Characteristics and drivers of venture capital investment activity in Romania

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Abstract. *The present paper aims at characterising the venture capital market and identifying factors affecting the venture capital investments activity in Romania in the period 2000-2010. With a view to assessing the intensity of manifestation of various factors on the supply and demand of venture capital we use an econometric model of macroeconomic variables already tested in the literature. We consider, however, that we bring contributions to the approach, by analysing the features of the venture capital market in Romania and impact factors, our work being, at the same time, support in assessing the types of decisions to be adopted by policymakers to the formation of an authentic market and stimulating innovation. Our results indicate that the total R&D intensity is the main determinant of the venture capitals invested in this period in the two phases (for early stages and expansion). A significant incidence, mainly on the supply side, also shows the annual long term real interest rate, while the market capitalisation, the effective marginal tax rate on corporate income, the annual inflation or unemployment rate do not impact on the venture capital. Our recommendations, in terms of formation and development of the venture capital market, look as a priority, strengthening the demand for resources, respectively encouraging of enterprises to innovate, creating of conditions for the supply to be manifested in the seed and start-up stages and the compatibilization of the need for resources with prudential rules by adapting regulations for institutional investors.*

Keywords: venture capital; innovation; enterprise; research and development.

JEL Codes: G24, O31.
REL Codes: 11E, 18F.

1. Introduction

Beginning with the work of researchers as Jaffee and Russell (1976) and Stiglitz and Weiss (1981), the arguments in favour of existing market imperfections that cause difficulty for firms to obtain external financial resources in addition to the internal ones, representing the main constraint on investment decisions, have gained a special attention in the literature. The firms involved in technological innovation may be the most affected by the financial market imperfections that characterize also bank financing (Carpenter, Petersen, 2002). In general, banks lack the skills for ex-ante evaluation and ex-post monitoring of investment projects developed by innovative enterprises. Although, in principle, adverse selection and moral hazard can be mitigated by providing guarantees to creditors (Berger, Udell, 1998), significant proportions of intangible assets in the total assets held by the high R&D intensity firms reduce their access to bank financing. Reduced access to the traditional external resources limits funding and threatens innovative companies to grow. Venture capitals are, generally, considered to be the most appropriate financial resources for the small and medium-sized enterprises (SMEs) that innovate technologically. Venture capital firms do not only provide resources for financing of projects, but they give also experience in research activities and diffusion of innovations, shaping the company's business strategy.

This study contributes by characterising the venture capital market and factors with impact on investments made in Romania. Of the later perspective, we introduce macroeconomic factors identified in the literature. However, there are few studies devoted to the identification of factors affecting the risk capital in Europe and, in particular, in Eastern Europe countries, where the relevant market is relatively young compared with the venture capital industries of Western Europe. The empirical studies in the literature proceed to test the incidence of various factors on the example of OECD countries (Jeng, Wells, 1998, Romain, van Pottelsberghe, 2004, Clarysse et al., 2009) or, of groups of states of the EU (Cherif, Gazar, 2011, Kelly, 2010) that are characterised by heterogeneous markets and institutional conditions. We consider that a nuanced approach, by tacking into account the particularities of the venture capital market, may lead to a better understanding of the incidence and intensity of manifestation of various factors, representing a useful approach in assessing the decisions to be adopted by government policy in order to attract financial resources for innovative enterprises. In principle, measures can be adopted both on the demand and supply side, depending on the factors affecting the two. The supply is determined by the ability and willingness of investors to provide financial resources to funds (limited partners), which, in turn, can be allocated

by the venture capital firms at the level of innovative enterprises. The demand is represented by innovative companies in need of funds. Objectively, the investments are attracted to countries that have developed capital markets and practice tax incentives for attracting of investors. On the demand side, tax incentives for research and development are provided and the implementation, on a larger scale, of measures to create an innovative environment.

Section 2 is allocated to the role of venture capital in the economy and to characterise qualitatively and quantitatively the venture capital market in Romania. The review of the main existing contributions in the literature on the identification of determinants of venture capital investments is allocated in section 3. From these, in section 4 we construct assumptions on the incidence of manifestation of different factors with potential impact on investment in Romania and identify indicators to be incorporated into the econometric analysis in order to highlight the main drivers on venture capital investment activity. The last section concludes and discusses on political implications.

2. The role of venture capital and the market development in Romania

The debate on technological innovation in the private sector cannot ignore the possibilities of financing of enterprises. In principle, firms can use equity, loans or a combination of the two funding resources. The term "venture capital" (or risk capital) can be used in a broad sense, to include all types of capital invested in high-risk projects, including resources from entrepreneurs. The insufficiency of resources available to the entrepreneur to cover the funding needs of projects involves attracting of external funds, equity being the most appropriate according to the innovation risk supported by various investors. This narrow meaning of venture capital is mostly invoked by researchers and practitioners, with reference to the external financial resources of companies, incorporating investments made either by individuals (business angels) by allocating their personal income or by specialised firms (venture capitalists) that carry out investments of resources made available by the various individual investors or financial intermediaries in innovative enterprises. The venture capitals as a result of financial intermediation "refers to equity investments made for the launch, early development, or expansion of a business" (EVCA, 2011, p. 7).

There is a large distinction between venture capital activity and buyout activity. The former tends to be provided to young and start up companies with high growth potential; the later generally involves investment to finance ownership changes: companies are purchased, restructured and improved to add value, and subsequently sold. Depending on the phase of development of the

enterprise, venture capitals can cover early stages (seed and start up) and expansion, excluding buyout operations. Seed capital covers the research, evaluation and development of a commercial idea or business concept, focused on determining its technical feasibility, market potential and economic viability and the start up capital is used to fund the development of a product prototype, initial market research and market-reach activities, and the establishment of a formal business organization. In turn, the expansion capital may be used to finance of production growth, product development, including increasing of working capital.

Although the venture capital firms tend to concentrate their activity in certain geographical areas located in the proximity of universities and research facilities, their geographical horizon of investment is larger than business angels' as a large part of the business plans submitted are rejected. Being in a constant contact with the technological innovation in the sectors in which they operate, the venture capitalists have assessments methods of investment opportunities with potential in obtaining of high rates of return, provide support by monitoring and their active role in the development strategy of firms in which they invest, in research activities, product development and commercialisation. Frequently, such investment opportunities are found in advanced technology sectors.

The funds collected offer investment opportunities to investors in the growing and innovative sectors of the economy and risk diversification. In the same context, the venture capital market provides connections between innovative enterprises in need of funding with sources of capital. The centre of the venture capital process consists in linking investors with innovative enterprises in which they invest. The economic theory emphasises the information asymmetry existing on the capital market that affects the financing possibility of SMEs, particularly those in high-tech industries, based on the difficulty of investors in assessing enterprises. Specialized financial intermediaries, such as venture capital firms, address these issues by professional assessments of projects before providing capital to companies and their subsequent monitoring alleviating agent conflicts between entrepreneur and investor, leading to improving efficiency (Cornell, Yoshie, 2003; Hellmann, 1998).

Kortum and Lerner (2000) showed in their study at the industrial level in the US that the financing from venture capital has a strong positive impact on innovation; on average, a dollar of venture capital appears to be three to four times more potent in stimulating patenting than a dollar of traditional corporate R&D. Diffusion of technologies in the economy leads further to higher productivity and economic and social returns. Gottschalk et al. (2007) compares

the characteristics of German enterprises that have obtained financial resources from private investors, including venture capital firms, with enterprises that have not obtained such resources. Their results show that the first register higher growth rates, allocate more funds to R&D activities, are more innovative and commercialize innovations. Achleitner and Klöckner (2005) show that the rate of employment growth is, on average, higher at the level of firms that have received venture capital financing.

Venture capital have attracted particular attention in practice and in the literature through the positive impact on firms with high growth potential, such as those that innovate in the fields of new technologies, being associated with increasing sales resulted from innovation, industrial development and employment. Most government agencies recognize the importance of mobilization and investing of financial resources in high risk activities, as driving factors of creating innovative firms and sustainable development admitting, objectively, that their access to financing innovation projects is crucial for research and development activities, for obtaining results and ability to be diffused.

Despite the positive incidence in the economy, the size of private equity market, including venture capital, varies considerably over time in the European space. Over the past decade, the total funds raised (private equity) recorded a cyclic evolution, ranging from a maximum of EUR 112.3 billion raised in 2006 to a minimum of 16 billion raised in 2009 as a result of the severe economic crisis in 2009, with an upward trend in 2010 to EUR 20 billion. Over the same period, annual investment has averaged just over EUR 40 billion, peaking at EUR 72.7 billion in 2007 and followed by a decline over de period 2008-2009, growing after at EUR 42.6 billion (EVCA 2011). As a result, the private equity investments related to the average of the 27 EU countries increased from 0.2% of GDP in 2009 to 0.3% in 2010. Venture capital investments in the early stages held the lowest proportion in the 27 Member States. In 2010 they accounted for 8.8% of the total investment (private equity), while 20.3% investments were made in expansion and 70.9% in buyout operations. 44.71% of the total investments were performed in the UK, 13.74% in France, 9.72% in Germany and the rest in other member States in 23010 (calculations by using EVCA data, 2011).

Viewed as a whole, the investment activity in the Central and East-European countries (CEE) showed a similar trend of other EU countries, but the investment size was much smaller, representing less than 3% of the total investments made in the EU. In fact, the venture capital industry in this region is still a young one, with a continuous development since its inception. As in previous years, the investment activity in this region in 2010 was concentrated

in states such as Poland, Romania, Czech Republic and Hungary. In the Figure 1, we show that the size of venture capital invested in the early stages was the lowest and this characteristic has been maintained since the inception of the market:
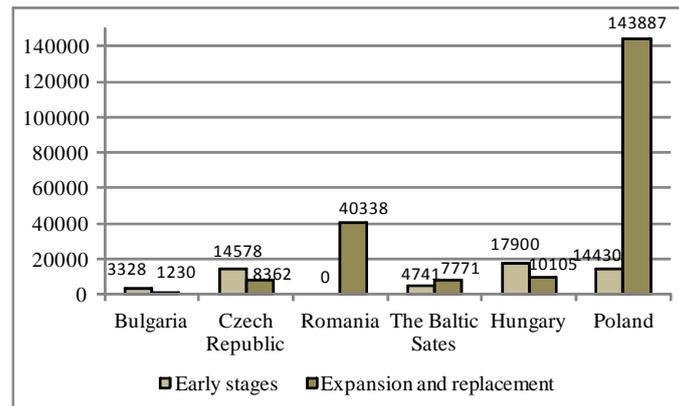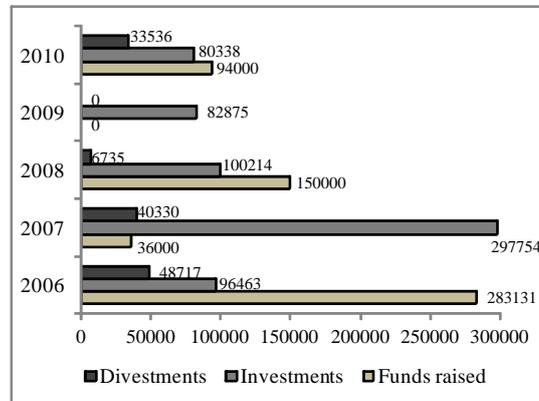

Sources: EVCA (2011).

Figure 1. *Venture capital investment activity in the CEE countries, year 2010 (ths. of euros)*

The concentration of venture capital invested mainly in the expansion stage and buyout also is a characteristic of Romanian market in the period 2000-2010 (Figure 2). Investments in the early stages have been sporadic and maintained at a level between 0 - 15% of the total venture capital invested (15% being recorded in 2002).
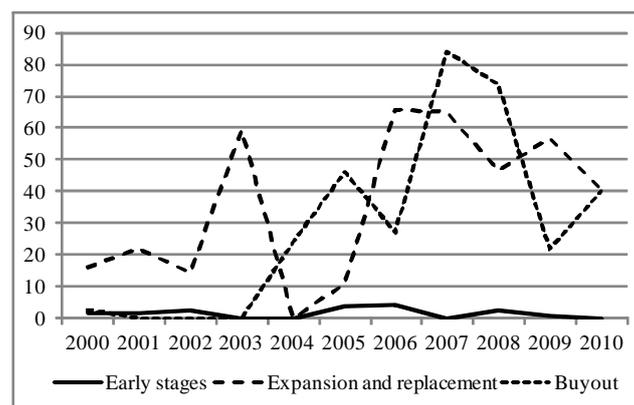
Sources: Eurostat database

Figure 2. *Private equity investments in Romania - evolution* 2000-2010 (mil. of euros)

Sources: EVCA (2011); BVK (2007-2009)

Figure 3. *Venture capital activity in Romania evolution* 2006-2010 (ths. of euros)

Even if the share of investments in expansion and buyout is dominant, its irregular and volatile evolution persists. Investments targeted mainly to the stages of expansion and buyout demonstrate obtaining of more attractive returns at a lower risk profiles to investors in these stages than in early (seed and start-up) stages of the small enterprises. We can admit that the later ones have been adversely affected by the lack of financing due to the absence of the (visible) market segment of individual investors (business angels) and of venture capital of specialized firms.

In general, investments in Romania have been concentrated mainly in the life sciences sectors where 49.8% of the total investment has been carried out in the year 2010, in communications – 14.9%, consumer products, services and retail – 13.6%, energy and environment – 9.7% etc. High-tech sectors have been registered sporadic investments, reflecting the effects of the industrial structure (during 2006-2010 for which we have obtained detailed data, investments in high-tech sectors accounted for 5.6 per cent of the total investment in 2009, 56.60% in 2006 and 0% in other years; data sources: EVCA, 2011 and BVK, 2007-2009).

Funds raised and divestments show also large oscillations (Figure 3) reflecting the fragility of the private equity market in Romania. This feature is even more evident the more funds raised, for example, in 2006-2010, came from European government agencies (external funds counted more than 90% of the total), while investors such as pension funds, funds of funds, insurance companies and banks have been absent from the capital providers spectrum in recent years, being inclusively the consequence of a poor adapted regulatory

framework for making high risk investments. Divestments, in turn, have been performed mainly through trade sales of the companies to strategic investors and not through initial public offering (IPO) – regarded as the signal of a successful venture capital process in terms of yields achievable by venture capital firms and investors (OECD, 2006, p. 96). This has been the dominant divestment mode to unlocking capital, obtaining earnings and their subsequent reinvestment.

3. Literature review on the drivers of venture capital investments activity

Although there are few, some studies undertaken in this area have looked at both the demand and supply side from a general partners and investee company perspective, in order to determine drivers of activity. Some of them have focused on the supply side to understand in particular what makes limited partners to provide funds.

Gompers and Lenter (1998) examine the determinants of fundraising in venture capital industry in the US for the period 1972-1994, reflecting that the demand for funds plays a dominant role, along with the capital gains tax rate. In the same context, the economic growth, the R&D expenditure and performance of firms, reflected by indicators, impact on the supply side of venture capital.

Jeng and Wells (2000) analyze the determinants of venture capital on the example of 21 OECD countries for the period 1986-1995. They use venture capital (in early stages and expansion) as dependent variable, considering also investments made in the early stages and the size of the new funds raised separately. The results obtained show that the various types of investment are affected differently by the factors considered. In this respect, while investments in expansion stage are sensitive to the size of initial public offerings, those made in the early stages are unaffected by the exit mechanisms, but other variables associated with labour market rigidities impact on them, which in turn, do not affect the expansion investments. The growth rate of gross domestic product (GDP) and market capitalisation are variables that do not have a significant impact on venture capital in the Jeng-Wells model.

In the equilibrium model considered, Romain and van Pottelsberghe (2004) test the gross domestic product growth rate, variables reflecting technological opportunities (proxied by the growth rate of business R&D outlays, the business R&D capital stock, and the number of triadic patents), and variables associated with the entrepreneurial environment (the tax rate on corporate income, the entrepreneurial activity index and the index of labour market rigidities) in terms of their impact on both the demand and supply of venture capital. From the empirical study conducted using panel data of 16

OECD countries in 1990-2000, the authors observe that increasing the gross domestic product and interest rate has a positive impact on the venture capital intensity. The indicators related to technological opportunities have also positive impact on the relative size of venture capital, while the index of labour market rigidities reduces the positive incidence of the GDP growth or of R&D spending on the intensity of venture capital. The size of funds raised in the private pension system is another determinant manifested over the time, positively impacting the venture capital invested, without observing differences between states.

In a more recent study, Felix et al. (2007) analyze the determinants of venture capital invested in 23 European countries in the period 1993-2003 using a model in two variants (with fixed and random effects), concluding that the GDP growth rate, the stock market capitalisation and the interest rate explain, by the positive and significant incidence, the amount of venture capital. In the same framework, the sizes of divestments through the IPO mechanism or sale of shares to strategic investors have the most powerful incidence. As Jeng and Well (2000), they intend to identify drivers of various types of investments performed according to the stages of business development. In the high-tech sectors, the GDP growth, the long-term interest rate, the unemployment rate, and the stock market capitalisation have significant impact on investment. In the early stages, the long-term interest rate, the unemployment rate, divestments through IPO mechanism and the price to book ratio of shares are identified to be the main determinants.

Clarysse et al. (2009) use a panel technique to identify supply and demand drivers of venture capital activity for the UK (1985-2006), Israel (1999-2007) and the US (1980-2007). They found that the amounts of early stage and total VC invested in the three countries are determined by three main factors, namely total entrepreneurial activity (as measured by the Global Entrepreneurship Monitor), the stock market capitalisation, and the R&D expenditure.

Looking purely at the supply side, and focusing on the supply of funds from limited partners to general partners, Groh and Liechtenstein (2009) undertake a study to see the attractiveness of Central and Eastern Europe for risk capital investors. Their study is based on questionnaires addressed to institutional investors, asking them about the importance of several emerging markets allocation criteria, which yields a tailored ranking of an emerging countries' attractiveness for private equity investors. In this respect, the authors show that CEE countries are less attractive than the EU-15 average. In this region, investors are attracted by a lower tax rate on corporate income arising as the strength of these countries, but they are discouraged by low liquidity of

national capital markets. In a further study, Groh and Liechtenstein (2010) present detailed results of the composite indices constructed based on the same indicators used in their 2009 paper to compare the attractiveness of 27 European countries (on the six tier groups of attractiveness, namely tax regime, protection of investors and corporate governance, human and social environment, entrepreneurial culture and opportunities, prosperity of economy and size and liquidity of national capital markets). They find that the UK is the most attractive country to institutional investors, followed by Denmark, Ireland, Sweden and Norway. Germany is more attractive than the average of EU countries, followed by France, Italy and Spain. In the same framework, by ordering states according to their index, Bulgaria, Greece, Slovakia and Romania are the least attractive. Romania is considered to present the main strengths on the low level of corporate income taxation and strong investor protection (considering adequate information provided), the low attractiveness resulting from a weak entrepreneurial culture (measured by the EIS innovativeness index, the R&D intensity etc.) and a weak activity of the capital market (low liquidity and the difficulty to identify the potential partners in exit operations).

4. Drivers of venture capital investments activity in Romania

4.1. Assumptions regarding the incidence of different factors
Existing studies in the literature on the determinants of venture capital investment activity in various countries aimed at identifying the factors with potential impact on the level and increasing investments and proceed to constructing of indicators reflecting their incidence, followed by testing them econometrically. Generally, such factors can be regarded as cyclical or structural, the last reflecting the entrepreneurial activity and culture formed in the R&D field, the capital market activity, the institutional environment and taxation on corporate income or on capital gains etc. In this section we highlight the mechanisms of manifestation of the incidence of various factors affecting the equilibrium amount of venture capital invested in Romania and opt for the constructing of indicators that subsequently introduce them into the analysis by using a multiple regression model being interested, in particular, of those as a result of fiscal policy promoted.

The evolution of the economy reflected by the GDP growth is associated with an increase on the number of start-ups (Acs, Audretsch, 1994). Also, Gompers and Lerner (1998) and Jeng and Wells (2000) argue that macroeconomic expansion reflects an increasing number of start-up enterprises that leads further to raising of the venture capital demand. In the same time, an

increasing trend of the GDP growth leads to enlarge expectations regarding the gains obtainable by divesting, with potential impact to increasing the venture capital supply. Under these assumptions, we expect a positive relationship between the increase of the annual GDP growth rate and the supply of venture capital for innovative enterprises.

The rate of return on the financial market can be considered a factor affecting venture capital investments. Gompers and Lerner (1998) show that the level of interest rates can influence the venture capital supply. Since investing in bonds can be an alternative to venture capital investments, when the interest rate increases the attractiveness of making investments in high risk activities diminishes. Thus, for a given rate of return from the high risk activities, there will be a lower supply of funds. On the other hand, if one considers the cost of bank loans to increase as the interest rate grows, this can lead to increasing demand for venture capital from innovative enterprises. Under these assumptions, in which the interest rate variation influence both the demand and supply of venture capital, the incidence on the venture capital invested depends on the net (equilibrium) effect resulted. In our analysis we use the annual real long-term interest rate and formulate the hypothesis that the effect of the interest rate on the amount of venture capital invested will be negative if the (unfavourable) effects on the supply are higher than the (favourable) effect on the demand.

At the same time, it is recognized that an economic space characterized by a well functioning of the capital market is attractive to investors. Exit operations of venture capitals require *liquid market*, allowing investors to unlock their funds and achieve gains from investments. In general, variation of indicators reflecting favourable changes of the capital market in terms of its size and liquidity facilitates the increase of venture capital supply. Also, some authors (Schertler, 2003) argue that the stock market liquidity is a prerequisite in creating skills. Entrepreneurs seeking to sale their affairs on the stock market become candidates of the venture capital firms and are able to provide managerial support and funds to other firms. These arguments have empirical support in the literature. Gompers and Lerner (2000) note that the activity of venture capital firms is enhanced in countries with developed capital markets. Clarysse et al. (2009), Kelly (2010) and Cherif and Gassing (2011) identify the positive impact of the market capitalisation on the venture capital investments.

An increase of the market capitalisation has a similar significance to the GDP growth, reflecting expectations of the investors regarding the evolution of the economy. Thus, the market capitalisation growth can lead to the increase in the available funds for venture capital investments enhancing, also, the demand for funds due to favourable expectations coming from entrepreneurs. The stock

market capitalisation can be calculated by multiplying the number of shares with their market values on the stock market. In this study, we use the stock market capitalisation to GDP as indicator of the size and liquidity of the capital market and formulate the hypothesis that the increase of the market capitalisation is a driver to increasing the venture capital investments.

Research and development expenditures. The supply of venture capitals cannot exist without a demand side came from innovative enterprises. From this perspective, innovative enterprises in early stages or expansion generate the demand for venture capitals. Innovativeness of enterprises is a result of the research and development expenses carried out at their level, and of the culture formed in the research and development field which, in turn, is fostered by the government support (public R&D expenditures), including scientific research performed in institutions of higher education and research.

There are numerous empirical evidences to the support of the above hypothesis. Gompers and Lerner (1998) and Schertler (2007) identify a direct correlation between the gross expenditures on R&D and venture capital investments. In addition, Romain and van Pttelsberghe (2004) identify a strong positive correlation between the business expenditures on R&D and venture capitals invested. Clarysse et al. (2009) obtained similar results by using a synthetic indicator of entrepreneurial activity provided by the Global Entrepreneurship Monitor.

Measuring the quality of entrepreneurship focused on innovation activities can be performed by using the R&D intensity (the gross or business expenditure on R&D to GDP) as a proxy. Statistic data of different countries provided by Eurostat show that the supply of venture capital increases to the increase of the technological opportunities of the entrepreneurial environment reflected by the amount of R&D expenditures. Thus, the indicator R&D intensity allows the activity of the high-tech enterprises to be captured. When the gross expenditure on R&D rises, that means that both the number of firms that perform R&D activities and the government support increase. In this frame, we suppose that the increase of both the efforts of the firms in research activities and the culture formed in the R&D field promoted by the government support, reflected in the gross expenditure on R&D, present a positive incidence on the venture capital investments, through the positive impact on both the demand and supply of venture capital funds.

The tax regime is an important consideration for both the funds supplied and demand for venture capitals. An increase of the amount of taxes to be paid on income leads to the reducing of the net rate of return obtainable by entrepreneurs and investors, bearing the same investment risk, with a potential impact of discouraging investments.

The size of corporate income tax, as a result of the tax rate and tax incentives practiced for research and development and diffusion of technologies, influences both the venture capital supply and demand. For instance, the decrease in corporate income taxes is stimulatory to the creation of new businesses and R&D activities, with a potential impact to the increase in demand for risk capital. The supply of funds is, also, driven by reducing the corporate income tax that diminishes the gross rate of return through the reduction of the required rate of return to investments.

Gompers and Lerner (1998) note that the reduction of capital gains tax rates increases the inclination of individuals to become entrepreneurs, including to spin out of existing businesses, leading to the increase of the demand for risk capital. Poterbba (1989) notes that capital gains taxation influence both the demand and the supply of venture capital; the reduction of tax rates leads to increasing the supply as a result of the increase of the post-tax rate of return on investments and, also, stimulates the demand by the increase the number of entrepreneurs who decide to establish new businesses units. It is obvious that, from the perspective of the investee companies (general partners), whereas the largest proportion of returns results from capital gains of existing investments, their tax treatment is included as a determinant of the supply of risk capital.

The empirical evidence on identifying the impact of taxes on venture capital investments is mixed. Gompers and Lerner (1998) find the significant impact of the size of capital gains tax rate on venture capital investments. Romain and van Pottelsberghe (2004) and Felix et al (2007) introduce the corporate income tax rate as dependent variable, but their results do not confirm its impact on venture capital. Other authors, such as Kelley (2010), use sub-indicators provided by the EVCA that cover aspects of the attractiveness of tax systems for venture capital firms concerning fiscal incentives for R&D activities, technology transfer and cooperation between enterprises and research institutions, the creation of innovative firms, contracting researchers and incentives for the supply of venture capitals. Such indicators are available for Romania, but only for two years (2006 and 2008).

In Romania, the tax rates with significance regarding their influence on the venture capital investments didn't suffer major changes over the time. In this respect, the corporate income tax rate was 25% in the period 2000-2005, decreasing to the level of 16% since 2005. In turn, the tax rate on capital gains has been maintained at the level of 1% until 2007, subsequently increasing to 16% (European Commission, 2010). Given on the one hand, the significant fluctuations of the venture capital between 2000-2010 and, on the other hand, the constant size of the taxes on capital gains on long-term intervals, we assume that the latter cannot be used as explanatory variables. Therefore, we try to use

the effective marginal tax rate on corporate income (dimensioned by the European Commission, 2010) as explanatory variable of venture capital presenting, in principle, the advantage of incorporating both the tax rate and tax incentives applied with impact on the amount of taxes to be paid on corporate income.

The institutional environment. The innovative enterprises and entrepreneurial culture generate the demand for venture capital. Such an environment is a necessary condition, without shaping, however, a sufficient frame for the formation and development of venture capital. For manifesting the supply of funds, the investment made by institutional investors need, also, to be protected. The institutional environment must be a suitable one for such investments: to protect the investments made by investors and the allocation of funds to high risk activities to not be discouraged. From the supply side perspective, another condition concerns the existence of an institutional environment that allows investors to create their own investment model. Schertler (2003) notes that the supply of active involvement by experienced venture capitalists is only positive if regulations and contract law do not prevent them from having exclusive control rights (such as board and voting rights) in the enterprises they have chosen to finance.

Another area of importance concerns the pension funds regulations that are, in many countries, the major suppliers of funds for the equity capital industry. It is known, in fact, the development of the venture capital market in the US since 1979, just after changes were made in prudential rules, which allowed pension funds investing in high risk activities. The US experience suggests that a substantial pool of institutional savings, with a flexible regulatory regime, is conducive to the development of the venture capital market. Conversely, in a space with low savings or where institutional savings are affected by rigid regulations, difficulties will be registered in forming and development of the venture capital industry (OECD, 2006). Moreover, it is argued that the result of removing restrictions imposed to pension and insurance funds for investing in private equity funds may be more favourable than the government participation to the formation of these funds (OECD, 2004, p. 26). The empirical studies (La Porta et al., 1997, 1998) confirmed the incidence of the legal framework on the ability of firms to obtain financing resources, especially from abroad.

There are many specific aspects of institutional environment that would be of importance for our analysis. However, it is difficult to capture and quantify them without having the necessary statistical data. We observe, however, that the absence of the private pension funds, at least until the year 20007 (when the Pillar II of private pension funds has been launched) can shape

an explanation of the modest size of venture capital invested in Romania. However, even some countries with well developed funded pension schemes have had only a limited success with venture capital investments. For example, pension funds are important sources of institutional savings in the Netherlands and Switzerland, but the pension fund sector is not a major investor in venture capital in these countries. Many analysts attribute this to rigid regulations that limit investments carry high risk (OECD, 2006). In Romania, since 2011 the limit of the private equity investment has been increased to 10% for both types of pension funds (Pillar II and III). The discouraging regulatory context for venture capital investments is mentioned also by the EVCA (2008), referring to restrictions imposed to the pension funds to invest in unlisted companies and to the lack of tax incentives to promote innovative young firms, of contracting research activities, technology transfer and cooperation between enterprises and institutions of higher education or research.

4.2. Methodology, data and results obtained

To identify the determinants with the strongest incidence on the evolution of venture capitals invested in Romania in the period 2000-2010, we use a multiple regression model defined by the following equation:

$$Y = \alpha + \beta_1 \times X_1 + \beta_2 \times X_2 + ... + \beta_p \times X_p + \varepsilon$$

where:

Y - the dependent (exogenous) variable is the amount of venture capital invested; X_1, X_2,…,X_p are independent variables (predictors); β_i are the regression coefficients; ε is the disturbance term. The following table provides an insight in the variables collected and the sources of the data:

Table 1

Variables included in the model and sources of information used

Variable	Symbol	Sign expected	Sources of the data
The venture capital invested (Y)	Invest	na.	Eurostat
The annual real growth rate of GDP (X_1)	GDP_rate	+	World Bank
The real long term interest rate (X_2)	Int_rate	-/+	World Bank
The market capitalisation to GDP (X_3)	MCA_GDP	+	World Bank
The gross expenditure on R&D (GERD) to GDP (X_4)	GERD_GDP	+	Eurostat
Effective marginal tax rate on corporate income (X_5)	EMTR	-	European Commission (2010)

It is recognized that the impact of the various factors may present different intensity depending on the capital allocated according to the phase of the innovative enterprises (early stages or expansion). However, given still limited size of venture capital in Romania comparing to those recorded in other EU or Central European countries, especially in the early stages, we sought to identify factors affecting the total size of venture capital invested (seed, start-up and expansion). The descriptive analysis characterises the statistical distribution of the variables we use (Table 2):

Table 2

Descriptive statistics[a]

		Invest	GDP_rate	Int_rate	MCA_GDP	GERD_GDP	EMTR
N		11	11	11	11	11	11
	Missing	0	0	0	0	0	0
Mean		37473.3636	4.2182	5.9636	15.2182	0.4382	14.2545
Median		40338.0000	5.2000	6.5000	15.6000	0.4100	11.9000
Mode		0.00[a]	-8.50[a]	10.10	10.00	0.39	11.90
Std. Deviation		23964.05692	4.92195	3.63133	8.06348	0.06691	2.88457
Variance		574276024.055	24.226	13.187	65.020	0.004	8.321
Skewness		-0.100	-1.876	-0.291	0.015	1.059	0.257
Std. Error of skewness		0.661	0.661	0.661	0.661	0.661	0.661
Kurtosis		-1.580	4.434	-1.436	-1.140	0.420	-2.304
Std. Error of kurtosis		1.279	1.279	1.279	1.279	1.279	1.279
Minimum		0.00	-8.50	0.30	2.90	0.37	11.50
Maximum		69761.00	9.40	10.10	26.70	0.58	18.00
a. Multiple modes exist. The smallest value is shown.							

The results of the Table 2 show the mean values of the variables, as well as the larger concentration of values of the variables analysed around the mean. Distributions with positive and negative values of the asymmetry coefficient (skewness) can be observed, indicating the existence of distributions with deviations in either directions (to the right or left). The values for the vaulting coefficient (kurtosis) are generally negative, indicating that the distributions are platykurtic. The value of the vaulting coefficient is bigger than 0 in a single case, indicating a stronger clustering of the values around the central value, the distribution being leptokurtic.

We started the analysis with all variables considered in the model. The correlation matrix between variables is shown below (Table 3):

Pearson correlations matrix

	Invest	GDP_rate	Int_rate	MCA_GDP	GERD_GDP	EMTR
Invest	1.000					
GDP_rate	-0.139 (0.341)	1.000				
Int_rate	-0.597* (0.026)	-0.516 (0.052)	1.000			
MCA_GDP	0.494 (0.061)	-0.057 (0.435)	-0.175 (0.304)	1.000		
GERD_GDP	0.599* (0.026)	0.057 (0.434)	-0.347 (0.148)	0.416 (0.102)	1.000	
EMTR	-0.525* (0.049)	0.175 (0.304)	0.150 (0.330)	-0.772** (0.003)	-0.750** (0.004)	1.000
*. Correlation is significant at the 0.05 level (1-tailed).						
**. Correlation is significant at the 0.01 level (1-tailed).						

One of the factors affecting risk capital not captured in the model is the amount of divestments (sale sales to strategic investors as exit procedure is specific to Romania), due to the difficulty of collecting suitable data for the period 2000-2005. However, we note that, in general, the assumptions we made above correspond to the results obtained concerning the statistical relationship (direct or inverse) between dependent and independent variable (except GDP_rate), registering differences on the intensity of relationships. In this respect, the level of investment is best correlated with Int_rate and GERD_GDP given the statistically significant relationship; a direct one between Invest and GERD_GDP and inverse between Invest and Int_rate. We get low correlations between MCA_GDP and Invest, as well as between Invest and EMTR. However, it follows also strong correlations between predictors as there are between GDP_rate and Int_rate, EMTR and MCA_GDP as well as between EMTR and GERD_GDP, which can give rise to multicollinearity issues. Because the purposes of our analysis is to select the best regression model able to explain the relationships established between the variables analyzed, we tried building several models in this respect. We started the analysis with all variables considered and removed the weakest predictor at every step, respectively the independent variable that determines the smallest reduction of Fisher statistics:

Table 4

Regression coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-18506.240	160985.575		-0.115	0.912		
	Int_rate	-2821.153	1929.105	-0.427	-1.462	0.194	0.788	1.269
	MCA_GDP	890.613	1369.312	0.300	0.650	0.540	0.317	3.152
	GERD_GDP	125943.745	168995.942	0.352	0.745	0.484	0.303	3.305
	EMTR	285.114	5342.979	0.034	0.053	0.959	0.163	6.414
2	(Constant)	-10321.725	45291.831		-0.228	0.826		
	Int_rate	-2854.109	1692.406	-0.432	-1.686	0.136	1.878	1.139
	MCA_GDP	833.269	785.897	0.280	1.060	0.324	0.826	1.211
	GERD_GDP	118980.562	99446.247	0.332	1.196	0.270	0.749	1.335
3	(Constant)	-15027.829	45422.325		-0.331	0.749		
	Int_rate	-2918.196	1704.403	-0.442	-1.712	0.125	0.879	1.137
	GERD_GDP	159532.524	92507.137	0.445	1.725	0.123	0.879	1.137
4	(Constant)	-56532.468	42334.543		-1.335	0.215		
	GERD_GDP	214536.129	95606.249	0.599	2.244	0.050	1.000	1.000
a. Dependent variable: Invest.								

We eliminate the variables of the models until a threshold of significance set for F is not reached by using the backward method of the SPSS software. Our results show that the best model that explains the variation of venture capitals in Romania incorporates GERD_GDP as the only independent variable:

Table 5

The results of the best model explaining the variation of Invest

	Invest – venture capital invested (unstandardized coefficients)
GERD_GDP	214536.129
(Constant)	-56532.462
Model 4	
F-statistic	5.035
Adjusted R-square	0.422
(number of observations)	11

This means that the size of venture capital has the highest sensitivity to the dynamics of GERD_GDP:

$$\widehat{Y} = -56532.462 + 214536.129 \text{GERD\_GDP}$$

According to the model held that highlights the importance of funding research and entrepreneurial culture, as the total R&D intensity increases by 0.2 units investments increase by 42.907 million Euro. Introducing the alternative variable into the analysis, respectively BERD_GDP (used as a proxy for technological opportunities), reflecting the research efforts of enterprises, did not show any impact on venture capital. Although GERD_GDP incorporates, to a large extent, especially research expenditures of enterprises, the dependence

of the venture capital on the global indicator signifies the importance of funding of public sector research that, in turn, drives innovation in the private sector.

Another variable with significant impact on the venture capital invested is the real interest rate (Int_rate); however, its using with GERD_GDP in the same model leads to unacceptable results in terms of probability. Nevertheless, the negative algebraic sign of the interest rate coefficient shows that the impact on the supply of capital has been (on average) larger than on the demand and this can be explained by a shorter vision of financial constraints (or return achievable) at the entrepreneurs than at the level of fund providers.

The venture capital insensibility to the annual GDP growth rate (GDP_rate) is not surprising, as a result of multiple influences that drive economic growth but which are uncorrelated with the size of venture capital investments. We obtain also similar results when this variable is introduced in the absence of interaction with the size of the market capitalisation (MCA_GDP).

The market capitalisation also has no impact on venture capital. We justify entering this as explanatory variable as a proxy of the size and liquidity of the capital market by a dominant proportion of investment performed to the expansion than to the early stages of the enterprise that requires exit mechanisms for investment firms. The insensibility of the dependent variable is relevant for Romanian market and highlights that IPOs have been rarely practiced.

Regarding the incidence of corporate income taxation, by considering the tax rate and incentives practiced and synthesized in the expression of the effective marginal tax rate on corporate income (EMTR), that is insignificant as a result of its constancy on long periods. A similar effect we obtain for the annual inflation and unemployment rate used as predictors (not centralised in the tables 1-4).

The adjusted R-squared obtained for the best model (Table 5) is 0.422, meaning that GERD_GDP as a predictor explains 42.2% of the variation of venture capital investments, which reflect, according to Cohen (1998), a significant incidence.

5. Conclusions and policy implications

The venture capital invested in Romania, in absolute and relative amount (as a proportion of GDP), has been one of the lowest in comparison with the EU average in the period 2000-2010, with a clear investment tendency to the expansion phase of the enterprises. The absence of individual investors (business angels) and almost no supply of venture capital coming from

institutional investors to the early stages of innovative firms have been a major impediment to the development of the R&D intensive industries. Abandoning the R&D projects due to the lack of funding can not be captured by the venture capital variation to the ratio of business expenditure on R&D (BERD) to GDP.

Our results show that the venture capital investment activity in the two segments (to the early stage and expansion) is influenced mainly by the total R&D intensity (GERD_GDP). This result has important implications for the fiscal policy, given the role of venture capital highlighted in section 2. In this respect, stimulating the supply of venture capital requires, first of all, strengthening the demand by boosting enterprises to innovate and development of attractive investment projects, both through mechanisms of direct and indirect support to access the research results funded from the state budget, including the transfer of the research results to business sector to be valued.

In the same context, supporting the supply of funds is necessary for seed and start-ups stages that are uncovered by the intermediated market of venture capital. This measure is able to meet the demand of these stages, including by facilitating development of networks for individual investors by providing of infrastructure support. Since success in each stage of development of innovative enterprise depends on perceived ability to progress to the next stage, appropriate funding mechanisms are needed for each stage. However, increasing the financial resources of innovation can not be achieved by limiting pension funds to invest. Elimination of the restrictive ceiling may be able to provide financial resources for innovative enterprises and raising, also, the expected returns of funds through harmonizing investment risk with anticipated profitability.

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