

Master Thesis

# **The Performance of Cross-Border Venture Capital-backed IPOs: Anglo-Saxon vs Rhine Capitalism**

University of Groningen  
Faculty of Economics and Business  
MSc Finance

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## **Abstract**

This paper compares the aftermarket performance between European Union companies with venture capital sponsorship. The venture capital firms are classified in this paper as either originating from liberal- or coordinated- market economies. I used the buy-and-hold abnormal returns to measure the post-IPO performance of 420 backed companies between 2001 and 2017. I document statistical evidence of significant differences between the two types of venture capitalists. Using multivariate regression models, I find evidence of a positive relationship between the ratio of liberal market economy sponsors to total syndicate size over the long-run.

Keywords: venture capital, IPO, aftermarket performance, capitalism models

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Author: Alexandru Serban, S3841502  
Supervisor: Dr. Adri S.R. de Ridder

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## 1. Introduction

There are few ways a Private Equity (PE) or a Venture Capital (VC) firm can successfully exit its investment: merger and acquisition (M&A) transactions, secondary sales, repurchasing, dividend recapitalization, liquidation and initial public offerings (IPOs). An IPO is arguably the most profitable exit strategy (e.g., Black and Gilson, 1998), as theory would suggest that higher quality firms are more likely to go public whereas lower quality ones, firstly in terms of market competition, have a higher propensity of being acquired (Bayar and Chemmanur, 2011). Findings by Poulsen and Stegemoller (2008) and Chemmanur et al. (2009) show that this is actually the case, IPO firms having higher total factor productivity and higher sales growth than similar acquired firms and being larger overall, consistent with the argument that firm size is a proxy for the firm's viability in market competition.

The VC and PE industries have grown immensely in the last 20 years. 25 years ago, in 1994, VC and PE funds had under management approx. \$100 billion (Metrick and Yasuda, 2011), and in 20 years, in June 2015, they managed \$2.4 trillion internationally (Preqin, 2016).

What's more, VC<sup>1</sup> backing of a public offered company can also mean one of two things: the advisory role the VC firm assisted the entrepreneurial firm, therefore adding value<sup>2</sup> and, secondly, the presence can certify the quality of the company, in order to diminish the informational asymmetries between it and the new principals<sup>3</sup>.

Therefore, it is of significant importance to ask questions such as can we notice any differences between non-backed IPOs and PE/VC-backed ones, can we get a better understanding of what makes some IPOs successful and others not, or can we deeper understand the relation of the value of a firm and the presence of a PE/VC firm?

The European financial environment and market is significantly different from the U.S. one. In "Varieties of Capitalism", Hall and Soskice (2001) provide a more coherent taxonomic view on the differences between Liberal Market Economies<sup>4</sup> (LME) and Coordinated Market Economies<sup>5</sup> (CME) and they argue that institutions are not only shaped by the law, but also by informal rules or common knowledge developed through the history, culture and tradition of a nation. LMEs are also known as

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<sup>1</sup> In their classical sense, Private Equity (PE) firms invest in more established companies, private or public, holding majority stakes financed with large debt amounts. Indeed, in the US for instance, VC and PE are different businesses, but in Europe the term can be sometimes used interchangeably, PE firms operating VC strategies for part of their funds (Kaplan and Stromberg, 2009). VC is usually a speculative investment in a young, privately owned company with high expected growth. In this paper, as it will be better outlined in Section 3, PE and VC firms will be both part of the sample, screening out the leveraged buy-outs (LBOs) and related deals, leaving only VC-type backed investments in the dataset.

<sup>2</sup> See, e.g., Hellmann and Puri (2002), Hsu (2004), Kanninen and Keuschnigg (2003, 2004), Sahlman (1990).

<sup>3</sup> See, e.g., Lerner (1994), Lin and Smith (1997), Gompers and Lerner (2003), Brav and Gompers (1997, 2003), Megginson and Weiss (1991)

<sup>4</sup> LMEs are represented by Anglo-Saxon countries, e.g., U.S., U.K., Canada, Australia, New Zealand, Ireland

<sup>5</sup> e.g. France, Germany, Japan, Sweden, Austria

Anglo-Saxon capitalistic or Anglo-Saxon model countries, whereas CMEs are also known as Rhine capitalistic or social market economy countries, by the prevalence of these capitalism types in these nations. Doupnik and Perera (2015) further outline that the U.S. market exhibit heavy equity orientation and openness to high leverage ratios, while European markets are characterized by weaker equity markets and lower acceptance for high debt levels. More specifically to the VC topic, Arundale (2017) found strong differences between the VC funds of US, UK and continental Europe. He observed that the average size of funds of the firms with fund info available is \$282m in the US, \$168m in the UK and \$128m in Continental Europe. Arguably, a bigger fund would entail more experience and better know-how. Another aspect found in his study would be the different behaviors regarding risk, US VCs having a more proactive focus whereas continental Europe VCs being more risk adverse.

In this paper we aim to contrast the differences between Anglo-Saxon (or LME) PE/VC firms and mainland European (or CME) VC firms' participation in European Union companies listed on stock exchanges between the years 2001 and 2017. For the sake of clarity and simplicity, I will define in this paper Anglo-Saxon PE/VCS to be LME PE/VCS and mainland European PE/VCS to be CME, as outlined in Table I. An important aspect to consider is the presence of sponsors having the country of incorporation tax havens such as Bermuda, British Virgin Islands or Cayman Islands. I consider those as jurisdiction of UK since they are either former or current dependencies of it and still use the same core legal structures as (Picciotto, 1992).

**Table I. Sponsor Country Classification**

This paper's classification of PE/VC sponsors' countries of origin of the IPOs, in accordance to the taxonomy proposed by Hall and Soskice (2001) which takes into account dimensions such as the legal system, informal rules or common knowledge as the result of history and culture, interactions and relationships between actors of the market.

<b>Liberal Market Economies (LME)</b>	<b>Coordinated Market Economies (CME)</b>
Australia, Bermuda, British Virgin Islands, Canada, Cayman Islands, Ireland, United Kingdom, United States.	Austria, Belgium, Denmark, Finland, France, Japan, Netherlands, Norway, Sweden, Switzerland.

The academic literature has already documented that VC involvement positively influence IPO performance (Brav and Gompers, 1997). With regards to foreign VC firms, numerous studies with evidence from Chinese market have examined the foreign intervention and they generally find out that there is no significant increase in the likelihood of successful exit (Wang and Wang, 2010; Humphery-Jenner and Suchard, 2013; Hain et al., 2014). Wang (2016) finds that US VC firms with more investment experience at home have weaker investment performance in China but better performance when syndicating with other United States VCs and investing in ventures with larger top

management team. However, Wang (2016) finds that syndicating with Chinese VC firms decreases US VC firms' investment performance in China, argument that has been proven to be true by Humphery-Jenner and Suchard (2013). Espenlaub et al (2014) find a time related relation between foreign intervention and exit, foreign VCs exiting more quickly than domestic ones.

According to the overview of recent literature performed by Tykvova (2018), the clear focus has been so far on the North American region, with more than half of the research papers being done on US Data by July 2016. Just 20% had been done using European data by then. Moreover, none of the studies study the aftermarket performance of cross-market-economy PE/VC-backed IPOs. Most of academic literature around this topic focuses on the macro-perspective, studying the internationalization, or the effect of country of operation affects the VC or vice-versa, as per the same study (Tykvova, 2018). The only comparisons between domestic and foreign VC/PE-backed IPOs are made on a country basis<sup>6</sup>, not a market economy one.

This research is a valuable addition to the current academic literature for three reasons: firstly, it adds to the low amount of studies done on the European VC transactions. Secondly, it uses a new type of taxonomy for comparing cross-border VC participation and its effect on aftermarket performance, and lastly, it sheds some light on the growing, elusive, VC industry in European Union.

This paper is organized in the following manner: Section 2 will provide a review of the current relevant academic literature; Section 3 describes the data used and the methodology applied; Section 4 presents the results and Section 5 concludes, discusses limitations of the study and proposes further future research.

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<sup>6</sup> See, e.g., Cumming et al (2016), Guo and Jiang (2013), Wang (2016), Wang and Wang (2010)

## 2. Literature Review

### 2.1. *Aftermarket Performance*

#### 2.1.1. *IPO Underperformance*

IPO performance is a topic of significant interest in the financial academic literature and has been that way for a very long time. Significant initial advancements in this subject understanding have been made by authors such as Ibbotson (1975), Ritter (1991), Loughran et al. (1994), and Loughran and Ritter (1995). Ritter (1991) argues that there are three common periods in which we can split the performance of IPOs: the initial return period, a one day long window, comprising of the offer price and the trading price on the secondary market; the short-term period, less than a year; and long-term period, more than a year. In the paper released in 1994 they discuss international findings from 25 countries, finding underpricing in the short run. Initial returns are proportionate with the degree of government interference, the intrinsic risk of the company going public and the sooner in the process of IPO a fixed offering price is set. They also found underperformance in the long-term, which is dependent on the risk of the particular firm and the level of the market at the time of flotation<sup>7</sup>. Moreover, on the issue of long-term underperformance, in 1995's paper they confirm that issuing firms significantly underperform non-issuing forms on a five-year period after the IPO in the US between 1970 and 1990. The latter study only confirms Ritter's findings (1991), in which he finds out that the strategy of investing in IPOs at the end of the first day of trading and holding the investments for 3 years would result in a 17 percent loss in the firms listed on the US stock exchanges. Adding to this body of research, Gompers and Lerner (2003) undertook a large study with 3,661 US IPOs, ranging from 1935 to 1972. They found underperformance when using event-time buy-and-hold abnormal returns, which disappears when cumulative abnormal returns and calendar-time analysis methodologies are used.

In 2002, Ritter and Welch provided an exhaustive review of the literature at the time, which tries to explain why firms go public, why they reward first-day investors with significant underpricing and the IPO long-term performance. They document that the aforementioned IPO phenomena are not stationary and that asymmetric information is unlikely to be the main driver of IPO fluctuations in activity and underpricing, taking into account the excesses of the dot-com bubble period. The authors suggest that market conditions are the most important factor in the decision to go public, after which the stage of the firm in its life cycle comes in a close second. Average initial returns were in the range of 65 percent at the time, and the long-run performance was found to be different from

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<sup>7</sup> IPO market cycles from "hot" to "cold", according to economic cycles, new emerging industries. Hot IPO markets are characterized by unusual high volume of offerings, significant underpricing, oversubscription. See, e.g., Ibbotson and Jaffe (1975), Ritter (1984).

study to study, papers invoking either efficient market points of view or behavioral views. They also indicate that Fama-French multifactor regression can produce especially odd results in their opinion.

Moving to more recent years, Levis (2011) still finds evidence of long-term underperformance in UK IPO market, studying issues from 1992 to 2005, especially so for those that are not backed by either PE or VC sponsors. Boulton et al. (2009) studied how the differences in country-level governance affect the underpricing of IPOs by investigating 4,462 IPOs across 29 countries from 2000 to 2004. They document that underpricing is higher in countries with corporate governance that offers more strength to investors rather than insiders. This type of corporate governance is typical to Anglo-Saxon countries, where the liberal market economy model is established. The authors propose that the issuers underprice more to create excess demand for the offer, creating more ownership dispersion, which in turn decreases the incentives to monitor the behavior of corporate agents.

### *2.1.2. VC-backed Aftermarket Performance*

Continuing with the motif of agency theory, as mentioned in the introduction, one of the key roles of VCs in the context of initial public offerings is signaling to potential investors in the IPO that the quality of the backed firm is superior (Megginson and Weiss, 1991), as VC investments are defined by information asymmetry and uncertainty (Sahlman, 1990). Kirshnan et al. (2011) especially found that there is a proportional relation between a VC's reputation and the long-run aftermarket performance of target companies. The more reputable VC firms initially select superior-quality firms, which creates, in time, an association between the respective VC firms and long-term superior performance independent of selectivity.

However, in the grand scheme of the VC – target company relationship, this is only a temporary role, which is far from being the only benefit to having this type of backing. Hellman and Puri (2002) suggest that venture capitalists play roles besides those of traditional financial facilitators and intermediaries. Through VC backing, companies obtain skills and know-how related to an assortment of organizational milestones, ranging from the human resource policies, the development of stock option plans, the hiring of key top management roles and setting up of different systems and procedures in place. Coincidentally, firms with VC backing are more likely and quicker to replace the founder with an outsider as CEO. Despite this, founders typically remain within the company, even after the transition.

One of the earliest studies done on aftermarket performance of venture capital backed IPOs has been carried by Brav and Gompers (1997). Basing their hypothesis on the earlier works of Ritter (1991) and Loughran and Ritter (1995), they investigated the long-run underperformance of firms both backed and not by venture capital from 1972 to 1992. The authors found that underperformance is clearly significant in the case of small, nonventure-backed IPOs. They also

showed that the underperformance documented by past authors is not unique to firms offering equity, demonstrating for their US sample that the IPOs perform in a similar fashion to comparable nonissuing firms. More recently, evidence from Chinese data reported by Cao et al. (2013), Guo and Jiang (2013), and Wang (2016) support the VC-backing superior performance school of thought. However, Wang and Wang (2011) found that the local entrepreneurs' experience is much more important, as incumbent CEO, than VCs involvement in IPOs from Chinese market. In Europe, Bessler and Seim (2012) documented that during the period from 1996 to 2010, VC-backed IPOs have consistently and significantly outperformed a large part of the non-venture-backed flotations, with abnormal returns for the former for almost three years after offering.

## **2.2. Market Economies - Differences in Sponsorship**

It is no surprise to anyone to say that the US, and Anglo-Saxon in general, business environment and financial markets as a whole are different from those European. In the following chapter I will outline some of the key concepts that build up to an important research question when considering the current European Union VC climate.

### **2.2.1. Cultural Differences**

A starting point for our discussion could be the findings of Hofstede (1980, 1991). His theory of cultural dimensions<sup>8</sup> created a framework for cultural differentiation among countries, describing the influence a nation's culture has on the values of its members, and how they relate to types of behavior. We'll take as an example the main economic players for each of the market economies outlined before: France and Germany for CMEs, and United Kingdom and United States for LMEs. According to Hofstede Insights, divergence between the two pairs occurs especially for the individualism, uncertainty avoidance, long-term orientation and indulgence. The two CME countries are less individualistic, therefore entrepreneurship affinity could suffer; more uncertainty avoidant, which could explain different risk profiles and expectations, needing strong regulatory framework to structure their way of life; more long-term oriented, meaning they are willing to sacrifice short-term impressive gains for long-term stability, and lastly, less indulgent, restrained, meaning a tendency to pessimistic outlooks, therefore affecting risk attitude even further.

### **2.2.2. CME vs LME**

Hall and Soskice (2001) are expanding on the differences between these two varieties of capitalism. I stated in the introduction that I guided any comparison on their taxonomic work, as they

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<sup>8</sup> The now six dimensions outlined in his studies are: power distance, individualism, uncertainty avoidance, masculinity, long term orientation and indulgence.

outline the differences among them on five spheres<sup>9</sup>, ranging from cultural to law frameworks. Moreover, they focus on the coordination issues between firms and other relevant actors as a way of clearly outlining the two economies. CMEs have a tendency towards non-market forms of collaboration in the organization of their relationships with other players, whereas LMEs actors rely on coordinating their actions through market mechanisms and by way of hierarchies.

Starting from our point of interest, financial markets, it is readily noticeable that LMEs are characterized by equity-based, large stock markets, while CMEs are giving a more important role to banks through credit-based financing. The investors in LMEs can change assets easily, putting strong accent on the short-term gains. On the other side, CMEs investors, often times the banks, take direct roles in corporate governance and decision-making, being represented in companies' boards and dictating a longer-term outlook. Regarding Hall and Soskice's spheres of coordination, in industrial relations, CMEs commonly have a higher presence of trade unions and a higher level of membership in organizations of employers, with wage negotiations happening at industry, sectoral, or national level. Comparatively, in LMEs, the workforces and employers are usually less organized, wage bargaining happening only at company level. On the matter of training and education, in CMEs, the workers are inclined to have specific skills that are closely connected to the firm or industry, where in LMEs, the workforce has a more generalist approach to skills, which can be transferable. The two market economies tend to distribute employment and income in different manners. The authors noticed a clear clustering when comparing the index of employment protection (Estevez-Abe, Iversen, and Soskice, 2001) with the stock market capitalization of domestic companies as a percentage of GDP. CME countries have lower market capitalizations but stronger regulation around employment protection. Moreover, similar clustering occurs when comparing the full-time equivalent employment<sup>10</sup> to the GINI coefficient<sup>11</sup>, CME countries having lower FTE employment and lower GINI coefficients, therefore lower levels of income inequality and shorter working hours. Lastly, regarding the workforce, in the relations with employees, CMEs' managers oftentimes have to cooperate with employees to arrive at key decisions, where in LMEs, there is usually a more adversarial relationship between management and staff, managers being the main decision-makers.

The inter-firm relations in CMEs are usually more collaborative, while in LMEs are more prone to competitiveness and the cooperation relations are more arm's length principled. The corporate governance in CMEs is shaped by so-called patient capital, capital that does not necessarily depend

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<sup>9</sup> The five spheres of relationship development among players proposed by authors: Industrial relations, vocational training and education, corporate governance, inter-firm relations, and relations with employees

<sup>10</sup> Defined as the total number of hours worked per year divided by the full-time equivalent hours per year per person multiplied with the working age population

<sup>11</sup> GINI coefficient is the measure of income distribution, a proxy for economic inequality, concretely post-tax, post-transfer income inequality.



on financial transparency and short-term returns on investment. LMEs are heavily reliant on public information about financial aspects and focus on short-term capital, characteristic to stock markets.

Regarding the topic of comparative advantages between institutional players of the two market economies, LME sponsors have an edge on radical and disruptive innovation, whereas CME sponsors are better suited for incremental innovation. This is certainly a reason for why high-tech and service companies are in the spotlight in places like the US, whereas in Europe the main players come from manufacturing.

### *2.2.3. US and European VC environment*

Therefore, it's no surprise to find out that the first private equity and consequently venture capital deals were done in the US. The growth of Silicon Valley could only be achieved through the financing of starting and expanding companies which were developing breakthroughs in diverse technology sectors during the 1960s and 1970s. It is commonly believed that the first venture-backed startup was Fairchild Semiconductor, funded in 1957 through a loan offered by Fairchild Camera and Instrument with the help of Arthur Rock from Hayden Stone New York, receiving 20% equity of the newly founded company (Berlin, 2001). It is thus safe to say that VC strategy was specifically tailored in the beginning to the US, therefore an Anglo-Saxon environment, hence LME background.

The PE-, and subsequently, VC-industries are heavily fragmented in Europe and are confronting differences in culture, legal and institutional frameworks when attempting to cross national borders (Tykvova and Schertler, 2014). In Europe, as opposed to Britain or US, there are predominantly non-independent VC funds such as: governmental funds, controlled by regional, national or supra-national bodies; funds that are subordinated to a non-financial corporation, corporate VC; and funds that are affiliated with banks. Governmental funds prioritize seed and start-up stages, governments trying to encourage innovation together with economic growth. Therefore, European private VC investors typically are refraining from seed investments. There are studies which document that public VC programmes are doing worse than independent VCs when considering innovation, productivity and efficiency of backed companies (Pahnke et al., 2015, and Alperovych et al., 2015). Moreover, exit performance of companies backed by governmental funds is also inferior to that of ones backed by independent VCs<sup>12</sup>. However, looking the full half of the glass, public VC programmes signal and certify new opportunities that would be otherwise left ignored, regionally or at company-level (Kovner and Lerner, 2015, and Guerini and Quas, 2016). Moreover, when syndicating with an independent VC fund, governmental funds strengthen positive impact on innovation, invention, sales growth and successful exit<sup>13</sup>.

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<sup>12</sup> See, e.g., Cumming et al. (2017), Kovner and Lerner (2015), Munari and Toschi (2015).

<sup>13</sup> See, e.g., Bertoni and Tykvova (2015), Brander et al. (2015), Grili and Murtinu (2014).

#### 2.2.4. Differences in Aftermarket Performance

Specifically, for the subject of this paper, aftermarket performance comparison, so far, the studies that compare the companies backed by domestic VCs to foreign VCs show that the latter have a tendency to outperform the former (Cumming et al, 2016; Guo and Jiang, 2013). Espenlaub et al. (2015) contrasted the performance of the two types in terms of the time it takes sponsors to exit the companies backed, and controlling for macro factors such as economic and market activity, and legal framework, they find that foreign VCs exit quicker their investments. However, the conclusion which many studies reached is that syndication between domestic and foreign VCs is the most beneficial path<sup>14</sup>. Foreign sponsors have a disadvantage when it comes to the collection of information and monitoring their investment, due to geographical and institutional obstacles, whereas domestic investors are usually smaller and less experienced (Dai et al., 2012; Kraussl and Krause, 2014).

In conclusion, Hall and Soskice (2001) are not proposing a clear superior market economy. Concisely, LMEs typically lead to more growth while CMEs are typically more stable. Also, the studies realized so far on performance comparison of foreign and domestic VCs are saying that either foreign VCs have an edge, or a partnership between foreign and domestic is the optimal solution. However, for the purposes of this study, I will assume that, due to the factors listed above, LME-originating VC firms probably have advantages over the other VCs which can show in the long-run aftermarket performance. Therefore, the main hypothesis studied in this paper are:

*Hypothesis 1:* LME-originated VC-backed influence positively aftermarket performance in the European Union's flotations.

*Hypothesis 2:* LME-originated VC-backed IPOs perform better than other market economies originated VC-backed IPOs in the European Union.

*Hypothesis 3:* LME-originated VC-backed IPOs perform better than CME-originated VC/PE-backed IPOs in the European Union.

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<sup>14</sup> See, e.g., Dai et al. (2012), Humphery-Jenner and Suchard (2013), Tykvova and Schertler (2014).

### 3. Data & Methodology

#### 3.1. Sample

##### 3.1.1. IPO Data

To answer the study's research questions, the IPO data is collected using Bureau van Dijk's Zephyr database and further information on the firms that have been listed was collected, together with crosschecks<sup>15</sup>, using Orbis. Datastream has been used for market (e.g. daily stock prices, IPO underpricing, market value) and company specific operational (e.g. assets, net revenue, operating margin etc.) data.

The initial sample was comprised of 703 European Union (28) completed IPOs stock markets between 2001 and 2017 with VC prior investment. In order to arrive at a relevant dataset while still being exhaustive, companies and their respective flotations have been screened out for financial and regulated utilities sectors, for missing ISIN codes, for missing information about their sponsors, for LBO deals involving publicly offered firms, reaching the final 420 transactions.

Table II presents more detailed information about the country-wise distribution of the IPOs in the sample. United Kingdom holds the first place for the biggest number and largest amount raised. Amount-wise, no other country comes close; however, when talking numbers, France is coming immediately second, and Germany finishes the top 3 at quite a significant difference. An interesting fact to take away from this table is that the raised amount relative values are not always congruent with the number of IPOs in a specific EU-28 country from this sample. One stark difference is between France and Germany, the former having nearly double as many IPOs as latter, but less capital raised.

Lastly, the top three countries account for approximately 50 percent of both number of IPOs and amount raised in the sample used.

Besides geographical disposition, another aspect interesting to analyze is the time distribution of the IPOs between 2001 and 2017. I chose to start this study's sample from 2001 because I wanted the results and empirical analysis not to be skewed by the dot-com bubble, as the period of heavy VC investments occurred prior to that year, internet-based companies peaking in value on March 10, 2000, immediately before crashing afterwards, bringing the number of investments steeply down.

The aftermath cooldown can be clearly seen in the numbers of IPOs in the succeeding years, with only 6 in the years 2001-2003, comparatively lower than any other year with the exception of

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<sup>15</sup> One major factor to consider is that Zephyr does not have an ownership database as extensive as Orbis, therefore previous (to IPO) rounds of funding were included in the analysis as sponsors. Moreover, when and if there were inconsistencies between data points, a tertiary source was used (the relevant stock exchange webpage)

2009, immediately after the Global Financial Crisis. In the multivariate regression model, I will further discuss immediately I considered two dummy variables, one only for the IPOs in the financial crisis of 2008 which encompassed both 2008 and 2009 and one for both the financial crisis and the aftermath of the dot-com bubble. Neither were statistically significant dependent variables, nor have statistically significantly improved the fit of the model, according to the Adjusted R-squared.

**Table II. Sample Distribution**

The final sample consists of 420 European Union (28) IPOs between 2001 and 2017 collected from BvD Zephyr database. The following table shows the geographical and yearly distribution of the flotations by the country and each respective amount of capital raised, expressed in historical values.

**Panel A – Geographical Distribution**

Country	# of IPOs	Relative (%)	Amount raised (th EUR)*	Relative (%)
Austria	4	0.95	204,349	0.24
Belgium	15	3.57	2,127,509	2.53
Cyprus	1	0.24	24,177	0.03
Denmark	14	3.33	5,631,767	6.70
Finland	4	0.95	532,943	0.63
France	84	20.00	11,591,092	13.78
Germany	54	12.86	14,445,511	17.18
Ireland	2	0.48	122,999	0.15
Italy	17	4.05	3,839,280	4.57
Latvia	1	0.24	118,382	0.14
Luxembourg	7	1.67	2,437,610	2.90
Netherlands	27	6.43	6,627,414	7.88
Poland	23	5.48	558,521	0.66
Portugal	1	0.24	72,696	0.09
Spain	16	3.81	5,942,130	7.07
Sweden	33	7.86	5,066,402	6.02
United Kingdom	117	27.86	24,750,766	29.43
<b>Total</b>	<b>420</b>	<b>100.00</b>	<b>84,093,550</b>	<b>100.00</b>

**Panel B – Annual Distribution**

Years	# of IPOs	Relative (%)	Amount raised (th EUR)*	Relative (%)
2001	3	0.71	19,500	0.02
2002	2	0.48	560,396	0.67
2003	1	0.24	68,600	0.08
2004	9	2.14	845,699	1.01
2005	37	8.81	3,992,880	4.75
2006	60	14.29	7,164,535	8.52
2007	42	10.00	10,801,757	12.84
2008	8	1.90	88,916	0.11
2009	3	0.71	203,567	0.24
2010	19	4.52	6,391,484	7.60
2011	14	3.33	2,329,804	2.77
2012	12	2.86	1,431,082	1.70
2013	30	7.14	11,040,049	13.13
2014	69	16.43	15,327,702	18.23
2015	68	16.19	15,814,413	18.81
2016	43	10.24	8,013,166	9.53
<b>Total</b>	<b>420</b>	<b>100.00</b>	<b>84,093,550</b>	<b>100.00</b>

\* 21 deals had no data regarding the proceeds raised through IPO.

One further step to understand the IPO climate of European Union (28) between 2001 and 2007 is to account for the industry distribution of the offerings. The statistical classification of economic activities in the European Community, abbreviated as NACE, was used in order to arrive at this classification and in order to screen out the firms not suitable for study, i.e., regulated financial and utilities businesses, namely NACE Rev. 2 codes 3511-3900, 6411-6630.

From the excluded codes exceptions make 6420 (Activities of holding companies), 6499 (Other financial service activities, except insurance and pension funding n.e.c.), 6619 (Other activities auxiliary to financial services, except insurance and pension funding) which were considered on a case-by-case basis. The decision was made having in mind recent fintech sector developments, which can be equally treated as tech companies and the possibility of companies which have a different operational activity to be owned by a holding company, customary for fiscal engineering practices, to arrive at an exhaustive sample. There were seven holding companies with different operational activity and two special cases: EQS Group AG, an investor relations software platform and Nets A/S, a digital payment service provider.

**Table III. Industry Classification of IPOs**

The final sample consists of 420 European Union (28) IPOs between 2001 and 2017 collected from BvD Zephyr database. The following table shows the industry distribution of the flotations according to the NACE Revision 2 classification codes and for each the respective amount of capital raised, expressed in historical values.

Main Industry section - NACE rev. 2	# of IPOs	Relative (%)	Sum of Amount raised (th EUR)*	Relative (%)
A - Agriculture, forestry and fishing	2	0.48	14,000	0.02
B - Mining and quarrying	5	1.19	58,906	0.07
C - Manufacturing	153	36.43	26,417,542	31.41
F - Construction	5	1.19	1,146,731	1.36
G - Wholesale and retail trade; repair of motor vehicles and motorcycles	48	11.43	12,067,505	14.35
H - Transportation and storage	5	1.19	1,636,647	1.95
I - Accommodation and food service activities	10	2.38	2,263,262	2.69
J - Information and communication	66	15.71	11,575,427	13.76
K - Financial and insurance activities	9	2.14	3,027,323	3.60
L - Real estate activities	9	2.14	2,667,032	3.17
M - Professional, scientific and technical activities	54	12.86	10,415,579	12.39
N - Administrative and support service activities	18	4.29	6,331,503	7.53
O - Public administration and defense; compulsory social security	2	0.48	783,564	0.93
P - Education	5	1.19	90,279	0.11
Q - Human health and social work activities	21	5.00	4,144,327	4.93
R - Arts, entertainment and recreation	6	1.43	1,428,991	1.70
S - Other service activities	2	0.48	24,932	0.03
<b>Total</b>	<b>420</b>	<b>100.00</b>	<b>84,093,550</b>	<b>100.00</b>

\* 21 deals had no data regarding the proceeds raised through IPO.

The leading industries were Manufacturing, with more than a third of the IPOs in the sample and similar amount raised, followed loosely but closer among each other by Information and Communication companies, Professional, Scientific and Technical Activities, and, lastly, Wholesale and Retail Trade firms.

### *3.1.2. Auxiliary Data*

Lastly, independent datasets had to be collected. Regarding the proxy for the market conditions near each single IPO in the sample 6,071 completed flotations in European Union (28) in the period 2000-2017 were collected. Additionally, for screening out the PE involvements in the form of LBOs, a dataset with all 5,141 LBOs available on BvD Zephyr's database for EU-28 was constructed. Moreover, a database with all the sponsors which appear in the sample had to be built using BvD's Orbis in order to crosscheck the originating country and to find the date of incorporation, in order to compute the average age of the VC syndicate, variable which will be used and explained later, in chapter 3.2.3.

## **3.2. Methodology**

### *3.2.1. Subsamples*

To draw relevant and self-explanatory inferences the sample will be analyzed as a whole but also in subsamples according to each IPO's syndicate. In order to arrive at an OLS model which will try to explain some of the statistical relations, the full sample will be taken into consideration. However, to reach appropriate BHAR results, the dataset will be split into subsamples. My proposed approach is to consider the following division among VCs:

1. Syndicates which must contain VCs incorporated in LME countries but are not limited to those sponsors, meaning this subset can have IPOs backed by both LME and CME originated VCs;
2. Syndicates which must contain VCs incorporated in CME countries but are not limited to those sponsors, meaning this subset can have IPOs backed by both CME and LME originated VCs;
3. Syndicates which must contain only VCs incorporated in LME countries (i.e. no CME-originated VCs in the syndicate of any IPO in this subsample)
4. Syndicates which must contain only VCs incorporated in CME countries (i.e. no LME-originated VCs in the syndicate of any IPO in this subsample)

### *3.2.2. Buy-and-Hold Abnormal Returns*

Long-term event empirical research's goal is to identify whether or not certain events affect asset prices over long periods of time, across several months or years. Therefore, they can be

interpreted as tests of performance persistence. In this paper, to determine the differences in IPO performance of the subsamples outlined above buy-and-hold abnormal returns (BHARs) methodology will be used. The investment windows tested in this study are disposed in increments of 6 months, ranging from half of year to two years. When any particular stock was delisted during any of the four holding periods, it is no longer included in that window and any subsequent ones, but the preceding ones are kept in order to not create a survivorship bias. The BHAR is calculated for any event as

$$BHAR_i = \prod_{t=1}^T (1 + R_{i,t}) - \prod_{t=1}^T (1 + E(R_{b,t})). \quad (1)$$

There are a number of alternative methods of arriving at an expected return for any sample firm. A number of studies employ the reference portfolio method as a way to arrive at this expected value in the form of a market index return benchmark<sup>16</sup>. The biases present with this simple yet efficient way of proxying the benchmark for BHAR are irrelevant for the purpose of this study, since I am looking for differences in the syndicates split by market economy origination, not for BHAR values and statistical tests in a vacuum.

MSCI Europe stock index is suitable to be the benchmark for the BHARs since the distribution of VC-backed IPOs among EU-28's countries in the sample is greatly skewed towards the more developed ones, aspect seen in Table II, as is the case with the index. Even percentage-wise, there is substantial overlap, with the exceptions of Norway and Switzerland which are not present in the study's sample (given they are not part of EU-28) and Poland absence in the case of the index.

To test the null hypothesis that the average BHAR is equal to zero for any sample the parametric test is

$$t_{BHAR} = \frac{\overline{BHAR}_{l,t}}{\frac{\sigma_{BHAR}}{\sqrt{N}}}. \quad (2)$$

BHARs are positively skewed (Barber and Lyon, 1997, Kothari and Warner, 1997), therefore, this study will feature a skewness-adjusted t-test when analyzing BHARs. The statistical test was originally developed by Johnson (1978), and it is a transformed version of the common t-test to remove the skewness predisposition. The test statistic for the null hypothesis that the average BHAR is equal to zero is

$$t_{Skewness-Adjusted} = \sqrt{N}(S + \frac{1}{3}\hat{y}S^2 + \frac{1}{6N}\hat{y}) \quad (3)$$

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<sup>16</sup> See, e.g., Ritter (1991), Ikenberry, Lakonishok and Vermaelen (1995), Loughran and Ritter (1995), Spiess and Affleck-Graves (1995).

where N is the size of the sample, S is the skewness and

$$\hat{\gamma} = \frac{\sum_{i=1}^n (BHAR_i - \overline{BHAR})^3}{N \hat{\sigma}_{BHAR}^3} . \quad (4)$$

### 3.2.3. Multivariate Regression Analysis

In order to better understand the relations between syndicate composition, market conditions and operational data, a linear regression model will be employed. The dependent variable used will be the two-year BHAR. 409 out of the 420 offerings in the sample have data required to compute the outcome variable, and 311 remain after combining the requirements of all independent variables, leaving a sizeable sample to our disposal.

The explanatory variables used will be firstly dichotomous variables regarding the presence of LME or CME VCs in the syndicate. Two separate regressions will be used in order to avoid the dummy variable trap. For a third model, we will consider a ratio variable of the number of LME VCs in a syndicate divided by the total number of sponsors in any VC-backed IPO. We consider only LME VCs for the ratio independent variable since, as we will see in chapter 4, these yield statistically significant results in the previous-to-regression analyses.

Furthermore, another variable which may be of interest is the syndicate size, as in the number of total sponsors of any single IPO. This has not been addressed frequently in the current literature – however, it can be of interest to further understand the composition of IPO sponsorship. Consequently, Arthurs et al. (2008) proposes that both board experience and monitoring by the insiders as a consequence of multiple sponsors decreases underpricing.

Continuing with the syndicate composition matter, another variable which can be seen as a proxy for VC experience and/or reputation is VC age. The variable is expressed in years and it is an average of the years since incorporation up to the IPO of every sponsor backing it up. There are a number of papers which argue that this is a measure for experience which translates into target company performance and survivability<sup>17</sup>. There is also the so-called grandstanding hypothesis, proposed by Gompers (1996), which states that young VC firms have the incentive to “grandstand”, rushing their investments public prematurely and untimely, to quickly raise capital for new opportunities and consequently establish a reputation. Barnes (2003) tests the hypothesis on the UK VC industry. He finds that this phenomenon does not lead to significant underpricing but younger VC

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<sup>17</sup> For instance: Hsu (2004), Krishnan et al. (2009).



firms do tend to rush their target companies public, and such, spend less time and fewer resources on restructuring, advising and building the firms.

Regarding market conditions, two variables used are underpricing or initial return in percentages and market conditions prior to any particular IPO in the sample. The underpricing has a significant effect on the long-term aftermarket performance of IPOs. The general outline is that underpricing varied considerably over the past decades. Not only it varies over time, but it also vastly changes from case to case, industry to industry, or market to market. For instance, Cao (2011) finds that the average initial return of non-backed IPOs is more than twice as high as it is for backed ones, which indicates that sponsorship reduces underpricing. This overreaction is mostly limited to the first trading day after flotation. The market conditions variable will be established based on the total number of European Union (28) IPOs in the previous three months to any flotation in the sample. The statistical relation with the aftermarket performance derives from the market timing hypothesis. It has been documented that if a company was offered during a so-called “hot issue period”, i.e., a period in which a relatively large number of firms were publicly offered, the expectation is that the initial price is comparatively high, leading to aftermarket underperformance. As mentioned before, in chapter 3.1.2, data on all the EU-28 IPOs present in Zephyr’s database was excerpted in order to arrive at the information needed for the regressor. Moreover, to adjust for potentially large differences in the first-day returns this study measures aftermarket performance from the second day onwards.

Operationally related variables used in the model were the natural logarithm of the total assets and the operating margin. The margin represents a measure of how capable is a company of generating revenues and, subsequently profits, using its assets. Consequently, the two variables have been included in the final model, being one of the most relevant measures for company operational performance.

The following control variables have been considered for the regression and subsequently deemed inadequate after comparing the outputted models and their respective goodness of fit: dummy variable regarding the two subsequent years of financial crisis of 2008 (2008-2009); dummy variable regarding both the aforementioned financial crisis aftermath and the aftermath of the dot-com bubble, selected as the period 2001-2003, when only 6 IPOs were completed in the sample; D/E ratio; return on assets; natural logarithm of revenues and natural logarithm of market value before flotation.

## 4. Results

### 4.1. Buy-and-Hold Abnormal Returns

Applying the methodology outlined in chapter 3 we arrive at the following BHARs for each of the subsample explained beforehand. The skewness adjusted t-tests show us before taking into account any differentiation between sponsors that the average BHARs among the 420 IPOs are statistically significantly different from zero at 5% level for the 6- and 24-months periods and at 10% level for the 12 months one. Thus, there is a trend towards zero abnormal returns up to a year/a year and a half after flotation which rebounds afterwards. A potential explanation for this behavior could be, firstly, the lockup period, which typically lasts anywhere from six months to two years, the usual scenario being the former. Brav and Gompers (2003) found evidence of price decline of 2% on average at lockup expiration using a sample of 2,794 US stocks, increasing proportionally with moral hazard potential and lack of VC backing.

**Table IV. Buy-and-Hold Abnormal Returns**

The table below presents for each subsample of the 420 EU-28 IPOs between 2001 and 2017 the respective BHARs for each increment of 6 months, up to two years. The benchmark used is MSCI Europe stock index. The sample is then split into the following manner for the purpose of the study: syndicates of VCs which must contain LME VCs but are not limited only to them, syndicates which must contain CME VCs but not limited to them, and then syndicates which contain LME and then CME VCs, respectively, exclusively (i.e. an IPO which was backed only by sponsors are incorporated in LME/CME countries). For all subsamples and time windows the t-tests and skewness adjusted t-tests statistics are presented.

	Investment Window	N	BHAR (%)	Skewness adj. t-test
<b>Full Sample</b>	6 months	420	8.00	2.300**
	12 months	417	4.34	1.694*
	18 months	414	4.77	1.538
	24 months	409	7.16	1.966**
<b><i>Syndicates containing, but not limited to</i></b>				
<b>LME VCs</b>	6 months	246	5.28	2.691***
	12 months	244	9.53	2.974***
	18 months	243	12.39	3.24***
	24 months	238	16.67	3.56***
<b>CME VCs</b>	6 months	208	4.10	1.390
	12 months	207	-2.40	-0.711
	18 months	205	-4.00	-0.919
	24 months	204	-2.30	-0.432
<b><i>Syndicates containing only</i></b>				
<b>LME VCs Only</b>	6 months	169	7.24	3.318***
	12 months	167	15.37	3.805***
	18 months	168	19.58	4.177***
	24 months	169	24.80	4.463***
<b>CME VCs Only</b>	6 months	131	5.90	1.499
	12 months	131	-1.80	-0.386
	18 months	129	-4.36	-0.733
	24 months	129	-3.13	-0.456

\*, \*\* and \*\*\* represent significance at the 10%, 5% and 1% level, respectively.

When splitting the sample into the aforementioned syndicate characteristics, a clear statistically significant pattern emerges. IPOs backed by syndicates which contain CME VC firms, either exclusively or non-exclusively, are described by an aftermarket performance with abnormal returns which are not statistically different from zero, whereas IPOs backed by syndicates which contain LME-originating VC firms, exclusively or non-exclusively, have an aftermarket performance with abnormal returns which are statistically significantly different from zero at 1% level for every investment window studied. Moreover, the lockup effect described above seems to be affecting in part only the IPOs backed by CME-originating VC, BHARs decreasing drastically after the 6 months mark.

One important thing to report is that when the first day of flotation is taken into the event window, the resulting BHARs become largely insignificant. However, the trend of LME VCs backing IPOs with positive abnormal returns when CME VCs are backing IPOs with negative or zero abnormal returns still emerges.

This is potentially signaling that the presence of LME-originated VCs is having an enhancing effect on the performance after flotation of the respective European-incorporated companies. Not only that the returns of CME VC-backed IPOs are not statistically different from zero, but they do not present a clear pattern neither, whereas the LME VC-backed IPOs have a clear upward trend. This characteristic is present both in exclusive and non-exclusive syndicates as seen in Table IV. However, before drawing any definite inferences, one must take into account several different variables.

#### *4.2. Key Variables*

Further analysis into the relevant characteristics of the IPOs in the sample shows small differences. However, none come close to the magnitude of the two-year buy-and-hold abnormal returns, where the average abnormal returns of LME characterized syndicates are in the domain of double digits whereas the means for the CME characterized ones are in the negative, close to zero. The median for the whole sample is -9.71%, whereas the subsamples marked by LME syndicates have their sets split at close to 0% for the non-exclusive and at 11.59% for the LME exclusively backed deals, as can be observed in Table V. The standard deviations are not particularly different, and the difference is statistically significantly different at 1% level, as shown in Appendix B, therefore reinforcing the school of thought that LME VC-backed IPOs might perform better than the others.

**Table V. Comparison of key Variables between Subsamples**

The table below presents for each subsample of the 420 EU-28 IPOs between 2001 and 2017 the most relevant variables for this paper's discussion, characteristics regarding the VC syndicates and the IPOs themselves. The split is done in the following fashion: firstly I present the descriptive statistics for the full sample, then for syndicates containing but not limited to LME-originated sponsors and CME-originated sponsors, respectively, and, finally, for syndicates which contain LME and then CME VCs, respectively, exclusively (i.e. an IPO which was backed only by sponsors that originate in LME/CME countries). For each variable, the table lists the number of observations, average, median, standard deviation, minimum and maximum values.

		<b>N</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<b>Two-year BHAR (%)</b>	Full Sample	409	7.16	-9.71	79.28	-149.14	500.15
	LME	238	16.67	-0.17	83.43	-140.85	500.15
	CME	205	-2.62	-18.45	73.58	-149.14	347.61
	LME Only	163	24.80	11.59	86.84	-140.85	500.15
	CME Only	130	-3.56	-18.63	74.21	-149.14	239.35
<b>Underpricing (%)</b>	Full Sample	417	4.42	1.88	21.18	-98.99	219.87
	LME	246	4.56	3.52	20.51	-98.99	121.26
	CME	208	4.62	0.19	11.90	-19.70	53.13
	LME Only	169	4.02	4.81	22.92	-98.99	121.26
	CME Only	132	3.89	0.01	10.56	-16.96	50.76
<b>VC Average Age (years)</b>	Full Sample	409	42.89	30.00	34.98	0.06	111.63
	LME	242	44.58	37.79	32.87	1.05	111.63
	CME	206	36.40	23.79	29.89	3.03	109.87
	LME Only	165	45.93	35.61	35.58	1.05	111.63
	CME Only	129	33.24	18.55	31.60	3.03	109.87
<b>Syndicate Size (# VCs)</b>	Full Sample	420	2.61	2.00	2.18	1.00	17.00
	LME	247	3.00	2.00	2.48	1.00	17.00
	CME	209	3.32	2.00	2.60	1.00	17.00
	LME Only	170	2.05	2.00	1.42	1.00	8.00
	CME Only	132	2.28	2.00	1.60	1.00	8.00

The descriptive statistics for the initial return/underpricing of each sample and sub sample studied present similarities. However, the CME-characterized sub samples have medians close to 0 and relatively low standard deviations, together with a smaller range. The greater variability can be attributed to the difference of choices regarding – and ability to recognize – hot and cold IPO markets of the two types of VC firms. We will discuss more about this possible relation in chapter 4.4.2.

In terms of average VC age in a particular syndicate from the sample, it seems that there is a slight difference between each two compared subsamples. The mean (median) for the LME exclusive subsample is 45.93 years (35.61), a staggering 38% difference compared to the CME exclusive average, statistically significantly different at 1% level (see Appendix B). When comparing medians, the average of the former subsample is almost double (92%) larger than that of the latter. As discussed before, the academic literature suggests<sup>18</sup> that there is a positive relationship between sponsor age and IPO performance. Kraussl and Krause (2014) found out that market players in Europe

<sup>18</sup> See, e.g., Barnes (2003), Gompers (1996), Krishnan et al. (2009)

are less experienced than in the US, easily proxied by a measure of average age. This might explain in part the statistical outperformance of LME-originating VC characterized syndicates. However, this is not the case in this study, as this will be discussed further into detail in chapter 4.3. Lastly, Syndicate size is not described by massive differences from one subsample to another.

The four subsamples are not vastly different in terms of transaction numbers, with each pair of exclusive or non-exclusive syndicates having small differences between them, and each large enough to make valid statistical inferences, therefore any differences cannot be attributed to sample/subsamples influence to statistical power.

#### *4.3. Multivariate Regression Models*

Furthermore, to make statistical inferences we used multivariate regression, the dependent variable for each model being the 520-day, i.e. two years in trading days, buy-and-hold abnormal return of each IPO with available data from the sample. In table VI, the first column shows the results for the regression that uses as main explanatory variable a dichotomous regressor which takes the value of 1 if there is at least one LME-originated VC firm in the syndicate. The second column shows the results for the model that uses a CME-originating VC dummy variable. Lastly, the third column shows the results for a ratio variable, computed by dividing the number of LME-originating VCs to the total amount of VCs in any syndicate from the backed IPOs in the sample.

It seems that there is a fine balance, and neither of the types of sponsors are the absolute and final option alone. As explained in chapter 2.2.4., when mixing foreign and domestic sponsors in a syndicate the results usually tend to be the best. We can see that neither dichotomous variables, for any of the two types of VC firms are greatly significant, CME regressor even being statistically insignificant.

There is a negative, but weakly significant relationship between syndicate size and long-term aftermarket performance. This reinforces some of the findings documented so far in the relevant literature, which state that conflicts of interest, misalignment of incentives and information asymmetries can negatively impact IPOs backed by large syndicates. Apart from that, there is also a syndication size difference between the two types, as it can be seen from Table V and Appendix B, which can, in part, explain this negative coefficient.

We can observe that even if the average VC age differs, as seen from the Table V analysis in chapter 4.2., it does not statistically significantly influence the 520 days (i.e., 2 trading years) BHAR dependent variable.

**Table VI. Multivariate Regression Model Results**

The dependent variable is the 520 days (two years in trading days) buy-and-hold abnormal return which was obtained having the MSCI Europe Index as benchmark. The main explanatory variables for the purpose of this study are: a dummy variable for IPOs backed by syndicates containing at least one LME-originated VC for column (1), for column (2) at least one CME-originated VC and for column (3) a ratio between the number of LME-originated VCs and the total number of sponsors in the VC syndicate. For each column the remaining independent variables are the syndicate size, the average age of VCs in years, the initial return of the IPO, the natural logarithm of the total assets and the operating margin of publicly offered company and the European Union's (28) IPO market conditions, as the number of IPOs in the 90 days before any flotation in the sample. The heteroskedastically robust standard errors are presented in parentheses.

	(1)	(2)	(3)
LME VC Present Dummy Variable	0.177* (0.103)		
CME VC Present Dummy Variable		-0.129 (0.101)	
Ratio of LME VCs over Syndicate Size			0.235** (0.111)
Syndicate Size	-0.043** (0.021)	-0.024 (0.021)	-0.032* (0.020)
VC Average Age	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Underpricing	0.000 (0.002)	0.000 (0.002)	-0.000 (0.002)
Log Total Assets	0.038** (0.019)	0.045*** (0.017)	0.040** (0.018)
Operating Margin	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Market Conditions (Number of IPOs)	-0.002** (0.001)	-0.002** (0.001)	-0.001* (0.001)
Constant	-0.195 (0.269)	-0.134 (0.281)	-0.261 (0.261)
N	318	318	318
Adjusted R-squared	0.056	0.052	0.062

\*, \*\* and \*\*\* represent significance at the 10%, 5% and 1% level, respectively.

To control for the influence of target companies' operational characteristics we considered some of the most relevant ones: logarithm of total assets, operating margin, D/E ratio, return on assets, logarithm of revenues and natural logarithm of market value before flotation. However, in the final models, employing stepwise regression, we remain only with the logarithm of total assets and operating margin, out of which only the variable log of total assets is positively significant.

We preferred to use the number of IPOs as a proxy of hot/cold IPO market instead of a dummy variable as the model's explanatory power and variable significance are both higher this way, making the variable statistically significant at 5% level in all three models. Multicollinearity was only a problem for independent variables no longer included in the final regression, operational ones such as logarithm of total revenues, return on assets and market cap.

#### *4.4. Robustness Checks*

We have devised a number of robustness checks to verify whether or not our conclusions change if there are alterations in the assumptions used so far. The following chapters will go through each of the pivotal parts of methodology used in order to double check the inferences made. We will test the BHAR methodology with three new subsamples and benchmarks, dictated by country of IPOs. The multivariate regression will have different dependent variables, time-wise and benchmark-wise. Lastly, we will further analyze the inverse of the relationship used in the regression models between the hot issue offerings market and the main explanatory variable used thus far, studying the ability of each type of VC to time the IPO market.

##### *4.4.1. Buy-and-Hold Abnormal Returns*

In order to unbiasedly test the methodology used in calculating the BHARs in this study, a random string generator has been used to select three countries from the sample of 420 IPOs from European Union (28) between 2001 and 2017. In order to have reasonably large enough subsamples, we selected only from the countries which had at least 10 IPOs during the years in the total sample. Therefore, we arrived at two CMEs, Netherlands and Sweden and one Mediterranean market economy, Italy. For each of the countries, their major equity index was used.

From Table VII, where the results of the robustness checks for BHARs can be found, we can observe that there are fewer statistically significant values, especially when considering Italy, with none. However, the trends presented previously are still present, with CME VCs having either statistically insignificant, or large statically significant negative abnormal returns, whereas LME VCs having statically significant positive ones. The greatest discrepancy is in the case of Netherlands IPOs backed by exclusive syndicates.

However, with these sample sizes, the statistical power of the tests is largely questionable, but they do provide an interesting insight. According to Hall and Soskice (2001) classification, Italy is a Mediterranean Market Economy, a hybrid between the two market economies studied in this study, characterized by a large agrarian sector and a history of extensive state intervention. Further research can be conducted in this area of interaction between sponsor market economy origin and target company origin.

**Table VII. Robustness Checks for Buy-and-Hold Abnormal Returns**

From the total sample of 420 IPOs from European Union (28) in the period 2001-2017 three countries with at least 10 transactions have been chosen at random in order to test both smaller, regionally specific samples and different benchmarks for the BHARs. For each country, its major equity index was used. For Italy, FTSE MIB, for Netherlands, AEX and for Sweden OMX Stockholm 30. The skewness adjusted t-statistics are reported in parentheses.

	Investment Window	Italy		Netherlands		Sweden	
		N	BHAR (%)	N	BHAR (%)	N	BHAR (%)
<b>Full Subsample</b>	6 months	17	-1.57 (-0.28)	26	12.90 (1.55)	29	11.64* (1.68)
	12 months	17	0.46 (0.04)	26	14.14 (1.51)	29	13.44* (1.81)
	18 months	17	5.06 (0.44)	26	4.28 (0.43)	28	21.49* (1.85)
	24 months	17	-0.48 (0.01)	25	9.71 (0.84)	28	25.10* (1.77)
	<b><i>Syndicates containing, but not limited to</i></b>						
<b>LME VCs</b>	6 months	9	0.62 (0.06)	23	16.64** (2.02)	13	16.58** (2.30)
	12 months	9	-0.52 (-0.04)	23	18.62** (2.04)	13	19.53** (2.08)
	18 months	9	6.80 (0.35)	23	9.13 (0.87)	13	33.15** (2.20)
	24 months	9	1.62 (0.12)	22	15.81 (1.26)	13	41.45** (2.11)
<b>CME VCs</b>	6 months	7	-7.17 (-0.61)	15	4.46 (0.35)	21	9.66 (1.11)
	12 months	7	-10.26 (-0.51)	15	3.84 (0.27)	21	11.97 (1.29)
	18 months	7	2.29 (0.15)	15	-7.48 (-0.55)	20	18.84 (1.24)
	24 months	7	-7.77 (-0.22)	14	-2.31 (-0.13)	20	26.69 (1.33)
<b><i>Syndicates containing only</i></b>							
<b>LME VCs Only</b>	6 months	4	6.81 (0.71)	10	26.47*** (4.73)	8	16.83 (1.62)
	12 months	4	13.67 (1.00)	10	28.82*** (3.14)	8	17.29 (1.53)
	18 months	4	4.83 (0.32)	10	19.87* (1.74)	8	28.13** (1.97)
	24 months	4	11.07 (0.55)	10	26.45* (1.91)	8	21.14* (1.75)
<b>CME VCs Only</b>	6 months	2	-14.27 (-0.81)	2	-25.65 (-0.99)	16	7.63 (0.71)
	12 months	2	-6.24 (-0.24)	2	-41.17 (-1.16)	16	8.49 (0.78)
	18 months	2	-12.93 (-0.83)	2	-61.72*** (-5.07)	15	11.39 (0.67)
	24 months	2	-12.34 (-0.70)	2	-57.80*** (-13.77)	15	10.93 (0.56)

\*, \*\* and \*\*\* represent significance at the 10%, 5% and 1% level, respectively.



#### 4.4.2. Multivariate Regression

Moving on to the robustness checks for the regression models employed, one important thing to mention is that the main explanatory variable of the STUDY REMAINED the ratio of LME VCs over the total syndicate size, because of its statistical significance in the main model and because of the academic support it is documented to have.

The first step natural stage was to assess whether a different (longer) time horizon would change the results. Studies sometimes have long-term investment windows of up to 5 years. However, in my opinion once a trend is significantly achieved, the following years can only be affected by noise. Therefore, to ascertain the validity of our model, the 3-year BHAR has been used as the dependent variable in the model with results in the first column of Table VIII. Clearly enough, the explanatory variable gained in statistical significance, reaching the 1% level. However, the adjusted R-squared decreased slightly when compared to the initial model presented in column 3 of table VI.

Another aspect of the model to be tested is the dependence of the outcome variable, the 2-year BHAR, on the benchmark used to determine it for each IPO. Therefore, we tested two other benchmarks for the return model, and we arrived at the results presented in the last two columns of table VIII. The statistical significance of the main explanatory variable decreased slightly.

**Table VIII. Robustness Checks for Regression Analysis**

The dependent variable in column (1) is the three-year buy-and-hold abnormal return, while in columns (2) and (3) the benchmarks used for the two-year BHAR are S&P Europe 350 Index (2) and STOXX Europe 600 Index (3), respectively. The main explanatory variables for the purpose of this study are: a ratio between the number of LME-originated VCs and the total number of sponsors in the VC syndicate. For each column the remaining independent variables are the syndicate size, the average age of VCs in years, the initial return of the IPO, the natural logarithm of the total assets and the operating margin of publicly offered company and the European Union's (28) IPO market conditions, as the number of IPOs in the 90 days before any flotation in the sample. The heteroskedastically robust standard errors are presented in parentheses.

	(1)	(2)	(3)
Ratio of LME VCs over Syndicate Size	0.355*** (0.137)	0.187* (0.111)	0.188* (0.112)
Syndicate Size	-0.015 (0.031)	-0.041** (0.020)	-0.044** (0.020)
VC Average Age	0.002 (0.001)	0.001 (0.001)	0.001 (0.001)
Underpricing	0.001 (0.004)	-0.000 (0.002)	-0.000 (0.002)
Log Total Assets	0.035 (0.023)	0.038** (0.018)	0.036** (0.018)
Operating Margin	0.002* (0.001)	0.001 (0.001)	0.001 (0.001)
Market Conditions (Number of IPOs)	-0.002 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Constant	-0.250 (0.407)	-0.281 (0.267)	-0.235 (0.267)
N	279	318	318
Adjusted R-squared	0.057	0.043	0.040

\*, \*\* and \*\*\* represent significance at the 10%, 5% and 1% level, respectively.

Furthermore, an analysis of LME VCs choices regarding industry and country of origin of their target companies is warranted. In Appendix C you will find the distribution of IPOs backed by these VCs, and generally, industry-wise, they're generally similar. However, the main distinction comes into play, naturally, when considering country allocation, UK being more preferred to any other European Union (28) country. However, there are many cases of companies from Europe which prefer the UK stock market for its exposure to international investors or fiscal treatment as opposed to their home stock exchange. In this study we only controlled for IPOs inside European Union (28), but future research could control for target company's country of origin too.

Lastly, considering the body of literature surrounding this aspect, it is also of interest to see if the two types of VCs outlined in this paper have different timing abilities when it comes to hot versus cold IPO markets. There are numerous papers which study the relation between the state of the offerings market and aftermarket performance, which have also been discussed in chapter 2.1.1. Therefore, we will test this possibility through a logit univariate regression between the three main explanatory variables considered in chapter 4.3. and the dummy variable which takes the value of 1 if in the past three months up to a flotation from the study's sample the number of offerings is above the median. We find statistically significant evidence that, indeed, the LME VC syndicates, exclusive or not, tend to avoid hot IPO market periods, whereas CME VC ones do the opposite.

**Table IX. Univariate Hot IPO Market Relation**

The dependent variable in all three columns is the hot IPO market dichotomous variable, which takes the value of 1 if in the past three months up to a flotation - from the sample of 420 IPOs from European Union (28) between 2001 and 2017 – the number of offerings is above the median, and 0 otherwise. The main explanatory regressors for the purpose of this study are: a ratio between the number of LME-originated VCs and the total number of sponsors in the VC syndicate for column (1), for column (2) at least one CME-originated VC and for column (3) a dummy variable for IPOs backed by syndicates containing at least one LME-originated VC. Panel A presents the Logit regression results and Panel B presents the marginal effects of the odds ratios. The standard errors are presented in parentheses.

<b>Panel A</b> Logit Regression	(1)	(2)	(3)
Ratio of LME VCs over Syndicate Size	-0.606*** (0.218)		
LME VC Present Dummy Variable		-0.511** (0.200)	
CME VC Present Dummy Variable			0.498** (0.197)
Constant	0.277* (0.142)	0.291* (0.154)	-0.257* (0.139)
Observations	420	420	420
Pseudo R-squared	0.0134	0.0113	0.0111
<b>Panel B</b> Marginal Effects	(1)	(2)	(3)
Ratio of LME VCs over Syndicate Size	-0.149*** (0.051)		
LME VC Present Dummy Variable		-0.126*** (0.048)	
CME VC Present Dummy Variable			0.123*** (0.047)
Observations	420	420	420

\*, \*\* and \*\*\* represent significance at the 10%, 5% and 1% level, respectively.

## 5. Conclusions

The objective of this paper is to compare the aftermarket performance of 420 European Union (28) IPOs from 2001 to 2017, splitting the sponsorship backing in coordinated market economy VCs and liberal market economy VCs. This study provides statistically significant evidence of a positive relationship between the number of LME VCs present in a syndicate and the 2-year buy-and-hold abnormal returns of the IPOs, starting from the second day after flotation, in order to control for overreaction. Moreover, significant differences can be observed also at the 6-, 12- and 18- months marks in terms of BHARs between syndicates containing, either exclusively or not, one of the types of VC. We also compared a number of variables of interest, such as the underpricing of the IPOs, the VC average age and syndicate size, but found little to no difference with the exception of age. Krishnan et al. (2011) documented a relation between VC experience and reputation and the aftermarket performance of the backed IPOs and Gompers (1996) discussed the grandstanding hypothesis as a potential explanation of underperformance of young VC firms. However, despite the difference observed in age, as a proxy for experience and reputation, when introduced into the multivariate regression analysis, it yielded no significant relationship for our sample.

This study is subject to a number of limitations, which stem either from the VC environment as a whole, or from the objective of this study. Firstly, we aimed to compare the IPO performances between the two types of VC sponsorship, not to provide clear evidence of the exact magnitude. That can only be achieved through more extensive and in-depth analysis on a case by case basis, taking into account the Fama-French factors, each country financial environment and even industry-level determinants. Secondly, the way data is reported surround VC transactions is not fully transparent oftentimes, therefore there is a potential survivorship bias present in any analysis performed on them even though a comprehensive database was used.

Other suggestions for further future research include looking into the potential causes of these differences, such as the effect of syndicates with VC firms originating from target company's country of incorporation, together with LME-originated VCs and study the relationship of the ratio of each sponsor type on the aftermarket performance. Perhaps there is an optimal number, depending on the region or even universal. Also, future studies could control for the target company's country of origin, since in this paper, only the country of flotation was taken into consideration. Subsequently, the interaction between the sponsors and target companies of different market economies could be an interesting subject to discuss in the future studies, seeing as Italy, a Mediterranean market economy, did not show the same trends documented for the sample used.

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## Appendix A

### Sponsors' Countries of Incorporation Distribution

The following table shows the distribution of the countries of incorporation of the VCs present in this study's sample of 420 transactions from European Union (28) between 2001 and 2017.

Country of Incorporation	Number	Relative (%)
Australia	1	0.17
Austria	4	0.68
Belgium	18	3.06
Bermuda	2	0.34
British Virgin Islands	2	0.34
Canada	3	0.51
Cayman Islands	3	0.51
Cyprus	1	0.17
Denmark	12	2.04
Estonia	2	0.34
Finland	4	0.68
France	123	20.92
Germany	68	11.56
Greece	1	0.17
Hong Kong	3	0.51
India	1	0.17
Ireland	3	0.51
Israel	2	0.34
Italy	11	1.87
Japan	1	0.17
Luxembourg	6	1.02
Netherlands	14	2.38
Norway	3	0.51
Poland	16	2.72
Portugal	1	0.17
Singapore	2	0.34
Spain	23	3.91
Sweden	20	3.40
Switzerland	9	1.53
United Kingdom	110	18.71
United States	119	20.24
<b>Total</b>	<b>588</b>	<b>100.00</b>



## Appendix B

### Independent Samples t-test for the Relevant Explanatory Variables

The following table shows the t-tests for the differences between the relevant explanatory variables: two-year buy-and-hold abnormal return, initial return/underpricing of the IPO, VC average age in any given syndicate and the syndicate size. We compare the independent subsamples characterized by LME-originating sponsors, with 163/169/165/170 data points for each variable, and CME-originating VC firms, respectively, with 130/132/129/132 data points for each variable discussed. The study's total sample consists of 420 transactions from European Union (28) between 2001 and 2017.

	BHAR	IR	VC Average Age	Syndicate Size
<b>LME only vs CME only (exclusive syndicates)</b>	-3.22***	0.06	3.23***	-1.28

\*, \*\* and \*\*\* represent significance at the 10%, 5% and 1% level, respectively.

## Appendix C

### LME VCs-only Syndicates' Investment Distribution

The following table shows the distributions by country and industry, according to the NACE Revision 2 classification codes, of the 170 IPOs backed by syndicates containing only LME-originating VCs exclusively. The study's total sample consists of 420 transactions from European Union (28) between 2001 and 2017.

Country	#	Relative (%)	NACE Rev. 2 main section	#	Relative (%)
Austria	1	0.59	B - Mining and quarrying	4	2.35
Belgium	2	1.18	C - Manufacturing	52	30.59
Cyprus	1	0.59	F - Construction	1	0.59
Denmark	1	0.59	G - Wholesale and retail trade; repair of motor vehicles and motorcycles	21	12.35
Finland	1	0.59	H - Transportation and storage	4	2.35
France	4	2.35	I - Accommodation and food service activities	6	3.53
Germany	12	7.06	J - Information and communication	32	18.82
Ireland	2	1.18	K - Financial and insurance activities	6	3.53
Italy	4	2.35	L - Real estate activities	5	2.94
Luxembourg	6	3.53	M - Professional, scientific and technical activities	17	10.00
Netherlands	10	5.88	N - Administrative and support service activities	7	4.12
Poland	1	0.59	P - Education	2	1.18
Spain	8	4.71	Q - Human health and social work activities	8	4.71
Sweden	8	4.71	R - Arts, entertainment and recreation	4	2.35
United Kingdom	109	64.12	S - Other service activities	1	0.59
<b>Total</b>	<b>170</b>	<b>100.00</b>	<b>Total</b>	<b>170</b>	<b>100.00</b>