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Relations between country R&D expenses and startup IPO in Europe: Empirical research of startup IPO activities from 2005 to 2014

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Abstract:

This paper put an attempt to find the impact of money supply, specifically in promoting research and development, of EU countries contributes in successes of startup IPO process. The paper is formulated to prove the hypothesis that the number of money supply in R&D affect the number of IPO within EU countries. This hypothesis comes from the previous research about the impact of patent in reducing asymmetric information of the firm before going to IPO. The model comes from Schumpeter assumption that economic growth is an effect of knowledge accumulation. The data come from 17 countries in Europe. The model is a data panel regression. The variables that used are number of IPO as dependent variable and number of money supply in research and development as independent variable. We use 10 years' data range period from 2005 until 2014. The paper finds the robust relationship between countries research and development expenses and the number of IPO activities in 17 European countries. This research will contribute in providing empirical research about the relationship between favourable research environment (proxied by money supply in R&D) and firms IPO. The expectation is a government will promote and allocate more fiscal project in research and development.

Keywords: IPO, startup, FDI, investment, Schumpeter
JEL codes: C33, G24

1. INTRODUCTION

The discussion related the importance of innovation toward the growth of company economic values has been discussed for years (Schumpeter, 1934, Brown *et al.*, 2009, Amess *et al.*, 2016). The existence of patent and research record has been proved as one of important factor that contributes in success of Initial Public Offering process (Useche, 2014; Nanda & Rhodes-Kropf, 2013). The purpose of having patent is to reduce the asymmetric information, especially in the company that related to technology. In the ecosystem of startup, the proportion of startup that able to find exit strategy in initial public offering is in the one to one hundred proportion,

which means that within 100 startups, only 1 that finally able to make an IPO process. While in macroeconomic level, innovation is also considered as the foremost factor in countries economic development (Schumpeter, 1934; Aghion & Howitt, 1992).

Apart from that, problem related to investment in innovation is the higher probability that the investment in technology firm will give zero return value (Galindo & Mendez, 2014). It is due to the fact that most of investments in innovation are categorized as risky or bad investment, which in a matter of yield, some of this investment will give zero value exit (Nanda & Rhodes-Kropf, 2013). The impact is, innovation either from a relatively small or new company, that does not have any experiences in business, will struggle to get funds. Moreover, most financing institution such as banks do not eager to put investment in such risky institution (Nanda & Rhodes-Kropf, 2013). Therefore the favourable environment in research and development is believed to be able in contributing to the success of IPO.

In terms of macroeconomic perspective, European macro financial situation in terms of GDP growth has been weak since the period of world crisis in 2008. One of the foremost factors is the low expanding in private consumption (Ptacek *et al.*, 2015). European central bank has been promoting a monetary policy that trigger the activities in micro level such as expanding its quantitative easing program and cut the interest rates, in order to increase the number of money supply in the market. Both of these policies are showing the intention of ECB in promoting any micro economic activities that giving economic value in micro level. Furthermore, European Capital Markets Union are becoming more open in last couple years and actively endorsing capital mobilization, including private investment, to be more accessible. By China economic slowdown, the swing investment is giving benefit to more developed market such as European countries. Moreover, the FED policy in United States 2015 has raised appreciation of dollar against euro, which also means that more investment abroad from US market. This entire dynamic macro environment has steamed the state of venture capital activities shifting into European region.

The main objective of this paper put an attempt to find the impact of money supply, specifically in promoting research and development, of EU countries contributes in successes of startup IPO process. The object of the research is a startup, the company object that potentially has a chance to grow rapidly and globally. The research takes this object instead of well establishing companies. Based on the report of European committee, startup is believed as the important factor of European economy. The flexibility and agility in facing the market demand is considered as the basic factor of the startup.

The paper is formulated to prove the hypothesis that the number of money supply in R&D affect the number of IPO within EU countries. This hypothesis comes from the previous research about the impact of patent in reducing asymmetric information of the firm before going to IPO. The model comes from Schumpeter assumption that economic growth is an effect of knowledge accumulation. The data

come from 17 countries in Europe. The model is a data panel regression. The variables that used are number of IPO as dependent variable and number of money supply in research and development as independent variable. We use 10 years' data range period from 2005 until 2014. The paper find the robust relationship between countries research and development expenses and the number of IPO activities in 17 European countries.

2. LITERATURE REVIEW

2.1. RESEARCH EXPENSES AND KNOWLEDGE ACCUMULATION

The development and alteration of the business environment grow tremendously fast in last decades. The rapid technology improvement, deregulation, and globalization have forced companies to go through the process of reinventing (Garanina & Pavlova, 2011). The investment, which companies put in creating their competitive advantage, will be recorded in two ways. One is a tangible asset, which has physical evidence, and another is R&D and technology development expense, which in opposite, does not have physical evidence. The success in constructing company R&D and technology development expense helps company in seeing 'roots of company value creation' (Garanina & Pavlova, 2011). Moreover, researcher believe that intangibles asset are "major drivers of company growth and value in most economy sector" (Lev, 2001).

R&D and technology development expense are the proxy to define the policy in the company which related with financial and corporate governance (Martins & Alves, 2010). Research and technology development expense has thin in a different way with goodwill and sunk cost. However, it can be seen in the future as giving the benefit for the company (Petkov, 2011). The characteristic of R&D and technology development expense, which is identifiable, make the expense is visible in terms of asset identification. Even though R&D and technology development expense are appraised as positive investment but the character of intangible that does not have physical substance makes this investment expecting high risk in nature.

Even though R&D and technology development expense bring so many advantages to the company, but all in all this particular asset is also close with a factor that trigger agency cost and end lead to the bankruptcy of the company. It is due to large sunk costs can generate a high level of returns in the future if the innovation succeed, but a null return if it fails (Martins & Alves, 2010). Align with an explanation above; many economists put allegation that the wrong way of manager in valuing and treating R&D and technology development expense also led to the world to the economic crisis in 2008 (Petkov, 2011). One interesting occurrence, which happened, is a bubble phenomenon. The condition where the price of asset going up, but later on going down and find the real price (White, 2011). Economists believe that bubble can be happen because of some asset that does not have the ability to be identifiable (Petkov, 2011).

The effect was that the prices of the asset not reflect the real number of intrinsic value. The increasing gap between market and book value of companies spurred reflections on the importance of R&D and technology development expense and the way they are measured (Garanina & Pavlova, 2011). From microeconomic point of view, intangible assets were significantly influencing the market value of the company (Garanina & Pavlova, 2011; Elveness & Widiantoro; 2012, Widiantoro, 2012). Neil Gross mentioned that, "The shifting from brick and mortar to patent and knowledge are the new realities that grow in latest Modern business competition" (Gross, 2001). From Corporate finance perspective, research expense remains governance's problems such as agency conflict and high liquidity risk, which triggers bankruptcy. The knowledge about managing this expense has been analyzed by many researchers in the latest business academic environment. Both of advantage and disadvantage are proven exist. Research about the relationship of R&D and technology development toward market value added in UK and Russian Company has proved that these expenses have positive relation with market value added (Garanina & Pavlova, 2011). Another research also proved that corporate governance was raised when company put high intensive investment in research and development (Alves & Martins, 2010).

2.2. INITIAL PUBLIC OFFERING

Initial Public Offering is the moment where the company registers their entity into public market. The purpose of initial public offering is to generate cash for company operation. For any kind of company, the moment of IPO is one of the most crucial moments in the company life cycle. It is due to so many determinants that categorized as shady information (Useche, 2014). Such as the information whether the company has potential future to grow or not. For investor the moment of IPO is also aligned with their investment in startup, which is gaining the capital gain.

As it mentioned before in previous paragraphs, the empirical evidence that a startup could finish and find exit strategy in IPO is 1 among 100. The high probability that startup will fail make the research in IPO become one of most interested subject to be conducted.

2.3. PRIVATE INVESTMENT IN EUROPE

The development of Private investment in European countries has been showing a great development in last couple decades (Figure 1). The establishment of Private Investment committee in European Union has made the atmosphere toward economies are more open for private investment. In Europe, startup investment, including venture capital and private equity buyout, has rose 14% to 41.5 Billion Euro (InvestEurope, 2015). The amount is a bit smaller in comparison with 50.75 Billion US dollar investment, which was conducted by Venture Capital firms in United States (Pofeldt, 2015).

The number of deal has reached the peak at first quarter 2014 by having 1534 deals. Unfortunately, the situations in 2015 have been not so swell like a year before, deals and volume has been declining since 2014 (Figure 2). The tight regulations in some countries are still becoming an obstacle to the more dangerous types of loaning and financing. More over European lending market are not as complex as the those in US, therefore the availability from alternate lenders when it comes to buyout is considerably less (Pitchbook, 2015).

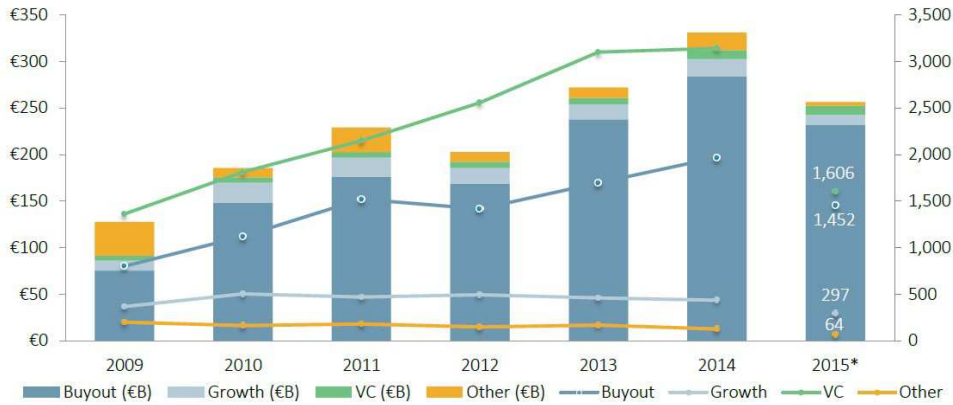

Figure 1. The flow of Private Investment in Europe
Source: Pitchbook (2015).

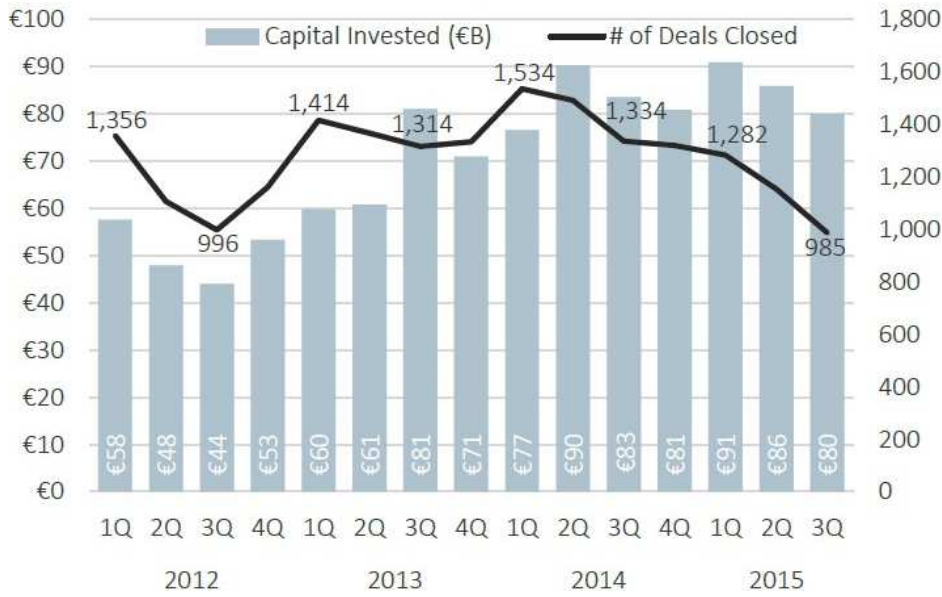

Figure 2. Number of Deal and Private Investment Volume in Europe
Source: Pitchbook (2015).

Apart from those decline trends, the supply of organizations in the business sector stays significant on a segment by regions. Furthermore, the length of the euro dollar difference stays appealing to US financial investor, American PE firms may well help buyout numbers. For funding financial specialist, Europe startup biological system is generally a system of genuinely dynamic centers, such as Stockholm, London and Berlin. In those areas, the surge in late stage numbers that has been the essential storyline of endeavour venture in the course of recent years is easily seen.

Very dynamic government establishments and program, such as the European speculation asset have strengthened the journey of the funds, however as frequently been noted, noteworthy deterrents to reinforcing the Eurozone system of startup action remains. A standout amongst the most essential variables to manage at the top of the priority list is when taking a gander at mainland crossing number. Provincial movements are vital to speculation dynamic, for instance UK center business sector surpassed Germany in terms of income.

Taking a gander at how wander action has plunged in the course of the last a few quarters its simple to see why concern has emerged. From 1Q 2014 to 3Q 2015, the check of VC financing dropped by more than half, from the second quarter of 2015 of 3Q alone the decrease in the general number of European endeavor round surpassed 20% (Figure 3). Yet even as action has dive the past there quarter every hit 3 billion in VC contributed, putting the year as an opening at about € 9.5 billion contributed as of now, overshadowing even a year ago.

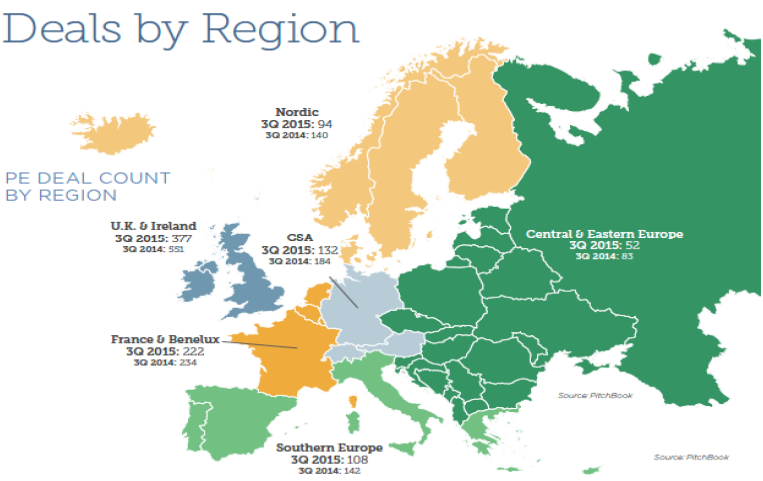

Figure 3. Number of Investment segregated by European Region
Source: Pitchbook (2015).

The immense aggregate contributed for the current year has been skewed by Spotify monstrous $526 million subsidizing. It makes sense that if there were an irregularity recently organize venture flooding a select gathering if built up new companies in the US, Europe would see a comparable overweighting. The issue

with the spread of VC financing is that numerous trepidation related to an absence of fundamental capital mixtures at prior stages of a startup.

3. MATERIAL AND METHODS

3.1. HYPOTHESIS

Based on aforementioned explanation, we propose the hypothesis that countries with the high activities in research will give more beneficial environment to Startup business. Within this specific environment the probability of the successes in Initial Public Offering will be higher.

The model of entrepreneurship, economic growth, and innovation has been developed for many years (Aghion & Howitt, 1992; Brown *et al.*, 2009; Ptacek *et al.*, 2015). Within this research, author belief that the situation within each region in Europe has different factor in attracting PE. Therefore, there is a gap in number of private investment that is flowing among regions. Our hypothesis is the number of innovation within the region play a role and makes a difference in terms of number of venture capital or private investment.

To answer those hypotheses, first we would like to know whether the climate of entrepreneurship, which is represented by the number of government expense in technology sector, affect the deal. To control the model, we also put into a model about the condition of government expenditure within a year. We propose the idea that countries that have better innovation track record will get higher private investment and the number of deal after all. The money supply in research and development contributes to the number of Initial public offering of startup. These proxies of research and development activities within a countries give better information and reason why the number of IPO's in Europe are various.

3.2. METHODOLOGY

Data

Type of data that is used in this research are secondary data. The data is taken from the database that is provided by private institution that count how many IPO in European countries from 2005 until 2014. The database of the data comes from European union statistic, Pitchbook Venture Capital, Merger and Acquisition database, and Dow Jones London Stock Exchange Database. The model is we have variable which is research expenses from government that will show us the impact R&D toward the number of IPO deal.

Formulation of model

In the previous research, the impact related to the impact of entrepreneurship, innovation and economic growth has been analyzed (Arora & Nandkumar, 2011; Galindo & Mendez, 2014; Örnek & Danyal, 2015). The model that propose the economic growth here will be replaced by the number of private deal as the proxies of private investment flow.

$$\ln(\Phi)_{it} = \beta_0 + \beta_1 \ln(\mathrm{rc})_{it-1} + \beta_2 \ln(\lambda)_{it-2} + \varepsilon_{it}$$

Variable explanation

The variable Φ is the number of IPO deal, which is invested in one region of the country. Variable rc here is money supply in research and development. It shows the accumulation of how much money that government spends to create a good climate in research and innovation within a year. Variable lambda here is the percentage of government expenditure, showed the proportion of number of total expenditure that the government has in comparison with the GDP.

4. RESULTS AND DISCUSSION

Presentation of Data

We have collected the number of IPO of startup in each country in Europe, these countries are Czech, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Italy, Lithuania, Luxemburg, Netherland, Norway, Poland, Rumania. Others country are not collected due to incomplete data in documentation. The data are consist of number of IPO deal in a year and classified by the number of money which is collected. One of the example from data that has been collected are Data from Czech and Denmark (Table 1).

Table 1. The example of data pool collection

	A	B	IPO	GovExpLn	IPOLn	LnRD
1.	Czech	2005	0	3.7328963	0	4.8331023
2.	Czech	2006	4	3.7086821	1.3862944	5.0059577
3.	Czech	2007	6	3.6888795	1.7917595	5.1682087
4.	Czech	2008	5	3.693867	1.6094379	5.2642434
5.	Czech	2009	5	3.7750572	1.6094379	5.2181913
6.	Czech	2010	1	3.7612001	0	5.2998162
7.	Czech	2011	13	3.7588718	2.5649494	5.4947062
8.	Czech	2012	17	3.7954892	2.8332133	5.6127631
9.	Czech	2013	18	3.7518543	2.8903718	5.6524892
10.	Czech	2014	16	3.7518543	2.7725887	5.6835798
11.	Denmark	2005	31	3.9357395	3.4339872	6.8472619
12.	Denmark	2006	36	3.908015	3.5835189	6.9062542
13.	Denmark	2007	55	3.9039908	4.0073332	6.9825844
14.	Denmark	2008	32	3.9219733	3.4657359	7.1097161
15.	Denmark	2009	47	4.0395363	3.8501476	7.1561766
16.	Denmark	2010	65	4.0448041	4.1743873	7.1558646
17.	Denmark	2011	78	4.0395363	4.3567088	7.1798414
18.	Denmark	2012	86	4.0656021	4.4543473	7.21524
19.	Denmark	2013	111	4.0342406	4.7095302	7.2389996
20.	Denmark	2014	132	4.0253517	4.8828019	7.2534704

Source: Pitchbook (2015); The World Bank (2016).

The average descriptive information from the number of IPO are placed in Table 2.

The Data Calculation

The data then is calculated by data panel fixed model. The year of research is started from 2005 until 2014 (Table 3).

Based on the panel data calculation above we could see that the government expense affects significantly the success of IPO with the power of 7%. The confident of the independent variable is quite accurate with the α less than 0.1. From this data we could take conclusion that countries with better research expense and more

Table 2. Average number of deal, capital invested, pre-money valuation, and post valuation median, divided per country for 10 years

Countries	Deal Count	Capital Invested Median	Pre-money Valuation Median	Post Valuation Median
Czech	9	9.598888889	2.91	259.6
Denmark	64	2.609166667	50.71125	54.881
Estonia	11	0.447272727	6.728	8.3
Finland	95	1.740909091	13.66142857	21.19818182
France	314	2.17	16.28333333	28.58166667
Germany	297	3.489	63.21090909	67.84818182
Hungary	12	1.354444444	1.6125	4.405
Iceland	7	0.674285714	3.28	113.3866667
Ireland	111	3.569166667	55.848	44.16545455
Israel	13	7.572727273	281.0685714	223.5311111
Italy	69	2.766666667	40.03625	33.14909091
Lithuania	9	2.857142857	9.12	29.84333333
Luxemburg	8	134.9944444	68.86	64.99666667
Netherland	106	4.244444444	181.55875	115.851
Norway	49	3.396363636	25.0425	50.90545455
Poland	33	1.919090909	6.075	59.806
Portugal	24	1.161818182	18.73	28.64
Rumania	5	1.80125	2	31.33

Source: Pitchbook (2015); The World Bank (2016).

Table 3. The Panel data calculation

```
Random-effects GLS regression                   Number of obs      =       170
Group variable: countrynum                      Number of groups   =        17

R-sq:  within  = 0.0314                         Obs per group: min =        10
       between = 0.3481                                        avg =      10.0
       overall = 0.2568                                        max =        10

                                                Wald chi2(2)       =     10.42
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0055
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IPOLn	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
GovExpLn	3.219029	1.050948	3.06	0.002	1.159209	5.27885
LnRD	.0775741	.089056	0.87	0.384	-.0969724	.2521205
_cons	-9.532897	4.018291	-2.37	0.018	-17.4086	-1.657192
sigma_u	1.1973381					
sigma_e	.84285128					
rho	.66866012	(fraction of variance due to u_i)				

Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: Pool regression of IPO activities as dependent variable, logarithmic of Government expenses in R &D and ratio of R&D expenses to GDP as independent variable, calculated by Statistica software.

favourable toward innovation get more benefit from the flow of foreign investment, especially in private sector.

5. CONCLUSIONS

The number of money supply in research and development robustly affects the number of IPO within a country. This proxy also able to explain why in some country they have better performance in IPO. The existence of startup in technology is believed as one of backbones for national economic growth. Intangible expense of European countries affects on their startup initial public offering successes. Technological expense has become a key function toward the success of Initial Public Offering. In venture capital market, due to 100/10/1, only one that will survive and probably going to IPO. Therefore, possibility of the firm will find an exit is very low and the support from external parties such as government is quite important. In microeconomic activities, Relationship of R&D and technology development are positive with market value added. We can assume that investor considers at countries that has more favourable climate with large R&D expenditures is a reliable place for their investment.

The number of research in the impact of research and development expense within a startup is relatively low. In the other hand, the development of economic growth relies on the accumulation of knowledge that represented by the existence of patent within a firm. This research will contribute in providing empirical research about the relationship between favourable research environment (represented by money supply in R&D) and firms IPO. The expectation is a government will promote and allocate more fiscal project in research and development.

REFERENCES

Aghion, P., & Howitt, P. (1992). A model of growth through creative destruction. *Econometrica*, 60, 323–351.

Alves, S., & Martins, J. (2010). The Impact of Intangible Assets on Financial and Governance Policies: UK Evidence. *International Research Journal of Finance & Economics*, 36, 147-169.

Amess, K., Stiebale, J., & Wright, M. (201). The impact of private equity on firms′patenting activity. *European Economic Review*, 86, 147-160.

Arora, A., & Nandkumar, A. (2011). Cash-out of flameout! Opportunity cost and entrepreneurial strategy: theory, and evidence from the information security industry. *Management Science*, 57, 1844–1860.

Brown, J.R., Fazzari, S.M., & Petersen, B.C. (2009). Financing innovation and growth: cash flow, external equity, and the 1990s R& D boom. *Journal of Finance*, 66, 151–185.

Elveness, V., & Widiantoro, D.M. (2012). Managing Risk of Shipping Industry in Financial Market. *Journal of Finance and Risk Perspective*, 1(1), 10-21.

Galindo, M.-A., & Mendez, M. T. (2014). Entrepreneurship, economic growth, and innovation: Are feedback effects at work? *Journal of Business Research*, 67, 825-829.

Garanina, T., & Pavlova, Y. (2011). *Intangible Assets and Value Creation of a Company: Russian and UK Evidence*. Proceedings of the European Conference on Intellectual Capital, 165-175.

Gross, N. (2001). Commentary: Valuing 'intangibles' is tough job, but it has to be done. *Bloomberg*, published online: August 6, 2001. Retrieved from: http://www.businessweek.com/magazine/content/01_32/b3744008.htm (20.06.2016).

InvestEurope (2015). *Venture capital to play central role in Capital Markets Union.* Retrieved from: http://www.investeurope.eu/news-opinion/newsroom/press-releases/capital-markets-union-action-plan (20.06.2016).

Lev, B. (2001). *Intangibles: management, measurement, and reporting*. Washington, D.C.: Brookings Institution Press.

Martins, J., & Alves, S. (2010). The Impact of intangible assets on financial and governance policies: A literature review. *Portuguese Journal of Management Studies,* 15(1), 87-107.

Nanda, R., & Rhodes-Kropf, M. (2013). Investment Cycles and Startup Innovation. *Journal of Financial Economics*, 110, 403-418.

Örnek, A.S., & Danyal, Y. (2015). Increased Importance of Entrepreneurship from Entrepreneurship to Techno-Entrepreneurship (Startup): Provided Supports and Conveniences to Techno-Entrepreneurs in Turkey. *Procedia – Social and Behavioral Sciences*, 195, 1146-1155. doi: http://dx.doi.org/10.1016/j.sbspro.2015.06.164

Petkov, R.R. (2011). The Current Financial Crisis and Its Potential Impact on Internally Generated Intangible Assets. *International Journal of Business & Management*, 6(3), 37-44.

Pitchbook (2015). *European PE Breakdown 4Q 2015*. Retrieved from: https://pitchbook.com/news/reports/4q-2015-european-private-equity-breakdown (20.06.2016).

Pofeldt, E. (2015). *The rise of billion-dollar European unicorns*. Retrieved from: http://www.cnbc.com/2015/12/07/european-venture-capitalists-spawn-unicorns.html (20.06.2016).

Ptacek, O., Kaderabkova, B., & Piecha, M. (2015). Venture Capital, Private Equity and Foreign Direct Investment: Case Study of the Czech Republic. *IISES 3rd and 4th Economics and Finance Conference*, 30, 680-689.

Schumpeter, J.A. (1934). *The Theory of Economic Development. An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle.* Cambridge M.A.: Transaction Publishers.

The World Bank (2016). *World Bank Open Data*. Retrieved from: http://data.worldbank.org (20.06.2016).

Useche, D. (2014). Are patents signals for the IPO market? An EU–US comparison for the software industry. *Research Policy*, *43*(8), 1299-1311. doi: http://dx.doi.org/10.1016/j.respol.2014.04.004.

White, L.J. (2011). Preventing bubbles: What role for financial regulation? *Cato Journal*, 31(3), 603-619.

Widiantoro, D.M. (2012). Measuring the Role of Intangible Asset toward Company Financial Health and Agency Conflict. *Journal of Finance and Risk Perspective*, 1(2), 25-40.

Author Contributions

The contribution of co-authors is equal and can be expressed as 50% each of the authors: S. Rismani prepared the literature review, while D. Widiantoro prepared the statistical calculations.