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The Endorsement Effects of Corporate Venture
Capital in the Creation of Public Companies

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Abstract

(Empirical research on the certification role of venture capital investment in initial public offerings (IPOs) tends to ignore how variant attributes and contexts might affect the benefits of affiliation received by a young firm undergoing an IPO. In this paper we argue that because corporate venture capital (CVC) and independent venture capital (IVC) investors possess different types of expertise and investment orientations, they provide different confidence-building signals to investors of newly public firms. Analysis of 1830 initial public offerings during 1990-1999 showed that CVC investment sends a different signal of quality than IVC investment, as reflected in the extent to which the offer price is lower than the market price at the end of the first day of trading than it would be with IVC investment alone. This effect is particularly pronounced when the corporate investor is a bank, or in the same industry as the IPO, and when equity markets are hot. We also found that this effect decreases at an escalating rate when the corporate investor's portfolio becomes larger. Our results confirm the premise that corporations, banks and independent venture capitalists play different endorsement roles in the creation of public companies, and that the value of CVC endorsements depends on key attributes of the CVC and the type of market uncertainty that dominates IPO investors' concerns.

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A substantial body of research has emerged to understand the causes and correlates of new venture performance in the initial public offerings (IPO) market. Performance in the IPO market reflects a young firm's ability to secure resources that are critical for its survival and growth (Gulati & Higgins, 2003; Stuart, Hoang, & Hybels, 1999). Understanding how public investors value a startup's offering is thus a central objective of research on entrepreneurship.

The most frequently used measure of IPO performance is "underpricing," a common phenomenon that occurs when the offer price is lower than the market price at the end of the first day of trading. IPO researchers generally ascribe the underpricing of IPOs to the existence of pre-market information asymmetries that exist between initial shareholders and first-day investors and view the abnormal initial return as an effort to compensate investors, who are, on average, less informed about the firm's potential performance than issuers (Ritter & Welch, 2002). Empirical research on the causes and correlates of IPO underpricing largely examines how different types of information about the firm send signals about IPO firm quality, thereby reducing uncertainty surrounding the stock offering and determining the price at which investors are willing to buy IPO shares on the first day of trading.

Our focus in this study is on the confidence-building signals provided by pre-IPO investor information regarding corporate venture capital investment. Specifically we examine how corporate investment in new ventures, which we call corporate venture capital — or CVC for short — investment may influence the level of IPO underpricing differently than independent venture capital (IVC) investment. We argue that because corporate and IVC investors possess different types of expertise and investment orientations, they send different signals to the IPO market regarding the quality of a young firm. Our study extends current research on the effects of venture capital investment on IPO performance by showing that different types of VC investors provide different kinds of endorsement and that the value of corporate venture capital investment depends on key attributes of the corporate investor and the type of market uncertainty that dominates IPO investors' concerns.

THEORY AND HYPOTHESES

IPO Stock Performance

Organization theorists examining the certification role of pre-IPO investor affiliation have tended to focus on common stock price performance. For example, Stuart, Hoang, and Hybels (1999) studied the effects of endorsement by prominent exchange partners on the pre-money market valuation of biotechnology firm IPOs. Gulati and Higgins (2003) looked at the endorsement effects of inter-organizational ties on the offering's net proceeds and 90- and 180-day market valuations in addition to the pre-money market valuation of biotechnology firm IPOs. Maula and Murray (2002) examined the effects of corporate venture capital investment on the market value of information and communications firm IPOs at the close of the offer.

Finance scholars have played an important role in drawing our attention to a crucial aspect of IPO stock performance referred to as "underpricing," which is the tendency of many IPO stocks to close at the end of the first day of trading at a price higher than the offer price. The finance literature provides a variety of theoretical explanations for the occurrence of underpricing and its magnitude (see e.g., Ritter, 1998; Michaely & Shaw, 1994; Yi, 2003). IPO investors who face high levels of uncertainty

regarding the firm's quality will submit purchase orders only at a discount to the expected value of the share price (Balvers, Affleck-Graves, Miller, & Scanlon, 1993). To attract uninformed investors to the overall pool of potential investors, the firm and its underwriters must therefore discount the price of new issues (Tinic, 1988; Ritter & Welch, 2002). Potential signals of a young firm's quality will reduce the level of uncertainty surrounding the IPO, thereby reducing the need to discount the stock price in order to attract potential investors, and thereby lowering the level of underpricing that occurs (Allen & Faulhaber, 1989; Grinblatt & Hwang, 1989).

In the language of organizational theorists, new organizations need strategies for encouraging a trusting party's beliefs in the aspiring entrepreneur (Aldrich & Fiol, 1994). In addition to the traditional liabilities of newness and smallness, firms undertaking IPOs must overcome a "liability of market newness," that is, the discount that investors place on IPO firms because these firms have not demonstrated an ability to cope effectively with the demands of public trading (Certo, 2003). Underpricing is a form of "illegitimacy discount" that makes up for public investors' lack of trust in a young firm's worthiness (Zuckerman, 1999). We next review the literature that examines how venture capital (VC) investment helps overcome the liability of market newness.

Endorsement Effects of Traditional Venture Capitalists

VCs represent a group of investors with significant experience in evaluating the prospect of new venture projects and monitoring their future development. Studies of the services provided by traditional VCs highlight their role in arranging additional financing, supporting strategic decision making, and recruiting key executives (Maula, Autio, & Murray, 2003a). Traditional VCs expend a great deal of time and effort in evaluating and screening transactions as well as on post-investment information collection and monitoring (Kaplan & Stromberg, 2001). They often possess considerable strategic planning and operating know-how and strong ties to top-tier underwriters and commercial banks, which they marshal to help make the firm successful (Fried & Hisrich, 1995; Gorman & Sahlman, 1989; Lerner, 1994).

Empirical studies provide evidence of the impact of VC expertise on start-up performance. In a study of 173 start-up firms from California's Silicon Valley, Hellmann and Puri (2000) found that venture capital is associated with a significant reduction in the time to bring a product to market even after controlling for VC ability to select more successful companies. In another study of the same data set, they found that firms financed by traditional VCs are more likely and faster to professionalize by adopting stock option plans, hire a vice president of sales, and more likely to bring in CEOs from outside the firm (Hellmann & Puri, 2002). Other studies show that VC backed companies produce more and more valuable patents (Kortum & Lerner, 2000), form relatively better governance structures (Hochberg, 2002), and that VC involvement improves a young firm's post-IPO returns (Brav & Gompers, 1997) and chances of survival in the post-IPO period (Jain & Kini, 2000; Fischer & Pollock, 2004).

The skills and the activities in which traditional VCs engage enable them to provide pre-market certification to firms being taken public, which should lead to a lower level of underpricing. However, empirical evidence on the impact of venture capital investment on IPO underpricing is mixed. Megginson & Weiss (1991) found that VC-backed IPOs are associated with higher underwriter prestige, higher institutional holdings, and lower level of underpricing than non VC-backed IPOs. Barry, Muscarella, Peavy and Vetsuypens (1990) found that monitoring by VCs is recognized by

capital markets through lower IPO underpricing. Cyr, Johnson and Welbourne (2000) found that venture-backed IPOs tend to experience less underpricing because they provide access to key human resources. Studies by Jain and Kini (1995) and Lin (1996) demonstrate that higher levels of VC participation lead to better post-issue performance and lower levels of underpricing. In a more recent study, Li and Masulis (2003) show that there is a strong certification effect and reduced IPO underpricing when the lead underwriter is also a VC. However, in a meta-analysis of the published empirical research on the signaling impact of different types of information on underpricing, Daily et al. (2003) found a significantly positive relationship between the extent of venture capital equity and underpricing.

In addition to investments made by traditional venture capital companies that tend to be privately owned and independently operated, an increasing number of venture capital investments have been made by public corporations that take an equity stake in a pre-IPO company. This is usually done through their own, usually autonomous, investment unit, which participates in the private equity market imitating the set-up and behavior of traditional venture capital firms. However, as we will discuss, there are important differences between corporate venture capital (CVC) investment and traditional, or independent venture capital (IVC) investment, which may affect the signals that are sent to the IPO market.

Endorsement Effects of Corporate Venture Capital Investors

IVC and corporate investors share a common interest in investing in high risk, early stage companies, but they differ in terms of their goals, expertise, and monitoring and evaluation practices. Whereas IVCs' goals are purely financial, that is they look for attractive returns from the performance of the start-up, CVCs' goals may also be strategic, i.e., they may also desire to increase the sales and profits of the corporation's core business by seeking to identify and exploit synergies with the new venture, or by seeking a foothold in new and emerging technologies. Indeed, empirical research has found that corporations engaging in corporate venture capital investment have higher levels of innovativeness (Dushnitsky & Lenox, 2002), are more likely to recognize technological discontinuities (Maula, Keil & Zahra, 2003b), and to engage in explorative learning (Schildt, Maula, & Keil, 2004).

Historically, the tendency of CVCs to focus on strategic goals have been a major reason for the tendency of IVCs to demur from jointly investing with CVCs, or for the propensity for such partnerships to produce significant tensions when they occurred. However, discussions with IVC firms have identified the ability to bring value to portfolio companies through for example, market access, manufacturing expertise, or proprietary technology is a key characteristic that makes a CVC an attractive investment partner (Brody & Erlich, 1998).

The beneficial impact of corporate venture capital investment on the success of early stage firms is supported by empirical research. In an analysis of over 32,000 investments in privately held venture-backed firms between 1983 and 1994, Gompers (2002) reports that, contrary to previous assumptions, corporate venture capital investments have, on average, been more successful than independent venture capital investments. Firms backed by corporate venturing groups were significantly more likely to have gone public and were less likely to have been liquidated. More recently, Maula and Murray (2002) found that new technology based firms co-financed by CVC investments of Global Fortune 500 companies received higher IPO market valuations than comparable firms financed exclusively by IVC investments.

The value-adding contributions of corporate venture capital and independent venture capital are different both in their origins and consequences, the latter being particularly helpful for “enterprise nurturing” and the former being superior in “commerce building” (Maula Autio, & Murray, 2003). Enterprise nurturing refers to such activities as raising additional finance, recruiting key employees and professionalizing the organization; commerce building refers to helping the young firm build commercial credibility and capacity and by providing technological support. In a survey of CEOs and founders of CVC financed, U.S. based technology firms, Maula, Autio & Murray (2003) found that IVCs were perceived as being better at satisfying the needs of entrepreneurs when assisting with arranging financial support, recruiting key employees, advising on competitive moves, and developing the organizational resources of the growing enterprise. In contrast, CVC investors were seen as comparatively more effective in attracting foreign customers and providing advice on the technologies employed by the portfolio firm.

In sum, because CVC investors have orientations, skills, and practices that add value over and above those of IVCs, CVC investment should increase concomitantly the level of confidence that IPO investors have in the quality of the young firm and thereby reduce the discount they expect, as reflected in lower underpricing. Specifically, we posit the following hypothesis:

H1: Underpricing will be lower for IPO firms that are co-financed by corporate venture capital investors than for IPO firms that are financed exclusively by independent venture capital investors.

Bank VC

Key differences in goals, skills, and practices exist not just between IVCs and CVCs, but also between CVCs that are owned by banks and those that are not. As observed by Hellmann (1997), while the natural role of commercial banking in the financing of new companies is on the debt side, a relatively small number have successfully developed their own VC operations, which allows them to participate on the equity side. Because regulation proscribes banks from participating in the supply of equity, the VC operations of commercial banks are typically organized as subsidiaries of bank holding companies and SBIC (small business investment company) affiliates of banks, which are exempt from such regulation (Hellmann, 1997).

Research conducted by Hellmann, Lindsay, and Puri (2003) suggests that banks are strategic investors in the VC market and that their primary value is not in their unique expertise at origination or screening of deals, as others have suggested (e.g., James, 1988). Rather their goals are to forge relationships with future banking clients. As observed by Hellmann et al. (2003), unlike independent venture capital firms, banks can seek complementarities between their venture capital and lending activities. Their study found a strong relationship between banks making venture investments and companies subsequently raising loans. They also found that having a prior venture capital relationship significantly increases a bank’s chance of participating in a company’s loan deal.

Differences in venture investment goals and practices may lead to differently perceived endorsement signals. Because banks expect to benefit from the complementarities between their venture activities and their traditional loan business, IPO investors should expect bank CVCs to pay more attention to post-IPO firm performance than non-bank venture capital investors. Accordingly, we would expect IPO investors to be more confident in the endorsement of a CVC investor when the CVC’s corporate parent is a bank than when it is not a bank. We therefore posit the following hypothesis:

H2: Underpricing will be lower for IPO firms that are co-financed by corporate investors that are commercial banks than for IPO firms that are co-financed by corporate investors that are non-banking institutions.

Relatedness of CVC investment

IPO firms can be related to a venture capital unit's parent corporation by operating in related industries. Industry relatedness reflects a number of shared industry characteristics, including the products and services they offer, the inputs and technologies they use, the customers they serve, the way they organize operations, and the cognitive schema that drive executive decisions (Schildt et al., 2004). In addition to facilitating knowledge exchange between the IPO firm and its corporate investor, similarity along these dimensions should lead to the imparting of know-how that is of greater benefit to the young firm's performance. This help is reflected in the ability of the investor to (1) mobilize suppliers, distributors, and other important resource providers on behalf of the young firm; (2) offer more valuable strategic and operating advice; and (3) exercise a higher level of discipline when monitoring downward performance.

Empirical evidence supports the importance of industry relatedness in enhancing venture performance. A study by Gompers and Lerner (1999) that compared performance of CVC-backed ventures to IVC-backed ventures found that CVC-backed ventures were more likely to outperform IVC-backed ventures when CVCs were in related industries. They also found that CVC investments in early-stage companies are more likely to be in a related company than later stage investments and that the probability of a CVC investment being made in a related industry increases over time as corporations learn about the value of related investments. Together, these results suggest that CVCs are more likely to benefit new ventures when they exploit complementarities with their parent company's existing line(s) of business.

Based on the above observations, we would expect IPO investors to be more confident in the endorsement of a CVC investor when the CVC's corporate parent is in an industry that is related to that of the IPO firm. Conversely, confidence of IPO investors in the quality of the young firm is likely to be lower when the corporate parent of the CVC is in a non-related industry. We therefore posit the following hypothesis:

H3: Underpricing will be lower for IPO firms that are co-financed by corporate investors in a related industry than for IPO firms that are co-financed by corporate investors in an unrelated industry.

Size of the CVC portfolio

Thus far we have examined how the experience base of the CVC investor influences the level of confidence that IPO investors have in the CVC's endorsement signals. We have argued that the different goal and skill sets possessed by different types of VC investors will influence the confidence level of IPO investors in different ways. In presenting this argument, we focused on whether or not the parent company of the CVC is a bank or not, or whether it is in a related industry, influence investor uncertainty. We now extend this discussion to examine how the size of the corporation's IPO portfolio may influence the endorsement value of CVC investment to investors contemplating the

purchase of IPO stock. While it is true that the total portfolio size of the corporate investor is also important, we focus on other IPOs in the portfolio because IPOs require more managerial attention than other startups.

The greater the volume of IPO investment in which the corporation is engaged, the thinner the corporation spreads its ability to impart the requisite level of know-how to each IPO in the portfolio. When the number of IPOs in which a CVC is invested hits an attention span threshold, it is likely to dilute the resources that need to be put into monitoring and evaluation, which in turn diminishes the effect of the commerce-building expertise the CVC possesses. In addition, when the number of IPOs in the corporation's venture investment portfolio appears to be too high, the CVC is more likely to appear to be overly interested in the financial returns that come from IPO liquidity events rather than those that come from post-IPO performance. Together, these arguments suggest that the level of confidence that a CVC inspires in IPO investors will decline when the size of the IPO portfolio becomes too large. We therefore hypothesize the following:

H4: The size of the CVC's IPO investment portfolio will affect underpricing negatively, and at a diminishing rate.

“Hot” vs. “cold” equity markets

An affiliation with a corporate venture capital investor can be very important in reducing uncertainty and increasing IPO investor confidence. However, from an attention-based perspective, the scarce resource is typically not information, but the amount of attention that decision makers can allocate to searching for, sorting through, and interpreting the available information (Hansen & Haas, 2001; Ocasio, 1997). Based on such a perspective, Gulati and Higgins (2003) propose that IPO investors shift from one concern to the other and from one source of information to another depending on the type of market uncertainty that dominates their concerns. They argue that different types of endorsement relationships mitigate different types of uncertainty and thus vary in importance at different times. Their argument is premised on two important claims. First, equity markets entail two overarching types of uncertainty concerns for investors – investing in low-potential firms or missing high potential opportunities. Second, investors' attention shifts more toward one or the other depending on the receptivity of the equity markets. When the equity markets are relatively hot for new issues many firms go public, making the probability, of, and concern about, investing in unworthy firms more salient; when the equity markets are relatively cold for new issues, fewer firms go public, making the probability of, and concern about overlooking good firms more salient (Gulati & Higgins, 2003).

To test their proposition, Gulati and Higgins examined the contingent value of different types of endorsement ties at the time of a young firm's IPO. Their analysis of a sample of young biotechnology firms shows that ties to IVCs are particularly beneficial to IPO success during cold markets when IPO investors pay more attention to VC endorsement; whereas ties to investment banks are particularly beneficial to IPO success during hot markets when IPO investors pay more attention to investment bank endorsement. This is because IVCs tend to conduct more focused and accurate screening during cold markets when they are not overwhelmed by the overconfidence and information overload to which they are vulnerable during hot markets (Zacharakis & Shepherd, 2001). In contrast, investment banks prefer to engage in post-offering deals (Wolfe, Cooperman & Ferris, 1994) and are extremely avoidant of risky ventures (Beatty & Ritter, 1986; Carter & Manaster, 1990), a propensity

that is particularly valuable during hot markets when investors are concerned about investing in bad deals.

While these results support the market-based contingent value of ties to independent venture capitalists versus investment banks, they do not examine the market-based contingent value of corporate venture capitalists versus independent venture capitalists. However, based on our previous observations regarding important differences between CVCs and IVCs, we argue that we should also find a concomitant difference in the way market uncertainty affects the receptivity of IPO investors. In contrast to IVCs, which are privately owned, CVCs operate out of publicly owned corporations. Public ownership brings about increased monitoring and disclosure, which lowers the flexibility managers have in taking excessive risks (Maksimovic & Pichler, 2001; Pagano & Roell, 1998). We would therefore expect investors to view CVCs as tending to be avoidant of risky ventures in contrast to IVCs. In addition, CVCs are much more interested in the long-term post-IPO performance of the young firm than are IVCs, as we have argued earlier. Such a propensity is particularly valuable during a hot market, when IPO investors are particularly concerned with investing in unworthy ventures. Accordingly, we hypothesize:

H5: The endorsement effects of corporate venture capital investment on underpricing will be stronger when the equity markets are hot than when they are cold.

METHOD

Data and Sample

We started with a dataset of 6,000 “firm commitment” Initial Public Offerings in the U.S. capital markets from 1990 to 1999. The firm commitment IPO is a type of offering that is purchased by the underwriters from the issuing companies at a certain offer price. Ultimately, these investment banks bear the risk of selling the new shares in the capital markets. Given our focus on venture-backed companies, we further selected a sub-sample of 2,008 IPOs that had at least one venture capitalist investor. Detailed information on these 2,008 companies were matched and checked from Venture Economics to verify the presence of venture capital investment in sample firms. In some cases we deleted unreliable SDC data and in other cases we substituted variables manually from the proxy statements submitted to the SEC. After going through this process we had consistent data available for 1,830 “bona fide” IPOs with at least one venture capitalist in the ownership structure.

We further traced the VC investor structure of all of these 1,830 IPOs and matched all individual VCs against the list of U.S. Public Companies in business in local and international capital markets primarily using Compustat data sources. We then cross-checked with the Center for Research on Securities Pricing (CRSP) listings, Datastream, and Worldscope data sources. This detailed search gave us a total sample of 315 of the VC-backed IPOs that had at least one publicly traded corporation — which we call a corporate venture capitalist or CVC — holding more than 5% of the equity of the venture prior to IPO. Additionally, we matched SIC components of publicly traded companies to detect the primary product line of these investors. From the CRSP and Compustat tapes, we found 20 of the sample companies whose primary product line specialization matched the primary activity of the 315 CVC-backed IPOs at the 4-digit SIC level (36 at the 2-digit level). There were 13 IPOs in which both bank and non-bank corporations made investments, so in the subsample analysis reported

here, we exclude those 13 for a sample of 302 CVC-backed IPOs. Excluding the 13 allows us to partition the subsample between those receiving bank-backed and those receiving non-bank-backed CVC. Including the 13 does not change the results, but makes the interpretation a little cleaner.

Dependent Variable

Following McGuiness (1993), we calculated IPO underpricing by first subtracting the initial offer price from the price at the end of the first day of trading and then dividing this difference by the initial offer price. In other words, underpricing is defined as the percentage change of the offer price (OP) from the pre-IPO price to the end of first day stock price (P1). Thus, if the price at the end of the first day is higher than the offer price IPO underpricing is positive, and if it is lower than the offer price IPO underpricing is negative. The first day stock price data used in calculating the underpricing was drawn from the CRSP database.

Independent Variables

We drew the data used to operationalize the independent and control variables in our analysis from the "Global New Issues" and "VentureXpert" components of the Thomson Financial Corporation's SDC Platinum database, the CRSP database, and COMPUSTAT data sources. We also hand-checked pre-IPO prospecti.

Corporate venture capital investment. This variable takes on the value of zero if there is no corporate venture capital (equity) investment made prior to the IPO and one if there is an investment from a traded-traded corporation prior to IPO, as confirmed by matching the names of investors against Compustat data on public companies. Additionally, we checked the institutional investors' 13(f) database to verify that these corporate investors continued their ownership involvement after the IPO firms became public.

Bank CVC Investment. The CVC variable can be associated with different types of corporate ownership. For example, in our IPO sample, some CVCs are associated with commercial banking institutions — termed as Bank-CVCs and others are associated with regular non-bank corporations. This variable is set equal to one if the corporate (equity) investors in the IPO was a commercial bank, zero if the corporate investor was a non-bank. We only use this distinction when examining the subsample of IPO firms with at least one CVC investor (hypotheses 2, 3, and 4).

Industry Relatedness. This variable is set equal to one if any one of the pre-IPO corporate equity investors was in the same 4-digit SIC code. For example, if a startup company in SIC 3625 had three investors, a professional VC firm and two corporations, one in SIC 3625 and another in SIC 7324, then we would say that one of the corporate investors was in the same line of business and thus this variable would take on the value of one. If they both were in different 4-digit SIC codes, the variable would take on a value of 0. The variable is undefined in the cases where there are no corporate investors.

Size of IPO Investment Portfolio. This variable is measured as the number of investments CVCs had with other VC-backed IPO investments and is only defined for those cases in which there was at least one corporate investor. In a small number of cases (seven), there was more than one corporate

investor. In this case, we took the average portfolio size of all the corporate investors. We also excluded these seven cases from our analysis with virtually identical results. We then took the squared value of this “other investments” variable to investigate a possible non-monotonic relationship with underpricing. To rule out collinearity problems, we transformed the variable and its square term into orthogonalized variables (see Pollock & Rindova, 2003 and fuller discussion below).

Control Variables

Following common practice in regression analysis of IPO performance (e.g., Pollock & Rindova, 2003; Carter & Manaster, 1990; Johnson & Miller, 1988), we control for (1) Age measured as the log number of years the firm has been in existence prior to the IPO, (2) *Total proceeds*, measured as the log dollar amount raised in the IPO, (3) *Insiders' fraction*, measured as the percent of management ownership in the venture prior to the IPO, (4) *Return on assets*, measured as net income divided by total average assets, (5) *Underwriter rank*, as measured by the criteria used by Carter and Manaster, 1990, and Carter, Dark, & Singh, 1998). We also control for (6) the *technology-intensiveness* of the industry in which the IPO firm operates (dummy variable set to one if firm is technology-intensive, 0 if not), and (7) *Year 1995-1999* (Dummy variable representing years in which stock returns were much higher).

Method of Analysis

We used OLS regression techniques to examine the relationship between CVC investment in startup companies and IPO underpricing. The specification for the model is:

$$Y_i = a + \mathbf{b}'\mathbf{X}_i + e_i$$

where for each IPO_{*i*} we associate the characteristics of the IPO (*X*, such as whether the IPO had a corporate investor or the total proceeds of the IPO) with the outcome *Y* (underpricing), with the values of the vector *b* reported as the coefficients of the independent and control variables. The reported t-statistics are based on standard errors adjusted for heteroscedasticity.

RESULTS

Table 1 presents the descriptive statistics and correlation coefficients of all the variables used in the full sample (used to test hypotheses 1 and 5), and Table 2 presents the descriptive statistics and correlation coefficients of all the variables used in the restricted CVC-recipient only sample (used to test hypotheses 2 through 4 where some of the independent variables are undefined in the full sample).

Table 1 : Descriptive Statistics and Correlations, full sample.

Variable	Mean	S.D.	1	2	3	6	7	8	9	10
1. Underpricing	0.2678	0.486								
2. CVC Investment	0.1721	0.378	-0.071*							
5. Insider's Fraction	0.1260	0.086	-0.001	-0.088*						
6. Underwriter Rank	7.0765	1.315	-0.044	0.398*	-0.057					
7. Firm Age at IPO ^a	3.76	2.37	0.049	0.339*	-0.026	0.102*				
8. Total Proceeds ^a	68.31	110.5	-0.067*	0.570*	-0.145*	0.228*	0.163*			
9. ROA	0.0673	0.719	-0.014	0.018	0.014	0.015	-0.007	0.012		
10. Year 1995-1999	0.568	0.495	0.262*	0.067*	0.012	0.028	0.057	0.071*	0.015	
11. Technology firm	0.249	0.433	-0.048	0.085*	-0.058	0.089*	0.049	0.078	-0.046	-0.013

^aLogarithm *p < 0.01

Table 2. Descriptive Statistics and Correlations, CVC restricted sample.

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10
1. Underpricing	0.15	0.29										
2. Bank CVC	0.32	0.47	-0.10									
3. Industry relatedness	0.06	0.24	-0.14	0.10								
4. Size of portfolio ^b	1.70	2.52	-0.07	-0.01	0.11							
5. Insider's Fraction	1.25	3.52	0.005	-0.05	-0.02	-0.04						
6. Underwriter Rank	8.23	1.25	-0.21*	-0.11	0.10	0.10	-0.04					
7. Firm Age at IPO ^a	1.75	0.67	0.06	-0.07	-0.10	-0.01	-0.007	-0.10				
8. Total Proceeds ^a	4.98	1.14	-0.10	-0.18*	0.06	0.03	-0.09	0.26*	-0.13			
9. ROA	0.10	1.53	-0.04	-0.04	-0.02	-0.02	0.94*	-0.006	-0.03	0.04		
10. Year 1995-1999	0.64	0.48	0.12	-0.41*	-0.02	-0.10	0.05	0.02	-0.005	0.06	0.04	
11. Technology firm	0.33	0.47	0.02	-0.11	0.01	-0.02	-0.06	-0.02	0.08	-0.05	-0.07	0.06

^aLogarithm ^bOrthogonal transformation *p < 0.01

Table 3 gives the results of OLS regressions on underpricing for the full sample of firms for the full ten-year panel. As shown in Table 3, multiple combinations of relevant variables were conducted to provide a robustness check of the results, to ensure that the results are not an artifact of multicollinearity, and to control for important, firm or industry/sector-specific phenomena. As shown in column 2, CVC investment has a significantly negative effect on underpricing. Columns 3-5 show that although the introduction of control variables affects the R-squared statistic, i.e., the percentage of variance in underpricing that is explained, the hypothesized effects remain significant in the directions that were posited. Specifically, the results indicate that the additional presence of a CVC investor has a negative relationship with underpricing at the 1% level of significance, thus providing support for Hypotheses 1.

Table 3 : Results of OLS Regression Analysis, full sample (N=1830)^{a,b}.

Variable	Model 1	Model 2	Model 3	Model 4
Intercept	0.292*** (23.50)	0.221*** (2.72)	0.109 (1.38)	0.11 (1.40)
CVC	-0.138*** (4.62)	-0.178*** (4.41)	-0.186*** (4.79)	-0.185*** (4.76)
Insider's Fraction (%)	-	-0.00098 (0.12)	-0.0027 (0.34)	-0.0029 (0.36)
Underwriter Rank	-	0.00054 (0.06)	0.00016 (0.02)	0.001 (0.12)
Firm age at IPO ^c	-	0.067*** (3.94)	0.059*** (3.62)	0.060*** (3.67)
Proceeds ^c	-	-0.0019 (0.16)	-0.0079 (0.69)	-0.0072 (0.64)
ROA	-	-0.54 (0.25)	-0.0048 (0.23)	-0.0056 (0.021)
Year 1995-1999 Dummy	-	-	0.26*** (11.97)	0.262*** (11.94)
Technology firm	-	-	-	-0.041 (1.64)
Adjusted R-Squared	0.011	0.0169	0.088	0.089
F-Statistics	21.38***	6.23***	26.22***	23.30***

^aDependent variable is Underpricing = (IPO Stock Price on Day 1 - IPO Offer Price) / IPO Offer Price.

^bt-statistics computed with White corrected standard errors of respective parameters are shown in parentheses.

^cLogarithm

*p < 0.10, **p < 0.05, ***p < 0.01

Table 4 shows the results of the regression analysis used to test hypotheses 2 through 4. As shown in column 2, bank-CVC had a significantly negative effect on underpricing, which suggests that the presence of bank CVC investors has a more pronounced negative relationship with underpricing than does the presence of non-bank CVC investors, thus providing support for Hypothesis 2. As shown in column 3, industry relatedness also has a negative impact on underpricing, significant at the 5% level of significance, thus providing support for Hypothesis 3. As also shown in column 3, the size of the CVCs' IPO investment portfolio variable and its square terms had significantly significant effects on underpricing and that the number of IPO investments of CVC investors affects underpricing at a diminishing rate, as evidenced by the coefficients of the variable and its squared term. These results thus provide support for Hypothesis 4. Columns 4-6 show that although the introduction of control variables affects the R-squared statistic, the effects conjectured in hypotheses 2 through 4 remain significant in the directions that were posited.

While the extent of involvement of CVCs in other IPOs recorded a strong negative association with underpricing, the square term of this variable reported a strong positive impact. Using a mean-centered transformation of the IPO portfolio size variable, we found highly similar results. Because of the skewness of the distribution, we also tried a median-centered transformation. However, because the variable and its square term are highly correlated, and the mean and median are both equal to one, those centered variables are also highly correlated. Variance inflation factor analysis confirmed that collinearity was a potential issue. Thus we undertook another method of investigating this association. Following the procedure of Pollock and Rindova (2003) for squared terms as

proposed by Cohen and Cohen (1983), we generated orthogonalized variables that "partial out" the main term from the squared term. Statistical significance of these orthogonalized variables corresponds to the statistical significance of the original variables, and it is these transformed results that we report in the columns of the tables where the IPO portfolio size and its square enter into the specification. We are therefore confident that the signs and statistical significance of the IPO portfolio size associations reported here are not due to collinearity.

Table 4 : Results of OLS Regression Analysis, restricted sample (N=302)^{a,b}.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	0.173*** (9.50)	0.215*** (10.11)	0.661*** (4.97)	0.610*** (4.47)	0.610*** (4.45)
Bank CVC Dummy	-0.085*** (2.54)	-0.086*** (2.60)	-0.092*** (2.83)	-0.069* (1.95)	-0.069* (1.93)
Industry relatedness	-	-0.246*** (3.88)	-0.221*** (3.59)	-0.221*** (3.60)	-0.221*** (3.58)
Size of portfolio ^c	-	-0.042*** (3.47)	-0.040*** (3.38)	-0.036*** (2.97)	-0.036*** (2.97)
Size of portfolio squared ^c	-	0.038*** (3.33)	0.039*** (3.48)	0.036*** (3.14)	0.036*** (3.13)
Insider's Fraction (%)	-		0.007 (0.56)	0.007 (0.52)	0.007 (0.52)
Underwriter Rank	-		-0.061*** (4.78)	-0.061*** (4.75)	-0.061*** (4.74)
Firm age at IPO ^d	-		0.019 (0.87)	0.020 (0.93)	0.020 (0.93)
Proceeds ^d	-		0.0036 (0.25)	0.0036 (0.26)	0.0036 (0.26)
ROA			-0.024 (0.78)	-0.023 (0.75)	-0.023 (0.75)
Year 1995-1999 Dummy	-	-	-	0.054 (1.61)	0.054 (1.61)
Technology firm	-	-	-	-	0.00006 (0.00)
Adjusted R-Squared	0.018	0.082	0.144	0.149	0.146
F-Statistics	6.46**	7.70***	6.62***	6.25***	5.66***

^aDependent variable is Underpricing = (IPO Stock Price on Day 1 - IPO Offer Price) / IPO Offer Price.

^bt-statistics computed with White corrected standard errors of respective parameters are shown in parentheses.

^cOrthogonal transformation.

^dLogarithm.

*p < 0.10, **p < 0.05, ***p < 0.01

Table 5 shows the regression analysis of the full sample variables for two five-year periods: cold (1990-1994) versus hot (1995-1999). In the "cold" period of 1990-1994, stocks as measured by the S&P 500 index returned 8.7%, the lowest five-year return in the 25 years through 1999. In the "hot" period, stocks returned 28.6%, the highest five-year return in at least 40 years. As shown in Table 5, the coefficients for the effect of CVC investment are larger for the hot period than for the cold period. The results of a Chow test analysis (Davidson & MacKinnon, 1993: 375-376) found that there were statistically significant differences between the two subsample time periods. These results support the expectations posited in Hypothesis 5.

Table 5: OLS Regressions for Cold (1990-1994) vs. Hot (1995-1999) Equity Markets, full sample^a.

Variables	Cold Period (1990-1994) (n=790)	Hot Period (1995-1999) (n=1040)
Intercept	-0.0013 (0.03)	0.455*** (3.38)
CVC	-0.051** (2.12)	-0.257*** (3.99)
Insider's Fraction (%)	-0.002 (0.30)	-0.006 (0.45)
Underwriter Rank	0.015*** (2.86)	-0.009 (0.56)
Firm age at IPO ^b	0.006 (0.58)	0.095*** (3.54)
Proceeds ^b	0.003 (0.40)	-0.013 (0.69)
ROA	-0.028 (1.41)	0.005 (0.16)
Technology company	0.052*** (3.50)	-0.111** (2.58)
Adjusted R-Squared	0.024	0.039
F-Statistic	3.78***	6.99***

^at-statistics computed with White corrected standard errors of respective parameters are shown in parentheses. Chow test *F* statistic of differences in regression slope =28.3***.

^bLogarithm.

*p < 0.1, **p < 0.05, ***p < 0.01

DISCUSSION AND CONCLUSION

Previous studies show that independent venture capitalists play an important endorsement role for young firms undergoing their initial public offering (IPO). In this study, we proposed that investment ties to corporate and bank-based venture capitalists provide additional signaling benefits that are linked to different types of goals and value-adding practices. To test this proposition, we studied a sample of 1830 young firms undergoing IPOs during 1990-1999 to examine the effects of these different types of endorsement relationships on IPO underpricing. We found that CVC investment sends a different signal of quality than IVC investment, as reflected in lower underpricing, even when controlling for underwriter reputation, percentage of insider holdings, firm age, ROA, size of stock proceeds, market period, and technology intensiveness of the IPO firm. We also found that IPO investors perceive different levels of quality depending on whether or not the parent of the CVC investor is a bank or not, or whether or not it is in the same industry as the IPO firm. In addition, we found that the relationship between underpricing and the volume of start-up investments made by the corporation is negative, but at a non-monotonic rate. Together, these findings support the proposition that corporations, banks and venture capitalists play different endorsement roles in the creation of public companies and that IPO investors pay more attention to CVC endorsements when equity markets are hot.

Certainly, it could be that CVCs select different types of ventures in which to invest, and by virtue of their selection, they tend to choose ventures that eventually have lower underpricing. This argument,

if true, would mitigate or reduce the logic of the endorsement effect. To rule out this argument, we undertook an additional *post hoc* study of CVC selection. We performed a simultaneous maximum-likelihood selection analysis with the following specifications:

Selection Model: $CVC = fn(\text{Age at IPO, Industry Relatedness, Insider Share, Assets, Technology Company, Portfolio Size, Portfolio Size-squared})$

Performance Model Underpricing = $fn(\text{Age at IPO, Underwriter Rank, Insider Share, Year 1995-1999, Technology Company, CVC})$.

This model (as shown in Table 6) and others with similar specifications do indeed demonstrate that CVCs are selecting different companies (older ones, ones with higher insider shares, more assets), but the main association with CVC from underpricing controlling for the selection effect is negative and statistically significant at $p < 0.01$. Thus we conclude that there *does* appear to be an endorsement effect above and beyond any selections that corporations make.

Table 6 : Predicting underpricing controlling for CVC recipient selection.

Simultaneous maximum-likelihood selection model			
	<i>Selection Model</i> CVC recipient	<i>Perf. Model:</i> Under-pricing	
Log age	0.779*** (0.070)	0.061*** (0.018)	
Related industry	13.06 (9251)		
Insider share	0.054*** (0.021)	-0.002 (0.008)	
Log assets	0.423*** (0.029)		
Technology company	0.524*** (0.524)	-0.042* (0.025)	
Other portfolio companies	1.251*** (0.228)		
Other portfolio companies-squared	-0.052*** (0.014)		
Underwriter rank		0.001 (0.009)	
Return on assets		-0.007 (0.021)	
Period 1995-1999		0.262*** (0.022)	
CVC recipient		-0.198*** (0.056)	
Constant	-4.218*** (0.196)	0.085 (0.069)	
Rho		0.00018	
Lambda		0.00082	
Wald chi-squared		164.4***	
Obs.	1830	1830	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, standard errors in parentheses

Implications of Results

This study has important implications for managerial perspectives on the endorsement benefits received by IPO firms from venture capital investors. Gulati and Higgins (2003) assert that young firms can gain from "ties" to "established" firms. Other research suggests that certain characteristics of firms lead to uncertainty reduction (or creation) with respect to firm quality, which in turn affects underpricing and ultimately how much money founders keep and investors pay for their shares (Allen & Faulhaber, 1989; Grinblatt & Hwang, 1989). Empirical evidence further supports the proposition that venture capital financing provides a major signal that reduces uncertainty about a young firm in the public markets (Barry et al., 1990; Li & Masulis, 2003). However, prior research on the endorsement effects of venture capital investment has generally concentrated on IVCs and has tended to ignore how the involvement of CVCs in general as well as the presence of key distinguishing features among CVCs might alter the signal that is received by the IPO market.

We extend this literature by considering different kinds of VC investment. We show that investors are fairly sophisticated in discerning different signals of quality that are reflected by the involvement of different types of VC investors. In particular, we show that CVC investment provides a signal that IPO investors value above and beyond the endorsement provided by IVC investment. Our study further demonstrates that IPO investors react differently depending on the type of corporation in which the CVC operates, specifically whether the corporate parent is bank or not, whether its core business is in the same industry or not, and how extensive is its portfolio of IPO investments. Last, in examining the different CVC endorsement effects that occur in hot vs. cold markets, our results support the arguments made by Gulati and Higgins (2003) that the value of endorsement relationships also depend on the type of market uncertainty that dominates IPO investors' concerns. In total, these results underscore the need for future research on the endorsement effects of pre-IPO investor relationships to take into account key attributes of the investor and the IPO markets.

Our study also expands the research on the role of corporate venture capital in the creation and development of new companies. Despite its having gone through many cycles of feast and famine, corporate venture capital appears to be an increasing part of VC investments that are involved in new firms. This heightens the need to understand the benefits that accrue to start-ups that get venture capital from corporations. Prior empirical work has focused primarily on the value that CVC investment provides to the parent corporation (e.g., Dushnitsky & Lenox, 2002; Maula et al., 2003b; Schildt et al., 2004). The studies that have examined the impact of CVC investment on new firm success have used measures such as likelihood of going public and liquidation (e.g., Gompers, 2002), or market valuation (e.g., Maula & Murray, 2002). Although the work of Maula and Murray (2002) makes an important contribution to the empirical literature on the effects of CVC investment on IPO performance, their study ignores the endorsement value that is reflected in underpricing. In addition, their study focuses on a particular industry sector, thereby making the implication of their findings less generalizable. In contrast, our study examined the endorsement impact of CVC investment on IPO underpricing in a variety of industry sectors, which we believe is a particularly useful way of understanding how CVC investment can help overcome the "illegitimacy discount" that is created by public investors' lack of trust in a startup's worthiness.

Limitations and Future Research Opportunities

Virtually every firm in our analysis had a traditional independent VC as an investor. We must therefore be cautious in generalizing our findings to endorsement effects of CVC investment in non-IVC-backed IPOs. Because of their confidence in the deal origination and screening skills of IVCs, most CVCs invest in a startup only when a traditional IVC leads the funding round (Maula, Keil, & Zahra, 2003). When only CVCs are involved, the investment may more likely be entirely strategic and may not send the same positive signal of quality. In other words, CVC investment may reduce underpricing significantly only when there are IVC investors present as well. Future research might examine to what extent the endorsement benefits IPO firms from the presence of a CVC investor depends on the additional presence of an IVC investor.

IPO investors might also look at the structure of the CVC program when evaluating the signal sent by the presence of a corporate investor. Corporate venture capital programs may vary in their organizational location, in the level of involvement between the CVC unit and the parent corporation, and in the compensation scheme that accompanies the structural design of the program (Chesbrough, 2000; 2002; Gompers & Lerner, 1999). Some programs are organized as separate units either as wholly owned subsidiaries that are responsible for pursuing venture capital investments, or as dedicated fund programs that are generally co-managed with an IVC; others are organized as direct investment programs under the umbrella of an operating business unit that is responsible for CVC investment activities. Direct investment programs are characterized by tight linkages between the start-ups in which they invest and the operations of the business unit as well as by compensation schemes that are based on corporate parent performance; dedicated fund programs are characterized by loose linkages between the start-ups in which they invest and the business operations of the corporation as well as by compensation schemes that are based on new venture performance; and wholly owned subsidiaries can be designed to have either tight or loose linkages and compensation schemes that are linked either to corporate or to start-up performance, or to both. Future research might usefully examine whether and how these different types of CVC structures influence the way in which IPO investors interpret the signals sent by CVC investment.

We looked at industry relatedness, which we characterized as within similar four-digit SIC classifications, an admittedly broad measure which may actually be a composite of several factors. Future research could also examine other kinds of relatedness. These include vertical market relatedness in which either the corporation is a customer of the start-up or vice versa, and technological relatedness in which the start-up possesses an innovation that complements the corporation technologically (Schildt et al, 2004). Perhaps the market values technological relatedness more than vertical market relatedness in certain situations, or if the corporation is a customer of the funding recipient, it might send a stronger signal about the viability of the company than if the corporation is a supplier.

Finally, we recommend that future research probe deeper into the validity of the signals that are sent by CVC investment. Apparently, corporations, by virtue of their investment in new ventures, bring additional value to the table, and investors in the public markets realize this. It could be that the corporation sends a signal that the venture is a viable entity, or that the corporations' investment, in and of itself, makes it a viable entity. The results of this study help provide a first step in understanding the longer-term strategic and financial benefits of CVC investment for both the investor and the entrepreneur. Specifically, this paper adds to prior evidence that there are potential financial

returns (in this case, the corporate investor receives a higher return from the IPO) in addition to strategic ones from investing in CVCs. From the new venture's side, this study adds credibility to what some founders already appear to know: despite some drawbacks, having a corporation as an equity partner provides not only an important source of funds, but also may help secure funding in later stage financial markets. Our results suggest that even though CVCs might have interests that are self-serving, the perception of the market is not mutually exclusive to benefits that accrue to the startup as well. The very value that the CVC brings to the table might potentially allow both it and the startup to benefit. We have shown that there is most likely an endorsement benefit that influences IPO underpricing. Future research should examine actual firm performance of the venture over the post-IPO growth period to see whether that same endorsement was indeed prescient.

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