Section I
REGIONAL DEVELOPMENT POLICIES AND STRATEGIES

DETERMINANTS OF REGIONAL COMPETITIVENESS IN ROMANIA - A PANEL DATA APPROACH*

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Abstract:
In this study, a few panel data models were estimated to analyze the regional competitiveness in the 42 counties (including Bucharest) of Romania. The dynamic panel with Arellano–Bover/Blundell–Bond estimators and robust standard errors showed that during 2000-2012 the GDP in the current period depends on the average number of employees and on the GDP value of the previous period. For a fixed effect model, 34.41% (Rho) of the total variation is due to the differences within the counties. The Moran's I index in 2000 is negative and close to zero (0.035) suggesting a negative but non-significant spatial autocorrelation. In 2012, the Moran I's suggests a positive and non-significant spatial auto-correlation.

Keywords: *competitiveness, panel, dynamic panel, GDP, Moran's I index*

JEL Classification: C23, C33, C51

Introduction

Even if there is not an unique perspective to take a picture of the complexity of "regional competitiveness" approach, there an aggregate of conceptions rather different between them (Chilian, 2011), for European Union the problems related to regional competitiveness raising the interest of European decision agents and of the members from many years, especially regarding the realization of economic and social cohesion. The growth of European returned and less prosperous regions competitiveness is considered crucial for the achievement of this objective, especially for achieving the monetary union and the integration of new members (Gardiner *et al*., 2006). The monetary integration and of the new members of EU has stimulated many theoretical developments of the economic science that assign a central place to the localization of the economic activities and to the evolution of regional economies (Martin, 2005; Petrakos *et al*., 2004).

In Romania, the problem of regions and counties competitiveness became a subject of major interest for researchers, but also for the factors of political and administrative decision at the local, county, regional and national level, especially for the possibility of the European funds access for the support of regional development in the periods before and after the accession. Studies regarding the economic development and regions competitiveness from Romania appreciated by the GDP per capita and its determinants (Vincze, 2003, Chilian, 2011, Chilian şi Iordan, 2008) showing gaps between regions with

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increase tendency, configuring three possible *levels of performance* (typologies): accelerated economic development, the motor type regions (*Bucureşti-Ilfov*), relative economic development follower regions type (regions from Transilvania and Banat) and relative economic stagnation (left behind regions- Moldova-Muntenia-Dobrogea-Oltenia).

On the other hand, there are also some common models of evolution of some regional competitiveness determinants (expressed by the evolution of real GDP for regions and counties) and the specificity of each region regarding its formation (Jula şi Jula, 2009; Chilian, 2011). The choice of the most suitable regional competitiveness strategy has as main goal the ensure of the cohesion between European Union regions. The regional competitiveness was analyzed for all countries from Central Europe with transition economies (93 regions at NUTS2 level from 8 countries).The competitiveness for the regions in Germany, Slovenia and Austria is stronger than in the case of the other regions from Central Europe (Lengyel şi Rechnitzer, 2013).

Even if the Kaldor model from 1970 for the regional growth was very controversial in the 40 years till its apparition, it did not lose its relevance. This model provides plausible explanations for regional differences and differences between countries regarding the economic growth and GDP per capita (Thirlwall, 2013).

In present, the tendency of regional economic growth that differences the areas determined many interpretations, more economic growth strategies being defined for each region. In literature the concept of *territorial capital* and its efficient exploration have recently developed, especially for European Union regions (Camagni şi Capello, 2013).

Panel data approach was used in few studies regarding this domain. A spatial dynamic model for panel data was applied for NUTS-1 and NUTS-2 regions from Europe on the horizon 1980-2005, getting that structural fund did not have a significant impact on regional GDP growth (Bouayad-Agha, Turpin şi Védrine, 2013).

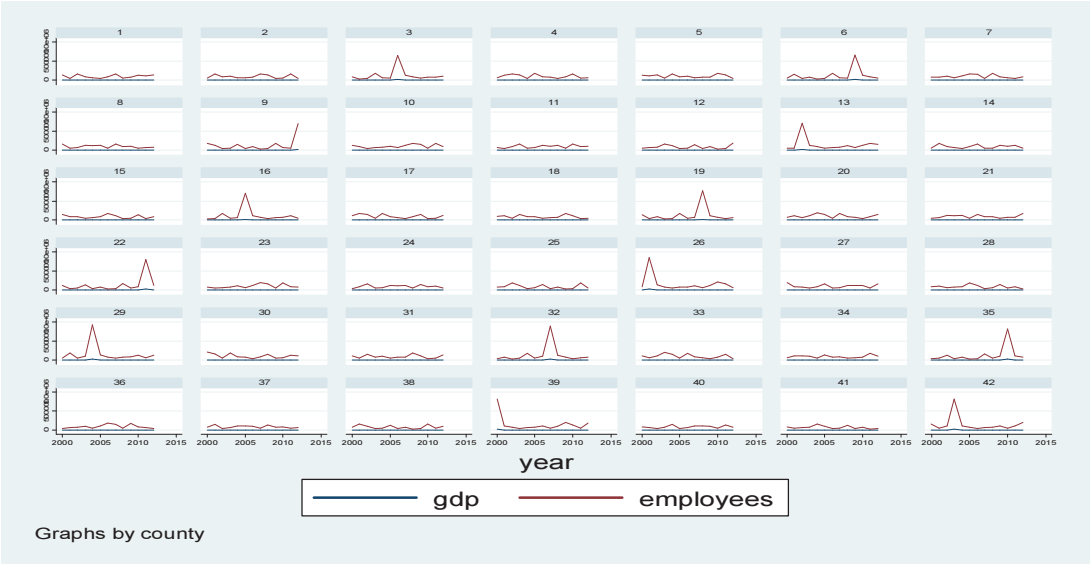
This work represents a continuation of the demarche study of regional competitiveness determinants, by the fact that using panel data models is deepened the analysis of regional competitiveness determinants for the Romanian counties for a period when significant changes regarding the development determinants have been taken place (2000-2012).

Panel data for competitiveness analysis

The data used in this study refers to GDP expressed in comparable prices (2000=100%) and the number of registered employees with annual frequency during 2000-2012 for all the Romanian counties, including Bucharest. The GDP expressed in current prices provided by National Institute of Statistics was deflated using the GDP deflator of the International Monetary Fund. The number of employees and nominal GDP were taken from the Tempo data base of National Institute of Statistics.

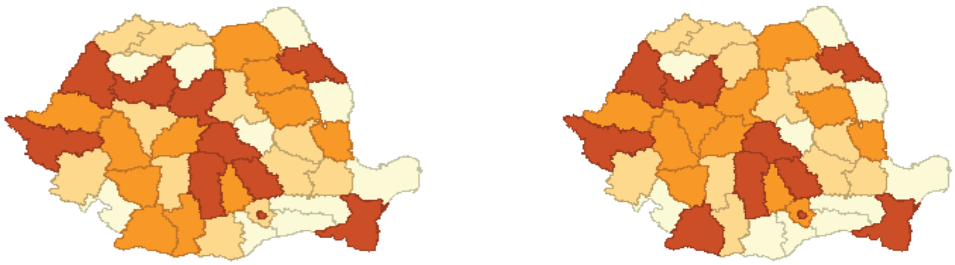
Figure 1 shows that real GDP had in the analyzed period a rather uniform distribution for each county. More variations in time are observed for the number of employees in all the counties. The maximal value for number of employees was reached in different periods, fact that suggests that there are some specific economic contexts for each county that determine a higher degree of occupation.

Figure 1: Real GDP and number of employees for the Romanian counties during 2000-2012



Forwards, depending on the values of GDP in 2000, respectively 2012, it was done the division of the counties of Romania in 4 groups (figures 2a and 2b). Thus, in 2000, 10 of the Romania counties registered a real GDP real between 572.1 and 952.7 million lei (constant prices) and also 10 counties between 2128 and 16870 million lei. 11 of the counties of Romania registered a real GDP between 1028 and 1359 million lei and also 11 counties between 1383 and 2106 million lei. In 2012, 10 of the Romanian counties registered a real GDP between 933.6 and 1370 million lei and also 10 counties between 3331 and 29660 million lei. 11 between Romanian counties registered real GDP between 1400 and 2126 million lei and also 11 counties between 2331 and 3171 million lei. In both periods Bucharest is different from the other counties, its GDP playing the role of outlier.

Figure 2: The map of the Romanian counties according to the real GDP in 2000 and 2012



a) 2000 b) 2012

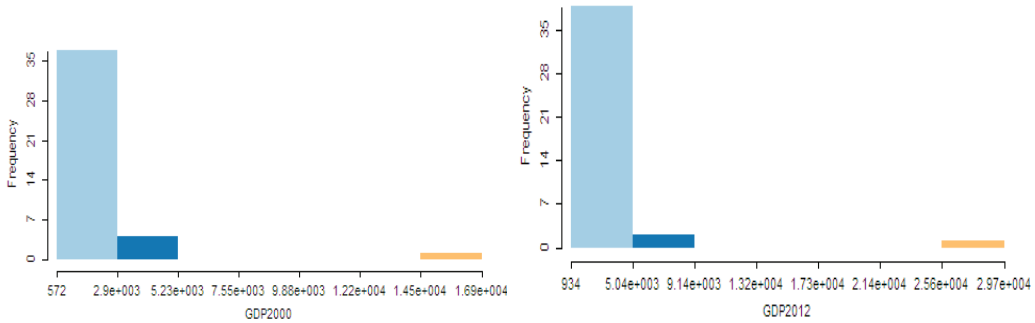
The representation of real GDP using a cartogram (figures 3a and 3b) show that in 2000 its value in case of Bucharest is different from the other values for the rest of the counties, being excluded from the analysis. In case of the 41 remained counties, we observed that 10 of them contributed with less than 25% of the total GDP (Bucharest never being taken in account), 9 of the counties contributing with more than 75% of the total GDP. The cartogram for 2012 shows that only the real GDP for Bucharest is considered as outlier, but also for Timiş county. In the case of the 40 remained counties, we observed that 10 of them have less than 25% of the total GDP (without Bucharest). 8 of the counties contributed with more than 75% of the total GDP.

Figure 3: Cartogram of the real GDP in 2000 and 2012

a) 2000 b) 2012

The analysis of real GDP histogram (figures 4a and 4b) indicates an increase in economic gaps between counties in the analyzed period. In 2000 we observed that the most counties (37) registered a real GDP between 572 million lei and 2900.3 million lei (comparable prices) and 4 counties a real GDP between 2900.3 and 5230.03 million lei (Cluj, Constanţa, Timiş, Prahova). In 2012, more counties (39) registered a real GDP between 934 million lei and 5040.03 million lei (comparable prices) and only 2 counties a real GDP between 5040.03 and 9140.03 million lei (Constanţa and Timiş).

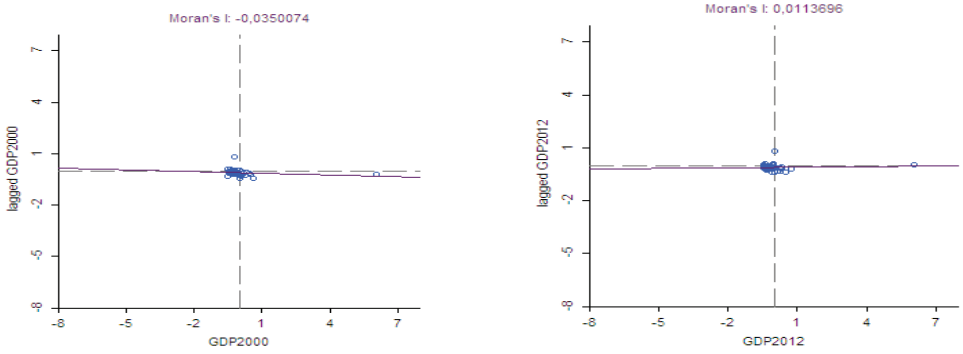
Figure 4: Histogram for real GDP on counties in 2000 and 2012



a) 2000 b) 2012

The I Moran's index for real GDP in 2000 has a negative value and close to zero (-0.035), indicating a negative spatial autocorrelation, but statistically insignificant (figure 5a). It is interesting that I Moran's index has a positive value close to zero, indicating a positive spatial autocorrelation, but statistically insignificant (figure 5b).

Figure 5: The I Moran's index for real GDP in 2000 and 2012



a) 2000 b) 2012

The stationary tests for applied panel data (Im-Pesaran-Shin test and Harris-Tzavalis test) showed that the real GDP data and number of employees data are stationary (Appendix 1). A dynamic panel model with Arrelano-Bond estimators in two stages, the standard errors being robust. The results from Appendix 2 indicate a statistically significant correlation between GDP in the current period and number of employees, but also between GDP in the current period and the GDP in the previous period. The estimations showed that there are not fixed effects in time that influence the GDP county. The model was re-estimated using Arellano–Bover/Blundell–Bond estimators with robust standard errors (table 1). The errors are not auto-correlated.

Table 1: Dynamic panel with Arellano–Bover/Blundell–Bond estimators and robust standard errors

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System dynamic panel-data estimation          Number of obs          =       504
Group variable: county                        Number of groups       =        42
Time variable: year
                                              Obs per group:     min =        12
                                                                 avg =        12
                                                                 max =        12

Number of instruments =     79                Wald chi2(2)           =   1171.08
                                              Prob > chi2            =    0.0000
One-step results
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gdp	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
gdp						
L1.	-.0155002	.0041998	-3.69	0.000	-.0237317	-.0072686
employees	.0303486	.0012195	24.89	0.000	.0279583	.0327388
_cons	-643.9503	107.7911	-5.97	0.000	-855.2169	-432.6837

```
Instruments for differenced equation
        GMM-type: L(2/.).gdp
        Standard: D.employees
Instruments for level equation
        GMM-type: LD.gdp
        Standard: _cons
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Source: authors' calculations.

Using the estimations results, we can conclude that for Romanian counties, the increase in number of employees generated grows in GDP.

Table 2: Arellano-Bond test for errors independence in first difference

Order	z-computed	Probability >z
1	-3.3635	0.0008
2	-1.4334	0.1517
3	0.4914	0.6231
4	1.2338	0.1992

Source: authors' calculations.

We observed that starting with the second lag the errors are independent.

We also estimated some fixed-effects and random effects models for real GDP and number of employees. The Hausman indicated that it is more suitable the fixed-effects model. In the case of our model, we observed that there is not a dependence of errors between counties, but the homoscedasticity assumption is not checked. Therefore, a fixed-effects model under the heterosceasticity hypothesis is estimated.

Table 3 : Modelling GDP for Romanian counties- fixed effects model (p values in brackets)

Constant	-390.7794 (0.000)
Number of employees	0.0275 (0.000)
Rho	0.3441

Wald statistic	*10895.48 (0.000)*
Pesaran statistic for units independence	-0.802 (0.4226)
Breusch-Pagan LM statistic for errors independence	15.342 (0.001)
Modified Wald statistic for errors heteroscedasticity between groups (H0: sigma(i)^2 = sigma^2 for all units i)	2.30 (0.7223)

Source: authors' calculations.

The interclass correlation suggests that 34.41% (Rho) of the total variation is due to differences between counties. The assumption of errors homoscedasticity, but also the independence one are checked. The results of Pesaran test indicated that there is no dependence between units.

Conclusions

The panel data approach with Arrelano-Bond and Arellano–Bover/Blundell–Bond estimations determined in two stages with robust errors and dynamic reflected for the Romanian counties during 2000-2012, that the number of employees and GDP for the previous year are determinants of regional competitiveness. A large part of the differences in GDP between counties is due to economic evolutions of each county. Moreover, the spatial autocorrelations between counties based on I Moran's index in 2000 and 2012 are not statistically significant.

The results are in accordance with the previous studies (Chilian, 2011), that put in evidence the positive influence of the occupied population on real GDP, but also the big inertial effect of economic conditions in the previous period (simultaneously with the increase in gaps of inter and intra-development), but also regional aspects of economic development (and also of the counties components, in the context of Romanian regions are not exactly territorial-administrative units).

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APPENDIX 1

Stationary tests

Variable	IPS test statistic	Harris-Tzavalis test statisic
GDP	-10,06 (p value=0,00)	-0,0303 (p value=0,00)
Employees	-0,9325 (p value=0,00)	-0,0449 (p value=0,00)

APPENDIX 2

Modele dinamice de tip panel

Dynamic Arellano-Bond panel	Coefficient	Robust standard error	z	P> modulus(z)
GDP L1.	-0.0158	-0.0047	-3.35	0.001
Employees	0.0302	0.00036	82.70	0.000

Arellano-Bond dynamic panel	Coefficient	Robust standard error	z	P> modulus(z)
GDP L1.	-0.013	0.01	-1.37	0.169
Employees	0.02986	0.0005	53.16	0.000
Year	-18.122	29.84	-0.61	>0.05
Year 2000	-10157.27	19385.33	-0.52	>0.05
Year 2001	-11661.24	13917.59	-0.84	>0.05
Year 2002	-9875.76	10967.92	-0.9	>0.05
Year 2003	-9514.09	10192.96	-0.93	>0.05
Year 2004	-10117.18	10192.3	-0.99	>0.05
Year 2005	-5973.77	9030.79	-0.66	>0.05
Year 2006	-2794.87	8179.12	-0.34	>0.05
Year 2007	820.64	4064.54	-0.2	>0.05
Year 2009	0	-	-	-
Year 2010	-907.45	3311.768	-0.27	>0.05
Year 2011	2069.24	5204.42	0.4	>0.05
Year 2012	4940.91	6450.54	0.77	>0.05

APPENDIX 3

Fixed effects and random effects models

Fixed effects model	Coefficient	Robust standard error	t	P> modulus(t)
Constant	-774.73	0.0002	122.53	0.000
Employees	0.0312	39.87	-19.43	0.000

Pesaran's test of cross sectional independence = -0.802, Pr = 0.4226
Average absolute value of the off-diagonal elements =0.226
Modified Wald test for groupwise heteroskedasticity in fixed effect regression model
H0: sigma(i)^2 = sigma^2 for all i
chi2 (42) = 2961.86
Prob>chi2 = 0.0000

xtgls gdp employees, igls panels(heteroskedastic)

Fixed effects model, heteroskedastic panels, no autocorrelation	Coefficient	Robust standard error	t	P> modulus(t)
Constant	-390.77	0.0002	-12.25	0.000
Employees	0.027	31.88	104.38	0.000

Random effects model	Coefficient	Robust standard error	t	P> modulus(t)
Constant	-777.29	0.00025	122.96	0.000
Employees	0.0312	78.88	-9.85	0.000