R&D ACTIVITIES' IMPACT ON ECONOMIC GROWTH: CASE STUDY ON ROMANIA

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Abstract: *Nowadays, in knowledge based economical context, research and development (R&D) field is considered one of the key factors that generate economic growth. The main goal of our research is to evaluate the economic impact of R&D expenditures on national economy. Therefore, one will assess the temporal variation of the ratio between two aggregate indicators at the national level, in terms of the evolution of the Gross Domestic Product (GDP) and the R&D expenditures both on the national level and also for each of the four Romanian macro-regions, corresponding to 2000-2012 period. In order to highlight the differences in approach to R&D activities, by using the data of two of the most important players in Romanian automotive industry, companies listed on the Romanian capital market, we have compared the evolution of the ratio between research-development expenditures and the turnover, on one hand, and the ratio of the global indicators, on national level, on the other hand. Our findings indicate a significant impact of R&D expenditures on the evolution and economic growth at both macroeconomic and microeconomic level.*

Keywords: Research and Development, GDP, Automotive Industry, Capital Market, Romania

1. Introduction

R&D is increasingly seen as one of the key success factors of economic growth. The efforts to promote the importance of research and development and of matters relating to it, such as intellectual capital, as factors, which produce a higher level of productivity and profitability, need to be strengthened. This statement can be proved by many facts, some of them presented bellow.

According to the study carried out by the National Institute of Statistics (INS) regarding INNOVATION IN ENTERPRISES IN THE BUSINESS ENVIRONMENT, during 2010-2012:

- one of five enterprises introduced or implemented a product, a process, a method of organization or of marketing, new or significantly improved;
- over half of products innovative enterprises developed their innovations within their own enterprise;
- 7.4% of the innovative enterprises had cooperation agreements for achieving the innovative activities;
- the advantages of the time advance has been the main method for maintaining or increasing competitiveness in the innovative enterprises;
- Most innovative SMEs registered in the South-East Region (36.1%) and the North-East Region (31.7%). (as cited by Nedelcu, Banacu & Frasineanu 2014)

With a 0,5% percentage of GDP allocated to R&D and a developing relief scheme, Romania ranks 48 among the most innovative countries worldwide. (Enache, 2014).

As Goschin (2014) mentioned, some authors consider that R&D could generate not only nationally economic growth, but regionally as well. In order to increase the competitiveness of the Romanian economy in the European context, the priority for the Romanian government should be to construct viable regional development units. Therefore, regional/local authorities will have the possibility to construct integrated policies at the regional level, in order to ensure a sustainable development (economical and also social) for the entire community (Strat, 2014). Creating fully functional development regions will enable Romania to reduce the obvious disparities in comparison to older EU member states (Davidescu, Strat 2014).

Considering that the research and development level and the human capital have a significant importance in attracting foreign direct investments in a host country or region (Strat, 2014), those levels should be well know and an efficient management should be applied. However, as Busu (2014) highlighted, the state aid for research and development in Romania still holds a small place compared to their evolution at European level. Therefore, the main goal of this this paper is to analyse the relationship between R&D and GDP. The analysis is based on the four major macro-regions, as they are defined by the EU legislation.

Most of the times, the research-development activity is financed by stock exchange mechanisms, especially in the case of the companies listed on regulated securities market. In our country, as in the entire CEE region, one of the industries that invest in research-development activities is the

automotive industry. The Automotive industry in the CEE region has a turnover of approx. £118bn, almost the double of UK's £60bn and has increased its output by 170% between 2009-2014. In the CEE were produced approx. 3.5 million vehicles in its 44 OEMs and the automotive industry contributes an average of 10% to the CEE countries GDP (as presented in the Regional Automotive & Aerospace Workshop hosted by the British Embassy in Budapest, in July 2014).

Using data collected from the annual reports of two major players on Romanian automotive market, and also from the Tempo database constructed by the National Institute of Statistics, this paper reveal the differences in approaching R&D activities.

2. Research methodology

In this article, the authors use quantitative analysis methods that refer to the research-development activities and the level of GDP, calculated at national level and at the one of the four macro-regions. The data was collected from the Tempo database of National Institute of Statistics for each year from the period between 2000-2012 and were analysed by calculating the correlation coefficients of the regional components of the GDP and the research-development expenditures (whose value provides clues about the correlated evolution of these exact measures). These Macro-regions are defined as:
- Macro-region 1: North-Western and Central Regions;
- Macro-region 2: North-Eastern and South-Eastern Regions;
- Macro-region 3: Bucharest – Ilfov and Southern Muntenia;
- Macro-region 4: South-Western Oltenia and Western Regions.

In the same time, the data analysis also had in view the evolution of the aggregate ratio (at the national level), between the research-development expenditures and GDP and comparing these values to the levels of data of the two companies listed on the Romanian capital market, that are active in the automotive industry. From all the automotive industry companies, two companies listed on the Romanian capital market (even if they are not automotive-producers, they are representative for the Romanian automotive industry, being listed on the Bucharest Stock Exchange) were chosen. In order to make proper observations on the levels of the research-development expenditures and the turnover of these two issuers, Compa Sibiu and Altur Slatina, we have analysed the annual activity reports, for the period between 2008-2012, prepared according to the stock legislation. The information were retrieved from the websites of the two companies and the one of the market operator, Bucharest Stock Exchange. The collected data were later processed in order to calculate the ratio between the research-development expenditures and turnover, in such a way that the annual results were then compared to the evolution of the ratio between the research-development expenditures and the GDP, at aggregate level.

3. Correlation between R&D and national and regional growth

A topic for researchers all over the world is the relationship between the expenditures in an economy on research-development activities, and the growth rate of that economy, thus being highlighted the positive relation between the evolution rhythms of these two indicators.

In this study, one will analyse the annual data, in the period between 2002-2012, provided by the National Institute of Statistics from Romania, at aggregate (national) level, in terms of the evolution of the Gross Domestic Product (GDP) and the expenditures on research-development area on national and on the four Macro-regions levels, as well as the extraregions.
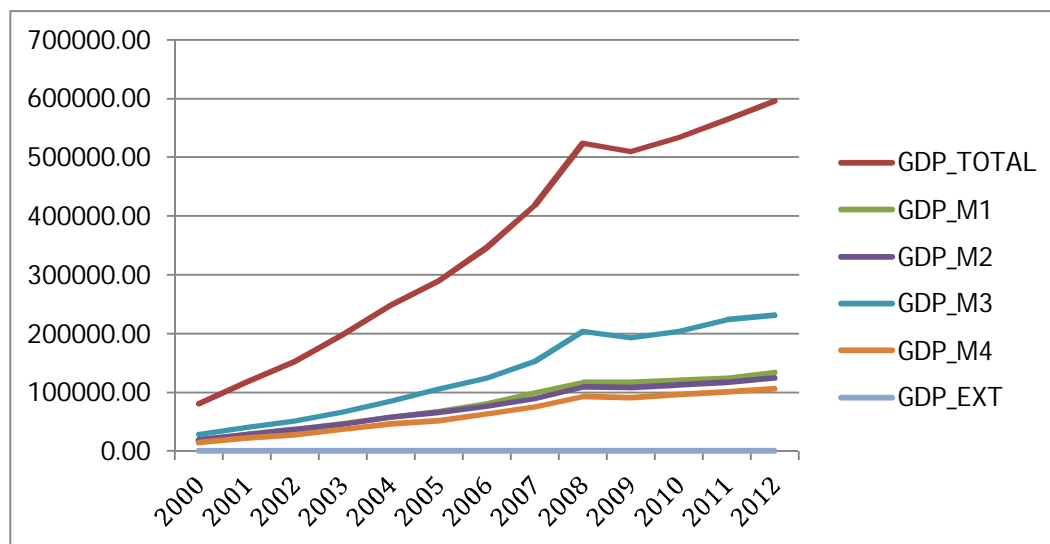
Figure 1. GDP and its macro-regional components' evolution for the period 2000 – 2012
Source: National Statistic Institute of Romania, authors' own calculations

Analysing the data that refer to the 4 Macro-regions and the GDP in the period between 2000-2012, we may notice that the GDP raised from a level of 81,275 billion RON (in 2000) up to a level of 596,681 billion RON (in 2012); Macro-region 3 (that includes Ilfov county and Bucharest) had the largest contribution to the GDP, while Macro-region 4 had the smallest one (there is an obvious exception in the case of the extra-regions). The correlation between the macro-regional components of the GDP is presented in Table 1.

Table 1. Correlations' matrix between the GDP of the 4 Macro-regions and extra-regions (the period between 2000-2012)

	GDP_M4	GDP_M3	GDP_M2	GDP_M1	PIB_EXT
GDP_M4	1.000000	0.997514	0.999440	0.999173	0.909431
GDP_M3	0.997514	1.000000	0.995631	0.995391	0.910613
GDP_M2	0.999440	0.995631	1.000000	0.999290	0.902550
GDP_M1	0.999173	0.995391	0.999290	1.000000	0.903283
GDP_EXT	0.909431	0.910613	0.902550	0.903283	1.00000

Source: National Statistic Institute of Romania, authors' own calculations

We can notice that, at the level of the macro-regions, there is a strong correlation in the evolution of the GDP, just as it is indicated by the high values of the correlation coefficients (that exceed 0.99), the only exceptions are the correlation coefficients of the GDP values registered in extra-regions (*besides, these correlations exceed 0.9*).

Starting from the level of the expenditures on research-development area at national and at macro-regional level, we remark that the highest value of this indicator was registered in 2007, and then, in 2008, amid the economic crisis outbreak, it compressed (it had the same dynamic just like the GDP). Macro-region 3 had the highest contribution to the total level of research-development expenditures, while the lowest one was registered by Macro-region 4, just like in the case of the GDP, analysed on macro-regions, as it is shown in the chart below:
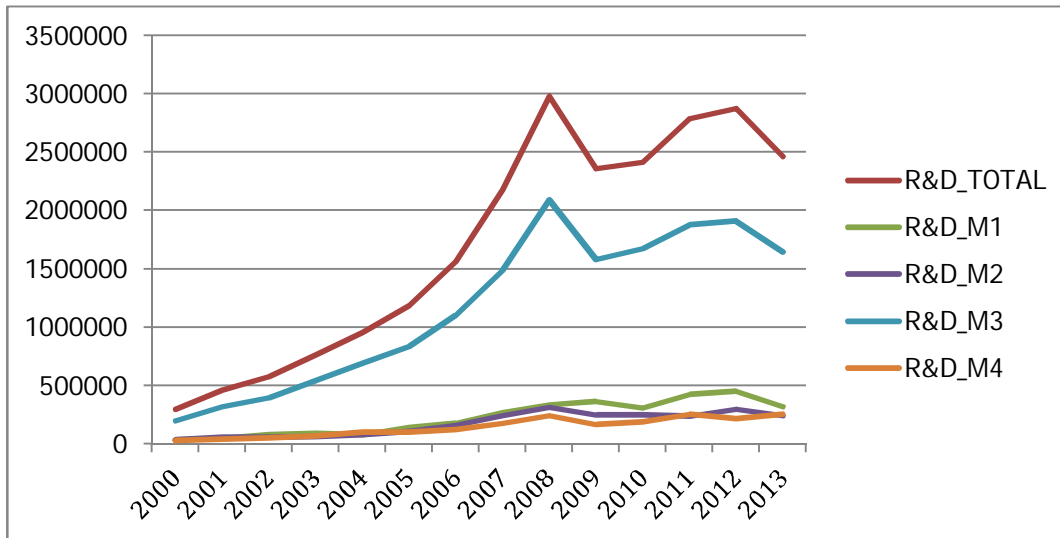
Figure 2. Overall and macro-regional components' evolution of expenditures in the research-development area, in the period between 2000-2012
Source: National Statistic Institute of Romania, authors' own calculation

At the macro-regional level, from the perspective of the correlations between research-development expenditure components, we may easily observe that these indicators are strongly correlated, and the highest correlation is between Macro-regions 2 and 3 (*a correlation coefficient of 0.984548*), and the lowest between Macro-regions 1 and 4 (*a correlation coefficient of 0.942826*). These results clearly show that there is a similar evolution of the expenditures in the research-development area at the level of the 4 macro-regions from Romania.

Table 2. Correlations' matrix of the research-development expenditures in the case of the 4 Macro-regions (in the period between 2000-2012)

	R&D_M1	R&D_M2	R&D_M3	R&D_M4
R&D_M1	1.000000	0.943142	0.956700	0.942826
R&D_M2	0.943142	1.000000	0.984548	0.949978
R&D_M3	0.956700	0.984548	1.000000	0.986112
R&D_M4	0.942826	0.949978	0.986112	1.000000

Source: National Statistic Institute of Romania, authors' own calculations

Analysing the relations between the level of development expenditures and the value of the GDP, we see that the ratio between these two indicators is between 0.36%-0.57%, with the lowest value at the beginning of the analysed period (*in 2000, the research-development expenditures represented 0,36% of the GDP*) and the highest one in 2008 (*it represented 0,57% of the GDP and this evolution was mainly determined by an abrupt decrease of the GDP and an increase of the absolute value of the research-development expenditures*). This evolution is presented in Figure 3.
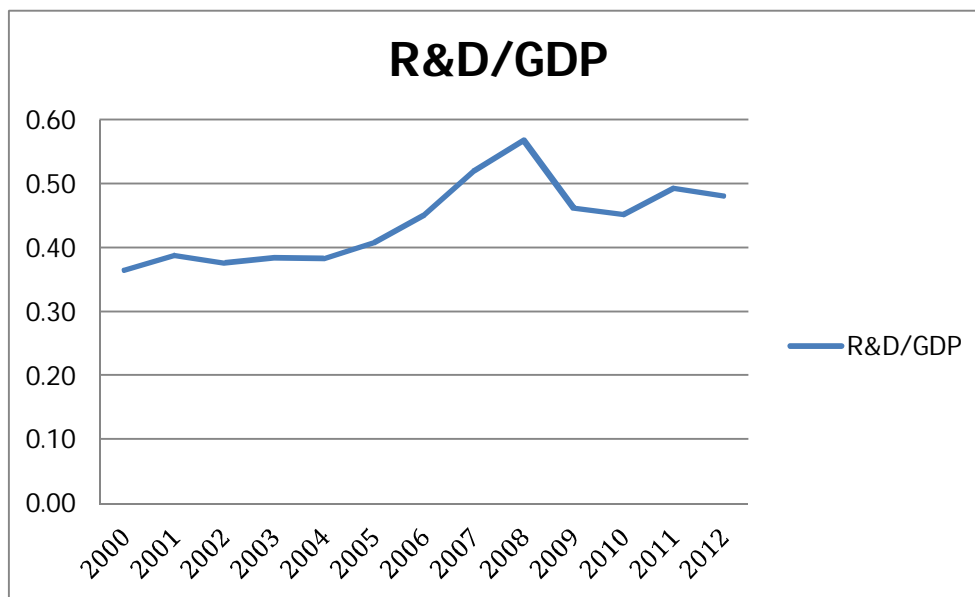
Figure 3. Evolution of research-development expenditures' contribution to the GDP, in the period between 2000-2012

Source: National Statistic Institute of Romania, authors' own calculations

In the same time, in the case of the analysed period, the potential relations between the level of the GDP and the research-development expenditures can be also identified with the help of the correlation coefficient between the two sets of data which show a value of 0.986072, that is a strong positive correlation between the two values. In order to partially remove the effects induced by the sets of data volatility, we may calculate the correlation coefficient of the growing rhythm of the two sets. The correlation coefficient is calculated as a ratio with the numerator as the result of the difference between the current and previous value of the indicator while the denominator has the previous value of the indicator. Therefore, calculating the correlation coefficient between the growth rhythms of research-development expenditures and GDP, it results a value equal to 0.899342, which shows strong, positive correlation.

However, further analysis of the relations between the two sets of data (by testing the stationarity of time series and a subsequent verification of the existence of a linear relationship between the growth rhythms of these indicators, by defining of a regression) is not possible in terms of the range of selected data (because there are not many observations, which would make the results statistically irrelevant).

4. The impact of R&D activities at microeconomic level

Further, we will consider the case of two issuers that are listed on the regulated capital market from Romania – the companies Compa Sibiu and Altur Slatina, whose main activity is in connection with the automotive industry. Choosing these companies proved to be simple because in all developed economies, the automotive industry is highly consuming when it comes to research-development resources. In this analysis, we had started from the premises that the main companies that are active in this industry in Romania - Automobile Dacia Piteşti and Ford Craiova were delisted from the capital market, in 2003 and in 2010, respectively, following the decision of the majority shareholder. In this context, the main companies that manufacture equipment and products for the automotive industry and which are listed on the capital market from our country, are Compa Sibiu and Altur Slatina; both of them are listed on Bucharest Stock Exchange, at the Standard category, a regulated market segment, according to the meaning of Directive no. 2004/39/EC, of the markets in financial instruments.

Using the data provided by the mandatory annual reports, for the period between 2008-2014, in the case of Compa Sibiu, and 2009-2014 for Altur Slatina, the authors have collected the data that refer to research-development activities in these companies that revealed different approaches of this type of activity.

In the case of Compa Sibiu (a company that manufactures components for the injection systems of motor-vehicles and has partners from the automotive industry and components suppliers, from the EU, especially), for the period 2006-2013, the expenditures on research-development activities reached a minimum level of 3,668,400 RON (in 2008, the equivalent of 1 million Euro, approximately) and a maximum level of 16,252,313 RON (in 2007, the equivalent of 5 million

Euro, approximately). In the same period of time, the turnover reached the following values: a minimum level of 241,841,158 RON (in 2006, which represented 69 million Euro) and a maximum of **505,464,110** RON (in 2012, 113 million Euro, approximately). The chart presenting the percentage that the research-development expenditures have in the turnover reveal a value of 1%, which is twice as much as the value of this indicator at aggregate level (at the level of the whole country). Figure 4 presents the evolution of the percentage of research-development activities.
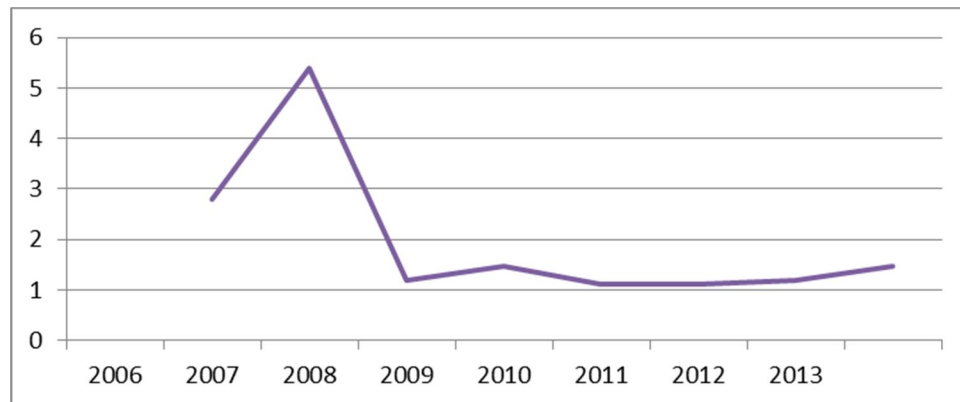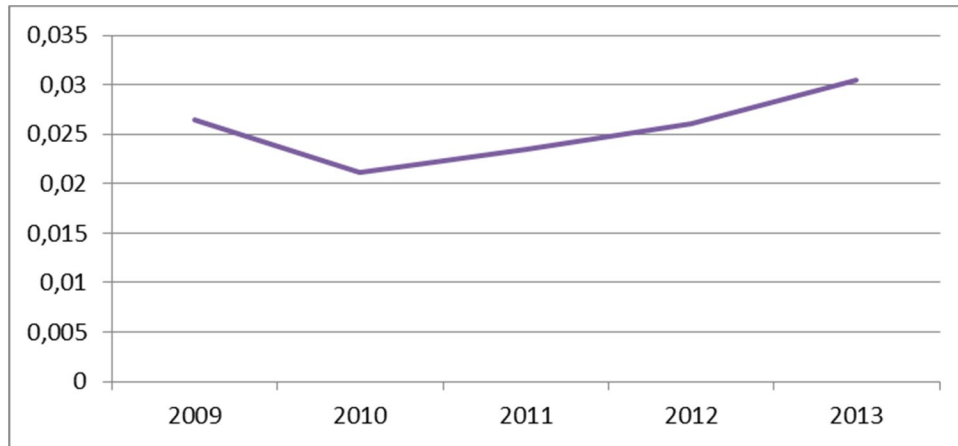

Figure 4. Evolution of research-development activities' contribution in the case Compa Sibiu's turnover, in the period 2006-2013
Source: Company's annual reports, authors' own calculations

In the case of Altur Slatina, we have analyzed the data concerning the research-development activities, in the period between 2009-2013, by collecting data from the company's own website and the one of the Bucharest Stock Exchange. In the period subjected to analysis, research-development expenditures reached a level of 22,500 RON (*in 2009, the equivalent of 5300 Euro*) and a maximum of 30,700 lei (*in 2013, the equivalent of 7000 euro*), which clearly shows that this activity was not among the priorities of this company. In the same period of time, the turnover reached a minimum of 84,867,949 RON (in *2009*) and a maximum of 115,652,749 RON (*in 2010*). So, the percentage of the research-development activities in the Altur Slatina's turnover reached a minimum of 0.021184% (*in 2010*) and a maximum of 0.0305% (*in 2013*), as we can easily see in Figure 5.

Figure 5. Evolution of research-development activities' contribution in the case Altur Slatina's
turnover, in the period 2009-2013
Source: Company's annual reports, authors' own calculations

The examples of these two companies from the automotive industry clearly show that the managers of these companies have a different approach when it comes to research-development activities, which might be explained by the differences in the development strategies of these two companies.

Thus, in the case of Compa Sibiu, the level of research-development activities show that the managers pay attention to such activities because they consider they are a proper way of making the technological processes more efficient and expanding trade relations with business partners from the automotive industry.

In the case of Altur Slatina, we notice that the company focused on maintaining the current business relations and contracts, rather than developing new business relations, which clearly shows a more cautious approach.

5. Conclusions

At national level, the research-development activity is distributed according to the contribution of each macro-region to the GDP – the highest contribution belongs to Macro-region 3 (Bucharest – Ilfov and Southern Muntenia) and the lowest one belongs to Macro-region 4 (South-Western Oltenia and Western Region). In the case of these 2 companies, listed on the Romanian capital market, we can easily see a different approach – while in the case of one company, a considerable amount of financial resources were spent on this type of activity, more than the national average, in the case of the other one, the resources spent have a constant level, 20 times less than the aggregate values.

In other words, in the case of these two issuers that are active on the automotive industry, the Romanian capital market is not used for orienting the resources from the economy towards the companies that have a research-development component. Moreover, companies from other

industries that have a strong research-development component in their activity are not present on the capital market (*that is the case of IT and telecommunications companies*, etc.) and the financial resources needed for such activities are obtained from alternative financing sources (*such as stockholders' own funds, grants, bank credits*). (Busu, 2014)

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