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Article

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EE
E u r o E c o n o m i c a
Issue 2(35)/2016 *ISSN: 1582-8859*

Growth, Trade, Investments and Expenditures: Analysis of the Nexus

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Abstract: The purpose of this paper is to investigate the relationship between economic growth, trade, investments, and R&D expenditures. An important type of trade is introduced in analysis, namely intra-industry trade, in order to underline the influence on growth, associated in literature with good growth performance. Aspects related to trade and the relationships between Romania and 13 countries (Austria, Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Italy, Poland, Portugal, Slovakia, and Spain) are underlined. These countries were chosen considering the volume of intra-industry trade with Romania. Based on econometric calculations for the period 1995-2012, the determinants of the economic growth are highlighted.

Keywords: economic growth; intra-industry trade; foreign direct investments; research and development expenditures

JEL Classification: O47

1. Introduction

In the literature various aspects related to the development of the economies are analysed. Contributions of A. Smith, Th. Malthus and D. Ricardo described the evolution of the economy taking into account issues such as land, population (labour) and capital. In classical theory, A. Smith and other authors believed that a combination of private capital and property, free operation of the market (or the "invisible hand") and labour are sources of economic growth, while trade has, in the theory, an important role in promoting development (Engel, 2010).

At the beginning of the twentieth century, economies have faced various problems and distortions, due to the economic crisis during 1929-1933. In 1936, J.M. Keynes published his book entitled "The General Theory of Employment, Interest and Money". According to Keynes's ideas, the government may intervene in the economy in order to stimulate demand and achieve full employment (Engel, 2010).

In the early 40s, R.F. Harrod and E. Domar developed growth models, called the post-Keynesian models of economic growth. Addressing economic growth has become popular in the literature because it had the following condition: GDP growth will be proportional to the share of investment expenditures in GDP (Easterly, 1997).

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The Harrod-Domar model is used to explain the growth rate of an economy with reference to the level of savings and capital productivity. According to this model, there are three national income growth rates, i.e.: the guaranteed rate (determined by individual decisions), the natural rate (determined by fundamental conditions-population growth, technical progress, etc.) and de facto rate (the rate that actually exists). The Harrod-Domar model is the precursor of exogenous growth model (Solow-Swan model) - the growth occurring in an economy influenced by what happens outside it.

Neoclassical theory (Solow-Swan exogenous growth model) shows how saving, population and technology progress influence production and growth. It takes into account aspects such as capital accumulation, labour or population growth and productivity growth, called technological progress. According to this model, the role of technological changes (exogenous variable) is very important for growth. In this model, the process by which countries continue their growth is exogenous and it represents the creation of new technologies that allow production with fewer resources.

In the mid-80s, a new theory of growth has emerged. P. Romer and R. Lucas have emphasized that economic growth occurs due to benefits associated with new knowledge, underlining the importance of investments in knowledge creation. Technological progress is a product of economic activity and this is often called "endogenous growth theory" because it internalizes technology in the model. It is considered that technology and knowledge strongly influence economic growth (Cortright, 2001).

Economic growth refers to increase in the size of the economy outputs and it is measured by the growth rate of GDP. Another indicator used is the ratio between GDP and population number (GDP per capita). Economic growth may be generated by the efficient use of inputs (intensive growth) or by an increase of their quantity (extensive growth).

The purpose of this paper is to investigate the relationships between economic growth (EG), intra-industry-trade (IIT), foreign direct investments (FDI) and research & development expenditures (RDE). In this paper an important variable is used to explain the economic growth, represented by IIT (Grubel-Lloyd index, computed for the trade between Romania and 13 partners - Austria, Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Italy, Poland, Portugal, Slovakia and Spain). These countries were chosen taking into account the volume of IIT with Romania.

The paper is structured as follows: the second section presents a review of the literature with emphasis on the determinants of economic growth. In the third section the research methodology is outlined. In the fourth section the determinants of the economic growth are highlighted, the model and the results are presented. Last section concludes the paper.

2. Literature Review

In the literature various studies assess the determinants of the economic growth. Many research papers have identified determinants of economic growth, such as physical and human capital accumulation, technological progress, etc. Also, international trade plays an important role in these relationships (see Table 1). The role of international trade in the development of the countries is considered very important in the literature, and classical and neoclassical economic theory pays a great importance to trade, which is seen as an engine of growth (Omoju & Adesanya, 2012).

Analysing the relationships between candidate and EU15 countries, Zaman and Vasile (2003) underlined that IIT was more intense between EU and Czech Republic, Slovenia and Hungary, and the relations between EU, Latvia, Lithuania and Romania had the lowest values, the evolution showing unbalanced trade relations of Romania with EU.

Countries engaged in international trade relations because they are different in terms of resources, preferences, technology, production, capacity for growth and development. Thus, through trade, countries can consume products of other countries (Omoju & Adesanya, 2012).

Lederman and Maloney (2003) examined the relationships between trade structure (influence of natural resource abundance, export concentration and intra-industry trade) and economic growth, and they found that these variables are important determinants of growth. Aka (2006) examined the influences of trade openness and globalisation on economic growth, the results showing that globalisation has a negative effect on growth. Although a positive effect of trade openness on growth is observed on the short term, increasing trade openness and globalisation does not positively contribute to the long term growth. The results also show that GDP, openness and globalisation are moving in the same direction in the long term, but globalisation has negatively influenced economic growth in the short or long term.

Table 1. Variables with influence on economic growth*, used in the analysis of the relationship between growth and international trade

Author	Variable	Expected sign of the coefficient	Obtained sign of the coefficient
Lederman & Maloney (2003)	• natural resource abundance	(-)	(+)
	• export concentration	(-)	(-)
	• IIT	(+)	(+)
Aka (2006)	• natural logarithm of the share of international trade (imports and exports of goods and services) in GDP	(+)	(-)
	• trade openness - logarithm of the share of imports of goods and services in GDP	(+)	(+)
Leitão (2012)	• initial level of GDP per capita	(-)	(-)
	• marginal intra-industry trade	(+)	(+)
	• FDI	(+)	(+)
	• KOF index of globalization	(+)	(+)
Leitão (2012b)	• initial level of GDP per capita	(-)	(-)
	• intra-industry trade	(+)	(+)
	• FDI	(+)	(+)
	• KOF index of globalization	(+)	(+)
Busse & Königer (2012)	• logarithm of real GDP per capita with lag	(+)	(-)
	• logarithm of the share of investments in real GDP	(-)	(+)
	• population growth rate	(+)	(-)
	• education - years of schooling for the population aged 15 years and over		(+)
	• logarithm of exports of goods and services		(+)statistically

			insignificant
	• growth rate of exports of goods and services		(+)
	• share of exports of goods and services in GDP		(-)statistically insignificant
	• share of exports of goods and services in GDP with lag of 5 years		(+)
	• exports of goods and services/no. of population		(+)
	• logarithm of imports of goods and services		(+)statistically insignificant
	• growth rate of imports of goods and services		(+)
	• share of imports of goods and services in GDP		(+)statistically insignificant
	• share of imports of goods and services in GDP with lag of 5 years		(+)
	• imports of goods and services/no. of population		(+)statistically insignificant
	• trade - logarithm of the sum of imports and exports of goods and services		(+)statistically insignificant
	• growth rate of trade in goods and services		(+)
	• share of trade - the share of imports and exports of goods and services in GDP		(-)statistically insignificant
	• share of imports and exports of goods and services in GDP with lag of 5 years		(+)
	• imports and exports of goods and services/no. of population		(+)
Omoju & Adesanya (2012)	• logarithm of FDI	(+)	(+)
	• logarithm of international trade, measured by the sum of imports and exports	(+/-)	(+)
	• logarithm of public expenditure	(+/-)	(+)statistically insignificant
	• logarithm of exchange rate	(+)	(+)
Yahya et al (2013)	• foreign private investment	(N)	(+)
	• trade liberalization - the share of international trade in GDP	(N)	(+)
	• population growth (total population of country/year)	(N)	(-)statistically insignificant
	• inflation (inflation rate)	(N)	(-)statistically insignificant
	• financial sector development (the volume of the bank credit for the private sector)	(N)	(+/-)
Alavinasab (2013)	• non-oil export value	(+)	(+)
	• value of imports	(-)	(-)
	• gross capital formation	(+)	(+)
	• value added of industry/agriculture	(+)	(+)
	• exchange rate	(+)	(-)

Source: Created by authors based on literature

*logarithm of GDP (Aka, 2006; Omoju & Adesanya, 2012); real GDP per capita (Lederman & Maloney, 2003; Leitão, 2012, 2012b; Busse & Königer, 2012); GDP (Alavinasab, 2013); real GDP (Yahya et al, 2013).

(N) - no significant relationship.

Busse and Königer (2012) examined the relationship between trade and GDP per capita, and stressed that the use of the ratio trade/GDP or "trade openness" (exports and imports to GDP) does not adequately reflect the impact of trade on GDP per capita. The authors have taken into consideration the exports and imports as share of total GDP with lag. This measure of trade avoids potential influences when exports, imports and GDP simultaneously changes. Trade has a positive and significant impact on economic growth, and trade expansion, through access to additional technologies, has a significant impact on income growth.

Omoju and Adesanya (2012) examined the impact of trade on economic growth. The results show that the variables represented by trade, FDI, government expenditure and the exchange rate have a significant positive impact on economic growth.

In the literature, Leitão (2012, 2012b) analysed the influences on economic growth induced by globalisation, FDI and international trade. According to the author, changes in IIT, FDI and globalisation have a positive impact on economic growth.

Alavinasab (2013) analysed the impact of international trade on economic growth. Variables such as non-oil exports, value added in agriculture, capital formation and value added of industry have a significant positive impact on economic growth, while the impact of imports and the impact of exchange rate are negative.

Yahya et al (2013) explored the relationship between trade liberalization and economic growth. The results indicated that trade liberalization and FDI have a significant positive impact on economic growth. On the other hand, financial development and inflation have a significant negative impact on economic growth, while population growth has an insignificant relationship with economic growth.

3. Approach and Methodology

Various information and formulas regarding the Grubel-Lloyd index calculation (Grubel and Lloyd, 1971) are available in literature, in order to determine IIT. In this paper the following formula is used.

Equation 1 Formula for Grubel-Lloyd index

$$IIT_i = 1 - \frac{|X_i - M_i|}{(X_i + M_i)}$$

Where X_i and M_i are the exports and imports of industry *i*. The value of this index may be between 0 and 1.

Grubel-Lloyd index measures the extent to which imported and exported goods are similarly classified, measuring IIT for a particular product. In this paper IIT is calculated with the disaggregation of four digits.

If $GL_i = 1$, then there is only IIT (country exports a similar amount of *i* product to that imported); if $GL_i = 0$, then there is no IIT, ie country is exporting or importing *i* product - there is an inter-industry trade.

In this paper the relationship between economic growth (the dependent variable expressed as GDP per capita) and IIT *(in motor vehicle parts and accessories sector*[1] - an explanatory variable) is underlined, and in addition other important variables are used.

Table 2. Variables and hypotheses used in the model

Variables	Explanations	Hypotheses
EG	GDP per capita (US $); proxy for the economic growth; dependent variable	
EG(-1)	GDP per capita (US $); proxy for the economic growth; the dependent variable with lag; it appears in the model estimated using Generalized Method of Moments	H1: EG is positively influenced by previous developments.
IIT	Grubel-Lloyd index (IIT for the analysed industry)	H2: IIT promotes EG
FDI	Foreign direct investment (US $)	H3: There is a direct relationship between the EG and FDI
RDE	Research and development expenditures (% of GDP); proxy for innovation efforts	H4: There is a direct relationship between the EG and RDE

Source: Authors' contribution

Based on the results of various studies, the hypotheses are formulated on the influence of variables represented by intra-industry trade (IIT) for motor vehicles parts and accessories sector, foreign direct investment (FDI) and research and development expenditures (RDE) on the economic growth (EG) (see **Table 2**). Thus, all hypotheses consider a positive influence on the dependent variable.

In order to estimate the relationship between variables, the Least Squares Method (LSM) was used, for 1995-2012 period. The model contains three independent variables: Grubel-Lloyd index (IIT for the analysed sector), FDI (US $) and RDE (% of GDP, proxy for the innovation efforts).

IIT variable considers the trade between Romania and 13 countries (Austria, Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Hungary, Italy, Poland, Portugal, Slovakia and Spain). These countries were chosen taking into account the volume of IIT with Romania.

Based on the LS method, the developed model is described as follows.

Equation 2. The model (LS method)

$$Y_t = \alpha + \beta X_t + u_t$$

[1] Parts and accessories of tractors, special vehicles, dump trucks, trailers and semi-trailers for all vehicles.

where Y_t is the dependent variable (EG) and X is a set of explanatory variables (IIT, FDI and RDE).

In this paper, the variables from the above model are also used in the Generalized Method of Moments (GMM) for panel data. This method uses (at least) the dependent variable with lag. GMM estimator is consistent, robust, and efficient and it is based on instrumental variables (variables correlated with the explanatory ones and uncorrelated with errors). The developed model is described as follows:

Equation 3. The model (GMM method)

$$Y_t = \alpha + \gamma Y_{t-1} + \beta X_t + u_t$$

where Y_t is the dependent variable (EG), Y_{t-1} is the dependent variable with lag (EG-1) and X is a set of explanatory variables (IIT, FDI and RDE).

4. Discussion of the Results

According to the obtained results by applying LS method, statistically significant explanatory variables at a significance level of 1% are FDI and RDE. IIT variable is statistically significant at a significance level of 10%.

The results of the model show direct influence on the dependent variable (EG) from explanatory variables (see **Table 3**). The results (the signs of the coefficients) are consistent with the literature.

Table 3. Determinants of EG, LS method for panel data

Dep. var.: EG; Sample (adj.): 1996 2011; Trans. sect. incl.: 13; Panel total obs. (unbal.): 187			
Variab.	**Coeff.**	**Std. err.**	**t Test**
IIT	3744.61	2158.53	1.74*
FDI	9.2e-8	1.9e-8	4.95***
RDE	12292.73	665.77	18.46***
C	-217.07	1582.50	-0.14
R-squared	0.72		
Adj. R-squared	0.71	Durbin-Watson stat	0.27

Source: Authors' calculations

***/**/* - Statistically significant at 1%, 5% and 10% levels.

DW test value obtained is less than the lower critical value, which means that error terms are positively autocorrelated.

The value of R^2 indicates a medium intensity relationship between variables. The results of the model need future researches and careful explanation for a detailed examination of the influences. It is necessary to improve the model, with the addition of other important variables.

Regarding GMM, the Sargan test probability value is important (it indicates whether the model is well specified and instruments are valid). The model is validated with the probability value of the Sargan test for over-identifying restrictions. Thus, the hypothesis H0 of the correct specification is not rejected (see Table 4).

Table 4. Determinants of EC, GMM for panel data

Dep. var.: EG; Met: GMM for panel data; Trans.: orthog. dev.; Sample (adj.): 1997 2011; Trans. sect. incl.: 13; Total panel obs. (unbal.): 174; White per. instr. weight. matr.; std. err. & White per. cov. (d.f. corr.); instr. list.: @DYN(EG,-2)			
Variab.	**Coeff.**	**Std. err.**	**t Test**
EG(-1)	0.89	0.01	78.71***
IIT	1051.77	530.60	1.98**
FDI	1.5e-8	5.1e-9	2.96***
RDE	2334.58	929.55	2.51**
R-sq.	0.73		
Adj. R-sq.	0.72	Sargan p-val	0.26

Source: Authors' calculations

***/**/* - Statistically significant at 1%, 5% and 10% levels.

The analysis aims to develop an econometric model in order to highlight the linkages between per capita GDP (economic growth) and various independent variables such as: IIT in the case of motor vehicles parts and accessories sector, FDI and RDE.

According to the results of GMM, two explanatory variables are statistically significant at 1% level (EG with lag and FDI) and two variables are significant at 5% level (IIT and RDE).

Economic growth variable (with lag) has a positive effect on the dependent one, meaning that it is influenced by past developments. Thus, Hypothesis 1 is confirmed. The dependent variable used with lag as independent variable is statistically significant and its positive influence underlines that the changes in the economic growth have a significant impact on long-term.

IIT in the case of motor vehicles parts and accessories sector is a determinant of growth in the estimated model, and a direct relationship exists between variables, confirming Hypothesis 2. Thus, growth is promoted by this type of trade.

We expected a positive effect of investments on growth, and the results confirm this, which means that positive changes in this variable stimulate economic growth. Thus, Hypothesis 3 is confirmed.

There is a positive relationship between growth and RDE and the coefficient for this variable is statistically significant in the model. This variable is used to show the impact of innovation efforts on growth, taking into account that a successful innovation process creates an advantage for the economy and stimulate growth. The results regarding the obtained signs of the coefficients are in line with the literature. Thus, for all variables the expectations are confirmed (see Table 5).

Table 5. Expected and obtained signs of the coefficients

LSM			**GMM**		
Variable	**Expected sign of the coefficient**	**Obtained sign of the coefficient**	**Variable**	**Expected sign of the coefficient**	**Obtained sign of the coefficient**
			EG(-1)	**(+)**	**(+)**
IIT	**(+)**	**(+)**	IIT	**(+)**	**(+)**
FDI	**(+)**	**(+)**	FDI	**(+)**	**(+)**
RDE	**(+)**	**(+)**	RDE	**(+)**	**(+)**

Source: Authors' calculations

The results of the model require further researches and careful explanations. It is important to carry out a detailed analysis of the influences. The model can be improved in future researches, with the use of other important variables that influence growth (for example, variables related to culture).

5. Conclusions

In this paper an important type of trade is introduced in analysis, namely the intra-industry trade. The analysis is focused on developing a model for the linkages between economic growth, trade, investments and RDE.

The results are consistent with the literature, showing that all three variables used (IIT, FDI, RDE - proxy for innovation efforts) are statistically significant and have a positive impact on growth. Also, when using economic growth variable with lag, a direct influence on dependent variable is found, meaning that it is influenced by past developments. Its positive influence underlines that the changes in the economic growth have a significant impact on long-term.

IIT has a direct relationship with growth variable, which means that growth is promoted by this type of trade, also underlying that a broader specialization of the economy is beneficial.

A positive effect of investments on growth is found, as expected, meaning that positive changes in this variable stimulate growth. Investments are needed for research and development, as they lead, in time, to an increase of the product quality, products and services diversification, and internal and external competitiveness. Growth process involves changes in various sectors of the economy, changes in the model of production, and so on. Thus, investments in sectors with significant contribution to economy are of high importance.

RDE have a positive relationship with growth. This variable underlines the impact of innovation efforts on growth, taking into account that a successful innovation process creates advantages for the economy. The innovation must be stimulated, leading to improved efficiency in various sectors of the economy, progress, development of new products or services, and so on.

Motor vehicle industry is a very important economic sector of Romania with systemic significance for the whole national economy. At the same time, it should be taken into consideration the FDI character of the companies in Romania in the sense that a high part of obtained profits are expatriated besides the reinvested part of profit in the company. On the other hand, it should not be neglected the companies' influences for labour force employment, the taxes contribution to state budget, as well as the impact of managerial expertise and technological progress related to upstream and downstream propagation effects. Companies from Romanian motor vehicle industry are an example in the area of R&D expenditures, in comparison with other companies with FDI participation from other sectors. Some companies are concerned with the development of specialised research centres and laboratories in Romania with highly qualified personnel.

Based on calculations, some influences are underlined, but the data on trade are related to just one sector, which can only provide a small picture of some connections and factors that determine the development of the economy. A further analysis should focus on providing details of the relationships

between economic growth and IIT in various other sectors of the economy in which this type of trade is present.

In future researches, it is also necessary to determine the marginal intra-industry trade and its influence on growth, and to carefully analyse the relationships between variables.

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