

The Determinants of Venture Capital Funding in G7 Countries

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Abstract

This paper investigates the main determinants of venture capital funding across G7 countries over 2007- 2017. We extend the equilibrium model from Jeng and Wells (2000) and evaluate four types of factors affecting supply and demand of venture capital including macroeconomic condition, financial market, entrepreneurship environment and technological opportunities. We collect and Compile data from OECD, World Bank, IMF as well as national database, to estimate panel data model. We find that market capital, market capital return, interest rate, unemployment and ease of starting a business have the main impact on venture capital.

1- Introduction

Venture capital is a type of private equity that is a source of finance for technologic start-ups and small and medium enterprises (SMEs). Private equity is an alternative investment class, which is composed of funds and investors that directly invest in private companies. Private equity is an active investor, which means to have an influence over management and flexibility of implementation. Private equity managers generally seek active participation in the company's strategic direction, from developing a business plan to selecting senior executives, introduction to potential clients, the merger and acquisition strategy and identification of business eventual acquire. Since private equity firms have management experiences and knowledge of the business environment, they can lead to better performance and generate high returns on average.

Private equity has several types and strategy for investment: leveraged buyouts, distressed funding, real estate, mezzanine finance, and venture capital.

2- Venture capital: Structure, History and Trend

Venture capital is a financial intermediary, which raise funds from various sources such as pension funds, banks, insurance companies, corporate and private investor and invests in the businesses that are supposed to have high growth potential. Venture capital invests in a business or industry that is a high- risk associated with the high potential return. In fact, venture capital provides capital to a business and take its risk of a failure in order to get high returns for their investment.

The structure of a venture capital firm typically comprises of three parts. First, venture capital fund that refers to a pooled investment vehicle that primarily invests the financial capital of the third-party investors in target companies. Secondly, limited partner (LP) that provides the capital of venture fund, as we mentioned before consist of pension funds, banks, insurance companies, a corporate and private investor. Thirdly, the general partner (GP) that runs the venture capital firm and makes the decisions on behalf of the other parties. The following diagram illustrates the structure of a venture capital firm:

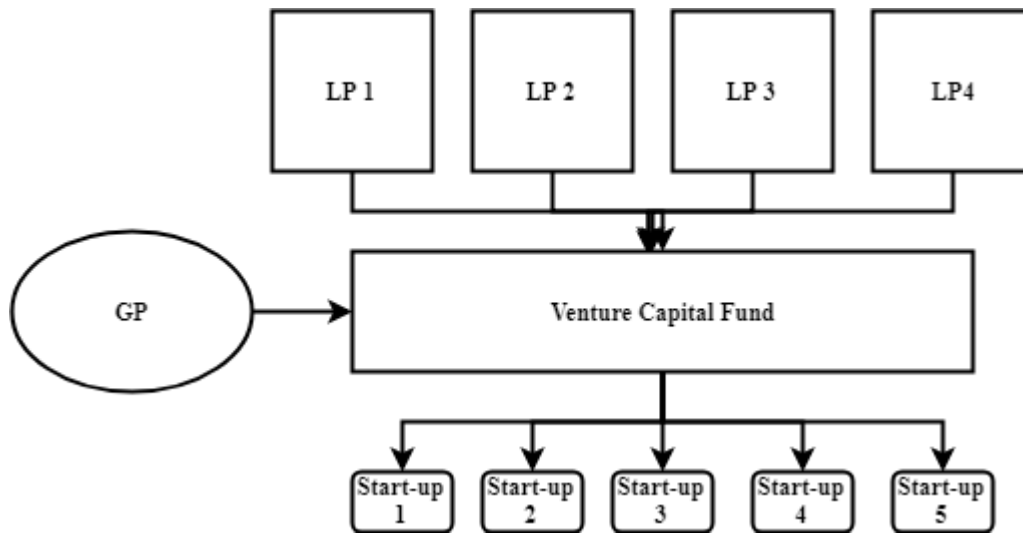


Figure 1- General Structure of Venture Capital Firm

We can summarize the operations of venture capital firms in three parts:

- 1- Venture capital firms serve as an intermediary between investors and entrepreneurs. Venture capital raises fund from many sources like pension funds, insurance companies, banks, corporate and individual and invests in target companies.
- 2- Venture capital firms provide finance for privately held companies. A general partner (GP) on behalf of a group of investors (LP) manages venture capital. GP is a professional to conduct young, fast-growing, and high-tech businesses which need capital to finance product development or growth (Black & Gilson, 1998; Aghion, Bolton, Tirole, 2004)
- 3- Venture capital firms provide capital generally in the form of equity or long-term convertible debt. Convertible preferred equity in the form of financing most commonly used by American venture capital. Varieties of securities are used in other countries (Cumming, 2002).

Venture capital can be categorized by four main factors: size, source of funds, stage and industry of companies that venture capital invested in them.

Although some activist in the market believe that the size and source of funds are not important and do not have an effect on the performance of venture capital, Mayer et al (2005) show that these two factors have an impact on investment activities. They argue that venture capital firms which raise fund from large institutes like banks and pension funds are larger than venture capital that raise fund from a corporate and private institute. In addition, the large venture funds tend to invest in mature enterprises while the small venture funds are more likely investing in start-ups.

There are different stages in the business cycle on how the venture capital funds finance companies. The first stage is the seed funding or seed capital that finance provides to research, assess and develop an initial concept. In this stage, accelerators and angel investors play a key role in addition to venture capital funds. The next stage is called the start-up stage or early stage that venture capital funds finance for product development and initial marketing. In this stage, the companies may be in process of being set up or may have been in a business for a short time, but have not sold their products commercially and will not yet be generating a profit. The third stage is called the expansion stage or later stage, in which the funds are financing for growth and expansion of a company, which is breaking even or trading profitably. The capital that is provided might be used to finance increased production capacity, market or product development, or provide additional working capital. The following famous diagram demonstrates the business cycle of a start-up and the source of finance for each stage.

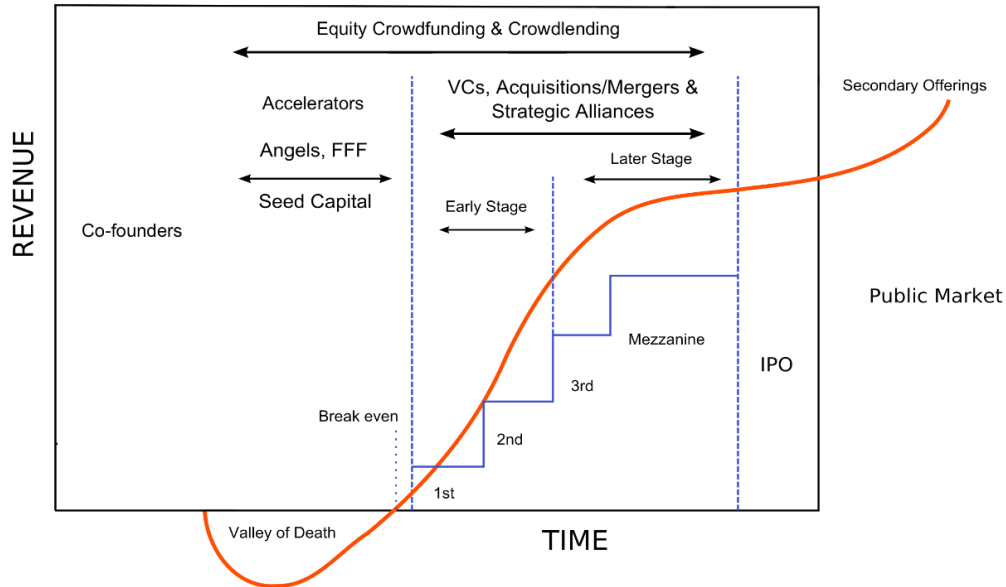


Figure 2- Start-up Financing Cycle, Source: TES Global Limited (2016)

Venture capital tends to invest in cutting-edge technology, science or innovation. The fast-growing industries like information technology, electronics, biotechnology, healthcare, cleantech etc. are tremendously interesting for venture capital. Due to these industries having the adequate potential of the huge advantage of the investment. In fact, there is a strong association between venture capital and advanced technology. In other words, they support software and biotechnology companies rather than a hamburger and retail chains. The chart below illustrates the top 10 industries that are attracting the most venture capital investment in the US in 2017.

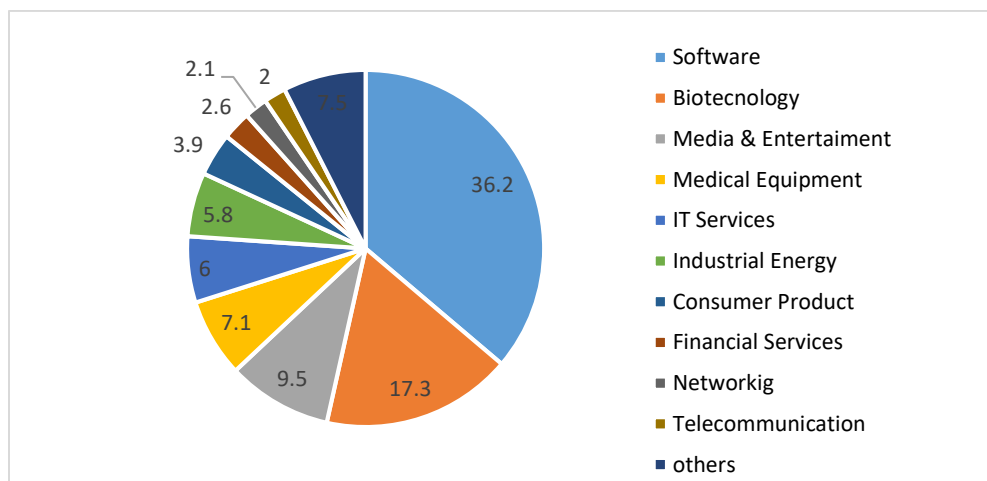


Figure 3- Share of Top 10 Attractive Industries for VC in the US in 2017, **Source:** Martin prosperity institute (2017)

Regarding the share of GDP, the venture capital industry is still small. In the US, which is the world's largest venture capital industry, VC per GDP (VC as a percentage of GDP) in the US was 0.37% in 2017. In other G7 countries, it is even smaller: the VC per GDP in Canada is around 0.15%, in UK, Italy and France is between 0.03% and 0.04% and in Germany is just around 0.001%.

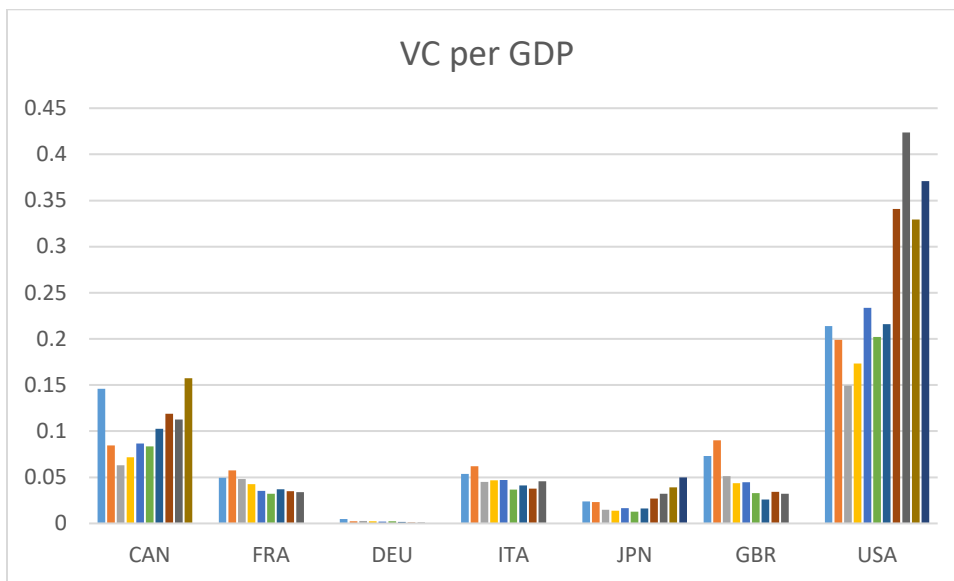


Figure 4- VC per GDP in G7 countries between 2007-2017

Although the share of venture capital in GDP even in the US is small, it has a significant impact on innovation and growth in the economy. Lerner (1999) argues, “On average a dollar of venture capital appears to be three to four times more potent in stimulating innovation than a dollar of traditional corporate R&D”. In terms of social return, the social return of venture capital is significantly higher than the social return of the business or public R&D (Romain and Potterie, 2004).

In addition, when we look at the pioneer and frontier companies in the last decades like Microsoft, Apple, Google, Amazon, Intel... we find that all of them are venture-backed companies. Gompers et al (2017) studied on 4,063 firms with a total market capitalization of \$21.3 trillion in December 2013. They clarify that 18% of the companies (710 out of 4,063) are venture-backed and their total market capitalization is \$4.3 trillion (20%). They find that in order to stay young and fast-growing, these companies spend 42% of their revenue on R&D that is

more than a quarter of the total government, academic, and private U.S. R&D spending of \$454 billion. They also had created four million jobs by then.

Venture capital industry is an attractive subject for economists to study because it is tied to innovation and technology and has a proven impact on economic growth and job creation. In addition, it is interesting to the government for policymaking. In this paper, we study the determinant of venture capital funding and our sample is G7 countries from 2007 to 2017. We develop the Jeng and Wells (2000) model and use panel data to estimate the model.

Venture capital is known to start-ups and innovative entrepreneurship but it might be vague to understand how and when it emerged. And also, why it concentrates on innovation and start-up?

The genesis of modern venture capital can be traced to the US after World War II when the American Research and Development Corporation (ARDC) was founded by George Doriot. He is known as “the father of venture capitalism”. He and his colleagues, Ralph Flanders and Karl Compton founded ARDC to motivate private sector investments in a business run by soldiers who were returning from World War II. Before this time, a business was just financed by wealthy family or credit. In 1968, ARDC invested in Digital Equipment Corporation for \$70,000 that would be valued over \$355 M after IPO (Initial Public Offering) in 1975. It represented the return of over 500 times on its investment that is 101% annual rate of return.

During the 1960s and 1970s, technology was achieving breakthroughs particularly in electronic industry and medical device. Also, entrepreneurs exploiting this opportunity that was interesting to venture capital. Since then, venture capital has become almost synonym to “technology financing”.

In the late 1970s and 1980s, the “prudent man rule” has a huge impact on the volume of fundraising and investment of venture capital. The US Labour Department relaxed certain restrictions for pension funds that led to a major source of capital available to invest in venture capital. Gompers in 1995 has conducted a major industry study and concluded, “Prior to 1979, pension funds were severely limited by ERISA¹ in the amount of money they could allocate to

¹ The Employee Retirement Income Security Act of 1974 (ERISA) is a federal law that sets minimum standards for most voluntarily established retirement and health plans in private industry to provide protection for individuals in these plans

high-risk assets, including venture capital. The 1979 change explicitly allowed fund managers to invest up to 10% of their capital in venture funds.

Pension fund commitments to venture capital rose dramatically. Increasing annual new contributions to venture capital funds from \$100-200 million during the 1970s, to more than \$4 billion by the end of the 1980s”. In addition, the number of venture capital was ramping up. The number of venture funds grew from 47 in 1980, to about 120 in 1984 (Thomson reutrers, 2008 investment benchmark report: venture capital).

Venture capital was playing a key role in developing the major technology companies in the 1980s. Tandem Computers, Apple Inc., Electronic Arts, Compaq, and LSI Corporation are the most notable firms that were developed by the venture capital in this decade.

In the1990s, the internet changed everything. Venture capital firms increased their investment in this sector after seeing the early success of IT companies such as Amazon and Netscape and their IPOs. Moreover, a sustainable growing economy in this decade caused to fundraising and investment to increase sharply. As we can see in the below chart, investment of venture capital increased from less than \$5 billion in 1990 to more than \$125 billion in 2000 which is the top volume of the venture capital history until now (statista.com).

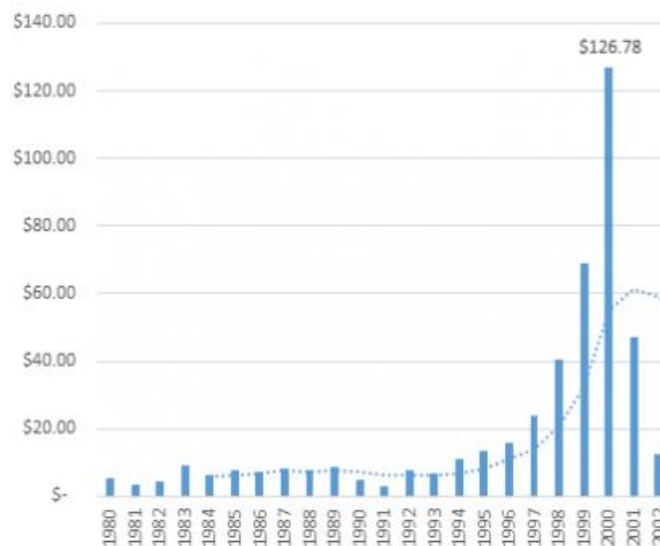


Figure 5- VC Funding in the US between 1980-2002, **Source:** Statista.com

This era is known as a “bubble dot com” because, in 2000, the stock exchange and the share of the IT companies collapsed and after this year venture capital decreased dramatically.

In the 2000s, two occurrences affect venture capital: first, bursting the bubble of the dot com companies affected the performance of venture capital. This caused, the investor of venture capital became conservative to take a risk like before. Secondly, the 2008 financial crisis that affected financial regulation. Both these occurrences restrict venture capital activity.

Nevertheless, the venture capital industry has developed among emerging economies and developing countries. In fact, the economic impact of venture capital that we mentioned in the previous chapter encourages the government of developing countries to establish the funds or relax the business environment to develop the venture capital industry in their countries.

In the last decade, many things have changed. “The economics of starting companies, and investing in them, has changed ... Before the ascendancy of the Internet, venture capitalists invested in areas that had high technical risk and low market risk. It took a lot of capital to get these companies off the ground, but the odds that the company would succeed were relatively high if the company could deliver on its technology promise. Today is the opposite.” (Andy Rachleff, a founder of Benchmark Capital New York Times, *Venture Capital Is Looking for Ways to Outrun the Herd*, 12/10/2014.) According to this argument, most established venture funds prefer to invest in later stage and invest in a large amount when concepts have proved themselves. Therefore, we can see the number of venture deals decreased in recent years while the amount of investment increased (NVCA venture monitor report, 2018).

On the other hand, development of innovative finance ways like crowdfunding² and ICO³ associated with emerging technologies like blockchain⁴ helps start-ups to finance themselves more easily than venture capital in seed and early-stage with less than commitment.

² Crowdfunding is the use of small amounts of capital from a large number of individuals to finance a new business venture. Crowdfunding makes use of the easy accessibility of vast networks of people through social media and crowdfunding websites to bring investors and entrepreneurs together, and has the potential to increase entrepreneurship by expanding the pool of investors from whom funds can be raised beyond the traditional circle of owners, relatives and venture capitalists.

³ An Initial Coin Offering (ICO) is the cryptocurrency space's rough equivalent to an IPO in the mainstream investment world. ICOs act as fundraisers of sorts; a company looking to create a new coin, app, or service launches an ICO.

⁴ A system in which a record of transactions made in bitcoin or another cryptocurrency are maintained across several computers that are linked in a peer-to-peer network.

Another fundamental change that has a strong impact on the venture capital industry is the way of exit. In the past, the most common way of exit was IPO while in recent years, M&A⁵ became an interesting way of exit for venture capital.

We should wait and see how the emerging technology like big data, IoT (internet of things), blockchain, green-tech and biotech will shape the venture capital industry.

3- Literature Review

There are many articles about entrepreneurship, innovation or high-tech finance. In addition, many researchers have studied the role and impact of venture capital in the economy but there are few articles, which have a concentrate on determinants of venture capital funding. Although the domain of these studies is similar and related, technically, there are some discrepancies among them. The reason is the nature of venture capital that we discussed in previous chapters. In terms of model and analysis, the following articles and papers are most related to the target of our study.

Gompers and Lerner (1999) have studied the factors that drive independent venture capital firms in the US for the period from 1972 to 1994. They studied both types of organizational and individual fundraising. They have found that economic factors like growth rate, capital gain tax rate and R&D expenditure affect fundraising demand for venture capital as well as corporate factors like performance and reputation. In addition, regulation change is the main factor to fund a venture capital. They tried to identify which factors effect on the demand side and which factor effect on the supply side. They also found that both sides are affected by the tax rate. Decreasing capital gain tax rate, on one side, motivates commitment of venture capital funds at all level: industry, state and firm. On the other side, it will increase demand for venture investment. Industrial firms R&D expenditure positively influences venture investment. In addition, reputation and performance are positively related to fundraising. For example, older and larger venture capital can raise money for new funds more easily.

Although Jeng and Wells (2000) is not the first study of this subject, it is a fundamental article that all next studies try to develop its model and analysis. Jeng and wells (2000) analyze the

⁵ Mergers and acquisitions (M&A) is the area of corporate finances, management and strategy dealing with purchasing and/or joining with other companies.

determinants of venture capital for a sample of 21 OECD countries between 1986 and 1995. They carry out analysis base on two part of venture capital investment: seed and start-up as an early stage and growth and expansion as a later stage. They also use IPO⁶, GDP growth, market capitalization growth, labour market rigidities, accounting standard, private pension funds and government programs as explanatory variables. A key finding is the dependent variables are differently influenced by the determinant factors of venture capital funding. IPOs positively and strongly affect later stage venture capital, while there is no effect on the early stage. In contrast, labour market rigidity negatively affects early stage but has no effect on a later stage. Private pension fund levels are a significant determinant over time but not across countries for both early and later stage. A surprising finding in their study is that GDP and market capitalization growth are not significant and accounting standard have a negative effect on venture capital funding. The role of governmental factors is considerable: government policies are effective and significant, not only by a galvanizing investment during the downturn but also by setting the regulatory stage.

Romain and La Poteria (2004) expand the subject by developing a theoretical model to clarify the factors that affect the demand and supply of venture capital. Their study contains 16 OECD countries over the period of 1990-2000. They divided the factors into three categories: first, macroeconomic factors including GDP growth rate and interest rate, secondly, technological opportunity factors including business R&D investment growth rate, business R&D capital stock and thirdly, the number of triadic patents and entrepreneurial environment factors contain taxation rate, labour market rigidities, IPO and market capitalization growth.

They conclude that GDP growth and both short term (one-year) and long term (10 years) interest rate have a positive impact on venture capital intensity but the effect of GDP growth is pro-cyclical. They mention the interest rate has a stronger impact on venture capital demand than on its supply. R&D expenditure and the number of triadic patents as factors of technological opportunity are significantly and positively associated with the relative level of venture capital. On the subject of the institutional quality affect entrepreneurial environment, they had found that rigidity in the labour market reduces the impact of the GDP and R&D on venture capital.

⁶ The process of offering shares in a private corporation to the public for the first time is called an initial public offering (IPO)

However, a minimum level of entrepreneurship is necessary to get a positive effect in the venture capital intensity of the available R&D on venture capital.

Felix et al. (2007) expand the equilibrium model from Jeng and Wells (2000) and examine the determinants of venture capital for 23 European countries with the new data from 1992 to 2003. They substitute the unemployment rate as a labour market indicator and add the trade sale divestment and the price/book ratio as the new factors to explain the determinants of venture capital. They have realized that GDP growth rate, interest rate, market capitalization growth and venture capital divestments significantly and positively affect venture capital. They have confirmed that divestment in the type of IPO and trade sales is an important determinant for venture capital financing and investing but in the type of write-offs is not significant. In the case of the unemployment rate and the price /book ratio, Similar to Jeng and Well (2000), they have concluded that different types of venture capital are affected differently by these factors. Their results show that R&D expenditures, TEA index as an entrepreneurial activity are not significant. They mention that in early stage venture capital investing, the long-term interest rates, unemployment rate, the IPO and the price-book ratio are its main determinants.

Cherif and Gazdar (2011) have tested most macroeconomic determinant that was examined in previous studies for 21 European countries for the period from 1997 to 2006 but the append variables capture the institutional environment for the first time. They confirm that GDP growth, market capitalization, R&D expenditures and the unemployment rate as a labour market index are the most macroeconomic determinants of venture capital investments. They have also found that institutional quality affects early stage investments and funds raising differently. Similarly, while funds raised are significantly and positively affected by the index of economic freedom, it has not a significant influence on early stage investments.

Groh and Wallmeroth (2016) expand the subject to examine the determinants of venture capital across developing countries. They studied 118 countries in which 78 are considered emerging market from 2000 to 2013. The main key finding is venture capital investment drivers can be different for developed and developing countries. They have shown that economic magnitude and direction of effect of the determinants are not the same for the two country categories in many parameters. Generally, they conclude that M&A activity, legal rights, investor protection,

innovation, IP protection, corruption and also corporate taxes and unemployment have a significant impact on venture capital.

We summarize the literature review of the determinants of venture capital in the table 1.

4- Factors affecting the venture capital

This section includes the theoretical basis of our empirical analysis and explains the driving forces behind venture capital flows. For the empirical analysis, we use data of G7 countries: Canada, France, Germany, Italy, Japan, UK and the US. The main reason to choose these countries is that they are the developed countries with a robust and similar economic, financial market and technological structure. It is almost clear that the US is known differently in order of economy size. We examine data of these countries over the period of 2007 to 2017 because before 2007, the methodology of collecting venture capital data from European Countries was different. Therefore, we cannot aggregate the data before 2007 and after that.

We do not include all variables that are used in previous studies like IPO for two reasons: first, as it is mentioned, the exit of venture capital has changed fundamentally in the last decade. In the past, IPO was the best way to exit for venture capital while in recent years M&A the become the dominant way. Secondly, using IPO data to compute the motivation of venture capital is deceptive because some portion of IPOs contains the private equity form like LBO (leveraged buyout). In addition, in some cases, the IPO of a start-up is in another country. We could not find the data of IPOs of venture-backed that invest in the same country.

We also examine two forms of some variables. For example, we use educated unemployed and overall unemployment to examine which one is more effective.

Explanatory variables in four categories: 1- Macroeconomic condition 2- Financial market factors 3- Entrepreneurship environment 4- Technological opportunities

1-Macroeconomic condition

The macroeconomic condition affects both sides of venture capital. It is clear that when the economy is in a growing phase and stable, every individual is motivated to participate in economic activities and take more risk in comparison to when an economy collapses. We use the following variable to examine the macroeconomic condition:

1-2- Interest rate

On one side, increasing interest rates have a negative impact on investment because the opportunity cost of investment will be rise. Gompers and Lerner (1999) confirmed this reason for venture capital investing. We use long-term interest rate for this part because the period of investment for venture capital firm is often long-term. Therefore, the venture capital firms compare their opportunity cost with the same period of the interest rate.

On the other side, Romain and La Potterie (2004) argue that the interest rates have a direct impact on the attractiveness of venture capital financing. In other words, when the interest rate increases, entrepreneurs prefer to finance their venture from venture capital funding rather than through financial institutions.

1-3- Unemployment rate

The higher volume of unemployment rate motivates individuals to start a business. Particularly, when the government provides a supporting program for entrepreneurship to make more jobs. Marti and Balboa (2001) have shown that the relation between the unemployment rate and demand for venture capital is positive. However, it might have a negative impact on the supply side of venture capital because the high volume of unemployment is a symptom of recession. Therefore, in the equilibrium model, the impact of unemployment on venture capital depends on either of the two dominants effects.

2-Financial market factors

Flix & Gulamhussen & Pacheo (2007) and Cherif & Gazdar (2011) have found that there is a positive relationship between market capitalization growth and venture capital. We might think the whole role of the financial market is similar to market capitalization but these factors only affect the supply side of venture capital.

2-1- Market capital

As we mentioned before the venture capital investments will be increased by bigger market capital because the larger size of market capital makes more affordability for an investor to provide funds to venture capital. Flix & Gulamhussen & Pacheo (2007) and Cherif & Gazdar (2011) have confirmed this argue.

2-2-Market capital return

We use market capital return issued to examine the effect of capital market on venture capital more accurately because market capitalization shows the effect of size and share of capital market on venture capital while we expect that the market capital return to have a negative effect on venture capital. When the market capital return is higher, the opportunity cost of investment for venture capital investor is higher. Therefore, the supply of venture capital will decrease.

3- Entrepreneurship environment

Unlike the financial market variables that have an effect on the supply of venture capital, the entrepreneurship variables have impact on the demand of venter capital. To examine the effect of entrepreneurship environment, we use the ease index of starting a business.

3-4- Ease of starting a business index

We use the ease index of starting a business that is calculated and provided by the World Bank. It merges some factors that affect the start and running a business such as days and cost related to a business in a country. In addition, it demonstrates the gap of each economy from the best regulatory performance observed on each of the indicators to all economies at the start of aof venture capital is positive business sample since 2005. One can both see the gap between a particular economy's performance and the best performance at any point in time and assess the absolute change in the economy's regulatory environment over time as measured by ease of starting a business.

4- Technological opportunities

There is a strong association between venture capital and technology. In fact, venture capital takes technical risks as well as commercial ones. He supports ICT, biotechnology, nanotechnology and other industries like these. For this reason, we add two factors that show the technological opportunity to start a business and which is attractive for venture capital are added.

4-1- Patent application

A patent is an intangible asset that is attractive for venture capital. Romain and La Potterie (2004) have shown that the number of the patent has a positive impact on venture capital. We will use both kind of patent: resident and non-resident for this variable.

4-2- R&D expenditure

Gompers and Lerner (1999) believe that the growth venture capital fundraising in the mid-1990s may be due to an increase in technological opportunities. In addition, Romain and La Potterie (2004) have confirmed that there is a strong and positive relationship between venture capital and R&D expenditure. We use R&D expenditure in our model. In addition, we examine the effect of government subsidiary for R&D.

Model and Methodology

The purpose of this paper lies in identifying determinants for venture capital funding in G7 countries. As we have argued in the fourth part, changes in the volume of venture capital funds come from changes either in the supply or in the demand of venture capital. The demand corresponds to the setting up an innovative start-up by entrepreneurs. The supply of venture capital comes from the interest of investors to take a risk in providing capital. The investor includes pension funds, banks, insurance companies, corporate and individual investors. The level of venture capital in the market represents the equilibrium between the demand and the supply.

Based on the previous studies Gompers & Lerner (1999), Jeng & Wells (2000) and Romain & La Potterie (2004), we will use a linear model for the supply and demand of venture capital funds. In our regression analysis, we estimate the coefficients of the equilibrium specification

The equation that describes the venture capital supply is the following one:

$$\text{Venture capital Supply}_{it} = \alpha_0 + \alpha_1 \text{Market capital}_{it} + \alpha_3 \text{Interest rate}_{it} + \alpha_2 \text{Market capital return}_{it}$$

The equation that describes the venture capital demand is the following one:

$$\text{Venture capital Demand}_{it} = \beta_0 + \beta_1 \text{Unemployment rate}_{it} + \beta_4 \text{Patent}_{it} + \beta_2 \text{Ease start business}_{it} + \beta_3 \text{R\&D expenditure}_{it} + \beta_5 \text{Government Subsidiery tax}_{it}$$

To get the equilibrium equation, we will use the same approach as Jeng and Wells (2000). We solve the supply equation with respect to the return variable and substitute it in the demand equation. Considering the equality between the quantities of funds supplied and demanded, we find the equilibrium amount of venture capital funds as a function of the explanatory variables:

$$\text{Venture capital Funding}_{it} = \gamma_0 + \gamma_1 \text{Market capital}_{it} + \gamma_2 \text{Market capital return}_{it} + \gamma_3 \text{Interest rate}_{it} + \gamma_4 \text{Unemployment rate}_{it} + \gamma_5 \text{Patent}_{it} + \gamma_6 \text{Ease start business}_{it} + \gamma_7 \text{R\&D expenditure}_{it} + \gamma_8 \text{Government Subsidiery tax}_{it}$$

Where i represent country dummies, which country-specific framework conditions has taken into account and t represent time dummies, which consider exogenous shocks that are common to several countries. Ln is the natural logarithm and D is the differentiation of sequences years of variables. The variables and sources in empirical results are defined as follows:

vc is venture capital that is the sum of early stage (including pre-seed, seed, start-up and another early stage) and later stage venture capital. As there are no harmonized definitions of venture capital stages across venture capital associations and other data providers, original data have been re-aggregated to fit the OECD classification of venture capital by stages (Sources: OECD Entrepreneurship Financing Database).

marketcap is the market capitalization (also known as the market value) which equals to the share price times the number of shares outstanding (including their several classes) for listed domestic companies. Investment funds, unit trusts, and companies whose only the business goal is to hold shares of other listed companies are excluded. Data is collected from the end of year values (Sources: World Federation of Exchanges database).

marketcapreturn is the stock market return which comprises of the growth rate of the annual average stock market index. The annual average stock market index is constructed by taking the average of the daily stock market indexes available at Bloomberg (Sources: tradingeconomics.com)

intrate10 is the long-term (10 years) national interest rate (Source: IMF)

unemp is the share of the labour force that is without work but available for and seeking employment. Definitions of the labour force and unemployment differ by each country. (Sources: ILO)

allpat is cumulative of resident and non-resident patent which is applications are worldwide patent applications are filed worldwide through the Patent Cooperation Treaty procedure or with a national patent office for exclusive rights for an invention a product or process that provides a

new way of doing something or offers a new technical solution to a problem. A patent provides protection to the owner for the invention of the patent for a limited period, generally 20 years (Source: World Intellectual Property Organization).

easestart is the ease of starting a business index. Low ease of starting business index means fewer procedures, time, cost and capital to open a new business (Source: World Bank)

patres is similar to allpat except for the owner of a patent is a resident of a country. Rest is the exact same as allpat. (Source: World Intellectual Property Organization).

unempedu is the percentage of the labour force with an advanced level of education who are unemployed. Advanced education comprises of a short-cycle tertiary education, a bachelor's degree or equivalent education level, a master's degree or equivalent education level, or doctoral degree or equivalent education level according to the International Standard Classification of Education 2011 (Sources: ILO)

rd is the domestic expenditures on research and development (R&D). They include both capital and current expenditures in the four main sectors: Business enterprise, Government, Higher education and Private non-profit. R&D covers basic research, applied research, and experimental development. (Source: World Bank)

govsubrd is government financial subsidiary for new technology development and technology transfer (Source: OECD)

Regarding the option between fixed and random effect models, the result of the Hausman test calculation suggests that we use the fixed effect model. When using fixed effect models we try to capture differences due to the alterations in the independent variable over time. Since there are heteroscedasticity and collinearity in the data, we use the FGLS method to estimate the model

5- Estimation and Result

5-1- Empirical Result

The variables chosen to be analyzed are summarized in Table 4, with a correlation table provided in Table 5. The dependent variable, venture capital funding, is the sum of venture capital fund in

the given country and the given year divided by the GDP. The results, for fixed effect models, are presented in Tables below.

Table 2- Summarize of Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
lnvc	68	7.28513	1.78254	3.60051	11.2486
lnmarketcap	73	29.2957	1.91241	26.7905	33.5854
marketcap~n	77	3.69078	19.1606	-49.53	56.7
intrate10	77	2.45495	1.39905	-0.0663	5.49268
unemp	73	6.98566	2.3856	2.8	12.6828
allpat	70	145610	192943	9212	605571
easestart	63	89.6021	5.36078	79.28	98.23
patres	69	92684	118848	4078	333498
unempedu	73	4.55549	1.64692	1.9813	9.192
lnrd	59	8.23545	0.3358	7.36047	8.59159
govsubrd	77	0.1726	0.15479	-0.03	0.45

Table 3- Correlation between Variables

	lnvc	lnmark~p	market~n	intra~10	unemp	allpat	easestart	patres	unempedu	lnrd	govsubrd
lnvc	1										
lnmarketcap	0.268	1									
marketcapr~n	-0.2208	0.0574	1								
intrate10	0.4508	-0.1291	-0.2464	1							
unemp	0.1813	-0.196	0.2698	0.3543	1						
allpat	0.5082	0.1165	-0.0594	-0.1917	-0.3388	1					
easestart	0.6384	0.1638	-0.116	0.3393	0.2144	-0.1091	1				
patres	0.3418	0.0738	-0.0995	-0.3063	-0.4245	0.953	-0.2299	1			
unempedu	0.2073	-0.4881	0.0412	0.4335	0.8358	-0.292	0.2193	-0.3095	1		
lnrd	-0.0765	0.4008	0.1731	-0.6559	-0.4514	0.319	0.137	0.3462	-0.6915	1	
govsubrd	0.25	0.1446	-0.11	-0.0251	0.1597	-0.3076	0.751	-0.2923	0.114	0.298	1

Table 4- Estimation Result

VARIABLES	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Inmarketcap	0.111*** (0.0199)	0.138*** (0.0235)	0.197*** (0.0263)	0.137*** (0.0227)	0.113*** (0.0203)
marketcapreturn	-0.0134*** (0.00313)	-0.0117*** (0.00390)	-0.00799*** (0.00263)	-0.0136*** (0.00354)	-0.0129*** (0.00337)
intrate10	0.274*** (0.0443)	0.354*** (0.0577)	0.285*** (0.0401)	0.325*** (0.0564)	0.308*** (0.0561)
unemp	0.102*** (0.0364)	0.138*** (0.0458)		0.145*** (0.0435)	0.0893** (0.0383)
allpat	8.18e-06*** (2.18e-07)		8.22e-06*** (2.24e-07)	8.24e-06*** (4.27e-07)	8.47e-06*** (3.87e-07)
easestart	0.161*** (0.0167)	0.203*** (0.0166)	0.164*** (0.0134)	0.161*** (0.0176)	0.147*** (0.0241)
patres		1.53e-05*** (1.12e-06)			
unempedu			0.283*** (0.0549)		
D.lnrd				2.165 (2.260)	
govsubrd					0.650 (0.743)
Constant	-12.85*** (1.661)	-18.14*** (1.594)	-16.31*** (1.325)	-14.24*** (1.605)	-11.86*** (2.017)
Observations	47	47	49	37	47
Number of country	7	7	7	7	7

Note: Panel data, G7 countries, 2007-2017. * Indicates the parameters that are significant at a 10% probability threshold, ** 5% probability threshold and *** 1% probability threshold. The econometric method is GLS. Standard errors in parentheses

It is now time to analyze the results of our estimation. Analyzing the results on the cited tables, result is concluded that all variables have the expected impact as far as their sign and significance are concerned. One aspect that should be highlighted is the fact that some variables, which are used in previous studies, are not significant and are eliminated from our models. For example, the GDP growth rate, in contrast to what authors such as Gompers and Lerner (1999), Romain, and La Potterie (2004) have concluded. However, the works of authors such as Jeng and Wells (2000) and Felix (2007) lead to conclusions similar to ours.

With respect to the market capitalization, we get a statistically significant positive impact on all models. The coefficient suggests that the venture capital will be increased when the size of the capital market becomes larger. As we mentioned in the theoretical part, the size of the capital market has an effect on the supply side and motivate investors to engage more in venture capital investment.

Regarding the market capital return, the impact represents the expected signal and statistical significance. Since the market capital return is an opportunity cost of money for investor, the negative sign shows that the venture capital investment will be decreased when the capital market has more return.

As previously mentioned, the interest rate has an impact on both sides: increasing in interest rate has a negative effect like market capital return because the opportunity cost of investment will be rise. In addition, it increases the cost of borrowing from the entrepreneurs' point of view. Therefore, the sign of interest rate should be positive and our result verifies it. It is also statically significant.

The unemployment rate has a strong positive impact on venture capital, especially in the form of the unemployment rate on the educated side. The positive effect of the unemployment rate on venture capital tells us that the increase in self-employment, which may occur with higher unemployment, is sufficient to dominate the negative impact that the unemployment rate may have a relationship with a recession in the economy. Another possible explanation for this result comes from our study. In this period, (2007-2017) financial crisis had a strong impact on everything. Unemployed people knew that the job market would not recover soon, so, they were motivated to start their own businesses. As we can see in the empirical result when we substitute educated unemployment variable instead of the overall unemployment rate, the coefficient

increase. The reason could be related to the potential of educated people to start a business that can be financed by venture capital more easily. In addition, the success of start-ups in the last two decades and government programs to encourage the entrepreneurs, motivate unemployed people to start a business.

Although the effect of the patent is significant and has a positive sign as we expected, the coefficient is extremely close to zero. We examine this technological index with two different variables, the residential patent and cumulative of residential and foreign patent. We have obtained the same result.

In the case of the ease start a business, which was used to measure the entrepreneurial environment in each country, our results confirm the expected theoretical impact. These results verify the theoretical impact, which argues that the mentioned businesses create more opportunities for entrepreneurs that led to more demand for venture capital financing

In the case of the R&D expenditures, our results do not confirm the expected theoretical impact and it is not statistically significant. In addition, we conclude the same result for a government subsidiary for R&D.

5-2- Comparison of Results with the Existing ones in Literature

We started by replicating the analysis performed in previous studies on the subject of the determinants of venture capital. We applied their methodologies in our data set and got the above results.

The capital market represents, in our analysis, a positive and statistically significant impact, confirming the results obtained by Gompers & Lerner (1999), Flix & Gulamhussen & Pacheo (2007), Cherif & Gazdar (2011).

The interest rate shows a positive effect in our data set. As it is illustrated in the table 4, Gompers and Lerner (1999), Romain and La Potterie (2004), Flix & Gulamhussen & Pacheo (2007) obtained a positive impact and Cherif & Gazdar (2011) did not get a statistically significant coefficient for this variable.

As we mentioned above, the unemployment rate has a strong positive impact on the venture capital in our model. Although we have concluded a result contrary to Flix & Gulamhussen &

Pacheo (2007), Cherif & Gazdar (2011), our results confirm the expected theoretical. Groh & Wallmeroth (2016) did not get a statistically significant coefficient for this variable.

With respect to the patent, our result confirms the result of Romain and La Potterie (2004), Groh & Wallmeroth (2016).

We have assessed the entrepreneurial environment by ease index of the business start. Our result is the same as what Romain and La Potterie (2004). Flix & Gulamhussen & Pacheo (2007) have found in which is not statistically significant.

With respect to the R&D effect, R&D expenditures and government subsidiary for R&D, we found that they are not significant. Flix & Gulamhussen & Pacheo (2007) got the same result as us but it is contrary to the Gompers & Lerner (1999), Cherif & Gazdar (2011).

6- Conclusion

The aim of this paper was to identify the main determinant of venture capital funding. To this purpose, we gathered data from G7 countries for the period from 2007 to 2017. These data are gathered from various sources like OECD, World Bank, IMF and national datasets and used panel data technique to estimate the model. We developed Jeng and Wells (2000) model, which analyzed the impact of factors on the equilibrium of the supply and demand of venture capital. We categorized the variables in four groups including macroeconomic condition, financial market, entrepreneurship environment and technological opportunities.

The result of our empirical model shows the market capital, market capital return, interest rate, unemployment and ease to start a business have a significant and strong impact on venture capital. Although the patent is significant, its coefficient is close to zero in both forms of residential patent and cumulative of the residential and foreign patent. Regarding the unemployment rate, we should mention that the results confirm that the effect of educational unemployment which is stronger than general unemployment. It is worth mentioning that R&D and the government subsidiary are not significant.

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