

# Venture Capital and Leveraged Buyout: What Is the Difference in Eastern Europe? – A Cross-Country Panel Data Analysis

Mihai Precup<sup>1</sup>

**Abstract:** *The aim of this paper is to compare the determinants of leveraged buyout activity, respectively venture capital activity in Eastern European countries. Additionally, this paper presents the main highlights in terms of evolution of leveraged buyout investments and venture capital investments during the recent crisis in the European emerging countries. The panel data analysis used in this paper will include determinants consecrated in previous studies such as GDP growth, market capitalization or R&D expenditures, as well as new variables such as productivity and corruption index. In order to estimate a panel data model with fixed and random effects, we collected data on leveraged buyout activity, respectively venture capital activity in Eastern European countries over the period 2000-2013. This paper will follow the methodology developed by Gompers and Lerner (1998), Jeng and Wells (2000), Romain and de La Potterie (2004), Félix (2007) and Bernoth and Colavecchio (2014). The present research paper shows that the LBO and the venture capital are differently affected by macroeconomic conditions. Based on our empirical results, we have pointed several strategic directions that are meant to support the development of the leveraged buyout and venture capital markets in Eastern Europe.*

**Keywords:** *Leveraged buyout, venture capital, market capitalization, unemployment rate, corruption, Eastern Europe*

**JEL Codes:** C23, G24, G34.

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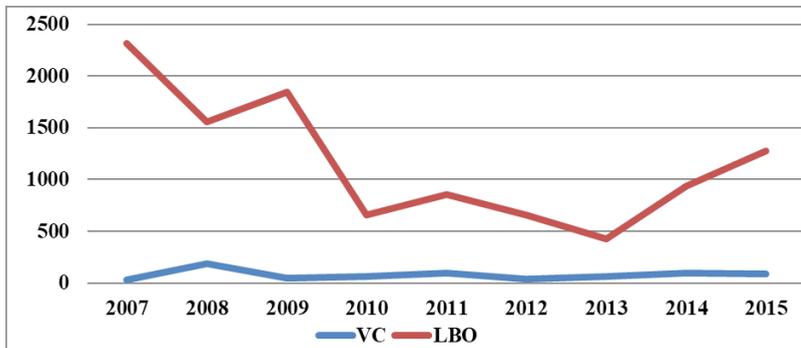
## 1. INTRODUCTION

The 2008 financial crisis strongly affected the LBO evolution: in 2008, 1 554 million euros were invested in Eastern Europe compared to 2 319 million euros in 2007. Venture capital market has not exceeded 100 million euros per year. As illustrated below, the level of venture capital (seed funding, venture early stage and late stage) in Eastern Europe was much lower than the level of LBO during the whole period analysed. Venture capital investments represented on average 0.013% of the GDP per country compared to 0.04% of the GDP for the leveraged buyout operations. This proportion of VC and LBO investments in the country's GDP is reflected in the average size of investments made in start-ups, which is 1.3 million euros when LBO montages are on average 34.6 million.

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Table 1 - The evolution of venture capital versus LBO in Eastern Europe (thousands of euros)



Source: the author based on the information provided by the report „European Private Equity Activity 2015”. Available: [www.evca.eu](http://www.evca.eu). Consulted in January 2017.

Most of the previous studies focused on analysing the determinants of venture capital or separately analysing the determinants of LBOs. Very few studies have tried to use the same methodology to analyse both the VC and the LBO at the same time in order to understand the motivations behind each type of investor. Furthermore, very few studies cover Eastern European countries.

This research tries to complete the literature that compares the phenomenon of venture capital with leveraged buyout. The objective of this paper is to compare the determinants of LBO activity and VC activity in the Eastern European countries. The analysis of panel data used in this paper will include determinants from previous studies (GDP growth, market capitalization, research and development expenditures, interest rates, etc.) as well as new variables such as productivity and the corruption index. At the same time, it is assumed that these activities are influenced by cyclical factors and also by structural factors. Our results confirm existent hypotheses regarding the importance of some macroeconomic determinants on the evolution of LBO activity, respectively on the evolution of venture capital activity. However, in the context of the last crisis new factors emerged important for the LBO and VC market in Eastern Europe such as productivity or corruption.

This study shows that macroeconomic determinants affect LBO investment and venture capital investments differently. In order to estimate a regression on panel data, fixed effect models and random effects models were used. The data used in this study covers the period 2000-2013 and analyses a sample of 8 groups<sup>2</sup> of countries from Eastern Europe. It should also be pointed out that the same groupings for East European countries used in our econometric models is also used by the *European Venture Capital Association* (EVCA) for the same reasons concerning the availability of data.

<sup>2</sup> Bulgaria, Czech Republic, Poland, Romania, Baltic States (Estonia, Latvia, Lithuania), States of the former Yugoslavia (Serbia, Bosnia and Herzegovina, Slovenia, Montenegro, Croatia, FYROM), Ukraine and Hungary, Slovakia.

The paper will be organized as follows: Section 2 will present the differences in terms of investment process for venture capital, respectively for leveraged buying. Section 3 will describe the cyclical and structural macroeconomic variables and will present the main studies that have advanced knowledge about the phenomenon of LBO and venture capital. Section 4 will present the methodology and will describe the equilibrium model of private equity investments and the Hausman specification test which will allow us to compare the consistency of fixed effects models and random effects models. Section 5 explains the results of our econometrical models and Section 6 concludes the research paper and points out several strategic directions that are meant to support the future development of venture capital and leveraged buyout investments in Eastern Europe.

## **2. INVESTMENT PROCESS: WHAT IS THE DIFFERENCE BETWEEN VENTURE CAPITAL AND LEVERAGED BUYOUT?**

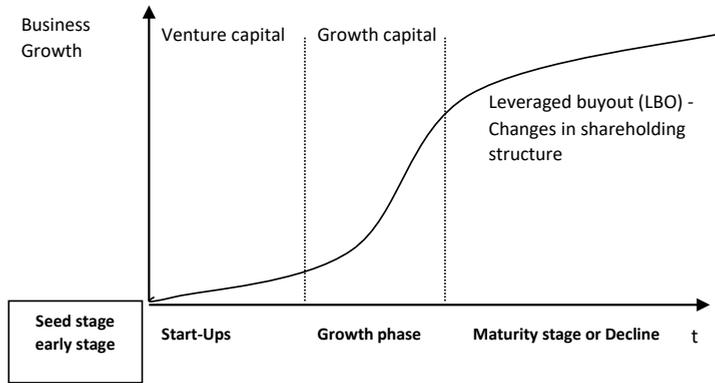
Private equity is a heterogeneous activity. There is a strong distinction between venture capital activity and LBO activity. VC investments are aimed at financing the start-ups with high growth potential. The objective of LBO operations is to finance transfers of ownership: companies are usually bought, restructured to improve performance and generate more value added and then sold. The idea of an LBO transaction is to eliminate the “*main agent*” problem that arises due to the difference in ownership and control for the state own companies: by introducing a more direct link between the ownership and the manager, the interests will be better aligned. The fact that LBO operations target non-listed companies, the pressure exerted by listed companies to sacrifice longer-term objectives for short-term performance is removed.

Venture capital is perceived as a long-term investment which is financed through funds which are raised for 10 years without being renewed. Furthermore, the size of the VC funds is lower than for LBO funds and involves greater risks than for an LBO, financial returns for VC investments are sometimes insufficient. The fund manager is required to have a deep understanding of the technical aspects of the sector when an institutional investor finances venture capital funds, however this knowledge of technical aspects is not widely shared within the institutional investor community.

Table 2 shows that private equity plays a role in financing companies at all stages of life, from the creation, to the development and then to the maturity of the company. Venture capital provides equity to start-up businesses, typically innovative small and medium-sized enterprises (SMEs), which are essential to ensure the sustainability and dynamism of Eastern European economies.

The VC funds and LBO funds invest in unlisted companies with the same objective of reselling them to realize a capital gain. Nevertheless, VC and LBO investments differ according to the type and size of the companies in which they invest and the financial tools they use. Subsequently, we will explore in detail these differences of the two types of private equity investments.

Table 2 - Stages of the company life cycle

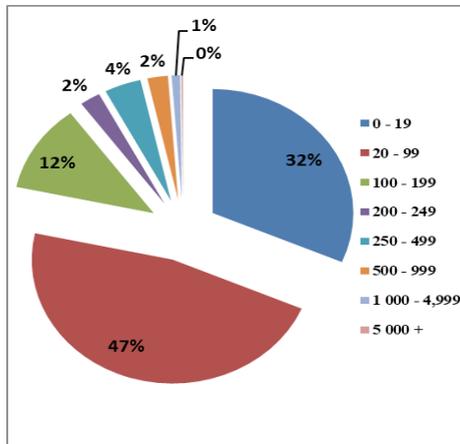


Source: The author

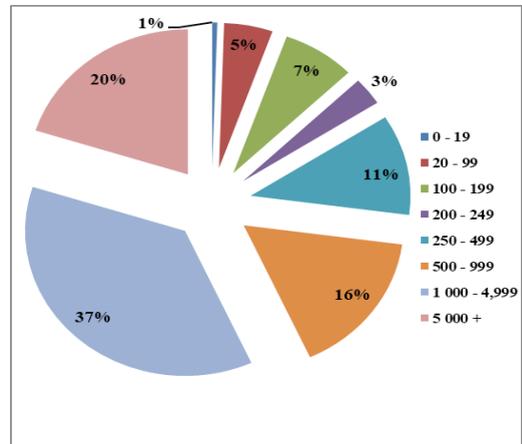
*Companies targeted*

LBO investments are aimed at achieving a majority takeover of a mature company operating on a stable market, enabling it to generate recurring cash flows. In addition, leveraged buyout operations also aim to finance mature businesses that are often undervalued and are experiencing difficulties or wish to grow. On the other hand, VC investments seek to provide equity to start-ups or expanding firms with irregular cash flows streams, no solid collateral and operating in technology sectors.

Table 3 - In Europe: Breakdown of investment volume by number of employees / company (2007-2015)



Venture Capital



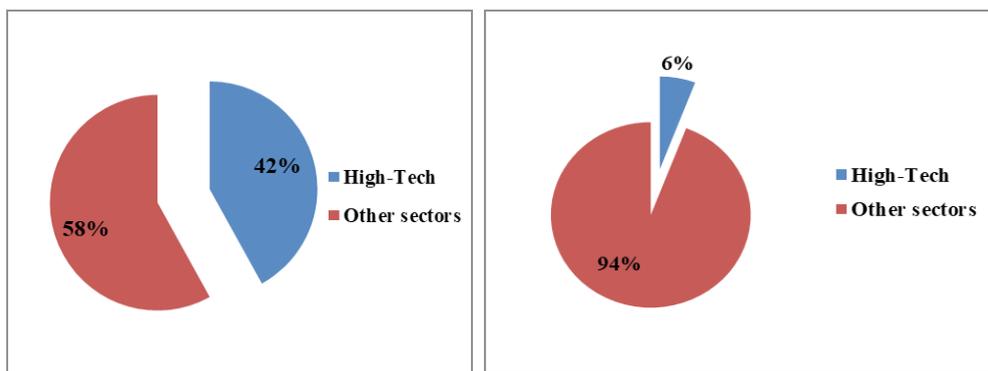
Leveraged Buyout

Source: the author's calculations based on the information provided by the report "European Private Equity Activity 2015". Available: [www.evca.eu](http://www.evca.eu). Consulted in January 2017.

Table 3 shows a high concentration of LBO investments in companies with more than 1,000 employees. In Europe, the LBO investments breakdown shows that: 37% of LBO investments went to companies with more than 5,000 employees; 20% to companies between 1,000 - 4,999 employees and 16% to companies between 500 - 999 employees. As regards VC investments, the majority of these investments (79% of all investments) went to small companies (with less than 99 employees) and 32% of the total VC at the European level went to companies with less than 19 employees.

*Industries targeted*

Table 4 - In Europe: The share of economic sectors in VC and LBO investments in 2007 vs. 2015



Source: the author based on the information provided by the report “European Private Equity Activity 2015”. Available: [www.evca.eu](http://www.evca.eu). Consulted in January 2017.

Table 4 shows a clear difference between the industries targeted by VC investors and LBO investors. Between 2007 and 2015, European countries benefited of 37.6 billion euros of venture capital investments and 296.2 billion euros of LBO investments. 42% of VC investments were oriented towards high value-added technology sectors such as technologies, biotechnologies and alternative energies. Hence, only 6% of LBO investments were directed towards high value-added technology sectors.

European LBOs have sought to invest in sectors such as retail, communication, transport or industry in general. LBO funds have sought companies in these sectors with a generally well-established market and with well-known products.

*Size of investments*

The data provided by EVCA show that generally VC funds invest less than 2 million euros per transaction. But it should be noted that some large venture capital funds can invest much more. Between 2007 and 2015, LBO funds invested on average for a transaction between 21 and 44 million euros. The size of LBO funds which were raised in Europe during that period ranged from millions of euros up to billions of euros for large funds.

### *Liquidity horizon (time to exit for the investor)*

In general, the LBO funds are interested to exit after 8-10 years of investment when enough value-creation is generated to remunerate the investors. On the other hand, venture capital funds have a shorter investment horizon. These funds exit after 4 years of being shareholders of a company.

### *Role of the fund manager*

The main objective of venture capital funds is to promote the internal growth of the companies from their portfolio. VC fund manager offers their advice, network and monitors business cash burn.

The LBO fund manager may not be involved in the decision making or may give management instructions. The LBO fund manager can go so far as to impose their own executive-management in a company which benefited from LBO investments. Very often, the logic of a leveraged buyout investment is the rationalization of company expenses with a return to the “core business”, limiting the executive-management opportunism.

The theory of “*agency-effect*” is promoted by Jansen and Meckling (1976), Fama and Jensen (1983), Jensen (1986) and Kaplan (1989). This theory asserts that within a company there is always a conflict of objectives between shareholders and professional management. The theory of the agency in an LBO operation aims to align interests between the executive-management and the shareholder through four types of leverage:

- a. Financial leverage: holding’s debt is fully paid by the result of the target company (which is why the chosen target companies are profitable or potentially profitable companies). The investor will try to increase the expected return on equity invested through the use of debt.
- b. Legal leverage: consists in multiplying the control of the LBO fund by creating a holding company or a succession of cascading holding companies.
- c. Managerial leverage: consists of reinforcing the motivation and loyalty of the management team of the target company by means of profit-sharing schemes guaranteeing an alignment of interests with the investors taking over.
- d. Fiscal leverage: the holding company may deduct interest from the corporate tax if it holds a large stake in the target company.

### *Shares owned by the investment fund*

Venture capital funds are highly specialized and they take minority stakes. The main objective of an LBO transaction is the repayment of the holding’s debt by using the dividends from the target company: Hence, it is important that LBO funds control the target company and these funds often own 100% of the share capital.

### *Financing Structure*

VC funds provide equity or quasi-equity to start-ups or high value-added companies without strong collateral.

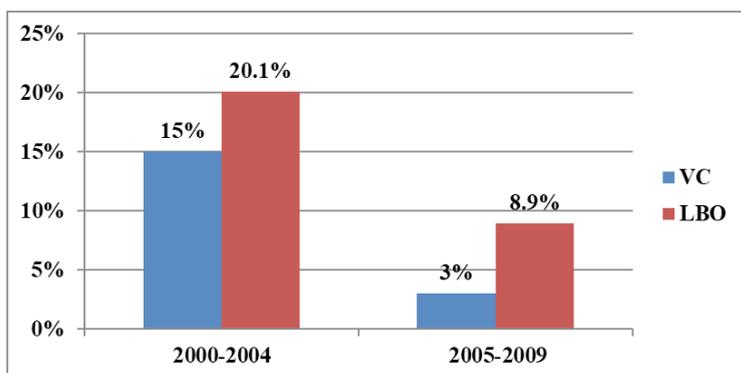
The leveraged buyout funds will buy target companies by using few equity and lot of debt, hence the leverage effect. The aim of the operation is to allow the buyers to buy a

target unlisted company by spending a minimum of money. In an LBO transaction, there is a wide variety of debt types (senior, junior, mezzanine, ...).

Financing of LBO operations is a combination of equity and debt. The “ideal” proportion for acquiring a target company is 40% equity / 60% debt, but this ratio may be different depending on risk aversion and the ability to repay the debt of the target company. In addition, the LBO fund may be viewed as having a risky approach if it will bring only 30% equity and 70% of the debt for the acquisition of the target company, and the LBO fund has a conservative approach if the acquisition ratio is 70% equity / 30% debt.

### *Return on investment*

*Table 5 - Performance of venture capital and LBO in Europe by period of investment*



*Source: information provided by European Venture Capital Association and Thomson Reuters. Available: [www.evca.eu](http://www.evca.eu) and [www.thomsonreuters.com](http://www.thomsonreuters.com). Consulted in January 2017.*

Table 5 shows solid and steady growth, which is often linked to the specific risk of each sector. In theory, LBO funds expect an annual internal rate of return (IRR) of 20%. VC funds invest in very risky companies, hence many happen to fail short after the investment. However, among these failures is the rare pearl that will become a future leader with exponential growth.

The performance offered by leveraged buyout operations was quite high in the European countries. Private equity investments offer a higher return than the one offered by the listed companies due to a 3.5% -4% “non-liquidity” premium, which is added to the price at which the shares of non-listed companies are traded.

This “non-liquidity” premium is closely linked to a long horizon, generally 10 years, for which private equity investments are made compared to the investments in listed shares which have a particularly short term horizon (days and even hours).

### **3. LITERATURE REVIEW**

The most relevant studies for this paper are the ones which are led by the following authors: Gompers and Lerner (1998), Jeng and Wells (2000), Romain and de La

Potterie (2004), Félix et al. (2007) and Bernoth and Colavecchio (2014). To examine the determinants of VC and LBO in Eastern European countries, first we will start by reviewing the dependent variables which were already confirmed by the literature and second we will introduce new dependent variables which we consider important for Eastern European market. The determinants of VC and LBO in Eastern European countries can be broadly classified into cyclical and structural factors:

*Cyclical factors*

➤ Economic growth: the first macroeconomic determinant for VC and LBO activity is expressed by real GDP growth per country. It is expected that economic cycles will have different impacts on the evolution of venture capital, respectively on LBO investments in the Eastern European countries. This indicator is important for our analysis due to the fact that it will study among others the contraction of economic activity during the last crisis. Gompers and Lerner (1998), Romanin and de la Potterie (2004), Félix et al. (2007), respectively Bernoth and Colavecchio (2014) validated a positive impact of the GDP growth on the evolution of venture capital in the developed countries of Western Europe and the United States. In our research, we will study whether the conclusions of these authors are confirmed also for the Eastern European countries and also for the LBO activity.

➤ Interest rate: this variable represents the annual real interest rate, which is characterized by high volatility for emerging countries such as the countries of Eastern Europe. Romain and de la Potterie (2004) studied the impact of the long-term interest rate on the evolution of venture capital in 16 OECD countries. The authors confirmed a positive relationship between the two variables. Gompers and Lerner (1998) focused on analysing the impact of the short-term interest rate on the evolution of US venture capital. The short-term interest rate expressed as the yield of US Treasury bills has been shown to have a negative impact on the evolution of venture capital. Authors such as Bernoth and Colavecchio (2014) have not validated in their studies a statistic significant relationship between the interest rate and the evolution of private equity, neither for Western European countries, neither for Eastern European countries.

➤ Unemployment rate: this variable is the total unemployment as a percentage of the total labour force. Félix et al. (2007) have shown that the unemployment rate has a negative impact on the evolution of private equity. Félix et al. (2007) studied the dynamics of the private equity market in 23 European countries between 1992 and 2003. Our study will also test a negative relationship between the unemployment rate and the evolution of venture capital and LBO investments in the countries of Eastern Europe.

➤ Market capitalization: this variable represents the aggregated value of the stock markets in Eastern Europe. Jeng and Wells (2000) considered that the stock market and the number of IPOs are the main drivers of private equity investments. The authors asserted that a dynamic stock market could offer attractive divestment opportunities and could be an important factor of motivation for private equity. Félix et al. (2007) also confirm a positive relationship between market capitalization and the evolution of private equity in Europe. In this study we will continue the work of Bernoth and Colavecchio (2014) who have shown a positive relationship between market capitalization and the evolution

of private equity in Eastern European countries. On the other hand, our research will show the importance of market capitalization on the evolution of venture capital and LBO investments in Eastern European countries.

#### *Structural factors*

➤ **Research and Development expenditure:** This variable reflects the total value of public R&D expenditure as a percentage of GDP. Gompers and Lerner (1998) showed that an increase in R&D spending was followed by an increase in technological opportunities and in the 1990s this had a positive impact on the demand and the supply of venture capital investments in the United States. Romain and de la Potterie (2004) also confirmed a positive impact of technological opportunities on the evolution of venture capital investments. In our study it is expected that R&D expenditure will be higher for venture capital investments than for the LBO. Kaplan (1989) and Smith (1990) consider that LBOs investments would lead to a reduction in research and development expenditure for the companies which have benefited of such investment. Two arguments are advanced to justify this last point: on the one hand, opponents of LBOs believe that this effect is due to the weight of the debt, and on the other hand, LBO supporters argue that this result could be explained by the fact that companies using the LBO would present a profile which requires a low level of R&D expenditure due to their maturity.

➤ **Productivity:** this new variable described the total value-added generated in one year per employee.

➤ **Corruption:** This variable represents the corruption index provided by Transparency International and reflects the perception of corruption in the business environment, including levels of government and legal corruption. Cherif and Gasdar (2009) were among the only authors who studied the impact of corruption on the evolution of venture capital in the United States. For these authors, corruption was significant and had a negative influence on the dynamics of venture capital.

## **4. DATA AND RESEARCH METHODOLOGY**

### *Data*

Data on venture capital investments and on LBO operations was collected for 16 countries in Eastern Europe: Bulgaria, Czech Republic, Poland, Romania, Baltic States (Estonia, Latvia Lithuania), States of the former Yugoslavia (Serbia, Bosnia and Herzegovina, Slovenia, Montenegro, Croatia, FYROM), Ukraine, Hungary, Slovakia. The initial sample of Eastern European countries had to be reduced due to the data available in the EVCA (European Venture Capital Association) reports. The sample covers a period of 14 years, from 2000 to 2013. The sample length had to be reduced due to the availability of data. While in the time series analysis, a 14-year sampling period would limit the number of independent variables that could be included in the regression, in our research the problem is mitigated by the use of panel data.

### *Research Methodology*

In this research paper we use a panel data analysis that includes both a horizontal dimension (i) and a temporal dimension (t). The basic structure for analysis of a panel data regression is the following:

$$Y_{it} = \beta_0 + \beta X_{it} + u_{it} \quad (1)$$

Where  $i = 1 \dots N$  relates to the number of countries and  $t = 1 \dots T$  relates to the number of years for which we conduct the empirical simulations.

Then, we introduce a cross-section fixed effects and a cross-section random-effects models. The fixed effects model assumes that all members of the panel have the same variance and that there is no correlation over time neither across, nor within the members of the panel. The random effects model assumes that the unobserved effect is uncorrelated with each explanatory variable and both could randomly vary over time and from one country to another. Jeng and Wells (2000) argue that the fixed effect estimation provides the best understanding of the evolution of private equity from one country to another; respectively random effects estimation gives a better understanding of the evolution of private equity over time.

As a quality check we will run the Hausman specification test in order to compare the consistency of fixed effects models and random effects models in explaining the evolution of the VC and LBO investments in Eastern European countries.

This study will validate a significant correlation between certain cyclical and structural macroeconomic determinants and the evolution of venture capital and leveraged buyouts in the countries of Eastern Europe during the last years (2000-13). In order to ensure comparability with the results obtained in the literature for similar studies, we will continue to develop the models use by the following authors: Black and Gilson (1998), Gompers and Lerner (1998), Jeng and Wells (2000), Romain et al. De la Potterie (2004), Félix et al. (2007) and Bernoth and Colavecchio (2014).

$$VC_{it} = \beta_0 + \beta_1 VarGDP_{it} + \beta_2 InterestR_{it} + \beta_3 Unemployment_{it} + \beta_4 R\&D_{it} + \beta_5 MarketCap_{it} + \beta_6 Corruption_{it} + \beta_7 Productivity_{it} \quad (2)$$

$$t=1, \dots, 8 \text{ and } t=1, \dots, 14$$

$$LBO_{it} = \lambda_0 + \lambda_1 VarGDP_{it} + \lambda_2 InterestR_{it} + \lambda_3 Unemployment_{it} + \lambda_4 R\&D_{it} + \lambda_5 MarketCap_{it} + \lambda_6 Corruption_{it} + \lambda_7 Productivity_{it} \quad (3)$$

$$i = 1 \dots 8 \text{ and } t=1, \dots, 14$$

*VarGDP* – gross domestic product growth in real terms.

*InterestR* – long term interest rate.

*Unemployment* – unemployment rate for each country.

*R&D* – public expenditure with R&D.

*MarketCap* – market capitalization for each country.

*Corruption* – corruption index as provided by [cpi.transparency.org](http://cpi.transparency.org).

*Productivity* – total value added generated per employee in one year.

## 5. EMPIRICAL RESULTS

### 5.1. Descriptive Statistics

Table 10 shows that the average annual volume of LBO investments has reached high levels, more than 500 million euros in countries such as Poland. The lowest LBO volumes were recorded in the Baltic countries, Bulgaria and the countries of the former Yugoslavia where the size of the unlisted companies is smaller compared to the average of the Eastern European companies and the access to the bank borrowing for these companies is constrained by the lack of a strong banking system.

A dynamic venture capital market has been found in Czech Republic, Poland, Romania and Hungary. In these countries there is also a fairly high demand for venture capital investments compared with the average of the Eastern European countries. Lower volumes of VC investments were recorded in countries such as Bulgaria and Ukraine. The reasons for this underinvestment in venture capital are mainly related to the difficulty of meeting supply and demand, the lack of expertise of venture capitalists and the lack of seed capital. Public measures are proposed to encourage the development of an efficient venture capital market.

### 5.2. Correlations

Table 11 shows that the correlations between venture capital and LBO investment and independent variables are less than 0.5. However, there is a more significant correlation between venture capital and changes in long-term interest rates (about 0.4). In the next part of this research, we will analyse the degree of significance of the relationship between the independent variable interest rate and the evolution of venture capital.

However, many economic variables have the property that they are correlated. This is not surprising given the natural links between variables such as the economic growth and the evolution of long-term interest rates or between the productivity and changes in long-term interest rates.

In the correlations matrix illustrated in Table 11, it is clear that the coefficients of correlation between productivity and R&D expenditures are relatively high, higher than 0.6. This correlation can induce “multi-collinearity” problems and could limit the relevance of the explanation of each variable studied. The most standard solution to address the phenomenon of “multi-collinearity” is to group together the variables that explain the same economic phenomenon (Daude and Stein, 2007) and we will try to avoid analysing the corruption variable and the productivity variable in the same econometric model.

### 5.3. Panel Regression Results

In this research, we will analyse the statistical significance of the impact of macroeconomic factors: cyclical and structural on the evolution of venture capital and LBOs investments.

#### *Cyclical factors*

Table 6 - Cyclical factors of **venture capital** in Eastern Europe

|                       |   |
|-----------------------|---|
| Economic growth       | + |
| Interest rate         | + |
| Market capitalization | - |
| Unemployment rate     | Ø |

*Source: author based on econometric results of this research.*

*(+) a variable which has an effect significantly and positively validated.*

*(-) a variable which has an effect significantly and negatively validated.*

*(Ø) a variable which was not validated.*

By analysing the results of the estimation of the fixed and random effects models presented in tables 12 and 13 of the Annexes, we can conclude that the economic growth, the long-term interest rates and the market capitalization are the cyclical macroeconomic variables that significantly determine the evolution of venture capital investment in the Eastern European countries.

Economic growth had a positive influence on the evolution of venture capital activity. This relationship was confirmed in the case of fixed-effect estimation and in the case of random-effects estimation where our models show a positive and statistically significant coefficient for the economic growth. Our research confirms the results of the studies carried out by the following authors: Gompers and Lerner (1998), Romain and de la Potterie (2004), Félix et al. (2007), Bernoth and Colavecchio (2014). These authors validated a significant and positive statistical relationship between economic growth and venture capital evolution in developed countries of the Western Europe and the United States.

The evolution of long-term interest rates has had a positive influence on venture capital activity in Eastern European countries. Our econometric models validated this relationship with a probability of 99% and these results confirm the conclusions of Romain and de la Potterie (2004) and Félix et al. (2007). These authors argue that the increase in interest rates has a favourable impact on the demand for venture capital investments because for the management of an unlisted company if the long-term interest rate rises, then its motivation to apply for a bank loan to develop the company will decline and this management will turn to venture capital investors.

On the supply side of venture capital investments, the authors Stiglitz and Weiss (1981) show that information asymmetry plays an important role in credit rationing and

the financing of risky projects by credit markets. In the presence of adverse selection in venture capital markets in certain types of market equilibria, venture capitalists only finance a limited number of innovative projects, thus selecting the most promising projects in terms of quality and opportunities of success, whereas it would be more cost-effective for them to finance additional projects. In other words, they ration their investments and set aside quality projects.

Tables 12 and 13 show that the market capitalization has had a significant negative impact on the evolution of venture capital in Eastern European countries, which is in contradiction with most of the previous studies. Our research has shown that venture capital investments target companies at the beginning of their cycle of life, companies which are not yet large enough to be publicly traded. It should also be noted that if stock markets develop further in Eastern European countries, the investors will be less attracted by venture capital deals and in the same time they will be more interested by segments of private equity (e.g. capital growth) which offer better exit opportunities.

This study did not validate a statistically significant relationship between the unemployment rate and the evolution of venture capital in Eastern European countries. Our conclusion is that an increase in the number of unemployed people does not necessarily translate into more entrepreneurs wanting to open their own start-up.

*Table 7 - Cyclical factors of LBO in Eastern Europe*

|                       |   |
|-----------------------|---|
| Economic growth       | Ø |
| Interest rate         | Ø |
| Market capitalization | + |
| Unemployment rate     | Ø |

*Source: author based on econometric results of this research.*

*(+) a variable which has an effect significantly and positively validated.*

*(-) a variable which has an effect significantly and negatively validated.*

*(Ø) a variable which was not validated.*

Market capitalization was the only cyclical variable that was validated as statistically significant for the evolution of leveraged buyout in Eastern European countries. Our study showed a positive relationship between stock market development and the evolution of LBOs, which allows us to state with a 99% probability that the existence of developed financial markets is essential for a country that wishes to attract LBO investments. The authors such as Black and Gilson (1998), Jeng and Wells (2000), Felix et al. (2007) and Bernoth and Colavecchio (2014) also showed the importance of stock market development in the evolution of private equity, in general.

The other cyclical factors analysed in this study such as economic growth, long-term interest rates, market capitalization, and unemployment rates were not validated as statistically significant determinants of LBO trends for the Eastern European economy.

Our results confirm the findings of the study conducted by Bernoth and Colavecchio (2014) who studied the phenomenon of private equity in Eastern European countries. In their study, Bernoth and Colavecchio (2014) did not validate a statistically significant relationship between private equity and the following variables: real GDP growth and interest rates.

*Structural factors*

*Table 8 - Structural factors of **venture capital** in Eastern Europe*

|                 |   |
|-----------------|---|
| Productivity    | Ø |
| R&D expenditure | + |
| Corruption      | + |

*Source: author based on econometric results of this research.*

*(+) a variable which has an effect significantly and positively validated.*

*(-) a variable which has an effect significantly and negatively validated.*

*(Ø) a variable which was not validated.*

R & D spending as percentage of GDP and the corruption were the structural factors that had a significant statistical impact on the evolution of venture capital in Eastern European countries.

This study showed that R&D spending had a strong positive impact on venture capital investments, confirming the results of the research led by Gompers and Lerner (1998) and Romain and de la Potterie (2004). Gompers and Lerner (1998) show that the innovative capacity of companies has benefited most from venture capital investment. These companies have issued more patents than those where the shareholder does not have benefited from venture capital investments, which illustrates a greater innovative capacity. The companies supported by venture capital adopt more innovation strategies and less imitation.

On the supply side of venture capital investment, Kortum and Lerner (2000) show the effectiveness of venture capital in generating innovation. The authors claim that one dollar invested in venture capital contributes to three or four times more to patent filing than a dollar spent on traditional R&D. In order to generate patents, venture capital is thus a more efficient investment than traditional R&D.

Corruption has had a positive impact on the evolution of venture capital in Eastern European countries during the period 2000 - 2013, which contradicts the studies mentioned by Cherif and Gasdar (2009). The two authors have shown a significant and negative statistical relationship between corruption and venture capital investment in the developed of Western European countries.

Productivity was a new variable introduced in our models to study the impact on the evolution of venture capital in Eastern European countries. Productivity was not validated as a statistically significant variable.

*Table 9 - Structural factors of LBO in Eastern Europe*

|                 |   |
|-----------------|---|
| Productivity    | Ø |
| R&D expenditure | - |
| Corruption      | + |

*Source: author based on econometric results of this research.*

*(+) a variable which has an effect significantly and positively validated.*

*(-) a variable which has an effect significantly and negatively validated.*

*(Ø) a variable which was not validated.*

R&D spending had a strong negative statistical impact on the evolution of LBOs in Eastern European countries. For authors such as Kaplan (1989) and Smith (1990), the debt repayment in LBO montages is at the expense of investment in business research and development. In addition, both authors argue that LBOs target companies at maturity of their life cycle and these companies have low R&D expenditure requirements.

In this study, corruption has been statistically validated as a facilitator of LBO investment in Eastern European countries. This conclusion confirms the work of Huntington (1968) and Leys (1965) who argue that in emerging countries corruption can be seen as a positive factor for private equity investments that can be seen as a way to compensate for maladministration (eg, bureaucratic or inefficient administration).

Productivity was not validated as a statistically significant explanatory variable for the evolution of LBO operations in Eastern Europe.

#### **5.4. Robustness – Hausman test**

In this paper we had run the Hausman specification test in order to compare the consistency of fixed effects models and random effects models. The null hypothesis of the Hausman test suggests that the coefficients of both estimations with fixed, respectively with random effects are consistent but only the coefficients of the estimation with random effects are more efficient for our model. Hence, the acceptance of the Hausman null hypothesis will lead us to conclude that the estimation with random effects is more suggestive to explain the impact of the independent variables on the evolution of VC and LBO investments in Eastern Europe.

Our econometric results led to the rejection of the null hypothesis of the Hausman test which suggests that the coefficients of the two fixed-effect and random-effect estimates are coherent, but only the coefficients of the fixed-effect estimate are effective for our econometric models. Tables 14 and 17 of the Annexes show the results of the Hausman test. It can be observed that the null hypothesis of the Hausman test is rejected for the

estimated models because the estimated value for  $\chi^2$  is lower than its theoretical value from the table of the Hausman test. We can therefore choose the fixed-effect estimate as the most optimal for our venture capital and LBO regressions in Eastern Europe.

## 6. POLICY RECOMMENDATIONS

### *Venture capital activity*

An empirical conclusion from this research was that an increase government R&D spending will develop venture capital activity in Eastern European countries. The studies of Lerner (2002), Lorenzi and Villemeur (2009) and Kettani (2011) show the impact of R&D expenditure on the evolution of venture capital in the United States. These authors argue that many of the projects developed by start-ups and supported by venture capital are rooted in research findings and prototypes developed within university laboratories, notably thanks to the Small Business Innovation Research program (SBIR).

Da Rin et al. (2007) argue that to stimulate the performance of R&D spending, companies can address two strategies: (i) purchasing external knowledge (eg technology transfer) and / or (ii) engages the internal means of the company. The role of venture capital investors is also to provide funds for external development through the purchase and consolidation of technology companies (built-up) but very often venture capital investors are specialties which provide technical expertise. To support the active role of business in know-how development, governments could promote public policy to support highly innovative projects by providing subsidies and tax incentives, and by encouraging venture capital investors to invest in risky products.

Another empirical conclusion of our research was that long-term interest rates had a positive influence on venture capital activity. The management willing to develop an unlisted company has to make an arbitrage between bank loan financing and equity financing of venture capital investors. To stimulate the financing of start-ups, governments can encourage tax deductions for investments in unlisted firms which need to be strengthened. Thus, thresholds for tax deductions can be increased in order to attract greater investment from individual investors.

Through the Small Business Investment Companies (SBIC) program, the US government provides low rate loans to start-up and seed companies in the communications and electronics sectors. In Europe, the European Fund for Strategic Investments was launched in 2014 by the European Commission and the European Investment Bank. The objective of this joint initiative was to provide guarantees to reassure banks in order to finance start-ups or to finance venture capital funds.

The governments of Eastern European countries should benefit more from the InnovFin scheme, a joint initiative of the European Investment Bank and the European Commission under the Horizon 2020 program to finance European innovation. InnovFin is expected to provide more than 24 billion euros in loans and equity to innovative companies in order to support final investment in research and innovation.

### *LBO activity*

This research shows that countries with more developed financial markets have benefited more from LBO investments. It should be noted that LBO investments target companies at the maturity stage and the developed financial markets offer better exit opportunities for the shareholders of the unlisted companies. The recommendation is that the governments of Eastern European countries have to take economic measures (e.g. the privatization of large state-owned enterprises), regulation measures (e.g. decrease the conditions for listing a company on the stock market) and tax reforms (e.g. lower the tax on re-invested dividends).

In addition, in order to stimulate LBO investments, the Eastern European governments need to strengthen tax deductions for investments in unlisted companies. Thus, thresholds for tax deductions can be increased in order to attract greater investment from individual investors.

To stimulate the injection of capital into LBO operations, governments can set up funds of funds with public money which could be managed by the National Development Banks, Dubocage and Rivaud-Danset (2003). These funds of funds could draw money from the institutional investors such as the European Investment Fund, the European Bank for Reconstruction and Development or the World Bank.

## **7. CONCLUSIONS**

The final results of this research show that in Eastern European countries the evolution of VC and LBO investments is determined by the same macroeconomic factors but in different ways. Market capitalization has been a cyclical factor that has a significant and negative influence on venture capital investments and a significant and positive influence on LBO investments. It should also be noted that if stock markets develop further in Eastern European countries, the venture capital investments will become less attractive and in the same time the investors will become more interested by other segments of private equity (e.g. growth capital).

The R&D expenditure (percentage of GDP) in the Eastern European countries during the period 2000 - 2013 had a positive contribution to the development of venture capital activity and a statistically significant and negative contribution to the evolution of LBO investments. Authors such as Kaplan (1989) and Smith (1990) considered that debt repayment in LBO operations is at the expense of investment in business research and development. In addition, both authors argue that LBOs target companies at the stage of maturity and these companies have low R&D expenditure needs.

However, the corruption had a strong positive influence on the evolution of venture capital investments as well as on LBO operations. It should be noted that in the literature, there are authors such as Huntington (1968) and Leys (1965), who support the hypothesis that corruption could be beneficial in emerging countries. Due to the hurdles caused by poorly functioning institutions, by an inefficient bureaucratic system that could be an obstacle to investment. These authors believe that the money could remedy the burdens in correct functioning of public administration. In other words, according to this

hypothesis, some corruption in public institutions could solve the inefficiency problem, therefore could be positive for the evolution of investments.

Economic growth and the evolution of long-term interest rates have validated a significant positive and statistical impact only on the evolution of venture capital investments.

The explanatory variables: the unemployment rate and productivity have not been validated in our models as variables having a significant positive and statistical impact neither on the evolution of the venture capital activity nor on the leveraged buyout activity.

The consistency of our econometric models has been validated by the Hausman test. This Hausman test indicates that fixed-effect models seem to be the most appropriate estimation for explaining the evolution of venture capital and LBOs in Eastern Europe.

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ANNEXES

Table 10. Descriptive statistics

|                       | Mean      | Maximum   | Minimum   | Std. Dev. | No. observations |
|-----------------------|-----------|-----------|-----------|-----------|------------------|
| LBO                   | 57 912,35 | 556 316,0 | 0,000000  | 112 826,2 | 112              |
| Venture capital (VC)  | 17 797,48 | 199 640,0 | 0,000000  | 29 133,25 | 112              |
| Economic growth       | 0,033698  | 0,121000  | -0,155481 | 0,042360  | 111              |
| Unemployment          | 0,106630  | 0,206910  | 0,044000  | 0,045015  | 111              |
| Interest rate         | 0,062202  | 0,120000  | 0,021100  | 0,020268  | 96               |
| R&D expenditure       | 0,008479  | 0,021333  | 0,000000  | 0,004006  | 110              |
| Productivity          | 1059,614  | 10552,00  | 3,773930  | 2913,230  | 111              |
| Corruption            | 0,776786  | 1,000000  | 0,000000  | 0,418272  | 112              |
| Market capitalisation | 2,84      | 2,07      | 5,05      | 4,07      | 104              |

Table 11. Correlations Matrix

|                       | Venture capital | GDP growth | Interest rate | Market capitalisation | Unemployment | Productivity | R&D expenditure | Corruption |
|-----------------------|-----------------|------------|---------------|-----------------------|--------------|--------------|-----------------|------------|
| Venture capital       | 1               | 0,111      | 0,446         | 0,004                 | 0,224        | -0,109       | -0,106          | 0,044      |
| LBO                   | 1               | 0,077      | -0,073        | 0,768                 | -0,089       | -0,078       | -0,101          | 0,195      |
| Interest rate         |                 |            | 1             | -0,097                | -0,004       | 0,384        | -0,286          | -0,226     |
| Market capitalisation |                 |            |               | 1                     | -0,054       | 0,040        | -0,063          | 0,071      |
| Unemployment          |                 |            |               |                       | 1            | -0,157       | -0,280          | -0,112     |
| Productivity          |                 |            |               |                       |              | 1            | -0,036          | -0,621     |
| R&D expenditure       |                 |            |               |                       |              |              | 1               | 0,394      |
| Corruption            |                 |            |               |                       |              |              |                 | 1          |

Source: the author

Source: the author

**Table 12. Empirical results with fixed effects models for the VC variable**

| Venture Capital (Fixed Effects) |                      |                       |                     |                     |                         |                      |
|---------------------------------|----------------------|-----------------------|---------------------|---------------------|-------------------------|----------------------|
|                                 | Model 1              | Model 2               | Model 3             | Model 4             | Model 5                 | Model 6              |
| <b>Economic growth</b>          | 304988,2<br>(5,247)* | 270257<br>(4,503)*    | 270886<br>(4,56)*   | 295206,4<br>(5,04)* | 345566,9<br>(5,281)*    | 346096,3<br>(5,142)* |
| <b>Interest rate</b>            | 1288295<br>(6,257)*  | 1204410<br>(5,929)*   | 1183770<br>(5,909)* | 1286836<br>(6,268)* | 1416046<br>(6,516)      | 1415561.<br>(6,449)* |
| <b>Market capitalisation</b>    | -2,767<br>(-3,347)*  | -2,977<br>(-3,172)*   | -3,277<br>(-3,338)* | -3,317<br>(-3,491)* | -2,997<br>(-3,128)*     | -3,007<br>(-3,026)*  |
| <b>Unemployment</b>             |                      | -74555<br>(-0,817)    | -44366<br>(-0,447)  | -105566<br>(-1,162) | -98945<br>(-1,103)      | -96903<br>(-0,933)   |
| <b>Productivity</b>             |                      | -11,76676<br>(-0,694) |                     |                     | -33,36885<br>(-1,637)** | -33,457<br>(-1,618)  |
| <b>R&amp;D expenditure</b>      | 2683975<br>(1,824)** |                       |                     | 2999133<br>(2,01)*  | 3327580<br>(2,240)*     | 3298920<br>(1,986)*  |
| <b>Corruption</b>               |                      |                       | 507.86<br>(0,803)   |                     |                         | 304,73<br>(0,04)     |
| <b>Adjusted R-squared</b>       | 0,631                | 0,612                 | 0,614               | 0,633               | 0,643                   | 0.637                |

Source: the author. In the table there are presented the results of fixed effects panel data models. In parentheses are presented the values of the *t*-statistics for each variable. The *t*-statistics values are significant at the following levels: \* significance at 1% and \*\* significance at 5%.

**Table 13. Empirical results with random effects models for the VC variable**

|                              | Venture Capital (Random Effects) |                         |                     |                        |                        |                      |
|------------------------------|----------------------------------|-------------------------|---------------------|------------------------|------------------------|----------------------|
|                              | Model 1                          | Model 2                 | Model 3             | Model 4                | Model 5                | Model 6              |
| <b>Economic growth</b>       | 284378,3<br>(5,101)*             | 275182,5<br>(5,033)*    | 262017<br>(5,077)*  | 291505<br>(5,141)*     | 314754,9<br>(5,807)*   | 314760,1<br>(5,99)*  |
| <b>Interest rate</b>         | 1177172<br>(6,639)*              | 1203233<br>(6,998)*     | 993468<br>(8,093)*  | 1194187<br>(6,624)*    | 1324882<br>(8,163)*    | 1325900<br>(9,465)*  |
| <b>Market capitalisation</b> | -2,22E-07<br>(-3,097)*           | -1,41E-07<br>(-1,931)** | 2,33E-09<br>(0,047) | -2,15E-07<br>(-2,705)* | -6,97E-08<br>(-1,114)  | 4,97E-08<br>(1,022)  |
| <b>Unemployment</b>          |                                  | 66019<br>(0,918)        | 197494<br>(4,006)   | 37013<br>(0,482)       | 130493<br>(2,097)*     | 191844,7<br>(3,712)* |
| <b>Productivity</b>          |                                  | -3,761<br>(-2,509)*     |                     |                        | -4,316472<br>(-3,503)* | -5,292<br>(-4,122)*  |
| <b>R&amp;D expenditure</b>   | 1989235<br>(1,690)**             |                         |                     | 2055202<br>(1,701)*    | 2075295<br>(2,256)*    | 2804617<br>(3,465)*  |
| <b>Corruption</b>            |                                  |                         | 768,699<br>(2,977)* |                        |                        | -511,9653<br>(0,182) |
| <b>Adjusted R-squared</b>    | 0,460                            | 0,451                   | 0,380               | 0,466                  | 0,457                  | 0,476                |

Source: the author. In the table there are presented the results of fixed effects panel data models. In parentheses are presented the values of the t-statistics for each variable. The t-statistics values are significant at the following levels: \* significance at 1% and \*\* significance at 5%.

**Table 14. Hausman test estimations – Venture Capital estimations**

| Model | Variables  | $\chi^2$ estimated value Hausman | $\chi^2$ critical value | Probability | Ho or Ha* validated | Estimation Efficient |
|-------|--|----------------------------------|-------------------------|-------------|---------------------|----------------------|
| 1     | Economic growth<br>Interest rate<br>Market capitalisation<br>R&D expenditure   | 13,48                            | 9,49                    | 0,009       | Ha                  | Fixed Effects        |
| 2     | Economic growth<br>Interest rate<br>Market capitalisation<br>Unemployment<br>Productivity                                  | 13,23                            | 11,07                   | 0,021       | Ha                  | Fixed Effects        |
| 3     | Economic growth<br>Interest rate<br>Market capitalisation<br>Unemployment<br>Corruption                                    | 47,82                            | 11,07                   | 0,000       | Ha                  | Fixed Effects        |
| 4     | Economic growth<br>Interest rate<br>Market capitalisation<br>Unemployment<br>R&D expenditure                               | 13,11                            | 11,07                   | 0,022       | Ha                  | Fixed Effects        |
| 5     | Economic growth<br>Interest rate<br>Market capitalisation<br>Unemployment<br>Productivity<br>R&D expenditure               | 23,96                            | 12,6                    | 0,0005      | Ha                  | Fixed Effects        |
| 6     | Economic growth<br>Interest rate<br>Market capitalisation<br>Unemployment<br>R&D expenditure<br>Corruption<br>Productivity | 35,99                            | 14,07                   | 0,000       | Ha                  | Fixed Effects        |

Source: the author based on the information provided by Hausman test. \*)  $H_0$  is null hypothesis,  $H_a$  is alternative hypothesis

**Table 15. Empirical results with fixed effects models for the LBO variable**

|                              | Leveraged buyout (Fixed Effects) |                       |                          |                       |                       |                       |
|------------------------------|----------------------------------|-----------------------|--------------------------|-----------------------|-----------------------|-----------------------|
|                              | Model 1                          | Model 2               | Model 3                  | Model 4               | Model 5               | Model 6               |
| <b>Economic growth</b>       | -188766<br>(-0,744)              | -492159<br>(-2,178) * | -364362,7<br>(-1,648) ** | -337569<br>(-1,525)** | -433170<br>(-1,721) * | -410771<br>(-1,591)** |
| <b>Interest rate</b>         | -512596<br>(-0,565)              | -822054<br>(-1,064)   | -745775<br>(-0,986)      | -548816<br>(-0,701)   | -797175<br>(-0,945)   | -822557,6<br>(-0,966) |
| <b>Market capitalisation</b> | 1,726<br>(4,789)*                | 1,026<br>(2,915)*     | 9,041<br>(2,486)*        | 8,997<br>(2,516)*     | 8,397<br>(2,289)*     | 7,987<br>(2,104)*     |
| <b>Unemployment</b>          |                                  | -1475436<br>(-4,322)  | -1286987<br>(-3,486)     | -1589280<br>(-4,639)  | -1602128<br>(-4,657)  | -1513662<br>(-3,807)  |
| <b>Productivity</b>          |                                  | 45,73<br>(0,720)      |                          |                       | 63,01<br>(0,805)      | 59,27<br>(0,748)      |
| <b>R&amp;D expenditure</b>   | 5609112<br>(0,861)               |                       |                          | 10472447<br>(1,833)** | 9889541<br>(1,712) ** | 8674743<br>(1,354)    |
| <b>Corruption</b>            |                                  |                       | 2952,48<br>(1,244)       |                       |                       | 1205,66<br>(0,453)    |
| <b>Adjusted R-squared</b>    | 0,591                            | 0,665                 | 0,671                    | 0,679                 | 0,677                 | 0,672                 |

Source: the author. In the table there are presented the results of fixed effects panel data models. In parentheses are presented the values of the t-statistics for each variable. The t-statistics values are significant at the following levels: \* significance at 1% and \*\* significance at 5%.

**Table 16. Empirical results with random effects models for the LBO variable**

|                              | Leveraged buyout (Random Effects) |                      |                      |                      |                      |                        |
|------------------------------|-----------------------------------|----------------------|----------------------|----------------------|----------------------|------------------------|
|                              | Model 1                           | Model 2              | Model 3              | Model 4              | Model 5              | Model 6                |
| <b>Economic growth</b>       | -194809<br>(-0,865)               | -143097<br>(-0,742)  | -128313<br>(-0,667)  | -240867<br>(-1,215)  | -212302<br>(-1,064)  | -249593<br>(-1,238)    |
| <b>Interest rate</b>         | -311616<br>(-0,570)               | 166594<br>(0,347)    | 72957<br>(0,157)     | -414491<br>(-0,865)  | -68665<br>(-0,132)   | -336109,8<br>(-0,623)  |
| <b>Market capitalisation</b> | - 2.046<br>(9,752)*               | 2.066<br>(11,253) *  | 2.016<br>(10,876) *  | 2,026<br>(11,193)*   | 2.046<br>(11,254) *  | 1,977<br>(10,617) *    |
| <b>Unemployment</b>          |                                   | -191847<br>(-1,026)  | -108733<br>(-0,584)  | -230448<br>(-1,195)  | -274157<br>(-1,406)  | -217814<br>(-1,166)    |
| <b>Productivity</b>          |                                   | -5,781<br>(-1,796)** |                      |                      | -6,14<br>(-1,743)**  | 1,15<br>(0,231)        |
| <b>R&amp;D expenditure</b>   | -2793925<br>(-0,949)**            |                      |                      | -3872278<br>(-1,436) | -3542761<br>(-1,307) | -6820244<br>(-2,166) * |
| <b>Corruption</b>            |                                   |                      | 2025,54<br>(2,074) * |                      |                      | 3094,74<br>(2,087) *   |
| <b>Adjusted R-squared</b>    | 0,574                             | 0,582                | 0,579                | 0,575                | 0,584                | 0,605                  |

Source: the author. In the table there are presented the results of fixed effects panel data models. In parentheses are presented the values of the *t*-statistics for each variable. The *t*-statistics values are significant at the following levels: \* significance at 1% and \*\* significance at 5%.

**Table 17. Hausman test estimations – Leveraged buyout estimations**

| Model | Variables   | $\chi^2$ estimated<br>value<br>Hausman | $\chi^2$ critical<br>value | Probability | Ho or Ha*<br>validated | Estimation<br>Efficient |
|-------|---|--|----------------------------|-------------|------------------------|-------------------------|
| 1     | Economic growth<br>Interest rate<br>Market<br>capitalisation<br>R&D expenditure   | 4,55                                   | 9,49                       | 0,336       | Ho                     | Random<br>effects       |
| 2     | Economic growth<br>Interest rate<br>Market<br>capitalisation<br>Unemployment<br>Productivity                                  | 22,69                                  | 11,07                      | 0,004       | Ha                     | Fixed<br>Effects        |
| 3     | Economic growth<br>Interest rate<br>Market<br>capitalisation<br>Unemployment<br>Corruption                                    | 21,52                                  | 11,07                      | 0,006       | Ha                     | Fixed<br>Effects        |
| 4     | Economic growth<br>Interest rate<br>Market<br>capitalisation<br>Unemployment<br>R&D expenditure                               | 26,43                                  | 11,07                      | 0,001       | Ha                     | Fixed<br>Effects        |
| 5     | Economic growth<br>Interest rate<br>Market<br>capitalisation<br>Unemployment<br>Productivity<br>R&D expenditure               | 25,16                                  | 12,6                       | 0,0003      | Ha                     | Fixed<br>Effects        |
| 6     | Economic growth<br>Interest rate<br>Market<br>capitalisation<br>Unemployment<br>R&D expenditure<br>Corruption<br>Productivity | 21,25                                  | 14,07                      | 0,0034      | Ha                     | Fixed<br>Effects        |

Source: the author based on the information provided by Hausman test. \*) H0 is null hypothesis, Ha is alternative hypothesis