VC Board Representation and IPO Performance

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Abstract

This paper studies the impact of five dimensions of venture capitalist (VC) power on the likelihood of VC board representation in their portfolio firms at the initial public offering (IPO) as well as the effect of the latter on IPO performance. The dimensions of VC power are based on Finkelstein's (1992) four dimensions of power which are ownership power, structural power (i.e. the VC's rank within the firm's financial hierarchy), expert power (i.e. VC industry specialization), prestige power (i.e. the number of IPOs the VC has been involved with so far). We add controlling power (i.e. how pivotal the VC is to the voted decision) to these four dimensions. We find that all five dimensions of power have a significantly positive impact on the likelihood of VC board membership. While controlling for the possible endogeneity of the latter, underpricing and the IPO premium are higher when there is VC board membership, which is consistent with both the grandstanding and management support hypotheses. Our results suggest that VCs have a real impact on IPO performance and that they do not just maintain a strong presence in better performing companies after the IPO.

Keywords: Underpricing, IPO premium, venture capital, voting power, board membership, chief executive officers

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1- Introduction

Most existing studies on the presence of venture capitalist (VC) firms in initial public offerings (IPO) focus on the effects of VC power and board independence on IPO performance. While VCs benefit from numerous stipulations and provisions in the term sheet agreements that enable them to intervene in their portfolio companies, many VCs also hold board seats (Lerner, 1995). Ultimately, VC board membership is the result of a bargaining process between the VC and the CEO with the bargaining power of each party depending on its relative power. VC board representation is therefore the outcome of the characteristics of the VCs, the CEO and the firm itself. Further, in this paper we argue that the decision to go public and in particular the pricing of the IPO are the result of the balance of power within the IPO firm, and more specifically within its boardroom.

The effects of VCs on IPO performance may be positive or negative. On the one hand, VC power and board representation may have a positive effect on firm performance as VC firms play a significant role in the development of their portfolio companies. Although they are not normally involved in the day-to-day management of their investee firms, they provide management guidance, networking for strategic alliances (Hellmann and Puri, 2002, Sorensen, 2007, Hochberg, Ljungqvist and Lu, 2007), and financial support (Gorman and Sahlman, 1989; Sahlman, 1990, Bygrave and Timmons, 1992, Gompers and Lerner, 1999). Moreover, VCs help their firms design their organizational structure, build their teams, and develop their market share (Hellmann and Puri, 2002). They are also active investors and they put in place mechanisms aimed at monitoring the management (Cornelli and Yosha, 2003; Hellman, 1998). All of this helps alleviate moral hazard and adverse selection problems between insiders and outside investors (Fama, 1985 Kaplan and Strömberg, 2003). Based on survey evidence, Rosenstein et

al. (1993) report that CEOs typically value VC representatives on the board of directors more than other board members as measured by their effort and their usefulness. VCs may therefore play a positive role which is likely to increase the growth opportunities of the IPO firm and thus increase the premium paid by outside investors, i.e. the difference between the offer price and the book-value per share. VC firms may also certify the quality of the company and increase its market value (Megginson and Weiss, 1991).

On the other hand, VCs may use their power and board representation purely for their own benefit and to the detriment of the other shareholders. In other words, via the power they have over the senior management of their portfolio companies, they may push through decisions which are in their own interest, but not in the interest of the other shareholders. Such decisions may consist of grandstanding, i.e. taking their portfolio companies public prematurely to enhance their own reputation (Gompers, 1999). The power of VCs may thus increase rather than reduce investors' concerns about the risk of adverse selection, thus increasing underpricing.

There are two major contributions of this paper to the existing research. First, whereas previous research has focused on the effect of board independence on underpricing and IPO premium, this paper concentrates on the equivalent effect of VC board representation. In particular, the paper provides empirical support for Casamatta (2003) who models the rationale for partnering with a VC. Second, contrary to prior research which measures VC power indirectly by the VC's reputation (Baker and Gompers, 2003), we use a more direct measure of VC power which is VC board representation. In addition to VC board representation, we use five measures of VC power. Four of these measures are based on Finkelstein's (1992) dimensions of power which are ownership power, structural power, expert power and prestige power. We add a fifth dimension

which is controlling power and which measures how pivotal the VC is to the voted decision. We also use other more indirect measures of VC power such as the level of independence of the VC, its location, a possible industry focus and whether the VC is from the USA or from overseas.

Based on a sample of 304 US VC-backed IPOs during 1997 and 2007, this paper sheds light on the outcome of the bargaining between CEOs and VCs. Loosely based on the bargaining model of Hermalin and Weisbach (1998), we expect that the probability for a VC to sit on the board depends on both VC and CEO characteristics. We find empirical evidence in support of such a relationship. First, the probability for a VC to sit on the board of directors is positively related to the VC's controlling power and ownership. The probability is higher for "lead" VCs, i.e. those VCs with the highest stake that participate in the first round of financing, as well as for more experienced VCs. It is also higher for VCs who are geographically close to their IPO firms, those specializing in the same industry as that of the investee firm, independent VCs, and foreign VCs. Second, VCs are more likely to hold a board seat in IPOs with more educated CEOs and those chairing the board of directors, whereas they are less likely to sit on the board of firms with higher CEO pre-IPO ownership. Finally, VCs are more likely to be on the boards of IPO firms with a loss in the year prior to the IPO, and of those managed by more reputable underwriters. Conversely, the probability for the VC to sit on the board is lower for firms going public during the bubble period of the late 1990s.

If an effect of VC board representation on IPO pricing and firm performance is observed, it may be due to either the VC's screening ability of picking high quality firms (Ivanov et al., 2009) or to the VC's skills as to the monitoring of its portfolio companies. In other words, if the first explanation applies, then VC board membership is not exogenous as it is determined by the VC's

view about the quality of the firm rather than by any improvements in firm quality the VC may expect to bring about via its expert and monitoring skills. Hence, we need to control for this possible endogeneity. Our regressions, which control for this self-selection and are based on Heckman (1979), suggest a positive association between VC board membership on one side and underpricing and the IPO premium on the other side is upheld. We find that VC board representation increases underpricing as well as the IPO premium, which provides support for both the grandstanding and management support hypotheses. On the one hand, the positive impact of VC board representation on underpricing suggests that VCs grandstand by taking their firms public too early. On the other hand, the positive impact of VC board representation on the IPO premium is consistent with value creation by VCs, i.e. the management support hypothesis. In other words, this result provides support for Casamatta (2003) who argues that, under a wealth constraint and costly unverifiable effort, it is optimal for the entrepreneur to hire a VC-director who is also a provider of finance.

As a robustness test, we allow for the simultaneous determination of VC board membership and IPO performance. This additional test confirms the positive effect of VC board membership on IPO performance. In addition, it suggests the absence of an effect of the latter on the former. Hence, there is evidence that VCs create value via their monitoring capabilities rather than via picking high quality firms and keeping their investment in the latter after the IPO.

The remainder of the paper is structured as follows. Section 2 reviews the literature and develops the hypotheses. Section 3 discusses the data and the research methodology. Section 4 presents the empirical results. Section 5 contains the results from a robustness test and Section 6 concludes.

2- Review of the Literature and Hypotheses

Despite a large body of studies, there is as yet no conclusive evidence as to the impact of the board of directors on firm performance (see e.g., Dalton, Daily, Ellstrand, and Johnson, 1998). However, the existing research provides a number of stylized facts on board composition. In a nutshell, the composition of the board of directors results from a bargaining process depending on the relative power of insiders (in particular the CEO) and outsiders (Hermalin and Weisbach, 1988). In other words, the composition of the board reflects the power sharing among different stakeholders (Lynall et al., 2003: 14), and is mainly influenced by the CEO and the external financiers, i.e. the most salient actors in the organization (Mitchell, Agle, and Wood, 1997).

The remainder of this section will first discuss the relationship between VC board membership and VC power. It will then proceed by discussing the relationship between the former and CEO power. Finally, it will review the impact of VC board membership and VC power on firm performance.

2.1. VC board membership and VC power

Prior research indicates that venture capital firms play a significant role in monitoring their portfolio companies. Sahlman (1990) argues that venture capitalists use contracts which provide them with extensive powers such as terminating managers' employment and ceasing funding. These contracts provide the VCs with extensive power to curb managerial discretion should the need arise. However, a more direct way of keeping a check on the management is via a seat on the board of directors. Such a board seat is the result of the power the VC has over the CEO.

Finkelstein (1992) proposes four dimensions of power. While he focuses on CEO power, these dimensions can also be used to qualify VC power. In particular, VCs may have *ownership power* which they derive from the percentage of shares they hold in the portfolio company (Kaplan and Strömberg, 2003). Kotha and Talmor (2004) argue that, since oversight is a costly activity, VCs need to have a sufficiently high financial stake to participate in the board of directors. Moreover, a VC may have *structural power* via its position in the portfolio firm's organizational structure. Wright and Lockett (2003) report that most firms with VC financing have obtained such financing via a syndicate of VCs rather than a single VC. Based on survey evidence for the UK, Wright and Lockett find that the lead VC in the syndicate, defined as the VC who coordinates the syndicate, has a key position not only within the syndicate, but also in terms of the syndicate's relationships with its portfolio firms. In particular, they find that lead VCs interact significantly more frequently with their portfolio firms than non-lead VCs. Further, Hochberg et al. (2007) argue that VC syndication has a positive impact on firm performance as it creates a network that facilitates the sharing of resources, contacts and information. As examples of such networks, Hochberg et al. give the syndicates' ability to increase the range of launch customers and strategic alliances available to their portfolio companies. In addition, VC syndicates are more likely to push successfully for board representation of their members than VCs which act as the sole providers of venture capital in their portfolio firms and which may have difficulty dealing with a powerful CEO. Similarly, De Clercq and Dimov (2008) argue that VC syndication creates value at the level of the portfolio firm via knowledge sharing and collaboration with other firms (see also Bygrave 1988). However, they also acknowledge that there may be diminishing marginal returns to VC syndication as the syndicate increases in size given that larger syndicates may find it difficult to make efficient decisions and to generate the knowledge effects. Hence,

the presence of a VC syndicate as well as the syndicate's size, albeit with diminishing returns to scale, is likely to provide structural power to the VC.

A VC firm with an industry focus is likely to have *expert power* and the ability to deal with various contingencies (Hickson et al., 1971). Such a specialized VC is more likely to assume board positions given its industry expertise (Hsu, 2004). A VC firm may also have *prestige power* derived from its past successful experience in the capital markets (Sorenson and Stuart, 2001; Hsu, 2004). Several studies have examined the effect of VC *prestige power* or reputation on the performance of portfolio firms at the time of the IPO. For example, Megginson and Weiss (1991) argue that stock markets are more likely to give credence to information disclosed by IPO firms whose existing investors have reputational capital at stake and therefore "certify" the quality of the offering. In particular, the VC may use its reputational capital and monitoring skills to mitigate the adverse selection and moral hazard problems which are prevalent in IPO firms (Brav and Gompers, 2003; Megginson and Weiss, 1991).

We also consider a fifth dimension of power, *controlling power*, which measures how pivotal the VC is to the voted decision (Zingales, 1994, and Nenova, 2003). This dimension complements *VC ownership power* and shows the extent to which a VC firm may extract private benefits at the detriment of the dispersed shareholders.

More loosely defined, power may also be derived from geographic proximity, VC independence and cultural distance. For example, prior research suggests that geographic proximity alleviates the cost of oversight. Hence, VCs are more likely to sit on the board of geographically close firms (Lerner, 1995). Further, independent VCs are more likely to seek out a powerful position to influence the going public process of their portfolio companies. Finally, foreign VCs tend to

insist on board representation as a way of compensating for the cultural distance between them and their portfolio firms. Hence, we propose the following hypothesis.

H1: Powerful VCs are more likely to hold a board seat

2.2. VC board membership and CEO power

Prior research suggests that small shareholders are usually subject to free-riding problems which are exacerbated by the power of owners-managers (Fama and Jensen, 1983). For example, powerful CEOs are likely to appoint board members who match their own preferences. They tend to avoid appointing independent board members who are legally bound to monitor the management and to protect minority shareholders against potential expropriation (Kaplan and Reishus, 1990; Rosenstein and Wyatt, 1990).

VCs are less likely to sit on the board of IPO firms with powerful CEOs and those with substantial ownership (Hermalin and Weisbach, 1988). VCs are also less likely to sit on the board of a portfolio company with a more experienced CEO and a CEO with a doctorate. They are also less likely to sit on the board of firms where the CEO also assumes the position of the chairman.

The above discussion suggests the following hypothesis.

H2: VCs are less likely to hold a board seat in firms with more powerful CEOs.

2.3. The impact of VC power and board membership on firm performance

VC firms play a significant role in financing new ventures. However, VCs do not limit their role to the supply of capital, but they also provide advice on strategic and financial matters. As such,

VCs are frequently long-term investors who work together with the management of their portfolio companies in order to create value. Jain and Kini (2000, p.1144) argue that, by virtue of their equity investment, VCs are able "to guide and influence managerial actions in determining strategy, structure and standard operating procedures". Moreover, using their industry specific expertise, VCs are expected to help managers "make resource allocation decisions that are best suited for the industry and market conditions relevant to the specific IPO firm" (p.1145). In line with their arguments, they find evidence that VC involvement improves the survival profile of IPO issuing firms. Over time, VCs accumulate area-specific experience that helps establish a solid network of contacts and long-term relationships with various stakeholders, including suppliers, customers, and investment bankers (Sahlman, 1990). In other words, VCs use their knowledge, expertise, and contacts to assist their portfolio companies in strategic, financial, and operational planning (Wright and Robbie, 1998).

Further, Jelic et al. (2005) argue that VCs act as third-party certifying agents, thereby reducing the initial underpricing. VCs are likely to possess the skills to add value to riskier ventures where internal resources (both in terms of the human capital of the entrepreneur and financial resources) are inadequate to take advantage of the available growth opportunities (Filatotchev and Bishop, 2002). Hence, VCs are likely to have a positive impact on the IPO premium and this impact is likely to be stronger for more powerful VCs. In turn, powerful VCs are likely to reduce the underpricing.

H3: The IPO premium is positively related to VC power.

H4: Underpricing is negatively related to VC power.

In addition to formal contractual mechanisms commonly used by VCs to monitor and control their portfolio firms, their presence on the board of directors may be a further and more direct mechanism to exert their power and influence on the management of the portfolio firm. In turn, the VC's board membership, via the certification and monitoring it provides, may reduce the extent to which an issue is underpriced (Barry et al., 1990) as well as increase the offer price of the shares in the IPO relative to their book value (i.e. the IPO premium).

Hence, VC representation on the board of directors should certify the quality of the IPO firm and reduce the level of underpricing. Investors are also more likely to pay a price premium for IPO firms with greater involvement of the VCs on the board of directors.

H5: The IPO premium is positively related to VC board representation

H6a: Underpricing is negatively related to VC board representation

While past evidence by Megginson and Weiss (1991) has found a negative impact of VCs on IPO underpricing, recent studies suggest the opposite impact. Indeed, recent VC-backed IPOs have higher underpricing than IPOs without VC backing (Francis and Hasan (2003) and Lee and Wahal (2004) for the US; Hamao et al. (2000) for Japan; Espenlaub et al. (1999) for the UK). One explanation for this reversal may be that VC firms are often in the form of partnerships that require fast results and timely realization of their investments (Lerner, 1995). In particular, Gompers (1996) proposes the "grandstanding hypothesis" whereby younger VC firms bring firms to the stock market sooner in order to build their good reputation or prestige power through successful deals, thereby increasing funding from private investors. Gompers finds evidence in support of his hypothesis as firms backed by younger VCs go public earlier than those backed by

older and more experienced VCs. They also have greater underpricing. Hence, younger VCs seem to take their portfolio companies public prematurely to improve their own reputation (Gompers, 1999). VC representation on the board of directors may thus give them the required power to accelerate the IPO process, which they would otherwise lack, and to push through higher underpricing. This leads us to the following competition hypothesis to Hypothesis 6b.

H6b: Underpricing is positively related to VC board representation, but this positive effect is reversed in the presence of strong VC prestige power

3- Data Sources, Sample and Methodology

3.1. Data Sources and Sample

The sample consists of 304 US VC-backed IPOs from 1997 to 2007 or 1,105 VC observations which we shall be focusing on. The sample is selected by applying a couple of filters to the list of all US IPOs in the US markets obtained from the Securities Data Company (SDC) database. First, REITs, ADRs, closed-end funds, foreign IPOs, unit offerings, financial IPOs, and those with an offer price below five dollars are excluded. Second, all IPOs without VC-backing are excluded. This results in 1,343 VC-backed IPOs.

VC characteristics are obtained from the Venture Expert database, whereas details on board composition, CEOs, and IPO firms are extracted from the IPO prospectuses available from the Securities and Exchange Commission's (SEC's) Electronic Data Gathering, Analysis, and Retrieval system (EDGAR). As this data gathering exercise is very-time intensive it was only conducted for a random sample of 304 VC-backed IPOs which amounts to 22.6% of all VC-backed IPOs over the period of study rather than the entire population of 1,343 VC-backed IPOs.

Table 1 compares the sample to the entire population of VC-backed IPOs. The distribution of IPOs across time (Panel A) and industries (Panel B) for the sample is very similar to that for the entire population of VC-backed IPOs. There is also a similar percentage of hi-tech IPOs (Panel B), which confirms the representativeness of the sample. Hence, our random sample is representative of the entire population of VC-backed IPOs.

[Table 1 Near Here]

3.2. Methodology

In order to test our hypotheses on the determinants of VC board representation as well as the impact of VC power on IPO performance, we proceed as follows. While the decision of VC firms to have board seats may be driven by their desire to add value to their portfolio companies, it (as well as the concurrent decision to maintain a large equity stake after the IPO) may just reflect the quality of the firm. Thus, the association of VC board membership with superior issuer performance may be due to the quality of the IPO firm and the VC's screening ability to spot firm quality rather than its ability to add value to its portfolio companies (Ivanov et al., 2009). Hence, VC board membership may suffer from a self-selection bias which we need to correct for. Our methodology is hence dictated by the necessity.

The Heckman (1979) two-step procedure deals with the possible endogeneity of VC board membership. In the first step, the probit regression in equation (1) is used to estimate the probability that a VC firm holds a board seat and to derive the inverse Mills' ratio (*Lambda*) that accounts for the possibility that the VC may decide to have a seat on the boards of high quality firms only. In the second step, the inverse Mills' ratio is included in equation (2) as an additional

regressor to obtain unbiased coefficient estimates for the VC board membership dummy and the other explanatory variables. Formally, the procedure is as follows:

First step (Selection Equation):

$$(Probit): Probability\ (Board\ Membership) = \alpha_0 + \alpha_1\ Control\ variables + \varepsilon \quad (1)$$

Second step (Performance Regression):

$$(OLS): IPO\ Performance = \beta_0 + \beta_1\ Board\ Membership + \beta_2\ Control\ variables + \beta_3\ Lambda + \eta \quad (2)$$

In detail, the selection equation is as follows:

$$VC\ Board\ Membership = \beta_0 + \beta_1\ VC\ Prestige\ Power + \beta_2\ VC\ Controlling\ Power\ (or\ VC\ Ownership\ Power) + \beta_3\ VC\ Expert\ Power + \beta_4\ VC\ Structural\ Power + \beta_5\ VC\ Other\ Power + \beta_6\ VC\ Participation + \beta_7\ VC\ Syndicate + \beta_8\ VC\ Syndicate\ Squared + \beta_9\ Number\ of\ Pre\text{-}IPO\ financing\ Rounds + \beta_{10}\ CEO\ Controlling\ Power\ (or\ CEO\ Ownership\ Power) + \beta_{11}\ CEO\ Education + \beta_{12}\ CEO\ Experience + \beta_{13}\ CEO\ Experience\ in\ Listed\ firms + \beta_{14}\ CEO\ Duality + \beta_{15}\ Log\ (Total\ Asset) + \beta_{16}\ Loss\ dummy + \beta_{17}\ Pre\text{-}IPO\ Leverage + \beta_{18}\ Hi\text{-}tech\ dummy + \beta_{19}\ LBO\ dummy + \beta_{20}\ Lock\text{-}up\ Period + \beta_{21}\ IB\ Rank + \beta_{22}\ Bubble\ Period\ dummy + \varepsilon_1 \quad (3)$$

The second-step equation is as follows:

$$IPO\ Performance = \beta_0 + \beta_1\ VC\ Board\ Membership + \beta_2\ VC\ Prestige\ Power + \beta_3\ VC\ Board\ Membership\ x\ VC\ Prestige\ Power + \beta_4\ VC\ Controlling\ Power\ (or\ VC\ Ownership\ Power) + \beta_5\ VC\ Expert\ Power + \beta_6\ VC\ Other\ Power + \beta_7\ VC\ Participation + \beta_8\ VC\ Syndicate + \beta_9\ VC\ Syndicate\ Squared + \beta_{10}\ Number\ of\ Pre\text{-}IPO\ financing\ Rounds + \beta_{11}\ CEO\ Controlling\ Power$$

$$(or\ CEO\ Ownership\ Power) + \beta_{12}\ CEO\ Education + \beta_{13}\ CEO\ Experience + \beta_{14}\ CEO\ Experience\ in\ Listed\ firms + \beta_{15}\ CEO\ Duality + \beta_{16}\ Log\ (Total\ Asset) + \beta_{17}\ Loss\ dummy + \beta_{18}\ Pre\text{-}IPO\ Leverage + \beta_{19}\ Hi\text{-}tech\ dummy + \beta_{20}\ LBO\ dummy + \beta_{21}\ Lock\text{-}up\ Period + \beta_{22}\ IB\ Rank + \beta_{23}\ Market\ Return + \beta_{24}\ Bubble\ Period\ dummy + \varepsilon_2 \quad (4)$$

The dependent variable in selection equation (3) is a binary variable, i.e. *VC Board Membership dummy*. This dummy variable is equal to one if the VC has a related director or a previously related director on the board,[1] and zero otherwise. IPO performance, the dependent variable in the OLS regression, equation (4), is measured by underpricing or the IPO premium. *Underpricing* is equal to the difference between the price at the end of the first day of trading and the offer price expressed as a fraction of the latter. The *Premium* is defined as the difference between the offer price and the book value per share expressed as a fraction of the offer price.

In line with Lee and Wahal (2004), *VC Prestige Power* is measured by the number of IPOs the VC has been involved with previously. In order to test competing Hypotheses 6a and 6b, the IPO performance regression also includes an interaction term between *VC Board Membership* and *VC Prestige Power*. The interaction term allows for a possible differential effect of both *VC Board Membership* and *VC Prestige Power* on IPO performance, in particular underpricing, for the case of less experienced VCs (i.e. those with less prestige power). A significantly negative coefficient on this interaction term (combined with a significantly positive coefficient on *VC Board Membership* and *VC Prestige Power*) would provide support for Hypothesis 6b (the grandstanding hypothesis) whereas a significantly negative coefficient on *VC Board Membership*

[1] While directly related directors are partners in the VC firm, indirectly related directors are those that previously held a position in the VC firm.

would provide support for Hypothesis 6a. *VC Controlling Power* measures the extent to which a VC is pivotal to the voted decision (Zingales, 1994, and Nenova, 2003). It is equivalent to the Shapley value, derived from the Milnor and Shapley (1978) power index for oceanic games for a given shareholder. This measure captures the concentration of voting power based on the ownership structure.[2] It is used by e.g. Zingales (1994) who explores the benefits of control in Italian firms with multiple classes of equity. *VC Ownership Power* is calculated as the number of VC owned shares prior to the IPO expressed as a fraction of the total shares outstanding immediately prior to the IPO date. As *VC Ownership Power* and *VC Controlling Power* are positively and significantly correlated with each other (the correlation coefficient equals 0.825), they cannot be used in the same regression model. As we do not have access to syndicated investment agreements and therefore cannot directly determine the identity of the lead VC in each syndicate (our measure of *VC structural power*), we define a lead VC as the VC in the first round of financing with the highest equity stake in the portfolio firm. As Wright and Lockett (2003) find that the lead VC typically holds the largest equity stake held by any VC in the portfolio firm, our lead VC is likely to coincide with the actual lead VC as stated in the syndication agreement. Hence, *VC Structural Power* is a dummy variable which is equal to one if the VC firm participates in the first round of financing and has the largest stake, and zero

[2] For example, assume a game with three shareholders A, B, and C who own 40%, 35%, and 25%, respectively. Although shareholder C is the least powerful in this game, there are three winning coalitions (i.e. majority coalitions) he can form with A and B. In detail, A and C represent 65% of the voting power whereas B and C have 60% of the votes and A, B and C 100%.

otherwise.[3] *VC Expert Power* is a dummy variable which is equal to one if the VC firm specializes in the industry of the IPO firm, and zero otherwise.

The other, more indirect, measures of VC power used in this paper are as follows. *VC Same Location dummy* is equal to one if the VC firm has a representation office in the state of the IPO firm, and zero otherwise. *VC Independent dummy* is equal to one if the VC firm is independent, i.e. a private equity firm investing its own capital, a private equity advisor or fund, and zero otherwise. *VC Foreign dummy* is equal to one if the VC firm is not a US VC, and zero otherwise.

A VC's involvement in its portfolio companies may also depend on CEO power (Hermalin and Weisbach, 1988). *CEO Controlling Power* is calculated using the Shapley power index based on pre-IPO ownership data as stated in the IPO prospectus. It represents the extent to which the CEO is pivotal to the voted decision (Zingales, 1994, and Nenova, 2003). *CEO Ownership Power* is calculated as CEO ownership expressed as a fraction of the shares outstanding prior to the IPO as specified in the IPO prospectus. Similar to the alternate inclusion of *VC Controlling Power* and *VC Ownership Power*, *CEO Ownership Power* is used as an alternative proxy for *CEO Controlling Power*, as the two variables are positively and significantly correlated with each other (the correlation coefficient is 0.693). *CEO Education* is a dummy variable equal to one if the CEO holds a doctorate, i.e. a Ph.D., a J.D. or an M.D., and zero otherwise. *CEO Experience* is the number of years since the CEO's graduation. In addition to *CEO Experience*, we use an alternative measure which consists of experience obtained by the CEO in other listed firms: *CEO Experience in Listed Firms* is a dummy variable which equals one if the CEO is

[3] For IPOs where there are several VCs in the first round of financing and some or all of them hold the same highest stake, we consider all of these VCs to have structural power.

currently or was previously involved in a listed firm as board member or top manager (i.e. President or Vice-President), and zero otherwise.[4] *CEO Duality* is a dummy variable which is equal to one if the CEO is also the chairman of the board of directors, and zero otherwise.

Prior research suggests that VC board representation is positively related to the ex-ante uncertainty and the need for monitoring and control (Lerner, 1995), including the size of the firm at the time of the IPO (Baker and Gompers, 2003) and the number of pre-IPO financing rounds (Kaplan and Strömberg, 2003). It is likely to be higher in smaller firms where the need for financial advice and managerial support is greater (Hellman and Puri, 2002). Firm size is measured by *Log(Assets)*, which is equal to the logarithm of total assets for the year prior to the IPO date. Further, VC board representation is stronger in firms subject to several rounds of financing, so called staged rounds (Kaplan and Zingales, 2003). *Number of pre-IPO financing Rounds* is the total number of pre-IPO financing rounds that involved VC firms. It is also likely to be greater in science-based, hi-tech firms where entrepreneurs may lack some of the essential business and management skills. *Hi-tech dummy* is equal to one if the IPO firm is a hi-tech firm, and zero otherwise.[5] VCs may also insist on board representation in firms with losses whereas they may be less interested in board representation in firms with high leverage where there is monitoring by the lenders. *Loss dummy* is equal to one if the IPO firm suffered a loss, i.e. had negative net earnings, during the fiscal year prior to the IPO date, and zero otherwise. Since debt

[4] In further empirical investigations, we have controlled for the experience of both the CEO and Chairman in listed firms, and the results remain significant.

[5] In line with Loughran and Ritter (2004), hi-tech stocks are defined as those with SIC codes 3571, 3572, 3575, 3577, 3578 (computer hardware), 3661, 3663, 3669 (communications equipment), 3671, 3672, 3674, 3675, 3677, 3678, 3679 (electronics), 3812 (navigation equipment), 3823, 3825, 3826, 3827, 3829 (measuring and controlling devices), 3841, 3845 (medical instruments), 4812, 4813 (telephone equipment), 4899 (communications services), 7371, 7372, 7373, 7374, 7375, 7378, and 7379 (software).

may limit managerial discretion and reduce potential conflicts of interests (Bruton et al., 2010), we control for the effect of financial leverage on both VC board membership and IPO performance. *Pre-IPO Leverage* is equal to pre-IPO long-term debt expressed as a fraction of pre-IPO total assets for the year prior to the IPO date. In line with prior research, this study controls for *VC Syndicate* and *VC Participation*. *VC Syndicate* is equal to the size of the VC syndicate, i.e. the number of VC firms investing in the IPO firm. The size of the VC syndicate is expected to increase the probability that the VC holds a board seat and also expected to increase IPO performance (Tian, 2009). The decision making process may however become more difficult with larger syndicates. In other words, there may be diminishing returns to scale from VC syndicates. Hence, we also include the square of the size of the VC syndicate in the performance regression. The sale of secondary shares by a VC firm at the IPO may also affect the decision to hold a board seat and the risk premium required by outside investors (Chahine et al., 2007). *VC Participation* is equal to the number of shares sold by the VCs in the IPO expressed as a fraction of the total number of shares offered in the IPO. It measures the extent of VC exit which is likely to have a negative impact on board representation and the IPO premium and a positive impact on underpricing.

Other control variables used in the previous literature relate to whether the IPO is an LBO, the IPO lock-up period, underwriter reputation and market conditions. Prior research shows evidence that buyout-backed IPOs, i.e. firms that are partly or fully owned by private equity firms, and have high pre-IPO leverage, have lower underpricing than closely matched IPOs of non-buyout-backed firms (Cao and Lerner, 2006). This reduction in underpricing may be due to the lower degree of information asymmetry of firms that have already been stock-exchange traded in the past (Ang and Brau, 2002) or the certification role played by VC firms (Megginson and Weiss,

1991). *LBO dummy* is equal to one if the IPO firm is a buy-out or involves a buy-out VC firm, and zero otherwise. Pre-IPO shareholders usually subject themselves to voluntary lockup arrangements that prevent the VC from selling more of its shares during a certain period following the IPO, the so-called lockup period. Further, lockup agreements may signal the confidence of the VC in its portfolio company (Bruton et al., 2010). Lock-up agreements are thus likely to increase the probability of the VC holding a board seat and are also likely to have a positive impact on the IPO premium and a negative effect on underpricing. *Lock-up Period* is equal to the difference (in days) between the IPO date and the lock-up period date. The underwriter's ranking, *IB Rank*, is based on Carter and Manaster (1990) and Loughran and Ritter (2004). As reputable underwriters certify the quality of managed offerings, this should affect IPO performance in a positive way. The IPO performance regressions include a *Market Return* variable, which is equal to the compound daily return of a value weighted index over the 20 trading days, preceding the IPO date. *Market Return* controls for the effect of market momentum. It is expected to affect IPO premium and underpricing positively (see e.g. Logue, 1973; Hanley, 1993; Loughran and Ritter, 2002, Lowry and Schwert, 2002). Given our period of study, we also include *Bubble Period dummy* to control for the effect of the internet bubble in 1999-2000. This dummy variable is set to one for IPOs during 1999-2000, and set to zero otherwise. The definitions of the variables used in this paper are summarized in the table in the Appendix

4- Empirical Results

We start the empirical analysis by discussing the descriptive statistics of CEO, IPO firm and VC characteristics. We then proceed by investigating the determinants of VC board membership. Finally, we study the impact of VC board membership on IPO performance.

4.1. Descriptive Statistics

Table 2 shows the descriptive statistics for the sample. IPO firms exhibit an average underpricing of 44%, which is highly skewed as evidenced by the much lower median of 11.3%. The skewness of the initial underpricing has also been observed by other studies such as Loughran and Ritter (2004). However, the skewness is particularly pronounced for our period of study given that a large fraction of our IPOs were during the bubble period of the late nineties. Hanley and Hoberg (2010) observe a similar increase in skewness during the bubble period. Despite the high underpricing, investors still pay a positive IPO premium amounting to an average premium of 78.5% above the book value per share.

Table 2 also reports an average board size of about 7 members. The board of directors consists of roughly a third of executives, a third of VC-related directors, and a third of independent directors, i.e. directors who are not executives and have no business relationship with the IPO firm. In terms of VC firm characteristics, there are on average roughly 4 VCs involved with each IPO, with an average 2.326 VCs who directly or indirectly hold board seats.[6] This number is equal to almost two thirds of the total number of VCs in the VC syndicate. Table 2 also indicates that VC participation, i.e. the proportion of secondary shares offered by the VCs in the IPO,

[6] See footnote 1.

represents only 5.1%. For the subsample of IPOs with actual VC participation in the IPO, this figure is 29.4% per IPO firm and 14.1% per VC firm (the figures are not reported in Table 2). Also, the average firm has around four financing rounds before its IPO. There is great variation in the number of financing rounds as evidenced by the difference between the minimum (i.e. one) and maximum of financing rounds (i.e. 12).

[Table 2 Near Here]

In terms of CEO characteristics, the average CEO holds 12.8% of the shares immediately prior to the IPO date (*CEO Ownership Power*), which confers an average controlling power of 12.1% (*CEO Controlling Power*). About 16% of CEOs have a doctorate (*CEO Education*) and the average CEO has about 17 years of working experience (*CEO Experience*) with a minimum of five and a maximum of 43 years. The CEO on the board of 47.7% of the firms is also the chairman, which is consistent with prior research on the US markets.[7]

Table 2 also reports the characteristics of the IPO firms and the market conditions. Sixty-six percent of firms suffered a loss in the financial year preceding the year of the IPO. The average leverage is low with total debt amounting to only 26.2% of total assets. About 42% of the sample firms are hi-tech firms and the average rank of the underwriter is 8.6. About 15.5% of the firms are buy-out firms. The lock-up period is on average 141 days with a median of 180 days which is in line with what other studies have found (see e.g. Espenlaub, et al., 2001 for an overview of this literature). Finally, 44.1% of the sample firms went public during the bubble period of 1999-2000 and the average market return during the 20 trading days preceding the IPO was 1.2%.

[7] Linck et al. (2008) document CEO duality in 58.2% of 53,602 firm-year observations covering 6,931 firms over the period 1990–2004 in the U.S.

Table 3 reports VC characteristics for the average VC. In other words, the table shows the descriptive statistics for the 1,105 VC firms (involved in the 304 sample firms), the focus of the remainder of this paper. The table also reports the descriptive statistics separately for the subsample of VCs without board representation and the subsample of VCs with board representation. The table shows that 663 out of the 1,105 VCs (i.e. 60%) sit on the board of their portfolio companies. *VC Prestige*, i.e. the number of IPOs the VC has been involved with previously, is equal to 10.24 on average, and this is significantly higher for VCs with board representation. This suggests that more prestigious or experienced VCs are more likely to have substantial bargaining power resulting in board membership and are more likely to influence the decisions made by the management.[8] It also shows that the average VC has 14.9% controlling power and 15.8% ownership power, and both are significantly higher (at the 1% level) for VCs who sit on the board . This suggests that the higher the VC's ownership and controlling power, the more likely it will monitor its portfolio company through board membership.

Moreover, Table 3 shows that almost half of the VCs focus on the industry of their portfolio companies (*VC Expert Power*). However, there is no significant difference in this respect between the subsamples with and without board representation. Also, 27% of VCs have structural power, 31% of VCs have representative offices within the same state of their IPO firms, 74% are independent VCs, and 12% are foreign VCs. The binomial test for the difference between two proportions shows that, while there is no difference across the two subsamples for *VC Expert Power* and *VC Foreign*, *VC Same Location* and *VC Independent* are significantly different (at the 1% level) across the two subsamples. Specifically, VCs with board

[8] Not shown in Table 4, VCs have an average age of 16 years, and this is significantly higher (at the 1% level) for VCs on the board.

representation have greater structural power and are more likely to be located in the same state than VCs without board representation (the difference is significant at the 1% level). Moreover, VCs on the board are more likely to be independent than those VCs without board representation. This may reflect the need for independent VCs to gain greater influence on IPO managers, such as to accelerate the decision to go public. Not shown in Table 3, VC-related directors have an average experience of about 13 years and 32% of them hold a doctorate.[9]

[Table 3 Near Here]

4.2. The Selection Bias of VC Board Membership and the effect on IPO Performance

Table 4 shows the results for the Heckman regression models. The models adjust for the possible endogeneity of VC board representation. Indeed, the latter may be driven by firm quality and the VC's skills to identify firms with superior quality rather than the VC's desire to create value. Each model (Model A and Model B) contains a selection equation for board representation (equation A.1 and B.1, respectively) in Panel A, which is based on equation (3) above and two performance equations, based on equation (4), one for underpricing (equation A.2 (a) and B.2 (a)) and one for the IPO premium (equation A.2 (b) and B.2 (b)) in Panel B. Since *VC (CEO) Controlling Power* is highly correlated with *VC (CEO) Ownership Power* (the correlation coefficients are 0.825 and 0.693, respectively), Model A includes *VC* and *CEO Controlling*

[9] Also not shown in Table 4, VC firms that do not hold a board seat are more likely to participate in the IPO offering (*VC Participation)* than those who sit on the board (3.6% versus 1.5% at the 5% level).

Power whereas Model B includes *VC* and *CEO Ownership Power*. As Panel B of Table 4 reports, the inverse Mills' ratio is negative and statistically significant in both models. This suggests that there may indeed be an issue about self-selection bias, i.e. VC board representation may not be exogenous.

The selection equation in Panel A for both Models A and B has reasonable explanatory power as evidenced by the McFadden R-squared. The selection equation for Model A, equation A.1, shows that VCs are more likely to sit on the board when they are more powerful in the voted decision (at the 1% significance level), and they have structural power (at the 1% level). More prestigious VCs (at the 1% level),[10] those geographically close to their portfolio companies (*p=1%*) and those with an industry focus (at the 10% level) are also more likely to have board membership. Independent VCs (at the 5% level) and interestingly also foreign VCs (at the 1% level) are also more likely to hold board positions. The selection equation for Model B, which substitutes *VC Ownership Power* for *VC Controlling Power*, confirms the above findings. The coefficients have similar magnitudes and similar levels of significance. To summarize, there is strong support for Hypothesis 1 which states that powerful VCs are more likely to sit on the board of directors.

In terms of the other VC firm characteristics, VCs are less likely to sit on the board when they they sell more shares in the IPO as reflected by higher *VC Participation* (at the 5% level). In line with our predictions, VCs are also more likely to sit on the board if they are part of a larger VC syndicate (the coefficient is significant at the 10% level), but this likelihood increases at a

[10] Further empirical investigations using *VC Age*, i.e. the age of VC firms since their inception, as a proxy for VC prestige power confirm the results from Models A and B. These results are available upon request.

decreasing rate as the syndicate becomes larger (at the 10% level). Moreover, the number of pre-IPO financing rounds increases the likelihood of VC board membership.

In terms of the CEO characteristics, the results in Table 4 show that the likelihood for the VC to sit on the board is negatively associated with the power of the CEO, as measured by *CEO Controlling Power* (at the 10% level) in Model A and *CEO Ownership Power* (at the 10% level) in Model B. Hence, there is evidence that powerful CEOs are reluctant to share their power in the boardroom. These results support Hypothesis 2. Interestingly, Models A and B show that VCs are more likely to sit on the board of directors of firms with more educated CEOs, but they are less likely to hold a board seat in firms with experienced CEOs in listed firms (at the 10% level). VCs are also more likely to be part of the board if the roles of the CEO and chairman are assumed by the same person.

In terms of the firm characteristics, VCs are more likely to be on the board of loss-making IPO firms (at the 10% level), those with a longer lock-up period (at the 10% level), and those underwritten by more reputable investment bankers (at the 10% level or better). They are however less likely to hold a board seat in larger firms (at the 1% level). This may reflect the lower risk and the higher qualification of the top management of larger firms, thus reducing the need for greater involvement by the VC. VCs are less likely to sit on the board of directors in firms that are buy-outs or involve buy-out VC firms. Interestingly, higher pre-IPO leverage, which may act as a substitute for VC monitoring and hence VC board membership, has no impact on the likelihood of the latter.

[Table 4 Near Here]

The regressions in Panel B report the estimation results from the estimation of the performance regression, equation (4), using underpricing and the IPO premium, respectively, as a measure of performance. All models suggest a positive and significant impact of VC board membership on the IPO premium as well as underpricing (at 10% and 1% level, respectively), which is consistent with Hypothesis 5 and Hypothesis 6b, respectively. Hence, there is evidence that VCs create value via their board membership. This confirms the hypothesis of management support provided by VCs and is consistent with Casamatta (2003). However, at the same time, there is also evidence in favor of the grandstanding hypothesis, which states that, in order to establish their reputation or prestige power, VCs are likely to exercise their power in the boardroom in such a way that their portfolio companies go public earlier than expected and at the cost of greater underpricing. In line with this argument, equations A.2 (a) and B.2 (a) in Panel B show that there is a negative impact of *VC Prestige Power* on *Underpricing*. The interaction term between *VC Prestige Power* and *VC Board Membership* is also significant and negative, suggesting that more prestigious VCs with board membership reduce underpricing even further. The question as to the overall effect of VC prestige power and board membership on underpricing arises. Evaluating equation A.2 (a) (B.2 (a)) at the averages reported in Table 3 for VC prestige power for VCs without board representation (8.382) and VCs with board representation (11.483), the overall effect on underpricing is -0.17 (-0.16) and -0.62 (-0.48), respectively. These results suggest that VC board representation without prestige power has a positive effect on underpricing, increasing underpricing on average by 0.162 and 0.167,

respectively, but that the overall effect of VC board representation on underpricing becomes negative when it is combined with strong VC prestige power. This result provides support for Hypothesis 6b, the grandstanding hypothesis.

Interestingly, VCs with greater controlling or ownership are more likely to increase underpricing (at the 1% and 5% level, respectively), whereas expert VCs reduce underpricing (at the 5% level) and increase the IPO premium (at the 10% level). Moreover, VC structural power is positively related to the IPO premium (at the 10% level), which suggests that VCs that are more powerful within the organizational structure of the firm add more value to their portfolio firm. In addition, there is evidence that independent VCs grandstand, given the higher underpricing they cause (at the 10% level). The fact that independent VCs are more likely to grandstand (as reflected by their positive impact on underpricing) suggests that they are keener on acquiring prestige power, as evidenced by a portfolio of successful IPOs, than VCs that are part of a larger corporation or financial institution and may therefore benefit from the reputation of the larger group they belong to. However, independent VCs also seem to provide active support to their portfolio companies as evidenced by their positive effect on the IPO premium (at the 5% level). Further, VC participation increases underpricing (at the 10% level) and decreases the IPO premium (at the 10% level). Underpricing is positively related to the number of pre-IPO financing rounds (at the 1% level). In line with our predictions, underpricing (IPO Premium) decreases (increases) as the size of the VC syndicate increases, but at a decreasing rate. This suggests that VC syndicates add value to their portfolio companies, but with diminishing returns to scale reflecting the reduced effectiveness in decision making for very large syndicates. Overall, the above results provide strong support for Hypothesis 3 which states that the IPO premium is positively related to VC power and Hypothesis 4 which states that underpricing is negatively related to VC power.

In terms of the CEO characteristics, the performance equations for Models A and B in Panel B show that powerful CEOs, as measured by ownership or controlling power, increase underpricing, but have no impact on the IPO premium. Also, CEOs who are more educated, more experienced, or have obtained experience via their (past) board membership of other listed firms are more likely to reduce underpricing (at the 10% level or better) and increase the IPO premium (at the 10% level).

In terms of the control variables, Models A and B indicate that underpricing is lower in larger firms (at the 10% level), firms with more leverage (at the 1% level), those with longer lock-up periods (at the 5% level) and those subject to leveraged buy-outs (at the 10% level). Conversely, underpricing is higher in hi-tech firms (at the 1% level), firms with more reputable underwriters (at the 5% level), firms going public following a positive market momentum (at the 1% level), and those going public during the bubble period (at the 1% level). The IPO premium increases with firm size and with the lock-up period (at the 1% level), but decreases with pre-IPO leverage. It is also lower for firms operating in hi-tech industries and those that went public following a positive market momentum (at the 5% level or better) or during the bubble period (at the 10% level or better).

To conclude, after controlling for the self-selection bias, there is a positive effect of VC board representation on the IPO premium as well as underpricing. This provides support for both the management support hypothesis and the grandstanding hypothesis. In the next section, we will test the robustness of this result by allowing for the simultaneous determination of VC board membership and IPO performance.

5- Robustness Checks: The Simultaneous Determination of VC Board Membership and IPO Performance

While in the previous section, we addressed the possible endogeneity of VC board representation by estimating a Heckman selection model, in this section we adopt a different econometric approach which consists of a three-stage least-squares (3SLS) model that controls for the possible simultaneous relationship between IPO performance and VC board membership.[11] The system of simultaneous equations includes a probit regression predicting VC board membership (equation (5)), and an OLS regression predicting IPO performance, i.e. IPO underpricing or the premium (equation (6)). In detail, the system is as follows:

$$VC\ Board\ Membership\ dummy = \alpha_0 + \alpha_1\ IPO\ Performance + \alpha_2\ Control\ variables + \varepsilon \quad (5)$$

$$IPO\ Performance = \beta_0 + \beta_1\ VC\ board\ membership\ dummy + \beta_2\ Control\ variables + \eta \quad (6)$$

For equation (5), we select two instrumental variables (IVs) that are VC location and VC nationality, and one instrumental variable that is equal to the pre-IPO market return for the IPO performance in equation (6). We have strong reasons to believe that VC firm location and VC origin are good IVs for the VC board membership equation, because we find that they are correlated with VC board membership, but unrelated to IPO performance. Similarly, while the pre-IPO market return affects IPO performance, it does not affect the decision of the VC firm to hold a board seat. Our IVs are therefore likely to be valid instruments.

[11] Three-stage least-squares (3SLS) is asymptotically more efficient than two-stage least-squares (2SLS) as it takes into account information on the error covariances as well as information contained in the endogenous variables included in the other equations (see Greene (2003) and Brooks (2008)).

Table 5 presents the results from the 3SLS regressions of equations (5) and (6) above. System A in Table 5 is the 3SLS system consisting of the probit regression based on the *VC Board Membership dummy* and the OLS regression on underpricing, and System B consists of the probit regression based on the *VC Board Membership dummy* and the OLS regression on the IPO premium. After the possibly simultaneous relationship is controlled for, Table 5 indicates that the *VC Board Membership dummy* positively affects underpricing and the IPO premium whereas neither of the IPO performance variables affects the *VC Board Membership dummy*. These results suggest that VC board membership may help accelerate the IPO process and improve the VC's prestige power by adding another successful IPO to its track record albeit at the cost of greater underpricing. VC board membership may also grant VCs greater access to information and ensure higher levels of control over the management, thus allowing them to add more value to their portfolio firms as evidenced by the higher IPO premium. Again, we find strong support for both the grandstanding and the management support hypotheses.

[Table 5 Near Here]

In terms of the control variables, Table 5 also confirms the results from Table 4. Specifically, VCs are more likely to sit on the board when they are more powerful and when the CEOs are less powerful. VCs are also more likely to sit on the board of directors of firms with better educated CEOs, and of firms with a dual leadership structure where the CEO is more likely to be entrenched. They are however less likely to have board representation in firms with CEOs that have obtained experience from board membership in other listed firms.

Moreover, System A shows that underpricing is positively related to VC controlling power, VC independence, VC participation, and CEO power. It is however lower in firms with more

prestige power, expert power, and structural power. Underpricing is also lower in large firms, those with higher financial leverage, and those with a longer lock-up period, whereas it is higher in hi-tech firms, those managed by more reputable underwriters, those going public during the bubble period and those going public following a period of positive market momentum. Similarly, the IPO premium is positively related to the controlling power of the VC and its prestige, but is negatively related to VC participation in the IPO via the sale of secondary shares. This is consistent with our prior results which suggest that greater VC participation may reflect their lack of ability to add value to their portfolio companies. The IPO premium is higher in large firms, those with losses, and those with a longer lock-up period. It is however lower in hi-tech firms, those with more financial leverage and those going public following a positive market momentum and within the bubble period.

To summarize, the results from the 3SLS estimation procedure confirm our previous results. Importantly, they suggest that the direction of causality flows from VC board membership to IPO performance and not vice-versa. Hence, our results about the effect of VC board membership on IPO performance cannot be merely due to the VC's screening skills, but must stem at least to some extent be due to the VC's ability to create value in its portfolio firms.

6- Conclusion

At the time of the initial public offering (IPO), powerful venture capitalists (VCs) may have beneficial as well as negative effects on their portfolio companies. According to the management support hypothesis, the beneficial effects are mainly via the monitoring of the management and the advice that VCs provide, both of which ultimately result in improved IPO performance as evidenced by lower underpricing and a higher IPO premium. As per the grandstanding

hypothesis, the negative effects stem from powerful VCs pursuing their own interests rather than those of the entire shareholder body. Indeed, powerful VCs who are keen on building up a good reputation by adding another successful IPO to their portfolio may be tempted to take their investee firms public prematurely at the cost of higher underpricing.

While existing research has measured VC power indirectly by the VC's reputation (Baker and Gompers, 2003), this paper uses a better proxy for VC power which is VC board representation. Based on Finkelstein's (1992) augmented categorization of power in corporations, we also investigate the impact on IPO performance of VC controlling power, ownership power, expertise power, structural power and prestige power, as well as other VC firm characteristics such as geographic closeness and VC type, and whether the VC is independent or affiliated.

However, if we observe a positive effect of VC board membership on IPO performance, this effect may merely reflect the VC's ability to identify firms of a superior quality rather than its monitoring skills. In other words, the question arises as to whether VC board membership truly adds value to the portfolio firm or whether the VC simply holds a board position in high quality firms. To answer this question, we control for the possible endogenous self-selection bias of VC board membership, and later for the simultaneous determination of VC board membership and IPO performance.

Based on a representative sample of 304 US VC-backed IPOs during 1997 and 2007 and 1,105 equivalent VC firm observations, we find the following. First, the probability of a VC sitting on the board of directors is positively related to its controlling power (as measured by its Shapley value) and its ownership power (as measured by its ownership stake). The probability is higher for VCs with structural power, i.e. those who have the highest stake in the first round of

financing, as well as VCs with prestige power, i.e. those with experience in the IPO market. It is also higher for VCs who are geographically close to their IPO firms, those with expert power (i.e. those with an industry focus), independent VCs, and foreign VCs. Second, VCs are more likely to hold a board seat in IPOs with more educated CEOs and those chairing the board of directors, whereas they are less likely to sit on the board of firms with higher CEO pre-IPO ownership. Finally, VCs are more likely to sit on the boards of IPO firms making a loss in the year prior to the IPO, and of those managed by more reputable underwriters as well as those going public during the bubble period of the late 1990s.

Our empirical findings also suggest that higher VC participation in the IPO, via the sale of secondary shares, positively affects underpricing, whereas it negatively affects the IPO premium. This suggests that VC participation in the IPO reflects the riskiness of the issuing firm, whereas the retention of shares makes investors confident enough to pay a premium for the IPO firm. More importantly, our results also suggest an effect of the oversight role of VCs on IPO pricing and valuation. VC board representation increases underpricing and the IPO premium, which provides support for both the grandstanding and management support hypotheses. This is consistent with Gompers (1999) who argues that younger VCs may grandstand, i.e. take their portfolio companies public prematurely to enhance their own reputation (Gompers, 1999). It is also consistent with Casamatta (2003) who argues that, under a wealth constraint and costly unverifiable effort, it is optimal for the entrepreneur to hire a VC-director who is also a financial provider. Finally, we observe this impact of VC board membership on IPO performance even after adjusting for the possible endogeneity of VC board membership or the simultaneous determination of VC board membership and IPO performance.

Appendix

VC Board Membership dummy	A dummy variable which is equal to one if the VC has a related director or a previously related director on the board, and zero otherwise.
IPO performance	
Underpricing	The difference between the price at the end of the first day of trading and the offer price expressed as a fraction of the offer price.
IPO Premium	The difference between the offer price and the book value per share expressed as a fraction of the offer price.
VC Power and Other VC-related variables	
VC Controlling Power	The extent to which a VC is pivotal to the voted decision. It is calculated using the Shapley power index based on pre-IPO ownership data as stated in the IPO prospectus.
VC Ownership Power	The number of VC owned shares prior to the IPO expressed as a fraction of the total shares outstanding immediately prior to the IPO date.
VC Prestige Power	The number of IPOs the VC has been involved with previously. (In further empirical investigations, we use VC Age, i.e. the age of VC firms since their inception, as a proxy for VC prestige power.)
VC Structural Power	A dummy variable which is equal to one if the VC firm participates in the first round of financing and has the largest stake, and zero otherwise.
VC Expert Power	A dummy variable which is equal to one if the VC firm specializes in the industry of the IPO firm, and zero otherwise.
VC Same Location dummy	A dummy variable which is equal to one if the VC firm has a representation office in the state of the IPO firm, and zero otherwise.
VC Independent dummy	A dummy variable which is equal to one if the VC firm is independent, i.e. a private equity firm investing its own capital, a private equity advisor or fund, and zero otherwise.
VC Foreign dummy	A dummy variable which is equal to one if the VC firm is not a US VC, and zero otherwise.
VC Participation	The number of shares sold by the VCs in the IPO expressed as a fraction of the total number of shares offered in the IPO.
VC Syndicate	The number of VC firms investing in the IPO firm.
Number of pre-IPO financing Rounds	The total number of pre-IPO financing rounds that involved VC firms.
CEO Power related variables	
CEO Controlling Power	The extent to which the CEO is pivotal to the voted decision. It is calculated using the Shapley power index based on pre-IPO ownership data as stated in the IPO prospectus.
CEO Ownership Power	The fraction of shares outstanding prior to the IPO as specified in the IPO prospectus.
CEO Education	A dummy variable which is equal to one if the CEO holds a doctorate, i.e. a Ph.D., a J.D. or an M.D., and zero otherwise.
CEO Experience	The number of years of experience since graduation.
CEO Experience in Listed Firms	A dummy variable which is equal to one if the CEO is currently or was previously involved in a listed firm as board member or top manager (i.e. President or Vice-President), and zero otherwise.
CEO Duality	A dummy variable which is equal to one if the CEO is also the chairman of the board of directors, and zero otherwise.

Control Variables	
Log(Assets)	The logarithm of total assets for the year prior to the IPO date.
Loss dummy	A dummy variable which is equal to one if the IPO firm suffered a loss, i.e. had negative net earnings, during the fiscal year prior to the IPO date, and zero otherwise.
Pre-IPO Leverage	Pre-IPO long-term debt expressed as a fraction of pre-IPO total assets for the year prior to the IPO date.
Hi-tech dummy	A dummy variable which is equal to one if the IPO firm is a hi-tech firm, and zero otherwise.
LBO dummy	A dummy variable which is equal to one if the IPO firm is a buy-out or involves a buy-out VC firm, and zero otherwise.
Lock-up Period	The difference (in days) between the IPO date and the lock-up period date.
IB Rank	The underwriter's ranking calculated based on Loughran and Ritter (2004).
Market Return	The compound daily return of a value weighted index over the 20 trading days, preceding the IPO date.
Bubble Period dummy	A dummy variable which is equal to one for IPOs during 1999-2000, and zero otherwise.

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Table 1 - Data Representativeness

Panel A – Number and Percentage of VC-backed IPOs per Year

	Studied Sample (N=304)		Entire Population (N=1343)	
Year	No.	%	No.	%
1997	73	24.01	172	12.81
1998	22	7.24	97	7.22
1999	62	20.39	305	22.71
2000	71	23.36	265	19.73
2001	7	2.30	48	3.57
2002	7	2.30	42	3.13
2003	7	2.30	42	3.13
2004	13	4.28	123	9.16
2005	16	5.26	77	5.73
2006	11	3.62	78	5.81
2007	15	4.93	94	7.00

Panel B – Number and Percentage of VC-backed IPOs per Industry

Industry Classification	No.	%	No.	%
Consumer Products and Services	28	9.21	126	9.38
Consumer Staples	5	1.64	22	1.64
Energy and Power	10	3.29	54	4.02
Healthcare	64	21.05	281	20.92
Software & IT Consulting Services	121	39.80	536	39.91
Industrials	16	5.26	50	3.72
Materials	5	1.64	29	2.16
Media and Entertainment	10	3.29	50	3.72
Retail	12	3.95	80	5.96
Telecommunications	33	10.86	113	8.41
Transportation	0	0.00	2	0.15
Hi-Tech IPOs (%)	127	41.77	569	42.37

Table 2 - Descriptive Statistics for the IPO Firms

Underpricing is equal to the difference between the price at the end of the first day of trading and the offer price expressed as a fraction of the offer price. The *Premium* is equal to the ratio of the difference between the offer price and the book value per share to the offer price. *Board Size* is the number of total seats on the board. *Board independence* is the number of non-executive and VC-unrelated board directors as a fraction of the total number of board members. *VC Syndicate* is the total number of VCs per IPO firm. *Number of VCs on Board* is the total number of directly or indirectly related directors on the board of directors, and *Proportion VC-related Directors on Board* is the fraction of VC-related directors on the board. *VC participation* is equal to the number of shares sold by the VCs in the IPO as a fraction of the total number of shares offered in the IPO. *Number of pre-IPO financing Rounds* is the total number of pre-IPO financing rounds that involved VC firms. *CEO Controlling Power* represents the extent to which the CEO is pivotal to the voted decision. *CEO Ownership* is the number of shares held by the CEO as a fraction of shares outstanding immediately prior to the IPO. *CEO Education* is equal to one if the CEO holds a Ph.D., a J.D. or an M.D., and zero otherwise. *CEO Experience* is equal to the number of years of experience prior to the IPO date. *CEO Experience in Listed Firms* is a dummy variable which is equal to one if the CEO is currently or was previously involved in a listed firm as board member or top manager (i.e. President or Vice-President), and zero otherwise. *CEO Duality* is a dummy variable which is equal to one if the CEO is also the chairman of the board of directors, and zero otherwise. *Log(Total Assets)* is the logarithm of total assets for the last year prior to the IPO date. *Pre-IPO Leverage* is equal to pre-IPO long-term debt as proportion of pre-IPO total assets. *Loss dummy* is equal to one if the IPO firm suffered from negative net earnings during the last fiscal year prior to the IPO date, and zero otherwise. *Hi-tech dummy* is equal to one if the IPO firm is a hi-tech firm, and zero otherwise. *LBO dummy* is equal to one if the IPO firm is a buy-out or involves a buy-out VC firm, and zero otherwise. *Lock-up Period* is equal to the difference, in days, between the IPO date and the lock-up period date. *IB Rank* is calculated based on underwriter ranking in Loughran and Ritter (2004). *Bubble Period dummy* is equal to one if the IPO occurs in 1999-2000, and zero otherwise. *Market Return* is equal to the compounded daily return of a value weighted index over the 20 trading days prior to the IPO date.

	Mean	Median	s.d.	Min	Max
IPO Performance					
Underpricing	0.440	0.113	0.769	-0.911	4.050
Premium	0.785	0.755	0.455	-0.307	4.301
Board Composition and VC Characteristics					
Board Size	7.007	7.000	2.656	2.000	13.000
Board Independence (out of VC-related dir)	0.397	0.400	0.203	0.000	0.875
VC Syndicate	3.852	4.000	1.960	0.000	11.000
Number of VCs on Board	2.326	2.000	1.303	0.000	6.000
Proportion VC-related directors on board	*0.340*	*0.333*	*0.184*	*0.000*	*0.833*
VC Participation	0.051	0.000	0.151	0.000	1.000
Number of pre-IPO financing Rounds	3.934	4.000	2.465	1.000	12.000
CEO Power and Characteristics					
CEO Controlling Power	0.121	0.046	0.201	0.000	1.000
CEO Ownership Power	0.128	0.068	0.174	0.000	0.980
CEO Education	0.161	0.000	0.368	0.000	1.000
CEO Experience	16.832	15.000	8.690	5.000	43.000
CEO Experience in Listed Firms	0.108	0.000	0.310	0.000	1.000
CEO Duality	0.477	0.000	0.500	0.000	1.000
IPO Firm Characteristics					
Log (Total Asset)	7.336	7.243	0.667	5.329	10.039
Loss dummy	0.661	1.000	0.474	0.000	1.000
Pre-IPO Leverage	0.262	0.112	0.378	0.000	3.236
Hi-tech dummy	0.418	0.000	0.494	0.000	1.000
LBO dummy	0.155	0.000	0.362	0.000	1.000
Lock-up Period	140.967	180.000	89.862	0.000	653.000
IB Rank	8.604	9.100	1.224	0.000	9.100
Market Conditions					
Bubble Period dummy	0.441	0.000	0.497	0.000	1.000
Market Return	0.012	0.018	0.040	-0.128	0.145

Table 3 - VC Characteristics and VC Board Representation

This table presents VC firms characteristics across all the VC firms and distinguishes between VC board members (i.e. those who are directly or indirectly related to the VCs) and VC non-board members. The variables are defined as follows. *VC Prestige Power* is the number of previous IPOs the VC has been involved with. *VC Controlling Power* is the extent to which a VC is pivotal to the voted decision (Milnor and Shapley, 1978). *VC Ownership Power* is equal to the number of shares held by VCs as a fraction of the shares outstanding immediately prior to the IPO. *VC Expert Power* is equal to one if the VC firm is specialized in a particular industry, and zero otherwise. *VC Structural Power* is a dummy variable which is equal to one if the VC firm participates in the first round of financing with the highest equity stake in the portfolio firm, and zero otherwise. *VC Same Location* dummy is equal to one if the VC firm has a representation office in the state of the IPO firm, and zero otherwise. *VC Independent* is a dummy variable equal to one if the VC firm is a private equity firm investing its own capital and private equity advisor or fund manager, and zero otherwise. *VC Foreign dummy* is equal to one if the VC firm is a non US VC firm, and zero otherwise.

	Total of 1105 VCs		VCs without board membership N= 442		VCs with board membership N= 663		Test for Diff. in
(Per VC firm)	Mean	s.d.	Mean	s.d.	Mean	s.d.	Means/ Prop's
VC Prestige Power	10.243	13.102	8.382	13.516	11.483	12.678	0.000
VC Controlling Power	0.149	0.217	0.086	0.107	0.192	0.260	0.000
VC Ownership Power	0.158	0.157	0.114	0.119	0.189	0.172	0.000
VC Expert Power	0.487	0.500	0.484	0.500	0.489	0.500	0.887
VC Structural Power	0.271	0.474	0.113	0.317	0.377	0.530	0.000
Other measures of VC power							
VC Same Location dummy	0.306	0.461	0.231	0.422	0.383	0.487	0.000
VC Independent dummy	0.740	0.439	0.653	0.477	0.798	0.402	0.000
VC Foreign dummy	0.119	0.323	0.118	0.323	0.119	0.324	0.940

Table 4 – Heckman Regression Models for VC Board Membership and IPO Performance

The table examines the effect of VC board membership on underpricing and the IPO premium by controlling for the self-selection bias in the VC's decision to hold a board seat for the 1105 VC firm observations. It is based on the Heckman self-selection procedure. In the first stage, Models (1a and 1b), a probit regression is used to estimate the inverse Mills' ratio that accounts for the correlation between the error terms of firm performance at the IPO, i.e. IPO underpricing and premium, and the decision to sit on the board. In the second stage, Models (2a and 2b) and (3a and 3b), the inverse Mills' ratio (*Lambda)* is included in the regressions on IPO performance as an additional regressor to obtain unbiased coefficient estimates for the VC board membership dummy and other explanatory variables. ***, **, * stand for statistical significance at the 1%, 5%, and 10% level, respectively. The figures in italic are the White heteroskedasticity-consistent standard errors.

	Panel A- First Stage	
	VC Board Membership	
	(A.1)	(B.1)
Constant	-1.228**	-1.069*
	0.550	*0.548*
VC Prestige Power	0.013***	0.014***
	0.004	*0.004*
VC Controlling Power	1.824***	
	0.398	
VC Ownership Power		2.072***
		0.486
VC Expert Power	0.160*	0.168*
	0.095	*0.095*
VC Structural Power	0.888***	0.893***
	0.127	*0.127*
VC Same Location dummy	0.515***	0.547***
	0.109	*0.108*
VC Independent dummy	0.229**	0.245**
	0.107	*0.108*
VC Foreign dummy	0.437***	0.425***
	0.145	*0.150*
VC Participation	-1.460**	-1.284**
	0.714	*0.626*
VC Syndicate	0.011*	0.013*
	0.006	*0.007*
VC Syndicate Squared	-0.012*	-0.018*
	0.006	*0.009*
Number of pre-IPO financing Rounds	0.063***	0.053**
	0.023	*0.023*
CEO Controlling Power	-0.377*	
	0.213	
CEO Ownership Power		-1.138***
		0.437
CEO Education	0.265*	0.274**
	0.136	*0.136*
CEO Prior Experience	-0.005	-0.006
	0.007	*0.007*
CEO Experience in Listed Firms	-0.084*	-0.173*
	0.050	*0.099*

CEO Duality	0.216**	0.234**
	0.108	*0.110*
Log (Total Asset)	-0.143***	-0.146***
	0.035	*0.034*
Loss dummy	0.200*	0.212*
	0.105	*0.126*
Leverage	-0.070	-0.034
	0.137	*0.136*
Hi-tech dummy	0.016	-0.005
	0.110	*0.110*
LBO dummy	-0.180*	-0.220*
	0.104	*0.126*
Lock-up period	0.001*	0.001*
	0.001	*0.001*
IB Rank	0.102**	0.078*
	0.047	*0.046*
Bubble Period dummy	-0.053	-0.012
	0.120	*0.119*
McFadden R-squared	0.229	0.227
LR statistic (23 df)	265.200	263.727
Probability(LR stat)	0.000	0.000

	Panel B- Second Stage			
	(A.2)		(B.2)	
	Under-pricing	Premium	Under-pricing	Premium
	(a)	(b)	(a)	(b)
Constant	-0.405**	1.541***	-0.178	1.479***
	0.162	*0.173*	*0.167*	*0.172*
VC Board membership dummy	0.297***	0.148*	0.346***	0.126*
	0.080	*0.078*	*0.092*	*0.076*
VC Prestige Power	-0.021*	0.015*	-0.019*	0.013*
	0.011	*0.008*	*0.011*	*0.007*
VC Prestige Power x VC Board Membership dummy	-0.088**	0.004*	-0.080**	0.001*
	0.038	*0.002*	*0.034*	*0.001*
VC Controlling Power	0.357***	-0.077		
	0.136	*0.131*		
VC Ownership Power			0.394**	0.007
			0.163	*0.160*
VC Expert Power	-0.093**	0.052*	-0.099**	0.054*
	0.041	*0.030*	*0.041*	*0.032*
VC Structural Power	-0.074	0.101*	-0.062	0.085*
	0.065	*0.052*	*0.064*	*0.051*
VC Independent dummy	0.075*	0.088**	0.088*	0.086**
	0.044	*0.040*	*0.044*	*0.040*
VC Participation	0.013*	-0.026*	0.010*	-0.024*
	0.007	*0.014*	*0.005*	*0.014*
VC Syndicate	-0.010**	0.008**	-0.010**	0.007*
	0.004	*0.004*	*0.005*	*0.004*
VC Syndicate Squared	0.008**	-0.010**	0.008**	-0.010***
	0.003	*0.004*	*0.003*	*0.004*
Number of pre-IPO financing Rounds	0.025***	-0.002	0.026***	-0.001
	0.009	*0.008*	*0.009*	*0.008*
CEO Controlling Power	0.258**	-0.111		
	0.106	*0.077*		
CEO Ownership Power			0.336**	-0.067
			0.156	*0.104*
CEO Education	-0.245***	-0.020	-0.245***	-0.016
	0.048	*0.039*	*0.048*	*0.040*
CEO Prior Experience	-0.010***	0.003	-0.009***	0.003
	0.003	*0.002*	*0.003*	*0.002*
CEO Experience in Listed Firms	-0.003***	0.069*	-0.002**	0.063*

	0.001	*0.036*	*0.001*	*0.035*
CEO Duality	-0.055	-0.043	-0.058	-0.040
	0.042	*0.034*	*0.042*	*0.035*
Log (Total Asset)	-0.026*	0.104***	-0.024*	0.109***
	0.014	*0.032*	*0.014*	*0.032*
Loss dummy	0.079*	0.009	0.087*	0.010
	0.048	*0.030*	*0.046*	*0.029*
Leverage	-0.125***	-0.095***	-0.123***	-0.094***
	0.038	*0.035*	*0.038*	*0.035*
Hi-tech dummy	0.344***	-0.060**	0.348***	-0.059**
	0.042	*0.029*	*0.042*	*0.030*
LBO dummy	-0.100*	0.053	-0.070*	0.055
	0.058	*0.041*	*0.042*	*0.041*
Lock-up period	-0.001**	0.001***	-0.001**	0.001***
	0.000	*0.000*	*0.000*	*0.000*
IB Rank	0.064**	-0.023*	0.068**	-0.023*
	0.031	*0.013*	*0.030*	*0.013*
Market Return	1.923***	-1.710***	2.230***	-1.669***
	0.461	*0.411*	*0.452*	*0.407*
Bubble Period dummy	0.617***	-0.062**	0.608***	-0.061*
	0.043	*0.031*	*0.043*	*0.031*
Lambda	-0.090**	-0.091*	-0.073*	-0.077*
	0.045	*0.048*	*0.038*	*0.046*
Adjusted R-squared	0.351	0.114	0.347	0.112
F-statistic	22.900	5.079	22.670	5.013
Prob(F-statistic)	0.000	0.000	0.000	0.000

Table 5 – Simultaneous-Equations Model for VC Board Membership and IPO Performance

This table examines the simultaneous relationship between VC board membership and IPO performance, i.e. IPO underpricing and premium, respectively, for the 1105 VC firm observations. Both the 1st and the 2nd simultaneous relationships are estimated using three-stage least squares (3SLS). ***, **, * stand for statistical significance at the 1%, 5%, and 10% level, respectively. The figures in italic are the White heteroskedasticity-consistent standard errors.

	System A		System B	
	VC Board Membership	Underpricing	VC Board Membership	Premium
Constant	0.202	-0.286	-0.873*	1.221***
	0.178	*0.244*	*0.446*	*0.215*
Underpricing	-0.063			
	0.059			
Premium			0.042	
			0.277	
VC Board Membership dummy		0.260**		0.349*
		0.110		*0.193*
VC Prestige Power	0.004***	-0.027**	0.003**	0.010***
	0.001	*0.012*	*0.002*	*0.002*
VC Board Membership x VC Prestige Power		-0.057**		0.007*
		0.028		*0.004*
VC Controlling Power	0.434***	0.154*	0.406***	0.108*
	0.081	*0.082*	*0.110*	*0.061*
VC Expert Power	0.057*	-0.032*	0.065*	-0.032
	0.033	*0.018*	*0.034*	*0.039*
VC Structural Power	0.251***	-0.054*	0.238***	0.108*
	0.034	*0.031*	*0.046*	*0.054*
VC Same Location dummy	0.165***		0.101***	
	0.033		*0.039*	
VC Independent dummy	0.071**	0.096**	0.112**	0.088**
	0.033	*0.044*	*0.046*	*0.038*
VC Foreign dummy	0.127***		0.146**	
	0.046		*0.072*	
VC Participation	-0.285	0.018**	-0.391*	-0.028**
	0.190	*0.008*	*0.202*	*0.013*
VC Syndicate	0.012*	-0.015*	0.013**	0.009**
	0.007	*0.008*	*0.006*	*0.004*
VC Syndicate Squared	-0.009**	0.010**	-0.009*	-0.009*
	0.005	*0.005*	*0.005*	*0.005*
Number of pre-IPO financing Rounds	0.019***	0.018*	0.022***	-0.007
	0.007	*0.011*	*0.008*	*0.010*
CEO Controlling Power	-0.259*	0.189*	-0.050	-0.062
	0.146	*0.106*	*0.103*	*0.112*
CEO Education	0.074*	-0.260***	0.064*	0.018
	0.043	*0.055*	*0.037*	*0.048*
CEO Prior Experience	-0.003	-0.008***	-0.001	-0.002
	0.002	*0.003*	*0.002*	*0.002*
CEO Experience in Listed Firms	-0.060*	-0.004*	-0.077*	0.071*
	0.032	*0.002*	*0.045*	*0.038*
CEO Duality	0.068**	-0.009	0.081**	-0.073*
	0.032	*0.052*	*0.037*	*0.038*
Log (Total Asset)	-0.042***	-0.032**	-0.054***	0.037***
	0.010	*0.016*	*0.019*	*0.014*
Loss dummy	0.173	0.101*	0.112	0.072*

	0.129	*0.055*	*0.135*	*0.039*
Leverage	-0.145	-0.123**	0.051	-0.076*
	0.189	*0.062*	*0.059*	*0.041*
Hi-tech dummy	0.002	0.358***	0.013	-0.075*
	0.041	*0.044*	*0.043*	*0.038*
LBO dummy	-0.127*	0.074	-0.077	0.055
	0.074	*0.070*	*0.055*	*0.062*
Lock-up period	0.002*	-0.001*	0.001*	0.001***
	0.001	*0.001*	*0.001*	*0.000*
IB Rank	0.067**	0.037*	0.032*	-0.033*
	0.031	*0.021*	*0.016*	*0.019*
Market Return		1.834***		-1.146***
		0.491		*0.430*
Bubble Period dummy	0.090*	0.593***	0.099*	-0.057*
	0.052	*0.048*	*0.057*	*0.034*
Pseudo R-squared	0.265	0.354	0.274	0.098

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