Angels and Venture Capitalists: Complements or Substitutes?

Thomas Hellmann[1]

Sauder School of Business, University of British Columbia and NBER

Paul Schure[2]

University of Victoria, Department of Economics

Dan Vo[3]

University of Victoria, Department of Economics

October 2012[4]

Highly Incomplete Draft!!! DO NOT DISTRIBUTE

This paper draft is still at the proposal stage

We are currently completing the constructions of the data set

We hope to obtain first results by the end of October

[1] 2053 Main Mall, Vancouver, BC, Canada V6T 1Z2, hellmann@sauder.ubc.ca

[2] PO Box 1700, STN CSC, Victoria, BC, Canada V8W 2Y2, schure@uvic.ca

[3] PO Box 1700, STN CSC, Victoria, BC, Canada V8W 2Y2, danvo@uvic.ca

[4] Financial support from SSHRC is gratefully acknowledged. Updated versions will be available at http://strategy.sauder.ubc.ca/hellmann/. All errors are ours.

Abstract

This paper examines the relationship between angel investors and venture capitalists, and their impact on the companies they finance. The paper juxtaposes the complements hypothesis – angels and venture capitalists have mutually reinforcing roles, against the substitutes hypothesis – angel and venture capitalists inhibit each other. We first examine complement/substitute relationships in terms of co-financing patterns, asking whether an initial choice of accepting funding from one type of investor increases or decreases the likelihood of obtaining funding from the other type of investors. We next examine the impact of investor combinations on company performance, asking whether the benefits of having one type of investor is either enhanced or reduced by the presence of the other investor type. We also examine heterogeneity amongst angels and venture capitalists, to identify which types of angel – venture capital combinations generate the strongest complementarities. The empirical analysis is based on a unique dataset of angel and venture capital investments in British Columbia, Canada.

Section 1: Introduction

The literature on entrepreneurial finance often associates early-stage funding of companies with venture capital. However, the venture capital industry is currently facing considerable turmoil. At the same time, alternative funding sources are becoming increasingly important for start-ups. A recent OECD report argues that "While venture capital tends to attract the bulk of the attention from policy makers, the primary source of external seed and early-stage equity financing in many countries is angel financing not venture capital" (OECD 2011, p.10). This same report estimates that the total angel market is approximately the same size as the venture capital market, an estimate in line with earlier studies (e.g. Sohl, 2003).

In recent years several angels (and some self-proclaimed 'super-angels') have attracted considerable media attention by arguing that the venture capital model is broken, and that angels are a better funding source for early-stage entrepreneurs. For example, Dave McClure, a somewhat outspoken super angel, recently argued that VCs are "stupid, insufferable, arrogant, (… they) don't know how to build communities or good products, and they don't back start-ups early enough."[5] Many other angel investors take a more cooperative approach. Basil Peters, a prominent angel investor in British Columbia (BC henceforth), notes "Ten years ago VC funds didn't want to co-invest with angels. Today it's exactly the opposite" (Lerner et al. 2012).

Our main research question is: are angels and venture capitalist complements or substitutes? As soon as one poses the question, one has to ask what this actually means. In this paper we distinguish between two different types of complement/substitute relationships. First we consider co-investment patterns, and ask the question whether angels and venture capitalists tend to finance the same or different companies. Second we consider complement/substitute relationships in terms of value-added to the investee company, and ask how the pattern of co-investment choices affect the start-ups' performance.

Consider co-investment relationships. Under the substitutes hypothesis, angels and venture capitalists constitute alternative investment models that do not mix well together. Once a start-up has chosen one type of investor, it is less likely to switch to the other type. Under the complements hypothesis, however, each type of investor offers a different piece of the puzzle. Obtaining one type of financing actually increases the start-ups' chances of obtaining the other. The complements hypothesis can be naturally applied to explaining the sequence of investments, where companies seek angel financing as a springboard for raising venture capital. Bart Copeland, another BC angel investor, argues that "When angels invest that brings credibility to the company, making it easier for venture capitalists to invest" (Lerner et al. 2012).

[5] See "Dave McClure Says Most VCs Are 'Stupid, Insufferable, Arrogant' And Terrible At Making Money" By Alyson Shontell, http://www.businessinsider.com/dave-mcclure-most-vcs-are-terrible-at-making-money-2012-8#ixzz28xM16Oij ; looked up on Oct 10th 2012

Consider next the performance implications of using different investor combinations. Under the complements hypothesis start-ups have supermodular production functions, where the use of one input becomes more valuable in the presence of the other. By contrast, the substitutes hypothesis argues that the production function is submodular, so that the use of one input becomes less valuable in the presence of the other. The difference between complements and substitutes can also be viewed as a horse race between the benefits of diversity versus the benefits of specialization.

One tempting answer to the questions about complements/substitutes is to say that angels are sometimes complements and other times substitutes. Clearly this is not a satisfying answer by itself, but it does suggest that we can go deeper with our fundamental research question by asking under what circumstances angels and venture capitalists are more likely to complement each other. We can think of circumstances in terms of company characteristics (i.e., what kind of companies lend themselves for co-investments, and at what stage of development), in terms of market characteristics (e.g., is co-operation more likely in boom or bust times) and, most intriguingly, in terms of investor characteristics. For this last one, we go beyond the binary classification into angels and VCs and look at the heterogeneity within each investor category. The question is whether there are meaningful subcategories of angels that are more likely to co-fund with VCs, and similarly whether there are subcategories of venture capitalists that are more likely to co-fund with angels.[6] Similarly for performance, where we ask whether certain choices of angel-VC combinations are better than others.

By far the biggest obstacle to research on angel funding has been access to credible and systematic data. We exploit a unique data set from BC that is based on regulatory filings. The BC context offers a unique opportunity to obtain systematic and detailed data on angel investments, due to the fact that BC has a 30% tax credit for investing in eligible entrepreneurial companies. While such programs exist in many part of the world, BC is one of the few places where the tax credits are made available not only to venture capital firms but also to angels (Sandler, 2004). Private investors have to satisfy some simple criteria (being accredited investors and residing in BC) to be eligible for investment credits. They also have to satisfy some reporting requirement when they want to claim a tax credits. Central to the development of the data base is a requirement to file documents that list all the companies' shareholders over time. This allows us to construct detailed and comprehensive financing histories of the start-ups.

Naturally the data also contains many challenges. In addition to converting data from hardcopies to electronic format, we need to augment the data from regulatory filings with many additional external data sources to obtain a usable dataset. One important problem concerns the classification of investor types. This actually brings up a more fundamental challenge, namely that there is no universally accepted definition for what exactly distinguishes angels from venture

[6] The answer to this question can even differ under the potential presence of other investor types (e.g. corporations, financial firms), which we observe in our data as well.

capitalists (see also OECD (2011) and Goldfarb, Hoberg, Kirsch, and Triantis (2012)). We adopt the following approach: an angel investor invests his/her own family's wealth, whereas a venture capitalist invests on behalf of other fund providers. This definition is based on a fundamental economic distinction between direct versus intermediated financing. From a theoretical point of view, one would expect that investors investing their own money face different incentives and constraints than investors who are intermediaries that act on behalf of others (Diamond, 1984, Axelson, Strömberg and Weisbach, 2009).[7]

INSERT HERE SOME KEY DESCRIPTIVE STATISTICS

Our first research question concerns co-financing patterns. For this we focus mainly on the companies' sequential investor choices. We also consider the composition of the initial investors. The main question is what determines the probability of obtaining funding (and how much) from each of the investor categories, as a function of the existing investors types in the company. We estimate the conditional probabilities that a company obtains funding from each of the investor categories, relative to the default of no funding. Our regressions contain a rich set of controls. Our panel data structure also allows us to exploit a variety of timing patterns.

Our main finds are as follows. INSERT HERE RESULTS ONCE WE HAVE THEM

Our second research question concerns performance. We consider several measures of company performance: employment growth, sales growth, survival, and exit performance. The key independent variables of interest are the investor types. Central to the estimation of complementarities are the coefficients on the interaction terms. Our primary interest is the effect of co-funding by angels and VCs on performance (see also Goldfarb et al., 2012, Brander, Hellmann and Du, 2012). We can also look at interactions among the various investor subcategories to see whether certain types of angels (say angel groups) have stronger or weaker complementarities with certain types of venture capitalists (say private venture capitalists). In addition, we examine the sequencing of investor types. This allows us to address questions such as whether it matters whether VCs and angels invested at the same time, or sequentially.

One important question is how to interpret the regression coefficients. The base regressions are of interest by themselves, as they reveal hitherto unknown co-investment patterns and performance patterns. However, we have to caution that the coefficients should not be interpreted as causal relationships. We follow a prior literature that discusses the challenges of estimating complementarities in the presence of unobservable heterogeneity (Athey and Stern,

[7] In the data we still have to deal with several borderline cases, most notably so-called "angel funds" where several individuals pool their investment funds. One of them typically takes a leadership role in terms of screening out projects, and hence acts a little bit like an intermediary for the others. Empirically it is difficult to distinguish between possibly active and passive investors, but the fact that all these individuals invest their own money suggests they are angels. In the more fine-grained investor distinction we give this particular borderline case of angel groups its own distinct category.

1998, Cassiman and Veuglers, 2006). Clearly there are unobserved company characteristics that may determine a company's initial choice of investors, as well as its subsequent time-pattern. We propose an instrumentation strategy that exploits exogenous temporal and geographic variation in the data. Over time there was considerable variation in the availability of tax credits, and the ease of accessing them. For example, before 2003 the system was administratively more cumbersome, perhaps making it worthwhile only for the more sophisticated or largest angel investors; after 2003 a revised program structure made obtaining angel credits much simpler, which led to their increased use by small angels. Our data also contains some interesting geographic variation. For instance, the distribution of angels is much more wide-spread than the distribution of venture capitalists – in fact, all of BC's venture capitalist are located in Vancouver, the largest city in the province. These venture capitalists do sometimes invest outside of Vancouver, however presumably there are substantial costs associated with doing so. We therefore exploit differences in the local availability of funding sources for our instrumentation strategy.

Our main finds are as follows. INSERT HERE RESULTS ONCE WE HAVE THEM

The academic literature on angel financing is rather small. The paper closest to our is Goldfarb et al. (2012), who make use of a unique dataset from a bankrupt law firm that contained term sheet from client firms, some of which obtained angel and/or venture capital financing. They show that venture capitalists obtain more aggressive control rights than angel investors. This finding is consistent with what we know about venture capitalists (e.g. Kaplan and Strömberg, 2003) and other research on angel investors (Van Osnabrugge and Robinson (2000) and Wong (2010)). Most interesting, Goldfarb et al. (2012) find a negative effect of mixing angel and venture capital funding. Their analysis suggests that this result is driven by split control rights, where neither angel nor VCs have firm control over the companies' board of directors. Our analysis complements the work of Goldfarb et al (2012) in several ways. While they only have snapshots of companies financing, we have the entire financing history. This allows us to model the dynamics of when co-investment relationships are formed. Our data includes a much greater variety of investor types, which allows us to examine the circumstances under which there are greater complementarities. Finally, we attempt to solve the identification problems of estimating complementarities in the presence of unobservables.

In the data we still have to deal with several borderline cases, most notably so-called "angel funds" where several individuals pool their investment funds. One of them typically takes a leadership role in terms of screening out projects, and hence acts a little bit like an intermediary for the others. Empirically it is difficult to distinguish between possibly active and passive investors, but the fact that all these individuals invest their own money suggests they are angels. In the more fine-grained investor distinction we give this particular borderline case of angel groups its own distinct category.

Kerr et al. (2013) examine data from two angel groups that keep track of what companies present in front of the group, and what companies actually get funded. Using a regression discontinuity approach, they find evidence that obtaining angel funding affects the companies' growth and survival rates. While they have more detailed evidence on the investment decisions of angel investors, they can only look at a specific part of the angel community, namely those associated with angel networks. They also do not consider the interrelationships between angels and venture capitalists.

Two papers provide some theoretical foundations for comparing angels and venture capitalist. Chemmanur and Chen (2006) assume that VCs add value but angels don't. Their model explains why entrepreneurs sometimes first obtain angel financing before switching to venture capital. By contrast, Schwienbacher (2009) assume that both angels and VCs can add value, but that only VCs have enough money to refinance a deal. Under that set-up angels endogenously provide more effort at adding value, because of the need to attract outside capital at the later stage.

The literature on venture capitalists is much larger than that on angel investors. Most relevant to this paper is the part of the literature that compares different types of venture capitalists, such as corporate VCs, bank VCs and also government-supported VCs. See Da Rin, Hellmann and Puri (2013) for a comprehensive survey of that literature.

The remainder of this paper is structured as follows. Section 2 discusses data sources and variable definitions. Section 3 examines the co-financing patterns across different investor types. Section 4 examines the relationship between co-financing patters and company performance. The final section provides further discussion and concluding thoughts.

Section 2: Data and Variables

2.1. The BC Venture Capital Program

The BC provincial government administers its Venture Capital Program (henceforth, the VCP), which is based on a 30% tax credit for investing in entrepreneurial companies. The VCP was first established in 1985 under the Small Business Venture Capital Act of British Columbia.

By the end of our sample period in 2009, the VCP program has four segments. The first two segments consist of what we will henceforth call *retail funds*. Retail funds have obtained a special license to raise money from the general public. Individual investors receive a 30% credit for investments into retail funds, up to some limit ($10K in 2009). The main eligibility criterion is that the investors are BC residents. The retail funds then have an obligation to invest these funds within a certain time. There were two types of retail funds in BC. The first was a part of the labour-sponsored venture capital program which involved sharing of the tax credit between

the federal and provincial governments. The second was a very similarly structured program that was purely funded by the provincial government.

The BC Government only granted licenses for retail funds only to venture capital firms. The other two segments of the VCP primarily target angel investors. The third segment of the VCP program consists of tax credits for investments in funds which do not have a license to gather funds from the general public. These funds can only raise money from BC-based "eligible investors". For individual investors this means they satisfy some qualified investor criteria (based on their wealth, earnings, or "sophistication"), or else satisfy some criteria of having a prior acquaintance with the fund managers, either based on family relationships or professional contacts. We will henceforth call these funds VCCs (for Venture Capital Corporations, as these funds are structured as corporations.[8]

The fourth segment of the program was introduced in 2003 and is called the EBC program. It consists of tax credits for direct investments into entrepreneurial companies called EBCs (for Eligible Business Corporations). This program is administratively much simpler for angels since it does not require them to set up an investment vehicle. Eligible investors, including angels, can simply claim the 30% tax credit on the basis of an investment in an EBC. Indeed, the EBC program was intended to reach out to a wider set of angels, including those for whom the volume of tax credits was too small to warrant the effort and costs of setting up a VCC. Under the EBC and the VCC segments of the VCP, individual investors can claim tax credits for investments up to $200K.

In other to qualify for any investment under any of the segments of the VCP, companies must be BC based small businesses that (together with affiliated companies) at the moment of registration under the program: have no more than 100 employees, pay at least 75% of the wages and salaries to BC employees, and operate in an eligible industry.[9]

2.2. Data sources

The data for this paper comes from a variety of sources. Our primary source is the Government of British Columbia, who administers the VCP program described above. What makes the VCP unique, and useful for our analysis, is that it applies to investments by both angel investors and venture capitalists. Sandler (2004) shows that the bulk of the North-American public policy initiatives target formal venture capital, rather than the angel segment of the market.

[8] To avoid confusion to readers familiar to the VCP, indeed the provincially funded retail funds are also structured as VCCs.

[9] Further information on the program can be found in Hellmann and Schure (2010), Lerner et al. (2012), and on the provincial government's website at http://www.jti.gov.bc.ca/ICP/VCP/.

Our primary data contain several components. The BC Government requests detailed company information at the moment the companies register under the program. The data naturally contains detailed data on all the tax credits claimed under the program. In addition we have data on the company's balance sheets, profit-and-loss accounts, and number of employees at the moment of registration. In some case we also have their business plans. In many cases companies continue to file these documents on an annual basis thereafter. For example, companies who successfully attract risk capital after registering for the program are required to submit so-called annual returns that contain some information about on financials (mainly revenues and assets), as well as employment figures.

For a substantial subset of our companies we also have share registries. These documents are particularly important for our analysis, since it contains the complete history of companies' shareholders, dating back to the date of incorporation, and listing the precise dates of when each shareholder obtained his/her share, and at what price.

We augmented the VCP data in several important ways. First, we consulted lists of venture capital firms and the internet to learn more about the investors in our dataset, and in particular their type. Investors do not only include angels and venture capitalists, but also corporations, other financial parties and many more. Secondly, we gathered additional data about the companies in the VCP dataset. We are interested in how companies evolve after their initial registration with the program. The BC Government data includes some information due to the fact that the VCP requires companies to file an annual report. However, we also gathered additional performance indicators than those that can be based on the BC Government data. The commercial datasets Capital IQ and ThomsonOne (VentureXpert, SDC Global New Issues and SDC Mergers and Acquisitions) were used for data on possible exits. Besides these two databases, we gather data from Bureau Van Dijk, a data provider that collects private company data. For Canada, the main source of the Bureau Van Dijk data comes from Dunn and Bradstreet. We also obtained data from SEDAR (which contains public companies and investment fund filings with the Canadian Securities Administrators), the BC companies' registry, as well as a variety of internet searches.

2.3. The company dataset

We have information of companies that registered under the VCP in the period 2001-mid 2009. Our dataset consists of 311 companies, although we are not always to observe all variables for all companies.

Collecting the data on these companies involved a labour-intensive manual process of scanning and transcribing paper documents into electronic format. Financial statements do not have a standardized format, so that we created some standardization.[10]

The business plans contain additional valuable information. For this study the names and biographical information on the companies' key personnel were used to classify shareholders into investors, directors, and managers (including founders). We also used the business plans to put companies into an industry classification. Table 1 below gives the industry classification for the 290 companies we had a business plan for.

TABLE 1: Classification of companies by industry

Index	Industry	Number of Companies	Percentage of Overall Sample %
1.	Agriculture, Forestry and Fishery	20	6.9
2.	Biotechnology	13	4.5
3.	Business services	8	2.8
4.	Communication and Media	17	5.9
5.	Computer hardware	8	2.8
6.	Internet-related	13	4.5
7.	Computer software	74	25.5
8.	Construction	9	3.1
9.	Industrial and Energy	19	6.6
10.	Hi-tech manufacturing	24	8.3
11.	Medical, Health, and Life science	14	4.8
12.	Semiconductor and Other electronics	19	6.6
13.	Tourism and Consumer-related	44	15.2
14.	Transportation	8	2.8
	Total	290	100%

DESCRIPTION TO BE COMPLETED WHEN COMPANY DATASET IS COMPLETED

2.4. The investor dataset

[10] Note also that some annual financial statements are audited, while others are not. The unaudited statements tend to be less complete and sometimes require some interpretation. For example, not all statements include a line item for total wages; and others do not properly identify total expenses. The coders who transcribed the hard copies were instructed to read through all parts of the financial statement to identify the key items required for the analysis.

Central to our main hypothesis is the classification of investor into distinct types. Our population of investors is derived from the companies' share registries. In total there are 18,284 investment transactions, made by 9,468 unique investors in 311 companies.

We adopted a two-stage approach to classify this population of investors. First, we separated the investors into two groups: humans and vehicles. Human investors are identified by their first and last name. Vehicle investors are the remaining. To ensure that no human investor is wrongly classified as vehicle investor, we checked on all vehicle investors to see whether there was some sort of corporate designation such as "Ltd.", "Corp.", etc. in the name. In the second stage we performed a name based matching with other data sources to classify the investors into groups.

With respect to the human investors, it is important to distinguish angels from founders. To do this, we matched the human investors in the share registry with the list of founders derived from the company business plan, annual return, and other documents and websites. Those investors who showed up in the list of founders were be classified as founders. The remaining human investors are classified as angels.[11] We distinguish angel investors from employees and management hires on the basis that the latter obtain stock options that allow them to purchase shares at a deeply discounted price.

The classification of the vehicle investors is more complex, as there are many types of vehicle investors. We first matched our list of vehicles with the list of Venture Capital Corporations (VCCs) described in section 2.1. We next matched the remaining vehicles with a list of venture capital firms. A venture capital firm is defined as such only when it is found in ThomsonOne or CapitalIQ. We matched primarily on the basis of vehicle names, which may or may not be similar to the names of the venture capital firms as these sometimes manage funds with quite different names. In case of uncertain matches we consulted the internet for extra information and clues. Location of the investor, which we have, was at times used as an additional clue. We identified a total 62 venture capital firms in our dataset.

Table 2 describes the types of investors and the number of investments they represent in our dataset.

[11] Note that our definition of angel investors includes family and friends. We plan to separate out family members on the basis on last names and addresses, but such a separation cannot identify all family relationships. As for the identification of friends, there is no objective criteria for separating those out from other angel investors.

TABLE 2: Investor types and the number of investments they make.

Index	Investor's Type	Description	Number of investments made	Percent of total investments (%)	Number of investors	Percent of total investors (%)
1.	Founder	Founders	1,406	7.7	568	5.99
2.	Angel	Investors other than founder	13,288	72.7	7,619	80.47
3.	Angel Group	Vehicle that is formed by more than one angels	986	5.4	124	1.31
4.	Retail Fund	Venture capital firm under the Program	95	0.5	5	0.05
5.	VC	Private venture capital firm as listed on Thomson One and CapitalIQ	253	1.4	51	0.54
6.	Financial Institution	Bank and other investment firms	215	1.2	95	1
7.	Consultancy	Consultant firm that invests in the company	171	0.9	90	0.95
8.	Corporation	Corporations that are not 6 and 7	605	3.3	308	3.25
9.	Non-profit organization	Non-profit organization including university venture.	142	0.8	26	0.27
10.	Other	STILL 2B CLASSIFIED	1,055	5.8	582	6.15
	Total		18,284	100	9468	100

DESCRIPTION TO BE COMPLETED WHEN INVESTOR DATASET IS COMPLETED

2.5. Variable Definitions

In this section we provide the motivation and methodology for our key variables.

TO BE COMPLETED ONCE WE HAVE RESULTS

Section 3: Co-funding patterns of angels and venture capitalists

In this section we examine the co-funding patterns of entrepreneurial companies. We consider a quarterly panel of our sample companies. Our main regressions model is follows:

$$J_{kt} = \alpha + \beta_k I_{k,t-x} + \beta_c X_c + \beta_{ct} X_{ct} + \eta_t + \eta_c + \varepsilon_{ct}$$

where

J_{kt} is the probability that company obtains follow-up funding from investor type k in period t

$I_{k,t-x}$ is a set of indicator variables whether at time t, a company has previously been funded by some investors of type k; This variable can take on alternative lag structures, as indicated by t-x, where x can take on different values; instead of indicator variables one can also use the amount of funding from each investor type

X_c is the set of variables that measure all time-invariant company characteristics, such as industry or location.[12]

X_{ct} is a set of variables that measure all time-variant company characteristics. This includes company age, and measures of the time that has elapsed since the last (or also first) date at which the company received funding. It may also include time-varying financial measures of the company, such as sales, asset or employment.

η_t is a set of time fixed effect, which control for the time at which the company is possibly raising funds. This measure allows us to controls for cycles.

η_c is a set of company fixed effects. We only use them for some model extensions, since these fixed effects erase a lot of natural variation in the data. However, for robustness they can be very powerful, since they allow us to control for all time-invariant company-specific unobserved heterogeneity.

ε_{ct} is the standard error term. We will use robust standard errors and explore possible cluster structures by calendar time, industry or geography.

[12] In principle it is possible for us to observe companies changing location or industry, in which case we may have to treat them as time-varying variables.

Note that our regression model does not consist of one single equation, but of a collection of k equations. At the highest level of aggregation we can consider the case of k=2, comparing only angels and venture capitalists. However, we also plan to exploit specifications with higher values of k, that allow for the disaggregation of the angel and venture capital categories, as well as the addition of other types of investors, such as corporations or other financial institutions.

The system of k equations can be estimated separately using standard Logit, Probit or OLS regressions. To recognize possible interdependencies of the error terms across the k regressions we can also estimate this as a system of equations, using multivariate Logit/Probit or SUR regression models.

One key concern is endogeneity, specifically the possibility that there could be some unobserved heterogeneity that creates a correlation between J_{kt} and ε_{ct}. We therefore want to use some instrumental variables for $I_{k,t-x}$ that satisfy both the rank condition and exclusion restriction. Our approach will be in the spirit of Berger et al. (2005) who exploit exogenous local market variation. In our data there is variation in the availability of tax credits that affect the availability of angel and venture capital funding over time. In addition, there is considerable geographic variation in the availability of the alternative funding sources. We can therefore constructed time-varying measure of local availability of the alternative investor types, which we would expect to naturally satisfy the rank condition. The harder question relates to the exclusion restriction. We would argue that after controlling for time and location effects separately it is not clear that any remaining time-local variation is relevant for the choice of investor. Note that we are not relying on current availability, all that we require is that the past local availability of investor types is uncorrelated with our dependent variables. We will explain this in greater detail in the full draft of the paper.

TO BE COMPLETED ONCE WE HAVE RESULTS

Section 4: The relationship between company performance and co-funding patterns

In this section we consider the relationship between the co-funding patterns and company performance. The main theoretical question concerns whether the companies' 'production' has a supermodular or submodular structure. To make this concrete, consider the following simple specification. Let Y be measure of company performance, and consider two potential inputs, called $a \in \{0,1\}$ for angel investments and $v \in \{0,1\}$for venture capital investments. A supermodular (submodular) production satisfied the following condition:

$$Y(a=1,v=1) - Y(a=0,v=1) \; > (<) \; Y(a=1,v=0) - Y(a=0,v=0)$$

Subject to the issues of unobserved heterogeneity discussed by Athey and Stern (1998) and Cassiman and Veuglers (2006), one can look for the presence of supermodularity by estimating adding the interaction effects of a*b into a regression of a and v and Y.

For our empirical estimation we consider a quarterly panel of our sample companies. Our main regressions model is follows:

$$Y_{kt} = \alpha + \beta_k I_{k,t-x} + \beta_M M_{k,t-x} + \beta_c X_c + \beta_{ct} X_{ct} + \eta_t + \eta_c + \varepsilon_{ct}$$

where the variables are the same as in section 3, with the following additions:

Y_t is performance of company in period t. We will consider measures of sales, asset, employment growth, as well as exits.

$M_{k,t-x}$ is a flexible characterization of interaction effects between the indicator variables $I_{k,t-x}$. There are many was of specifying M, depending on the exact choice of k (i.e. the number of types considered), and the choice of x (i.e., the types of lag structures used).

Unlike in section 3, we only have one equation to estimate at a time, and we can use standard pane OLS or Logit/Probit models.

Again we will consider the endogeneity of investor choices. The approach will be similar to our approach in section 3, where we exploit exogenous variation in the local availability of investor types. Note that unlike in section 3, instrumentation concerns not only for the main effects $I_{k,t-x}$, but also for the interaction effects $M_{k,t-x}$.

In addition to exploring alternative lag structures, we can also exploit the variation in the sequencing of investor choices. For example, for out interaction term we can distinguish between companies that first obtained angels and then venture capitalists, from those that obtained them in reverse order, or at the same time.

TO BE COMPLETEDD ONCE WE HAVE RESULTS

Conclusion

TO BE WRITTEN ONCE WE HAVE RESULTS

References

Athey, Susan and Scott Stern, 1998. An Empirical Framework for Testing Theories About Complementarity in Organizational Design, *NBER Working Paper*, 6600.

Axelson, Strömberg and Weisbach, 2009. Why Are Buyouts Leveraged? The Financial Structure of Private Equity Funds, *Journal of Finance*, 64-4, 1549-1582.

Berger, A., Miller, N., Petersen, M., Rajan, R. and Stein, J., 2005. Does function follow organizational form? Evidence from the lending practices of large and small banks, *Journal of Financial Economics*, 76, 237–269.

Cassiman, Bruno and Reinhilde Veugelers, 2006. In Search of Complementarity in Innovation Strategy: Internal R& D and External Knowledge Acquisition, *Management Science*, 52-1, 68-82.

Chemmanur, T. and Chen, Z., 2006. Venture capitalists versus angels: the dynamics of private firm financing contracts. *Unpublished working paper*.

Da Rin, Marco, Thomas Hellmann and Manju Puri, 2013. A survey of venture capital research. Forthcoming in George Constantinides, Milton Harris, and René Stulz (eds) *Handbook of the Economics of Finance*, 2, Amsterdam, North Holland.

Diamond, Douglas, 1984. Financial intermediation and delegated monitoring, *The Review of Economic Studies*, 51, 393–414.

Goldfarb, B., Hoberg, G., Kirsch, D. and Triantis, A., 2012. Does angel participation matter? An analysis of early venture financing. *Unpublished working paper*.

Hellmann, Thomas and Paul Schure, 2010. An Evaluation of the Venture Capital Program in British Columbia, *Report prepared for the BC Ministry of Small Business, Technology and Economic Development*

Kaplan, Steven and Per Strömberg, 2003. Financial Contracting Theory Meets the Real World: Evidence from Venture Capital Contracts, *Review of Economic Studies* , 70, 281–315.

Kerr, W., Lerner, J. and Schoar, A., 2013. The consequences of entrepreneurial finance: a regression discontinuity analysis, *Review of Financial Studies*, forthcoming.

Lerner, Josh, Thomas Hellmann and Ilkin Ilyaszade, 2012. Angels in British Columbia. *Harvard Business School Case Study*, 9 – 811 – 100.

OECD, 2011. Financing High-Growth Firms: The Role of Angel Investors, *OECD Publishing*, http://dx.doi.org/10.1787/9789264118782-en

Sandler, Daniel, 2004. Venture Capital and Tax Incentives: A Comparative Study of Canada and the United States, Toronto, ON: Canadian Tax Foundation.

Schwienbacher, A. 2009. Financing commitments and investors incentives in entrepreneurial firms. *Unpublished working paper*.

Sohl, Jeffrey E., 2003. The U.S. Angel and Venture Capital Market: Recent Trends and Developments, *The Journal of Private Equity*, 6-2, 7-18.

Van Osnabrugge, Mark and Robert J. Robinson, 2000. *Angel Investing: Matching Start-up Funds with Start-up Companies* (San Francisco, CA: Jossey-Bass).

Wong, Andrew, 2010. Angel Finance: The Other Venture Capital, in Douglas Cumming (ed.) *Venture Capital: Investment Strategies, Structures, and Policies* (Hoboken, NJ: John Wiley & Sons).