European Institute from Romania*.

http://www.insse.ro/cms/files/statistici/Statistici_teritoriale2007/rom/9.htm

ISLAM, N. (1995), Growth empirics: a panel data approach. *Quarterly Journal of Economics*, 110, pp.1127–1170.

JONES, C. (1997), On the Evolution of the World Income Distribution. *Journal of Economic Perspectives*, 11(3, pp. 19-36.

KRUGMAN, P. (1991), Increasing Returns and Economic Geography. *Journal of Political Economic*, 99, pp. 483-499.

KRUGMAN, P. (1992), A Dynamic Spatial Model. *NBER Working Paper No,* 4219, Cambridge, Massachusetts.

LEVINE, R. and RENELT, D. (1992), A sensitivity analysis of cross-country growth regressions. *American Economic Review*, 82, pp. 942–963.

LOPEZ-RODRIGUEZ, J. and FAIÑA, J.A. (2007), Regional Wage Disparities in the European Union: What role for Market Access? *Investigaciones Regionales*, 11, pp. 5-23.

LOPEZ-RODRIGUEZ, J. and NAKAMURA, D. (2011), Mind the Remoteness! Income Disparities across Japanese Prefectures. *Estudios de Economía*, 38 (2), pp. 393-417.

LOPEZ-RODRIGUEZ, J., FAIÑA, J.A. and LOPEZ RODRIGUEZ, J. (2007), Human Capital Accumulation and Geography: Empirical Evidence from the European Union. *Regional Studies*, 42, pp. 217-234.

LOPEZ-RODRIGUEZ, J., MARQUEZ, M. A. and FAIÑA, J.A. (2011) ¿Hasta qué punto la Perificidad Económica es Responsable de Las Diferencias en el PIB per Capita entre las Provincias Españolas. *El Trimestre Económico*, LXXVIII (3), 311, pp. 583-611.

MAGRINI, S. (1999), The Evolution of Income Disparities among the Regions of the European Union. *Regional Science and Urban Economics*, 29(2), pp. 257-281.

MANKIW, G. (1995), The growth of Nations. *Brookings Papers on Economic Activity*, 0(1), pp. 275-310

MARSHALL, A. (1920), *Principles of Economics*. London, MacMillan.

MAS, M., MAUDOS, J., PEREZ, F. and URIEL, E. (1995), Growth and Convergence in the Spanish Provinces. In Armstrong H.W.and Vickerman R.W. (Eds.). *Convergence and Divergence among European Regions*. London.

MINISTERUL ECONOMIEI ŞI COMERŢULUI (2006), Programul Operaţional Sectorial, *Creşterea Competitivităţii Economice* (www.minind.ro),

MION, G. (2004), Spatial Externalities and Empirical Analysis: The Case of Italy. *Journal of Urban Economics*, 56, pp. 97-118.

MONASTIRIOTIS, V. (2011), Regional Growth Dynamics in Central and Eastern Europe. *LEQS papers*, 33, London.

NIJKAMP, P. (1994), Regional Economics: A State of Art. *Regional Science and Urban Economics*, 24, pp. 649-659.

NIJKAMP, P. and REGGIANI, A. (1998), *The Economics of Complex Spacial Systems*. Berlin.

NITSCH, V. (2000), National borders and international trade: evidence from the European Union. *Canadian Journal of Economics*, 33(4), pp. 1091-1105.

OECD, Organization for Economic Co-operation and Development.

ORGANIZAŢIA MONDIALĂ A SĂNĂTĂŢII (2002), *Health status overview for countries of Central and Eastern Europe that are candidates for accession to the European Union*.

OVERMAN, H.G., REDDING, S. and VEBABLES, A.J. (2003), The Economic Geography of Trade Production and Income: A Survey of Empirics, in KWAN-CHOI and HARRIGAN, J. (Eds.), *Handbook of International Trade*, Oxford, Basil Blackwell.

PAELINCK, J.H. and NIJKAMP, P. (1975), *Operational Theory Method in Regional Economics*. Saxon House.

PHILIPPE, J.P. (1999), La Convergence Regionale Europeenne: Une Approche Empirique par les Clubs et les Panels. *Revue d´Economie Regionale et Urbaine*, 0(1), pp. 21-44.

PIRES, A.J.G. (2006), Estimating Krugman's Economic Geography Model for Spanish Regions. *Spanish Economic Review*, 8, pp. 83-112.

POPESCU, C., DIACONU, L. and MAXIM, A. (2008), Human Capital and Migration Costs for Romanian Economic Development. Available at SSRN: http://ssrn.com/abstract=1099362

PRITCHETT, L (1997), Divergence: big time. J*ournal of Economic Perspectives*, 11(3), pp. 3-17.

PUGA, D. and DE LA ROCA, J. (2010), Learning by Working in Dense Cities. *XXXVI Regional Studies Meeting Asociación Española de Ciencia Regional*, Badajoz.

QUAH, D. (1996), Regional Convergence Clusters Across Europe. *European Economic Review*, 40(3-5), pp. 951-958.

REDDING, S. and SCHOTT, P. (2003), Distance, Skill Deepening and Development: Will Peripheral Countries Ever Get Rich? *Journal of Development Economics*, 72(2), pp. 515-541.

REDDING, S. and VENABLES, A. (2004), Economic geography and international inequality. *Journal of International Economics*, 62, pp. 53-82.

REGGIANI, A. (2000), New Frontiers in Modelling Spatial and Economic Systems. In REGGIANI, A. (ed.) *Spatial Economic Science*, pp. 1-15. Berlin.

RODRIGUEZ-POSE, A. and VILALTA-BUFI, M. (2005), Education, migration, and job satisfaction: the regional returns of human capital in the EU. *Journal of Economic Geography*, 5, pp. 545–566.

ROMANIAN STATISTICAL YEARBOOK (2003), http://www.insse.ro/anuar_2003/asr2003.htm

ROMER, D. (1996), *Advanced Macroeconomics*. New York. McGraw Hill.

ROOS, M. (2001), Wages and Market Potential in Germany. *Jahrbuch fur Regionalwissen-schaft*, 21, 171-195.

SALA-I-MARTIN, X. (1996), The Classical Approach to Convergence Analysis. *The Economic Journal*, 106, pp. 1019-1036.

SALA-I-MARTIN, X. (2000), *Apuntes de Crecimiento Economico*. Antony Bosh Editor. 2nd Edition.

SARGAN, J. (1964), Wages and Prices in the United Kingdom: a Study of Econometric Methodology, in P. Hart y J. Whittaker (eds.), *Econometric Analysis for Natural Economic Planning*, London, Butterworths.

SEIDEL, H. (1995), Wirtschaftswachstum und Konvergenz. *Wifo-Monatsberichte*, 1, pp. 48-62.

SOLOW, R.M. (1956), A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics*, 70(1), pp. 65-94.

STOCK, J.H. and WATSON M.W. (2007), *Introduction to Econometrics*. Addison Wesley Longman.

SWAN, T.W. (1956), Economic Growth and Capital Acumulation. *Economic Record*, 32, pp. 334-361.

TEMPLE, J. (1999), A positive effect of Human Capital in Growth. *Economic Letters*, 65, pp. 131-34.

UNCTAD (1997), Trade and Development Report. *United Nations publication*, E.97.II.D.8, pp. 69-86.

UNGUREANU, D., RUXANDRA, D., HORIA, G. and FLORIAN, B. (2002), Romania´s real convergence to the European Union, *Econ papers*, volume 2, pp.(?).

Annexes

A. Appendix to chapter 1:

A.1 Derivation of Price Index

We start from the cost minimization problem of consumers in order to derive a compensated demand function for the *j*th variety of the manufacturing product. Whatever the value of *D*, each m_j needs to be chosen so as to minimize the cost of attaining *D*. This means solving the following minimization problem:

$$\min = \sum_{j=i}^{n} m_j p_j \tag{A.1}$$

$$s.t. M = \left[\sum_{j=1}^{n} m_j^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{A.2}$$

The first order condition to this expenditure minimization problem gives each location the equality of marginal rates of substitution to price ratios:

$$\frac{m_j}{m_k} = \left(\frac{p_k}{p_j} \right)^{\sigma} \tag{A.3}$$

In rewriting this, we obtain $m_j = m_k \left(\frac{p_k}{p_j} \right)^{\sigma}$ which we substitute in the original budget constraint. Bringing the common term $m_k p_k^{\sigma}$ outside the summation and rearranging we get the compensated demand function for the *k*th variety of the manufacturing product:

$$m_k = M \frac{p_k^{-\sigma}}{\left[\sum_{j=1}^{n} p_j^{1-\sigma} \right]^{\frac{\sigma}{\sigma-1}}} \tag{A.4}$$

We can use this demand function to obtain an expression for the minimum cost of attaining *M*. Expenditure on the *k*th variety is *pk*mk* – the minimum cost for obtaining *M* is, therefore, equal to the following summation:

$$\sum_{k=1}^{n} p_k m_k = \left[\sum_{j=1}^{n} p_j^{1-\sigma} \right]^{\frac{1}{1-\sigma}} M \qquad \text{(A.5)}$$

It is now common to define the term on the right hand side by which *M* is multiplied as the price index P, such that the price index times the quantity equals the expenditure.

Assuming only one location, this is the actual price index. However, we assume *R* regions. The price index in each region is, therefore, determined by the prices in all the other regions from which a region imports. The importance of the prices in each region is taken into account by using weights. Logically, the weight we use for each region equals the number of goods in region s with respect to the total number of goods produced. These weights reveal the importance of the regions.

The expression for the price index becomes:

$$P_j = \left[\sum_{n=1}^{R} n_n p_n^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \qquad \text{(A.6)}$$

B. Appendix to chapter 3:

B.1 Table of Codes from Figures 3.12, 3.13 and 3.14

COUNTRY	CODE	COUNTRY	CODE	COUNTRY	CODE
Bacău	RO211	**Dâmboviţa**	RO313	**Bihor**	RO111
Botoşani	RO212	**Giurgiu**	RO314	**Bistriţa-Năsaud**	RO112
Iaşi	RO213	**Ialomiţa**	RO315	**Cluj-Napoca**	RO113
Neamţ	RO214	**Prahova**	RO316	**Maramureş**	RO114
Suceava	RO215	**Teleorman**	RO317	**Satu Mare**	RO115
Vaslui	RO216	**Dolj**	RO411	**Sălaj**	RO116
Brăila	RO221	**Gorj**	RO412	**Alba**	RO121
Buzău	RO222	**Mehedinţi**	RO413	**Braşov**	RO122
Constanţa	RO223	**Olt**	RO414	**Covasna**	RO123
Galaţi	RO224	**Vâlcea**	RO415	**Harghita**	RO124
Tulcea	RO225	**Arad**	RO421	**Mureş**	RO125
Vrancea	RO226	**Caraş-Severin**	RO422	**Sibiu**	RO126
Argeş	RO311	**Hunedoara**	RO423	**Ilfov**	RO322
Călăraşi	RO312	**Timiş**	RO424	**Bucureşti**	RO321