HOW MUCH IS THE IT FIELD ENHANCING THE ECONOMIC ACTIVITY OF THE ROMANIAN COUNTIES?[*]

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Abstract

> *The main goal of this research is to provide a first quantitative assessment of the IT business sector at the level of the Romanian counties. The research is conducted using yearly data, presented at county level, for the period 2008 – 2014. All time series regarding characteristics of the IT businesses were acquired from the Office of the National Trade Register, while all other data were downloaded from the Tempo database of the NIS. The methodology employed during this research includes the evaluation of the evolution of the county level disparities and the identification of some important county level characteristics, which favor the development of the IT business sector. An important finding reveals that we can talk about a king and viceroy effect in the field, namely about Bucharest, Cluj County and Iasi County which concentrate a significant part of the field's activity. Moreover, the most important 10 counties account for over 90% of the total turnover from the field. Other significant findings indicate the following county level characteristics as good indicators of the development level of the IT field, at county level: R&D employees, GDP and population of the capital city.*

Keywords: IT field, panel data, Romanian counties, regional disparities.
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1. Introduction

The IT field is considered, in the nowadays reality, one of the main engines of the economic progress in many developing or developed countries. Taking into consideration its superior productivity and its main opportunities, it becomes obvious why most policymakers consider this domain as being an important priority.

At the level of the Romanian economy, a large variety of incentives have been offered to companies and employees from this field, starting from 2000, with the clear purpose of enhancing the intensity of this activity at national level.

Another notable fact is that this domain was considered as being very little affected by the general economic crisis and, therefore, its development over the period 2008 – 2014 increased its importance compared to other fields which were severely affected, contributing consequently to a structural change of the entire Romanian economy.

Taking into consideration all these previously mentioned aspects, the main goal of this paper is to provide an analysis of the evolution of the IT business field at the level of the Romanian counties, over the period 2008-2014. The paper is organized in three sections accompanied by introduction and conclusion. The first section is concerned with providing a general framework for the present study and also a brief literature review, identifying some major milestones of the field. The second section deals with data related aspects and also with the description of the employed methodology. Finally, the third part focuses on the main results and findings of the present research.

2. General framework

The European Council has identified five main skills that are required for a knowledge economy and, among these, one is represented by the information and communication technology. Moreover, there are scientific studies arguing that knowledge intensive business services are key economic drivers in both developing and developed economies.

At national level the development of the IT sector and its main drivers are a topic which was severely neglected by the scientific literature even though the policymakers and the practitioners are describing this domain as one of the main growth engines of the Romanian economy. Moreover, there are no research papers studying the regional distribution of this business sector at the level of the national scientific literature. Probably one of the main causes of this situation might be the novelty of this phenomenon at the level of the national economy (it is probably one of the youngest business sectors).

As far as the author of this research paper is informed, this study is the first empirical research focused on the IT business sector, at the level of the Romanian economy.3

The evolution of the IT domain could be linked with both entrepreneurial initiative an innovative activities which are both described by several authors as key drivers to success (Knudson et al., 2004, Certo and Miller, 2008). Therefore, this economic sector could be also considered as one of the main reservoirs of start-ups at the level of the Romanian economy. Moreover, due to the characteristics of this field and mainly to the possibilities offered to companies to access the global market no matter where the physical location of the company is, this field might reveal important opportunities both for Romanian and foreign entrepreneurs. Thus, this economic sector is regarded as one important target for high tech foreign direct investments (Danciu, Strat 2012) due to its characteristics, being therefore one of the main opportunities present today at the level of the Romanian economy to attract more of such investors.

Before ending this section it is important to list the key drivers of this sector's development at national level: the highly skilled labor force, the existence of well-known universities and the financial incentives provided by the authorities.

3. Research goal, methodology and data issues

During this section, the focus will be on the central goal of this research paper. Following the clear presentation of the main objective of the current research, the attention will fall on the methodology employed during the analysis conducted for this study. Finally, the section will end with a concise description of the time series used in the presented research.

3.1. Research goal

The main goal of the present research paper is to present the evolution of the IT field at national level for the period 2008 – 2014 with a clear focus on four main characteristics of the business sector: number of companies from the domain, turnover declared by the IT companies, number of employees working in the field and number of newly established companies. Providing a clear spatial description, at county level, of the evolution of the field for the analyzed period should be considered as an integrating part of the main goal of this paper. Moreover, the paper tries to identify some of the main macroeconomic characteristics of the Romanian counties, which can be used to assess the potential of each territorial unit for becoming a development pole in this field.

3.2. Methodology

In order to fulfil the main objective of this research paper, the evolution of the main characteristics of the field are analyzed over the period 2008 - 2014 for all Romanian counties. The entire analysis focuses on the analysis of the county level (regional level) disparities for the main characteristics of the field. This approach, of analyzing the regional disparities and their evolution, is common among researchers and is implemented with respect to different macroeconomic or social indicators in a large variety of studies: Taylor et al. (1997), Goschin et al. (2008), Boldea et al. (2012) and Strat (2014). In order to sum up this approach, the evolution of the disparities is analyzed with the help of time series of Gini coefficients.

In order to identify some main macroeconomic descriptors of the evolution of the IT field three regression models (no effects, fixed effects and random effects) were estimated.

The dependent variable for all the estimated models is represented by the number of employees from the IT field. The time period for all these models is 2008 - 2012, due to the availability of one of the independent variables included in the models, namely the GDP.

The first model is estimated for 42 territorial units and for a time period of five years (no effects):

$$Empl\_IT_{it} = \beta_0 + \beta_1 \cdot R\&D\_employees_{it} + \beta_2 \cdot GDP_{it} + \beta_3 \cdot U\_POP_{it} + \beta_4 \cdot POP_{it} + \beta_5 \cdot POP\_C_{it} + \varepsilon_{it} \qquad (1)$$

The second estimated model is the random effects model for the same 42 territorial units and for the five year time period:

$$Empl\_IT_{it} = \beta_0 + \beta_1 \cdot R\&D\_employees_{it} + \beta_2 \cdot GDP_{it} + \beta_3 \cdot U\_POP_{it} + \beta_4 \cdot POP_{it} + \beta_5 \cdot POP\_C_{it} + \varepsilon_{it} \qquad (2)$$

The third estimated model is the fixed effects model for the same 42 territorial units and for the five year time period:

$$Empl\_IT_{it} = \beta_{0i} + \beta_1 \cdot R\&D\_employees_{it} + \beta_2 \cdot GDP_{it} + \beta_3 \cdot U\_POP_{it} + \beta_4 \cdot POP_{it} + \beta_5 \cdot POP\_C_{it} + \varepsilon_{it} \qquad (3)$$

Following the estimation of the three models the Hausman test and the Redundant Fixed Effects Likelihood Ration are employed in order to select the appropriate model.

In order to display clearly the regional disparities (among Romanian counties) for the above mentioned characteristics of the IT business sector, a quintile analysis was conducted. In order to facilitate the presentation of the results, for 2008 and for 2014, two maps were constructed for the variable: number of employees in IT companies/1000 employees in all companies.

3.3. Data issues

The time series describing the characteristics of the IT field (and of the entire Romanian economy) were obtained from the Office of National Trade Register (they are the data for all companies which have submitted at the end of the year the required information to the Ministry of Finance) and they are not publicly available data. All time series are available for all Romanian counties for the period 2008 – 2014. The time series for the IT field were constructed for all firms with the NACE code from the 62 class. The following time series are available both at the level of the IT field and at the level of the entire Romanian economy.

Table 1 – Time series received from the Office of the National Trade Register

Number of companies
Number of employees
Total turnover of the companies
Number of newly established companies

All other time series included in the present analysis (econometric models are downloaded from the Tempo Database, available on the website of the National Institute of Statistics and they cover the period 2008 – 2012.

Table 2 – Time series downloaded from the Tempo Database

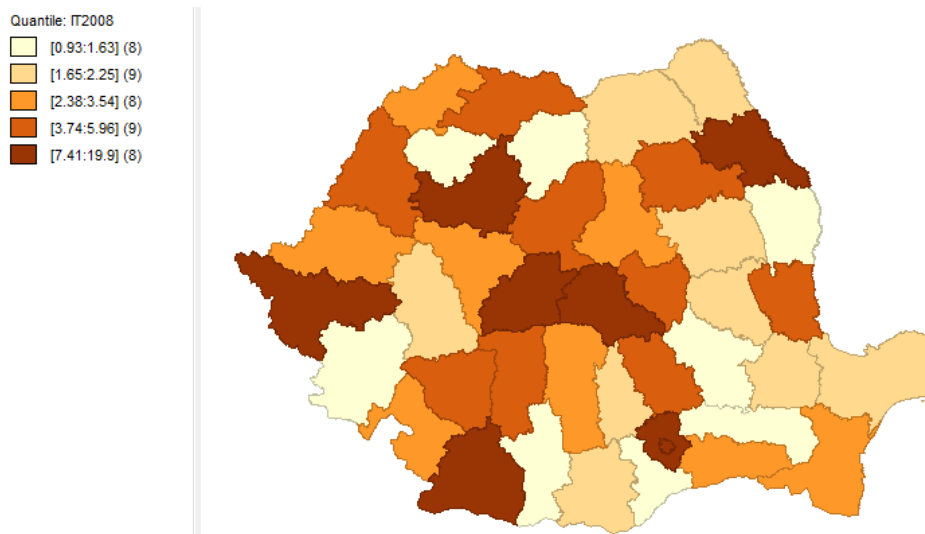| Gross domestic product |
| --- |
| Population of the county |
| Number of employees in the R&D field |
| Urban population of the county |
| Population of the capital city of the county |
| Number of PCs from the educational units |

4. **Empirical results**

While the total number of companies, at the level of the national economy, has decreased with almost 9% over the analyzed period, the number of companies from the IT field has increased with over 9.8%. The same tendency is also visible when talking about the number of the employees, where the number of employees from the IT field has increased with 7.4% while the total number of employees from all companies has decreased with almost 22%. It becomes obvious therefore that the IT sector should be regarded by the policymakers as one of the future development engines of the entire Romanian economy.

The total turnover of the IT companies has increased with over 44% during the period 2008 -2014, while the total turnover of all the companies from the Romanian economy has decreased with almost 21%. The average turnover per IT company, reported to the average turnover per Romanian company (all sectors included) has increased over the analyzed period with over 50%. In the same time, the turnover / employee (the productivity of an employee) in the IT sector reported to the turnover /employee, at the level of the entire business sector, has increased over the analyzed period with almost 33%. Both these presented indicators (turnover/company and turnover/employee) have also recorded an increase in absolute values, at the level of the IT sector, while their evolution, at the level of the entire business sector was a descendent one (or an oscillating one).

During the same period, the average size of the IT company (expressed in number of employees) has increased with 13% when reported to the average size of a Romanian company (in absolute figures, the size of the average IT company recorded a little decrease while the decrease was more severe for the average Romanian company).

The distribution of the IT business sector is not balanced at territorial level, but there are some clear concentration and development poles and also some counties with a very low level of development.

Source: Author's work

Fig. 1 – The distribution of the number of IT employees (represented as number of employees for 1000 employees from the entire economy) at the level of the Romanian counties for the year 2008

According to the map provided above, it is obvious that we can speak about seven development poles in the IT domain, as far as the year 2008 is regarded. Cluj is the county with the highest number of IT employees reported to the total number of employees of all the

companies located inside the county. On the 8th place we have the county Dolj with a value 7.41 employees in IT field / 1000 employees, which is less than half compared to the value recorded for Cluj. Other counties with a remarkable potential are Galati, Prahova and Constanta (Constanta is severely underdeveloped and should be regarded as a future development pole).

As we have identified the concentration poles we can easily identify the lagging counties where the number of IT employees (in IT businesses), reported to the entire number of employees is significantly lower. This phenomenon is obvious in the southern counties and also in those from Moldavia, except Iasi, Neamt and Galati. Other two areas are the south east part of the West development region and Salaj and Bistrita-Nasaud counties.

Also noteworthy is the fact that the main concentration poles are scattered in all development regions and are the counties where the capital city is recognized as having prestigious universities and also an important airport.
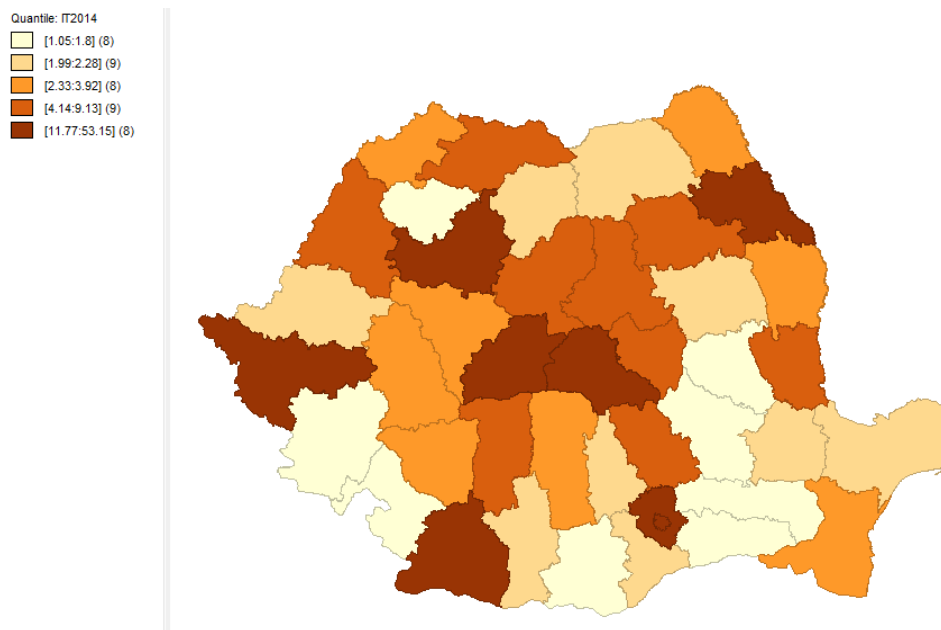

Fig. 2 – The distribution of the number of IT employees (represented as number of employees for 1000 employees from the entire economy) at the level of the Romanian counties for the year 2014

Source: Author

In 2014, the group of the development poles of the IT field has the same structure as in 2008. What is notable is the fact that Iasi County is ranked second after Cluj, while in 2008 it was ranked only 5th. Also noteworthy is the fact that the value of the indicator has

significantly increased for both Cluj County and Iasi County. The value for Cluj County has increased with over 167% while the value for Iasi County has increased with over 183%. The areas with a low development level remain the same.

The concentration has slightly increased over the analyzed period and in 2012 the ten most important counties account for 74.8% of the existing companies while in 2008 they were responsible for about 72.9%. In the same time the last ten counties (least attractive) have diminished their weight from little over 4.0% to 3.36% in 2012. The concentration of the IT business sector is even more obvious when analyzing the distribution of the number of employees. The most important ten counties host over 90.0% of the total number of employees from the IT business sector, both in 2008 and in 2012. In the same time, the least important 10 counties have diminished their importance from little under 1% to 0.77%. Also notable is the fact that the total number of employees from the least most important 10 counties has slightly diminished over the analyzed period.

The concentration is even higher when analyzing the total turnover of the IT companies, at county level. In 2008, the total turnover of the IT companies from the ten most important counties represented over 92.6% of the national total turnover of the IT companies. This percentage grew, over the analyzed period, to almost 94%, supporting the concentration hypothesis. In the same time, the turnover of the IT companies from the least attractive 10 counties decreased from 0.62% to 0.46%.

The same phenomenon is obvious when analyzing the evolution of the number of newly established IT companies. 72.44% of the total number of new IT companies were founded in the 10 most attractive counties at the level of the year 2008 while at the level of the year 2014 almost 80% of the new IT businesses were founded in the ten most attractive counties. The less attractive 10 counties were preferred by 3.15% of the new IT investors in 2008 and at the end of the analyzed period the percentage was of only 2.11%.

Taking into consideration all the aspects presented above, it is obvious that the IT field is characterized by a high concentration at the level of the Romanian counties and that this concentration is still increasing. Therefore, it is clear that we ca speak of a low number of concentration poles, at the national level, and a king and viceroys effect could be identified (Cerqueti and Ausloos, 2015). Bucharest could still be considered the King and Cluj County and Iasi County are the two viceroys in this business sector.
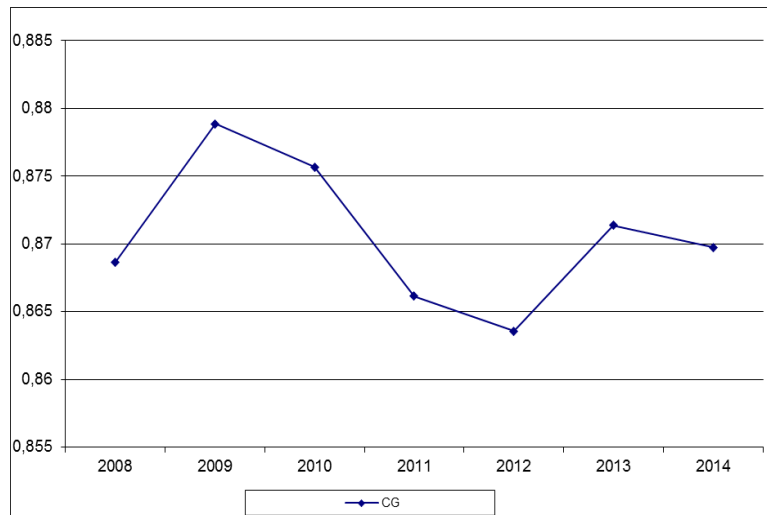
Fig. 3 – The time series of Gini coefficients computed for the total turnover of the IT companies at county level

As it is visible in the figure displayed above, the concentration level is very high, reaching a value of almost 0.88 in 2009. Noteworthy is also the fact that the concentration level is pretty stable over the analyzed period and the recorded fluctuations have a very small magnitude.

The estimation of the three models described in the methodology section are displayed in the following table:

Table 1. The Estimation Output Model - 2008 – 2012

Dependent Variable: **Number of employees in the IT companies**			
Independent Variable	**Model 1 (No effects)**	**Model 2 (Random effects)**	**Model 3 (Fixed effects)**
R&D_employees	0.4466*	0.4833*	1.5052*
GDP	0.1647*	0.2114*	0.5000*
Urban Population	-0.0029***	-0.00459*	-0.1659*
Total Population	-0.00289*	-0.00242*	0.0482***
Population of the capital city	0.00279**	0.00146	0.02376
Number of PCs in the education facilities	0.052*	0.03306	0.04290
C	2.3525	40.406	12883.83
Adjsuted R square	0.939	0.892	0.96
DW	1.16	1.23	1.43

*. 1% significance level, ** 5% significance level, ***10% significance level

Source: Author

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One of the most important findings of the modeling process is that the number of employees from the IT companies is positively linked, at the level of the Romanian counties, with the number of employees working in research and development (researchers plus technicians). The coefficient of the independent variable is positive and statistically significant for all three models. The GDP is the other variable with a positive and statistically significant coefficient for all three models.

Also, statistically significant parameters, for all three models, have both the total population and the population of the urban population (different significance levels). The coefficient of the urban population is always negative, suggesting a decrease of the IT employees when there is an increase of the urban population. In the same time the coefficient for total population is negative in the first two models and becomes positive in the third model, suggesting therefore mixed outcomes.

The population of the capital city and the number of PCs from the educational units have a positive coefficient in all three models. Although the coefficients of both variables are only statistically significant in the first model.

The Hausman test and the Redundant fixed effects – Likelihood ratio are both suggesting that the model with fixed effects is the appropriate version, from an econometric perspective. Therefore, it is obvious that there are a set of unmeasured characteristics of the Romanian counties which influence significantly, over the period 2008 -2012, the evolution of the employees from the IT business sector.

Summing up the results obtained for the third model, we can state that there are clear evidence suggesting that populated (with a higher overall population), larger economies (counties with a high GDP) which are more oriented towards research and development are locations where the IT business sector has a higher development propensity.

5. Conclusion

This research paper should be included in the broader literature dealing with regional disparities and regional development in different economic sectors. More exactly, the focus in the present research paper is on the Romanian IT field and the entire analysis is conducted at county level for the 2008 -2014 period.

The findings presented in this paper and their socio-economic implications should be regarded with the required attention due to their main limitation, which is related to the data coverage of the studied field. The time series used for the IT companies and, also, for the total number of companies from the Romanian economy were obtained from the Office of

National Trade Register and they were collected from the documents submitted at the end of the year to the National tax Authority (under the Ministry of the Finance). Therefore, it needs to be taken in consideration the fact that not all companies comply with the regulation and submit the documents at the end of the year.

The fact that the IT field was growing over the analyzed period while the entire economy was decreasing, should be considered one of the main findings of the paper. Notable is the magnitude of this phenomenon, quantified for all four characteristics of the IT business field: number of companies, number of employees, total turnover and number of newly founded companies. As far as the total number of companies is regarded, the indicator has increased with over 9.8%, for the IT field, while it decreased with almost 9% for the total national economy. The difference is increasing when analyzing the total turnover, which increased at the level of the IT sector with over 44%, while it decreased at the level of the national economy with almost 21%. The same tendency is visible for the number of employees. The indicator for the IT sector has increased with 7.4% while it has decreased with almost 22% at the level of the entire economy. Taking in consideration the figures presented in this section and, also, all other results presented in this paper, the main conclusion is that the IT sector became, over the analyzed period, the main growth engine of the Romanian economy and should be further supported by the policymakers.

Another important finding of the present research is that the IT business sector is not equally distributed at the level of the Romanian territory. There are some obvious concentration poles that account for most of the activity (over 94% of the total turnover of the IT business) and there are also a large number of counties that have a severely underdeveloped IT sector. The concentration and growth poles of the sector are: Bucharest, Cluj County, Iasi County, Timis County, Brasov County, Sibiu County, Prahova County and Dolj County. The concentration can be explained by the size of the capital city of these counties and by the fact that all these capital cities host important Romanian universities. Further evidence in this regard are brought by the estimated models where the number of the IT employees from a county can be explained by the R&D employees from that county, the GDP, the total population of the county and the population of the capital city (this coefficient is not statistically significant in the third model). An interesting result, which is not in line whit the previous presented findings, is the negative coefficient of the total urban population. Another notable finding is represented by the fact that the fixed effects model is the most appropriate, which clearly supports the idea that there are some unobserved (and not included in the models) characteristics of the Romanian counties that can explain better the evolution of the number of IT employees.

Taking into consideration the characteristics of the Romanian counties, Constanta County and Galati County should be regarded as counties with an important unexploited potential.

Acknowledgements

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