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Early-stage entrepreneurial financing: A signaling perspective ☆

Jin-Hyuk Kim [a,*], Liad Wagman [b,1]

[a] Department of Economics, University of Colorado at Boulder, 256 UCB, Boulder, CO 80309, USA
[b] Stuart School of Business, Illinois Institute of Technology, 565 W Adams Rd, Suite 452, Chicago, IL 60661, USA

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ABSTRACT

We analyze an entrepreneur's choice between angel and venture capital (VC) financing in a competitive investment market, where the entrepreneur seeks to maintain his ownership share as well as equity value. The key to our analysis is the idea that a negative signal is inferred by the market if an inside investor chooses not to follow on a subsequent investment. We first show that when ventures are ex-ante identical, entrepreneurs retain higher ownership shares by financing with angel investors who commit to not participate in a future round. When entrepreneurs are ex-ante heterogeneous, there is a separating equilibrium where entrepreneurs with higher (lower) likelihoods of success choose VC financing (angel financing) in the first round.

1. Introduction

The market for early-stage investments has grown dramatically in the past decade. Angel investing, which used to be a boutique practice partaken by some successful entrepreneurs, has become a mass market with hundreds of angel groups and platforms dedicated to make small investments in early-stage startups.[2] In contrast, traditional VCs have moved to larger and later stages of financing and tend not to invest in deals that seek less than three or four million dollars (OECD, 2011; Sohl, 2011). Therefore, it is commonly understood that angel financing is chosen by entrepreneurs because VC financing is simply unavailable in the early stages of the firm (e.g., Hellmann and Thiele, 2014).

This explanation, however, is incomplete because VC firms have put in place dedicated funds to make small, seed investments, viewing them as sources for potential follow-on investments. In fact, there are now hundreds of VC funds (such as those run by Andreessen Horowitz) that behave like angels in the early stages of investment. Hence, if one seeks to understand the choice between angel and VC financing in the early stages of a venture, it is crucial to gain insight into the different dynamics that play out in a model of staged financing. In particular, our focus in this paper is on the idea that a first-stage financier who decides not to re-invest at the next stage conveys a negative signal to outsiders.

We take explicit account of an entrepreneur's reluctance to cede ownership shares to financiers in exchange for financing. That is, our model incorporates entrepreneurs' tradeoffs in financing on favorable terms and sharing the ownership of a business.[3] This is consistent with the pecking-order theory (e.g., Myers and Majluf, 1984), according to which entrepreneurs seek financing in an order that minimizes ownership dilution. For instance, entrepreneurs would prefer to borrow from banks rather than to sell equity stakes, everything else being equal. As is commonly the case, however, for a

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* Corresponding author. Tel.: +1 (303) 492 3827.
E-mail addresses: jinhyuk.kim@colorado.edu (J.-H. Kim), lwagman@stuart.iit.edu (L. Wagman).
[1] Tel.: +1 (773) 980 9883.

[2] A taxonomy for these early-stage investors includes 'super angels' (e.g., Ron Conway, Peter Thiel, etc.), 'micro-VCs' (e.g., First Round Capital, True Ventures, SoftTech VC, etc.), and 'startup accelerators' (Y Combinator, TechStars, Seedcamp, etc.).

[3] Anecdotes abound in the popular press about the importance of share dilution in a founder's decision to raise capital. There is also growing evidence that there are indeed substantial non-pecuniary benefits for founder-CEOs (e.g., Hamilton, 2000; Moskowitz and Vissing-Jørgensen, 2002).

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penniless entrepreneur or an early-stage venture, debt financing is often unavailable.

We thus focus on how an entrepreneur's ownership incentives influence his choice of a financing source in the early stages of the venture, assuming that both angels and VCs provide competitive equity financing. Angel investors, who are characterized by a liquidity constraint (due to, e.g., a lack of larger follow-on funds), cannot participate in the subsequent round of investment, whereas VCs are characterized by having the option to decide whether or not to re-invest.[4] Importantly, a VC firm's second-round participation decision is observed by outside investors (e.g., through interviews and due diligence), which enables the market to partially update its posterior beliefs about a venture's likelihood of success.

More specifically, if a seed investor decides to re-invest, then a positive signal is sent to the market, which ramps up outside investors' valuation of the venture; if the seed investor decides to stay out of a subsequent round, then a negative signal is sent and the venture's valuation decreases. Because the re-investment decision leads to more competitive outside offers, a decision to re-invest ratchets up the expected value of the marginal venture, above which the seed investor is willing to re-invest. This endogenously creates an 'up' round with a higher valuation (or a 'down' round with a lower valuation) than what would have been observed without such strategic incentives.

We first show that given a competitive capital market, when ventures are ex-ante identical, entrepreneurs can retain higher ownership stakes by financing early rounds with angel investors. Intuitively, the signaling problem that follows VC financing in first-round investments creates uncertainty associated with the inside VC's participation decision in the second round. This uncertainty leads to an overall smaller expected ownership share for the entrepreneur compared to angel financing. This benchmark result (i.e., ownership advantage with angel financing) holds regardless of whether outside investors are willing to invest or the venture is simply liquidated in a 'down' round (where inside VCs do not follow through).

When entrepreneurs are heterogeneous with respect to ex-ante private information about their ventures' success probabilities as well as financing opportunities, a separating equilibrium exists where entrepreneurs with higher likelihoods of success ('high types') choose VC financing in the first stage while 'low types' choose angel financing. That is, our model can explain the coexistence of angels and VCs in the early financing stage and gives rise to the prediction that those ventures who finance with angel investors are on average of lower quality than those who finance with VCs.

The remainder of the paper is organized as follows. Section 2 presents the model, and Section 3 analyzes VC financing. Section 4 compares VC and angel financing in the benchmark case. Section 5 considers ex-ante heterogeneous entrepreneurs and characterizes the separating equilibrium. Section 6 examines robustness to interim liquidation. Section 7 discusses related works and our model's empirical implications. Section 8 concludes. All formal proofs are in the Appendix A.

2. The model

Penniless entrepreneurs seek to finance their ventures. Entrepreneurs are assumed to be risk neutral; and ventures are ex-ante identical (we later relax this assumption). The representative entrepreneur has preferences defined over his ownership share of the venture and the value of his equity. Specifically, his utility increases in both his expected ownership share and the value of his retained equity. This means that the entrepreneur is willing to trade off a (small) decrease in equity value for an increase in his ownership share of the venture. We do not need to assume anything specific about the functional form of the utility function or the degree of substitutability between its two components. All of our results hold as long as there is some (even arbitrarily small but positive) substitutability between ownership share and equity value.[5]

At the beginning of the game, nature draws a venture idea for each entrepreneur, which is characterized by a probability of success p. We assume that p is uniformly distributed between 0 and 1 in order to derive closed-form solutions. Venture development consists of two stages. In the first stage, an entrepreneur raises capital K to turn his idea into a prototype. No revenue is generated at this stage. Hence, if the venture is liquidated at the end of the first round, then the firm's equity is worthless. In the second stage, the entrepreneur raises growth capital F. At the end of the second stage, the venture either succeeds with probability p generating a revenue R, or fails with probability $1-p$ yielding zero revenue. We assume that ventures have ex-ante positive net values, that is, $R/2 \geqslant (K+F)$.

To raise capital in each stage, entrepreneurs approach risk-neutral investors. The investment market is perfectly competitive at both stages of financing, so that VCs or angel investors can only expect to earn a zero rate of return at the time of investment. This assumption reflects the recent evidence that VC funds do not significantly outperform small-cap traded securities, particularly when taking into account selection bias (e.g., Cochrane, 2005; Harris et al., 2014). Direct evidence on the performance of angel investments is rarer, but existing evidence suggests that angel groups and the venture capital industry seem to perform similarly (e.g., Kerr et al., 2014).[6] Therefore, the perfect competition assumption can serve as a useful benchmark which allows us to present our results in a clear manner.

For tractability, we assume that the entrepreneur is unable to secure debt financing due to the nature of the venture or the lack of collateral. There are two types of equity investors, 'VCs' and 'angels.' The difference between the two is that angel investors are those who commit not to re-invest in follow-on rounds for reasons that are exogenous to the model (e.g., due to portfolio policies or lack of funds) while VCs have the option of deciding whether or not to re-invest. This distinction largely matches how the inside-signaling problem with VCs is perceived by practitioners. Although the investor type can be convexified and endogenized by assuming an ex-ante probability of a liquidity constraint, this does not change any of the results in our model, but it can make closed-form analysis intractable.[7]

A venture's success likelihood, p, is initially unknown to both the entrepreneur and investors. If an investor invests in the first round, this 'seed' investor as well as the entrepreneur learn the venture's success likelihood, p. Information asymmetry arises because p is not observed by outside investors. However, before second-round bidding begins, outside investors can observe

[4] Angels typically do not follow on when a subsequent financing round involves VC participation (Wong et al., 2009). In a 2010 survey of angel investors in Europe, the number of deals made by respondents were 331, 222, and 127 in France, Italy, and the UK, respectively, of which the number of follow-on rounds were only 2, 7, and 4 (European Business Angels Network (EBAN), 2010).

[5] As previously mentioned, the main advantage of angel financing in our model is that entrepreneurs retain larger ownership shares. If entrepreneurs only cared about the value of their equity, then it can be shown that VC financing yields the same expected ex-ante equity value as angel financing.

[6] Cochrane (2005) and Cumming and Walz (2010) estimate the mean returns to VC investments to be around 66% using US and international data, respectively. DeGennaro and Dwyer (2014) estimate that the expected returns to angel investments is around 70%, which is the same order of magnitude as those from VC investments.

[7] See Supplementary Material which can be accessed online.