2012

Effects of Early Round Venture Capital Syndication on IPO Exits in Europe and the United States

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SUBMITTED TO

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AND

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BY

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FOR

SENIOR THESIS

SPRING 2012

APRIL 23, 2012

Acknowledgements

I would like to thank the truly unique faculty at the Robert Day of Economics and Finance for their continued dedication and contribution to my understanding of Economics and Finance. I am especially grateful to Professor Smith for helping me specify a thesis topic and for providing continued guidance throughout the progression of this thesis. The final product would not have been possible without her constant input and expertise on the subject matter. I would also like to extend a special thank you to Professor Ozbeklik, for his input on complex Econometric models that were utilized in this thesis, and to Professor Antecol, for being a phenomenal advisor throughout these last four years.

I would also like to thank the Financial Economics Institute (FEI) for granting me access to the computer lab and its facilities. The available software packages and the intellectual exchange with peers experienced at the FEI were instrumental to the completion of this thesis.

Lastly, I would like to thank my friends and family for providing an invaluable support system throughout these last four years. There are no words to describe how much I have cherished your company, emotional support, and humor.

Abstract

While the importance of venture capital (VC) can be highlighted by policy goals outlined in the 'Lisbon agenda', the European VC industry remains nascent in comparison to the more sophisticated VC market in the US. Researchers have identified key determinants that foster VC success on a broad level, and have often identified syndication as an important factor of success. This paper seeks to understand the role of syndication on the VC-backed company's success. I take a novel departure from past research in this area in three ways 1) I measure performance from the perspective of the portfolio company, rather than the VC firm which invests in the company 2) I isolate syndication in the first financing round and 3) I utilize a logistical model as well as a simultaneous equation model for which I introduce an instrumental variable. I gather VC data for both Europe and the US from the *VentureXpert* database to test various hypotheses regarding syndication. The results are significant and provide evidence to support that syndication in the first financing round is associated with greater success in achieving IPO exit in both regions. This should encourage VC firms, VC-backed companies, and policymakers to increase the practice of VC syndication in early financing rounds, thereby providing access to greater long-term growth opportunities. This paper adds to the existing, but limited, literature base on cross-region venture capital syndication.

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EFFECTS OF EARLY ROUND VENTURE CAPITAL SYNDICATION ON IPO EXITS IN EUROPE AND THE UNITED STATES

Recent economic turmoil has highlighted the growth concerns in Europe, where the jobless count has increased to 10.8 per cent[1] (FT.com, 2012). While the United States (US) and Europe have comparable capital markets, the development of venture capital (VC) within the two regions differs significantly. The US has a much more advanced VC industry compared to that of Europe's. However, European advances in the VC industry are notable, as the industry makes important contributions to the economy through rejuvenating existing industries, supporting high-growth-potential companies, and creating employment opportunities. Policy-makers would benefit from increased efforts in supporting financial environments that are suitable in fostering VC investment.

This paper looks at the specific aspect of VC syndication within the first stage of financing in European and US VC companies. Specifically, I focus on syndication activity and its effects on IPO exit. The literature on VC in Europe is somewhat limited due to the lack of sufficient data. The topic of syndication further limits the pool of literature which primarily focuses on the testing of theories of motivations for syndication and looks at the performance of the VC firm investing within the portfolio company, as opposed to the performance of the actual portfolio company. Furthermore, most research on syndication looks at overall syndication, without focusing on particular stages of financing. Deli & Santhanakrishnan (2010) find that syndication occurs mostly in the earliest stages of development and firms in the last stage of development, highlighting the importance of looking at particular investment rounds when considering syndication as a

[1] This figure is for the 17-country bloc within the eurozone as of April 9, 2012.

determinant of success. Thus, this research offers substantial novelty in the area of cross-regional research on venture capital financing. I find significant evidence to support syndication in first financing rounds as a contributor to successful exit (specifically, IPO).

I begin with a brief history of VC markets in Europe. I then review the literature on VC syndication, outlining the motivations behind syndication from the VC firm's perspective and past research on syndication from the perspective of the portfolio company. These aid in generating testable hypotheses of VC syndication. My approach has two parts. First, I use a logistical (logit) model to explain both the effects of the syndication presence on IPO exit and also the effects of magnitude[2] of syndication on IPO exit. The results are significant and associate European syndication with a 19% increase in the probability of IPO, while syndication in US portfolio companies is associated with a 40.9% increase in IPO success. Additionally, this approach provides evidence that supports the idea of diminishing returns to the addition of investors within the first round syndicate in US VC companies. This result is also seen with the European sample, but the result is not significant. In the second approach, I seek to mitigate endogeneity issues by using a simultaneous equations model (SEM) and introducing an instrumental variable (IV). I compare biased ordinary least squares estimates (OLS) with IV estimates derived from a two-stage least-squares (2SLS) computational method. Under this approach, I find that the effect of European syndication on IPO increases to 43.4%. This result is significant for the European sample. However, this approach cannot

[2] Throughout this paper magnitude refers to the number of investors within a particular financing round.

be used for the US sample[3]. Both methods offer good insight into the topic of syndication and add to the existing literature base on venture capital.

I. History of European Venture Capital

A. The Rise (and Fall) of Venture Capital and New Stock Markets in Europe

The US pioneered the unparalleled boom of the VC markets during the 1990s, with its dominance in the high tech realm. The booming VC industry was also seen in Europe, but not to the same extent. The growth of funds invested in European venture capital between 1995 and 2000 was about six-fold (Bottazzi, Da Rin, van Ours, & Berglöf, 2002). While this is impressive, this was a mere quarter of the growth experienced in the US during the same time period. Nevertheless, prominent efforts were made to establish a pan-European network to promote the listing of growth companies during the 1990's. In 1996, the Easdaq was established in Belgium as a pan-European market for growth companies. Similarly, in 1997, the Euro.nm was established as a pan-European network of regulated markets dedicated to growth companies, which included stock exchanges of Amsterdam, Paris and Brussels, along with Deutsche Börse AG and Borsa Italiana. Both networks were largely modeled after the American NASDAQ, but unlike NASDAQ, these European equivalents would be short-lived efforts due to the dot-com bubble burst in 2000. Easdaq was purchased by NASDAQ in 2001, and after being hampered by its small scale and undiversified nature it was closed in 2003 (Dierick & Vesala, 2005). The Euro.nm would also suffer an unfortunate fate. However, its failure was caused by different factors—namely, that its aim of creating a cooperative pan-European market was not upheld by the German and Italian new markets (Guidici &

[3] In the US sample, the IV is dropped because it is perfectly correlated with the dependent variable for IPO exit. Thus, the simultaneous equation cannot be identified, and the IV estimation cannot be used.

Roosenboom, 2004). The exchanges of Paris, Amsterdam and Brussels would be merged into Euronext, while Deutsche Börse AG would opt for independence, leaving the Euro.nm abandoned in 2000.

B. Lisbon Agenda (2000): An Unmet Goal

The previously mentioned failures of European "new" stock markets highlighted the lack of innovation and competitive prowess within Europe. Europe's inability to compete was underscored by its sclerotic growth during the last two decades of the 20th century, for which Europe possessed an average growth rate of just above 2.3% annually (Economist, 2003). During this same time, the US managed a 3.3% average growth rate (Still sclerotic, after all these years, 2003).With Europe trailing behind, the Lisbon Strategy[4] in 2000 set forth the goal of transforming Europe into the "most competitive and dynamic knowledge-based economy" by 2010 (Europarl.europa.eu, 2000).

By 2004, it was clear that Europe was not positioned to meet the goals outlined in the 2000 initiative. During this time, the European Commission revisited their strategy and provided an action plan for tackling entrepreneurship. The plan more explicitly outlined a framework for boosting strategic entrepreneurship segregating the strategy into five different policies: 1) fuelling entrepreneurial mindsets; (2) encouraging more people to become entrepreneurs; (3) gearing entrepreneurs or growth and competitiveness; (4) improving flow and finance (5) creating a more SME friendly regulatory and administrative framework (Arundale, 2007). Under 'improving the flow finance", a direct strategy listed suggests the improvement of availability of venture capital, business angel finance and investments by private individuals (Arundale, 2007).

[4] As there is no official title for this set of goals, the initiative is also popularly referred to as the "Lisbon Strategy for growth and jobs", "Lisbon Agenda" or "Lisbon Process".

In line with the Lisbon Agenda goals is a growing need for greater research into best practices. In 2005, Directorate-General for Enterprise and Industry, which operates under the European Commission, published a best practices report for early-stage finance. The European Venture Capital Association (EVCA) publishes an annual handbook, which encourages best practices. The 2012 handbook includes verbiage on the dynamics of syndication, without going in too great detail. Subsequently, there is a somewhat notable literature base on syndication practices in recent years.

II. Literature Review

Most research in this area focuses on the motivations of syndication, rather than the results of syndication. Additionally, the research that does focus on performance, usually measures performance from the point of view of the VC firm rather than the VC-backed company. My research will diverge from this in that it looks at performance from the perspective of the VC-backed company, and also focuses on a specific financing round, rather than syndication overall. In this section I outline past research on the motivations for syndication and then discuss past empirical studies that focus on VC performance.

A. Motivations for Syndication

Financial Perspective

Manigart et al (2002) outline main financial motivations for syndication, which stems from the need for risk sharing. While investors themselves, as opposed to the VC firm, are able to diversify their risks by participating outside of VC markets, diversification is difficult for firms to achieve since there is no listing for early stage companies. This makes portfolio diversification subject to the presence of ex-ante

asymmetric information issues. Syndication allows firms to diversify some of the risk of this uncertainty. Additionally, some VC firms may not have the capability to invest fully in an investment round for a particular venture. Syndication allows VC firms exposure to ventures that they may otherwise not have the capacity to enter, which increases the number of companies that they can invest in. In comparison to the stock market, the VC market is less liquid and since stock in the venture cannot be traded on a public exchange, syndication enables a space for risk sharing on a deal-by-deal or round-by-round basis, further reducing overall portfolio risk for VC firms.

Resource-sharing

Past research has indicated that VC syndication in the US is motivated by financial reasons as well as the need to share resources, whereas European VC syndication is more motivated by the financial perspective (Manigart, et al., 2002). The definition of "resource" encompasses a broad universe of attributes and can functionally include any strengths or weaknesses that VC firms possess. Manigart et al. (2002) identify different resources and organize them into two categories: ex-ante and ex-post resources. An example of an ex-ante resource is selection capability. A syndicate of VC firms are better-equipped to select "good" investments by greater due diligence or better assessment of information. This mitigates some of the adverse selection scenarios associated with the lack of information in the VC market. In essence, the involvement of an additional VC firm can provide an informed second opinion. Superior management capability is an example of ex-post resource sharing. Jääskeläinen, Maula, & Seppä (2006) show that there is an amount of companies for each VC manager that produces the "optimum portfolio". The number of IPOs in the manager's portfolio increases with the

amount of companies they manage up until this optimum. After this optimum, they are unable to optimally manage the portfolio company. Syndication is a vehicle through which the resource of management capability can increase its optimal portfolio size, allowing managers to manage more companies without mitigating the success of the portfolio company.

Access to Deal Flow

Access to deal flow can also be a motivation for VC syndication. Syndication expands investment scope across geography and industry, and allows for a "dense interfirm network" (Manigart, et al., 2002). Within this network, information is disseminated across geographic and industry boundaries. This aids in building the reputation of the VC firms within the syndicate, thereby creating a "reciprocal, ongoing, informal relationship" (Smith, Smith, & Bliss, 2011, pp. 105-106). This could be pivotal for young VC firms who want to gain credibility. Manigart et al. (2002) find consistent evidence that reciprocity benefits the originator of a syndicate. This result is significant across different European countries, indicating a high degree of institutionalization in the European VC industry.

B. Syndication and Performance

Hege, Palomino, & Schwienbacher (2008) look at a multitude of factors that determine the success of VC companies. They look at survey data from VC-backed companies and look to exit decisions and the internal rates of returns calculated from reported valuations. They investigate the variable for syndication (percentage of past deals that have been syndicated with at least one other venture capitalist) and find that more syndication has a negative impact for US venture capitalists, but a positive one for

European VCs. This result is questionable, as the dependent variable of exit gives equal weight for exits in the form of IPO and trade sale. Additionally, they do not control for the endogenous choice to syndicate. When they run the regression once again, placing greater weights on IPO exits, the above result is insignificant. However, Hege, Palomino, & Schwienbacher (2008) do find significance in the US VC's tendency to exercise greater control rights in their ability to better screen projects.

The most recent research on syndication and the performance of VC-backed companies and syndication is done by Tian (2012). This research isolates two reasons for increased value creation via VC syndication: 1) VC syndicates are better in creating product market value for the ventures, and 2) VC syndicates offer greater financial market value creation. The superiority of VCs in creating product market value for the entrepreneurial firm is derived from the resource-sharing based perspective. A VC syndicate provides a broader range of inputs for entrepreneurial firms. This results support the hypothesis that syndication does create product market value and financial market value. My research diverges from Tian's research in multiple ways. Firstly, it expands the sample size and looks at European ventures, as well as American ventures. Second, I define syndication differently, since I focus only on syndication within a particular financing round. A broad definition of VC syndication is merely that two or more VCs fund the entrepreneurial firm[5]. Tian uses a stricter definition of VC syndication and defines it as a situation in which a group of two or more VC firms share in *any*

[5] In this definition, a company can have a VC syndicate if every financing round has only one investing VC but has a different VC involved in one of the financing rounds. This type of syndication is insufficient for my research, as I focus on a specific financing round.

particular round of financing[6]. I will restrict this even further, by focusing on syndication in the first investment round. Additionally, I also restrict my definition of a "successful exit" as an IPO, since they provide the greatest return on VC investments (Gompers & Lerner, 1998).

Tian provides one of the only instrumental variable (IV) approaches to the question of syndication and uses the Industry Concentration Index (ICI) as his IV. The ICI measures the concentration of the lead VC firm's portfolio, by calculating the deviation of the VC firm from a hypothetical VC market portfolio. For a particular VC-backed company, the ICI associated with it would be the weighted average of the ICI's of the VC firms that invested in its first financing round. I use a similar method with a different IV in order to mitigate some of the issues with endogeneity.

III. Theoretical Framework

A. Benefits of Syndication

Syndication allows for great benefits to the portfolio company, and not only to the VC firm. Schwienbacher (2005) posits that the presence of syndication makes possible the existence of positive network externalities, which increases the pool of contacts available when looking for a potential buyer, which is important for harvesting.

Brander, Amit, & Antweiler (2002) describe the selection hypothesis in the context of VC syndication. The presence of having more than one venture capitalist evaluate a project ex-ante provides the main or lead venture capital with an informed second opinion. In exchanging their evaluations of the project, the venture capital firms are able to learn more about the investment than they would have otherwise. While it may

[6] In Tian's research, a company that has a VC syndicate invest in its second round, but not its first round would be identified as "syndicated".

seem that the primary beneficiary of this informed second opinion is the investor, *ex-ante*, the actual reduction in uncertainty from the exchange in information between syndicate members should aid in better decision making processes in subsequent rounds. Brander, Amit, & Antweiler (2002) highlight that this exchange process could occur in subsequent rounds and further reduce uncertainty. I argue that my focus on the first round is sufficient to capture the significance of syndication since this is where the greatest uncertainty lies. Thus, the information exchange that occurs in this round should, in theory, be a great source of reduced uncertainty about the company. This forms the hypothesis that *syndication in the first financing round of venture backed companies will positively correlate with exiting through IPO in both US and European venture-backed companies.*

B. Indirect Reduction of Principal-Agency Costs

In many ways, the relationship between the venture capitalist and the entrepreneur represents a principal-agent problem, wherein the venture capitalist is the principal and the entrepreneur is the agent. In this type of problem, the presence of asymmetrical information and incomplete information creates a moral hazard and a conflict of interest that can lead to shirking by the entrepreneur (Filatotchev, Wright, & Arberk, 2006). The mitigation of these agency costs is usually done through contracting. However, syndication can act as another means by which the VC can safeguard their investment, thereby allowing VC firms to take on riskier investments that may have more harvest-potential, thereby creating better IPO exit opportunities. This should also support the hypothesis introduced in the last section.

C. Regional Differences in VC Markets

The growing research on the value creation of syndication supports the idea that syndication will have an overall positive impact on IPO syndication in both the US and Europe. However, the effect of syndication is bound to be different between the two regions. Given the common perception that European venture capitalist are limited in their value-adding approach and focus on financial engineering, while American VCs add further value through greater monitoring of their portfolio companies, syndication may play a more significant role in value creation and subsequently IPO exiting (Schwienbacher, 2005). While I estimate that syndication positively affects both regions, I conjecture that *the effect of syndication on IPO exit will be stronger for the US VC-backed companies*.

D. Introduction of Principal-Principal Agency Problem

While VC syndication seemingly benefits everyone, there are counteracting forces that mitigate some of the advantages. In particular, the presence of syndication may lead to the emergence of a principal-principal agency problem, which is explored by Filatotchev, Wright and Arberk (2006). The standard principal-agent problem describes the dilemma of incomplete and/or asymmetric information when a principal (the investor) hires an agent (the investee or entrepreneur), which gives rise to conflicts of interest or moral hazard. Due to information asymmetries, the agent may engage in undue risky behavior. Within the syndicate, there are multiple "agents" and thus decision making is shared. The principal-principal agency problem arises from "the diverse objectives of members and the time-consuming nature of coordination" (Filatotchev, Wright, & Arberk, 2006). Such diverse incentives lead to an increase in conflicts of interest and lack

of cooperation. This lack of cooperation can manifest itself into time, which has tangible impacts on the VC company.

In most principal-principal situations, the lack of coordination is inherent. Unique to this particular situation is the fact that the syndicates are "temporary in nature with the financing structure constructed specifically for that transaction" (Filatotchev, Wright, & Arberk, 2006). This compounds the principal-principal problem, as it increases the avenues for moral hazard. Each principal is not only governed by their individual objectives; they may also have greater motivations for pushing their objectives since they are not obligated to partake in subsequent rounds. Of course, reputation plays a rather large role within the VC firms, and may act as a backstop to heightened moral hazards.

Furthermore, staging gives rise to more principal-principal problems, as a lead VC that was present in earlier rounds may have an informational advantage over other VCs in the syndicate that choose to enter in later rounds (Filatotchev, Wright, & Arberk, 2006). Since this paper focuses on the first round, the previous effects are paramount, with the reasonable assumption that the informational asymmetries between the different principals due to staging are reduced. However, overall informational asymmetries between principals within the first stage should still be reflected in the results. Thus, the final hypothesis is: *the number of investors in the first financing round of venture backed companies will positively correlate with IPO exits in both US and European venture-backed companies, but with diminishing returns*

IV. Methodology and Empirical Results

In this section I describe the dataset and methodology that aid my exploration of key hypotheses. First, I use a logistical regression approach in order to study the effects

of both syndication presence and syndication magnitude with different cuts of the dataset (All, US, and Europe). I then use a simultaneous equations model via two different estimation methods—ordinary least square (OLS) and two stage least squares (2SLS). For the US sample size, the instrumental variable is perfectly correlated with the endogenous variable. Therefore, the 2SLS estimation method cannot be used for this sample. I display results for both regressions to provide a more complete interpretation of the research question.

A. Dataset

The data used is constructed from the *VentureXpert* database provided through Thomson Financial. The data is updated as of December 3, 2009. The companies included in the regressions are those that have their first investment rounds between 1985 and 2005. The search is limited to the venture capital sample[7] (this screen thereby excludes private equity deals and those that are labeled as unknown). For the European sample, the countries are limited to the 27 countries within the EU and the four countries within the EFTA, as these comprise the European Economic Area[8]. The country variable depends on the location of the venture-backed company, and not on the location of the VC firm that is investing in the particular venture. This process yields a sample of 13,207 VC-backed companies within the European sample. The United Kingdom has the largest number of ventures with 3,904 companies; France is next with 2,453 companies, and Germany follows with 1,607 companies. For the United States, there are 25,370 observations.

[7] Thomson Reuters uses the term to describe the universe of venture investing. It does not include buyout investing, mezzanine investing, fund of fund investing, secondaries, etc.
[8] For a list of countries see Table 1

I created the variable of IPO_DUMMY, which is a binary variable equaling 1 if the venture-backed company's "Situation" is defined as "Went Public" in the *VentureXpert* database, and 0 otherwise. Some of the options under this variable include: "LBO", "Merger", "Acquisition", "Chapter 11", "Chapter 7", and "Defunct". A list of variables collected is described in Table 1.

B. Descriptive Statistics

Table 2 and Table 3 summarize the characteristics of the average venture capital firm in each European country, Europe as a whole, and the US. European venture backed companies overall have a smaller average number of investors within the first financing round as well as smaller number of financing rounds overall. The average number of investors in the first round is 1.51 for Europe and 2.11 for the US. The average number of financing stages in Europe is 1.7 versus 2.66 for the US, indicating that the US has a greater emphasis on stage financing. Syndication in the first investment round is much more popular in the US, with 56% of venture-backed companies syndicating in the first investment round, versus only 31% of the entire European sample. The method of IPO and acquisition are more popular exit options for the US, with 9% of companies having gone public, and 21% having been acquired. While the US seems to experience more upsides in exiting, it also experiences more downside with 11% of VC-backed companies categorized as "defunct" versus only 1% in Europe. However, only 6% of European companies experience successful exit, and only 7% of European companies are acquired.

Table 6 and 7 show information about the sector breakdown of the venture backed companies in the sample. The US sample is more evenly distributed across the six industries, with about 33% of the companies falling into Biotechnology and another 3%

falling into the Communications and Media industry. About a majority of the European venture-backed companies are within the Biotechnology industry (50.6%). Communications and Media is the second most popular sector, accounting for about a quarter of the venture backed companies. About 9% of European ventures are devoted to life sciences, while about 14% of US ventures in the sample lie within this sector. Conditional on the sector and location, the European nations generally have a smaller percentage of IPO exits[9]. For instance, within the biotechnology venture capital companies in the EU, only 4.81% of the largest sector in the European sample (biotechnology) went public. The European computer related sector has the largest percentage of IPOs given sector and region, with 9.54% experiencing IPO. In the US, non-high technology companies have the largest percentage of IPOs given sector and region with 17.58% experiencing IPOs. The Computer related sector trails behind Non-High Tech, with 12.59% of these firms experiencing IPO.

Table 7 shows other summary statistics for additional variables that are included in regression models. The variable INVESTORS_ROUND1 are the number of investors in round 1. The SYNDICATE_SIZE_ROUND_1 variable also represents the number of investors in round 1, but only for those firms that have a 1 for the SYND_RND1 variable, which is an indicator variable for syndication in the first round. NUM_ROUNDS is the overall number of staged financing rounds for a given venture capital company. Although this paper focuses on syndication within the first financing stage, overall staging is an important variable to examine. The general effect of staging increases the expected value

[9] This percentage is calculated by taking the number of companies that have IPO'd within X region and Y sector and dividing it by the number of VC companies in X region and Y sector.

of the venture, since it acts as an incentive for the entrepreneur to work harder in early stages (Schwienbacher, 2005).

The mean number of investors for the first investment round in US venture backed companies is 2.11 versus the European venture backed companies at 1.51 investors. The last column provides the p-value for a two-group mean comparison test that compares the differences between the means of the two regions for all four variables. For all the listed variables, the differences in the means between the two regions are significant in the 1% level. The median number of investors is also reported, as it provides meaningful insight into whether or not the median portfolio company has first round syndication or not. The median INVESTORS_ROUND1 in the US is 2, which forms a syndicate. The median INVESTORS_ROUND1 in Europe is 1, which does not form a syndicate. The US also has a higher average number of staged investment rounds at 2.67, whereas the mean number of rounds in Europe is 1.69. These figures support Hypothesis 1a and 1b. The DISCLOSED_ROUND_TOTAL_TH is significantly higher in Europe at $16.62 million vs. the US's $12.78 million. This makes intuitive sense given the smaller number of financing rounds in Europe. This means that the concentration of investment will be higher within a given round.

C. Standard Logistical Approach

The main regression tool used for further analysis of the dataset is the logistical regression (logit) model as is ensures that the estimated response probabilities are strictly between zero and one, and also makes calculation of the odds ratio easier.

I define:

$$p = prob\,(IPO\_DUMMY = 1) \qquad (1)$$

Equation 1 is incorporated into the following logit model:

$$Logit(p) = \log\left(\frac{p}{1-p}\right) = \alpha + \beta_1 SYND\_RND1 + \beta_2 NUM\_ROUNDS +$$

$$\beta_3 NUM\_ROUNDS\_SQR + \beta_N INDUSTRY\_DUMMY\_Y + \beta_R YEAR\_DUMMY_R + \varepsilon_j \quad (2)$$

Table 9 shows the results of the logit regression, where IPO_DUMMY is the dependent binary variable that indicates whether the venture-backed company went public; the variable is 1 if the company has gone public and 0 if it has not. SYND_RND1 is the independent binary outcome variable that indicates whether or not the venture backed company has syndicated its first financing investment round; the variable is 1 if the company has more than 1 investor in its first financing stage and 0 if there is only one investor in its first financing stage. NUM_ROUNDS is the number of rounds of financing that the venture backed company has had to date. A squared term for NUM_ROUNDS is also included to control for the effects of adding an additional financing round. I also control for year and industry with dummy variables for the six industry categorizations and each of the twenty years (respectively).

I estimate equation 2 for the European sample and the US sample separately. The results indicate that the SYND_RND1 is significant at the 5% level for Europe and at the 1% level for the US. The coefficients can be interpreted using the odds ratio. Taking the coefficient of β_1=0.176 implies that, fixing for other factors, syndicating the first round is associated with making IPO exit 1.19 times more probable (or a 19% increase in probability). For the US, this figure is much larger at 40.9%. This result is much higher

than what I expected from Tian's results that found that syndicate-backed[10] firms are only "12% more likely to exit through IPO instead of write-off relative to an individual backed firm" [11] (Tian, 2012, p. 10).

The NUM_ROUNDS is significant for both samples at the 1% level. The β_2 coefficient for Europe implies that a unit increase in the number of financing stages is associated with making the IPO event more likely to occur by 16.0%.

I use a similar set of equation to test the significance of the syndication magnitude (the number of investors in the first financing stage):

$$p = prob\,(IPO\_DUMMY = 1) \tag{3}$$

And,

$$Logit(p) =$$

$$\log\left(\frac{p}{1-p}\right) = \alpha + \beta_1 INVESTORS\_ROUND1 + \beta_2 INVESTORS\_ROUND1\_SQR +$$

$$\beta_3 NUM\_ROUNDS + \beta_4 NUM\_ROUNDS\_SQR + \beta_N INDUSTRY\_DUMMY_Y +$$

$$\beta_R YEAR\_DUMMY_R + \varepsilon_j \tag{4}$$

In this regression we care about the number of investors that comprises the syndicated or individually-backed first financing round. Table 9 shows the results of the logit regression. Let IPO_DUMMY be the binary outcome variable that indicates whether the venture backed company; the variable is 1 if the company has gone public and 0 if it has not. INVESTORS_ROUND1is the number of investors in the first financing rounds. NUM_ROUNDS is the number of rounds of financing that the venture backed company

[10] Note that Tian does not isolate syndication in the first stage of financing and considers syndication over all financing rounds.

[11] Note that my result is relative to other forms of exit and not just "write-off". Also note that Tian's results only apply to the US sample.

has had to date. Squared terms for both INVESTORS_ROUND1and NUM_ROUNDS are also included. There are industry and year dummies as well.

The regression is separately estimated for the European sample and the US. For the US sample, INVESTORS_ROUND1, INVESTORS_ROUND1_SQR, NUM_ROUNDS, NUM_ROUNDS_SQR were all significant at the 1% level. The coefficient for INVESTORS_ROUND1for the European sample is positive and significant at the 5% level, meaning that an increase in the number of investors in the first financing round in European companies is positively correlated with going public. The odds ratio is exp(0.169)= 1.184, implying that, fixing for other variables, a one unit change in the INVESTORS_ROUND1 by 1 is associated with an increased probability of IPO exit by 18.4%. For the US, this figure is 21.2%. Each one unit increase in NUM_ROUNDS in European VC-backed companies makes IPO exit more likely by 14.9%. For the US, this figure is only 13.2%. For both the US and Europe, INVESTORS_ROUND1_SQR and NUM_ROUNDS_SQR are negative. This means that there is a diminishing return to the increase in the number of investors in the first financing round, as well as a diminishing return to the increase in the number of rounds. If Equation (4) is differentiated with respect to INVESTORS_ROUND1, an optimal level of investors can be found that optimizes the logit equation. To determine this, the following condition must be met:

$$\frac{\partial}{\partial NUM\_INVESTORS} Logit(p) = \beta_1 + 2\beta_2 \cdot INVESTORS\_ROUND1 = 0 \qquad (7)$$

For the US, this implies an optimal number of investors in the first financing round of 10.62, and 13 for Europe. However, this figure is not significant for Europe. For the US,

this means that having more investors in the first financing round increases the likelihood of going public, but after ~11 investors, the likelihood of going public starts to decrease. The result is inconclusive for the European sample as the p-value is too high. This inconclusive result for Europe could simply be related to the smaller size of the European sample.

The same can be done for the number of financing rounds:

$$\frac{\partial}{\partial NUM\_ROUNDS} Logit(p) = \beta_1 + 2\beta_2 \cdot NUM\_ROUNDS = 0 \quad (8)$$

This implies an optimal number of rounds of ~6 rounds in the US, and ~13 in Europe. It should be noted that NUM_ROUNDS_SQR is not significant for the European sample and thus the optimal number of financing stages cannot be fully supported.

D. Simultaneous Equations Model (SEM) with OLS and 2SLS Estimates

Endogeneity is an important issue in econometric models. An important and sometimes overlooked form of endogeneity is simultaneity, which arises when "one or more of the explanatory variables is *jointly determined* with the dependent variable" (Woolridge, 2009, p. 546). Simultaneity can occur between IPO exiting and syndication in the first round. Although the two may not be decided simultaneously in a literal sense, there is a sense of dependency in the determination of the two. Multiple VC firms may be attracted to the IPO-worthiness of the particular venture, and thus syndication may occur. In a way, the decision to syndicate may go hand in hand with a preemptive decision to produce this particular exit.

The IV approach can often serve as a solution to the aforementioned issues. Using ordinary-least square (OLS) to estimate a model requires that each explanatory variable is uncorrelated with the error term. Using a SEM simplifies the IV approach, as it does not

necessarily require this fundamental condition (Woolridge, 2009). The variable CO_FIRM_NATION_SAME is introduced as the instrumental variable. This variable is 1 if the nation in which the VC-backed company is based in the same country as an associated "lead" investor firm within the first financing round, and 0 otherwise. The lead investor within the financing round is determined as the investor who contributes the largest investment amount within a particular financing round (i.e. the "lead" could be different in subsequent rounds, but this is immaterial since I do not look at subsequent financing rounds). If there is a tie[12], the lead investor is assigned to the investor which is based within the same country as the VC-backed company. Any ties between multiple investors from the same country as the company are immaterial since I only want to know if there exists a "lead" investor within proximity of the company[13]. In order to use the instrumental variable CO_FIRM_NATION_SAME and achieve a 2SLS estimation, the following must be met:

i. *Rank Condition: the first equation in a two-equation simultaneous equations model is identified if, and only if, the second equation contains at least one exogenous variable (with a nonzero coefficient) that is excluded from the first equation*

This condition is clearly met as there is only one endogenous variable, SYND_RND1, and there is at least one excluded exogenous variable, CO_FIRM_NATION_SAME, from the structural equation (11), which is explained below. The rank condition is

[12] A "tie" refers to a situation in which two or more firms invest the same amount into the portfolio company

[13] For instance, if Company A is in country X, and VC firms B and C are also from country X and have both invested the equal amounts within the same financing round, it does not matter if B or C is assigned as the "lead" since both are within X.

violated for the US sample since there is perfect correlation between the CO_FIRM_NATION_SAME variable and the endogenous variable, SYND_RND1, thus the IV estimation is not used for the US sample.

ii. The IV is correlated with the endogenous variable conditional on the other covariates.

The instrumental variable CO_FIRM_NATION_SAME is correlated with the endogenous variable SYND_RND1. Table 10 shows an OLS regression with the syndication dummy as the dependent variable. The coefficient for CO_FIRM_NATION_SAME is negative and significant at the 1% level. Sorenson & Stuart (2001) find that "VC firms with a history of provincial investment patterns and those without central positions in the industry's coinvestment network tend to invest locally; those who have established many and dispersed relationships with other VC firms invest across geographic and industrial spaces more frequently" (Sorenson & Stuart, 2001, p. 1584). In light of this, it may be the case that lead investors that are within geographical range of their portfolio companies do not have a great incentive to syndicate their deals. However, lead investors who are not within a certain geographic range of a particular portfolio company may find that they need to syndicate their deals. This is an extension of the "access to deal flow" motivation for syndication mentioned earlier. IV weakness tests are also performed to support this assumption. Results from these tests are reported in Table 11, and explored in greater detail for the latter part of this section.

iii. The IV is not correlated with the error term in the structural equation (i.e. the IV does not suffer from the same problem as the endogenous variable).

Of the IV criteria, this is usually the most contentious assumption, as there almost always exists a rationale against any offered justifications. Intuitively, it is fair to assume that CO_FIRM_NATION_SAME would not suffer from the same problem as SYND_RND1. The lead investor's proximity to the portfolio company in the first round should only affect the IPO probability through the syndication dummy, if we assume that lead investors would syndicate their deal if they were not close to the portfolio company, and thus lead to higher chances of IPO. If they do not do so, the success of the portfolio company would be jeopardized. One could argue that CO_FIRM_NATION_SAME may correlate to the error term as it may affect the unobserved variable of monitoring ability. I argue that any monitoring affects attributed to the firm's proximity to the company is explained by their decision to syndicate the deal.

The following structural equation is used:

$$IPO\_DUMMY = \beta_{10} + \beta_{11}SYND\_RND1 + \beta_{12}INVESTORS\_ROUND1\_SQR + \beta_{13}NUM\_ROUNDS + \beta_{14}NUM\_ROUNDS\_SQR + \beta_{15}TOTAL\_INVESTMENT\_B + \beta_{16}DISCLOSED\_ROUND\_TOTAL\_M + \beta_{1N}INDUSTRY\_DUMMY_Y + \beta_{1R}YEAR\_DUMMY_R + u_1 \quad (11)$$

The following equation is needed for the first-stage regression:

$$SYND\_RND1 = \beta_{20} + \beta_{21}IPO\_DUMMY + \beta_{22}DISCLOSED\_ROUND\_TOTAL\_M + \beta_{23} \cdot CO\_FIRM\_NATION\_SAME + \beta_{2N} \cdot INDUSTRY\_DUMMY_Y + \beta_{2R} \cdot YEAR\_DUMMY_R + u_2 \quad (12)$$

Equations 11 and 12 contain different exogenous variables, as exclusions restrictions were imposed on the model. This is generally done in order to distinguish between the two structural equations (Woolridge, 2009). This exclusions restriction is necessary so

that necessary assumptions can be made. In particular, this model assumes that once industry, stage rounds, years, and syndication are controlled for, then the amount invested in the first round has no effect on eventual IPO exit. The year dummy variables are exogenous, since the passage of time is exogenous, and thus these dummies act as their own instruments (Woolridge, 2009).

Table 11 shows the results from both OLS and the 2SLS estimates. The comparison between the OLS and the 2SLS results are astonishing. For the OLS results, SYND_RND1 is not significant at any of the specified levels. The coefficient is also very small and implies only a 2.1% increase in IPO probability with presence of syndication. With the 2SLS estimations, SYND_RND1 becomes significant at the 1% level and the coefficient implies a 43.4% increase in the probability of IPO exit. This drastic change reveals the inherent bias in the OLS and logit results. Stage financing also becomes more significant when the instrumental variable is involved. The coefficient for NUM_ROUNDS and NUM_ROUNDS_SQ become significant at the 1% and 5% level (respectively) in the 2SLS estimations. Furthermore, the 2SLS results report negative coefficient for NUM_ROUNDS, as opposed to the positive coefficient in the OLS results. Too much staging may decrease the likelihood of IPO since it may indicate that the VC-backed company is spending more time in a pre-harvest state. However, the positive and significant coefficient estimated for NUM_ROUNDS_SQR indicates that there is an increasing return to the number of financing rounds. Following a similar rationale in the logistical regression model[14], there is a least optimal number of financing rounds that

[14] In the earlier example, the INVESTORS_ROUND1 coefficient was positive and the INVESTORS_ROUND1_SQR coefficient was negative, implying that there is an optimal number of that

minimizes IPO probability. Additionally, the 2SLS estimates for the total investment amounts TOTAL_INVESTMENT_B and the disclosed investment in the first financing stage, DISCLOSED_ROUND_TOTAL_M are no longer significant at even the 10% level.

The weak instrument test outlined by Stock & Yogo (2005) will be used to test the viability of the 2SLS estimation. The general decision rule they provide is as follows: if the Cragg-Donald Wald F-statistic is less than the critical value, conclude that the instruments are weak, otherwise conclude they are strong. (Stock & Yogo, 2005). For the entire sample, the Cragg-Donald Wald F-statistic is 52.141. The 1% level Stock-Yogo critical value is16.38, which is less than the Cragg-Donald Wald value. Under the Stock-Yogo rule, the instrument is very strong for the whole sample. However, the Cragg-Donald Wald F-statistic is only 9.747 for the European subset, which implies a weak instrumental variable at the 1% level. However, the instrumental variable is still strong at the 15% level, where the Stock-Yogo critical value is 8.96, providing support of the IV used.

V. Conclusions

A. Results

Overall, the empirical tests generally support my hypotheses. Overall, the practice of syndication is significant in increasing the likelihood of IPO exits for both European and US venture backed companies. Under the logit model, I find that VC-backed companies in Europe that with syndicated first rounds are 19.1% more likely to IPO relative to other forms of exit. In the US, this figure is 40.8%. The results are generally

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yields the maximum probability of IPO. Conversely, in this example the degree one variable (NUM_ROUNDS) is negative and the degree two variable (NUM_ROUNDS_SQR) is positive, thereby providing a worst-case number of rounds that yields the least optimal IPO scenario.

more significant for the US companies. For the US sample, the diminishing returns of syndicate size are also significant, whilst this result is inconclusive for the European sample. The inclusion of an instrumental variable also yields significant results for the European sample. This approach implies that syndication in first financing rounds is associated with a 43.4% increase in IPO exit probability for European countries. This figure is much more in line with the US result in the logit equation. This cannot be directly compared to an IV result for the US sample size, as this approach cannot be used for this particular US sample size.

B. Implications

The results should provide researchers, practitioners and policy makers insight into the environments that best foster successful entrepreneurial ventures. For researchers, the significance of the results is meaningful, and where there are inconclusive results, there are avenues for future research. The results suggest that policy makers should facilitate public offerings by encouraging syndication via networks, especially for first round financings. The listed measures in the Lisbon Agenda for fostering venture capital investments mostly centers on guarantees and securitization. Policy measures should include discourse on syndication and possible avenues for fostering networks that endorse cooperation between investors. Practitioners, both investors and entrepreneurs should consider syndication when establishing best practices, and should be particularly cognizant of syndication presence along with size. For researchers, this paper also provides insight on the novel addition of the IV of CO_FIRM_NATION_SAME.

C. Avenues for Future Research

There is an abundance of future areas for research within this topic. Further investigation could be done on the diminishing effects of the syndication size for the European sample. This was very significant for the US sample, and it would make intuitive sense that there is an "optimal" syndicate size for European ventures. Significant results could better refine the optimal syndicate size in Europe. Additionally, more research into different IVs can lead to better, unbiased results.

This research was limited to the one method of exit, as IPOs are considered to be the more "successful" of the exit methods. Since IPOs tend to foster greater job creation, the focus on this successful exit method is relevant. However, further investigation can be done on the other methods (LBOs, Acquisition, Merger) listed on Table 3, which may also foster growth. Looking primarily at IPO and other "successful" methods can give greater insight on the upside potential of syndication in early financing stages. Additionally, performing similar regressions with a dependent variable for failure ("Defunct" in Table 3) can show if early financing round syndication provides any downside protection for venture capital firms.

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Tables

Table 1
List of Variables
This table explains the numerous variables used throughout the paper.

VARIABLE	DESCRIPTION
CO_EUROPE	Indicator variable for the company location; 1 if in the EU or EFTA
CO_FIRM_NATION_SAME	1 if the nation in which the venture-backed company and associated "lead[15]" investor firm within the first financing round is based in the same country, 0 otherwise
CO_INDUSTRY_MAJOR_BIOT	Indicator variable for the Biotechnology industry
CO_INDUSTRY_MAJOR_COMMS	Indicator variable for the Media and Communications industry
CO_INDUSTRY_MAJOR_COMP	Indicator variable for the Computer Related industry
CO_INDUSTRY_MAJOR_LIFE SCI	Indicator variable for the Medical/Health/Life Science industry
CO_INDUSTRY_MAJOR_SEMICON	Indicator variable for the Semiconductor/Other Electronic industry
DISCLOSED_ROUND_TOTAL_B	The disclosed investment amount for the first financing round, in billions of dollars
DISCLOSED_ROUND_TOTAL_M	The disclosed investment amount for the first financing round, in millions of dollars
DISCLOSED_ROUND_TOTAL_TH	The disclosed investment amount for the first financing round, in thousands of dollars

[15] The "lead" is the investor who contributes the largest investment amount within a particular financing round (i.e. the "lead" could be different in subsequent rounds, but this is immaterial since I do not look at subsequent financing rounds). If there is a tie, the lead investor is assigned to the investor which is based within the same country as the venture-backed company. Any ties between multiple investors from the same country as the company are immaterial since I only want to know if there exists a "lead" investor within proximity of the company.

Table 1
List of Variables (continued)

VARIABLE	DESCRIPTION
INVESTORS_ROUND1	Number of investors in the first round of financing
INVESTORS_ROUND1_SQR	The square of INVESTORS_ROUND1
IPO_DUMMY	Indicator variable if the company has gone public, 0 if the company has not gone public
NUM_ROUNDS	Number of financing rounds the company has had to date
NUM_ROUNDS_SQR	The square of NUM_ROUNDS
SYND_RND1	Indicator variable- 1 if the company has more than one investors in its first financing round, 0 otherwise
SYNDICATE_SIZE_ROUND_1	The number of investors in the first financing round, if the company syndicated its first financing round
TOTAL_INVESTMENT_B	This is the amount invested within the company to date, measured in billions of dollars

Table 2
Descriptive Statistics for Each Nation
This table shows descriptive statistics segregated by each country in the sample. This shows the number of observations, the average number of investors in the first financing rounds, the averaged disclosed investment in the first round (note that this is not based on the entire sample as some firms do not disclose their investment amounts), and the amount of companies that syndicated their first financing round . This data is available on Thomson One's *VentureXpert* database.

Nation		# of VC Backed Companies	Average # of investors in First Round	Average # of rounds	Average disclosed round 1 total investment ($000)	Companies with First Round Syndication	
						#	%
European Union	Austria	196	1.41	1.46	12,067.32	51	26%
	Belgium	339	1.55	1.60	13,177.10	104	31%
	Bulgaria	21	1.43	1.24	39,200.67	2	10%
	Cyprus	9	1.22	1.22	14,708.56	2	22%
	Czech Republic	71	1.38	1.66	5,186.72	20	28%
	Denmark	353	1.35	1.96	11,408.62	78	22%
	Estonia	14	1.07	1.14	6,317.70	1	7%
	Finland	567	1.39	1.80	8,777.98	137	24%
	France	2,453	1.67	1.73	17,735.29	921	38%
	Germany	1,607	1.49	1.56	15,540.02	465	29%
	Greece	38	1.18	1.08	10,847.92	5	13%
	Hungary	88	1.20	1.56	4,238.15	16	18%
	Ireland	269	1.68	2.00	10,317.88	107	40%
	Italy	455	1.40	1.35	20,140.77	119	26%
	Latvia	19	1.00	1.47	507.71		0%
	Lithuania	13	1.38	1.15	15,389.25	4	31%
	Luxembourg	36	1.56	1.67	93,608.30	14	39%
	Malta	1	1.00	1.00	.		0%
	Netherlands	592	1.45	1.80	31,692.11	167	28%
	Poland	176	1.39	2.13	6,904.66	47	27%
	Portugal	152	1.14	1.43	4,356.72	18	12%
	Romania	48	1.31	1.46	9,074.71	10	21%
	Slovakia	21	1.29	1.62	3,996.54	4	19%
	Slovenia	5	1.00	1.00	.		0%
	Spain	587	1.41	1.30	12,147.37	146	25%
	Sweden	668	1.45	1.96	12,693.38	174	26%
	UK	3,904	1.54	1.74	18,913.19	1,304	33%
EFTA	Iceland	21	1.29	1.48	3,196.89	2	10%
	Liechtenstein	-	-	-	-	-	-
	Norway	222	1.36	1.61	13,019.79	47	21%
	Switzerland	262	1.64	1.97	16,855.37	91	35%
	Europe	13,207	1.51	1.70	16,623.06	4,056	31%
	US	25,370	2.11	2.66	12,380.73	13,724	54%
	All	51,784	1.85	2.20	13,662.18	17,780	34%

Table 3
Number and Percent of Popular Exit Options
This table shows the number of venture backed companies within each country that have gone through the different popular exit options. Exit options not included in this summary are: "Active Investment", "Bankruptcy – Chapter 11", "Bankruptcy – Chapter 7", "In Registration", "Other", "Pending Acquisition", and "Unknown." This data is available on Thomson One's *VentureXpert* database.

	Nation	Current Situation Exit Options									
		IPO		Acquisition		Merger		LBO		Defunct	
		#	%	#	%	#	%	#	%	#	%
European Union	Austria	10	5%	7	4%	0	0%	10	5%	0	0%
	Belgium	21	6%	15	4%	3	1%	38	11%	5	1%
	Bulgaria	1	5%	1	5%	2	10%	2	10%	0	0%
	Cyprus	1	11%	2	22%	0	0%	0	0%	0	0%
	Czech R.	6	8%	7	10%	1	1%	8	11%	1	1%
	Denmark	9	3%	19	5%	2	1%	28	8%	2	1%
	Estonia	2	14%	1	7%	0	0%	0	0%	0	0%
	Finland	14	2%	33	6%	11	2%	38	7%	0	0%
	France	143	6%	87	4%	13	1%	353	14%	9	0%
	Germany	85	5%	81	5%	19	1%	149	9%	13	1%
	Greece	6	16%	0	0%	0	0%	3	8%	0	0%
	Hungary	4	5%	5	6%	1	1%	6	7%	0	0%
	Ireland	8	3%	19	7%	5	2%	7	3%	6	2%
	Italy	32	7%	19	4%	5	1%	89	20%	1	0%
	Latvia	0	0%	1	5%	0	0%	1	5%	0	0%
	Lithuania	0	0%	1	8%	0	0%	3	23%	0	0%
	Luxembourg	5	14%	2	6%	0	0%	5	14%	0	0%
	Malta	0	0%	1	100%	0	0%	0	0%	0	0%
	Netherlands	29	5%	33	6%	5	1%	96	16%	3	1%
	Poland	26	15%	11	6%	3	2%	13	7%	0	0%
	Portugal	6	4%	2	1%	0	0%	7	5%	0	0%
	Romania	3	6%	6	13%	0	0%	8	17%	0	0%
	Slovakia	0	0%	4	19%	0	0%	1	5%	0	0%
	Slovenia	0	0%	0	0%	0	0%	1	20%	0	0%
	Spain	13	2%	15	3%	0	0%	76	13%	1	0%
	Sweden	30	4%	68	10%	3	0%	63	9%	6	1%
	UK	266	7%	486	12%	50	1%	854	22%	40	1%
EFTA	Iceland	1	5%	0	0%	0	0%	1	5%	0	0%
	Liechtenst.	-	-	-	-	-	-	-	-	-	-
	Norway	20	9%	9	4%	2	1%	21	9%	0	0%
	Switzerland	24	9%	24	9%	2	1%	25	10%	2	1%
	Europe	765	6%	959	7%	127	1%	1906	14%	89	1%
	US	2315	9%	5419	21%	355	1%	694	3%	2712	11%
	All	3080	6%	6378	12%	482	1%	2600	5%	2801	5%

Table 4
Descriptive Statistics
This table reports the mean, median, minimum, maximum, standard deviation, variance, and skewness of multiple variables. The variables include: INVESTORS_ROUND1, which represents the number of investors within the first financing round; SYNDICATE_SIZE_ROUND_1, which represents the number of investors within the first financing round for those observation that do syndicate; NUM_ROUNDS, which represents the number of financing rounds for the VC-backed company; and DISCLOSED_ROUND_TOTAL_TH, which represents the total amount invested within the first financing stage. Individual statistics are reported for each region (US versus Europe).

United States Variable	mean	median	min	max	sd	variance	skewness
INVESTORS_ROUND1	2.1121	2	1	21	1.53	2.35	2.40
SYNDICATE_SIZE_ROUND_1	3.0558	2	2	21	1.55	2.41	2.55
NUM_ROUNDS	2.6624	2	1	23	2.31	5.33	2.13
DISCLOSED_ROUND_TOTAL_TH	12785	3000	1	4E+06	72200	6E+09	25.61

Europe Variable	mean	median	min	max	sd	variance	skewness
INVESTORS_ROUND1	1.5115	1	1	15	1.01	1.01	3.22
SYNDICATE_SIZE_ROUND_1	2.6654	2	2	15	1.17	1.37	2.93
NUM_ROUNDS	1.6989	1	1	18	1.38	1.90	3.10
DISCLOSED_ROUND_TOTAL_TH	16623	3137	1	2E+06	69855	5E+09	15.36

Table 5
Descriptive Statistics with Difference T-test
This table reports the mean and median statistics for the following variables: INVESTORS_ROUND1, which represents the number of investors within the first financing round; SYNDICATE_SIZE_ROUND_1, which represents the number of investors within the first financing round for those observation that do syndicate; NUM_ROUNDS, which represents the number of financing rounds for the VC-backed company; and DISCLOSED_ROUND_TOTAL_TH, which represents the total amount invested within the first financing stage. Individual statistics are reported for each region (US versus Europe). The p-value is reported to test the significance of the difference in means between Europe and the US. For each variable the p-value is very small (less than zero), and thus the difference in means is significant.

	Europe		US		Difference
Variable	mean	median	mean	Median	p-value
INVESTORS_ROUND1	1.51	1	2.11	2	0.00
SYNDICATE_SIZE_ROUND_1	2.67	2	3.06	2	0.00
NUM_ROUNDS	1.70	1	2.66	2	0.00
DISCLOSED_ROUND_TOTAL_TH	16623.06	3137	12784.71	3000	0.00

Table 6

Percentage of VC-Backed Companies by Region and Sector

This table reports the percentage of VC-backed companies by region and sector. The percentage is calculated by taking the number of companies in Y region and X sector and dividing it by the number of companies in Y region.

	Biotech-nology	Communications and Media	Computer Related	Medical/Health/ Life Science	Non-High Technology	Semiconductors/ Other Elect
EU	51.02	24.66	6.16	9.43	4.43	4.30
EFTA	38.81	26.53	7.13	12.67	7.92	6.93
EU + EFTA	50.56	24.73	6.19	9.56	4.57	4.40
US	33.36	33.10	9.49	13.93	4.26	5.86
Total	39.25	30.24	8.36	12.43	4.37	5.36

Table 7

Percentage of VC-Backed Companies within Respective Sector and Region That Have Gone Public

This table shows the percentage of VC-backed companies that have gone public, conditional on the respective sector and region. Each percentage is calculated by taking the number of VC-backed companies that have gone public in X sector and Y region and dividing it by the overall number of VC-backed companies within X sector and Y region.

	Biotech-nology	Communications and Media	Computer Related	Medical/Health/ Life Science	Non-High Technology	Semiconductors/ Other Elect
EU	4.81	5.30	9.72	6.59	8.70	6.96
EFTA	7.65	9.70	5.56	6.25	15.00	14.29
EU + EFTA	4.90	5.48	9.54	6.58	9.12	7.40
US	9.94	6.43	12.59	8.15	17.58	10.30

Table 8
Logit Regression Results
This table shows results for the logistical (logit) regression model used:

$$Logit(p) = \log\left(\frac{p}{1-p}\right) = \alpha + \beta_1 INVESTORS\_ROUND1 + \beta_2 INVESTORS\_ROUND1\_SQR + \beta_3 NUM\_ROUNDS + \beta_4 NUM\_ROUNDS\_SQR + \beta_N INDUSTRY\_DUMMY_Y + \beta_R YEAR\_DUMMY_R + \varepsilon_j$$

Note that there were also 20 year dummy variables that were included in the regression but not in this table. The regression is run for the European sample, as well as the US sample.

EQUATION	VARIABLES	EUROPE IPO_DUMMY	USA IPO_DUMMY
IPO_DUMMY	INVESTORS_ROUND1	0.169**	0.212***
		(0.0769)	(0.0319)
	INVESTORS_ROUND1_SQR	-0.00650	-0.00998***
		(0.00985)	(0.00337)
	NUM_ROUNDS	0.139**	0.124***
		(0.0566)	(0.0268)
	NUM_ROUNDS_SQ	-0.00534	-0.0109***
		(0.00588)	(0.00244)
	CO_INDUSTRY_MAJOR_COMP	0.269***	-0.324***
		(0.102)	(0.0625)
	CO_INDUSTRY_MAJOR_LIFESCI	0.675***	0.181**
		(0.138)	(0.0752)
	CO_INDUSTRY_MAJOR_COMMS	0.412***	-0.171**
		(0.133)	(0.0752)
	CO_INDUSTRY_MAJOR_BIOT	0.562***	0.639***
		(0.162)	(0.0943)
	CO_INDUSTRY_MAJOR_SEMICON	0.486***	0.124
	CONSTANT	-3.941***	-4.943***
		(0.198)	(0.258)
	OBSERVATIONS	13,207	25,370
	PSEUDO R2	0.0683	0.0823

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9
Logit Regression Results
This table shows results for the logistical (logit) regression model:

$$Logit(p) = \log\left(\frac{p}{1-p}\right) = \alpha + \beta_1 SYND\_RND1 + \beta_2 NUM\_ROUNDS + \beta_3 NUM\_ROUNDS\_SQR + \beta_N INDUSTRY\_DUMMY\_Y + \beta_R YEAR\_DUMMY_R + \varepsilon_j$$

Note that there were also 20 year dummy variables that were included in the regression but not in this table. The regression was ran twice, one for the European sample, and one for the American sample.

EQUATION	VARIABLES	Europe IPO_DUMMY	USA IPO_DUMMY
IPO_DUMMY	SYND_RND1	0.176**	0.343***
		(0.0829)	(0.0470)
	NUM_ROUNDS	0.148***	0.135***
		(0.0563)	(0.0268)
	NUM_ROUNDS_SQ	-0.00586	-0.0114***
		(0.00584)	(0.00244)
	CO_INDUSTRY_MAJOR_COMP	0.275***	-0.319***
		(0.102)	(0.0625)
	CO_INDUSTRY_MAJOR_LIFESCI	0.689***	0.195***
		(0.138)	(0.0751)
	CO_INDUSTRY_MAJOR_COMMS	0.424***	-0.161**
		(0.133)	(0.0751)
	CO_INDUSTRY_MAJOR_BIOT	0.597***	0.664***
		(0.161)	(0.0939)
	CO_INDUSTRY_MAJOR_SEMICON	0.496***	0.144
		(0.173)	(0.0964)
	CONSTANT	-3.767***	-4.782***
		(0.180)	(0.256)
	Observations	13,207	25,370
	Pseudo R2	0.0668	0.0799

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10
OLS Regression Results
This table shows results for the OLS regression model:

$$SYND\_RND1 = \alpha + \beta_1 \cdot DISCLOSED\_RND\_TOTAL\_B + \beta_2 \cdot CO\_FIRM\_NATION\_SAME + \beta_N \cdot INDUSTRY\_DUMMY + \beta_R \cdot YEAR\_DUMMY_R$$

Estimates are determined for the entire sample as well as the European sample. Note that there were also 20 year dummy variables that were included in the regression but not in this table.

VARIABLES	(1) OLS ALL	(2) OLS Europe
DISCLOSED_RND_TOTAL_B	0.000314***	0.000637***
	(3.82E-05)	(8.64E-05)
CO_FIRM_NATION_SAME	-0.172***	-0.0564***
	(0.00854)	(0.0124)
CO_INDUSTRY_MAJOR_COMP	0.151***	0.120***
	(0.00729)	(0.0149)
CO_INDUSTRY_MAJOR_LIFESCI	0.159***	0.141***
	(0.0108)	(0.0253)
CO_INDUSTRY_MAJOR_COMMS	0.146***	0.145***
	(0.00927)	(0.0200)
CO_INDUSTRY_MAJOR_BIOT	0.199***	0.266***
	(0.0143)	(0.0286)
CO_INDUSTRY_MAJOR_SEMICON	0.187***	0.187***
	(0.0131)	(0.0292)
CONSTANT	0.350***	0.305*
	(0.0260)	(0.161)
OBSERVATIONS	28,730	6,565
OBSERVATIONS	.	.
R-SQUARED	0.052	0.055
F	58.45	14.08
CDF	.	.

Standard errors in parentheses
*** P<0.01, ** P<0.05, * P<0.1

Table 11
OLS and IV Regression Results
This table shows results for the following model:

$$IPO\_DUMMY = \beta_{10} + \beta_{11}SYND\_RND1 + \beta_{12}INVESTORS\_ROUND1\_SQR + \beta_{13}NUM\_ROUNDS + \beta_{14}NUM\_ROUNDS\_SQR + \beta_{15}TOTAL\_INVESTMENT\_B + \beta_{16}DISCLOSED\_ROUND\_TOTAL\_M + \beta_{1N}INDUSTRY\_DUMMY_Y + \beta_{1R}YEAR\_DUMMY_R + u_1$$

This table features 5 different regressions. First, OLS estimates were determined for each sample (All, Europe, US). After this, 2SLS estimation was used for the entire sample and the European sample. This was not used to estimate the regression for the US sample as the IV was dropped for the US sample. The IV used is CO_FIRM_NATION_SAME and is instrumented on the SYND_RND1 variable. First-stage results are not shown. The simultaneous equation where SYND_RND1 is the left-hand side variable is:

$$SYND_{RND1} = \beta_{20} + \beta_{21}IPO\_DUMMY + \beta_{22}DISCLOSED\_ROUND\_TOTAL\_M + \beta_{23} \cdot CO\_FIRM\_NATION\_SAME + \beta_{2N} \cdot INDUSTRY\_DUMMY_Y + \beta_{2R} \cdot YEAR\_DUMMY_R + u_2$$

Note that there were also 20 year dummy variables that were included in the regression but not in this table.

VARIABLES	(1) OLS ALL	(2) IV ALL	(3) OLS EUROPE	(4) IV EUROPE	(5) OLS US
SYND_RND1	0.0167***	0.00641	0.00209	0.434***	0.0231***
	(0.00338)	(0.0315)	(0.00632)	(0.165)	(0.00401)
TOTALINVESTMENT_B	0.0755***	0.0763***	-0.00735	-0.0305	0.271***
	(0.0204)	(0.0205)	(0.0213)	(0.0292)	(0.0394)
DISCLOSED_RND_TOTAL_B	0.000225***	0.000228***	0.000292***	4.13E-05	2.49E-05
	(3.11E-05)	(3.23E-05)	(4.96E-05)	(0.000116)	(4.90E-05)
NUM_ROUNDS	0.00883***	0.00944***	0.00310	-0.0379**	0.00709***
	(0.00193)	(0.00268)	(0.00511)	(0.0170)	(0.00220)
NUM_ROUNDS_SQR	-0.000760***	-0.000796***	0.000601	0.00360***	-0.000735***

Table 11 (continued)

	(0.000171)	(0.000202)	(0.000586)	(0.00138)	(0.000186)
CO_INDUSTRY_MAJOR_COMP	-0.0125***	-0.0111*	0.0107	-0.0324*	-0.0176***
	(0.00426)	(0.00600)	(0.00759)	(0.0192)	(0.00512)
CO_INDUSTRY_MAJOR_LIFESCI	0.0320***	0.0334***	0.0681***	0.0251	0.0237***
	(0.00628)	(0.00755)	(0.0129)	(0.0236)	(0.00722)
CO_INDUSTRY_MAJOR_COMMS	-0.00796	-0.00663	0.0148	-0.0374	-0.0148**
	(0.00539)	(0.00673)	(0.0102)	(0.0240)	(0.00633)
CO_INDUSTRY_MAJOR_BIOT	0.0745***	0.0761***	0.0658***	-0.0253	0.0753***
	(0.00830)	(0.00964)	(0.0148)	(0.0398)	(0.00987)
CO_INDUSTRY_MAJOR_SEMICON	0.0174**	0.0191**	0.0324**	-0.0285	0.0122
	(0.00756)	(0.00915)	(0.0150)	(0.0304)	(0.00875)
CONSTANT	0.164***	-0.00794	0.182**	-0.0924**	0.229***
	(0.0139)	(0.0156)	(0.0818)	(0.0404)	(0.0168)
OBSERVATIONS	28,713	.	6,559	6,559	22,154
OBSERVATIONS	.	28,713	.	.	.
R-SQUARED	0.055	0.055	0.053	-0.623	0.058
	(1)	(2)	(3)	(4)	(5)
VARIABLES	OLS All	IV All	OLS Europe	IV Europe	OLS US
F	55.47	54.64	12.29	7.394	45.29
Cragg-Donald Wald F	.		.		.
Stock Yogo Weak ID test critical values	.	52.141	.	9.747	.
1% maximal IV size	.	16.38	.	16.38	.
15% maximal IV size	.	8.96	.	8.96	.
20% maximal IV size	.	6.66	.	6.66	.
25% maximal IV size	.	5.53	.	5.53	.