Relation Specific Investments and the Choice between Bank and VC Finance *

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Abstract

We analyze the feasibility of debt and equity when the entrepreneur can decide on the degree of relation specificity of investments in an incomplete contracts setting. Each entrepreneur has different opportunity to invest in relation specific assets, which increase productivity and decrease the bargaining power of the financier. Entrepreneurs prefer bank financing for low relation specific investments. Banks provide short term loans but can extend the term of the loan if undertaking an IPO is optimal, which makes cash flows observable. Entrepreneurs prefer to finance high relation specific investments with VC equity because a VC can contribute to the success of the project by exerting effort. The VC can only recover its investment if the entrepreneur decides to do an IPO. The optimal VC contract is similar to equity but may include features resembling options.

1 Introduction

Recent literature on financial contracting when contracts are incomplete (see, e.g. Hart and Moore (1994, 1998)) has emphasized the beneficial aspects of debt contracts in getting firms to pay out cash to their creditors. At the heart of this argument lies the lender's ability to force a firm into bankruptcy if the debt claim is not paid in a timely manner, with the creditor obtaining the liquidation value of the firm in such a contingency. One overlooked issue, however, is that given the importance of the firm's liquidation value to the contracting arrangement, the firm's management may have an incentive to take actions to alter the value of the firm under liquidation as a way of lowering the credibility of the lender's liquidation threat. In other words, to the extent that an entrepreneur can lower the firm's liquidation value after obtaining financing for his project, such action reduces the value to the lender under bankruptcy and thus reduces the likelihood that the firm will be liquidated by its creditors.

In this paper, we propose a model of relation-specific investments and financial structure based on the simple idea that a firm's liquidation value is (at least partly) under the control of the firm's managers. While pure destruction of liquidation value is seldom optimal, we argue that one likely channel for reducing a firm's value under liquidation while at the same time preserving, or even enhancing, long term value is to invest primarily in assets that are specific to the project being undertaken. By investing in relationship-specific assets, a manager reduces the value of those assets under alternative use, but in all likelihood increases their value if retained within the project. However, such investments in relationship-specific assets introduce an inefficiency in financial contracting in that a lender, anticipating that the firm's liquidation value will be low, may be unwilling to lend even if the firm has very good long term prospects. Interpreting such a financier as a "bank" - an institution which grants credit primarily via debt-like contracts - we thus show that bank financing is more difficult to obtain when there is scope for a high degree of asset-specificity in firms' investments choices. In the limit, if assets are extremely specific and have limited use outside of the current

operations (i.e., if the liquidation value is extremely low), bank financing may no longer be feasible and entrepreneurs may have to forgo profitable projects due to their inability to commit not to specialize the assets.

We argue that one way of resolving such inefficiencies is to involve an investor who shares in the long term prospects of the company's investment decisions, and who stands to "cash out" when and if the firm is able to go public. This is exactly the role played by a venture capitalist (VC) in that a VC can be seen as both adding value to the firm through the strategic, marketing, or distribution assistance it provides, and as having an interest in the firm's ongoing value since the VC relies on the IPO mechanism to earn his return. Our model thus predicts that VC financing should be optimal when there is the opportunity for management to acquire capital assets that are highly specific but that yield high long term value when operated within the firm, benefitting from the input of both the firm's managers as well as from the VC.

We formalize this discussion by introducing a second financier into the model that can, through some additional effort, improve the firm's prospects and add value to the firm. Unlike a bank, however, this financier is not very efficient at achieving a high value for the assets under liquidation. We call such a creditor a Venture Capitalist. By taking an equity stake, the VC is only able to earn a return on his investment if the firm successfully undertakes an IPO. Moreover, the upside potential obtained as a result of the equity stake gives the VC an incentive to exert effort toward increasing the firm's value. Since the VC does not rely on the firm's interim liquidation value to extract value from his investment, he is not negatively affected by the entrepreneur's decision to specialize the assets and may indeed benefit from the increase in long term value that arises as a result of specialization. We find that venture capital financing may thus be optimal when investments can be made highly relation-specific, which is just the instance when bank financing is a rather poor option.

While venture capital financing has a clear beneficial side, it is not always feasible. By granting the VC a stake in the upside associated with the long term value of the firm, which

is necessary to obtain the VC's input, the entrepreneur dilutes his own claim and reduces his own incentives to exert effort. If the stake that must be relinquished to the VC is sufficiently large, and if the firm's prospects are sufficiently dim in the long term, the entrepreneur may prefer to divert the cash flows in the interim rather than commit to undertake an IPO and allow the VC to cash out his shares. The optimal contract between the VC and the entrepreneur thus balances out the entrepreneur's incentive to divert the cash flows for his own consumption against the need to provide both parties with a stake sufficiently high that they are willing to contribute and follow through with an IPO. In such situations, which correspond to when there is little specificity in the assets, VC financing will add little value for the firm (and will in fact not even be feasible), and bank financing will be optimal.

At the heart of our analysis is the premise that a fundamental change occurs in the firm as a result of the process of going public in that, by being forced to file audited financial statements, increase disclosure, and improve transparency, a firm in essence makes some of its future cash flows at least partly contractible. The stock market provides verifiable information about the firm (Holmstrom and Tirole, 1993), which makes the VC's share liquid (Boot, Gopalan, and Thakor, 2006). This allows for claims (such as equity claims) that derive value from the long term prospects of the firm, and that would not be possible if cash flows are non-verifiable. This assumption represents a departure from the extant literature on financial contracting with incomplete contracts in that we allow for some contracting over cash flows to take place as long as the firm can commit to undertake an IPO. Otherwise, we assume, as in much of this literature, that no contracting is possible over future cash flows since the entrepreneur always has the option to steal them and claim that no cash flows materialized.

Several papers focus on the optimal contracts in VC financing (Dessi, 2005; Admati and Pfleiderer, 1994). Schmidt (2003) and Casamatta (2003) analze the optimal financial contracts in VC financing when both VC and the entrepreneur exerts effort. Hellmann (1998) studies how entrepreneurs may optimally cede control to VC's, even allowing the VC

to fire them, as a way of providing proper incentives. This paper also considers the optimal revenue sharing contract under moral hazard but focuses on the choice of entrepreneur between bank and VC financing. Dessein (2005) focuses on the allocation of control between the entrepreneur and the VC under information asymmetry, where entrepreneur relinquishes control to the VC to signal the congruence of their goals. In our model, VC financing exists even when the entrepreneur keeps control and have all the bargaining power if there is some chance that firm will become public and the VC can sufficiently contribute to the success of the project. Recent work by Ueda (2004) also studies an entrepreneur's choice between bank and VC financing by arguing that VC's have better ability to evaluate projects than banks but at the same time have potential to steal the entrepreneur's idea. Our work, by contrast, focuses on the role of liquidation and asset specificity to understand firms' choice of financing source.

On the empirical front, Sahlman (1990) and Gompers (1995) provide information about the role of VC's and optimal contracts. Several papers provide avidence about the beneficial role of VC's in helping firms to succeed (Gorman and Sahlman, 1989; Megginson and Weiss, 1991; Hellmann and Puri, 2000, 2002; Baum and Silverman, 2004; Hsu, 2004). VC's may help to "professionalize" an entrepreneurial firm by bringing in professional management teams and shortening the time to IPO. Our model incorporates these beneficial aspects attributed to VC financing to understand the tradeoffs between VC and bank financing.

2 The Model

An entrepreneur is endowed with a project, which requires an initial investment of I. The entrepeneur has capital of $W \leq I$ and needs to raise the remaining amount either from a bank or a venture capitalist. Both the banking and the VC industries are competitive, and we normalize both of their opportunity costs to zero. The entrepreneur decides the type of financing from the menu of contracts provided by the VC and the bank.

The entrepreneur has some degree of flexibility in how to use the capital, and may choose to invest in specific assets such as human capital, or assets for which it is necessary to develop unique skills in order to run the project. The range of investments available to the entrepreneur is $k \in (1, k_h)$, where larger k denotes a higher level of asset- (or relation-)specificity. Although both the venture capitalist and the bank observe k_h, third parties cannot enforce contracts that depend on k. The entrepreneur decides on the level of k after raising the funds. As k gets higher the value of investment for alternative uses decreases, but the value of the project increases. Therefore, it is socially optimal to invest in high relation-specific investments.

The liquidation value or the value of alternative use of the investment at period one is equal to $L_1 = \frac{\gamma I}{k}$, where $\gamma \in (0, 1)$ represents the fraction of the asset's value the financier can obtain under liquidation. Therefore, as the relation-specificity increases the liquidation value of the investment decreases. This creates an important problem for the entrepreneur in raising funds, since the entrepreneur cannot credibly commit to invest only in low relation-specific assets. Partial liquidation of assets is not possible.

We assume that the bank has a superior ability than the venture capitalist in liquidating projects, i.e., $\gamma_{bank} > \gamma_{VC}$. The liquidation value of the assets decreases over time. For simplicity we assume that the liquidation value is equal to zero at time 2.[1]

At time one, the first period cash flow C_1 is realized, which is a random number with probability density function $f(c)$ bounded below by C_0, which is $\frac{2}{Y} \leq C_0$. The entrepreneur decides whether to obey its contractual obligations and how much effort e_{EN} to exert. If he chooses not to follow through with his obligations, he can either run away with all of the cash, or he propose an alternative contract to the financier (more below). The bank lacks the personnel and experience to help the entrepreneur to manage the company; therefore the bank cannot exert effort to increase the second period cash flow. On the other hand, the venture capitalist (VC) is specialized in helping firms to succeed. VC firms may pro-

[1] In a similar setting, Hart and Moore (1998) show that only short term debt is feasible because the financier can only exit with the threat of liquidating assets.

vide portfolio companies with strategic advice, help them professionalize their management, and attract better resources, business partners and human capital.[2] We formalize this by assuming that the VC can also exert effort e_{VC} at time 1 that increases the time 2 cash flows.

The expected value of second period cash flow depends on the realization of C_1, the level of relation-specific investment k and the effort levels. The second period cash flow is equal to $C_2 = C_1 k e_{EN}$ in the case of bank financing and $C_2 = C_1 k(e_{EN} + \phi e_{VC})$ in the case of venture capital financing. The VC contributes effort e_{VC} and ϕ measures the relative contribution of the VC with respect to the entrepreneur. The expected value of ϕ is common information at time zero, however the actual value of ϕ is revealed at the end of the first period. The cost of effort is equal to $c(e) = \frac{1}{2}e^2$ for both the entrepreneur and the VC. The value of the firm at time 2 is YC_2, where Y is an exogenously given multiplier such as P/E ratio.

The actions of agents, the entrepreneur's choice of k, and cash flows are not observable by third parties. The cash flow becomes observable only if the entrepreneur decides to do an IPO in the first period. Undertaking an IPO requires paying a fixed cost of F. Once the IPO process starts, the entrepreneur can no longer run away with the cash since several market participants monitor the cash flows of the firm.[3]

After signing the contract at time 0, agents can renegotiate the contract at time 1. For simplicity, we give all bargaining power to the entrepreneur. The entrepreneur can make a take it or leave it offer to the financier after the realization of the first period cash flows.[4]

[2]See (Gorman and Sahlman, 1989; Megginson and Weiss, 1991; Hellmann and Puri, 2002, 2000; Baum and Silverman, 2004; Hsu, 2004).

[3]This captures the notion that filing for an initial public offering leads not only to greater scrutiny by regulatory agencies (i.e., the SEC), but also forces the firm to more carefully track their accounts by certifying their financial statements, hiring independent auditors, etc. All of these decrease the ability of the entrepreneur to steal the cash from the firm by pretending no cash flow was realized.

[4]The results can be extended to the case where both the financier and the entrepreneur have bargaining power with positive probability.

3 Bank Financing

It is natural to analyze a debt-like contract, where the entrepreneur promises to pay and amount P at time 1 in exchange for receiving $I - W$ from the bank. Later, we will show that and equity-like contract is not feasible when the bank is the financier. At time 2, the firm can be either public or not. If the entrepreneur decides at time 1 to undertake an IPO, the firm becomes public at time 2 and cash flows to the firm become observable. Therefore, if the entrepreneur commits at time 1 to an IPO, the bank and the entrepreneur can then sign a contract that depends on the cash flows at time 2. The entrepreneur will repay the bank as long as the observable cash flow is sufficient to make the payment. Conversely, if the firm does not go public at time 2, cash flows will not be observable and hence the entrepreneur can steal the entire value of the firm YC_2. In this case, the bank receives nothing.

Assume that the entrepreneur decides not to go public. The bank has no power in the ex-post bargaining game because the liquidation value of the assets is zero at time 2 and the firm value is not observable by a third party. Therefore, if the entrepreneur decides not to go public, the bank must require payment at time 1. The entrepreneur may make the payment to the bank and stay to run the project into the second period, or he may decide to steal the cash flow at time 1 and run away. Assuming that the entrepreneur does not run away, the entrepreneur decides on its effort level by solving the following optimization problem:

$$\max_{e} Yk(C_1 - P)e_{EN} - \frac{1}{2}e^2 \tag{1}$$

The entrepreneur's optimal effort level is equal to $e_{EN} = Yk(C_1 - P)$. For the entrepreneur to stay, his payoff after paying the bank and staying one more period should be larger than the payoff from running away. The equation below shows the participation constraint of the entrepreneur, given his optimal level of effort e_{EN}:

$$\frac{1}{2}Y^2k^2(C_1 - P)^2 \geq C_1 + L - P \tag{2}$$

The entrepreneur may also decide to do the IPO if the productivity of the cash flow is high in the second period and the second period cash flow is large enough to make the payment. In this case, the bank may agree to receive the payment P in the second period. The entrepreneur decides to do the IPO if the expected cash flows from doing the IPO is larger than paying the debt at time 1 or running away. This condition can be expressed as

$$\frac{1}{2}Y^2k^2(C_1 - P)^2 \leq \frac{1}{2}Y^2k^2(C_1)^2 - F - P \tag{3}$$

Simplifying, this becomes

$$C_1 + L - P \leq \frac{1}{2}Y^2k^2(C_1)^2 - F - P \tag{4}$$

When the productivity is high enough, doing the IPO is Pareto improving because it allows for long term financing by making the cash flows observable. After the first period's cash flow is realized, agents can renegotiate the terms of the contract that they signed at time 0. The renegotiation process works as follows: The entrepreneur makes a take it or leave it offer to the bank. The bank decides whether to take the offer or liquidate the assets. If the entrepreneur offers to pay more than or equal to the loan value P, the bank accepts otherwise the bank liquidates. Therefore, regardless of whether the entrepreneur runs away, stays or does the IPO, the bank receives the minimum of either the promised repayment P or the liquidation value L.

At time 0, after the entrepreneur receives financing, the entrepreneur chooses the level of relation-specificity of the investment k. Since k is not observable by a third party, the entrepreneur and the bank cannot contract on the value of k. As the value of k increases, the productivity of assets for this project is decreased. At the same time, however, the value of assets for uses outside of the project decreases as well. It is advantageous for the entrepreneur to both increase productivity and decrease the liquidation value of the assets. Increasing productivity increases the expected cash flows of the entrepreneur, and decreasing liquidation

value increases the bargaining power of the entrepreneur. Therefore, the entrepreneur always chooses the highest possible k.

In equilibrium, the bank correctly anticipates the entrepreneur's choice of relation-specificity. Therefore, the bank will agree to lend only if the expected payment is more than or equal to the loan amount. The participation constraint of the bank is as follows:

$$I - W \leq \min\{\frac{\gamma_{bank} I}{k_h}, P\} \tag{5}$$

Assuming that the banking industry is competitive, the participation constraint will hold with equality. If the wealth of the entrepreneur is less than the difference between the liquidation value and the amount of investment, the bank loan is not feasible. Therefore, companies with an opportunity to make highly relation-specific investments may never receive financing from banks even if the projects are highly productive.

4 Venture Capital Financing

The VC has a disadvantage in lending compared to the bank because the bank has a better ability to liquidate projects. Since the bank loan is always cheaper than the VC loan, we ignore the VC loan and initially limit ourselves to equity type contracts to see whether such contracts are feasible.

The entrepreneur agrees to pay β fraction of profits to the venture capitalist in return for raising the required funds $I - W$. At time 2, if the firm is public the cash flow becomes observable. Therefore the VC can liquidate its equity share. If the firm is not public, the VC's payoff is zero since the entrepreneur can steal the entire value of the company.

After observing the realization of the first period cash flow, the entrepreneur decides in period 1 whether to do an IPO. The entrepreneur decides to take the firm public if the expected payoff from going public is larger than the expected payoff from running away. The effort level of the entrepreneur when he participates in the IPO is denoted by e_{EN} and the

effort level when he runs away is denoted by e'_{EN}. If the entrepreneur decides to do the IPO, he shares the revenues with the VC, who also exerts effort. This increases the value of the firm. If the entrepreneur decides to do the IPO, the effort levels of the entrepreneur and the VC is sub-optimal because of the classical double sided moral hazard problem (Holmstrom, 1982).However, if the entrepreneur decides to run away, the entrepreneur captures all of the value and invests more because there is no moral hazard problem. The effort level of the entrepreneur when he decides to do IPO is obtained from the following problem:

$$\max_e (1-\beta)[kYC_1(e+\phi e_{VC}) - F] - \frac{1}{2}e^2, \tag{6}$$

which in equilibrium yields,

$$e_{EN} = (1-\beta)kYC_1. \tag{7}$$

We do not consider the case in which entrepreneur steals the cash flows but does not invest. Even if the cash flows are equal to the lower bound, it is still optimal to continue the project. The effort level of the entrepreneur when he decides to run away is obtain from

$$\max_e [kYC_1(e_{EN})] - \frac{1}{2}e_{EN}^2 \tag{8}$$

The solution is

$$e'_{EN} = kYC_1 \tag{9}$$

The effort level of the VC when the entrepreneur decides to do IPO is obtained by maximizing

$$\max_e \beta[kYC_1(e_{EN}+\phi e) - F] - \frac{1}{2}e^2. \tag{10}$$

The solution to this problem yields

$$e_{VC} = \beta kYC_1\phi. \tag{11}$$

The effort levels of the entrepreneur and the VC depend on how the cash flow of the firm is shared. The agent who has the highest share of the revenue has higher incentives to invest. However, the sharing rule that agents agree on at time 0 may not be the optimal sharing rule. At time 1, agents can renegotiate to the sharing rule that maximizes the joint payoff. If the optimal sharing rule makes one of the agents worse off, his participation constraint can be satisfied by making a fixed transfer to him from the observable cash flow at time 2.

Proposition 1 *The optimal sharing rule is determined by the relative contribution of the VC and the entrepreneur, ϕ. If necessary, agents can employ fixed transfers using observable cash flows at time two to satisfy the participation constraints.*

$$\beta^* = \frac{\phi^2}{1+\phi^2} \tag{12}$$

The optimal share of the VC gets larger if the relative contribution of the VC with respect to the entrepreneur, ϕ, gets larger. At time 1, agents agree on the sharing rule that maximizes the joint payoff regardless of the sharing rule agreed on at time 0. The negotiation works as follows: the entrepreneur makes a take it or leave it offer to the VC and the VC decides whether to participate or not. The negotiation between the VC and the entrepreneur depends on whether the entrepreneur's participation constraint is satisfied under the initial sharing rule:

$$(1-\beta)[kYC_1(e_{EN}+\phi e_{VC})-F]-\frac{1}{2}e_{EN}^2 \geq kYC_1e'_{EN}-\frac{1}{2}e'^2_{EN}. \tag{13}$$

If the entrepreneur's participation constraint is satisfied, the renegotiation proceeds as follows. The entrepreneur proposes a new sharing rule that maximizes the joint payoff and gives the VC its outside option, where P_{VC} and P_{EN} are the fixed payments received by the VC and the entrepreneur, respectively. The value of the fixed payment has to be lower

than the total cash flows of the company to maintain the budget balanced. In this case, the participation constraint of the VC is as follows.

$$\beta^*[kYC_1(e_{EN}(1-\beta^*)+\phi e_{VC}(\beta^*)-F-P_{VC}-P_{EN}]+P_{VC}-\frac{1}{2}e_{EN}^2(\beta^*)\geq \quad (14)$$
$$\beta[kYC_1(e_{EN}(1-\beta)+\phi e_{VC}(\beta))-F]-\frac{1}{2}e_{EN}^2(\beta).$$

The participation constraint of the entrepreneur is satisfied if the realized cash flow at time 1 is higher than C_h, which is determined by the initial sharing rule and the fundamentals of the model:

$$C_h=\sqrt{\frac{F}{f(\beta,\phi)k^2Y^2}}, \quad (15)$$

where

$$f(\beta,\phi)=\frac{1-\beta}{\frac{1}{2}(1-\beta)^2+\beta^2\phi^2-\frac{1}{2}}. \quad (16)$$

If the participation constraint of the entrepreneur is not satisfied, the outside option of the VC is equal to zero. Therefore, the VC accepts any offer that provides him a net payoff of zero or more. In this case, the VC's participation constraint is:

$$\beta^*[kYC_1(e_{EN}+\phi e_{VC})-F-P_{VC}-P_{EN}]+P_{VC}-\frac{1}{2}e_{EN}^2\geq 0. \quad (17)$$

We can find the level of cash flows such that that the entrepreneur always runs away in terms of the fundamental parameters of the model:

Proposition 2 *The entrepreneur always runs away if the cash flow is smaller than C_l and always stays if the cash flow is larger than or equal to C_l:*

$$C_l=\sqrt{\frac{F}{f(\phi)k^2Y^2}}, \quad (18)$$

where

$$f(\phi) = \frac{1+\phi^3}{1+\phi^2} - \frac{1+\phi^4}{2(1+\phi^2)^2} - 1/2. \tag{19}$$

Depending on the amount of the realized cash flow in the first period, the renegotiation between the entrepreneur and the VC can be described as follows. If $C_1 < C_l$, the entrepreneur runs away and the VC's payoff is equal to zero. If $C_h > C_1 > C_l$, the entrepreneur decides to do the IPO, agents agree on a Pareto optimal sharing rule, the entrepreneur captures all the surplus and VC again gets zero. If $C_1 > C_h$, the entrepreneur decides to do IPO, agents agree on a Pareto optimal sharing rule and the VC gets his outside option determined by the initial sharing rule. Although agents always agree on the optimal sharing rule, the initial sharing rule is not irrelevant because it determines the outside option of the VC in the renegotiation at time 1.

We can calculate the payoff of the VC from undertaking the project, which is equal to the expected cash flow from the project minus the initial investment. The VC captures surplus only when the entrepreneur's participation constraint is satisfied with the initial sharing rule. The captured surplus is equal to the VC's share of revenues minus the cost of effort according to the initial sharing rule. Since we assume that the VC industry is competitive, the expected payoff of the VC is equal to zero.

$$-(I-W) + \int_{C_h}^{\infty} f(c)(\beta(1-\beta)k^2Y^2C_1^2 + \frac{1}{2}\beta^2\phi^2k^2C_1^2 - \beta F)dc = 0 \tag{20}$$

The initial share of the VC is determined based on this equation and as long as $\beta < 1$, the entrepreneur can raise funds from the VC. The relation-specificity of assets only increases the payoff of the VC. Unlike the bank, the VC prefers projects with high relation-specificity because as the relation-specificity increases, the VC's effort becomes more valuable, the entrepreneur is less likely to run away and is more likely to do the IPO.

5 Bank versus VC Financing

Both the bank and the VC evaluate the entrepreneurs' project and propose financial contracts if financing the investment is feasible. The bank financing has higher chance of being feasible when the liquidation value of the assets are high, i.e. entrepreneur's opportunity to invest in relation specific assets is low. The feasibility of bank financing is determined by the condition below:

$$I - W \leq min(\frac{\gamma_{bank} I}{k_h}, P) \tag{21}$$

Therefore if $\frac{\gamma_{bank} I}{k_h} < I - W$ the bank financing is no longer possible, it is easy to see that as k increases the liquidation value of the assets decreases and the bank financing may not be feasible. The payoff of the entrepreneur from bank financing is equal to:

$$\begin{aligned} EN_{bank} &= -W + \int_{C_0}^{C_a} f(c)(C + L - P) && (22) \\ &\quad + \int_{C_a}^{C_b} f(c)\frac{1}{2}k^2Y^2(C-P)^2 && (23) \\ &\quad + \int_{C_b}^{\infty} f(c)\frac{1}{2}k^2Y^2C^2 - F - P && (24) \end{aligned}$$

The entrepreneur can run away, stay and do IPO. Payoff to the entrepreneur is $C_1 + L - P$, $\frac{1}{2}k^2Y^2(C_1 - P)^2$ and $\frac{1}{2}k^2Y^2C_1^2 - F - P$, respectively. Using long-term loan and taking the firm public may or may not always dominate the short-term loan depending on the parameters of the model. We write down the payoff of the entrepreneur from bank financing assuming that a region exits such that short-term loan dominates the long-term loan. In the equation above C_a solves $\frac{1}{2}k^2Y^2(C-P)^2 = C + L - P$ and C_b solves $\frac{1}{2}k^2Y^2(C-P)^2 = \frac{1}{2}k^2Y^2C^2 - F - P$.

On the other hand, VC financing has a higher chance of being feasible when the productivity is high, i.e., when the entrepreneur's opportunity to invest in relation specific assets is high. The feasibility of the VC equity financing depends on the condition below. As k

increases the right hand side of the equation becomes larger. Both the payoff from the IPO and the probability of IPO increases (C_h is decreasing in k).

$$\exists \ \beta \in (0,1) \quad such \quad that \quad (I-W) = \int_{C_h}^{\infty} f(c)(\beta(1-\beta)k^2Y^2C_1^2 + \frac{1}{2}\beta^2\phi^2k^2C_1^2 - \beta F) \quad (25)$$

The entrepreneur's payoff from VC financing is equal to:

$$\begin{aligned} EN_{VC} &= -W + \int_{C_0}^{C_l} f(c)\frac{1}{2}Y^2k^2C_1^2 \\ &\quad + \int_{C_l}^{C_h} f(c)[V(\beta^*) - c_{EN}(\beta^*) - c_{VC}(\beta^*)] \\ &\quad + \int_{C_h}^{\infty} f(c)[V(\beta^*) - \beta(V(\beta) + c_{VC}(\beta) - c_{EN}(\beta^*) - c_{VC}(\beta^*)], \end{aligned}$$

where

$$\begin{aligned} V(\beta) &= (1-\beta)Y^2k^2C_1^2 + \beta k^2Y^2C_1^2\phi^2 - F \\ c_{EN}(\beta) &= \frac{1}{2}(1-\beta)^2k^2Y^2C_1^2 \\ c_{VC}(\beta) &= \frac{1}{2}\beta^2k^2Y^2C_1^2\phi^2 \end{aligned}$$

When only one type of financing is feasible the entrepreneur has no choice. However, both VC and Bank financing can be feasible at the same time. In this case, the VC prefer the financial contract that maximize his payoff.

Proposition 3 *If both a bank loan and VC equity is feasible, the entrepreneur always chooses VC equity over bank financing.*

The payoffs of the bank and the VC from financing are equal to zero. Therefore, the entrepreneur's payoff is maximized when the total payoff is maximized. In the case when

entrepreneur decides to do IPO venture capitalist exerts effort, which increases the aggregate payoff. We know that VC financing is feasible and there is some probability that entrepreneur will do IPO. Therefore, total payoff from VC financing is larger than total payoff from bank financing. Although the bank has better liquidation ability that does not help bank financing to dominate VC financing because the entrepreneur optimally chooses always to invest instead of liqudating. We can use the same method to compare the bank loan to the VC loan. Entrepreneur will choose the loan that maximize the total payoff from the project.

Proposition 4 *If both a bank loan and a VC loan are feasible, the entrepreneur always chooses the bank loan over a VC loan.*

The bank has better liquidation ability, which minimizes the dead-weight loss from liquidation. Therefore the total payoff from the project is larger when the entrepreneur borrows from the bank instead of borrowing from the VC.

6 Conclusion

We address the question why some entrepreneurs raise financing from banks and others from VC firms. The entrepreneurs inability to credibly commit on the relation-specificity of investments creates a conflict between the entrepreneur and the bank. Banks want investments with low relation specificity and high liquidation value, whereas entrepreneurs prefer to invest in profitable and relation specific assets. It is infeasible to finance several profitable projects by using bank financing when contracts are incomplete and entrepreneur can not commit to invest in assets with high liquidation value. On the other hand, VC equity has higher chance of becoming feasible when relation specificity of investment is higher. The VC can only get paid if the company goes public and the cash flows of the company become observable. VC may be able to persuade entrepreneur to go public because VC exerts effort and increase firm value during the IPO process.

One implicit implication of our model is that VC financing has higher change of being feasible when the stock markets provide better information about firms cash flows and fixed costs of doing IPO is lower. Our model can easily be extended in this direction by making only certain fraction of cash flows observable, which will provide implications about the developemnt of VC industry across countries. It is also possible to analyze the optimality of VC equity with fixed transfers compared to other contracts when there is uncertainty.

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7 Appendix

7.1 Optimal Sharing Rule in VC Financing

We want to maximize the joint payoff:

$$\beta^* \in \arg\max 1 - \beta k^2 Y^2 C_1^2 + \beta k^2 Y^2 C^2 \phi^2 - \frac{1}{2}[(1-\beta)kYC_1]^2 - \frac{1}{2}[\beta kYC_1\phi]^2. \tag{26}$$

From the first order condition:

$$\beta^* = \frac{\phi^2}{1+\phi^2} \tag{27}$$

7.2 Condition for the Existence of Short Term Loan

As the cash flow gets larger it is certain that staying will dominate running, however it is not clear whether staying can actually dominate running before it is dominated by the IPO choice. The existence of a region where staying dominates both the IPO and running requires payoff from staying to be larger than payoff from running and payoff from the IPO. If we add up these two conditions we get:

$$k^2 Y^2 (C-L)^2 \geq C + \frac{1}{2}k^2 Y^2 C^2 - F + L - 2P \tag{28}$$