ECONOMIC GROWTH AT REGIONAL LEVEL AND INNOVATION: IS THERE ANY LINK?

GEORGETA GRIGORE NAE, CRISTIANA SIMA *

ABSTRACT*: The role of innovation on growth has been analysed to some extent and has been relying mostly on research findings undertaken in developed countries. The aim of this paper is to analyse whether innovation has any role at regional level for potentially explaining the variations in growth among regions, particularly in developing countries. The paper draws upon previous work and to undertake the research, data available from the Enterprise Survey was used to test the potential impact of innovation on economic growth at regional level. The results showed that innovation affects growth using a sample for Romania. This study can constitute the basis for understanding the concept of innovation in relation to regional economic growth and further research in Romania and beyond.*

KEYWORDS: *economic development; regional growth; innovation; regional innovation system.*

JEL CLASSIFICATION: *O47, R58.*

1. INTRODUCTION

Differences across regions within countries are often greater than differences between countries, and little attention was paid to regional development compared to national growth priorities. Regions should promote their own growth by mobilizing local assets and resources so as to capitalize on their specific competitive advantages, rather than depending on national transfers and subsidies to help them grow. Traditional policies based only on infrastructure or schooling/education are not sufficient for this task and a more comprehensive policy is needed, one integrating these two policies in a coordinated agenda across levels of government and which foster business development and innovation. The role of innovation at regional level for potentially explaining the variations in growth among regions in Romania needs

* *Assist. Prof. University of Pitesti, Pitesti, Romania, georgeta_grig@yahoo.com*
Lecturer, "Constantin Brâncoveanu" University, Pitesti, Romania

further research. In this paper we would like to check whether innovation positively affects growth just as endogenous theory suggests.

2. LITERATURE REVIEW

According to the neoclassical theory, the growth has been seen as being determined by the accumulation of physical and human capital, while according to the endogenous growth, this has been seen as a process linked to the features of the place, as it is the case for innovation, knowledge and human capital. The neoclassical theories rely on capital accumulation, as in the case of Solow (1956) and Swan (1956) and technology has been seen as exogenous (Barro, 1997) and therefore not included in models. Technology has been brought into the models via the including R&D theories, as in the case of Romer (1990), Barro and Sala-i-Martin (1995). All these theories state that economic growth can be explained via the stock of physical capital, human capital and innovation. While much more attention has been given to their analysis at national level, the regional and local dimension does not have to be neglected. In the case of innovation, the interaction of economic agents and the exchange of ideas require social capital.

According to the neoclassical theories, growth in the long term is based on the continuous technological progress in the form of new goods, markets or processes (Aghion and Howitt, 1998) and it can be mathematically expressed as a function of capital accumulation under the assumption of perfect competition and diminishing returns (Solow, 1956; Swan, 1956). The R&D theories were introduced and imperfect competition was factored into the model (Romer, 1990).

An innovation system consists of elements and relationships which interact in the production phase, dissemination and use of new knowledge. This knowledge is exploited by the practice, including commercial use. Thus, the knowledge created, disseminated and used are not always in the form of commercial products or services, but may have practical and social effects. More specifically knowledge may take the form of ideas and concepts, new skills or competencies, and organizational or technological advances.

An innovation system is a dynamic social system and a central activity in the system, learning regional innovation system (RIS) is a normative and descriptive approach that aims to capture how the technological development takes place in a territory. The approach has been considered in several studies, emphasizing the importance of regions as economic and technological modes of organization and the effect on policies and measures to increase the innovative capacity of all types of regions.

It is generally accepted that the innovative performance of regions is improved when firms are encouraged to be innovative best by interacting with various support organizations and companies within their region. In this respect, the institutional characteristics of the region, transmission infrastructure and knowledge transfer system, as well as strategies and performance of individual firms can constitute the basic conditions and stimuli in promoting innovation activities.

However, the variety of regional innovation systems of definitions creates confusion and problems of empirical validation studies making it difficult for researchers and policy makers from what should be a regional system of innovation. Approach suffers from the absence of a conceptual base unit through a universal model, or even smaller, there may be to conduct research and policy.

Emphasizing a localized learning and the existence of interdependence is not sufficient simply to understand the scale of a regional innovation system can work study. Place more emphasis on the landscape of local institutions without a satisfactory outcome which institutions are or how they interact in different systems at different scales, or different levels of inter-relationship.

Current research on RIS has many shortcomings. The theoretical base is not well developed and many things which were written in this regard lack clarity, it is necessary to accurately assess and research firm conclusions on policy. It is not appropriate to define RIS as all those factors which influence the innovation process. Such definitions are not operational. For this reason, need more and better research on RIS in order to formulate guidelines for regional innovation policies, in particular small and medium-sized regions.

Buesa (2010) studied the main factors for regional innovation in Europe using a knowledge production function which combines regression with factorial analysis.

Drivera (2008) analyzed the role of micro and macroeconomic factors in the innovation process by using a database on innovation across British regions in over 1990-2006. In addition to confirming that the impact of the classic factors which explain the decline in innovation in the 1990's, the study evidenced that there is relation between innovation and the importance of human capital.

3. SOME METHODOLOGICAL ASPECTS

Following the literature review, we will briefly mention some key methodological elements that will be used in conducting the research. We intend to use the concepts presented in previous section and apply them to the regional growth and innovation. The study aims to analyze the key determinants of regional growth, the length of time needed for these factors to generate growth, and the most successful combination of factors leads to several suggestions for effective regional policies. Particular emphasis will be on innovation and research and development (R&D). We estimate that investments in R&D have a positive effect on patent activity in all categories, as do R&D expenditures by businesses, the public sector, higher-education institutions and the private non-profit sector.

In order to analyze regional innovation, we propose the use of a linear model inspired from the models used by the OECD for the regional growth analysis where we test the potential impact of several variables on regional economic growth in Romania - previous studies have shown a link between R & D and trademarks as well as a link between them and growth, since investment is higher in R & D, greater innovation capacity and growth - this would be tested using Eurostat, Enterprise Surveys and Romanian National Institute for Statistics for 2006-2009, as data is available for

Romania. Variables like education, infrastructure, employment, patenting investments in R&D, are considered.

For conducting the research, we selected the main determinants of regional growth in the relevant theories (neoclassical and endogenous growth, and more recently the new economic geography). Models not only include variables related to traditional theories of neo -classical growth, but also endogenous determinants. One of the most important neo -classical models is convergence. The implication is that the convergence of the poorer regions that are more steady state would tend to grow faster and therefore converge. One of the ways in which economic growth models attempt to test this hypothesis is by including in the equation the initial levels of income. A negative sign of the estimated coefficient, therefore, would indicate that lagging regions catch up with other regions and convergence occurs. Conversely, a positive signal would be higher rates of growth in rich regions and, therefore, the phenomenon of divergence would occur.

The main difficulties were related to the data collection needed to identify appropriate indicators for measuring certain complex phenomena as innovation is. In addition to the convergence hypothesis, neo -classical growth theory relies heavily on capital, the main determinant of economic growth. The lack of regional data prevents the use of a measure of physical capital such as private investment or gross fixed capital formation. However, road infrastructure indicator is used as a proxy for physical capital. Endogenous growth theory emphasizes the role of human capital and R & D as a source of unlimited growth. However, the lack of regional data limits the ability to capture the qualitative nature of the effects of human capital.

Technological change is represented in the model by using input and output indicators for innovation. For input indicators, a measure of research and development expenses is used while for output indicators, the patenting activity is captured. The proposed model includes variables for labor market measures of agglomeration economies and geographical measures (distance from markets and accessibility to markets) as proxies for transport costs.

4. RESULTS

The results showed that innovation affects growth as endogenous growth theory suggests. However, this positive relationship between innovation and economic growth is revealed using patents as measurement unit, and not total expenditure on R&D. Although initially this may seem puzzling, it refers to the innovation process itself. R&D spending is actually one of many inputs used in production process innovation. Patenting is only one possible outcome and patents often end up not being used by industry, they are often more a result of a larger process. R&D expenses should be related to patent, not directly from economic growth, so this indirect relationship with economic growth could explain these results. This indirect relationship is supported by the results of the model 11, when R&D expenditure by source of funding are considered (Table 1, 2).

The first five models aim to check the impact of infrastructure, education, employment on regional growth. Infrastructure by itself does not seem to have a

significant impact (very small only) but it becomes significant when it is put in conjunction with education.

Although infrastructure was included as a proxy for physical capital, based on this measure has two limitations. First, the highways are just part of the infrastructure (public capital) and other investments with direct impact on productive activities - either by allowing them or reducing costs - such as energy, telecommunications, railways and airports are not accounted for. Second, public investment, however, private capital stocks are not considered because data is not available for this sector regionally. Thus it is not surprising that results are not significant on their own.

Table 1. Results (Model 1-5)

	Model 1	Model 2	Model 3	Model 4	Model 5
Const	0.0257	0.0009	0.1342	0.1463	0.1485
	(2.5)**	(0.1)	(10.67)**	(8.9)**	(9.1)**
Y*initial*	-0.0004	0.001	-0.011	-0.0082	-0.0087
	(-0.4)	(0.8)	(-8.2)**	(-5.9) **	(-5.3) **
Infr	-	0.005	-	0.008	0.011
		(0.7)		(1.2)	(1.6)
EducPrim	-	-	-0.008	-0.021	-0.02
			(-8.9)**	(-10.7) **	(-10.9) **
EducTert			0.006	0.002	0.008
			(7.4)**	(9.04) **	(8.3) **
Empl					-0.03
					(-2.4)**
Patent					
R&DTotal					
R&Dpriv					
R&Dguv					
R&Dinsteduc					
AglAg					
AglMan					
AglInt					
Accessmarket					
Distmarket					
R	0.001	0.0087	0.284	0.306	0.354
R adjusted	-0.0019	0.0017	0.2812	0.284	0.342
F	0.7	1.43	38.73 **	29.44 **	26.39 **
N	382	346	305	293	293

The level of education has an influence on the economic growth (measured through tertiary education has a positive effect while measured through primary

education it is negatively influencing growth). This is what it was expected as the highly educated people are likely to generate innovative ideas.

Table 2. Preliminary results (Model 6-11)

	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Const	0.1967	0.197	0.29	0.282	0.116	-0.011
	(7.1)**	(4.8)**	(6.1)**	(9.7)**	(1.2)	(-0.2)
Y*initial*	-0.017	-0.023	-0.04	-0.042	-0.03	-0.003
	(-5.11) **	(-4.05) **	(-5.8) **	(-8.06) **	(-4.8) **	(-1.05)
Infr	0.012	0.018	0.0111	0.015	0.0162	0.027
	(1.98)*	(2.44)*	(1.3)	(2.3)	(1.5)	(3.3.)**
EducPrim	0.0027	-0.003	-0.006	-0.0063	-0.008	-
	(-3.8) **	(-4.1) **	(-4.9) **	(-5.2) **	(-5.95) **	
EducTert	-	-	0.007	0.008	0.0098	0.005
			(5.8) **	(-5.9) **	(7.5) **	(4.7) **
Empl						
Patent	0.0018					
	(2.6)**					
R&DTotal		0.001	-0.0005		-0.0003	
		(0.8)	(-0.4)		(-0.34)	
R&Dpriv						-0.003
						(-2.4) **
R&Dguv						-0.0036
						(-2.8) **
R&Dinsteduc						-0.005
						(-4.95) **
AglAg			-0.0018	-0.0006	-0.0023	
			(-2.07) *	(-1.05)	(-1.02)	
AglMan			-0.0033	-0.006	-0.0013	
			(-2.97) **	(-3.95) **	(-0.9)	
AglInt			-0.004	-0.0036	-0.0017	0.0016
			(-2.17) *	(-3.05) **	(-0.85)	(0.99)
Accessmarket			0.00016	0.0008		0.003
			(0.5)	(1.5)		(2.3)*
Distmarket					0.0425	
					(3.85) **	
R	0.148	0.1364	0.4552	0.4589	0.5298	0.4011
R adjusted	0.133	0.126	0.425	0.426	0.498	0.384
F	10.35 **	7.45 **	15.36 **	18.32 **	16.45 **	11.4 **
N	274	231	217	282	217	196

Regions with insufficient human capital will not increase while those with high levels of endogenous elements will reap the benefits of growth. It is also important to note that the employment rate did not significantly affect growth, although of course, affects the levels of income per capita. Results for employment may reflect convergence mechanics. Regions with lower employment rates do not fully exploit their labor resources and, therefore, are located far from the ideal situation of production possibilities curve.

Patents (model 6) seem to have a small but significant impact on growth when education and infrastructure indicators are included. Total expenditure with R&D does not seem to have a significant impact but when this is broken down by categories, this becomes significant and the coefficient is negative. Other variables such as those related to agglomeration, distance and accessibility to market are included.

5. CONCLUSION

The paper brought into discussion the role of innovation in the context of economic growth and regional development and it provided a short review of the literature in this sense. This is the basis for an extensive research on the role of innovation in regional growth. R & D is a determinant of growth indirectly through its impact on patenting activity. The preliminary results showed that economic growth depends on endogenous factors like infrastructure, education, innovation.

Investments in R & D have an effect on patent activity in all categories considered, costs to businesses, public sector, higher education institutions and private non-profit sector, and when the education and infrastructure related variables are included.

However, innovation is a longer-term process. When measured by number of patent applications, seems to have a positive influence on regional development only after some years. Nevertheless, more research needs to be undertaken by making the distinction between the product and process innovation and to allow for a longer timeframe being subject to analysis in order to make the results and conclusions stronger and more relevant.

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