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Agglomeration and Economic Growth. A New Economic Geography approach for Romania's Counties

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Abstract: Over the last 25 years and particularly over the last 10 years, Romania has achieved an important economic growth pace. Nevertheless, the level of economic development is not the same across the country and, like many other states, Romania displays a heterogeneous territory with different economic, social and geographical characteristics and therefore with great disparities among regions and among counties. Regarding this aspect, and built on the principles of the New Economic Geography approach, this paper proposes to explain the inequalities stemming from the location, distribution and spatial organization of economic activities.

Using the endogenous growth theory as a foundation, and using panel data models in order to uncover the role of both agglomeration economies and positive externalities in regional development, our inquiry focuses on Romania's 41 counties plus Bucharest, analysing data from 2005 to 2012.

The results show a certain positive impact of both the employment and unemployment rates, research and development and education. Nevertheless, all these components are statistically significant only in the long run, given the fact that in the short run it is very difficult to uncover and evaluate their impact on economic development. By the same vein, even if a different result was expected, in some models, public infrastructure and market potential seem to have a negative impact on Romania's regional development.

Keywords: agglomeration economies; positive externalities; regional disparities, regional development; economic growth.

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1. Introduction

Systematic economic research on the relationship between agglomeration economies and economic development in some regions circumscribed to a wider geographical area have led to the creation of an extensive collection of economic literature. This is creating an analytical method of thinking that integrates economic concentration activities with endogenous growth theory and New Economic Geography. Theoretical literature on agglomeration economies highlights the subject of positive externalities that are simply contributing to economic growth, as evidenced in empirical studies, even if the types of agglomeration economies with substantial influence or magnitude of their effects may lead to different and sometimes even contradictory results. Depending on the phase of aggregation and spatial extent which formed the foundation for analysis, econometric techniques used, and especially the agreed measures of agglomeration externalities that were regarded as potential determinants in regional development, consequences and their implications vary widely among researchers.

By introducing a spatial dimension to the analysis of economic growth, we look at the principles of agglomeration externalities and the way in which they emerge and break into a specific geographical region. These principles address the implications of both the static and dynamic effects of this type of externalities. On the one hand, taking into account the static effects, one can rely on the positive relations existing between incremental productivity growth in one of economic units, and the repercussions that this phenomenon has on other entities in a region. On the other hand, dynamic effects involve, for instance, the dissemination of knowledge within a region, an economic phenomenon that contributes to the economic growth of the concerned region (Doring & Schnellenbach, 2006). Therefore, a large part of the variation in GDP per capita can be explained by the availability of raw materials and intermediate inputs (Redding & Venables, 2001) and thus the quality and quantity of infrastructure networks.

Beginning with the uneven distribution of economic activities, the cores (or poles) of growth have developed over time, around some cities or even covering larger geographical areas. During this time, other regions have confirmed their status as "*periphery*", having an increasingly reduced population density and a low standard of living in comparison with the regions that have gained the status of "*core*". The core-periphery model is a characteristic of the New Economic Geography, being developed by Paul Krugman. In his work, developed in the early 1990s, the spatial structure of an economy, transport costs, the various economies of scale and economic development are closely linked (Krugman, 1991). Considering the spatial distribution of the economy, which in some regions allows the outlining of a core-periphery model, there is a close correlation between the regions or counties within the periphery and their level of development (Bruna et al, 2014), a phenomenon that can be observed at the European Union level as well.

The process described above has led to the formation of a geographic concentration of interconnected economic activities (industrial agglomerations or clusters). They are specialized in a particular field, and their appearance is due to the increase in the productivity of enterprises within the cluster because of the interrelationships between those components of the system (Porter, 1998). The development and upgrading of

clusters has become strategically important both for national and regional authorities. The process involves a particularly important contribution from the private sector as well. Initiatives present in these programs outline a new direction in economic development, however, relying on the efforts of previous macroeconomic stabilization, stimulation of the process of learning and, particularly, research and market liberalization.

Brakman *et al* (2009) highlight the importance of neighboring regions for the development of a particular region, whereas the examples established at this level do not allow for the existence of developed enclaves surrounded by poor areas. However, the empirical data from Romania suggests that this phenomenon is possible in the richest counties, attracting investments and developing at a pace much faster than the less developed counties. This could be explained by the fact that the interlocking is more pronounced where there are a high degree of integration at all levels. In this case, the political-administrative component of the counties of Romania can be a factor which promotes polarization.

There are, however, costs associated with the concentration of economic activities. Hanson (2004) states that the phenomenon of congestion limited the creation of industrial conglomerations and Combes et al. (2012) note that there is a possibility that the land price will rise unduly high in large industrial centers. In addition, labor costs are higher in the more developed, and thus more crowded regions, this being an advantage for employees and, at the same time, a drawback for employers.

Estimates based on econometric analysis can identify key factors in the economic growth of regions, among the most important finds in the literature being human capital, the initial level of GDP/capita, public infrastructure (measured, for example by means of density highways) innovation activity (rate of patent application) and agglomeration economies (such as industrial specialization and diversity) as well as the market potential. To these are added variables to the functionality and development of markets and the total economic activity indicators (trade opening rate, foreign direct investment, demographic and socioeconomic dimensions etc.).

The models, borrowed both from the New Economic Geography and endogenous growth theories, come to establish real-world observations and to explicate the mechanisms and channels of influence of urbanization and localization externalities. Valuation of the impingement of these externalities on GDP growth requires empirical studies and this is why we aimed to spotlight the use of different types of agglomerations on growth in the counties (or areas) of Romania. Even if the analysis of a not so large number of years makes it more difficult to highlight the long-term characteristics and to better distinguish the contradictory influences of economic crisis, we consider the results as relevant and having the ability to encourage further research.

2. Regressions

In our analysis, we used panel data and semi and double-log models, in order to observe the effects of various explanatory variables.

The panel data model measures the impact of independent variables on growth, comprising both the country effects (cross-section) and time-specific effects. The specification of the panel data is widely practiced due to the benefits and facilities related to the technical possibilities of estimating diversity and to the opportunities to appraise

the effects on national economic growth in the sub-space components that construct the national soil. Perhaps the most important positive aspect is that, noting regional data every year, allow recording results over time, i.e. after some investments and / or expenses may prove their usefulness and purpose within the productive activities. Use of estimates on the data panel allows the identification of the specific effects of the regions' controlling missing or unnoticed variables (Judson & Owen, 1999).

The estimated specification on data panel, measuring the forces affecting regional growth, takes place at three levels: once regional effects are taken into consideration by the coefficients of the independent variables, the effects of regional (cross sectional) ones capture the indicators that do not vary in space, and time effects that measures the change in volume in all regions in a given time (year), highlighting the invariant characteristics over time.

At this stage we are exploring the effects of density growth variable proxy using different econometric techniques. Models with panel data can be specified with fixed or random effects. Fixed effects panel allows the correlation of disturbances within the spatial areas (counties or regions, in our case), random effects taking into account this correlation.

$$\ln(GDP/cap) = \beta_0 + \beta_1 \ln Infrast + \beta_2 \ln MP + \beta_3 \ln Div + \beta_4 \ln Empgrowth\_rate + \beta_5 \ln Unem\_rate + \beta_6 \ln R\&D + \varepsilon$$

Where: *GDP/cap*= GDP/capita, *Infrast*= public roads relative to population density (kilometers of road / capita), *MP*=market potential, *Div*=sectorial diversity, *Empgrowth_rate*= growth rate of employment, *Unem_rate*= unemployment rate, *R&D*= share of expenditure on R & D expenditure in GDP.

3. Results and interpretations

The sample panel comprises 41 counties plus the city of Bucharest, the estimates of the seven models being comprised of the fixed and random effects, while choosing the right one was performed using the Hausman test.

Table 1 The results of GDP/capita growth models at county level, using fixed and random effects, 2005-2012

	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se	Model 5 b/se	Model 6 b/se	Model 7 b/se
log_GDP_cap	2.598*	1.688	-0.222	5.877*	6.536*	7.847**	59.139***
	(1.17)	(1.06)	(2.27)	(2.72)	(3.28)	(2.91)	(5.98)
log_Infrast	0.257	-0.182	4.226	11.716	23.278*	23.989*	-23.687
	(0.58)	(0.52)	(9.82)	(21.19)	(11.51)	(10.20)	(20.57)
Empgrowth_rate		1.013***		1.658***		1.119***	
		(0.12)		(0.20)		(0.12)	
log_Unemp_rate			-12.449***				
			(1.55)				
log_R&D				-2.255*			
				(1.10)			
log_MP					-12.792	-11.163	2.975
					(9.94)	(8.80)	(9.00)
log_Div							-31.106
							(45.75)
Constant	-21.393*	-11.328	1.775	-117.758	-144.484*	-164.398**	-369.673**
	(8.86)	(8.08)	(65.41)	(128.79)	(71.05)	(62.96)	(122.86)
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R-squared	0.321	0.228	0.192	0.323	0.018	0.233	0.468
F/Wald	7.57	86.38	23.100	18.344	1.782	21.976	26.855
N observations	336.000	336.000	336.000	200.000	336.000	336.000	168.000

* p<0.05, ** p<0.01, *** p<0.001

GLS Regression, OLS Regression, Note: Standard errors are presented in brackets

Source: Own preparation using Stata 12.0

The results of the seven developed models highlight the high levels of statistical significance of the coefficients estimated by the method of least squares, on the basis of fixed and random effects.

Also, the Wald and Fisher tests validate the common influence of explanatory variables of the dependent t-test, confirming the individual influence (positive or negative) of each variable. Breusch-Pagan test in the case of models with random effects and modified Wald test for group-wise heteroskedasticity models with fixed effects, confirm the hypothesis of homoscedasticity. Therewith the Wooldridge test removes the possibility of first order serial correlation in the residual variables, so the accuracy of the estimated coefficients is high.

According to our estimated models, the coefficient of elasticity of the GDP/capita does not highlight a convergence of views between the counties, but on the contrary, the fact that in the period 2005-2012, differences in GDP between counties grew. The level of GDP/capita is important in the process of growth when it is accompanied by the effect of other factors, such as infrastructure and especially the employment rate, according to Models 4 and 6.

Replacement of the employed population by the unemployment rate as an explanatory variable in combination with infrastructure results in an appearance of a convergence in relation to the previous period, a decrease in the unemployment rate, contributing to the reduction of differences in GDP/capita. Moreover, the demonstration of a possible process of convergence is statistically significant (Model 3). A proxy measure of the changing labor market radically alters the results of the equation. However, the use of the employment rate measure does not seem to be a good estimator, even if the results are statistically relevant and explanatory power is high, whereas if any other determinants were introduced into the models, the significance of the employment variable would not change.

The same conclusion leads us and the replacement measure population employed with the unemployment rate, the explanation being that a reduction of it (unemployment rate) would mean a greater mobilization of resources from poor counties, which would contribute to their economic growth dynamics. To correct a possible problem of endogeneity and to increase the relevance of the results, we performed estimations using the method of maximum likelihood.

With regard to the level of GDP/capita in cross-country regressions' elasticities variable section, GDP/cap yields understanding that a certain tendency towards convergence of GDP between counties exists, but very low values of the coefficient of determination (R^2) do not allow a clear conclusion on this influence or, at least, requires additional precautions in interpretation. Instead, these results are different in predicting the panel, but more stable, highly statistically significant, and confirm the hypothesis of a divergence in GDP growth between counties. Analysis of the panel suggests a divergence in relation to the previous period in the models 1-2 and 4-7. This trend is clear in Model 7, where the GDP/capita variable coefficients are statistically significant at the 1 per cent (but subject to a number of factors).

The first measure externally introduced into the models is the infrastructure. Alongside the level of GDP/capita it can affect regional growth to a certain extent, with statistical

relevance, and later, through the gradual introduction of other variables of agglomeration and control, the estimated coefficient of the infrastructure becomes negative in all models, contrary to expectations, but statistically insignificant (models 2-7). We interpret these results as being due to improper measurements of the variable included as a proxy for physical capital, due to several reasons. Firstly, public roads are only part of the infrastructure (public funds) and other investment having a direct impact on productive activities either by allowing their development or by reducing costs (such as energy, telecommunications, railways, airports), are not taken into account. Furthermore, public investment does not take into account private equity stocks and data unavailability in this respect at the regional level. In addition, we must not forget that the indicator comprises public roads in general, without distinguishing between European, national, regional or municipal roads, with features and capabilities that are fundamentally different. Thus, it is not surprising the results are not significant in themselves.

In general, the empirical literature identifies a positive relationship between regional growth and infrastructure. The Study *How Regions Grow. Trends and Analysis* (OECD, 2009) conducted at the level of large regions of 335 territorial level 2 of the OECD area, regarding the effects of infrastructure growth in dynamic models with offsets, concludes on the role required, but not enough of it, pointing out that it takes three years for it to have an impact on infrastructure growth and five years, in the presence of human capital measured by the number of pupils in primary, secondary and tertiary education. In addition, the indicator is calculated based on the length of a certain type of public roads, highways, which might not be relevant in our research.

As a result of the OECD study estimates, the authors concluded that infrastructure is significant only in the presence of human capital and innovation, which in terms of political action would suggest corroborating certain types of measures in order to have the desired effect. Highways can increase access to other markets, but also can increase competition to lead to local firm's exit from the market, possibly through the migration of production to other regions (OECD, 2009). You can thus apply the theories and models of the new economy, which describe geographically how goods can be sent to the Center in order to obtain savings, increasing earnings of foreign company scale. However, it may be attractive to keep capital in regions where employment and innovative activity are present, in order to benefit from a high labor supply market.

In the developed models, infrastructure is a positive factor influencing the growth dynamic of the richest counties (i.e. a process of divergence), but only with human capital, measured by employment, whose coefficient is statistically significant and very robust (Model 2, 4 and 6). This would also suggest that education and innovation could corroborate a positive growth process, but the measures available for education or school population as measured by the number of students by level of education, have led to significant results in this respect.

Regarding specific and labor market performance in all three models in which we introduced the influence of employed population, retention of estimated coefficients' elasticity regardless of variable influence indicates the need for cautious interpretation of the results. When we introduced the unemployment rate as an independent variable (Model 4), to observe the impact of employment on GDP growth, the negative sign and high statistical significance support the role of labor in production (a decrease in the unemployment rate results in an increase in GDP / capita level), a reduction in the

unemployment rate could induce a faster growth in counties with a lower GDP / capita, as a reflection of an increased capacity of counties to raise their labor resources. This measure, associated with the infrastructure in areas with lower labor resources that are not used enough, cannot promote sustained growth of these regions. On this line, as otherwise stated in the literature (OECD, 2009), a reorganization of the regional economy could foster more profitable use of the potential of untapped labor.

Endogenous growth emphasizes the importance of innovation in the economic growth process. In the model developed, this is expressed by R & D spending, and not patents, due to not having observations available in the counties in complete annual series, which makes it difficult to estimate a positive relationship with an endogenous growth model estimation. Expenditure on research and development still seem to exert a significant influence on growth, as the elasticity of estimated coefficients is lower (higher for public sector spending), with the business sector not being very involved in this activity (low value volume of private investment in research at the territorial level).

This could be due to the fact that they represent only one of the entries which are necessary in an effective R&D process and therefore should be connected directly to innovation, but they do not fully explain the developments in this area. These elements can lead to better coordination of infrastructure development policies, with the formation of human capital and promotion of innovation to support economic growth in each and every region.

Conclusions

One of the essential results of our models represents the important role of economies of agglomeration in locating and developing economic activities. In the New Economic Geography models, agglomeration economies are seen as an important element of concentration. Our panel estimates suggest that the agglomeration economies are partly responsible for the overall more growth of rich areas, suggesting a conditional divergence process, unlike the cross-sectional analysis.

Positive externalities have influenced a faster growth of GDP / capita in the richest counties, mainly due to the increased market accessibility of these areas. In this case, the GDP/capita variation in relation to the potential market accessibility is enlightening. Although this is not statistically significant, some models suggest that a region with good accessibility has an added advantage for its growth prospects, along with human capital, innovation, infrastructure and economies of agglomeration.

The lack of convergence between the counties of Romania is conditioned by other factors related to agglomeration economies. Thus, the trend of a process of divergence is supported by specialization. A concentration of labor in agriculture, construction and public services do not encourage growth and regional convergence. The elasticity with statistically significant values and influence of these variables confirms this result, which, looked at in the mirror, is in line with the theory of Jacobs (1969) regarding the explosive growth of cities and concentrated areas (especially given the negative sign of the sectorial diversity of these models).

These estimates suggest that, in general, a high degree of accessibility confers an advantage to a region in its growth prospects, especially with the better use of skilled labor force resources, but also in conjunction with other externalities. We emphasize the importance and statistical significance of sectorial diversity together with good market

access for richer regions at the expense of the poorest (we must keep in mind that the positive sign of the GDP / capita variable does not imply a faster growth in poorer regions and regional income convergence but, on the contrary, a widening income gap).

Similarly, market access and the degree of industrial specialization are combinations of externalities that promote growth of regions with higher GDP / capita. It should be pointed out that with the inclusion of other variables, the number of available observations decreases because data on all variables are not available for all regions and over the entire period analyzed (some are limited to 2008-2011).

In general, the fact that these regional determinants are highlighted so strongly underlines their importance in regional growth, requiring policies not only nationally, but also regionally, to mobilize labor resources, develop local facilities, and exploit comparative advantages.

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