STUDIA UBB NEGOTIA, LX, 4, 2015, pp. 79 - 94
(RECOMMENDED CITATION)

IT SECTOR DEVELOPMENT IN CLUJ-NAPOCA. THE CASE OF SMEs

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ABSTRACT. The purpose of this paper is to to explore the evolution of SMEs from Cluj-Napoca in the IT sector by looking into the following problems: the relationship between number of employees, type of ownership and type of activity, as well as relationship between profit, liabilities, turnover, type of ownership and type of activity. The results indicate that the sector is attractive for the investors no matter what type of activity they want to develop (production or outsourcing). The main reason that makes them invest is the well prepared and relatively low cost workforce. Moreover, under favorable conditions (increase in turnover, decrease in liabilities or liabilities/capital ratio), the trend of the profit is ascending, making from this sector an interesting one for the investors (Romanian or international). Thus, our models show that this possible increase of the profit is a moderate one. Further investigations show that the development of the sector is rather a moderate one not a "booming" one. The results are normal if we take into consideration the fact that the process of developing Cluj-Napoca as an IT pole is at the beginning.

Key words: IT sector, SMEs, profit, linear model, log-linear model

JEL classification: L86

1. Introduction

Romania has been acknowledged as one of the preferred destinations of IT companies. This is due to a large and talented pool of resources of IT graduates and professionals, lower labor costs compared to Western Europe and US, and a

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business culture similar to these countries than the more distant countries from Asia. Geographic and time zone proximity to Western Europe are supplementary featured that enhance Romania attractiveness as for IT companies (*Software & IT Services in Romania Study, by ANIS,* (http://www.anis.ro).

Romania's IT sector has reached an average annual turnover of EUR 2.8 billion. In 2014, Romania registered over 64,000 employees in the IT sector, being ranked first among the EU countries based on the number of employees in the IT sector per capita. Moreover, the sector was the third gross contributor to Romania's GDP (*http://www.romania-insider.com/romanias-itc-sector-reaches-eur-2-8-billion/148554/*).

Favorable economic conditions ensured a positive evolution for the Romanian IT sector. According to a study made by the Romanian National Institute for Computers the IT sector (software, hardware services and electronics) showed a strong upward trend during 2010 and 2011.

In an attempt to support the IT sector, the Romanian Government has been playing an active role in attracting foreign investment to this sector. A 100% income tax exemption for IT employees has been introduced and maintained even after joining the European Union. State aid schemes are also likely to be granted in the years to come (*http://www.clujbusiness.ro/why-cluj/main-industries/*).

Moreover, Romania's major cities were classified as strategic development poles in order to provide a fruitful environment to the areas in which they excel. A new strategic plan, endorsed by the Romanian Ministries of Economy and Regional Development, ranked Cluj-Napoca as the center of information services in Romania. On November 14th, 2012 Cluj-Napoca IT Innovation Cluster was officially launched at national level. The Cluj-Napoca IT Innovation Cluster has its role model in the Silicon Valley concept and aims to transform Cluj-Napoca into the most important center for IT research & development of Romania. The Cluster aims to provide an officially supported growth platform for local IT sector representatives.

With more then 300 IT companies established in the city and about 10,000 active software engineers, Cluj-Napoca has become in 2015 the first IT export hub of Romania, delivering 78% of the Romanian IT exports. This hidden treasure of South-Eastern Europe investment map stands out through its multicultural and multilingual community (*http://www.codespring.ro/news/cluj-napoca-growth-pole-of-romanias-ict-industry*).

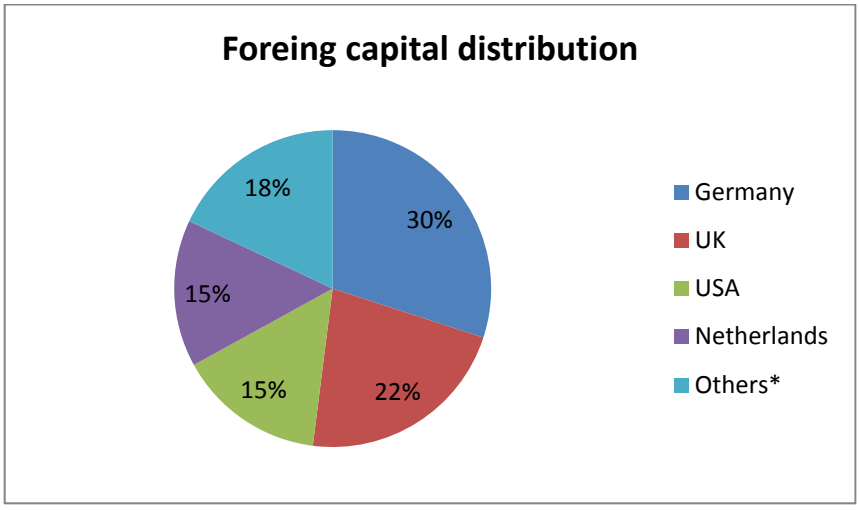
Cluj-Napoca has a significant potential for development in the IT sector, mainly due to the 1,500 specialists who graduate each year from the two top universities: Technical University of Cluj-Napoca and Babes-Bolyai University. More than 5,000 software engineers work in the companies that deliver customized software development, outsourcing and IT Services in Cluj-Napoca.

Cluj-Napoca has found a winning strategy in developing its IT production and outsourcing capacities. The software businesses in the city have registered constant growth even during the recent global recession. Local software engineers are valued not only for their technical skills but also for their wide knowledge of various foreign languages: English, German and French (*http://www.clujbusiness.ro/why-cluj/main-industries/*).

Both domestic and foreign investors are financing the IT sector in Cluj-Napoca. The foreign capital comes from the following countries: Germany (30%), UK (22%), USA (15%) and The Netherlands (15%) as major investors; they are followed by Austria (5%), Finland (4%), France and Sweden (3% each), Denmark and Switzerland (2% each), and Italy (0.5%) (*http://www.clujbusiness.ro/why-cluj/main-industries/*).

The chart below presents the foreign capital invested in IT sector in Cluj-Napoca distributed by countries of origin:

Figure 1. Foreign Capital Distribution by country of origin



Source: Data used from http://www.clujbusiness.ro/why-cluj/main-industries/

Cluj-Napoca IT Association has been legally established in October 2012 as a non-profit association and is set to coordinate the activities and projects undertaken by the Cluj-Napoca IT Innovation Cluster. It comprises 23 technology companies, with a total turnover of EUR 100 million. Cluj-Napoca IT Association aims to increase the capacity of research and development, by fostering

cooperation between public institutions undertaking research, development and innovation (RDI), and private companies, maximizing the underlying potential of IT and its application in both the public (public administration, education, health) and the private sector (enterprises, citizens). Furthermore, increasing the competitiveness of local IT industry representatives, supporting economic trade and commercial activities between members of the cluster, supporting entrepreneurship and SMEs among local IT members, identifying and attracting resources (investments, hedge funds) to attain long-term development in the sector are also among the objectives of the Association.

The activity of the IT companies located in Cluj-Napoca made the region one of the most attractive destinations for IT investments in Romania. Its high focus on export, especially towards EU and US markets, helped Cluj-Napoca rank among the first Romanian cities from an IT export revenue perspective.

These are some reasons for which we decided to study the evolution of this sector in terms of profit, turnover, number of employees, liabilities and the capital invested. We will also try to find out if there is a boom in the IT sector in Cluj-Napoca.

Regarding the literature review, to the best of our knowledge, this is the first study using econometric models in order to analyze the IT sector from the perspectives announced above. The sector is analyzed every year by *ANIS – Employers association of the software and services industry* but without using econometrical tools.

2. Methodology

Within our study, due to the difficult access to information, we used data collected from 82 SMEs from the IT sector in 2014. These companies were studied by analyzing the following variables:

- **Profit** (**y**), which is the dependent (quantitative) variable, measured in lei;
- **Turnover**, which is an independent (quantitative) variable, measured in lei;
- **Number of Employees,** which is an independent (quantitative) variable;
- **Liabilities**, which is an independent (quantitative) variable, measured in lei;
- **Capital**, which is an independent (quantitative) variable, measured in lei;
- **Type of Activity** – an indicator which is treated as a **dummy independent variable** expressed by 0, 1 (code). If the company is of **outsourcing** type, the code is **0**, if it deals with **production,** the code is **1**;
- **Type of Ownership** – an indicator which is treated as a **dummy independent variable** expressed by 0, 1 (code); if the company is **Romanian** the code is **1**, if it's **international,** the code is **0**.

In order to study these companies and make forecasts regarding the evolution of the entire sector we used descriptive statistics and econometric models (linear and log-linear).

First, we will study the sample in order to obtain information regarding the structure, type of activity and type of ownership and also the average values of the indicators that we are using.

Next, we will study the evolution of the number of employees related to the type of activity and type of ownership in order to see if these variables are related. For this we are using a multiple linear model.

The evolution of the profit is studied in relation with turnover, liabilities, capital, type of activity and type of ownership. We are using a multiple linear model and also a multiple log-linear model showing in the end which one is better from the econometric point of view.

Finally, we will try to give an answer to the following question: "Is this a real boom?"

For this we are using a Cobb-Douglas function (log-linear form) in order to see the relation between turnover, capital and number of employees.

3. Finding and results

3.1. The structure of the sample. Descriptive statistics.

Table 1 presents the structure of the sample based on type of company, type of activity and type of ownership. The sample is dominated by small companies (56.1%), oriented toward outsourcing (64.6%) and financed by domestic capital (71.1%).

Table 1. The structure of the sample related to type of company, type of activity and type of ownership

Type of company	Frequency	Type of activity	Frequency	Type of ownership	Frequency
Medium	17	Outsourcing	53	International	23
Small	46	Production	29	Romanian	59
Micro	19				

Source: Authors' calculation

Table 2 presents the average values for the investigate variables.

Table 2. Average values for profit, turnover, number of employees, liabilities and capital (in lei)

Type of company	Average profit	Average turnover	Average no. of employees	Average liabilities	Average capital
Medium	1,940,287	25,266,798	145	6,257,913	4,359,267
Small	494,505	3,436,515	21	760,662	1,065,322
Micro	457,443	3,874,531	5	655,696	885,663
Overall	785,653	8,063,797	43	1,876,015	1,706,585

Source: Authors' calculation

At the level of 2014, the average turnover of the investigated 82 companies was of 8 million lei; they have an average profit of about 0.8 million lei, and an average number of 43 employees. The average level of liabilities and capital is almost similar. The medium-sized enterprises are the most profitable, while the small and micro entities seems to have similar performances, thus with a largely different number of employees.

Starting from the above-mentioned descriptive statistics we can estimate, with 95% confidence, that the average profit of all companies from the domain was, in 2014, between 536,372 and 4,034,930 lei, and the average number of employees was between 29 and 57. Table 3 presents the estimates for all the variables included in the study.

Table 3. Confidence limits for each average value (95% confidence)

95% confidence	Lower limit	Upper limit
Turnover	5,091,640	11,035,900
Profit	536,372	1,034,930
Employees	29	57
Liabilities	1,012,860	2,739,170
Capital	1,133,090	2,280,080

Source: Authors' calculation

In order to study the relationships between the variables, it is very important to see how correlated they are. In the next table we present the correlation matrix.

Table 4. The correlation matrix

	Turnover	Profit	Employees	Liabilities	Capital	Liabilities/ Capital	Activity	Ownership
Turnover **p-value**		0.8068 0.0000	0.6698 0.0000	0.6801 0.0000	0.7995 0.0000	0.2434 0.0275	0.0850 0.4479	-0.4054 0.0002
Profit **p-value**			0.6445 0.0000	0.4430 0.0000	0.8684 0.0000	-0.0244 0.8277	0.1129 0.3125	-0.2961 0.0069
Employees **p-value**				0.3941 0.0002	0.6758 0.0000	0.0685 0.5407	0.1480 0.1845	-0.5812 0.0000
Liabilities **p-value**					0.4203 0.0001	0.5186 0.0000	0.0187 0.8676	-0.3529 0.0011
Capital **p-value**						-0.0601 0.5916	0.1103 0.3241	-0.3068 0.0051
Liab./Capital ratio **p-value**							0.0396 0.7236	-0.2462 0.0258
Activity **p-value**								-0.2763 0.0120

Source: Authors' calculation

As expected, the most intense correlation appears between turnover and profit. Since the profit is the dependent variable, this relationship is expected to continue to be highlighted by the other models.

A high correlation exist between turnover and capital, which can lead finally to multicolinearity.

Even if the correlation matrix shows some moderate to strong relationships between our explanatory variables, overall the models that we will discuss are not significantly influenced by this phenomenon.

On the other hand, working with cross-sectional data, the heteroskedasticity of the error term could appear. In all cases, White's test shows that the error terms are homosckedastic.

3.2. The relationships between variables

3.2.1. The relationship between the number of employees, type of activity and type of ownership

In this part we study the influence the type of activity and the type of ownership have on the number of employees. Using a linear model we obtain the following results.

Table 5. The relationship between the number of employees, type of activity and type of ownership (linear model)

Parameter	Estimate	P-Value	F-Ratio	R-squared	Adjusted R-squared
CONSTANT	103.107	0.0000			
Type of activity	-1.803	0.8871			
Type of ownership	-82.736	0.0000			
Model		0.0000	20.16	0.3379	0.3211

Source: Authors' calculation

As we can observe the model is significantly related to the type of ownership and it is not significantly related to the type of activity at 5% level of significance. Overall, the model is significant (see p-value corresponding to the entire model).

As we can see 32.11% from the variability of the labor force in the domain is explained by the type of activity and the type of ownership.

However, the type of activity seems to play a next to none role in employees choice of a workplace.

The next table, Table 6, shows the evolution of the number of employees corresponding to each type of activity and ownership, with 95% confidence.

Table 6. The relationship between the number of employees, type of activity and type of ownership

Type of activity	Type of ownership	*Average no. of employees*	*Confidence 95%*	
Outsourcing	**International**	103	77	129
Outsourcing	**Romanian**	20	5	35
Production	**International**	101	77	125
Production	**Romanian**	18	1	35

Source: Authors' calculation

The results in Table 6 above indicate that Romanian companies are smaller than those financed by foreign capital, which are of medium size. Moreover, it seems that the IT companies financed by foreign capital seems to have a similar number of employees regardless of the type of activity, as indicated by the results in Table 5.

3.2.2. The relationship between profit, turnover, liabilities, type of activity and type of ownership

Further, we will study the relationship between profit, turnover, liabilities, type of activity and type of ownership. We will use the two models: the multiple linear model and the multiple log-linear model.

- **The linear model**

The results for this model are presented in Table 7.

Table 7. The relationship between the profit, turnover, liabilities, type of activity and type of ownership (linear model)

Parameter	Estimate	P-Value	F-Ratio	R-squared	Adjusted R-squared
CONSTANT	152118.	0.4438			
Turnover	0.0792125	0.0000			
Liabilities	-0.0544555	0.0389			
Type of activity	106755	0.5077			
Type of ownership	82258.4	0.6614			
Model		0.0000	39.77	0.6738	0.6568

Source: Authors' calculation

At 95% confidence, we can observe that the model is significantly related to each of the quantitative variable (turnover and liabilities) and overall.

The model shows that 65.68% from the variability of the profit is explained by the variability of the turnover and liabilities and also by the type of activity and type of ownership.

What is interesting in this model is the fact that the sign of the estimator corresponding to the liabilities is negative, which indicated that the most profitable companies are those that borrow less.

The following table, Table 8, shows the estimated profit corresponding to each type of activity and ownership.

Table 8. The average profit related to turnover and liabilities for each type of company and each type of ownership

Type of activity	Type of ownership	Average profit
Outsourcing	**International**	Profit=152,118+0.0792*Turnover-0.0544*Liabilities
Outsourcing	**Romanian**	Profit=237,376.4+0.0792*Turnover-0.0544*Liabilities
Production	**International**	Profit=258,873+0.0792*Turnover-0.0544*Liabilities
Production	**Romanian**	Profit=341,131.4+0.0792*Turnover-0.0544*Liabilities

Source: Authors' calculation

For example, for a Romanian production company, having the same level of liabilities, if the turnover increases by 1,000 lei, the average profit will increase by 79.2 lei. On the other hand, at the same level of turnover, if the liabilities increase by 100 lei, the average profit will decrease by 54.4 lei. An interesting fact is that if we maintain the turnover and the liabilities constant, the highest average profit is obtained by the Romanian production companies.

- **Partial elasticity. The log-linear model**

It would be interesting to see if the profit is elastic related to the turnover or to the liabilities. For this we shall use a multiple log-linear model. The results are presented in Table 9:

Table 9. The relationship between the profit, turnover, liabilities, type of activity and type of ownership (log-linear model)

Parameter	Estimate	P-Value	F-Ratio	R-squared	Adjusted R-squared
CONSTANT	1.80793	0.3285			
log(Turnover)	0.782697	0.0000			
log(Liabilities)	-0.100732	0.3090			
Type of activity	0.504081	0.0173			
Type of ownership	0.63018	0.0247			
Model		0.0000	11.94	0.3828	0.3508

Source: Authors' calculation

As we can observe the log-linear model is no longer significant related to the liabilities, but is significant related to the turnover, type of activity and type of ownership. Moreover, the model is overall significant. Therefore, it would be a wise decision to keep liabilities in the model. In this way we will see that the profit is rigidly related to the turnover and the liabilities. In fact, the model reveals that the profit is rigidly related to each quantitative explanatory variable, meaning that if any of those is modified by 1%, the corresponding change in the average profit will be less than 1%.

One fair question is which one to choose: the linear model or the log-linear one.

From the econometric point of view the answer is simple. We have to compare these two models. One problem that arises when we want to compare models is whether to use the R-squared in order to determine which model is better. This is due to the fact that in those two models (linear and log-linear) the R-squared expresses two different things. That is why, in order to compare models, we have to use the RSS (residual sum of squares). For this we have to consider a new dependent variable in which all values are divided by the geometric mean of the values. The reason for this is to make the values of the RSS comparable. In this way we obtain:

Table 10. Value of Residual Sum of Squares

RSS – linear model	174.807
RSS – log-linear model	56.936

Source: Authors' calculation

In conclusion, the best model from the econometric point of view is the log-linear model. The results are presented in Table 11:

Table 11. The average profit using the log-linear model

Type of activity	Type of ownership	Average profit
Outsourcing	**International**	Log(Profit)=1.80793+0.782697*Log(turnover)-0.100732*log(Liabilities)
Outsourcing	**Romanian**	Log(Profit)=2.43811+0.782697*Log(turnover)-0.100732*log(Liabilities)
Production	**International**	Log(Profit)=2.312011 +0.782697*Log(turnover)-0.100732*log(Liabilities)
Production	**Romanian**	Log(Profit)=2.942191+0.782697*Log(turnover)-0.100732*log(Liabilities)

Source: Authors' calculation

For example, in all cases, at the same level of liabilities, if the turnover increases by 1%, the average profit will increase by 0.782697%.

3.2.3. The relationship between profit, turnover, liabilities/capital ratio, type of activity and type of ownership

Due to the fact that the absolute value of liabilities might be misleading, we replaced this variable with the liabilities/capital ratio.

Using a multiple linear model we obtain the following results presented in Table 12.

Table 12. The relationship between the profit, turnover, ratio liabilities/capital, type of activity and type of ownership (linear model)

Parameter	Estimate	P-Value	F-Ratio	R-squared	Adjusted R-squared
CONSTANT	290579	0.1382			
Turnover	0.0724412	0.0000			
Liabilities/Capital	-116088	0.0005			
Type of activity	122167	0.4239			
Type of ownership	27029.5	0.8802			
Model		0.0000	46.05	0.7051	0.6898

Source: Authors' calculation

As we can see, the model is significant in relation with the turnover and to the new ratio, as well as overall, and it shows that 68.98% from the variability of the profit is explained by the variability of turnover, liabilities/capital ratio, type of activity and type of ownership. The model also show that the most profitable companies are those with a low liabilities/capital ratio.

The evolution of the average profit in relation with the turnover and the new ratio is presented in Table 13.

Table 13. The average profit related to turnover and liabilities/capital ratio for each type of company and each type of ownership (linear model)

Type of activity	Type of ownership	Average profit
Outsourcing	**International**	Profit=290,579+0.0724412*Turnover-116,088*(Liabilities/Capital)
Outsourcing	**Romanian**	Profit=317,608.5+0.0724412*Turnover-116,088*(Liabilities/Capital)
Production	**International**	Profit=412,746+0.0724412*Turnover-116,088*(Liabilities/Capital)
Production	**Romanian**	Profit=439,775.5+0.0724412*Turnover-116,088*(Liabilities/Capital)

Source: Authors' calculation

Table 13 shows that at same value of the liabilities/capital ratio, if the turnover increases by 1,000 lei, the average profit for each type of company and each type of ownership will increase by 72.44 lei. If the turnover and the liabilities/capital ratio are maintained at the same level, then the highest average profit is obtained by the Romanian production companies.

Using a log-linear model we will obtain the results presented in Table 14.

Table 14. The relationship between the profit, turnover, ratio liabilities/capital, type of activity and type of ownership (log-linear model)

Parameter	Estimate	P-Value	F-Ratio	R-squared	Adjusted R-squared
CONSTANT	-0.150108	0.9304			
Log(Turnover)	0.818668	0.0000			
Log(Liabilities/Capital)	-0.318746	0.0000			
Type of activity	0.447628	0.0194			
Type of ownership	0.493964	0.0519			
Model		0.0000	19.10	0.4980	0.4719

Source: Authors' calculation

Table 14 reveals the best model that we have determined so far. This model is significant related to each explanatory variable (even to the type of ownership, corresponding p-value is almost 0.05) and overall.

Using this model we obtain the results in Table 15.

Table 15. The average profit related to turnover and liabilities/capital ratio for each type of company and each type of ownership (log-linear model)

Type of activity	Type of ownership	Average profit
Outsourcing	**International**	Log(Profit)=-0.150108+0.818668*log(Turnover)-318,746*log(Liabilities/Capital)
Outsourcing	**Romanian**	Log(Profit)=0.343856+0.818668*log(Turnover)-318,746*log(Liabilities/Capital)
Production	**International**	Log(Profit)=0.29752+0.818668*log(Turnover)-318,746*log(Liabilities/Capital)
Production	**Romanian**	Log(Profit)=0.791484+0.818668*log(Turnover)-318,746*log(Liabilities/Capital)

Source: Authors' calculation

Table 15 shows that at same value of the liabilities/capital ratio, if the turnover increases by 1%, the average profit for each type of company and each type of ownership will increase by 0.818668% no matter what type of activity or ownership company has. That means that the profit is rigid with respect to the turnover.

Comparing these two models we obtain:

Table 16. Value of Residual Sum of Squares

RSS – linear model	157.981
RSS – log-linear model	46.155

Source: Authors' calculation

In conclusion the best model is the log-linear one.

3.2.4. Is the IT sector development slow, constant or fast?

To see if this IT sector development is really a boom we will study the relationship between turnover, number of employees and capital, using a Cobb-Douglas function in the logarithmic form

$$log(Turnover)=B_0+B_1log(employees)+B_2*log(capital)$$

and we will call this the unrestricted model.

We obtain the results presented in Table 16.

Table 16. The relationship between turnover, number of employees and capital (log-linear model)

Parameter	Estimate	P-Value	F-Ratio	R-squared	Adjusted R-squared
CONSTANT	7.9176	0.0000			
log(Employees)	0.338427	0.0000			
log(capital)	0.454117	0.0000			
Model		0.0000	40.58	0.5067	0.4942

Source: Authors' calculation

Table 16 shows that the model is significant in relation with each explanatory variable and overall. Moreover, we can see that the turnover is rigidly related to the number of employees and capital.

The purpose is to determine the development rate of the sector.

From the econometric point of view, the sum of the parameters B_1+B_2 represents the return to scale. If $B_1+B_2>1$, then there are increasing returns, and if $B1+B_2<1$, there are decreasing returns.

In our case if we obtain that $B_1+B_2>1$, the answer to the question is positive: there is a boom.

We will assume that $B_1+B_2=1$ and in this way we obtain the following restricted model:

*log(Turnover/employees)=B_0+B_2*log(capital/employees) – restricted model*

The hypotheses that we have to test are the following:

H_0: the restriction is valid ($B_1+B_2=1$)

H_1: the restriction is not valid

In order to test these hypotheses we have to determine the value of F-statistic using the formula:

$$F = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR}/(n-k-1)},$$

where:

- m is the number of restrictions;
- n is the number of observed values;
- k is the number of independent variables in the unrestricted model.

This value has to be compared with the critical one $F_{(m, n-k-1)}$. If $F > F_{(m, n-k-1)}$, then we can reject H_0.

In our case, we have the following results in Table 17:

Table 17. Value of the F-statistic

RSS – unrestricted model	47.808
RSS – restricted model	51.0139
F – statistic	5.29756
Critical F	3.96

Source: Authors' calculation

Because F-statistic>Critical-F, we can conclude, with 95% confidence, that H_0 is rejected; therefore, the restriction is not valid.

An interesting fact must be highlighted. Because the sum of the estimators is less than 1, from the econometric point of view, we can see that the development is not (quite) a boom. In fact, the evolution is a moderate one.

4. Conclusions

As we have seen, the model that we have determined is significant related to the type of the ownership and overall, and it is not significant in relation with the type of activity. From the economic point of view, that means the sector is attractive for the investors no matter what type of activity they want to develop (production or outsourcing). The main reason that makes them invest is the well prepared and relatively low cost workforce.

All four models that we have determined (see 3.2.2 and 3.2.3) show that, under favorable conditions (increase in turnover, decrease in liabilities and/or liabilities/capital ratio), the trend of the profit is ascending, making from this sector an interesting one for the investors (Romanian or international). On the other hand, our models show that this possible increase of the profit is a moderate one (for example, both log-linear models show that the profit is rigid in relation with the turnover and liabilities or liabilities/capital ratio).

The hypotheses tested in section 3.2.4 show (similar to point 2 of this section) that the development of the sector is rather a moderate one not a "booming" one. Even if most people are expecting to find that this development is a rapid one, the results obtained are normal if we take into consideration the fact that the process of developing Cluj-Napoca as an IT pole is at the beginning. Nevertheless, the signs are favorable to an acceleration of this development.

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