Journal of Empirical Finance 18 (2011) 2–15

Contents lists available at ScienceDirect

Journal of Empirical Finance

journal homepage: www.elsevier.com/locate/jempfin

Fund size, limited attention and valuation of venture capital backed firms

Douglas Cumming [a], Na Dai [b,*]

[a] Schulich School of Business, York University, 4700 Keele Street, Toronto, Ontario M3J 1P3, Canada
[b] School of Business & Center for Institutional Investment Management, SUNY at Albany, 1400 Washington Ave, Albany, NY 12222, United States

ARTICLE INFO

Article history:
Received 4 March 2010
Received in revised form 27 September 2010
Accepted 29 September 2010
Available online 14 October 2010

JEL classification:
G24
G32

Keywords:
Venture capital
Fund size
Limited attention
Private equity valuation

ABSTRACT

This paper examines the effect of fund size on investee firm valuations in the venture capital market. We show a convex (U-shape) relationship between fund size and firm valuations. We further document that firm valuations are positively correlated to measures of limited attention. In addition, we show a concave (inverse U-shape) relationship between fund size and venture's performance measured as the probability of successful exits. Further, this relation is particularly strong when the pre-money valuation of the investment is high. Our findings hold across a wide range of robustness checks, including but not limited to sample selection and correction for unobserved company-level value drivers. Our findings support the notion that there is diseconomy of scale in the venture capital industry, which is partially due to the constraints from the quality and quantity of human capital when fund size grows.

1. Introduction

> "We all had too much money. It was just too easy… The problem…was that the funds had grown so big that the 2 percent became just as important as the 20 percent… Success had less to do with performance or risk management…and more to do with bulking up." — A Confession by a Private Equity Manager, The New York Times (September 22, 2009)

Valuation is important to both venture capitalists (VCs) and entrepreneurs, and thus often a contentious negotiation point in venture capital contracting (Hsu, 2004; Engel and Keilbach, 2006; Hochberg et al., 2010; Gompers et al., 2010, etc.). For VCs, their ultimate return is positively associated with the difference between exit proceeds at a liquidity event (e.g., Initial Public Offering (IPO) or Mergers & Acquisitions (M&A)) and the price they paid up to invest in venture firms. For entrepreneurs, the valuation they receive at a financing round determines how much ownership stake they have to give up for a certain amount of capital infusion, which directly impacts the control structure of the venture firm. There is surprisingly a dearth of empirical works on the determinants of valuations in the private equity industry, despite its importance. Furthermore, earlier studies typically focus on the impact of entrepreneurs (entrepreneurial firm) characteristics and market condition on VC valuations (e.g., Gompers and Lerner, 2000; Hsu, 2007; Keienburg and Sievers, 2009). Unlike previous literature, this paper examines how characteristics of venture capital funds, particularly, fund size, impact the pricing in the venture capital industry.

The typical compensation package for VCs consists of management fee which is a fixed percentage (typically 2%) of the fund's capital and "carried interest" which is a fixed percentage (often 20%) of profits as investment returns are realized. When the funds

* Corresponding author. Tel.: +1 518 442 4962; fax: +1 518 442 3045.
E-mail address: ndai@uamail.albany.edu (N. Dai).

0927-5398/$ – see front matter
doi:10.1016/j.jempfin.2010.09.002

grow larger, the former becomes as important as the latter, which provides VCs with incentives to bulk up the fund while the excess fees are seldom used to "invest in resources to grow the skill base of their funds."[1] Thus, the typical venture capital fund has seen an increase in capital managed per partner as fund size grew (see Gompers and Lerner, 2000; Metrick, 2006). This raises the following questions: when the VCs manage larger amount of capital, are they able to provide the similar quantity and quality of services to their investee company? If there is a decline in the quantity or quality or both of their services, how are the valuation of their investee firms as well as their ultimate performance impacted? This paper also explores these questions.

We empirically examine several hypotheses regarding the relation between VC characteristics (VC reputation, fund size, and limited attention), and valuations in the VC industry, using a sample of over 9000 financing rounds with valuation data between 1991 and 2006 provided by VentureXpert database. We project that the most reputable VCs are likely to pay a lower price, ceteris paribus. Larger VC funds are likely to pay a lower price as they have greater outside option. On the other hand, when funds become big, agency problem may kick in, which predicts a convex (U-shape) relationship between fund size and venture pre-money valuation. Further, if human capital does not keep up with the fund growth, the resulted diluted attention could reduce either funds' outside option or continuation option, thus leads to a higher or lower pre-money valuation.

Following Gompers and Lerner (2000), we adopt a hedonic regression approach.[2] A hedonic price function describes the equilibrium relationship between characteristics of a product or service and its price. We start with OLS regressions of pre-money valuations of ventures on VC reputation, fund size and its square term, and measures of limited attention, controlling for various characteristics of ventures, such as entrepreneurial firm's size, their stage of development, industry, and location, and the market conditions, including the capital commitment and number of IPOs during the previous calendar year. We show that the most reputable VCs pay a lower price for ventures of similar quality. Further, we show a convex relationship between fund size and valuations of ventures. We also find a significantly positive association between limited attention and valuation. When we include fund size and its square term together with measures of limited attention as the right hand-side variables, the significance of fund size square term disappears with the exception for the group of less reputable VCs. These findings suggest fund size is in general positively associated with VCs' negotiation power which allows them to get lower price for their investments. However, when fund becomes unnecessarily large, the diluted attention due to human capital constraint kicks in and reduces VCs' outside option, which increases the price of investments or ventures' pre-money valuation. For the less reputable VCs who often have weaker inside governance mechanisms, agency problem may also play a role in paying too much for certain investments.

The major challenge to our empirical design is that the VentureXpert data does not provide detailed company-level data that influence valuation, such as the company's accounting performance data (sales, assets, earnings, etc), the characteristics of the management team, or the strength of their intellectual property. Leaving out these potential value drivers could introduce serious omitted variable problem in our OLS models. To remove, at least, partially the effect of unobserved company-specific factors, we conducted the following diagnostic analyses. First, following Hochberg et al. (2010), we exploit the panel structure of the round data by utilizing a company-level random effect panel regression. Second, we group VCs into quartiles based on their past performance and rerun the basic models within each quartile. Sørensen (2007) shows that higher quality ventures are often matched with more reputable VCs. Thus the heterogeneity in company quality should be reduced within investments financed by VCs with similar reputation. Our results are robust to both approaches.

The second part of our paper examines the performance implication of fund size and limited attention. We find a concave (inverse U-shape) relationship between fund size and the probability of successful exits, which is particularly strong when the pre-money valuations of the venture are high. Our findings suggest that the concave relationship between VC performance and its size as shown in Kaplan and Schoar (2005), to some extent, is because larger funds are more likely to overpay portfolio companies holding their quality constant.

This paper makes contributions to several strands of literature in venture capital. Valuation is important to both VCs and entrepreneurs. However, there is a dearth of work on how valuation is determined in the private equity investments with a few exceptions. Gompers and Lerner (2000) show that venture capital valuation is impacted by market conditions. Hsu (2007) find that various characteristics of founders are important determinants of venture capital valuation. One significant difference between private equity valuation and public equity valuation is that the value of the firm is, to a large extent, determined through the negotiation between capital providers and entrepreneurs given the lack of an efficient pricing mechanism (a liquid trading market) in the VC market. Not only venture quality and market conditions, but also many factors associated with VCs, such as their reputation, size, and services available, are expected to change the relative bargaining power of VCs and entrepreneurs in the negotiation. For the first time, as far as we know, our paper presents empirical evidence in this regard. By examining how various characteristics of VCs impact their negotiation power and thus valuations in addition to venture quality and market conditions, we are able to provide a more complete picture of how VC deals are priced.

A large number of academic papers that address the issue of whether and why scale economies/diseconomies exist among financial intermediations (e.g., Berger and Humphrey (1997); Chen et al. (2004); Pollet and Wilson (2008)). Less attention has been paid to the size effect in the VC and private equity literature. Kanniainen and Keuschnigg (2003, 2004); Keuschnigg (2004); Fulghieri and Sevilir (2005); Cumming (2006), and Knill (2009) and others explore the determinants of optimal portfolio size (the number of portfolio companies) both theoretically and empirically. Goldfarb et al. (2007) show that venture capitalists' belief and their limited ability could result in over-investments/over-entry and thus not able to deliver a return that is

[1] "A Financier Peels Back the Curtain," by Andrew Ross Sorkin, The New York Times, Septermber 22, 2009.

[2] As Gompers and Lerner (2000) has argued, the typical gaps of one to two years between re-financings of venture-backed firms makes it incomplete and misleading to use a price index based on purely on the changes in valuations between financings for the same company.