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R&D and Regional Regeneration. The Case of Alba Subregion in Romania

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R&D and Regional Regeneration. The Case of Alba Subregion in Romania

Zizi Goschin¹, Georgiana-Gloria Goschin²

Abstract. Research, development and innovation could be among the factors that are accountable for the increasing regional disparities in Romania, as the territorial distribution of research and development (R&D) resources is very unbalanced. In order to address this problem, Romania is currently trying to define a regional strategy for R&D, as well as appropriate policies and priorities for innovation at regional level. In this context we address the issue of the regional intensity of R&D as one of the main determinants of economic growth in Alba County (subregion NUTS 3) in Romania. The Alba subregion can be considered an obvious example of a successful economic transformation since its GDP per capita increased more than 2 times in 10 years, based on a high rate of economic growth. We have analysed the regional intensity of R&D, measured as the share of total research and development expenditures in regional GDP, and have developed an economic growth model that aimed to capture the influence of R&D intensity alongside other potential influence factors. The results point to a highly significant impact of research and development intensity on the long-run economic development of Alba County, as measured by GDP per capita. This positive effect of R&D on the economic performance in Alba County can be largely attributed to the creation and modernization of the business support infrastructure aimed at developing industrial parks, business incubators, industrial and scientific clusters, technological and logistic platforms, centers for research and transfer of technology, etc.

Keywords: R&D, economic growth, regional regeneration, Romania.

JEL Classification: R11, R58.

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1. Introduction

Innovation and competitiveness are essential factors for promoting economic growth not only nationally, but regionally as well and R&D is increasingly indicated in the literature as a main driver of regional economic growth (e.g. Goldstein and Renault, 2004; Rodriguez-Pose and Crescenzi, 2005; Capello et al, 2011) based on various measures of R&D potential, activity and results. Many such analyses are using the regional intensity of research and development, computed as the share of total R&D expenditure in regional GDP, and they usually point to significant inequalities among regions and countries (Koschatzky and Sternberg, 2000; Martin, 2002).

Significant regional disparities in terms of R&D intensity exist in Romania as well: the ratio of R&D expenditures to GDP ranges from 0.76% in Bucharest-Ilfov region, which concentrates the largest part of Romania's R&D resources, to 0.01% in South-Muntenia region. Although the unbalance is severe, Romania is still lacking a strong R&D policy to address such disparities (Ranga, 2010; Sandu, 2010; World Bank, 2011). The national innovation strategy states the need to boost development and competitiveness at regional and local level as well, but advancement in this direction is still limited. Romania is currently trying to define a regional strategy for R&D, as well as appropriate policies and priorities for innovation at regional level. The lack of coordination between national and regional policy is one of the main factors limiting the effectiveness of local innovation policy in Romania (Ranga, 2010). Nevertheless, studies targeting the relationship between research, development and innovation and economic growth in Romania revealed positive effects of R&D activity, both at national and regional level (Sandu and Modoran, 2008; Zaman and Goschin, 2010; Goschin, 2014).

In this context we address the issue of the regional intensity of R&D as one of the main determinants of economic growth in Alba County (subregion NUTS 3) in Romania. The Alba subregion can be considered an obvious example of a successful economic transformation since its GDP per capita increased more than 2 times in 10 years, based on a process of rapid economic growth. We aim to explore the main trajectories of economic development and structural change

in Alba County and to identify the factors of influence, focusing on the role of R&D and innovation.

2. Trajectories of economic development and structural change in Alba County

Alba is a Romanian county (NUTS 3 territorial unit) located in Transylvania, having Alba-Iulia as its capital city. Its mountains, accounting for about 59% of county's total area of 6,242 square km, are rich in mineral resources such as metals (gold, silver, copper), salt and construction materials (marble, granite, etc).

Alba County has a population of 327,224 persons (1.74 % of Romania's total population) and a population density of 52 persons per square km, well below the national average of 79.9 in 2010. Urban population accounted for 58.8% in 2010, overtaking the national average. In the past 20 years, the county's population decreased by 12.3%, one of the most severe rates of decline in the country, and the age group structure reveals a pronounced aging process.

Between 1990 and 2000 the county went through a troubled period of economic decline marked by a slow transfer of ownership and difficult restructuring of inefficient economic activities, the loss of traditional markets in Eastern Europe, the deteriorating of macroeconomic equilibrium and galloping inflation.

Post socialistic transformation processes can be considered completed in the Alba County around 2000, when the transition to market economy broadly ended. From 2001 the economic climate has improved, the economy resumed its growth and the period 2006 to 2008 consolidated the economic growth. The economic and financial crisis that began in the second half of 2008 had a negative impact on Alba's GDP and employment, but economic growth resumed in 2010.

The GDP/capita in Alba County reached in 2011 6388 euro, slightly above the national average, but only 46.2% of the European Union average (Table 2). Nevertheless, it is noteworthy that this ratio increased more than 2 times in 10 years due to the high rate of economic growth recorded in Alba.

Table 1. GDP/capita* in Alba County against Romania and EU averages

	1998	2000	2005	2008	2009	2010	2011
% national average	80.2	93.2	91.9	98.1	96.2	102.03	104.72
% EU average	21.7	26.0	31.5	46.1	45.2	46.0	46.2

* at PPP

Source: own calculations based on National Institute of Statistics (NIS) and Eurostat data

Since 2009 the economic performance of the county, as measured by GDP, worsened in the context of economic crisis (Figure 1), but the county is still in a better position than the Center Region to which it belongs, and its performance is close to the national average.

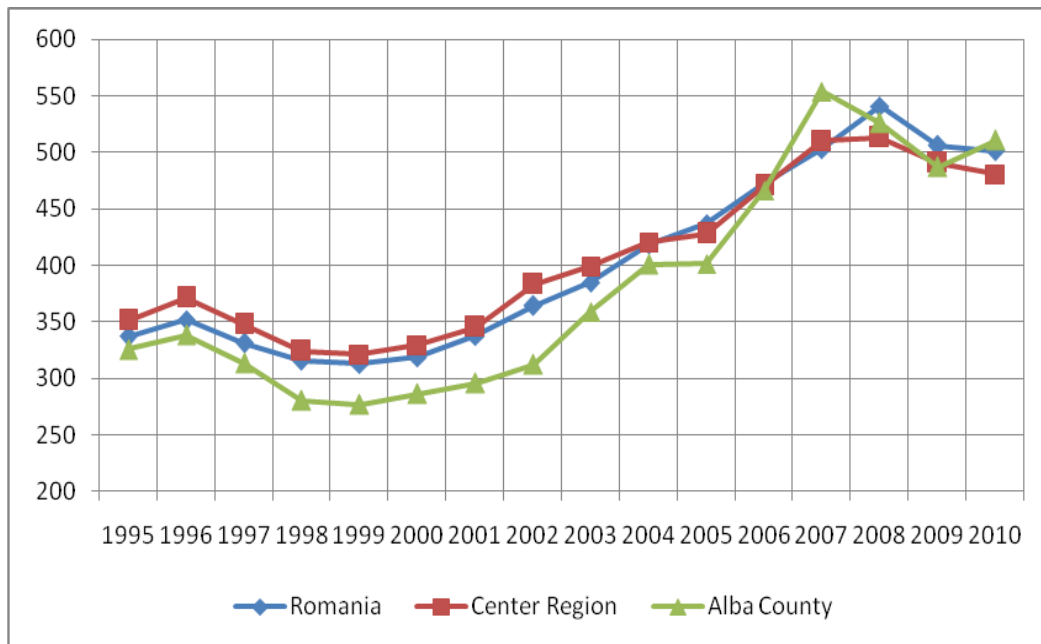


Fig. 1. GDP/capita evolution over 1995-2010

Source: own elaboration based on NIS data.

Labour productivity in Alba County remained slightly below national average on the long run and reached close to it in 2007 and 2010, following a long period of growth that mirrored the national productivity dynamics (Figure 2).

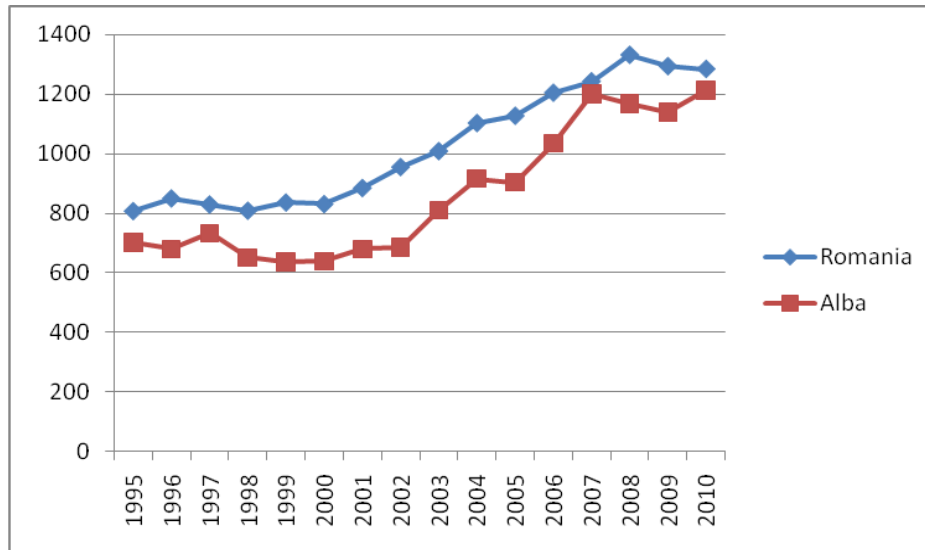


Fig. 2. Labour productivity in Alba County against national average (fixed 1995 lei)

Source: own elaboration based on NIS data.

The highest levels of labour productivity in Alba County in 2008 were in trade and in the production and distribution of electricity, thermal energy, gas and water, while low levels of productivity were recorded in education, hotels and restaurants, and health.

The structure of Gross Value Added in Alba County shows the predominance of the services and industry (46.8% and 36.5% of the total, respectively in 2008). The share of agriculture declined from 23.1% to only 9.2% of GDP over 1998-2008, while the construction sector rose from 5.2% to 7.5%. Industry had a steep increase in the 1990s and reached a peak in 2000, followed by a slow decline. It still has a dominant position in Alba's economy. The main industries in the county are: food, textile, wood, mechanical components, paper and packaging materials and chemical industry.

From the point of view of employment, the main sectors in Alba's economy are agriculture and manufacturing, although they have been steadily declining on the long run. The mining and quarrying industry is downsizing as well (Figure 3).

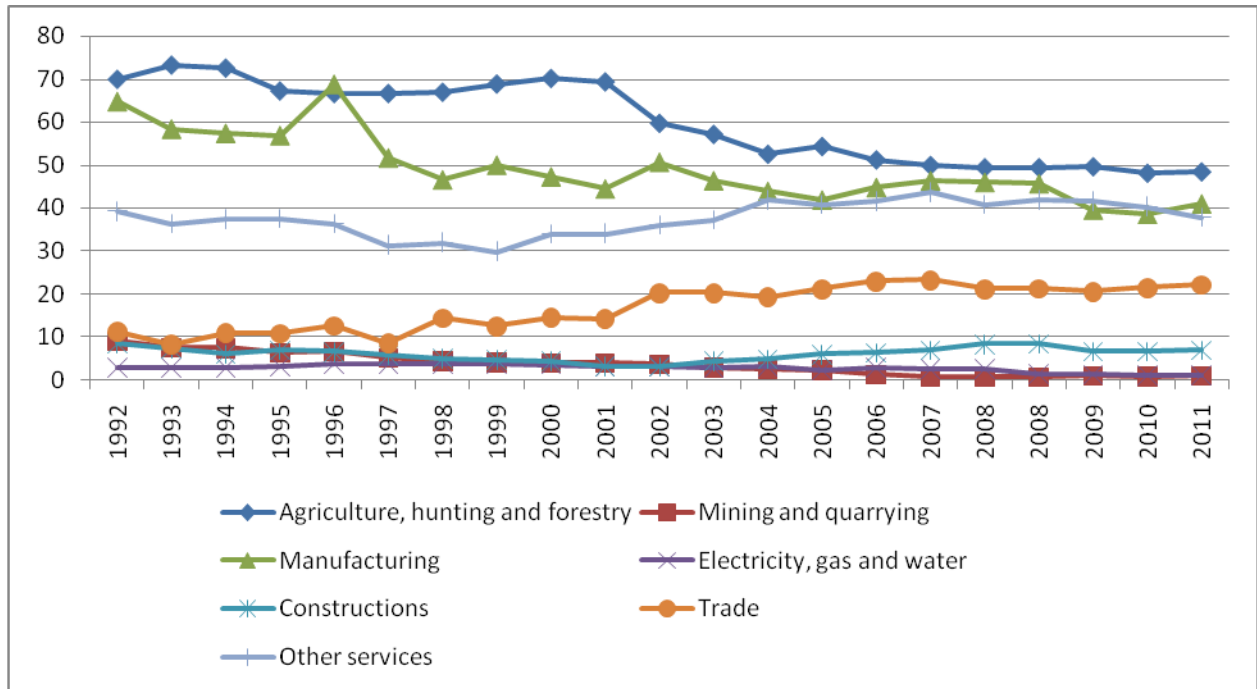


Fig. 3. Employment by sector (thou persons)

Source: own elaboration based on NIS data.

On the opposite, trade and other services have been on the rise. Employment in services outpaced manufacturing during 2009-2010. Although agriculture still owns the top position in Alba's employment, it creates less than 10% of the Gross Value Added because of very low labour productivity. Variations in construction employment followed closely the macroeconomic trends, growing strongly during the economic boom (2000-2008) and falling amid economic crisis and recession. Compared to the structure of employment in the national economy, Alba County is more industrialised, and has lower employment in services.

3. Factors that played key role in economic development of the region

The rapid development of the Alba County was positively influenced by the large natural resources and the existence of cheap labour. Other positive factors were foreign investments, increased exports, the programmes financed from European funds, as well as partial

improvement of transport infrastructure. Research and development was another important factor, promoting innovation and economic growth in Alba County.

There have been also some obstacles that hindered the development process in the region. The business infrastructure of Alba County is underdeveloped and poorly exploited. Connection with the European market is still relatively low, and there is little participation of local companies in international economic cooperation networks. Another problem is the demographic decline, the accelerated aging process deepened by the extensive external migration. There are relatively low rates of activity, unemployment rate is higher than national average, and intra-regional disparities in terms of employment have increased in the last years. Most rural settlements depend on low-tech agriculture, with modest productivity, and the farms are small and economically unsustainable. City infrastructure, education and health are poor in small towns and rural areas of the region.

The impact of EU membership on regional development. Beneficial effects of European Union membership include enlarged and diversified financial resources, accelerated reforms, and larger openness of the economy. Improvement of the transport infrastructure in the rural areas of Alba County is visible after accession, as well as a slight increase in foreign investment and reduction of agricultural holdings' debt. EU membership is perceived as a catalyst for modernization and a change in mentality also occurred. Among the adverse effects is the abolition of custom duties that reduced the protection for domestic producers. Accession to EU also brought risks such as increased vulnerability to external shocks such as the recent economic crisis. Structural and cohesion funds have had a low absorption rate, and foreign direct investments did not promote innovation and growth throughout the country, as they are highly concentrated in Bucharest-Ilfov region. Moreover, FDI's did not bring the sought after technological advancement as they targeted mainly low-tech activities, such as trade.

The impact of financial crisis on regional development. The economic and financial crisis had uneven effects on regions, depending on their specific economic structure. The economy of Alba County was most severely hit by the crisis in construction sector, and in mining and quarrying as well. Turnover declined in many sectors. The gross investments have been also on steep decline in all sectors, except for electricity, gas and water. Many public and private investments (excluding those who have received EU funding) have been suspended. High

cuts in the number of employees occurred in most sectors, but mining and quarrying significantly increased employment, despite lower turnover. Effects of the crisis were felt most intensely during 2009 – 2010, when massive restructuring took place in industry and commerce, the construction sector collapsed and the lack of liquidity in the banking sector was severe. The activity of micro-, small and medium-sized business in trade and other services has dropped significantly due to lower purchasing power of the population and the banks' restrictions on loans for private firms' investment.

Regional labour market. Active population represents 49% of the total population of Alba and is declining on the long-run both because of the increasing number of retirees and the tendency of young people to prolong their studies, thus delaying the entry into the labour market. Similarly, the number of employed and employees reduced. These evolutions resulted in significant decreases in the activity rate and in the employment rate of the working age population. The number of unemployed and the unemployment rate developed largely in accordance to economic cycles, with decreases in times of economic growth (1995-1996, 2000-2007) and increases during recessions (1997-1999, 2008-2009). As a consequence of reducing the number of the employed and the growth in the number of inactive people, the economic dependency ratio of the population has gradually increased during 1995-2010, reaching 1370 %. Unemployment rate reached a peak of 12.9% in 2000 in the context of economic downturn that accompanied the transition to the market economy. Sustained economic growth in the 2000s, combined with massive external migration of the workforce reduced the unemployment rate to a minimum of 5.7% in 2007, followed by increase due to economic crisis. The activity rate reached a maximum of 90.8% in 1993 and steadily declined afterwards, but remained constantly well above the national average.

Exports of goods played an important role in the economic development of Alba County. Exports of Alba County increased nearly 2.3 times between 2001 and 2007, falling slightly in 2009 to EUR 486 million, but data for 2010 indicate record high exports. Share in national exports remained constant at 1.7-1.8%, which indicates that Alba has followed the trend of national exports. Export/capita of Alba County increased over 3 times between 2001 and 2010, partly due to population decrease. The main goods exported in recent years were products of wood (43% of total), footwear, furniture, textiles, machinery and equipment, chemicals.

Agricultural products and raw materials exports have negligible weights in the county's exports (below 2%).

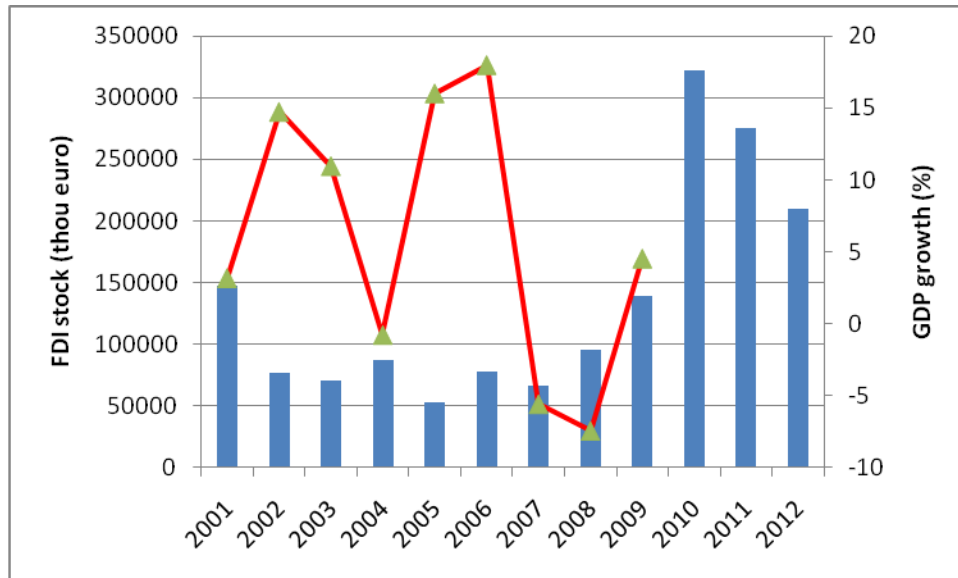


Fig.4. FDI stock against economic growth in Alba county

Source: own elaboration based on NIS data and Chamber of Commerce data.

The value of **foreign direct investment** in Center Region (that includes Alba county) reached up to € 605 million in 2008 alone, FDI stock summing at the end of the same year EUR 4.146 billion (8.5% of total FDI in Romania). Central Region ranks 2nd position after the Bucharest-Ilfov region in terms of total foreign investment. The most important investments were directed towards industrial activities such as wood processing industry, food industry, building materials, machinery. In Alba county the level of FDI stock reached a peak of EUR 320 million in 2010 (Figure 4) despite the financial crisis. Nevertheless, the trend of economic growth in Alba County was weakly related to FDI stock over 2001-2009 (Figure 4), as foreign investments account for a relatively small part of total investments.

SMEs in the regional economy. At the end of 2008, there were 8270 active companies in Alba County, 88% of them being micro enterprises, 9.6% small, 1.9% in the medium-sized, while only 33 firms (0.4 % of the total) were large enterprises. Companies whose main activity is trade are prevailing (nearly 35% of the total), followed by manufacturing (17.5%) and those in the real estate and business services (13.7%). 26 of the 33 large firms with over 250 employees

activate in manufacturing. At the end of 2010, the active companies in Alba County were downsized to 7398, as follows: 88.2% micro enterprises, 9.8% small, 1.6% medium-sized and only 28 firms (0.4 % of the total) large. Except for the production and distribution of electricity, water and gas, the proportion of small and micro enterprises is above 90% of the companies for every industry. Therefore the SMEs sector is absorbing the most important segment of the workforce and is actually a driver for the local economy. Consequently, incentives for SMEs investors in specific locations should be a strategic priority for policy makers in Alba County.

A good business environment and the creation of real opportunities for SMEs will increase the overall economy of the county and strengthen the competitiveness on the European market. In order to achieve this objective, support is aimed for establishing economic zones around the localities, creating and developing business incubators, industrial parks, research and technology transfer centers, improving access to information infrastructure and business networks, supporting the development of commercial and financial centers and enhancing logistic capabilities.

A goal of economic and social development strategy of Alba County over 2012-2016 is to create at least five economic development poles in the county, each one having a business center with the appropriate infrastructure (USL, 2012). Each economic pole will integrate a socio-economic development zone which comprises infrastructure, education - including specialized vocational education- and a health infrastructure.

The number of private entrepreneurs had a positive evolution in Alba County during the transition to the market economy, and then remained stable until 2006. While the family enterprises diminished in the context of economic crisis, the number of independent workers increased as the job shortage forced more unemployed to start their own business.

R&D and innovation. Development of the research - development - innovation sector is one of the endogenous factors that increased the competitiveness in Alba County. Improved access to information and the dynamics of urbanization in recent years triggered an increase in the development of most cities in the county. Creation and modernization of business support infrastructure aimed at developing industrial parks, business incubators, industrial and scientific clusters, technological and logistic platforms, centers for research and transfer of technology, etc. These structures are designed to support business development in areas affected by industrial

restructuring, but also economic activities in other areas with development potential in the county, providing favorable conditions for productive SME development, which will contribute to economic development and job creation in both underdeveloped and rising areas. The need to strengthen the link between research and business environment draws the future development of the knowledge economy, speeding up technological transfer into productive activities.

There is also the need to improve linkages between innovative activity and higher education. The two main higher education institutions in Alba County include a number of 9 faculties, the main areas of training being: trade, tourism and business, business administration, finance, banking, accounting, marketing, informatics, land measurements and surveying, applied electronics, environmental engineering, law. In Alba County there are specialized companies that provide professional training and also an educational network which runs programs aimed at providing adult education opportunities among those seeking professional reconversion or acquiring new skills.

The university "1 December 1918" in Alba Iulia is conducting through its research centers many studies for the benefit of business environment, especially SMEs: consultancy for decision making, applied research, survey design and analyses in areas such as: land measurements, geodesy, geology, sociology, economics, spatial development, environmental engineering, etc. There are also several research institutes in Alba County, such as the Research and Development Station for Viticulture and Vinification Blaj, the Center for Refractory Research, Design and Production (CCPPR) in Alba Iulia and the Institute of Systemic Archaeology Alba Iulia.

The Alba County Council and the University "1 December 1918" in Alba Iulia have participated in 2013 as founding members in the formation of the Association of the National Innovative Cluster "Competitiveness Pole of Metal Processing Transylvania" based in the industrial park Cugir. Its overall objective is to increase competitiveness of Romanian enterprises that are processing metals by promoting applied research, innovation and technology transfer in order to create new jobs in the area. There are also emerging clusters in the wood processing industry, biomass, electrical engineering, and food industry.

4. Model, variables and data

R&D based models of growth aim to explore the link between the propensity to invest in research and the economic performance. Such models are also relevant for the regional growth, since bigger regions having wide markets and large resources are more motivated to perform research activities, which in turn foster their economic growth (Romer, 1994). Higher incomes available in wealthy regions provide customers an incentive to seek top quality and differentiated products that are the result of intensive R&D activities (Markusen, 1986). Empirical evidence suggest a correlation between R&D activity and economic growth in Romania as well (Sandu and Modoran, 2008; Zaman and Goschin, 2010; Goschin, 2014).

Starting from the main factors of economic development analysed in the previous section, we have developed an economic growth model that aims to capture the influence of R&D intensity as a major driver of creativity, innovation, and finally economic development in Alba County.

The dependent variable in this model is logarithm of Gross Domestic Product per capita, the indicator of choice for measuring the development level of a country or region. The variable of interest is R&D intensity and the control variables are other main factors of production used in the literature.

Labour is represented by two variables: employment rate – a basic measure of the inclusion of labour force in economic activities and labour productivity – the traditional indicator of the performance of the workforce. The number of domestic and international emigrants (excluding temporary migration for work) relative to total regional population is measuring the definitive loss of work through migration.

The share of manufacturing in regional economy, measured as the percentage of the persons employed in manufacturing in total employment, is used as a proxy for the technology, since the technological level of production is expected to be higher in this economic sector. The extent of private entrepreneurship in industry, measured as the share of industry in total number of private entrepreneurs might also capture the potential positive effect of entrepreneurial spirit on economy.

The life expectancy is used as a proxy for human capital, as recommended in the literature (e.g. Mathur, 2007).

Since the impact of crises is clearly visible in the economic trajectory of Alba economy (Figure 1) we introduced in the model a dummy variable for economic crisis, taking the value 1 for 1996, 1997, 2008 and 2009 and 0 otherwise. Table 2 offers the complete list and description of the variables in the model.

Table 2. The variables

Variable	Description
GDP per capita	Gross Domestic Product divided by total population (constant 1995 RON per inhabitant)
R&D_rate	R&D intensity, measured as the share of total research and development expenditures in regional GDP (%)
CRISIS	Dummy variable for crisis (1 for 1996, 1997, 2008, 2009 and 0 otherwise)
EMIGR	Emigration rate, measured as the ratio of the number of domestic and international migrants (excluding temporary migration for work) to regional population.
EMPL_rate	Employment rate – employment relative to total workforce (%)
LIFE_EXP	Life expectancy at birth (years)
MANUF	The share of the persons employed in manufacturing in total regional employment (%)
INDUSTRY	The share of industry in total number of private entrepreneurs
PRODUCTIVITY	Labour productivity, calculated by dividing regional GDP by employment (constant 1995 RON per person)

The dataset used to estimate this regression model cover the period 1995 to 2012. The time span is limited by the available statistics. The time interval under consideration includes both a period of constant and relatively rapid economic growth and the economic decline in the context of global crisis. The main data source for the variables in the model was the National Institute of statistics of Romania, supplemented by Eurostat online database.

The correlation matrix for the variables in the model shows that the development level proxied by GDP/capita correlates robustly with the regional research intensity, as well as with the employment rate, labour productivity, life expectancy and the others variables.

5. Results and discussion

The economic growth model for Alba County was estimated in EViews 7 and yield the results displayed in Table 3.

Table 3. The results

Variable	Coefficient	t-Statistic	Prob.
R&D_rate (-3)	0.377739	12.07435	0.0000
CRISIS	0.012315	2.435567	0.0508
EMIGR	-0.005295	-4.479370	0.0042
EMPL_rate	0.008784	8.076189	0.0002
LIFE_EXP	0.000365	0.103961	0.9206
MANUF	0.341885	2.359740	0.0563
INDUSTRY	0.303783	4.993763	0.0025
PRODUCTIVITY	0.001254	57.26131	0.0000
C	4.273346	14.86891	0.0000
Adjusted R-squared	0.979470		
F-statistic	3300.835		
Durbin-Watson stat	2.306390		

These results confirm at high significance level that GDP per capita growth in Alba County was indeed supported by increased regional R&D intensity. In a broader sense, R&D intensity was a major factor of influence for the improved economic performance of the county. This influence is better captured at three-year lag. This positive effect of R&D on the economic growth in Alba county can be largely attributed to the creation and modernization of the business support infrastructure aimed at developing industrial parks, business incubators, industrial and scientific clusters, technological and logistic platforms, centers for research and transfer of

technology, etc. These structures were designed to support business development in areas affected by industrial restructuring, but also economic activities in other areas with development potential in the county, providing favorable conditions for productive SMEs development, which can further contribute to economic growth and job creation in both the underdeveloped and the rising areas of Alba County.

Another positive factor of influence on economic growth has been labour productivity, while the large ratio of domestic and external emigration in total population exerted a significant negative influence, as expected.

The two variables that convey the specialisation of Alba County -share of the persons employed in manufacturing in total regional employment and share of industry in total number of private entrepreneurs both have statistical significance and the estimated coefficients have the expected positive sign. This result suggests that industry in general, and manufacturing in special, have positively impacted economic performance in Alba County, possibly owing to their higher technological level. The life expectancy was not an appropriate proxy for human capital, since its effect seems statistically non-significant.

The coefficient of determination (R-squared adjusted) shows a very good fit for the model, with almost 98% of GDP per capita explained by the variables in the model.

6. Conclusions

Following a long period of economic decline and difficult restructuring during the transition to market economy, Alba County's economy entered a trajectory of rapid economic growth, only slightly decelerated by the recent crisis. This paper explored the main factors that underpinned the successful transformation of Alba economy focusing on endogenous factors, especially the contribution of research, development and innovation to the economic growth, as captured by GDP per capita.

The results point to a highly significant impact of research and development intensity on the long-run economic development of Alba County. This positive effect of R&D expenditure can be largely attributed to the creation and modernization of the business support infrastructure aimed at developing industrial parks, business incubators, industrial and scientific clusters,

technological and logistic platforms, centers for research and transfer of technology, etc. This larger and improved research, development and innovation infrastructure entailed increased competitiveness and efficiency in Alba's economy. Enhancement of the research - development - innovation sector is a key factor that may continue to improve the competitiveness in Alba County in the future. To this aim, strengthening the link between research institutes, universities and business environment draws the future development of the knowledge economy, could speed up technological transfer into productive activities.

The main policy message emerging from this research is the need for specific regional R&D strategies that explicitly address the existing high territorial inequalities in research activities and support the Romanian regions in developing their R&D potential. Future regional development strategies should include concrete measures able to support and foster innovative activities, based on increased R&D investments, both public and private.

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