PANEL DATA MODELS FOR REGIONAL DEVELOPMENT

Sorin Daniel MANOLE
Associate Professor, Ph.D., "Constantin Brâncoveanu" University of Piteşti
e-mail: danielsorinmanole@yahoo.com

Antonio TACHE
Main researcher 3, National Institute for Research and Development in Constructions, Urbanism and Sustainable Spatial Development URBAN-INCERC, e-mail: tonytache@yahoo.ro

Abstract. One of the goals of the national development policy is to support the sustainable economic and social growth of regions territorially balanced in Romania in order to reduce economic and social disparities among regions. This paper aims at identifying influential factors to the number of tourists and national road density, indicators that characterize tourism, namely transports - two of the regional development priorities. To this end, pooled linear regression models with spatial specific effects have been used for cross-sectional units. However, model equations quantify the intensity of highlighted links and assess the effects of influence factors upon the two indicators. The study shows that the nominal GDP is an important direct influence factor upon national road density and, the GDP per capita and the number of employees per 1,000 inhabitants are relevant factors which influence tourist activity, the former directly and the latter reversely.

Key words: regional development; sustainable development; panel data models; Romania

1. Introduction

1.1. Regional Development Policy

Regional development policy is one of the most important and most complex policies of the European Union as by its aim of reducing economic and social disparities among various regions of Europe, it acts upon some significant areas to development, such as: economic growth and the SME sector, transports, agriculture, urban development, environmental protection, employment and occupational training, education, gender equality etc.

Regional progress has paramount importance in terms of the principles and objectives of sustainable development and due to the fact that our country shows a tendency to increase regional disparities related to economic and social growth, rational use of resources, and environmental infrastructure quality (Ministry of

Environment and Sustainable Growth, National Centre for Sustainable Growth, 2008).

At the same time, regional development must have a key feature - sustainability. In order to get a real advantage in the future, Romania must implement the sustainable development concept at regional level, where structures are more flexible and the good practical solutions can be rapidly assimilated (Fistung et al, 2005).

The Regional Development National Strategy (SNDR) for 2014-2020 which shows the Romanian Government's view on regional development sets regions' development priorities as well as the institutional relationships that facilitate the correlation with sectoral strategies. Two of the development priorities envisage transports and tourism: Development Priority 3 – The development of regional and local infrastructure and Development Priority 6 – Sustainable Tourism Development.

The road network, a significant constituent of transport infrastructure is the basic support to an area's socio-economic development. The quantity and quality of road infrastructure reflect both the civilization level, and the availability for development and growth (Ministry of Regional Development and Public Administration, 2013).

Tourism development helps increase regions' attractiveness, quality of life, environment protection and preservation, and also achieve a high degree of social cohesion (Ministry of Regional Development and Public Administration, 2013).

Specialized literature reflects regional development issues in many studies. Fistung, in „Sustainable Regional Growth, a New Concept or a Need" comparatively analyzes the concepts of sustainable development and regional development and reviews sustainable development models at regional level. Mocanu and Perdichi proposes a model to assess sustainable development at county and regional level comprising 19 indicators grouped into four dimensions (economic, social, institutional and environmental dimensions) aggregated into a composite index. Chiriță and Dobrescu propose several steps within national priorities as a Romanian development model at regional level. Antonescu shows that the profound changes taking place at world level make specialists develop regional theories and models characterized by increased realism as compared to the old approaches, studies the issue of disparities with many facets when introducing this concept (convergence, polarization, agglomeration, concentration, dispersion) and analyzes the assessment of public interventions at regional level.

In order to clearly render the processes and phenomena that occur in an economic or administrative system, with the aim of increasing efficiency and improving its performance, a modelling process is required. Multiple model types for regional development are highlighted, willing to truly capture current facts and to emphasize economic laws that approximate such facts.

1.2. Panel Data Models in Economic and Econometric Studies

The presence of multiple functional links in regional economy among processes, being variable in time and space leads to the use of panel data models. Such models include *regression equations* where one uses series that are a combination of time *series* and *cross-sectional* data series. Since the situation occurs frequently when analyzing socio-economic issues and processes, panel data models are the subject of many studies in specialized literature.

Fischer, Mankiw, Romer, Weil, Levine and Renelt have undertaken studies related to long-run economic growth based on models with panel data, by using some large samples of countries. Brueckner provides an overview of the strategic interaction among local governments based on two categories of models with panel data. Arkadievich Kholodilin, Siliverstovs and Kooths undertake a forecast of the annual growth rates of the real GDP in each of the 16 German Länder, using dynamic panel data models. Partridge investigates the link between the income distribution and economic growth in the U.S.A. using 1960-2000 state data.

At the same time, the issue of panel data models plays a central role in econometrics. Complex theoretical developments of this topic are the subject of many books, of which: Analysis of Panel Data by Hsiao, Econometric Analysis of Panel Data by Baltagi and Wooldridge.

Numerous articles approach the study of specific issues related to panel data models. Thus, Bai tackles the issue of panel data models with unobservable interactive effects which are correlated with the regressors, if both the cross-sectional dimension and the temporal dimension are large. Elhorst effects a survey of the specification and estimation of spatial panel data models, in the circumstance of including spatial error autocorrelation or using a spatially lagged dependent variable. Hsiao, Pesaran and Tahmiscioglu focus on the estimation of fixed effects dynamic panel data models by maximizing the likelihood function, after the application of a linear transformation that eliminates the individual effects. Donald and Lang investigate the inference in panel data when the number of groups is small as is typically the case for the DID (differences – in - differences) estimation method and when some variables are fixed within groups. Wooldridge proposes a simple, flexible, widely applicable approach to handling the initial conditions problem in dynamic, non-linear, unobserved effects panel data models.

2. Metodology

2.1. Panel Data Models

The following are panel data models in a particular form, with one and two explanatory variables, as needed in the long run.

One can notice two and three variables (features) respectively x and y, and x, y and z for N units (marked $1, 2, \ldots, N$), called cross-sectional units for T consecutive periods $(t_0, t_0+1, t_0+2, \ldots, t_0+T-1)$ respectively

$(x_{i,t}, y_{i,t})$, $i = 1,2,\ldots,N$,
$t = t_0, t_0+1, t_0+2, \ldots, t_0+T-1$ $(x_{i,t}, y_{i,t}, z_{i,t})$,
$i = 1,2,\ldots,N$, $t = t_0, t_0+1, t_0+2, \ldots, t_0+T-1$

The cross-sectional dimension is N, and the temporal dimension is T, hence the size of the panel data is $N \cdot T$. It is believed that x is an endogenous variable and the others exogenous variables. The panel data models to be estimated are as follows, respectively:

$$x_{i,t} = \alpha + \beta y_{i,t} + \delta_i + \gamma_t + \varepsilon_{i,t},\ i = 1,2,\ldots,N,$$
$$t = t_0, t_0+1, t_0+2, \ldots, t_0+T-1 \qquad (1)$$
$$x_{i,t} = \alpha + \beta_1 y_{i,t} + \beta_2 z_{i,t} + \delta_i + \gamma_t + \varepsilon_{i,t},$$
$$i = 1,2,\ldots,N,$$
$$t = t_0, t_0+1, t_0+2, \ldots, t_0+T-1 \qquad (1')$$

where
α, β, respectively α, β_1, β_2 are model parameters to be determined;
δ_i represents specific (random or fixed) effects for cross-sectional units;
γ_t represents specific (random or fixed) effects for time periods;
$\varepsilon_{i,t}$ is the error terms.

One can specify the panel data models including one type of effects or both types of effects (for cross-sectional units and for time periods) in case at least one specific effect is fixed. In order to specify models with random effects both for cross-section and time, it is compulsory the panel should be balanced (we have the same time periods for each cross section observation).

This paper uses pooled linear regression models with cross-sectional specific effects, so that the equations shown previously are rewritten as such:

$$x_{i,t} = \alpha + \beta_1 y_{i,t} + \delta_i + \varepsilon_{i,t},\ i = 1,2,\ldots,N,$$
$$t = t_0, t_0+1, t_0+2, \ldots, t_0+T-1 \qquad (2)$$
$$x_{i,t} = \alpha + \beta_1 y_{i,t} + \beta_2 z_{i,t} + \delta_i + \varepsilon_{i,t}, i = 1,2,\ldots,N,$$
$$t = t_0, t_0+1, t_0+2, \ldots, t_0+T-1 \qquad (2')$$

In order to estimate models (2), and (2′) respectively, first the spatial fixed effects δ_i are eliminated from the regression equation by demeaning the dependent and independent variables. Then, the transformed regression equation is estimated by the ordinary least squares method (Elhorst, 2010).

2.2. Model Structure

The model includes five variables and is made up of two independent behavioral equations. The model pursues the quantification of factors' influence related to economic efficiency (the number of employees per 1,000 inhabitants) and to growth level (GDP per capita and nominal GDP) upon indicators that characterize transport infrastructure (national road density) and tourism performance (the number of tourists) using data about regions in Romania.

The following information is used in the two equations:
Dens_dr_nat = national road density (km./100 sq. km.) (endogenous variable);
Nr_tur = number of tourists (endogenous variable);
PIB_pr_c = nominal gross domestic product (million Lei) (exogenous variable);
PIB_per_cap = gross domestic product per capita (Lei/inhabitant) (exogenous variable);

R_sal = number of employees per 1,000 inhabitants (exogenous variable);
$a_{11}, a_{12}, a_{21}, a_{22}, a_{23}$ = equation parameters to be determined.

To estimate model equations, the authors have used the values of the five indicators during 2007 – 2011, in eight Romanian regions. That is why we need two indices:
t = generic index of time
$t = 2007, 2008, \ldots, 2011$;
i = generic index of region $i = 1, 2, \ldots, 8$

according to correspondence:
North-West region $\rightarrow 1$;
Central region $\rightarrow 2$;
North-East region $\rightarrow 3$;
South–East region $\rightarrow 4$;
South-Muntenia region $\rightarrow 5$;
Bucureşti-Ilfov region $\rightarrow 6$;
South-West Oltenia region $\rightarrow 7$;
West region $\rightarrow 8$.

The former model equation expresses the linear dependence between national road density and nominal gross domestic product, hence its next form obtained by customizing equation (2):

$$\text{Dens\_dr\_nat}_{i,t} = a_{11} + a_{12}\ \text{PIB\_pr\_c}_{i,t} + \delta_i + \varepsilon_{i,t},\ i = 1, 2, \ldots, 8,\ t = 2007, 2008, \ldots, 2011 \qquad (3)$$

where $\varepsilon_{i,t}$ is a residual variable, and δ_i represents cross-section specific fixed effects.

The latter model equation emphasizes the linear dependence between the number of tourists per gross domestic product per capita and the number of employees per 1,000 inhabitants, with explanatory variables acting with a two-year lag. Equation (2′) shows that the functional relation has the following form:

$$\text{Nr\_tur}_{i,t} = a_{21} + a_{22}\ \text{PIB\_per\_cap}_{i,t-2} + a_{23}\ \text{R\_sal}_{i,t-2} + \delta_i' + \varepsilon_{i,t}',\ i = 1, 2, \ldots, 8,\ t = 2009, 2010, 2011; \qquad (4)$$

where $\varepsilon_{i,t}'$ is a residual variable and δ_i' represents cross-section specific fixed effects.

3. Results

3.1. Statistical Parameters and Tests

The required econometric values have been performed by means of the EViews 9.0 programme package. Estimating the coefficients in the former equation has been based on the data in Table 1 and Table 2 (progress of national road density and nominal GDP during 2007-2011 for eight Romanian regions). For the latter equation, estimating the parameters has been done according to the data in Table 3, Table 4 and Table 5 (changes in the number of tourists, in the GDP per capita and in the number of employees per 1,000 inhabitants during 2007-2011, in eight Romanian regions).

First, one performs the Hausman Test to determine whether to choose random effects or fixed effects for the models. The random effects need to be uncorrelated with the explanatory variables. At the same time, the Hausman Test compares the fixed and random effects estimates of coefficients.

The null hypothesis of the Hausman Test is that the random effects estimates of coefficients are consistent, namely the random effects are uncorrelated with the explanatory variables. One rejects null hypothesis if the difference between the two estimators is large.

Table 1. Dynamics of National Road Density during 2007-2011 in Romanian Regions

Region	National road density (km./100 sq. km.)				
	2007	2008	2009	2010	2011
North-West region	5.922051	6.434340	6.560216	6.630473	6.738785
Central region	6.568969	6.633486	6.639351	6.624688	6.727328
North-East region	7.256479	7.248337	7.278188	7.283616	7.294471
South-East region	5.950500	6.610424	6.176999	6.182592	6.193777
South-Muntenia region	8.100893	8.086381	8.092186	8.109601	8.100893
Bucureşti-Ilfov region	6.967301	16.967301	16.967301	16.967301	16.967301
South-West Oltenia region	7.055395	7.247099	7.250522	7.250522	7.452496
West region	5.906378	5.906378	5.906378	5.968813	5.975056

Source: The table data have been generated by the authors according to the information in the 2008-2012 Romanian Statistical Yearly Book

Table 2. Nominal GDP during 2007-2011 in Romanian Regions

Region	Nominal gross domestic product (million Lei)				
	2007	2008	2009	2010	2011
North-West region	50724	58639	57900	59293	61370
Central region	49417	57303	57101	59120	63669
North-East region	45990	55022	54408	55669	60298
South-East region	44273	53851	52706	56340	60841
South-Muntenia region	52014	64535	65142	66115	70923
Bucureşti-Ilfov region	95798	134163	124289	131579	137579
South-West Oltenia region	34420	40340	39954	41941	44841
West region	42996	50393	49200	52983	56507

Source: The table data have been generated by the authors according to the information in the 2008-2012 Romanian Statistical Yearly Book

Table 3. Dynamics of the Number of Tourists during 2007-2011 in Romanian Regions

Region	Number of tourists				
	2007	2008	2009	2010	2011
North-West region	889707	908076	732474	702838	799774
Central region	1329992	1291514	1072785	1126887	1435771
North-East region	717592	725646	656501	620961	696188
South-East region	1231058	1308569	1157087	1044043	1134824
South-Muntenia region	729221	750157	591251	572912	615931
Bucureşti-Ilfov region	996740	1038161	989805	1125213	1282616
South-West Oltenia region	403071	429370	366114	337102	426845
West region	674544	673814	575118	542801	639657

Source: The table data have been generated by the authors according to the information in the 2008-2012 Romanian Statistical Yearly Book

Table 4. GDP per capita during 2007-2011 in Romanian Regions

Region	Gross domestic product per capita (Lei/inhabitant)				
	2007	2008	2009	2010	2011
N-W region	18611	21542	21297	21827	22583
Central region	19580	22708	22619	23428	25239
N-E region	12341	14795	14649	15015	16282
S-E region	15642	19099	18738	20077	21709
South-Muntenia region	15758	19648	19914	20288	21798
Bucureşti-Ilfov region	43037	59680	55079	58137	60677
S-W Oltenia region	15097	17832	17753	18735	20083
West region	22342	26173	25602	27640	29526

Source: The table data have been generated by the authors according to the information in the 2008-2012 Romanian Statistical Yearly Book

Table 5. Number of Employees per 1,000 Inhabitants during 2007-2011 in Romanian Regions

Region	Gross domestic product per capita (Lei/inhabitant)				
	2007	2008	2009	2010	2011
N-W region	231,751	237.163	225.840	210.951	209.453
Central region	242,658	250.669	232.153	215.571	216.612
N-E region	155,351	159.138	149.720	134.499	132.905
S-E region	202,975	209.076	197.740	178.995	174.473
South-Muntenia region	180,656	182.494	175.365	158.841	157.997
Bucureşti-Ilfov region	423,708	457.531	440.546	405.920	402.014
S-W Oltenia region	184,177	186.674	177.668	161.978	162.013
West region	270,960	277.023	254.838	236.926	242.755

Source: The table data have been generated by the authors according to the information in the 2008-2012 Romanian Statistical Yearly Book

The relevant portion of the test output is:

a) for the former equation

Correlated Random Effects - Hausman Test			
Pool: POOL02			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	62.444692	1	0.0000

Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Prob.
PIB_PR_C?	0.000006	0.000011	0.000000	0.0000

b) for the latter equation

Correlated Random Effects - Hausman Test			
Pool: POOL02			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	7.975731	2	0.0185

Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Prob.
PIB_PER_CAP?(-2)	20.750058	16.777168	2.034478	0.0053
R_SAL?(-2)	-7569.65223	-2230.77863	3889023.823	0.0068

According to the above-shown information, the fixed effects are selected for both equations. For the estimation of panel data models, the Pooled Least Squares Method has been used for this type of data. Additionally, it is necessary one should choose a method for computing the variance-covariance matrix of estimators. The author has chosen the White cross-section standard errors, considering the cross-section heteroskedasticity. The above-mentioned software has provided the following information regarding the estimation of coefficients and the econometrics tests:

a) for the former equation

Dependent Variable: DENS_DR_NAT? Method: Pooled Least Squares Date: 04/24/14 Time: 13:33 Sample: 2007 2011 Included observations: 5 Cross-sections included: 8 Total pool (balanced) observations: 40 White cross-section standard errors & covariance (d.f. corrected)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.732894	0.039438	196.0748	0.0000
PIB_PR_C?	5.93E-06	4.04E-07	14.69244	0.0000
Fixed Effects (Cross)				
_01--C	-1.617261			
_02--C	-1.434109			
_03--C	-0.782597			
_04--C	-1.827952			
_05--C	-0.012982			
_06--C	8.494916			
07--C	-0.720703			
_08--C	-2.099312			
Effects Specification				
Cross-section fixed (dummy variables)				

R-squared	0.998569	Mean dependent var	8.105014
Adjusted R-squared	0.998200	S.D. dependent var	3.457374
S.E. of regression	0.146686	Akaike info criterion	-0.805935
Sum squared resid	0.667022	Schwarz criterion	-0.425937
Log likelihood	25.11870	Hannan-Quinn criter.	-0.668540
F-statistic	2704.377	Durbin-Watson stat	1.699482
Prob(F-statistic)	0.000000		

b) for the latter equation

Dependent Variable: NR_TUR?				
Method: Pooled Least Squares				
Date: 05/05/14 Time: 00:49				
Sample (adjusted): 2009 2011				
Included observations: 3 after adjustments				
Cross-sections included: 8				
Total pool (balanced) observations: 24				
White cross-section standard errors & covariance (d.f. corrected)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2117774.	526098.4	4.025434	0.0013
PIB_PER_CAP?(-2)	20.75006	2.330065	8.905356	0.0000
R_SAL?(-2)	-7569.652	2341.876	-3.232303	0.0060
Fixed Effects (Cross)				
_01--C	-44759.61			
_02--C	475644.1			
_03--C	-577606.1			
_04--C	162950.3			
_05--C	-548250.1			
_06--C	1258495.			
_07--C	-707605.6			
_08--C	-18868.30			
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.965875	Mean dependent var	801895.8	
Adjusted R-squared	0.943937	S.D. dependent var	305737.0	
S.E. of regression	72391.22	Akaike info criterion	25.51189	
Sum squared resid	7.34E+10	Schwarz criterion	26.00275	
Log likelihood	-296.1427	Hannan-Quinn criter.	25.64212	
F-statistic	44.02816	Durbin-Watson stat	1.828083	
Prob (F-statistic)	0.000000			

The coefficient estimates in the two equations (respectively $\hat{a}_{11}$, $\hat{a}_{12}$ and $\hat{a}_{21}$, $\hat{a}_{22}$, $\hat{a}_{23}$) are to be found in the Coefficient column of the above tables, whereas the region-specific fixed effects (respectively $\delta_1, \delta_2, \ldots, \delta_8$ and $\delta'_1, \delta'_2, \ldots, \delta'_8$) are to be supplied from the same column after the Fixed Effects (Cross) mention, so that functional relations (3) and (4) become:

$$\text{Dens\_dr\_nat}_{i,t} = 7.732894 + 5.93 \cdot 10^{-6}$$
$$\text{PIB\_pr\_c}_{i,t} + \delta_i + \varepsilon_{i,t}, i = 1,2,\ldots,8,$$
$$t = 2007,2008,\ldots,2011, \qquad (5)$$

where

$\delta_1 = -1.617261$, $\delta_2 = -1.434109$,
$\delta_3 = -0.782597$, $\delta_4 = -1.827952$,
$\delta_5 = -0.012982$, $\delta_6 = 8.494916$,
$\delta_7 = -0.720703$, $\delta_8 = -2.099312$,

respectively

$$\text{Nr\_tur}_{i,t} =$$
$$2117774 + 20.75006\ \text{PIB\_per\_cap}_{i,t-2}$$
$$- 7569.652\ \text{R\_sal}_{i,t-2} + \delta'_i + \varepsilon'_{i,t},$$
$$i = 1,2,\ldots,8, t = 2009,2010,2011, \qquad (6)$$

where

$\delta'_1 = -44759.61$, $\delta'_2 = 475644.1$,
$\delta'_3 = -577606.1$, $\delta'_4 = 162950.3$,
$\delta'_5 = -548250.1$, $\delta'_6 = 1258495$,
$\delta'_7 = -707605.6$, $\delta'_8 = -18868.30$

The last column (Prob.) of the tables includes the significance levels to which the equation coefficients are different from zero, respectively

$\alpha_{11} < 0.01\%$, $\alpha_{12} < 0.01\%$,
$\alpha_{21} = 0.13\%$, $\alpha_{22} < 0.01\%$, $\alpha_{23} = 0.60\%$

All these values are less than the 5% threshold, which is why one can accept that the model parameters are significantly different from zero.

The coefficient of determination (R-squared) that indicates how much of the variability of a variable can be explained by its relationship to the other variables has high values (0.998569 – for the former equation and 0.965875 – for the latter equation), which shows that the factors considered in the model are essential. Moreover, the adjusted value of this coefficient that has a similar interpretation as R-squared, but is much more accurate and helps protect us against overfitting by penalizing us for including too many useless variables, is high (0.998200 - for the former equation and 0.943937 - for the latter equation).

The F-statistic reported in the tables above is necessary to test the null hypothesis that all of the coefficients in a regression are equal to zero. Since the significance level of the F - statistic (Prob(F-statistic)) is less than 0.05, one rejects the null hypothesis, hence at least one of the regression parameters is non-zero.

The results provided by these econometric tests validate the model and lead to its acceptance and possible use in an economic forecast.

3.2. Economic Analysis of the Model

The model, by the two univocal dependencies among economic-social variables related to development level, economic efficiency, transport efficiency and tourism performance, highlights a few essential issues concerning regional development.

The former equation shows the linear functional relationship between national road density and nominal gross domestic product, which is a direct relationship. Therefore, an increase in the nominal GDP results in an increase in national road density. Still, the high value of the coefficient of determination (0.998569) means that 99.86% of the national road density variation is due to a variation of the nominal GDP, in the context of including specific fixed effects. That shows the factor considered within the equation is essential.

The estimation of the nominal gross domestic product coefficient in equation (5) shows that an increase in the nominal gross domestic product by 1 million Lei produces an increase in national road density by $5.93 \cdot 10^{-6}$ km./100 km.2.

The latter equation quantifies the linear dependence among the number of tourists, the GDP per capita and the number of employees per 1,000 inhabitants. For the equation, there is a direct relationship as compared to the former factor and an inverse relationship as to the latter factor. The direct relationship between the number of tourists and the GDP per capita is a normal issue since an increase in the GDP per capita leads to an increase in the number of tourists. At the same time, the inverse relationship with the latter factor is surprising as it shows that an increase in the number of employees per 1,000 inhabitants generates a decrease in the number of tourists. Several explanations of this can be given, generated by the current socio-economic context of our country. A possible explanation could be that an increase in the number of employees per 1,000 inhabitants, which would mean an increase in the number of employees, would cause a decrease in average personal income, although the economic crisis has not yet come to an end and it would lead to a decline in tourism performance, since it would reduce household budgets allocated for recreational trips. It is also essential that lately, the Romanians have been biased to visit destinations outside the country, with high quality services at reasonable prices. However, migration is continuing and migrants especially spend their vacations abroad, for the reasons shown above.

The value of the coefficient of determination shows that, within the context of including specific fixed effects, 96.59% of the variation in the number of tourists is due to the variation of the GDP per capita and to the number of employees per 1,000 inhabitants which means the two indicators are strong influence factors to an endogenous variable.

Equation (6) results in the fact that an increase in the GDP per capita by 1 Leu leads to an increasing number of tourists by 21 over the next two years. Still the same equation shows that an increase in the number of employees per 1,000 inhabitants by 1 has the effect of a reduction in the number of tourists by 7570 over the next two years.

4. Conclusions

The results show that the study demonstrates the need for the use of panel data models for well-founded scientific analyses in the field of regional development. Moreover, the study shows that nominal gross domestic product is an important direct influence factor upon road infrastructure. Furthermore, GDP per capita and the number of employees per 1,000 inhabitants are significant factors that influence tourist performance, the former directly and the latter reversely. Hence, there is the need to implement certain steps to encourage the Romanian tourism. It is also required that an accurate assessment of tourism infrastructure should be done and its improvement should take place.

The model shown is a regional development model that can also be used to forecast the economic and social processes at the level of administrative units.

In order to get a more consistent analysis at regional level, it would be firstly necessary to have a larger number of significant indicators. Among the processes at regional level, there is a lot of inter-dependencies and inter-conditioning, variable in time and space. Highlighting these inter-dependencies and inter-conditioning could be achieved through a more complex model that, in addition to the already highlighted equations, might also include simultaneous equations and a whole series of defining equations, balance sheet equations and equilibrium equations. Meanwhile, for better relevance of information that can be obtained, it would be necessary to have a more extensive statistical data base including the values of indicators over a longer period of time, possibly 15 to 20 years.

The data from this analysis could be of great use to central and local authorities in order to improve integrated territorial development strategies for various territories and to correlate national development strategies with the regional ones so that to concentrate and specialize urban and rural areas.

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