Investment, Duration, and Exit Strategies for Corporate and Independent Venture Capital-backed Start-ups*

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Abstract

We propose a model of investment, duration, and exit strategies for start-ups backed by venture capital (VC) funds that accounts for the high level of uncertainty, the asymmetry of information between insiders and outsiders, and the discount rate. Our analysis predicts that start-ups backed by corporate VC funds remain for a longer period of time before exiting and receive larger investment amounts than those financed by independent VC funds. Although a longer duration leads to a higher likelihood of an exit through an acquisition, a larger investment increases the probability of an IPO exit. These predictions find strong empirical support.

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Entrepreneurs and venture capitalists make investment decisions and choose the length of their involvement in a start-up to maximize the chances of success and the value of their ventures. They also look ahead and develop strategies to cash in on their companies. In particular, these strategies allow venture capitalists to liquidate their shares. Planning an exit strategy is as important as deciding how to start the enterprise.

There are two main exit routes for a successful start-up. The company can go through an Initial Public Offering (IPO) or can be sold to an existing firm via an acquisition.[1] Under an IPO, the venture obtains a stock market listing, which enables the company to receive additional financing for its projects and enables the insiders to eventually sell their shares to the public. If the start-up is acquired, the insiders obtain immediate cash in return for their shares.

The optimal exit route for start-ups depends on multiple factors, such as the expected profitability of the venture, the level of uncertainty, the asymmetry of information between the insiders and outsiders (e.g., potential buyers and new investors),[2] the possible conflicts of interest among insiders,[3] the financial market conditions at the time of the exit, and the characteristics of the venture capitalists. Some of these factors are affected by the partners' investment and duration decisions. Understanding the main trade-offs faced by startups at the exit stage is crucial because this understanding not only allows one to determine how venture capitalists and entrepreneurs divest their companies but also affects the decisions taken at the onset of the venture.

One important determinant of a start-up's investment, duration and exit route is the characteristics of the venture capital funds that are involved. Whether the start-up receives financing from Corporate Venture Capital (CVC) funds or receives financing only from Independent Venture Capital (IVC) funds is particularly important.

Unlike traditional IVC funds, which are limited partnerships, CVC funds are private equity funds in which large corporations invest (i.e., CVC funds are subsidiaries of corporations) (Chemmanur, Loutskina and Tian (2011)). Several differences exist between

[1]Two other exit routes that are not as commonly used are Management Buy-out and Refinancing (or secondary sales); see Schwienbacher (2009).

[2]See Cumming and MacIntosh (2003) for a discussion about the information asymmetries between sellers and the potential buyers of start-ups.

[3]See, for instance, Gompers (1995), Kaplan and Strömberg (2003), Schmidt (2003), and Macho-Stadler and Pérez-Castrillo (2010).

the two types of funds. First, whereas the sole objective of an IVC fund is to actualize a financial return on capital, CVC programs also care about strategic returns, such as the development of new, related business (see Sykes (1990); Yost and Devlin (1993); Dushnitsky and Lenox (2006); Hellmann, Lindsey and Puri (2008)). Second, because of the presence of the corporate parent, CVC funds can provide more industry-related knowledge and support to start-ups than IVC funds (Riyanto and Schwienbacher (2006); Chemmanur, Loutskina and Tian (2011)). Third, CVC managers are likely to be less concerned with immediate financial returns from their portfolio firms than IVC managers (Chemmanur, Loutskina and Tian (2011)) because of several reasons. CVC investors have more unused resources, such as technology and marketing resources (Sahaym, Steensma and Barden (2010); Basu, Phelps and Kotha (2011); Da Gbadji, Gailly and Schwienbacher (2011)). Moreover, IVC managers' payments are performance-based, whereas managers of CVC programs usually have fixed salaries and receive corporate bonuses. Finally, the IVC managers' abilities to raise additional funds depend on their reputations, which are influenced by their history of success (Gompers (1996); Dushnitsky and Shapira (2010)). As a result of these differences, IVC fund managers are more concerned about quick exits than CVC fund managers.

In this paper, we focus on the fact that CVC funds are more patient than IVC funds in realizing financial returns from their investments in start-ups, and we explore how this difference influences the investment, duration, and exit strategies of the start-ups. We propose a simple model that accounts for the high level of uncertainty regarding the returns from an investment in a start-up, the existence of private information in the hands of insiders, and the discount rates of the partners in the start-ups. This model allows us to capture the differences between CVC- and IVC-backed start-ups. We choose to study a rather parsimonious model in which we abstract from possible internal conflicts among insiders and some of the dynamic interactions between investment and duration. Our objective is to build a model that encompasses three crucial decisions in the lives of start-ups (investment, duration, and exit) rather than focusing on other, albeit interesting, aspects that appear at particular moments in time. This modeling strategy allows us to obtain theoretical results concerning the aforementioned decisions, which we test using data from U.S. start-ups.

In our model, the amount of capital invested in a start-up influences the start-up's expected value. We assume that a higher investment leads to a more favorable distribution of the set of potential values. Furthermore, the decision regarding the duration of the start-up (i.e., the length of the relationship between the entrepreneur and the VCs until the exit of the start-up), affects the market information about the probability of the venture's success. We assume that the potential value of the venture at the time of its exit will be known to every market participant. Nevertheless, insiders have more precise information about the expected profitability of a start-up because they know the probability of its success. Whether outsiders are informed of this probability depends on how long the start-up remains in the market before exiting.

We show that the ventures with a higher probability of success are more likely to attempt an IPO, whereas those with lower probabilities prefer to seek an acquirer. Moreover, the likelihood of exiting through an IPO increases with the potential value of the start-up as long as that value meets a minimum level. In contrast, start-ups with low potential value are liquidated.

We link a start-up's exit strategy with the investment decision and with the market level of information. We show that a higher investment level induces a greater likelihood of a successful exit. Of the successful exits, the higher the investment level is, the higher the likelihood of an IPO exit. Moreover, the IPO exit rate is lower if outsiders receive more precise information. Finally, we analyze the optimal investment and duration decisions of the start-up. In particular, we show that both the level of investment and the duration of the venture decrease with the discount rate of the venture capital.

According to our model, the difference in the discount rate between IVC- and CVC-backed start-ups causes the two types of ventures to exhibit different behaviors. First, a lower discount rate for CVC-backed start-ups implies a higher investment level and a longer duration. Second, although the identity of the VC fund does not directly affect the choice of the exit route, the identity does have two strong indirect effects. On the one hand, the larger amounts of capital invested by CVC funds lead to more IPO exits. On the other hand, the longer duration of CVC-backed start-ups induces more exits through acquisitions. Therefore, the two forces that we identify move in opposite directions. Third, a larger investment implies a higher success rate for CVC-backed start-ups.

We empirically test our theoretical predictions using data from U.S. start-ups from 1969 to 2008. We find several interesting results. First, CVC-backed start-ups receive approximately 23% more investment amount than those start-ups financed by IVC funds. Moreover, the effect doubles if the syndicate leader of a start-up is a CVC fund. Second, CVC-backed start-ups remain longer before exiting than IVC-backed start-ups do. Third, we show that a 1% increase in the level of investment significantly increases the probability of an IPO exit by 0.076%. Fourth, we find that a 1% increase in the duration of the venture significantly decreases the likelihood of an IPO exit by 0.023%. Fifth, after controlling for the effects due to the duration and investment decisions, we show that there is no significant difference in the rate of IPO exits between IVC- and CVC-backed start-ups. In fact, the presence of CVC investors has a positive, albeit insignificant, effect on the IPO exit rate. All of the previous empirical results strongly support the predictions of the theoretical model.

The empirical analysis also provides further support for the theoretical results with respect to the effects of a change in the discount rate on the investment, duration, and exit decisions. In our dataset, two additional variables are related to the VC fund's discount rate: the size of the fund (one expects larger funds to have a lower discount rate) and the age of the fund (managers of older VC funds are expected to have a lower discount rate) (Gompers (1996)). We show that increases in the size and age of the fund have an effect similar to the presence of CVC financing in the venture. That is, the age and size of the fund have a strong positive effect on the level of investment and on the duration but do not directly influence the likelihood of an IPO exit.

The theoretical and empirical academic research on venture capital is growing. However, the impact of the type of VC funds on the investment, on the exit and, in particular, on the duration strategy of start-ups has not received much attention in the previous literature.[4] We discuss briefly the contributions that are most relevant to our paper.

With regard to the influence of VC fund characteristics on the level of investment for a start-up, the theoretical model of Hellmann (2002) and the empirical analyses of Gompers and Lerner (2000) and Masulis and Nahata (2009) also find that start-ups re-

[4] See Da Rin, Hellmann and Puri (forthcoming) for a survey of the academic work on venture capital and, in particular, for a review of the papers that examine the structures and strategies of VC funds.

ceive higher investment amounts from CVC funds than from IVC funds. Concerning the choice of an exit route (i.e., IPO vs. acquisition), most papers suggest that because of the CVC funds' strategic returns, CVC-backed start-ups are more likely to exit through an acquisition than IVC-backed start-ups. This argument has been put forward by theoretical studies (Hellmann (2002); Riyanto and Schwienbacher (2006)) and has received empirical support from a study using a European dataset (Cumming (2008)). Based on survey evidence, Siegel, Siegel and MacMillan (1988) and Sykes (1990) also find that the percentage of acquired CVC-backed start-ups is higher than the percentage of acquired IVC-backed ventures. However, this result is challenged by Gompers and Lerner (2000) and Chemmanur and Loutskina (2008), who find that CVC-backed start-ups exit more frequently through the IPO market than IVC-backed start-ups do. Moreover, few start-ups appear to be acquired by the parent companies of the CVC funds that financed these ventures. In the VentureXpert database, only 5% of the start-ups with CVC financing that exit via acquisitions are bought by the parent company of the CVC fund. Maula and Murrey (forthcoming) find a similar result. Our paper introduces the duration strategy as an important determinant of the exit choice. In this way, we provide an explanation for the disagreement in the empirical results regarding the exit choices made by CVC- and IVC-backed start-ups.

The rest of the paper is organized as follows. In Section I, we introduce the model. In Section II, we develop an analysis of the optimal exit strategy. In Section III, we analyze the impact of investment and duration decisions on the likelihood of an IPO and on the success rate. In Section IV, we examine the optimal investment and duration decisions. In Section V, we derive the empirical hypotheses concerning the differences in behavior between CVC- and IVC-backed start-ups, as suggested by our theoretical results. In Section VI, we describe the dataset that we use to empirically test the hypotheses in Section VII. In Section VIII, we discuss some additional empirical analyses and we present our conclusions in Section IX. Proofs are included in the Appendix.

I The Model

We propose a model to analyze the optimal investment and duration decisions, as well as exit strategy of start-ups (S) financed by CVC funds versus those financed only by IVC funds. We model the difference between the two types of startups through the discount rate r. As we outlined in the Introduction, CVC funds tend to be more patient than IVC funds. Therefore, CVC-backed start-ups have lower discount rates than IVC-backed ones. In our model, the decisions made by start-ups at any stage aim to maximize the expected discounted profits.

The first decisions made by a start-up concern the level of investment I and the duration of the venture d. In our model, these decisions are made at the beginning of the life of the start-up, and we do not account for some dynamic aspects of the start-up that are not relevant for our purposes.[5] The level of investment has a positive impact on the expected quality of the venture, whereas the duration influences the amount of information that flows to the acquisition market.

When a start-up makes its first decisions, there is a high degree of uncertainty with respect to both the potential value of the venture V and the probability p that the start-up will realize this value. Some of this uncertainty is resolved as the start-up develops. All of the market participants can observe some of the information, but the insiders acquire more precise information on the expected quality of the project than the outsiders do. In our model, we reflect this information asymmetry between insiders and outsiders in a simple way. If the quality is revealed, everyone can observe the potential value V. Moreover, insiders always learn the probability p. However, the precision of the information received by outside acquirers about p depends on the duration of the venture (i.e., the longer the duration d is, the more precise the potential acquirers' information.)[6]

[5]We acknowledge that in the real market, start-ups usually receive stage financing from VC funds. Therefore, at each stage, VCs update the information on the development of the start-ups and decide whether to continue both the investment and the duration strategies. In this paper, the total investment amount and the duration are fully determined at the beginning of the model. This simplification allows us to examine the start-ups' choice of investment, duration, and exit strategy within the same model. Additionally, with stage financing, the uncertainty is somewhat but not completely mitigated. The simplified one-period model is just one extreme case in which more uncertainty exists at the time when decisions are made.

[6]We could also assume that the potential asymmetric information concerns the parameter V instead of p without affecting the results of the paper.

The venture requires additional financing C to achieve the value V. Hence, if the potential value V is low, the start-up is liquidated. This route is the first exit option. On the contrary, if continuing the venture is profitable, then the start-up either looks for a firm (an acquirer) interested in adding the venture to its business, or issues an initial public offering (IPO). In the first case, the acquirer offers a deal to the start-up that reflects the expected value of the business and the bargaining power of the parties. The acquirer then integrates the venture into its organization, and if it confirms that the venture is worthwhile, it pays the additional financing C to obtain V.

If the start-up attempts an IPO, then the market investors conduct a thorough analysis concerning all possible aspects of the start-up. The market investors carefully audit various aspects of the start-up, such as the corporate valuation and market prospects. The outcome of the analysis is a new signal regarding the profitability of the start-up, which we also model in a simple manner. The market makers are either convinced that the start-up is successful with a probability of 1 (High signal) or are unable to assess it with certainty (Low signal). All of these processes are costly, and the start-up must cover the costs. The market investors make an offer to the start-up owners in the event of a High signal.

More precisely, the model is as follows:

At $t = 1$, the start-up decides the level of investment I and the duration d.

- The value of I determines the distribution of the potential value of the start-up V. The value of V follows a distribution function $\Gamma(V; I)$, with density function $\gamma(V; I)$. For the sake of simplicity, we assume that ex ante V is uniformly distributed over the interval $\left[f(I), \widehat{V} + f(I)\right]$, where $\widehat{V} > 0$ and $f(I)$ is an increasing function of I. The potential value V can only be cashed out if the new funding C is offered at later stages. After the investment and before the exit decision, the value of V is realized and can be observed by not only the start-up but also the outside market.

- The level of d determines the information accessed by the potential acquirers about a signal p of the likelihood of success (i.e., the probability of realizing V). We assume that p is uniformly distributed ex ante over the interval $[0, 1]$. The start-up always learns p. The potential acquirers learn p with probability $h(d)$, which increases as the duration d increases.

At $t = 2$, the start-up makes the exit decision. There are three possibilities: liquidation, an acquisition, or an IPO.

- The liquidation value of the start-up is always 0.
- In the event that the start-up decides to seek an acquirer, a deal price is negotiated. This price depends on the bargaining power of the two parties and the information possessed by the acquirer. The bargaining power of the start-up is denoted by m. In the case of an acquisition, the acquirer invests C to realize V if the company confirms that the project is successful.
- Going to an IPO is the most complex and costly exit route for the start-up. We use F to denote all of the fixed costs due to the IPO process. The process leads to one public signal $\widetilde{\beta}$ regarding the profitability of the venture, $\widetilde{\beta} \in \{H, L\}$. We assume that β represents the probability that the market can verify a successful project after receiving the public signal. Therefore, the probability of observing $\widetilde{\beta} = H$ is equal to βp. If the signal is H, the competitive market sets a price Z for the IPO. If the start-up accepts the price, then a successful IPO is executed. To realize V, in addition to Z, the market needs to raise C to cover the remaining amount of capital needed by the firm. If the signal is L, no offer is issued.[7]

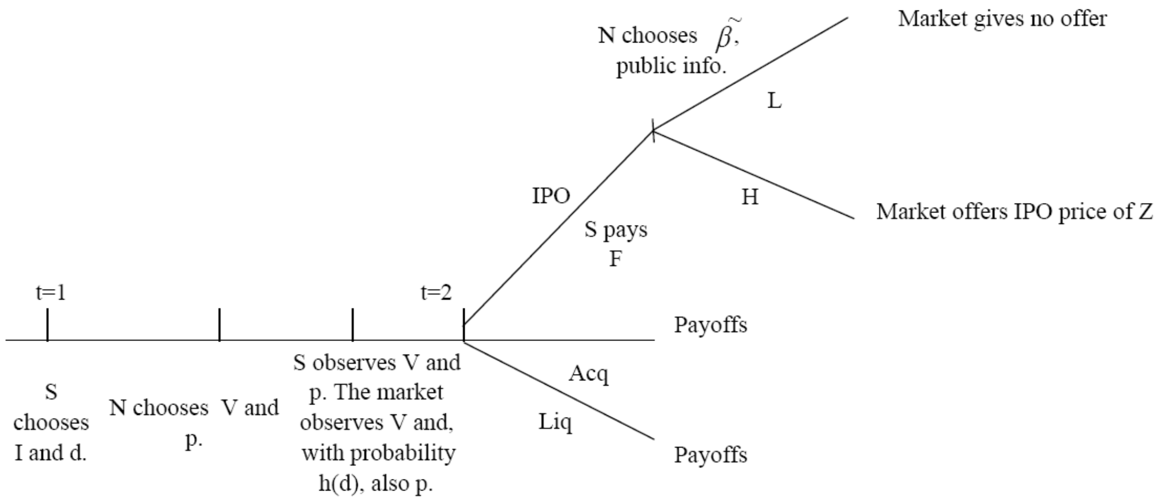
The time line is captured by Figure 1.

We make assumptions regarding the functions $f(I)$ and $h(d)$ to ensure that the three exit routes are possible. We assume that $\hat{V} + f(0) > C + \frac{F}{\beta - m}$ and that $f(I)$ is concave enough (specifically, $\lim_{I \longrightarrow \infty} f(I) \leq C$). Also, the screening is informative enough: $\beta >$

[7] We assume that a start-up that receives a low signal does not receive any offers and quits the market. We make this assumption for the sake of simplicity. First, for those start-ups that receive a signal L, the situation is often similar to the market for lemons in Akerlof (1970)'s model; that is, taking into account the set of start-ups that accept the offer, there is no price under which market profits are non-negative. Therefore, the assumption that the start-ups do not receive any offer from the IPO market after a low signal can be sustained as a result of a more general model. Second, the start-ups may go to the acquisition market (at $t = 3$) once they fail at an IPO. In that market, the acquirers would consider the new information produced at the IPO. This possibility adds some (small) additional profits for those ventures that choose the IPO exit. However, the qualitative results of our analysis do not change if we add this possibility (For an analysis of the previous extensions, see Guo (2010)).

Figure 1: The Time Line

This figure shows the time line of the game. The start-up chooses an investment and a duration strategies at the first stage, and determines an exit strategy at the second stage.



m. Finally, the venture makes interior choices of I and d if $\lim_{I\longrightarrow 0} f'(0) = \lim_{d\longrightarrow 0} h'(0) = \infty$ and $h(d)$ is concave enough.[8]

We solve the model through backward induction, realizing that asymmetric information may exist among the participants. Therefore, we use sequential equilibrium as the solution concept because it combines subgame perfection ideas with Bayesian updating.

II The Analysis of the Optimal Exit Strategy

In this section, we start at $t = 2$. At this stage, the duration has already been decided, and the investment made at $t = 1$ is sunk. The potential value of the venture V is realized and observed by all of the participants. Moreover, the start-up has received a private signal concerning the probability of success p. The potential acquirer may or may not

[8] If $\beta < m$, then the IPO route is never chosen. If $\hat{V} + f(0) < C + \frac{F}{\beta - m}$, then those start-ups with low investment levels never take certain exit routes. If $\lim_{I\longrightarrow\infty} f(I) > C$, then those start-ups with high investment levels never undergo liquidation. However, our qualitative results would remain the same, despite the changes in the hypotheses. Similarly, if $\lim_{I\longrightarrow 0} f'(0) = \lim_{d\longrightarrow 0} h'(0) < \infty$, then the optimal decision concerning I and/or d may be the corner solution $I = 0$ and/or $d = 0$, which would complicate the analysis without adding new insights.

have this information p (this information is accessed with probability $h(d)$). We study the optimal exit strategy in both situations.

A Optimal Exit Strategy with Informed Acquirers

As mentioned in the previous section, the value of the start-up in the case of liquidation is 0. The deal price in an acquisition corresponds to the share m of the expected value of the venture. Given that the acquirer knows p and must invest C to realize V after confirming that the venture is successful, the expected value of the venture is $p[V-C]$. Therefore, if the start-up goes to the acquisition market at $t=2$, the deal price is $mp[V-C]$, whenever $V-C>0$ (otherwise, profits are always non-positive).[9]

Consider a start-up characterized by (V,p) that goes through an IPO with $V-C>0$. After the start-up pays F, the market receives the signal $\widetilde{\beta}$. If the realization is $\widetilde{\beta}=L$, which happens with a probability of $(1-\beta p)$, the start-up does not receive any offer. If the realization is $\widetilde{\beta}=H$, then the competitive investors' market offers $Z=V-C$, which the start-up accepts.

The start-up obtains higher expected profits by issuing an IPO rather than searching for an acquirer if and only if

$$\beta p[V-C]-F\geq mp[V-C]. \tag{1}$$

Proposition 1, whose proof follows the previous discussion, describes the optimal exit strategy in this case, where we denote

$$p_o(V)\equiv\min\left\{\frac{1}{[\beta-m]}\frac{F}{[V-C]},1\right\}. \tag{2}$$

Proposition 1. *Consider a start-up characterized by (V,p) in a situation where the potential acquirers have learned p. The start-up's optimal exit strategy is as follows:*

1. *If $V-C\leqslant 0$, the start-up is liquidated and realizes the payoff $U_o(V,p)=0$.*

[9] We use the convention that a start-up, that is indifferent between being liquidated or not, chooses liquidation. Similarly, a start-up that is indifferent between going to an IPO or looking for an acquirer at $t=2$ goes to an IPO.

2. *If $V - C > 0$ and $p < p_o(V)$, the start-up goes to the acquisition market and obtains a deal value $U_o(V, p) = mp\,[V - C]$.*

3. *If $V - C > 0$ and $p \geqslant p_o(V)$, the start-up invests F and goes to the IPO market. Moreover,*

   (a) *If the public signal is H, then the start-up receives an offer $Z = V - C$ from the IPO market and accepts it;*

   (b) *If the public signal is L, then the start-up does not receive any offer from the IPO market.*

   Therefore, in this case, the start-up's expected payoff is $U_o(V, p) = \beta p\,[V - C] - F$.

The basic trade-off between an IPO and an acquisition is that, although the IPO process is costly, it also allows the owners of profitable ventures that receive a high signal to realize a larger share of the ventures' value. Start-ups with a sufficiently high probability of success are ready to pay the cost of the process. To analyze the effect of the different parameters on this trade-off, we conclude our analysis of the optimal exit strategy by performing the comparative statics of $p_o(V)$ with respect to all of the parameters for the interior case, where $\frac{1}{[\beta - m]}\frac{F}{[V-C]} < 1$. This analysis highlights the characteristics of start-ups and the market that increase the probability of exits through IPOs or acquisitions. A higher $p_o(V)$ implies a lower likelihood of an exit through an IPO.

Corollary 1. *Consider the situations where potential acquirers learn p. Then the likelihood of an IPO increases with V and β but decreases with F, C, and m.*

According to Corollary 1, the higher the potential value V (similarly, the lower the additional funding C), the more willing the start-up is to go to the IPO market. Given the costly IPO process, only those start-ups that truly benefit from the more competitive IPO market are willing to follow this path. As expected, a higher bargaining power m in the acquisition market leads to fewer IPO exits. Finally, an efficient IPO process, reflected by a low cost F and a powerful screening capability β, increases the attractiveness of an IPO exit.[10]

B Optimal Exit Strategy with Uninformed Acquirers

If the potential acquirers do not know the value of p, the optimal strategy of a start-up searching for an exit can only be analyzed by finding the Bayesian Nash equilibrium of a game where one of the parties (the start-up) has private information relevant to the relationship (the probability of success). However, the analysis has some similarities to the previously developed analysis. First, if the start-up's potential value V is lower than C, it is liquidated. Second, the IPO offer is $Z = V - C$ if the start-up receives a signal $\widetilde{\beta} = H$, which implies that the start-up accepts the offer. Finally, the difference between potential profits from an IPO and those from an acquisition increases with the value of p. Therefore, there is a cut-off equilibrium value $p_{oo}(V)$ (that may be equal to 0 or 1) above which the start-up goes to an IPO.

If the value of p is unknown to the potential acquirers, the price that they may offer depends not on the real value of p but on its expected value from the acquirer's perspective. This expected value is a function of the start-up equilibrium behavior. Therefore, the expected (equilibrium) value of p is $\frac{p_{oo}(V)}{2}$ and the deal price at $t = 2$ is $m\frac{p_{oo}(V)}{2}[V - C]$.

Similar to the informed acquirer's case, a start-up whose probability of success is equal to $p_{oo}(V)$ must be indifferent (if $p_{oo}(V) \in (0,1)$) with regard to whether it goes to an IPO or looks for an acquirer. Therefore, an interior $p_{oo}(V)$ is characterized by

$$\beta p_{oo}(V)\,[V - C] - F = m\frac{p_{oo}(V)}{2}\,[V - C]\,. \tag{3}$$

Equation (3) implies that the cut-off value is

$$p_{oo}(V) \equiv \min\left\{\frac{1}{\left[\beta - \frac{m}{2}\right]}\frac{F}{[V - C]}, 1\right\}. \tag{4}$$

[10]A higher fixed cost F may reflect a better screening capability β. An efficient IPO process achieves a high β without excessively increasing the fixed cost F.

For the sake of completeness, in Proposition 2, we describe the equilibrium behavior of start-ups in a situation where outsiders do not know the value of p.

Proposition 2. *Consider a start-up characterized by (V, p) in a situation where the potential acquirers do not know the value of p. The start-up's equilibrium exit strategy is as follows:*

1. *If $V - C \leqslant 0$, the start-up is liquidated and realizes the payoff $U_{oo}(V, p) = 0$.*
2. *If $V - C > 0$ and $p < p_{oo}(V)$, the start-up goes to the acquisition market and obtains a deal value $U_{oo}(V, p) = m\frac{p_{oo}(V)}{2}[V - C]$.*
3. *If $V - C > 0$ and $p \geqslant p_{oo}(V)$, the start-up invests F and goes to the IPO market. Moreover,*
   - *(a) If the public signal is H, then the start-up receives an offer $Z = V - C$ from the IPO market and accepts it;*
   - *(b) If the public signal is L, then the start-up does not receive any offer from the IPO market.*

   Therefore, in this case, $U_{oo}(V, p) = \beta p[V - C] - F$.

Moreover, at equilibrium, the likelihood of an IPO increases with V and β but decreases with F, C, and m.

The logic behind Proposition 2 is the same as that explained after Proposition 1 and Corollary 1.

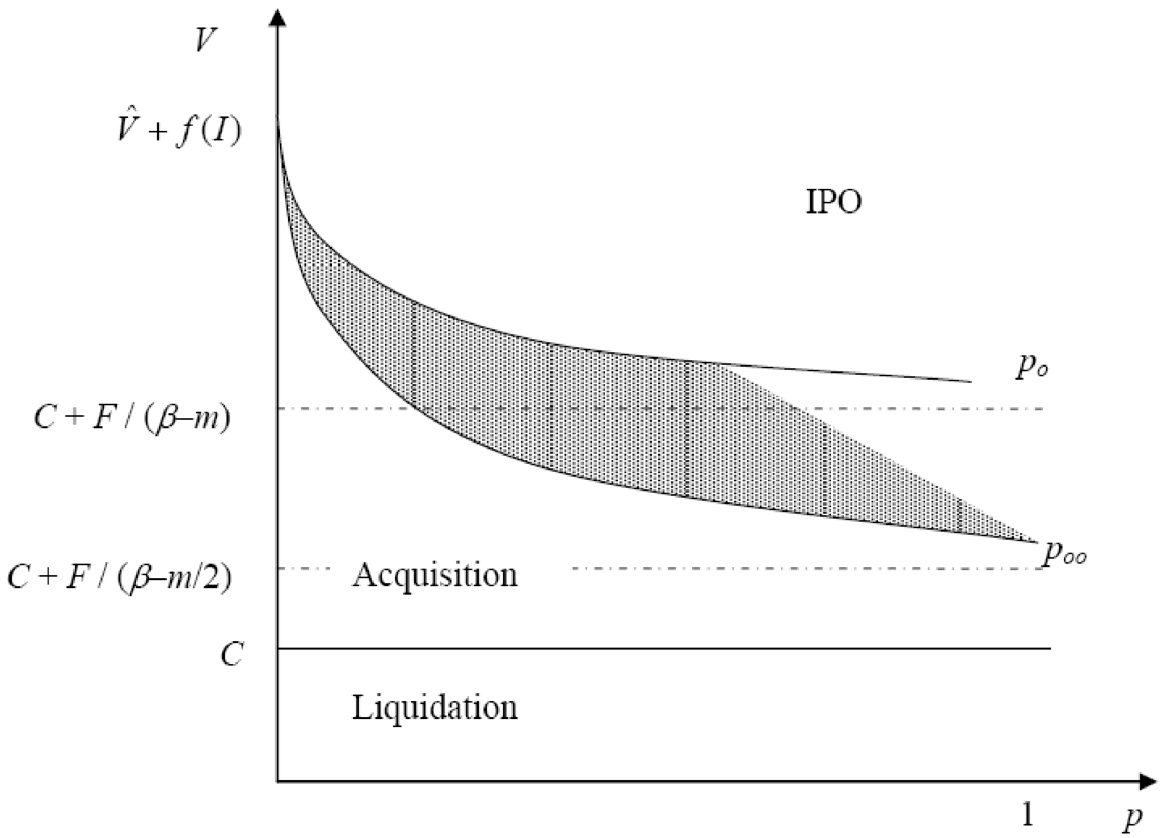
III The Impact of Investment and Duration on the Likelihood of an IPO and on the Rate of Success

We now analyze how a start-up's optimal exit strategy is influenced by its investment and duration decisions.

A higher investment level implies a shift in the distribution of V toward higher values. As shown in Propositions 1 and 2 (see also Figure 2), the higher the value V is, the more likely the exit is to occur through an IPO rather than through an acquisition, regardless of whether the potential acquirers know the value of p. Therefore, a higher investment level should imply a higher IPO rate among successful cases. Proposition 3 presents this result.

Figure 2: The Optimal Exit Strategy

This figure depicts the optimal exit strategy. For high values of p and V, an IPO is the optimal exit route. Going to the acquisition market is the optimal start-up strategy for low values of p and V. In the shadow region, start-ups turn to an IPO if the outsiders have not learned the value of p. However, start-ups prefer going to the acquisition market if outsiders do know the value of p.



Proposition 3. *The likelihood of an IPO among successful exits increases with the investment I.*

Moreover, a larger investment implies a shift in the distribution of V toward higher values, which should also lead to a greater likelihood of a successful exit. Proposition 4 states this result, whose proof is immediate.

Proposition 4. *The rate of successful exits increases as the investment I increases.*

A longer duration indicates that the market has precise information about the start-up. In our model, this increased availability of information is reflected by a higher likelihood that the acquisition market knows the probability of success p. The next proposition investigates whether an IPO exit is more likely with informed or uninformed acquirers. The proof of the proposition is derived from Equations (2) and (4).

Proposition 5. *The probability of issuing an IPO is higher if the potential acquirers have not learned the value of p than if they have learned the value of p. More precisely, $p_{oo}(V) < p_o(V)$ whenever $p_{oo}(V) \in (0,1)$, and $p_o(V) = 1$ whenever $p_{oo}(V) = 1$.*

Figure 2 explains Proposition 5 and depicts the optimal exit strategy highlighted in Propositions 1 and 2. For high values of p and V, an IPO is the optimal exit route, regardless of the information known by the potential acquirers. Similarly, going to the acquisition market is always the optimal start-up strategy for low values of p and V (provided that $V > C$). In the intermediate (shadow) region of Figure 2, start-ups turn to an IPO if the outsiders have not learned the value of p. However, start-ups prefer going to the acquisition market if outsiders do know the value of p.

The intuition for the existence of the intermediate region in Figure 2 is as follows. If the acquirers observe the true value of p, they offer a deal according to p. However, if they do not observe the true probability of success, they can only offer a deal according to the expected probability, which is independent of the true value of p. Consider a start-up whose realized probability is $p_o(V)$, that is, the company is indifferent between an IPO or an acquisition if the information about its p is public. If information on a start-up's probability of success is not public, the deal that the company obtains in the acquisition market is lower, because the offer is based on the expected probability. Therefore, the company would rather issue an IPO than look for an acquirer. As a consequence, an uninformed acquisition market is more likely to promote IPO exits.

Longer durations cause more information about p to become available to outsiders. According to Proposition 5, this relationship implies, ceteris paribus, a reduction in the likelihood of an IPO exit. We state this argument in the following corollary:

Corollary 2. *The likelihood of an IPO among successful exits decreases as the duration d increases.*

We note that, according to our model, the duration has no effect on the level of V. Therefore, the rate of successful exits is not influenced by the duration d.

IV Investment and Duration Decisions

In this section, we address the optimal initial decisions made by the start-up at $t = 1$. The analysis presented in Section II allows us to compute the expected income $U_o(V, p)$ or $U_{oo}(V, p)$ of a start-up whose potential, publicly known value is V and whose probability of success is p, depending on the degree of information known by the outsiders. We now calculate the expected profits for a given duration d and a given investment I, which is denoted as $U(d, I)$. Performing the calculation requires us to take the expectation of the expected income over the possible values of V (whose distribution function $\Gamma(V; I)$ depends on I) and p:

$$\begin{aligned} U(d, I) &= e^{-rd} \int_V \int_p \left[h(d)U_o(V, p) + [1 - h(d)]\, U_{oo}(V, p)\right] dp d\Gamma(V; I) - I \\ &= e^{-rd} \left[h(d)EU_o(I) + (1 - h(d))EU_{oo}(I)\right] - I \end{aligned} \tag{5}$$

where we denote

$$EU_o(I) = \int_V \int_p U_o(V, p) dp d\Gamma(V; I), \tag{6}$$

$$EU_{oo}(I) = \int_V \int_p U_{oo}(V, p) dp d\Gamma(V; I). \tag{7}$$

We can interpret $EU_o(I)$ as the expected profits at the exit time of a start-up that has invested I at $t = 0$ and whose realized probability p is always known by its potential acquirers. Similarly, $EU_{oo}(I)$ is the start-up's expected profits if the realization value of p is unknown to outsiders. $h(d)$, the probability that the information is known by the potential acquirers, increases with the duration. Moreover, the longer the duration d is, the lower the expected profits at $t = 0$ because of discounting.

Lemma 1 shows that $EU_o(I)$ is always higher than $EU_{oo}(I)$. That is, the start-up's expected profits are higher when the potential acquirers learn p than when they do not. While interesting by itself, this result is particularly useful in the analysis of the optimal duration and the investment decisions.

Lemma 1. *$EU_o(I) \geq EU_{oo}(I)$ for every $I > 0$, and the inequality is strict whenever $p_{oo}(\overline{V} + f(I)) < 1$.*

The intuition behind Lemma 1 is as follows. The asymmetry of information between start-ups and potential acquirers makes it more profitable for some ventures (i.e., those whose probability of success lies in the interval $(p_{oo}(V), p_o(V))$) to go to the IPO market, though they would obtain a better deal in the acquisition market if the information were symmetric. Therefore, in expectation, the start-up's profits are higher if information about p reaches the potential acquirers (i.e., $EU_o(I) \geq EU_{oo}(I)$).

The optimal duration and investment decisions (d^*, I^*) are interior. Therefore, they satisfy the first-order conditions $\frac{\partial U}{\partial d}(d^*, I^*) = \frac{\partial U}{\partial I}(d^*, I^*) = 0$. In Proposition 6, we examine the effect of the discount rate r on (d^*, I^*).

Proposition 6. *The optimal duration d^* and investment I^* decrease as the discount rate r increases.*

Proposition 6 is intuitive. If the participants in the start-ups care less about the future, they invest less in the venture and stay in the venture for a shorter period of time.

Proposition 6 allows us to discuss the effect of r on the likelihood of an IPO exit. A lower discount rate r indicates both a higher investment level and a longer duration, which, according to Proposition 3 and Corollary 2, have opposite impacts on the likelihood of an IPO exit. On the one hand, a larger investment leads to more exits through IPOs. On the other hand, a longer duration implies a better-informed potential acquirer, which leads to more acquisitions.

V CVC- versus IVC-backed Start-ups: Empirical Implications from the Theoretical Model

The analyses presented in the previous sections allow us to contribute to the discussion on the differences between the start-ups that receive investments from CVC funds and the start-ups that receive only IVC funding. CVC funds are typically less compelled to recover their investments early in the process (Chemmanur, Loutskina and Tian (2011)). We have represented this difference in the model by associating a lower discount rate to the start-ups that receive CVC funding. We use our theoretical results to propose empirical hypotheses concerning the differences between CVC- and IVC-backed start-ups with respect to investment amounts, duration before exits, exit strategies, and success rates.

First, Proposition 6 shows that the start-ups with lower discount rates choose higher investment levels. Therefore, we should observe higher investments in CVC-backed start-ups than in IVC-backed start-ups. We state this empirical implication in the following hypothesis.

Hypothesis 1: CVC-backed start-ups receive higher investment amounts than IVC-backed start-ups.

Second, Proposition 6 also implies that CVC-backed start-ups (having lower discount rates) choose to stay longer before they exit. This argument is reflected in Hypothesis 2.

Hypothesis 2: CVC-backed start-ups have longer durations than IVC-backed start-ups.

Third, our theoretical model shows that the characteristics of VC funds *indirectly* impact the exit strategies of start-ups. As previously mentioned, CVC-backed start-ups invest more in their projects than those backed by IVC financing. The model predicts that a higher investment level increases the probability of an IPO exit (see Proposition 3). Furthermore, a start-up with CVC backing also stays longer and is less likely to exit via an IPO, according to Corollary 2. Our model states that once we account for the effects of investment and duration, the characteristics of the VC funds do not play a role in the choice of the exit strategy. We test the previous theoretical results using Hypothesis 3.

Hypothesis 3a: The investment amount has a positive effect on the probability of an IPO exit.

Hypothesis 3b: The duration of a start-up before it exits has a negative effect on the probability of an IPO exit.

Hypothesis 3c: CVC-backed start-ups have the same probability of undergoing an IPO exit as IVC-backed start-ups.

Fourth, higher investments imply higher rates of successful exits (see Proposition 4), whereas the duration of start-ups and the characteristics of funds do not have any direct effect on the rate of successful exits. Hypothesis 4 states these implications from our theoretical model.

Hypothesis 4a: The investment amount has a positive effect on the probability of a successful exit.

Hypothesis 4b: The duration of a start-up before it exits has no effect on the probability of a successful exit.

Hypothesis 4c: CVC-backed startups have the same probability of a successful exit as IVC-backed startups.

VI Data and Measures

We obtain the venture capital data from the VentureXpert database. This database contains detailed information regarding the characteristics of U.S. start-ups and their venture capital investors, such as exit routes (IPO vs. acquisition), exit dates, type of venture capital funds (CVC vs. IVC), investment amount, and fund size. We gather additional data from Compustat and Morgan Stanley Capital International (MSCI).

After matching the three data resources, we obtain our final sample, which consists of 4,801 successful U.S. start-ups from 1969 to 2008.[11] Table I provides an overview of the industry composition of the sample based on two-digit SIC codes. The majority of the start-ups are from the chemical, electronic, and business service-related industries,

[11] Our theoretical model predicts that CVC-backed start-ups have higher investment levels and stay longer before exiting. This model considers both successful exits (IPOs and acquisitions) and unsuccessful exits (liquidation). However, we obtain the same results when we only consider the successful exits in the theoretical model. In the later sections, we use an enlarged dataset (with both successful and unsuccessful start-ups) to test Hypothesis 4, though the dataset is poor in quality because of the information restriction of VentureXpert. Therefore, we test our main theoretical predictions (Hypotheses 1 to 3) only based on the successful start-ups.

where venture capital investments are more common.

⟨Insert Table I here⟩

To test whether CVC funds have different investment amounts, duration periods, and exit strategies compared with IVC funds, we construct three dependent variables at the start-up level: the total investment amount, the duration before the exit, and the exit route (IPO or acquisition). To measure the amount invested in a start-up, we add up the disclosed investment amounts across all rounds.[12] We define the duration before the exit as the difference in days between the start-up's exit date (IPO date or acquisition date) and the date at which it received its first investment from VC investors. Finally, a start-up's exit strategy is denoted by an indicator variable *IPO*, which equals 1 if a start-up exits through an IPO and 0 if it exits through an acquisition.

The main independent variable of interest assesses whether a start-up receives financing from CVC funds. The VentureXpert database provides information on the type of investor. We use two measures to identify the characteristics of VC funds.[13] The first measure is a dummy variable that takes a value of 1 if a start-up has at least one CVC investor and 0 if it is fully financed by IVCs. The second measure is a continuous variable calculated as the percentage of the investment amounts from CVC funds scaled by the start-up's total investment amount. This measure proxies for the degree of participation by CVC funds in a start-up.

Panel A of Table II presents the summary statistics of the variables. In our sample, 37% of the start-ups are partially financed by CVC funds, whereas the rest are financed exclusively by IVC funds. Moreover, 35% of the start-ups exit through IPOs, and 65% exit through acquisitions. Panel B of Table II reports the Pearson pairwise correlation among the variables. The correlation between the indicator variable *CVC* and *Investment Amount* or between *CVC* and *Duration* is positive and statistically significant at the 1% level. This finding suggests that compared with IVC-backed start-ups, CVC-backed start-

[12]The Thomson VentureXpert database displays both the disclosed and the estimated investment amounts for start-ups. To calculate the total investment amount for a certain start-up, we use the disclosed amount.

[13]See Chemmanur, Loutskina and Tian (2011) for reference.

ups receive greater investment amounts and tend to stay longer before exiting .[14]

⟨Insert Table II Panel A and Panel B here⟩

VII Empirical Results

A Univariate Evidence

We start our analysis by providing some univariate evidence on the differences in the investment and duration strategies of CVC- and IVC-backed start-ups. Panel A of Table III presents a univariate comparison of these two groups of start-ups. There are significant differences between them across several dimensions. For instance, CVC-backed start-ups have higher investment levels than IVC-backed start-ups. The average amount invested in CVC-baked start-ups is approximately 50 million USD, whereas the average amount invested in IVC-backed start-ups is approximately 21 million USD. Consistent with Gompers and Lerner (2000), the difference in investment amounts between these two groups is approximately 30 million USD and is statistically significant at the 1% level. Furthermore, there is a large gap between the average duration periods of these two types of start-ups. The average duration for CVC-backed start-ups is $1,929$ days, whereas the average duration for IVC-backed start-ups is $1,649$ days. This difference is statistically significant. However, there is no significant difference in the IPO exit rates. Moreover, in contrast with IVC-backed start-ups, CVC-backed start-ups have more investment rounds, start investment at earlier stages and tend to exit at later stages of the business cycle.

⟨Insert Table III Panel A here⟩

It is also interesting to investigate whether CVC and IVC funds select different types of start-up projects and whether this difference leads to different behavior with respect to the investment amounts. To determine this point, we divide our successful start-ups dataset into groups based on the investment round in which CVC investors first enter.

[14] The correlation between *Duration* and *Investment Amount* is only 0.07, which mitigates the concern that these two variables are highly correlated and may cause potential multicolinearity problems in the multivariate analysis of exit strategies.

Calculating the average investment amount at each round for different groups, we do not find strong evidence that the CVC-backed start-ups are initially different from the IVC-backed ones. Specifically, we find that the investment amount changes only if CVC funds enter the start-ups. Panels B and C of Table III report the corresponding statistics.

⟨Insert Table III Panel B and Panel C here⟩

Panel B of Table III describes the number of start-ups at each investment round. The columns denote the different investment rounds, and the rows denote the groups of start-ups differentiated by the round in which CVC investors enter. We provide statistics until group 8, in which CVCs enter the project in the eighth investment round.[15] The numbers in bold represent the number of surviving start-ups at the point when CVC funds join the venture. For example, the first row (Gr.0) describes the group of start-ups that only receive IVC financing. Originally, 2, 778 of these start-ups exist. With each round of financing, the number of start-ups decreases (e.g., 2, 117 receive second-round financing, and 1, 492 receive third-round financing). The third row (Gr.2) includes the group of start-ups that begin receiving CVC investments in the second round. There are 415 of these start-ups and 291 of them also receive third-round financing, and so on. It is worth mentioning that most CVC funds start investing during the early rounds. One-third (548 out of 1, 792) of the start-ups receive CVC funds in the first round, and approximately 55% of them obtain CVC financing during the first two rounds.[16] This result is consistent with the findings of Chemmanur, Loutskina and Tian (2011) but differ from those of other papers, which suggest that CVC funds typically enter start-ups in the later investment rounds (Hellmann, Lindsey and Puri (2008); Masulis and Nahata (2009); Dushnitsky and Shapira (forthcoming)).

Panel C of Table III provides the average investment amount per round and per group. Interestingly, before CVCs enter the ventures, the investment amount is similar across all groups. For example, the average investment amount for the start-ups that never

[15] In certain start-ups, CVC funds only enter after the eighth round. Because the number of these ventures is small, we do not show the details of those cases.

[16] In addition to the investment round, we also calculate the number of start-ups at each investment stage (seed, early, expansion, or late stages). We find that more than half of CVC-backed start-ups receive their first CVC investment at the seed or early stage.

receive CVC financing (Gr. 0) is approximately 5.4 million USD in round 1, whereas the average amount for those that receive CVC funds in round 2 is 5.47 million USD.[17] However, these numbers are considerably lower than the 8.9 million USD received by the CVC-backed start-ups in round 1. A similar effect appears for all rounds. Thus, before CVC funds begin investing in start-ups, IVC funds seem to invest in start-ups of similar quality, as indicated by the investment amounts. This finding suggests that there is no apparent start-up selection bias. These statistics mitigate the concern that CVC funds self-select to invest in high-quality start-ups.

B Fund Characteristics and Investment Strategy

Next, we examine the impact of CVC funds on the investment strategies of start-ups in a multivariate framework (H1). Specifically, we use the following ordinary least squares model to estimate this effect:

$$\ln \textit{Investment Amount}_i = \alpha_0 + \alpha_1 CVC_i + \sum_{k=1}^{10} \alpha_k Z_{ki} + \epsilon_i \quad (8)$$

In the above model, the variable *Investment Amount* denotes the total investment amount at the start-up level. The indicator variable *CVC* captures whether a start-up receives CVC financing.

Based on the prior literature, we also control for a set of variables that may explain the total investment amount based on characteristics in addition to the investor type. For instance, Masulis and Nahata (2009) argue that if a start-up and the parent company of the CVC investor are in the same industry, the latter is likely to have more information about the potential value of the venture than it would if the two firms operated in different industries. This argument leads to the endogeneity concern that CVC funds invest more because they have more precise information about the start-ups. To control for such effects on the investment amount, we include an indicator variable, *CVC Strategic Rel.*, which is 1 if the parent company and the start-up have the same four-digit SIC code (i.e.,

[17] The t-statistics for the difference in the first round investment between Gr. 0 and Gr. 2 is −0.1654, which is not statistically significant.

they are competitors in the same industry).[18] In addition, we control for both syndicate size (i.e., the number of VC firms in one syndicated deal) and syndicate leader type. A syndicated deal involves two or more VC firms that take equity stakes in an investment for a future joint payoff (see, for example, Toldra (2010)). A larger syndicate size indicates that there are more investors in the start-up, which may lead to a higher investment amount. The syndicate leader is the main fund in the syndicated deal. This fund calls the syndicate and arranges and manages the project. The variable *Syndicate Leader CVC* takes the value 1 if the fund that provides the maximum investment amount in a syndication is a CVC firm and 0 otherwise (Masulis and Nahata, 2009). If a CVC fund is the leader, it has more decision power that, according to our theoretical prediction, should lead to an increase in the investment amounts. Furthermore, more mature VC funds have more experience, better reputations, and richer resources, which are likely to lead to higher investment levels in start-ups. Thus, we also add the age of the VC fund in the regression. This variable is measured as the average fund age across all funds investing in start-ups. To control for the influence of the starting date of the investment on the investment amount, we include an indicator variable, *Early Invest Stage*, which is 1 if the first investment is made at the seed or an early stage of the start-up's development. Finally, Table 1 shows that the Business Service Industry (SIC=73) covers almost half of the observations in the sample. To control for the possibility that our results are mainly driven by this particular industry, we include an indicator variable, *Industry 73*, in the analysis. *Industry 73* takes the value of 1 if a start-up belongs to the Business Service Industry and 0 otherwise.

Table IV presents the results of the regressions that estimate Hypothesis 1. In Model 1, the estimated coefficient of *CVC* is positive and statistically significant at the 1% level. This finding is consistent with the theoretical prediction that CVC funds invest more in start-ups than IVC funds do. The economic magnitude is also significant. The amounts invested in start-ups financed by CVC funds are 24% greater than the amounts invested in those financed by IVC funds. Moreover, if the syndicate leader of a start-up is a CVC investor, the start-up experiences an additional 30% increase in its investment

[18]We also define the indicator variable *CVC Strategic Rel.* using a two-digit SIC code. The regression results are similar to those defined with a four-digit SIC code. These empirical results are available upon request.

level. In Model 2, we redefine the *VC fund age* and calculate it as the average age of IVC funds. Managers of young IVC funds are more eager to show success than managers of old IVC funds. Therefore, the effect of age of the fund should be stronger for IVC funds than for CVC funds that may stay in business for strategic reasons other than success. The results are robust to this alternative definition of fund age. Furthermore, in Models 3 and 4, we use the percentage of CVC investments as an alternative measure to capture the influence of CVC financing. The results are similar to those of Models 1 and 2. Additionally, more investment rounds, larger fund sizes, larger syndicate sizes, more promising industries, and the existence of non-Business Service industries lead to increased investments in start-ups. We do not find any significant effect of the CVC funds' relationships with the start-ups (competitive or not) on the amounts invested in the start-up. Taken together, the results in Table IV strongly support the prediction that CVC-backed start-ups are associated with higher investment levels.

⟨Insert Table IV here⟩

C Fund Characteristics and Duration Strategy

Our theoretical model predicts that the start-ups financed by CVC funds stay longer than those financed by IVC funds (H2). To test this prediction, we use a survival model because the dependent variable represents the period of time before the exit. The model is as follows:

$$Duration_i = \alpha_0 + \alpha_1 CVC_i + \sum_{k=1}^{8} \alpha_k Z_{ki} + \epsilon_i \tag{9}$$

The dependent variable in Equation (9) is the duration of the start-up before its exit, as measured by the number of days between the exit date and the first investment date. As before, the main independent variable of interest is CVC, which indicates whether the start-up receives financing from CVC funds. We include the same set of control variables used in the regression that estimates the effect of CVC funds on the total investment amount. We also estimate four regression models. We use the indicator variable CVC to indicate that a start-up is financed by CVC funds for Models 1 and 2. In Models 3 and 4, we use the percentage of the investment financed by CVC funds as the dependent variable.

We assume a Weibull distribution of the residual values and parametrically estimate the survival model.[19] The hazard rates of the regression are shown in Table V. Consistent with Hypothesis 2, the CVC-backed start-ups stay longer before exiting than the IVC-backed start-ups. Moreover, the start-ups that receive funds from larger and more mature VC funds have a longer duration. However, the start-ups with more investment rounds and those with a CVC fund as the syndicate leader seem to stay for a shorter period of time.

Finally, the impact of the competitive relationship between CVC funds and start-ups on duration is not significant. Together with the similar finding concerning the level of investment, this result suggests that whether CVC investors have more information about the start-ups and whether the CVC's parent company and the start-up are competitors do not appear to affect the investment and duration strategies.

⟨Insert Table V here⟩

D Fund Characteristics and Start-up Exit Strategies

In this section, we test the direct effect of CVC funds and their indirect impacts through investment and duration decisions on start-ups' exit strategies (H3) using the following model:

$$\begin{aligned} Exit_i = {} & \alpha_0 + \alpha_1 CVC_i + \alpha_2 \ln Duration(Days)_i \\ & + \alpha_3 \ln Investment\ Amount_i + \sum_{k=1}^{9} \alpha_k Z_{ki} + \epsilon_i \end{aligned} \tag{10}$$

The dependent variable *Exit* is an indicator variable that takes the value 1 if a start-up exits through an IPO and 0 if it exits through an acquisition. The main independent variables of interest are the *CVC*, *Investment Amount* and *Duration (Days)*. We also control for other variables that may explain the exit strategy. For instance, Aghion and

[19] The assumption of a Weibull distribution is based on the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). We also tried the semi-parametric estimation (COX estimation) of the survival model. However, the post-estimation PH-test rejected the proportional hazards assumption of the COX estimation.

Bolton (1992) and Cumming (2008) note that the balance of controlling power between the entrepreneur of a start-up and the VC investors may influence the exit strategy. Entrepreneurs are likely to prefer IPOs over acquisitions because the entrepreneurs can continue to enjoy the private benefits of running the firm in the event of an IPO, whereas venture capitalists may prefer acquisitions over IPOs because of the significant costs involved in preparing IPOs. Thus, the likelihood of IPOs increases as the controlling power of entrepreneurs increases. To account for this effect, we include the indicator variable *Later Exit Stage* in the regression. This variable is equal to 1 if the start-ups exit at the expansion or later stages and 0 if they exit at the seed or early stages. The intuition behind this variable is that entrepreneurs tend to have more control over their technologies and/or business operations if their start-ups exit in the expansion or later stages of the business cycle (Smith (2005); Schwienbacher (2009)). Furthermore, we also control for the stock market performance three months prior to the start-ups' exit dates (three-month MSCI). Presumably, a strong stock market performance can increase the value of IPO exits.[20]

Table VI reports the results of the regressions that estimate Hypothesis 3. Our base models are Models 1 to 4. In all of the models, the effect of CVC funds on an IPO exit is not statistically significant when either the CVC indicator variable or the percentage of investment amounts made by CVC funds is used. These results provide strong support for Hypothesis 3*c* and suggest that the type of investor does not directly impact the exit strategy. However, CVC funds indirectly influence the exit strategy through the investment amounts provided to the start-up and the duration of the start-up. Specifically, the coefficient of *Ln(Investment Amount)* is positive and statistically significant. In terms of economic magnitude, a 1% increase in the investment amount increases the probability of an IPO exit by 0.076%, as evidenced in Model 1. Furthermore, a longer duration leads to a significantly lower probability of an IPO exit. A 1% increase in the duration decreases the probability of an IPO by 0.023%. These results are robust to both OLS and Logistic

[20]We do not include *Early Invest Stage* in this regression because we control for the *Duration*, which is defined as the number of days (or years) between the first investment date and the exit date. In addition, we control for the *Late Exit Stage*, which captures the stage at which start-ups exit. These two variables account for the effect of the first investment stage.

regression specificatons and provide strong support for Hypotheses 3a and 3b.

⟨Insert Table VI here⟩

In Model 5, we include a quadratic form of the duration to test the non-linear effect of duration on the exit strategy. The coefficient of this quadratic duration term is positive and statistically significant at the 1% level, which suggests that the negative effect of the duration on the probability of an IPO exit is stronger if the duration is shorter. To better understand this quadratic effect, we run similar regressions for the start-ups with durations less than eight years and more than eight years, respectively. These subsample analyses confirm that the effect of duration on the likelihood of an IPO exit has two regions. The effect is linear and significant for the start-ups whose durations are less than eight years. Conversely, the effect is insignificant in a linear or quadratic manner if the duration for the start-up is more than eight years. In our dataset, the average duration of the start-ups is approximately four to five years, and more than 80% of the start-ups in our sample stay for less than eight years. Therefore, the quadratic effect of the duration does not alter our conclusions regarding the effect of duration on the exit strategy.

In Model 6, we remove the variables related to investment amount and duration. Interestingly, the variable *CVC* is positive and statistically significant at the 1% level. Therefore, the indirect effect of investment amount dominates the indirect effect of duration because the estimated coefficient on the variable *CVC* is positive.

Furthermore, Table 6 provides additional evidence on the effect of the discount rate on the exit strategy. Specifically, the effect of the VC fund size on the probability of an IPO is not statistically significant if both the duration and investment effects are controlled for in the first five models. However, in Model 6, when we remove the duration and investment amount, the estimated coefficient on *Ln (VC Fund Size)* is positive and statistically significant. The effect of the VC fund size is particularly interesting because the discount rate of a fund is likely to decrease with its size, as, larger funds have more resources than smaller funds. Thus, the fund size should have effects on investment, duration, and exit strategies that are similar to the effects of the type of investor. According to Tables 4 and 5, the fund size also positively impacts the investment amount and the duration as the variable *CVC*, although Table 6 shows that fund size does not directly affect the exit strategy. A similar conclusion can be obtained for the variable *VC Fund Age*. According to Gompers (1996), young fund managers are under greater pressure to show success than old fund managers. Therefore, the discount rate of the former is higher than that of the latter. Empirically, fund age also has a strong positive effect on investment and duration (Tables 4 and 5) but does not have any direct effect on the exit strategy (Table 6). This result remains robust when we measure the fund age based only on IVC funds.[21]

Moreover, the sign of the control variables are also as expected. For instance, a stronger stock market performance three months before the exits significantly increases the likelihood of IPOs. The estimated coefficient on the variable *Later Exit Stage* is positive and statistically significant. This finding is consistent with the results of the prior literature, which states that start-ups are more likely to exit through IPOs if entrepreneurs have controlling power (Cumming (2008)). In addition, the firms in industries with greater growth opportunities (proxied by industry market-to-book ratio) are more likely to exit through IPOs. Whether the start-ups and the parent companies of CVC funds are in the same industry has no significant impact on the exit strategy.

A potential concern is that CVC funds may be better at selecting high-quality start-ups that are more likely to exit via IPOs. To address this endogeneity concern, we use the instrument variable approach. Specifically, following Chemmanur, Loutskina and Tian (2011), we construct an instrument that measures the total investments made by CVC funds in a given year in the firms operating in a given two-digit SIC industry as a percentage of the total VC investments for that year. This instrument captures the tendency of CVC funds to invest in a particular industry. This tendency is highly correlated with the likelihood that they will invest in firms that belong to this industry. In the untabulated first-stage regression, this instrument significantly explains the *CVC* variable. The partial R^2 is approximately 2%, and the partial F-statistic is 76.88. The partial F-statistic is well above the critical value suggested by Stock et al. (2002) to be a

[21] Although in Model 3, we only provide the results of the Model 2 regression, we run the same regressions for the rest of the models using IVC fund age (Models 1, 4, 5 and 6 in Table 6). We obtain consistent results for the models using both CVC and IVC fund age. The results are available upon request.

strong instrument.[22] Furthermore, the industry-level investment is unlikely to influence an individual firm's exiting strategy. Therefore, this instrument also satisfies the exclusion restriction for the IV estimation. In Model 7 of Table 6, we present the second-stage regression results for the IV approach. Consistent with the OLS and Logistic results, the variable CVC has a negative but insignificant effect on the likelihood of an IPO exit. This finding suggests that our results are robust to the IV identification strategy.[23]

VIII Additional Analysis

A Fund Characteristics and Rate of Successful Exits

Our theoretical model also predicts the indirect effects of the amounts invested by CVC funds on the rate of successful exits by startups (Hypothesis 4). To test these effects, we use a dataset that includes both the successful and unsuccessful start-ups in the U.S. from 1969 to 2008. We construct a new dependent variable, *Failure*, which is equal to 1 if a start-up is defunct, as indicated by the VentureXpert database, and 0 if it exits through an IPO, an acquisition, or another successful route.[24] In this case, the duration of the start-ups is defined as the number of days between the first and last investment dates. We control for a set of explanatory variables similar to that in the IPO exit regression.[25]

Table VII presents the results of the Logistic regressions of Hypothesis 4. In Models 1 and 2, we use the CVC indicator variable and the percentage of the amount invested by the CVC funds to measure whether a start-up is backed by CVC funds. We find that

[22]Stock et al. (2002) develop the suggested critical F-statistics for different numbers of instruments. In the case of one instrument, the F-statistic should be at least 8.96 to ensure that the instrument is not weak.

[23]We also estimate Model 6 using the IV approach and find consistent results. Specifically, the IV estimation corrects the omitted variable problem caused by the exclusion of the investment and duration variables, and the result indicates that CVC has a negative but insignificant impact on the likelihood of exiting via an IPO.

[24]The success rate of the start-ups in our dataset is high. Approximately 65% of the start-ups have experienced successful exits and 35% are defined as "Defunction" in the dataset. This finding may be due to the restrictions of the database. The VentureXpert database does not include information on all of the failed cases.

[25]We exclude some control variables, such as the industry market-to-book value and fund age, because of data insufficiency. Furthermore, we do not observe the dates on which the start-ups are listed as "Defunction" in VentureXpert . Hence, we also remove the control variables that require exact defunction dates.

funds characteristics, duration, investment amount, and the identity of the syndicate leader (i.e., whether the CVC is the syndicate leader) negatively but not significantly influence the probability of failure. These results support our theoretical predictions, which state that the fund characteristics (CVC funds vs. IVC funds) and the duration do not have any impact on the rate of successful exits. Interestingly, the coefficient estimate on *CVC Strategic Re.* is positive and statistically significant, which suggests that if the start-up and the parent company of the CVC funds are potential competitors, the probability that the start-up is liquidated is higher.

⟨Insert Table VII here⟩

Our model also predicts that the investment amount has a positive effect on the rate of successful exists, whereas the empirical impact is not significant. This discrepancy may be due to the above-mentioned poor quality of the VentureXpert dataset with regard to the set of failures because of information restrictions. Our theoretical predictions regarding the impact of CVC funds on the exit strategy are closer to those of Chemmanur and Loutskina (2008), who find that CVC investments in start-ups lead to a higher, albeit not significant, rate of successful exit. Furthermore, a higher investment level increases the rate of success, as predicted by our theoretical model. Other empirical studies also confirm that CVC-backed start-ups perform better than IVC-backed start-ups. For example, Dushnitsky and Shapira (forthcoming) find that CVC-backed start-ups exhibit a higher rate of successful portfolio exits. Depending on the CVC portfolio manager's compensation incentives, the increase in the rate of successful exits ranges from 9.7% to 20%.

B Endogeneity Concerns

One potential concern is that the investment amount, duration, exit strategy, and type of investor may depend on the potential value of the start-up (parameter V in the theoretical model).[26] This dependence would bias the coefficient estimates on the main independent

[26] Our analysis in Section VI.A suggests that there is no obvious selection bias between the CVC and IVC project exits.

variables. We have used an instrument variable approach to solve the endogeneity problem in the estimation of the exit strategy. However, although the instrument variable used is good for the exit strategy, it is not applicable to the investment and duration strategies.[27]

We use the following method to mitigate the concern regarding this omitted, correlated variable in the estimations of the investment and duration strategies. We split our sample into two groups. The first group is composed of those start-ups that exit through the IPO market, whereas the second group comprises those that exit through the acquisition market. According to our theoretical model, the start-ups that exit through the IPO market have higher values than those that exit through acquisitions. Within each subsample, the start-ups should have similar potential values. We re-run the regressions using either the investment amount or the duration as the dependent variable for these two subsamples. Table VIII presents the corresponding results.

For the investment strategy in Panel A of Table VIII, the results indicate that the main conclusions still hold for both types of start-ups (i.e., those that exit through IPOs and those that exit through acquisitions). Specifically, in the two subsamples, we find that the CVC-backed start-ups receive significantly higher investment amounts. One interesting difference is that for the start-ups that are acquired, the strategic relationship between start-ups and CVC funds plays a role. This finding suggests that if start-ups and the parent companies of CVC funds are in the same industry (i.e.,potential competitors), the start-ups are more likely to be acquired.

⟨Insert Table VIII Panel A here⟩

For the duration strategy in Panel B of Table VIII, the CVC investment significantly increases the duration of the start-ups in the acquisition market. Interestingly, whether the start-ups are backed by CVC funds is not important in determining the duration of the start-ups that issue IPOs. This result matches our theoretical predictions: the decision regarding the duration or the level of information only matters if the start-ups

[27]The instrument variable is the percentage of the CVC investment over all of the investments made at the industry level. This variable can be highly correlated with the firm-level investment amount, which does not satisfy the exclusion restriction of the IV estimation.

go to the acquisitions market.

⟨Insert Table VIII Panel B here⟩

As we show in Panels B and C of Table III, CVC funds enter start-ups in different investment rounds. Hence, another potential endogeneity problem is that if start-ups stay longer in the market before exiting (i.e., longer duration), there is a higher probability that they will receive investments from CVC funds. To control for this effect, we re-estimate the investment and duration regressions using a subsample of our dataset with successful start-ups. This subsample only includes the IVC-backed start-ups and the CVC-backed start-ups that receive their first CVC investments within the first two investment rounds. Table IX presents the corresponding results. The results are consistent with our previous findings with respect to the impact of CVC funds on investment and duration strategies. In fact, these effects become statistically more significant in this subsample.

⟨Insert Table IX Panel A and Panel B here⟩

IX Conclusion

In this paper, we study the optimal initial and exit decisions made by start-ups. In particular, we focus on the difference in behavior between CVC-backed start-ups and IVC-backed start-ups.

In our theoretical analysis, we find that CVC-backed start-ups have longer durations before their exits and larger investment levels than those financed by IVC funds. In turn, these properties lead to higher rates of successful exit and to two opposite impacts on the likelihood of an IPO exit. A longer duration, which implies the existence of more information in the acquisition market, increases the probability that the start-up search for an acquirer. Conversely, higher investment levels, which increase the value of the start-up, encourage an IPO exit.

We find strong empirical support for our theoretical predictions by using data from the VentureXpert database. The presence of CVC financing leads the start-ups to higher levels of investment and to stay longer before exiting. Moreover, the effect of the venture capital funds' characteristics on start-ups' exit strategies can be explained by the investment and duration decisions. Shorter durations and greater investment levels lead to a greater likelihood of IPO exits. However, once these effects are considered, whether the venture capital fund is corporate or independent does not significantly influence the exit decision.

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Appendix A

Proof of Proposition 3

Proof. We notice that the rate of IPO exits over the total successful exits is either

$$\frac{1}{1-\Gamma(C;I)}\int_{V\geq C+\frac{F}{\beta-m}}\left[1-p_o(V)\right]\gamma(V;I)dV \tag{11}$$

or

$$\frac{1}{1-\Gamma(C;I)}\int_{V\geq C+\frac{F}{\beta-\frac{m}{2}}}\left[1-p_{oo}(V)\right]\gamma(V;I)dV. \tag{12}$$

Given that V is uniformly distributed over the interval $\left[f(I),\hat{V}+f(I)\right]$, we have

$$\frac{\gamma(V;I)}{1-\Gamma(C;I)}=\frac{1}{\hat{V}+f(I)-C}. \tag{13}$$

Therefore,

$$\frac{\partial}{\partial I}\left[\frac{1}{1-\Gamma(C;I)}\int_{V\geq C+\frac{F}{\beta-m}}\left[1-p_o(V)\right]\gamma(V;I)dV\right]=\frac{\partial}{\partial I}\left[\frac{1}{\left(\hat{V}+f(I)-C\right)}\int_{C+\frac{F}{\beta-m}}^{\hat{V}+f(I)}\left[1-p_o(V)\right]dV\right]$$

$$=\frac{f'(I)}{\left(\hat{V}+f(I)-C\right)^2}\left[\left[1-p_o(\hat{V}+f(I))\right]\left(\hat{V}+f(I)-C\right)-\int_{C+\frac{F}{\beta-m}}^{\hat{V}+f(I)}\left[1-p_o(V)\right]dV\right]>0,$$

where the inequality holds because $f'(I)>0$ and $[1-p_o(V)]$ is an increasing function of V. Therefore, the expression (11) is increasing in I. A similar argument allows us to prove that (12) is also increasing in I. □

Proof of Lemma 1.

Proof. Propositions 1 and 2 imply

$$\begin{aligned} EU_o(I) &= \int_{V\geq C}\left[\int_0^{p_o(V)} mp(V-C)dp + \int_{p_o(V)}^1 \left[\beta p(V-C)-F\right]dp\right] d\Gamma(V;I) \\ &= \int_{V\geq C}\left[\frac{1}{2}\beta(V-C) - \left[\frac{1}{2}\left(\beta-m\right)p_o(V)^2(V-C) + F\left(1-p_o(V)\right)\right]\right] d\Gamma(V;I) \end{aligned}$$

and

$$\begin{aligned} EU_{oo}(I) &= \int_{V\geq C}\left[\int_0^{p_{oo}(V)} m\frac{p_{oo}(V)}{2}(V-C)dp + \int_{p_{oo}(V)}^1 \left[\beta p(V-C)-F\right]dp\right] d\Gamma(V;I) \\ &= \int_{V\geq C}\left[\frac{1}{2}\beta(V-C) - \left[\frac{1}{2}\left(\beta-m\right)p_{oo}(V)^2(V-C) + F\left(1-p_{oo}(V)\right)\right]\right] d\Gamma(V;I). \end{aligned}$$

Therefore, $EU_o(I) \geq EU_{oo}(I)$ if

$$\frac{1}{2}\left(\beta-m\right)p_o(V)^2(V-C) + F\left(1-p_o(V)\right) \leq \frac{1}{2}\left(\beta-m\right)p_{oo}(V)^2(V-C) + F\left(1-p_{oo}(V)\right). \tag{14}$$

Equation (14) holds with equality if $p_{oo}(V) = 1$ (and then, $p_o(V) = 1$ as well). Otherwise, denote

$$j(p) \equiv \frac{1}{2}\left(\beta-m\right)p^2(V-C) + F\left(1-p\right).$$

Then,

$$j'(p) = \left(\beta-m\right)p(V-C) - F < 0$$

for all $p < \min\{p_o, 1\}$, given the definition of p_o. Therefore, $j(p_{oo}(V)) > j(p_o(V))$ whenever $p_{oo}(V) < 1$, that is, (14) holds with strict inequality when $p_{oo}(V) < 1$ for some V in the support of the distribution $\Gamma(d;I)$, that is, when $p_{oo}(\hat{V} + f(I)) < 1$. □

Proof of Proposition 6

Proof. The optimal values d^* and I^* maximize $U(d,I)$, where $U(d,I)$ is defined in Equation (5). Therefore, d^* and I^* are characterized by

$$\frac{\partial U}{\partial d}\left(d^*, I^*\right) = 0 \tag{15}$$

$$\frac{\partial U}{\partial I}(d^*, I^*) = 0. \tag{16}$$

We differentiate Equations (15) and (16) and solve the system to obtain that, at (d^*, I^*),

$$\frac{\partial I^*}{\partial r} = -\frac{\Lambda_I}{\Delta} \tag{17}$$

$$\frac{\partial d^*}{\partial r} = -\frac{\Lambda_d}{\Delta}, \tag{18}$$

where

$$\Lambda_I = \frac{\partial^2 U}{\partial d^2}\frac{\partial^2 U}{\partial I \partial r} - \frac{\partial^2 U}{\partial I \partial d}\frac{\partial^2 U}{\partial d \partial r}$$

$$\Lambda_d = \frac{\partial^2 U}{\partial I^2}\frac{\partial^2 U}{\partial d \partial r} - \frac{\partial^2 U}{\partial I \partial d}\frac{\partial^2 U}{\partial I \partial r}$$

and

$$\Delta = \frac{\partial^2 U}{\partial I^2}\frac{\partial^2 U}{\partial d^2} - \left(\frac{\partial^2 U}{\partial I \partial d}\right)^2.$$

Before the analysis of the second derivatives of the function

$$U(d, I) = e^{-rd}\left[h(d)EU_o(I) + (1 - h(d))EU_{oo}(I)\right] - I,$$

we analyze the functions $EU_o(I)$ and $EU_{oo}(I)$.

$$EU_o(I) = \int_{V \geq C} \frac{1}{2}\beta(V - C)d\Gamma(V; I) - \int_{V \geq C}\left[\frac{1}{2}(\beta - m)p_o(V)^2(V - C) + F(1 - p_o(V))\right]d\Gamma(V; I). \tag{19}$$

Taking into account that $d\Gamma(V; I) = \frac{1}{\hat{V}}$, the first term of the right-hand side of (19) is

$$\int_C^{\hat{V} + f(I)} \frac{1}{2}\beta(V - C)d\Gamma(V; I) = \frac{\beta}{4\hat{V}}\left(\hat{V} + f(I) - C\right)^2$$

and, using that $p_o(V) = \min\left\{\frac{1}{(\beta - m)}\frac{F}{(V - C)}, 1\right\}$, we split the second term in the right-hand side of (19) in two parts:

$$\int_C^{C + \frac{F}{\beta - m}} \frac{1}{2}(\beta - m)(V - C)\frac{1}{\hat{V}}dV = \frac{F^2}{4(\beta - m)\hat{V}}$$

and

$$\int_{C+\frac{F}{\beta-m}}^{\hat{V}+f(I)} \left[\frac{F^2}{2(\beta-m)(V-C)} + F\left(1-\frac{F}{(\beta-m)(V-C)}\right)\right]\frac{1}{\hat{V}}dV =$$
$$-\frac{F^2}{2(\beta-m)\hat{V}}\left[\log\left(\hat{V}+f(I)-C\right)-\log\left(\frac{F}{\beta-m}\right)\right]+\frac{F}{\hat{V}}\left[\hat{V}+f(I)-C-\frac{F}{\beta-m}\right].$$

Therefore,

$$\begin{aligned} EU_o(I) &= \frac{\beta}{4\hat{V}}\left[\hat{V}+f(I)-C\right]^2 - \frac{F}{\hat{V}}\left[\hat{V}+f(I)-C-\frac{3F}{4\left(\beta-m\right)}\right]+ \\ & \frac{F^2}{2(\beta-m)\hat{V}}\left[\log\left(\hat{V}+f(I)-C\right)-\log\left(\frac{F}{\beta-m}\right)\right]. \end{aligned} \tag{20}$$

Similarly, taking into account that $p_{oo}(V) = \min\left\{\frac{1}{\left(\beta-\frac{m}{2}\right)}\frac{F}{(V-C)}, 1\right\}$, we obtain:

$$\begin{aligned} EU_{oo}(I) &= \frac{\beta}{4\hat{V}}\left[\hat{V}+f(I)-C\right]^2 - \frac{(\beta-m)F^2}{4\left(\beta-\frac{m}{2}\right)^2\hat{V}} - \frac{F}{\hat{V}}\left[\hat{V}+f(I)-C-\frac{F}{\left(\beta-\frac{m}{2}\right)}\right]- \\ & \frac{(\beta-m)F^2}{2\left(\beta-\frac{m}{2}\right)^2\hat{V}}\left[\log\left(\hat{V}+f(I)-C\right)-\log\left(\frac{F}{\beta-\frac{m}{2}}\right)\right]+ \\ & \frac{F^2}{\left(\beta-\frac{m}{2}\right)\hat{V}}\left[\log\left(\hat{V}+f(I)-C\right)-\log\left(\frac{F}{\beta-\frac{m}{2}}\right)\right]. \end{aligned} \tag{21}$$

From (20) and (21),

$$EU_o'(I) = \frac{f'(I)}{\hat{V}}\left[\frac{\beta}{2}\left[\hat{V}+f(I)-C\right]-F+\frac{F^2}{2(\beta-m)\left(\hat{V}+f(I)-C\right)}\right] \tag{22}$$

$$EU_{oo}'(I) = \frac{f'(I)}{\hat{V}}\left[\frac{\beta}{2}[\hat{V}+f(I)-C]-F+\frac{\beta F^2}{2(\beta-\frac{m}{2})^2(\hat{V}+f(I)-C)}\right]. \tag{23}$$

As it is intuitive and easy to check, $EU_o'(I) > 0$ and $EU_{oo}'(I) > 0$.

We now analyze the sign of the second derivatives of the function $U(.,.)$.

$$\frac{\partial^2 U}{\partial d^2}(d^*, I^*) = e^{-rd}[h''(d) - rh'(d)][EU_o(I) - EU_{oo}(I)]. \tag{24}$$

In Equation (24), $h'(d) > 0$ and $h''(d) < 0$. Moreover, Proposition 1 implies that $EU_o(I) > EU_{oo}(I)$. Therefore, $\frac{\partial^2 U}{\partial d^2}(d^*, I^*) < 0$.

$$\frac{\partial^2 U}{\partial I \partial r}(d^*, I^*) = -d < 0. \tag{25}$$

$$\frac{\partial^2 U}{\partial I^2}(d^*, I^*) = e^{-rd}[h(d)EU_o''(I) + (1 - h(d))EU_{oo}''(I)] < 0 \tag{26}$$

because

$$EU_o''(I) = \frac{f''(I)}{\hat{V}}\left[\frac{\beta}{2}(\hat{V} + f(I) - C) - F + \frac{F^2}{2(\beta - m)\left(\hat{V} + f(I) - C\right)}\right] - \frac{f'(I)^2}{2\hat{V}}\left[\beta - \frac{F^2}{(\beta - m)\left(\hat{V} + f(I) - C\right)^2}\right]$$

and

$$EU_{oo}''(I) = \frac{f''(I)}{\hat{V}}[\frac{\beta}{2}[\hat{V} + f(I) - C] - F + \frac{\beta F^2}{2(\beta - \frac{m}{2})^2(\hat{V} + f(I) - C)}] + \frac{f'(I)^2}{2\hat{V}}[\beta - \frac{\beta F^2}{(\beta - \frac{m}{2})^2(\hat{V} + f(I) - C)^2}.$$

Therefore, both $EU_o''(I) < 0$ and $EU_{oo}''(I) < 0$ if $f(I)$ is concave enough.

$$\frac{\partial^2 U}{\partial d \partial r}(d^*, I^*) = -e^{-rd}[h(d)EU_o(I) + (1 - h(d))EU_{oo}(I)] < 0. \tag{27}$$

We notice that

$$\frac{\partial^2 U}{\partial I \partial d}(d^*, I^*) = -r + e^{-rd}h'(d)[EU_o'(I) - EU_{oo}'(I)],$$

with

$$EU'_o(I) - EU'_{oo}(I) = \frac{f'(I)F^2}{\hat{V}\left(\hat{V} + f(I) - C\right)} \frac{\frac{m^2}{4}}{2(\beta - m)\left(\beta - \frac{m}{2}\right)^2} > 0.$$

Therefore, investment and duration may be complement or substitute, depending on the comparison of the two terms. If they are complements, that is,

$$\frac{\partial^2 U}{\partial I \partial d}(d^*, I^*) \geq 0,$$

then $\Lambda_I > 0$ and $\Lambda_d > 0$. If they are substitutes, the same inequalities hold as long as the functions $h(d)$ and $f(I)$ are sufficiently concave, which also imply that $\Delta > 0$ (Δ is always positive in any strict maximum).

Therefore, $\frac{\partial I^*}{\partial r} < 0$ and $\frac{\partial d^*}{\partial r} < 0$, as we wanted to prove. □

Appendix B

Variable Definitions

Variables	Definitions
CVC	Indicator variable equal to 1 for CVC-backed start-ups and 0 for IVC-backed start-ups
CVC_Per	Percentage of investment by CVC funds in each start-up
IPO	Indicator variable equal to 1 for an IPO exit and 0 for an aquisition exit
Investment amount	Total investment amount at start-up level, measured by disclosed equity amount (USD Million) summed over investment rounds
Duration (Days)	Difference in days between the exit date and the date at which a start-up receives the first investment from VC funds
Duration (Years)	Duration (Days) divided by 365
Investment rounds	Number of investment rounds for a start-up
Syndicate size	Number of VC funds that invest in a start-up
Syndicate leader CVC	Indicator variable equal to 1 if the VC that provides the maximum amount of investment is a CVC and 0 otherwise
VC fund size	Average size (USD Million) of VC funds that finance the start-up
CVC strategic relationship	Measure of CVC strategic competitors, indicator variable of 1 if a CVC has the same 4-digit SIC code as its start-up, and 0 otherwise
VC fund age (Years)	Average fund age across all of the funds that invest in a start-up
IVC fund age (Years)	Average fund age across IVC funds that invest in a start-up
Industry MB	Industry market-to-book value at the year at which the first CVC fund invests
3-month MSCI	MSCI return 0-3 months prior to the exit date
Later exit stage	Indicator variable equal to 1 if a start-up exits at expansion or later stage and 0 otherwise
Early Invest stage	Indicator variable equal to 1 if a start-up receives the first investment at seed or early stage and 0 otherwise
Industry 73	Indicator variable equal to 1 if a start-up is from the Business Service industry and 0 otherwise

Table I

Industry Composition of the Sample

This table provides an overview of the industry composition of the sample by two-digit SIC code. The majority of the start-ups are from chemical, electronic, and business service related industries, where VC investments are more common.

Two-Digit SIC Code	Industry Name	Number of start-ups
13	Oil and gas extraction	27
20	Food and kindred products	21
27	Printing and publishing	24
28	Chemicals and allied products	360
35	Industrial machinery and equipment	274
36	Electronic and other electronic equipment	510
38	Instruments and related products	348
48	Communications	199
50	Wholesale trade - durable goods	57
51	Wholesale trade - nondurable goods	20
59	Miscellaneous retail	64
62	Security and commodity brokers	20
63	Insurance carriers	29
73	Business services	2,199
80	Health services	127
87	Engineering and management services	195
N/A	No. of observation less than 20	327

Table II Panel A
Summary Statistics

This panel presents the summary statistics of the variables. Please refer to Appendix B for variable definitions. In the sample, 37% of the start-ups are partially financed by CVC investors and 35% of these start-ups exit through IPOs.

	No. of Obs.	Mean	Std. Dev.	Min	Max
CVC	4801	0.37	0.48	0	1
CVC_Per	4801	0.23	0.34	0	1
IPO	4801	0.35	0.48	0	1
Investment amount	4801	31.47	78.04	0.02	4653.06
Duration (Days)	4801	1753.26	1197.6	10	12056
Duration (Years)	4801	4.8	3.28	0.03	33.03
Investment rounds	4801	4.26	2.87	1	27
Syndicate size	4801	5.81	4.37	1	35
Syndicate leader CVC	4801	0.05	0.22	0	1
VC fund size	4801	211.75	383.62	0.09	6011.62
VC fund age (Years)	4737	7.98	5.46	0	45.33
IVC fund age (Years)	4801	7.01	6.07	0	29
CVC strategic relationship	4801	0.01	0.12	0	1
Industry MB	4801	13.51	22.53	0.74	432.1
3-month MSCI	4801	2861.97	1391.96	113.88	4881.96
Later exit stage	4801	0.81	0.39	0	1
Early invest stage	4801	0.71	0.45	0	1
Industry 73	4801	0.46	0.50	0	1

Table II Panel B
Correlation Matrix

Panel B reports the Pearson pairwise correlation among the variables. The correlation between the dummy variable *CVC* and *Investment Amount* or *CVC* and *Duration* is positive and statistically significant at the 1% level. However, the correlation between *Duration* and *Investment Amount* is only 0.07, which mitigates the concern of the potential multicolinearity problem in the multivariate analysis of exit strategies. ***, ** and * denote statistical significance at 1%, 5% and 10% level. Please see Appendix B for variable definitions.

	VC Fund Age	Synd. L. CVC	CVC	Invest Amount	Invest Rounds	Duration	Synd. Size	VC Fund Size
VC Fund Age	1.00							
Syndicate Leader CVC	−0.01	1.00						
CVC	0.06***	0.29***	1.00					
Investment Amount	0.03**	0.04***	0.18***	1.00				
Investment Rounds	0.05***	−0.04***	0.25***	0.19***	1.00			
Duration	−0.02	−0.01	0.12***	0.07***	0.46***	1.00		
Syndicate Size	0.05***	0.01	0.46***	0.25***	0.58***	0.29***	1.00	
VC Fund Size	0.03**	−0.02	−0.02	0.14***	−0.03	−0.04***	−0.06***	1.00
CVC Strategic Re.	0.02	0.13***	0.15***	0.04***	0.04***	0.02	0.06***	−0.01
IPO	−0.10***	0.05***	0.01	0.04***	0.07***	−0.05***	0.14***	−0.12***
Industry MB	0.07***	0.01	0.06***	0.03**	−0.02	−0.01	−0.02	0.07***
CVC_per	0.04**	0.39***	0.85***	0.16***	0.10***	0.04***	0.36***	−0.02
3-month MSCI	0.21***	0.02	0.14***	0.16***	0.01	0.08***	−0.01	0.22***
Later Exit Stage	0.00	−0.01	−0.03**	0.01	−0.02	0.01	−0.02	0.02
IVC Fund Age	0.72***	0.01	0.1***	0.04***	0.07***	−0.02	0.07***	0.01
Industry 73	0.07***	0.02	0.07***	0.005	−0.04***	−0.06***	−0.03**	0.09***
Early Invest Stage	0.05***	−0.002	0.15***	0.07***	0.20***	0.08***	0.22***	0.01

	CVC Strt. Re.	IPO	Ind. MB	CVC_per	3-mon. MSCI	Later St.	IVC Fd. Age	Ind. 73	Early St.
VC Fund Age									
Syndicate L. CVC									
CVC									
Investment Amount									
Investment Rounds									
Duration									
Syndicate Size									
VC Fund Size									
CVC Strategic Re.	1.00								
IPO	0.03	1.00							
Industry MB	0.00	−0.23***	1.00						
CVC_per	0.12***	−0.01	0.07***	1.00					
3-month MSCI	0.05***	−0.49***	0.24***	0.12***	1.00				
Later Exit Stage	−0.04***	−0.01	0.02	−0.03**	−0.01	1.00			
IVC Fund Age	0.03**	−0.07***	0.03**	0.08***	0.18***	−0.01	1		
Industry 73	−0.05***	−0.25***	0.24***	0.08***	0.28***	0.01	0.06***	1	
Early Invest Stage	0.04***	−0.10***	0.06***	0.12***	0.14***	−0.22***	0.06***	0.05***	1

Table III Panel A
CVC vs IVC Funds: Summary Statistics

Panel A presents a univariate comparison across IVC- and CVC-backed start-ups. On average, CVC-backed start-ups have an investment amount more than twice of that for-IVC backed startups. Additionally, start-ups with CVC financing stay one year longer than those with IVC financing. These results are statistically significant at 1% level. ***, ** and * denote statistical significance at 1%, 5% and 10% level. Please see Appendix B for variable definitions.

	IVC	*CVC*	*Difference*	*t-statistics*
IPO	0.35	0.36	−0.01	−0.64
Investment amount	20.5	49.88	−29.38	−12.83***
Duration	1648.86	1928.57	−279.71	−7.88***
Investment rounds	3.71	5.19	−1.48	−17.9***
Syndicate size	4.25	8.42	−4.16	−35.93***
VC fund size	216.7	203.43	13.27	1.16
VC fund age	7.73	8.39	−0.66	−4.03***
Later exit stage	0.77	0.88	−0.11	−9.46***
Early invest stage	0.66	0.8	−0.14	−10.71***
Industry 73	0.43	0.5	−0.07	−4.63***

Table III Panel B
CVC vs IVC Funds: No. of Start-ups per Investment Round

Panel B describes the number of start-ups at each investment round. The columns denote different investment rounds and the rows denote the groups of start-ups differentiated by the round in which CVC investors enter. The numbers in bold represent the number of surviving start-ups at the point when CVC funds join the venture. Most CVC-backed start-ups start receiving CVC financing at very early stages.

No. of S	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**
Gr. 0	2778	2117	1492	977	617	408	238	161
Gr. 1	**548**	422	322	233	164	95	63	44
Gr. 2	401	**415**	291	188	114	68	39	24
Gr. 3	344	334	**352**	254	156	95	54	35
Gr. 4	183	178	179	**187**	131	83	41	25
Gr. 5	97	99	96	95	**100**	54	30	19
Gr. 6	50	51	51	49	49	**55**	28	20
Gr. 7	25	23	20	24	24	22	**26**	13
Gr. 8	11	10	9	9	9	10	11	**11**

Table III Panel C

CVC vs IVC Funds: Investment Amount per Start-up per Round

Panel C provides the average investment amount per round and per group. The columns and the rows are the same as those in the Panel B of Table III. Before CVC funds enter the ventures, the investment amount is similar across all groups. The investment amount becomes significantly higher only after CVC funds start investing in the start-up.

Invest.	**R1**	**R2**	**R 3**	**R4**	**R5**	**R6**	**R7**	**R8**
Gr. 0	5.39	6.05	7.11	6.71	6.41	5.64	4.24	4.57
Gr. 1	**8.90**	11.34	10.91	10.95	9.83	6.76	4.56	4.49
Gr. 2	5.47	**16.42**	11.74	13.18	11.37	15.23	7.13	9.37
Gr. 3	3.91	9.06	**18.16**	14.15	12.33	8.90	10.14	7.09
Gr. 4	2.97	6.28	9.53	**18.26**	14.66	11.21	14.81	8.17
Gr. 5	2.89	5.12	7.48	8.34	**15.54**	11.41	9.19	6.89
Gr. 6	2.75	5.46	5.20	3.84	6.46	**17.56**	12.97	12.07
Gr. 7	2.45	4.41	3.60	6.51	5.09	10.05	**14.03**	17.30
Gr. 8	2.18	3.38	3.57	6.27	7.26	6.94	12.31	**18.43**

Table IV
Investment Strategy

The table presents the results of the regressions that estimate the effect of CVC funds on the investment levels. Please refer to Appendix B for variable definitions. In all the models, the estimated coefficient of *CVC* is positive and statistically significant at the 1% level. More investment rounds, larger fund sizes, more mature VC/IVC funds, larger syndicate sizes, more promising industries, and the existence of non Business Service industries lead to increased investments in start-ups. The t-statistics are reported in parentheses. ***, ** and * denote statistical significance at 1%, 5% and 10% level.

	Dependent Variable: ln(Investment Amount)			
	Model 1	*Model 2*	*Model 3*	*Model 4*
CVC	0.239***	0.229***		
	(7.54)	(7.28)		
CVC_per			0.277***	0.265***
			(6.23)	(6.02)
Investment Rounds	0.1068***	0.107***	0.1117***	0.1117***
	(19.31)	(19.54)	(20.03)	(20.22)
Syndicate Size	0.1297***	0.129***	0.132***	0.1314***
	(32.79)	(32.93)	(33.48)	(33.64)
Syndicate Leader CVC	0.3004***	0.2854***	0.282***	0.267***
	(4.88)	(4.71)	(4.4)	(4.24)
ln(VC Fund Size)	0.3616***	0.3622***	0.3613***	0.362***
	(33.01)	(33.4)	(32.93)	(33.32)
VC Fund Age	0.0123***		0.0127***	
	(5.28)		(5.36)	
IVC Fund Age		0.015***		0.015***
		(7.00)		(7.11)
CVC Strategic Re.	0.1248	0.1248	0.1656	0.1631
	(1.14)	(1.15)	(1.51)	(1.5)
ln(Industry MB)	0.032*	0.0344*	0.0334*	0.036*
	(1.73)	(1.87)	(1.8)	(1.95)
Early Invest Stage	−0.012	−0.014	−0.011	−0.013
	(−0.41)	(−0.49)	(−0.39)	(−0.47)
Industry 73	−0.21***	−0.211***	−0.212***	−0.213***
	(−6.94)	(−7.04)	(−6.97)	(−7.08)
Year Fixed Effects	Yes	Yes	Yes	Yes
N	4737	4801	4737	4801
Adj. R^2	0.66	0.67	0.66	0.67

Table V
Duration Strategy

This table shows the hazard rates of the survive model. The estimated coefficient of *CVC* is larger than 1 and statistically significant for three models, implying that the CVC-backed start-ups stay longer before exiting than the IVC-backed start-ups. The Z-values are reported in parentheses. ***, ** and * denote statistical significance at 1%, 5% and 10% level. Please see Appendix B for variable definitions.

	Dependent Variable: Duration (Days)			
	Model 1	*Model 2*	*Model 3*	*Model 4*
CVC	1.064*	1.052		
	(1.68)	(1.39)		
CVC_per			1.15***	1.14**
			(2.6)	(2.48)
Investment Rounds	0.86***	0.86***	0.86***	0.86***
	(−21.12)	(−21.61)	(−20.77)	(−21.27)
Syndicate Size	0.99*	0.99	0.99**	0.99*
	(−1.74)	(−1.39)	(−2.09)	(−1.8)
Syndicate Leader CVC	0.869**	0.87*	0.826**	0.828**
	(−1.94)	(−1.91)	(−2.51)	(−2.5)
ln(VC Fund Size)	1.06***	1.06***	1.06***	1.06***
	(4.72)	(5.00)	(4.68)	(4.95)
VC Fund Age	1.01***		1.01***	
	(4.42)		(4.48)	
IVC Fund Age		1.01***		1.01***
		(5.74)		(5.74)
CVC Strategic Re.	1.03	1.04	1.04	1.05
	(0.23)	(0.30)	(0.29)	(0.33)
ln(Industry MB)	0.99	0.99	0.99	0.99
	(−0.56)	(−0.43)	(−0.63)	(−0.51)
Early Invest Stage	1.06	1.05	1.06	1.05
	(1.63)	(1.41)	(1.62)	(1.39)
Industry 73	1.137***	1.13***	1.136***	1.13***
	(3.66)	(3.56)	(3.62)	(3.52)
Year Fixed Effects	No	No	No	No
N	4737	4801	4737	4801

Table VI
Exit Strategy

This table reports the results of the regressions that estimate the impact of CVC investors on the exit strategy. The coefficient of *CVC* is not statistically significant when both *Investment Amount* and *Duration* are controlled (Models 1 to 5 and 7). The effect of investment amount on the the probability of an IPO exit is positive and statistically significant at 1% level whereas duration negatively influences the probability of an IPO exit. The duration effect is statistically significant at 10% level. The impact of fund types becomes positive and statistically significant at 1% level if the investment amounts and the duration are not controlled (Model 6). These results are robust to the Instrument Variable method (Model 7). The t-statistics and the Z-values are reported in parentheses. ***, ** and * denote statistical significance at 1%, 5% and 10% level. Please see Appendix B for variable definitions.

	Dependent Variable: IPO						
	Model 1 *OLS*	*Model 2* *LOGIT*	*Model 3* *LOGIT*	*Model 4* *LOGIT*	*Model 5* *LOGIT*	*Model 6* *LOGIT*	*Model 7* *IV*
CVC	−0.0055 (−0.41)	−0.03 (−0.31)	−0.035 (−0.35)		−0.039 (−0.39)	0.457*** (5.01)	−0.16 (−1.55)
CVC_per				−0.122 (−0.85)			
ln(Duration)	−0.023*** (−2.84)	−0.117* (−1.90)	−0.1133* (−1.86)	−0.118* (−1.93)			−0.018** (−1.98)
Duration Year					−0.082** (−2.54)		
(Duration Year)^2					0.005*** (2.95)		
ln(Investment amount)	0.076*** (13.89)	0.602*** (13.27)	0.601*** (13.27)	0.608*** (13.66)	0.61*** (13.36)		0.099*** (6.25)
ln(VC Fund Size)	−0.0055 (−1.03)	−0.01 (−0.24)	−0.012 (−0.29)	−0.012 (−0.29)	−0.004 (−0.1)	0.218*** (5.76)	−0.013* (−1.77)
VC Fund Age	0.0005 (0.51)	0.0088 (1.06)		0.0086 (1.03)	0.01 (1.22)	0.019** (2.36)	0.0005 (0.44)
IVC Fund Age			0.008 (1.13)				
Syndicate Leader CVC	0.052* (1.92)	0.316 (1.64)	0.293 (1.54)	0.3637* (1.82)	0.307 (1.58)	0.283 (1.52)	0.136** (2.2)
CVC Strategic Re.	0.084* (1.76)	0.453 (1.46)	0.452 (1.46)	0.46 (1.50)	0.466 (1.5)	0.446 (1.45)	0.139** (2.3)
ln(3-month MSCI)	0.2625*** (2.84)	2.54*** (3.11)	2.588*** (3.18)	2.55*** (3.12)	2.45*** (2.99)	2.45*** (3.10)	0.263*** (2.82)
ln(Industry MB)	0.024** (2.48)	0.154* (1.88)	0.163** (2.00)	0.157* (1.91)	0.155* (1.89)	0.183** (2.3)	0.031*** (2.86)
Later Exit stage	0.049*** (3.18)	0.459*** (3.67)	0.472*** (3.8)	0.457*** (3.65)	0.439*** (3.51)	0.808*** (7.08)	0.05*** (3.24)
Industry 73	−0.093*** (−6.62)	−0.627*** (−6.16)	−0.615*** (−6.08)	−0.623*** (−6.12)	−0.612*** (−6.01)	−0.764*** (−7.81)	−0.089*** (−6.07)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	4512	4512	4562	4512	4512	4512	4511
Adj./Pseudo R^2	0.37	0.35	0.35	0.35	0.35	0.38	0.35

Table VII
Rate of Successful Exits

The table presents the results of the Logistic regressions that estimate the effects of CVC investors on the rate of successful exits. Funds characteristics, duration, investment amount and the identity of the syndicate leader are negatively but not significantly influence the probability of failure. The estimated coefficient of *CVC Strategic Re.* is positive and statistically significant at 5% level. The Z-values are reported in parentheses. ***, ** and * denote statistical significance at 1%, 5% and 10% level. Please see Appendix B for variable definitions.

	Dependent Variable: Failure rate	
	Model 1	*Model 2*
	LOGIT	*LOGIT*
CVC	−0.003	
	(−0.06)	
CVC_per		0.0005
		(0.00)
ln(Duration)	−0.024	−0.024
	(−0.92)	(−0.93)
ln(Investment Amount)	−0.002	−0.0023
	(−0.09)	(−0.11)
Syndicate Leader CVC	−0.139	−0.141
	(−1.14)	(−1.18)
ln(VC Fund Size)	0.02	0.02
	(1.03)	(1.04)
CVC Strategic Re.	0.642**	0.64**
	(2.07)	(2.05)
Later Exit Stage	−0.076	−0.076
	(−1.23)	(−1.23)
Industry 73	17.73***	17.73***
	(12.49)	(12.53)
Year Fixed Effects	No	No
Industry Fixed Effects	Yes	Yes
N	9354	9354
Pseudo R^2	0.0008	0.0008

Table VIII Panel A

Investment Strategy for IPO-exit Startups and for Acquisition-exit Start-ups

This table provides the results of the regressions on the investment strategy for IPO-exit start-ups and for Acquisition-exit start-ups. They are similar to those in Table IV. The estimated coefficients of *CVC* for the two subsamples are positive and statistically significant at 1% level. For Acquisition-exit start-ups, the estimated coefficient of *CVC Strategic Re.* is positive and statistically significant at 10% level. The t-statistics are reported in parentheses. ***, ** and * denote statistical significance at 1%, 5% and 10% level. Please see Appendix B for variable definitions.

	Dependent Variable: ln(Investment Amount)			
	IPO Exits		Acquisition Exits	
	Model 1	*Model 3*	*Model 1*	*Model 3*
CVC	0.2068***		0.214***	
	(3.61)		(5.79)	
CVC_per		0.2975***		0.224***
		(3.56)		(4.39)
Investment Rounds	0.147***	0.1513***	0.091***	0.095***
	(14.67)	(15.08)	(14.06)	(14.57)
Syndicate Size	0.1002***	0.1005***	0.146***	0.150***
	(16.19)	(16.3)	(28.06)	(28.82)
Syndicate Leader CVC	0.4349***	0.3809***	0.115	0.112
	(4.29)	(3.53)	(1.52)	(1.44)
ln(VC Fund Size)	0.3107***	0.3106***	0.367***	0.367***
	(15.09)	(15.08)	(29.53)	(29.45)
VC Fund Age	0.0068	0.0073	0.013***	0.013***
	(1.35)	(1.44)	(5.21)	(5.23)
CVC Strategic Re.	−0.136	−0.125	0.248*	0.299**
	(−0.78)	(−0.72)	(1.79)	(2.17)
ln(Industry MB)	−0.0017	0.002	0.056***	0.056***
	(−0.04)	(0.06)	(2.82)	(2.81)
Early Invest Stage	0.067	0.068	−0.003	−0.03
	(1.34)	(1.35)	(−0.88)	(−0.90)
Industry 73	−0.212***	−0.216***	−0.164***	−0.163***
	(−3.89)	(−3.97)	(−4.63)	(−4.58)
Year Fixed Effects	Yes	Yes	Yes	Yes
N	1650	1650	3087	3087
Adj. R^2	0.73	0.73	0.63	0.63

Table VIII Panel B

Duration Strategy for IPO-exit Startups and for Acquisition-exit Start-ups

This table indicates the results of the regression on the duration strategy for IPO-exit start-ups and for Acquisition-exit start-ups. The results are similar to those of Table V. The estimated coefficient of CVC on the duration is only statistically significant (at 1% level) for those start-ups exit through and acquisition market. The Z-values are reported in parentheses. ***, ** and * denote statistical significance at 1%, 5% and 10% level. Please see Appendix B for variable definitions.

	Dependent Variable: Duration (Days)			
	IPO Exits		Acquisition Exits	
	Model 1	*Model 3*	*Model 1*	*Model 3*
CVC	1.013		1.167***	
	(0.21)		(3.32)	
CVC_per		1.113		1.28***
		(1.14)		(3.79)
Investment Rounds	0.896***	0.897***	0.84***	0.84***
	(−9.36)	(−9.29)	(−19.58)	(−19.07)
Syndicate Size	1.007	1.005	0.97***	0.967***
	(0.97)	(0.67)	(−5.03)	(−5.21)
Syndicate Leader CVC	0.882	0.821	0.929	0.88
	(−1.09)	(−1.55)	(−0.79)	(−1.26)
ln(VC Fund Size)	1.08***	1.08***	1.06***	1.06***
	(3.51)	(3.51)	(4.01)	(4.05)
VC Fund Age	1.01**	1.01**	1.02***	1.02***
	(2.17)	(2.2)	(5.22)	(5.3)
CVC Strategic Re.	1.02	1.01	0.98	1.02
	(0.1)	(0.07)	(−0.15)	(0.1)
ln(Industry MB)	0.953	0.95	1.04*	1.04*
	(−1.4)	(−1.49)	(1.88)	(1.87)
Early Invest Stage	0.89**	0.89**	1.18***	1.18***
	(−2.10)	(−2.13)	(3.99)	(3.99)
Industry 73	1.16***	1.16***	1.11**	1.11**
	(2.58)	(2.58)	(2.45)	(2.44)
Year Fixed Effects	No	No	No	No
N	1650	1650	3087	3087

Table IX Panel A

Investment and Duration Strategies - IVC v.s. Early CVC Financing

This table presents the results of the regressions that estimate the effects of VC fund characteristics on the investment and duration strategies for IVC-backed start-ups and CVC-backed start-ups that receive the first CVC investment in the first two investment rounds. The results are similar to those in Tables IV and V. The effect of CVC financing on the duration strategy is stronger in this subsample. The coefficient of *CVC* is positive and statistically significant at 1% level for both strategies. The t-statistics and the Z-values are reported in parentheses. ***, ** and * denote statistical significance at 1%, 5% and 10% level. Please see Appendix B for variable definitions.

	ln(Investment Amount)		Duration (Days)	
	Model 1	*Model 3*	*Model 1*	*Model 3*
CVC	0.185***		1.14***	
	(4.64)		(2.86)	
CVC_per		0.207***		1.22***
		(4.03)		(3.47)
Investment Rounds	0.108***	0.109***	0.87***	0.87***
	(16.58)	(16.64)	(−17.96)	(−17.74)
Syndicate Size	0.146***	0.148***	0.99*	0.99*
	(30.71)	(31.27)	(−1.72)	(−1.87)
Syndicate Leader CVC	0.22***	0.21**	0.79***	0.75***
	(2.95)	(2.81)	(−2.86)	(−3.30)
ln(VC Fund Size)	0.373***	0.373***	1.06***	1.06***
	(31.16)	(31.15)	(4.59)	(4.57)
VC Fund Age	0.011***	0.011***	1.01***	1.01***
	(4.36)	(4.33)	(4.17)	(4.18)
CVC Strategic Re.	0.209	0.246	1.07	1.11
	(1.34)	(1.58)	(0.39)	(0.58)
ln(Industry MB)	0.036*	0.036*	0.99	0.99
	(1.73)	(1.74)	(−0.31)	(−0.34)
Early Invest Stage	−0.036	−0.036	1.05	1.05
	(−1.11)	(−1.14)	(1.44)	(1.44)
Industry 73	−0.22***	−0.22***	1.12***	1.12***
	(−6.43)	(−6.45)	(3.03)	(3.00)
Year Fixed Effects	Yes	Yes	No	No
N	3941	3941	3941	3941
Adj. R^2	0.64	0.64	N/A	N/A

Table IX Panel B

Exit Strategy - IVC v.s. Early CVC Financing

This table shows the results of the regressions that estimate the effects of VC fund characteristics on the exit strategy for IVC-backed start-ups and CVC-backed start-ups that receive the first CVC investment in the first two investment rounds. The results are similar to those in Tables VI. The t-statistics and the Z-values are reported in parentheses. ***, ** and * denote statistical significance at 1%, 5% and 10% level. Please see Appendix B for variable definitions.

	Dependent Variable: IPO				
	Model 1	*Model 2*	*Model 4*	*Model 5*	*Model 6*
	OLS	*LOGIT*	*LOGIT*	*LOGIT*	*LOGIT*
CVC	−0.015 (−0.95)	−0.114 (−0.92)		−0.116 (−0.94)	0.308*** (2.65)
CVC_per			−0.217 (−1.33)		
ln(Duration)	−0.023*** (−2.71)	−0.133** (−2.04)	−0.136** (−2.08)		
Duration Year				−0.079** (−2.33)	
(Duration Year)^2				0.005*** (2.62)	
ln(Investment Amount)	0.07*** (12.27)	0.565*** (11.7)	0.568*** (11.87)	0.57*** (11.76)	
ln(VC Fund Size)	−0.005 (−0.92)	−0.012 (−0.26)	−0.014 (−0.3)	−0.006 (−0.12)	0.213*** (5.2)
VC Fund Age	0.00001 (0.01)	0.004 (0.46)	0.004 (0.43)	0.005 (0.58)	0.016* (1.82)
Syndicate Leader CVC	0.041 (1.32)	0.289 (1.24)	0.347 (1.45)	0.27 (1.16)	0.209 (0.91)
CVC Strategic Re.	0.066 (1.03)	0.387 (0.9)	0.386 (0.91)	0.396 (0.92)	0.387 (0.91)
ln(3-month MSCI)	0.255** (2.54)	2.54*** (2.84)	2.55*** (2.85)	2.46*** (2.74)	2.35*** (2.72)
ln(Industry MB)	0.019* (1.88)	0.125 (1.54)	0.127 (1.42)	0.125 (1.4)	0.158* (1.83)
Later Exit stage	0.05*** (3.28)	0.478*** (3.66)	0.475*** (3.64)	0.455*** (3.49)	0.8*** (6.65)
Industry 73	−0.084*** (−5.54)	−0.58*** (−5.14)	−0.578*** (−5.11)	−0.568*** (−5.02)	−0.71*** (−6.55)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	3733	3733	3733	3733	3733
Adj./Pseudo R^2	0.38	0.35	0.35	0.35	0.32