ABSTRACT

Title of Document: ANTECEDENTS AND CONSEQUENCES OF INSIDERS' EQUITY SHARE SELLING AT IPO: THREE ESSAYS

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Secondary share sales at the initial public offering (IPO) by insiders happen frequently and on a large scale. Current literature offers mixed explanations. For example, signaling theory (Leland & Pyle, 1977) suggests that secondary share sales at the IPO by insiders signal poor quality of the IPO firm. The premise is that insiders have more private information about the firm than outsiders. Therefore, insider sales should be indicative of trouble in the firm. This implies that insiders' secondary share sales will be associated with poor pre- and post-IPO performance. Agency theory (Jensen & Meckling, 1976) suggests that insiders will lower their commitment to the firm after they sell part of their shares; after such sales, managerial and firm interests are more poorly aligned. This theory suggests that poor post-IPO performance is causally associated with insiders'

secondary share sales at the IPO. Finally, risk aversion may drive insiders to diversify their risk away from the focal firm by selling secondary shares at the IPO. This would suggest that sales have nothing to do with firm quality or managerial commitment.

Although the above theories provide different implications for this practice, the mixed nature of their explanations prevent us from having a clear understanding of the phenomenon. Additionally, prior studies are unable to tease them apart. To address this issue, this dissertation investigates the following related questions: what factors predict insiders' secondary share sales at the IPO and how do such sales affect various firm performances. Only by looking at the antecedents and consequences of insiders' share sales at the IPO, as well as finding exogenous variation that affects secondary share sales and is unrelated to the characteristics of the firm, can we see if the sales are associated with firm quality or risk aversion or if insiders lower their commitment after sales.

The answers to these questions are investigated in three essays. In Essay 1, I ask which chief executive officers (CEOs) sell shares at the IPO and under what conditions? Using a sample of 651 U.S. software IPOs from 1990 to 2011, I find that when more of the CEOs' wealth is invested in their firms, they are more likely to sell. The effect is especially strong for CEO founders. Interestingly, when board members also engage in equity share sales at the IPO, CEOs are more likely to sell. This latter result suggests weakened board oversight of the CEOs. Using an instrumental variable approach, I tease apart contemporaneous selling due to poor firm quality and selling that only occurs with the reduction of oversight.

In Essay 2, I ask when equity share sales at the IPO influence the IPO underpricing. Through an analysis of 633 IPOs in the United States' (U.S.) computer

software industry, I find that the equity share sales by outside directors (venture capitalists and other institutional investors) are associated with upward offer price revision pre-IPO and lower IPO underpricing. The interpretation is that outside directors may be able to bargain for a higher offer price when they attempt to sell part of their equity shares at the IPO. As such, the upward offer price revision pre-IPO results from outsiders' bargaining leads to lower the IPO underpricing. These results are robust to a Heckman two-stage approach that addresses potential selection bias.

In Essay 3, I examine whether insiders' secondary share sales at the IPO impacts a variety of performance measures post-IPO and the contingencies under which any impact may vary. Through the analysis of 500 IPOs of the U.S. computer software industry, in general, I find that insiders' secondary share sales at the IPO are not associated with sales or sales growth. Rather, they are only associated with slower research and development (R&D) growth in the year post-IPO. This effect is less negative for large firms. The results are robust to an instrumental variable approach to address the potential endogeneity issues.

Taken together, this dissertation finds that insiders' secondary share sales are not significantly associated with post-IPO firm performances, providing no support to signaling theory or agency theory. The findings are more consistent with risk aversion theory and imply that insiders' secondary share sales at the IPO are not a significant negative signal and traditional wisdom may overreact to the sales.

ANTECEDENTS AND CONSEQUENCES OF CEO'S EQUITY SHARE SELLING AT IPO: THREE ESSAYS

By

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CHAPTER 1: INTRODUCTION

To align interests between management and owners, equity ownership has been widely adopted in the last several decades. Whether and how equity ownership affects managerial behavior and firm outcomes has been a research interest for scholars for a long time (Finkelstein, Hambrick, and Cannella, 2009). Although prior studies suggest that equity ownership does affect executive actions, the link between equity ownership, executive actions and organizational outcomes can be described as weak (Devers, McNamara, Wiseman, and Arrfelt, 2008; Wowak and Hambrick, 2010). Several theoretical perspectives such as agency theory (Jensen & Meckling, 1976), signaling theory (Leland & Pyle, 1977), and risk aversion are drawn upon to examine equity ownership-related research questions. In addition, because of the limitations of research design, data, and methodologies, many prior studies cannot effectively identify causal relationships between the variables of interest. To tease the theories apart and make causal inferences, this dissertation examines the antecedents and consequences of insiders' equity share sales at the IPO and adopts an instrumental variable approach to address potential endogeneity issues.

An IPO is a good context to investigate equity ownership. An IPO provides insiders an opportunity to sell equity shares (known as secondary shares) along with newly issued shares (primary shares) to the public on the IPO date. By selling equity shares at the IPO, insiders can change their equity ownership in the firm and these sales may affect incentive alignment, which provides an opportunity to investigate the antecedents and consequences of insiders' equity share holdings. There are advantages to

studying the IPO firms. First, they are generally comparable to each other. They are usually at an early stage in their development, need to raise financial capital, and in order to go public they must receive at least an acceptable evaluation from an underwriter. Second, whether insiders can sell secondary shares at the IPO is partly dependent on external market conditions at the time of the IPO and, as such, is partly exogenous. This allows me to adopt an instrumental variable approach and separate signaling and treatment effects. Lastly, secondary share sales are common, and this makes the study feasible.

In Essay 1, I investigate the antecedents of CEO equity share sales at the IPO. It is usually interpreted as a negative signal that CEOs sell equity shares at the IPO because of possible moral hazard and signaling concern. However, in the past 21 years in the U.S. software industry, over a quarter of CEOs sold part of their equity shares at the IPO. The research questions in this essay are given that share sales at the IPO may be interpreted as a negative signal by the market, what drives CEOs to sell and why do board members permit CEOs from selling? Drawing on risk aversion and endorsement arguments in behavioral agency theory, I argue that when much of the CEOs' wealth is tied up in a firm, CEOs are exposed to high risk. To lower risk, CEOs are likely to sell. In addition, I find that this relationship is stronger when a CEO is the founder. If we believe founder status is correlated negatively with CEO wealth, this provides further evidence in support of the risk diversification hypothesis. I also find that when board members sell shares at the IPO, CEOs are more likely to sell. To eliminate a negative signal, board members should prevent secondary share selling. However, if they themselves attempt to sell part of the shares for whatever reasons, they are less morally powerful to prevent the CEO

from selling as well. To draw a causal relationship between board members' share sales and CEO share sales, I adopt an instrumental variable analysis. To sum up, risk aversion and weakened oversight improve the likelihood of CEO equity share sales at the IPO.

In Essay 2, I investigate the impact of insiders' equity share sales at the IPO on the IPO's underpricing. Although it is widely documented in theories and anecdotal evidence that insiders' share sales at the IPO may be a negative signal, I find that secondary share sales at the IPO may benefit the IPO firm by lowering underpricing. Underpricing is the difference between stock closing price on the IPO date and offer price and is a measure of the amount of money left "on the table" for the IPO firms. Therefore, a lower underpricing indicates less money left on the table, which suggests that the IPO firms raise more proceeds from selling the same amount of shares to the public. I find that not every insider's share sales at the IPO have the same influence on the IPO underpricing. Specifically, outside directors' (venture capitalists and other institutional investors) share sales at IPO are significantly associated with lower underpricing. I also examine the possible mechanism and find that outside directors' share sales at the IPO are significantly associated with upward IPO offer price revision. That is, when outside directors attempt to sell part of their shares at the IPO, they are able to bargain effectively for a higher IPO offer price so that they can sell their shares at a higher price. Therefore, a higher offer price benefits not only outside directors but also the IPO firm. Interestingly, CEOs' share sales at the IPO are found to have no significant impact on underpricing or upward offer price revision. The reason may be that VCs and other institutional investors have repeated business relationships with underwriters and hence have more power in bargaining for a higher offer price. In contrast, a CEO as an individual most likely has

only one opportunity to have a transaction with underwriters and hence does not have much bargaining power over underwriters. In the IPO process, the underwriter is a powerful player and may result in selection bias of the IPO firms. That is, more prestigious underwriters choose IPO firms of higher quality. To address this concern, I adopted a Heckman two-stage approach and found robust results. In summary, insiders' share sales at the IPO may be a negative signal to the market but it can benefit the IPO firms when outside directors sell part of their shares.

In Essay 3, I examine the impact of insiders' equity share sales at the IPO on post-IPO firm performance. Agency theory suggests that when insiders' wealth is contingent on firm performance, insiders' interest and firm interest are more aligned. Accordingly, when insiders sell part of their equity shares at the IPO, their interest is less aligned with that of the firm and insiders may decrease their effort after such sales. As a result, a firm may experience poor performance. To test this prediction, I examine how insiders' equity share sales at the IPO influence post-IPO performance. Through the analysis of 500 IPOs of the U.S. computer software industry, I find that the percentage of secondary shares in an offering is associated with slower R&D growth in the year post-IPO. This effect is less negative for large firms. In addition, I also use other performance outcomes and find no significant impacts. That is, the negative effect of insiders' secondary share sales is only found on the R&D growth rate. This finding suggests that insiders' equity shares do have an incentive alignment effect and decreases in insider holdings are associated with lower long-term investment. In addition, the negative effect becomes stronger for small firms. This may be because smaller firms are likely to have more immature bureaucracies which

lead to greater influence of individuals. To address the potential endogeneity issue, I adopted an instrumental variable approach and obtained the robust results.

Taken together, the three essays investigate the antecedents and performance consequences of insider equity share sales at the IPO. Specifically, although equity ownership can align CEO interest and firm interest, it also creates risks for CEOs. The more risks a CEO faces, the more likely the CEO wants to lower the risk. CEOs' equity share sales at the IPO are partially driven by the risks associated with equity ownership. In addition, although equity share sales at the IPO by CEOs may be interpreted as a negative signal, CEOs are more likely to be able to sell when board members also sell their shares. The oversight on CEOs is weakened when board members also sell shares at the IPO. Interestingly, although CEOs' equity share sales at the IPO are usually interpreted as a negative signal, I find that when outside directors sell equity shares at the IPO, they can bargain for a higher offer price and hence lower underpricing. As a result, IPO firms also benefit from insiders' equity share sales at the IPO. In terms of the post-IPO performance, I find that insiders' share sales at the IPO have a negative impact on post-IPO R&D growth rate and this impact becomes stronger for small firms. Through the instrumental variable approach, I identify a causal relationship between secondary share sales at the IPO and post-IPO performance and provide evidence to support the incentive alignment effect of equity ownership.

CHAPTER 2: ESSAY 1

A BIRD IN YOUR HAND IS WORTH TWO IN THE BUSH: CEO SHARE SELLING AT IPO

ABSTRACT

I study how CEO's managerial equity ownership affects CEO's equity share sale behavior at the IPO: and adopt and extend a model of person-pay interaction to study how the effect varies with CEO wealth constraint and board members' share sale at the IPO. Using a sample of 651 U.S. software IPOs from 1990 to 2011, I find that CEOs are more likely to sell equity shares when the proportion of equity ownership value to their cumulative firm interest stake is high, when they are founders, and when board members also sell equity shares at the IPO. In addition, the effect of CEO equity ownership value proportion on the likelihood of equity share sale at the IPO is larger for founders and when board members also sell equity shares at the IPO. The result on CEO founder status suggests a wealth constraint effect and the latter result suggests a breakdown of board governance. I use VC fund age and non-focal board members' equity share sales as instruments for focal directors' equity share sales to address potential endogeneity and still obtain the same results.

INTRODUCTION

How managerial equity ownership of top executives affects their behaviors has long been a research interest for scholars (Finkelstein, Hambrick, and Cannella, 2009). Although prior studies suggest that managerial equity ownership does affect executive actions, the link between managerial equity ownership, executive actions and organizational outcomes can be described as weak (Devers, McNamara, Wiseman, and Arrfelt, 2008; Wowak and Hambrick, 2010). In addition, managerial equity ownership does not invariantly yield beneficial effects envisioned by their proponents and at times can yield harmful effects (e.g., Harris and Bromiley, 2007). To explore why managerial equity ownership and more generally compensation schemes, often fail to achieve their envisioned effects, prior studies, mostly in compensation literature, have adopted a contingency perspective to examine the fit between pay design and company strategy (Balkin and Gomez-Mejia, 1990), between pay design and industry characteristics (Hoskisson, Hitt, and Hill, 1993), between pay design and administrative systems (Shaw, Gupta, and Delery, 2002), and between pay design top executive characteristics (Wowak and Hambrick, 2010). The insights of those studies are that managerial equity ownership or pay cannot be studied in isolation and that other factors play major roles in influencing executive responses to their equity ownership or pay in general. However, prior literature largely ignores how CEOs' firm interest stake structure (the proportion of equity ownership value) affects their response to equity shares at the IPO. In addition, prior literature also ignored the role that CEO wealth constraint and board governance play in shaping, or moderating the above effect. This paper adds to this discourse by

investigating how CEO's firm interest stake structure affects CEO equity share sale behavior at the IPO and how CEO wealth constraint and board governance interact with CEO's firm interest stake structure to affect CEO equity share sales at the IPO (see Figure 1).

Founders may be significantly different from non-founders in their wealth constraints (e.g., Wasserman, 2012). For example, founders invest more of their personal wealth in their firms, and are more willing to sacrifice cash compensation to gain share compensation and count on these shares to repay their hard work (Wasserman, 2006). These differences presumably affect how founders perceive equity shares they own in the firm and, thus, how they respond to them when there is an opportunity to sell. In addition, board actions have been suggested to affect executives' behaviors (Wiseman & Gomez-Mejia, 1998). For instance, Devers, McNamara, Wiseman and Arrfelt (2008) suggest that the reloading and repricing of share options by the board attenuates the risk that CEOs would normally bear from high levels of accumulated value of equity-based pay and encourage risk taking. Any of these differences associated with founder status and board actions could contribute to variation in how executives respond to managerial equity ownership, and the efficacy of the response when there is a sale opportunity. Specifically, this paper examines CEOs' equity share sales at the IPO as a response to their equity ownership.

An IPO provides insiders an opportunity to sell equity shares (known as secondary shares) along with newly issued shares to the public on the IPO date. By selling equity shares at the IPO, CEOs can lower their equity ownership and thus affect shareholder-management incentive alignment. Moreover, an IPO has severe information

asymmetry between the firm and public investors (Ritter, 1991). Theories and anecdotal evidence suggest that secondary share selling may be interpreted as a negative signal since insiders may become less committed to the firm or be pessimistic about the firm's prospect (Jensen & Meckling, 1976; Junkunc & Eckhardt, 2009; Leland & Pyle, 1977). Nevertheless, in the last twenty-one years in the U.S. software industry, over a quarter of CEOs sold their equity shares at their firms' IPO, which is a significant phenomenon that needs study.

I test my theory with data gathered in 651 U.S. software IPOs from 1990 to 2011. I find that CEOs are more likely to sell secondary shares when their proportion of equity ownership value to their cumulative firm interest stake is high, when they are founders, and when directors sell equity shares at the IPO as well.[1] The founder result is only robust for non-VC-backed IPOs. I adopt an instrumental variable approach to address the potential endogeneity that arises from that equity share sales at the IPO may be driven by unobservable firm quality and I achieve the robust results.

This study makes several contributions. First, prior studies largely focus on the effect of managerial equity ownership, or more generally CEO compensation, on firm-level strategic risks such as R&D spending, capital expenditures, and long-term debt (e.g., Devers, McNamara, Wiseman & Arrfelt, 2008; Hoskisson et al, 1993; Miller & Bromiley, 1990). Although insightful, the links between CEO equity ownership and strategic risks include multiple intervening factors such as other non-CEO top executives and board members, which may confound the effect of managerial equity ownership on individual CEOs (Tosi, Werner, Katz & Gomez-Mejia, 2000). In contrast, this study focuses on a

[1] Proportion of equity ownership value to cumulative firm investment stake is calculated as $\frac{The\ number\ of\ shares\ held\ by\ CEO * offer\ price}{The\ number\ of\ shares\ held\ by\ CEO * offer\ price + \sum cash\ compensation}$

CEO's individual behavior, equity share sale at the IPO, which is a more immediate response to his/her equity ownership. In so doing, I provide direct and individual level evidence of how CEOs respond to managerial equity ownership, which serves as the micro foundation for prior studies on the link between CEO equity ownership and firm-level outcomes. Without the individual level knowledge, our prior understanding of how CEO equity ownership influences organizational outcomes may build on unverified or oversimplified assumptions of CEO response to equity ownership.

Prior research suggests that the effect of CEO equity ownership may be contingent on CEO characteristics and needs further study (e.g., Wowak & Hambrick, 2010). This study contributes to a model of person-pay interaction (Wowak & Hambrick, 2010) and explores a characteristic of CEO: CEO's wealth constraint, which is proxied by founder status in this study. Founder status is important since founders may have a different share of their personal wealth invested in their firms and hence face different wealth constraints than non-founders (Wasserman, 2006). Hence, similar managerial equity ownership may have varying risk implications for founder CEOs and non-founder CEOs. Given that a significant portion of CEOs are founders, especially in high-technology entrepreneurial firms, it is critical to have a better understanding of how wealth constraints influence CEOs' responses to their ownership shares in the firm. The empirical differences I find between founder CEOs' and non-founder CEOs' behaviors have important implications for executive compensation, upper echelon, and entrepreneurship literatures.

Third, this paper extends a model of person-pay interaction by examining how board action affects CEOs' responses to their equity ownership (Wowak & Hambrick,

2010). Equity ownership provides an ex ante incentive alignment to CEOs and board governance provides oversight (Zajac & Westphal, 1994). Although these two governance forces have been studied extensively in prior literature, we know little about how the effect of equity ownership on CEOs' behavior is influenced by board actions. I theorize that CEO oversight is weakened when board members themselves sell secondary shares, and hence this is correlated with CEO equity share sales at the IPO. Therefore, since incentive alignment derived from equity ownership is contingent on board oversight, this suggests a model of board-pay interaction in addition to a model of person-pay interaction. Empirically, a potential problem is that equity share sales by both directors and CEOs may be driven by unobservable firm quality. Thus, selling directors may simply be indicative of particularly bad firms – and hence this behavior may be a poor indicator of compromised directors. To address this issue I introduce an instrumental variable to isolate the effect of director behavior on the probability of CEO equity share sales at the IPO and achieved robust results.

THEORY AND HYPOTHESES

A key premise is that individuals prefer sure gains to risky gains. Both behavioral and rational models can support this premise, though I draw on behavioral models because of their superior empirical support (e.g., Devers, McNamara, Wiseman and Arrfelt, 2008; Larraza-Kintana, Wiseman, Gomez-Mejia and Welbourne, 2007; Martin, Gomez-Mejia and Wiseman, in press). Drawing from prospect theory research, the behavioral agency model (BAM) provides an alternative perspective to traditional agency

theory. BAM replaces the agent's risk aversion assumption (e.g., Jensen & Meckling, 1976) with the agent loss aversion (Wiseman & Gomez-Mejia, 1998). Risk aversion suggests that agents are more sensitive to uncertainty than to either gains or losses. That is, a certain amount of value is preferred to uncertain equal amount. In contrast, loss aversion implies the motive of avoiding loss, highlighting agents' desire to protect perceived wealth or reverse anticipated losses to wealth even at the expense of accepting greater uncertainty or risk (Tversky & Kahneman, 1991). One important concept in BAM is endowment, which suggests that perceived wealth "in hand" (income in the calculations of personal wealth) is valued higher than an equivalent amount of potential but uncertain wealth (Martin, Gomez-Mejia & Wiseman, in press). Based on the concept of endowment and loss aversion, BAM suggests that agents value certain gains more than variable gains with the same expected value (Martin, Gomez-Mejia & Wiseman, in press; Wiseman & Gomez-Mejia, 1998).

With board approval, insiders have an opportunity to sell equity shares at the IPO directly to the public, and avoid the uncertainty associated with waiting for a longer time, at least a six-month lock-up period. This is often the first such opportunity as prior to the IPO, equity shares are generally illiquid (Ritter, 1991). At the IPO, insiders may sell their equity shares directly to the public.

However, an IPO is also a moment when there is severe information asymmetry between insiders and investors (Junkunc & Eckhardt, 2009; Ritter, 1991). Theories suggest that after insiders reduce their positions in their firms, they may be less committed to the firm (Jensen & Meckling, 1976) or be pessimistic about the firm's prospects (Leland & Pyle, 1977). As such, insiders' secondary share sales at the IPO may

send a negative signal to the market and put the firm at risk (Ang & Brau, 2003; Gompers & Lerner, 2001). The anecdotal evidence that insiders' equity share sales at the IPO can cause a negative market reaction is also widely documented (Draho, 2004). For example, Ang and Brau (2003) find that insiders deliberately conceal and confound this adverse signal by underreporting the number of equity shares they intend to sell in an IPO. For this reason, the board of directors, whose fiduciary duty is to protect shareholders' interests, may prevent insiders from selling shares at the IPO.

CEO's Loss Aversion

CEO equity ownership can mitigate goal conflicts with shareholders and CEOs generally hold substantial amount of equity shares in young and entrepreneurial firms (Wasserman, 2006). Shareholders' ability to diversify generally makes them relatively risk neutral and to prefer greater risks to increase potential returns (Eisenhardt, 1989). In contrast, CEOs are likely risk-averse since their financial and human capital are tied to the fortunes of the firm (Jensen & Meckling, 1976). The greater the proportion of a CEO's personal wealth that is invested in the firm, the more risk averse he/she may be. This divergence in risk preferences has been a principal concern of research on incentive alignment (e.g., Bloom & Milkovich, 1998).

While this logic is compelling and sits at the basis of agency theory, the evidence in support of relative differences in risk preferences between CEOs and shareholders is scant. Alternatively, we can also appeal to the more empirically grounded behavioral agency model, or BAM.

Before a private firm goes public, its equity shares are illiquid and do not have a market-based price. As a result, CEOs may not have a clear sense of how much of their

personal wealth is vested in the firm. When a private firm goes public, underwriters will estimate a price of its equity shares to determine the offer price (Ritter, 1991). When IPO firms have an offer price for its shares, the value of the equity ownership held by a CEO is clearer. In practice, usually, a private firm's equity ownership structure has long been determined before even applying for an IPO with the Securities and Exchange Commission (SEC). Therefore, it is almost impossible for CEOs to adjust their equity ownership after they know about the offer price. According to the concept of endowment in BAM, upon receipt, CEOs endow (include) value from an asset in their perceptions of personal wealth (Kahneman, Knetsch, & Thaler, 1991; Miller & Shapira, 2004; Peters, Slovic, & Gregory, 2003; Thaler & Johnson, 1990). Once a private firm's equity shares receive an offer price, CEOs then use this figure as a reference point and calculate any potential gains and losses based on this price (Wiseman & Gomez-Mejia, 1998). However, post IPO, the value invested in the equity ownership is vulnerable to loss from a decline in the share's market price. According to BAM, CEOs will reduce their risk taking in order to mitigate threats to the personal wealth invested in the shares.

This effect is likely to be sensitive to the amount of a CEO's wealth that is tied up in the firm (Gomez-Mejia, 1994; Shavell, 1979; Wiseman & Gomez-Mejia, 1998). According to prior literature (e.g., Devers et al., 2008; Garen, 1994), the proportion of equity share ownership value to the whole cumulative interest stake the CEO has with the firm (hereafter, equity share value proportion) to a large extent indicates how much personal wealth of the CEO is exposed to loss and accordingly, the degree of loss aversion. While selling equity shares may reduce the CEOs risk exposure, doing so may put the firm and, thus, the rest of their equity holdings at risk because of the negative

signal associated with the CEO's equity share sales. If CEOs choose not to sell equity shares at IPO, they avoid the negative signal and risks associated with share sales at the IPO but their personal wealth invested in the shares remains exposed to possible losses. When the proportion of equity shares value is high in the overall interest stake CEOs have in the firm, CEOs have more personal wealth exposed to loss and have a higher degree of loss aversion and accordingly a higher likelihood of selling some shares at IPO. Therefore, I have the following prediction:

H1: The CEO's equity share value proportion is positively related to the likelihood of the CEO equity share sales at the IPO.

CEO Wealth Constraint

Although I argue that the CEO's equity share value proportion affects how a CEO perceives losses, other factors, such as wealth constraint, may also matter (Wiseman & Gomez-Mejia, 1998). Wealth constraint means how badly a CEO needs cash for whatever purposes. When a significant proportion of a CEO's personal wealth is vested in the firm and, therefore, there is less outside the firm, the CEO may have a higher need for cash and hence a higher wealth constraint. In this paper, I use CEOs' founder status as a proxy for their wealth constraint. Founder CEOs are different from non-founder CEOs in two important regards. First, founder CEOs may have more investments in the firm. Founders usually invest a large proportion of their personal wealth into the firm, providing most of the financing to the firm in its early stage (Prowse, 1998; Wasserman, 2012; Da Rin, Hellmann & Puri, 2012). For example, in a study on founding teams, Wasserman (2012) finds that in 77% of the founding teams, at least one founder

contributed seed capital early in the life of the startup.[2] Since pre-IPO equity shares are generally illiquid, founders generally lack a good exit opportunity for their investments and thus are likely to have a larger portion of their personal wealth concentrated in the firm. In contrast, most non-founder CEOs are professional managers and are likely to have less personal wealth tied up in the firms, as well as lower ownership stakes generally. Thus, we might expect founders to seek to reduce their equity shares and withdraw some cash out of the firm at the IPO.

In addition, founder-CEOs are also suggested to have greater emotional attachment to the wealth vested in their equity shares (Wasserman, 2012). Wasserman (2012) notes in his book:

> For many founders, the main financial motivation to join a founding team is the equity stake rather than the cash compensation. Cash poor startups generally cannot pay much salary or bonus, but confident, passionate founders usually believe that their equity stakes will eventually repay that sacrifice. For Ockham cofounder-CEO Jim Triandiflou, not receiving a salary was an entrepreneur's badge of honor: "April 19 was the first day of Ockham because that's the first day we did not have a paycheck. You're not getting paid, so you're now an entrepreneur."

The emotional attachment founder CEOs have to their equity share may lead them to value the wealth vested in the equity share more and have higher loss aversion at the IPO since every penny in their equity shares is the reward for their hard work. These distinctions between founder CEOs and non-founder CEOs suggest that even having the same interest stake in the focal firm, founder CEOs are more loss averse and, thus, are more likely to sell equity shares at the IPO than non-founder CEOs. Based on the above argument, I have the following prediction:

[2] Part of the reason why some founders self-fund their startups is that they are motivated to retain control of their startups, to be able to make all the decisions themselves, and not to have to spend time managing investors rather than growing the business (Wasserman, 2012).

H2a: CEO's founder status is positively related to CEO's likelihood of equity share sales at IPO.

As argued above, the CEO's firm interest stake structure affects the CEO's loss aversion and risk bearing (Wiseman & Gomez-Mejia, 1998) and this effect is also suggested to be moderated by individual characteristics (Wowak & Hambrick, 2010). Although I hypothesize the main effect of founder CEO status on the likelihood of share sale, I also expect that CEO founder status moderates the relationship between CEO equity share value proportion and their likelihood of share sale at IPO. As suggested, founder CEOs may have less personal wealth outside the focal firm than non-founder CEOs and therefore the risk bearing and loss aversion may be exacerbated for founder CEOs. Confronted with the same proportion of equity share ownership value in the whole interest stake in the firm, founder CEOs have higher loss aversion than non-founder CEOs. That is, founder CEOs are more sensitive to potential loss. The same increase in equity share value proportion means higher concern for loss aversion for founder CEOs and accordingly higher likelihood to sell equity shares. In addition, founder CEOs' power in the firm makes it more likely that they can win over the board if the board opposes their share sales at the IPO. As a result, for founder CEOs and non-founder CEOs, even if they face the same equity share value proportion in their cumulative firm interest stake, being founder can enhance the likelihood of their equity share sales at the IPO. Therefore, I have the following prediction:

H2b: The CEO's founder status positively moderates the relationship between the CEO's equity share value proportion and his/her likelihood of equity share sales at the IPO.

Board of Directors Actions

As suggested, equity share sales by the CEO at the IPO may send a negative signal to the market (Gompers & Lerner, 2001; Ritter, 1991). Both theories and anecdotal evidence suggest this line of thinking (Da Rin, Hellmann, & Puri, 2011). Therefore, the board of directors, who largely are investors, may oppose the CEOs' equity share sales at the IPO. Board actions have been suggested to be critical in understanding CEO behavior (cf. Golden-Biddle & Rao, 1997). One particular board action studied in this paper is if board members (excluding the CEO) also engage in equity share sales at the IPO.

Before a CEO sells equity shares at the IPO, the CEO needs to discuss the sales plan with the board (Ghosh, 2006). Since most board members are investors of the firm and hold a significant amount of equity shares, board members may be concerned that the CEO will become less committed to the firm after the equity share sales or that such equity share sales will depress the firm's share price. Thus, we might expect the board generally to oppose such sales. However, if board members themselves also plan to sell part of their equity holdings at the IPO for whatever reason, this action may foster CEO equity share sales as well. First, if board members sell shares, this suggests that they may not be concerned as much with the negative signal to the market. If this is the case, the CEO's equity share sale may not result in a negative signal either and therefore the CEO's equity share sale may not be strongly opposed by the board. Board members' equity share sale may indicate a friendly environment within the firm towards all other insiders' equity share sales including the CEO. On the other hand, if board members sell equity shares but are still concerned about the negative signal, they may still oppose the CEO's equity share sales and try to save the privilege for themselves. Specifically, board members may only allow themselves to sell some shares and oppose the CEO's equity

share sales. However, they may be unable or ineffective in their efforts to prevent the CEO from selling even if they do not want the CEO to sell shares. Since the board's oversight on the CEOs is essentially a bargaining between the two sides (Daily, Dalton & Cannella, 2003), when board members sell equity shares at the IPO, they are morally less powerful and thus have a disadvantageous position in bargaining with the CEO when CEOs plan to sell equity shares as well. In this case, the low bargaining power of the board makes the CEO's equity share sales more likely. Overall, when board members also sell equity shares at the IPO, the CEO is more likely to sell equity shares. Based on the above argument, I have the following prediction:

H3a: The Directors' equity share sales at the IPO are positively related to the likelihood of the CEO's equity share sales at the IPO.

The moderating effect of board actions on the effect of CEO compensation on CEO behavior has been documented in prior studies (Devers et al., 2008). Following and extending prior literature, this paper also predicts a moderating effect of equity share sales by board members on the relationship between CEO equity share value proportion and the likelihood of CEO equity share sales at the IPO. As hypothesized, CEOs are driven by loss aversion to sell part of their equity shares at the IPO. However, even though CEOs have the motivation to sell, whether they can successfully sell shares largely depends on the approval of the board. As suggested, when the board members also plan to sell part of their equity shares at the IPO, on the one hand, the board may have less concern for the negative signal; on the other hand, the board may be less effective in preventing the CEO from doing the same thing. Therefore, given the same proportion of equity share value to the CEO's cumulative interest stake in the firm, when

the board members also engage in equity share sales at the IPO, the CEOs may have higher bargaining power over the board and hence are more likely to be able to sell equity shares successfully. I have the following prediction:

H3b: The Directors' equity share sales positively moderate the relationship between the CEO's equity share value proportion and the CEO's likelihood of equity share sales at the IPO.

METHODOLOGY

Data

My sample includes 651 U.S. IPOs issued from 1990 to 2011 in three sectors of the computer software industry: computer programming services (SIC 7371), computer software (SIC 7372), and computer integrated systems design (SIC 7373). I constructed the sample of IPO firms from the Securities Data Corporation (SDC) Global New Issues database. Following prior research (Chen, Hambrick & Pollock, 2008; Pollock & Rindova, 2003; Ritter, 1991), I exclude any spin-off or equity carve-out IPOs to ensure that the sample firms were only independent entrepreneurial firms. I also excluded foreign firms issuing shares in the U.S. market. Firm characteristics, pre-IPO financial data, IPO-related data and upper echelons biographical data were drawn from IPO firms' prospectuses (424B form), SDC, and COMPUSTAT database. These prospectuses are available from the SEC Edgar online service and ThomsonONE database. VC-related data were collected from the VentureXpert database.

Dependent Variable

The dependent variable is a dummy variable that takes the value of 1 if the IPO firm's CEO sells equity shares at the IPO and zero otherwise. Alternatively, I also measure the percentage of equity shares the CEO sold relative to his/her own equity holdings of the focal IPO firm. I identify who the CEO is from the "Management" section of the IPO prospectus and if and how many equity shares the CEO sells at the IPO from the "Principal and Selling Shareholders" section. Other related CEO information is also identified in the prospectuses.

Independent Variables

Proportion of equity share value to the CEO's whole cumulative interest stake with the firm. This variable is constructed as follows:

$$\frac{\text{Number of focal IPO firm's shares held by the CEO} \times \text{IPO offer price}}{\text{Number of focal IPO firm's shares held by the CEO} \times \text{IPO offer price} + \sum\text{CEO annual cash compensation}}.$$

The variable measures the proportion of a CEO's wealth invested in his or her firm's equity shares to the CEO's whole cumulative interest stake in the firm since the CEO joined the firm. The higher the value, the higher the proportion of the CEO's interest state with the firm exposed to uncertainty.

CEO wealth constraint. CEO wealth constraint is measured by founder status and it is a dummy variable that is coded as 1 if the CEO is also a founder of the firm; 0 otherwise. Founder information was collected from the IPO firms' prospectuses. As argued above, founder CEOs may have less personal wealth outside their firm and hence have a higher need for cash and wealth constraint.

Board member equity share sale action. A dummy variable is used to indicate if any non-CEO board member sells focal firm's equity shares at the IPO. The variable is

coded as 1 if any board member sells equity share at the IPO; 0 otherwise. The data come from the IPO firms' prospectuses.

Control Variables

CEO characteristics. I include the following individual CEO characteristics in my analysis to control for possible effects on the individual level: (1) Age. The CEO's age may affect his/her likelihood of equity share sales at the IPO. The CEOs at different ages may have different needs for cash, which may affect their equity share sale decision. (2) Prior entrepreneurial experience. This variable is coded as 1 if a CEO founded other firms (at least one) prior to joining or founding the focal firm, 0 otherwise. Founder experience may capture the CEOs' risk preference, experience and wealth situation, which may in turn affect the CEOs' decision of equity share sale at the IPO (Fairlie, 2002). (3) Annual cash compensation. To control for the wealth effect, I also include annual cash compensation. Specifically, annual cash compensation includes annual salary, bonus, and other annual cash compensation. (4) Chairman of the board of directors. I use a dummy variable to indicate if the CEO is also the chairman of the board of directors. Being the chairman of the board may give the CEOs power to influence board decisions including equity share sale at the IPO. (5) Firm tenure. The CEO firm tenure refers to the number of years since the CEO joined or founded the firm. (6) The CEO equity share ownership percentage prior to the IPO. The CEO equity share ownership percentage variable is calculated as the percentage of common shares relative to the whole firm held by a CEO prior to the IPO. The CEO equity share ownership percentage prior to IPO measures ownership-related factors such as power. CEOs who own a significant

percentage of equity shares are suggested to have more power within the firm and be able to influence important decision making (Finkelstein, 1992).

***Board characteristics*.** In my analysis I control for the following board characteristics. (1) Size of the board. Size of the board may indicate monitoring strength of the board. The bigger the board is, the stronger the board monitoring is. Specifically, I control for the number of non-CEO board members in my regression. (2) Inside director proportion. An inside director is a director who is also a firm officer (Johnson, Hoskisson, & Hitt, 1993; Seward & Walsh, 1996). Prior studies suggest that inside directors may be less effective in monitoring CEOs since they work under CEOs and their career prospects are significantly affected by CEOs. I divide the number of inside directors by the total number of directors to obtain the inside director proportion. I exclude the CEO from the calculation when the CEO was also a director of the firm.

Firm characteristics. Firm size-related variables such as the log value of total assets one year prior to the IPO, the log value of sales prior to the IPO and the log value of sales one year post-IPO are included in the regression to control for firm size effects and firm quality (Bloom & Milkovich, 1998). In addition, I include the firm's age.

IPO characteristics. To control for IPO-related factors, I include the following variables: (1) Log value of the IPO proceeds. This variable measures the size of the IPO. (2) Offer price/book value measures how profitable the share sale is at the IPO. Presumably, the higher the ratio, the more profitable the share sale is. This profitability may affect the CEOs' share sales. (3) Number of the IPOs in the whole market in the 3 months preceding the focal IPO. This variable is used to measure the "hotness" of the IPO market. If a large number of firms conduct their IPOs then the IPO market is hot,

which can potentially affect a CEO's expectation about the market and their share sale decision. (4) Number of IPOs in computer software industry in the 3 months preceding the focal IPO. Although I control for the number of IPOs in the entire market to measure the hotness of the market, the IPO market for software industry could be driven by some industry-specific factors. That is, the computer software industry could face a cold market when the IPO market is hot for other industries or vice versa. To control more accurately for the hotness of the IPO market for software industry, I control for the number of computer software industry IPOs in the 3 months preceding the focal IPO.

Underwriter prestige. Underwriters are important players during the IPO process (Carter & Manaster, 1990). Underwriter prestige data can be constructed in the spirit of the methodology of Cater and Manaster (1990) and are available online at http://bear.warrington.ufl.edu/ritter/ipodata.htm. The online data are constructed by Jay Ritter and extensively used in the finance literature (e.g. Ljungqvist & Wilhelm, 2003; Loughran & Ritter, 2004).

VC. The variable of VC is a dummy variable that indicates if the IPO firm is backed by any venture capital firm. The variable is coded as 1 if the IPO firm is backed by a venture capital firm; 0 otherwise. The data were drawn from the SDC database and I collected the relevant information from IPO firms' prospectuses and VentureXpert database to validate the SDC data.

Year period dummy. Because my sample includes IPOs covering 1990-2011, I create year period dummies to control for possible year effects. According to prior studies (e.g., Loughran & Ritter, 2004), the IPO market followed relative stable patterns in the

periods 1990-1998, 1999-2000, and post-2000, respectively. In my analysis, I create three dummy variables to indicate these time periods.

Method of Analysis

Because the dependent variable is a dummy variable, a Probit model is appropriate. The unit of analysis is the IPO. The results are robust to a logit model. In another robustness check, I use Tobit regression to predict the percent of equity shares sold by the CEO relative to the CEO's own holding of their firm and report results in Table 2. In addition, I adopt an instrumental variable approach to address possible endogeneity issue and get the robust results. I discuss my analysis in the following section.

RESULTS

Table 1 presents the descriptive statistics and correlations for all variables. 26% of sample CEOs engage in share sales at the IPO. 87% of the dollar value of CEOs' whole cumulative interest stake with the firm is concentrated in the focal firms' equity shares. 44% of the CEOs in the sample are also founders of their firm. 34% of the sample firms have at least one non-CEO director who sells equity share at the IPO. 65% of the sample firms are backed by VCs. Sample firms have an average age of 8.3 years. On average, CEOs have been with their firms for 6.12 years. Specifically, founder CEOs have a firm tenure of 8.25 years and non-founder CEOs 4.47 years. We can see that the sample firms are largely entrepreneurial firms. The likelihood of CEOs' equity share sale has a correlation of .21 with CEO founder status and .52 with non-CEO director equity share sale dummy, which is consistent with my hypotheses.

Insert Table 1 about here

Table 2 presents the results of a Probit and Tobit regression analysis predicting the likelihood and percentage of CEO's equity share sale at the IPO. Marginal effects are reported in Probit models in Table 2. Model 1 includes control variables as a baseline model. Model 2 includes CEO equity share value proportion and the coefficient is positive and significant (β=.52; $p< .01$), suggesting that when the proportion of equity share value in the CEO's whole cumulative interest stake with the firm is high, the CEO is more likely to engage in equity share sales at the IPO and consistent with H1. CEO equity share value proportion is a measure of the degree of uncertainty associated with CEO cumulative interest stake in the firm. The finding suggests that the higher the equity share value proportion, the higher the uncertainty and CEO lass aversion and the higher the likelihood of equity share sale at the IPO. In Model 2, I include CEO founder status and find it positive and significant (β= .11; $p< .01$), suggesting that compared with non-founder CEOs, founder CEOs are more likely to sell equity shares at the IPO. If I assume that CEO founder status is able to measure wealth constraint well, the finding implies that founder CEOs may invest much of their personal wealth into the focal firm, have less personal wealth outside the firm and hence really have a high need for cash. This finding supports my H2a. In Model 2 the coefficient on board action of equity share sale dummy is positive and significant (β=.32; $p< .001$), suggesting that when board members sell equity shares at IPO, CEOs are more likely to sell equity shares as well. As argued, directors' equity sale indicates a weakened oversight on the CEO. When the oversight on the CEO becomes weak, the CEO is more likely to sell some equity shares at the IPO to lower the concern for loss aversion. This finding provides support to H3a. Similar results

can be founder when I use the percentage of equity shares sold by the CEO as my dependent variable in Model 5 Table 2.

Insert Table 2 about here

To test interaction hypotheses 2b and 3b, I include interaction terms in Model 3. To reduce multicollinearity, I mean-center CEO equity share value proportion, CEO founder status, and board action of equity share sale dummy before creating the interaction terms. From Table 2, we can see that none of the interaction terms are significant in Model 3. Since I adopt a Probit model to test my hypotheses, the interpretation of the interaction terms can not only be based on the significance level of the estimated coefficients in the table reported. To test more accurately and interpret the interaction terms in a Probit estimator, I adopt a simulation-based approach (King, Tomz & Wittenberg, 2000; Holburn and Zelner, 2010; Zelner, 2009). The advantage of this simulation-based approach is that it displays the relationship and significance level over the full range of the independent variable rather than only a single point. With this approach, I can see over which range the relationship is significant and over which it is not. Based on this approach, I report the interaction graph of CEO equity value proportion and founder status in Figure 2. In Figure 2, x-axis is my independent variable CEO equity share value proportion and y-axis is the change of likelihood of CEO's equity share sale at the IPO when the CEO founder status turns from zero to one. From Figure 2, we can see that the interaction is significant at 95% level over most of the range of CEO equity share value proportion. The vertical red dotted lines from left to right indicate the mean minus two standard deviations, mean minus one standard deviation, mean, and maximum. The line in Figure 2 is inverted-U shaped. On its upward-slope part,

the line is significantly above zero, suggesting that the likelihood of founder CEO's equity share sale is higher than that of non-founder CEO. In addition, this part of the line has positive slope, suggesting that with the increase of CEO equity share value proportion, founder CEOs have an increasingly higher likelihood of selling equity shares at IPO than non-founder CEOs. Therefore, the positive-slope part of the line supports my H2b, suggesting a positive moderating effect of CEO founder status on the relationship between CEO equity share value proportion and the likelihood of equity share sale at the IPO. More interestingly, the negative-slope part of the line is not consistent with H2b. The negative-slope part is still above zero, suggesting that founder CEOs are still more likely to sell equity shares at IPO than non-founder CEOs at each corresponding level of CEO equity share value proportion. The negative slope suggests that with the increase of CEO equity share value proportion, the difference between founder CEOs and non-founder CEOs' likelihood of equity share sales at the IPO is decreasing, implying that at high levels of CEO equity share value proportion, founder CEOs behave more and more like non-founder CEOs. This negative-slope part may suggest that founder CEOs on this part may have plenty of personal wealth outside the firm or they are more committed to the firm and hence do not want to sell equity shares at the IPO.

Insert Figure 2 about here

To test H3b, I adopt the same approach as above and report the graph in Figure 3. Similarly, y-axis displays the change of likelihood of CEO equity share sale at the IPO when director equity share sale dummy turns from zero to one. The line in Figure 3 is significant over most of the range of CEO equity share value proportion. The significant part of the line is above zero, suggesting that the likelihood of CEO equity share sale at

the IPO is significantly higher when directors also sell shares than when no directors sell. In addition, the line has a positive slope, suggesting that with the increase of CEO equity share value proportion, the difference between the likelihood of CEO equity share sale at the IPO is becoming increasingly large when directors sell shares versus not sell. This finding supports H3b, implying that directors' equity share sale action positively moderates the relationship between CEO equity share value proportion and the likelihood of equity share sales at the IPO.

Insert Figure 3 about here

Although I controlled for factors that may affect CEOs' share sale at the IPO as much as possible, it is still possible that some firm-specific unobservable factors affect insider share sales at the IPO. For example, firm-related variables such as total assets, sales and firm age may not completely capture firm quality and therefore, firm quality may be unobservable to researchers but it could significantly affect CEOs and board members' decisions to sell shares. CEOs and directors of poor quality firms are more likely to sell shares at the IPO and vice versa. If this is the case, firm quality is an omitted variable and is contained in the error term of the regression, causing the correlation between board action of share sale and the error term. That is, the above results may omit unobservable firm quality and thus suffer from endogeneity (Wooldridge, 2002) and the real driver of CEO share sale at IPO may be the unobservable firm quality rather than board members' share sale at IPO.

To address this possible endogeneity issue, I adopt two approaches. First, I tried to control for expected firm quality or insiders' private information about firm quality. Specifically, I use firm total asset, firm sales one-year prior to the IPO, and firm age to

regress on sales one-year post-IPO and then use the predicted value of sales one-year post-IPO as a proxy for private information of future firm quality. I employ the predicted value of sales one-year post-IPO as a control variable and obtain the same results as in Table 2 (results not reported here). Alternatively, I use the real sales one-year post-IPO as a control variable in Table 2 to predict the likelihood of CEO share sale at the IPO. All the significant results in Table 2 remain significant in either way.

Second, I adopt an instrumental variable approach. In this study, a good instrumental variable must be (1) correlated with board members' share sale at the IPO and (2) not correlated with the error term of the regression or should not be controlled for as a direct explanatory variable of dependent variable. To find appropriate instrumental variables, I split my sample into VC-backed firms and non-VC-backed firms. VC fund age may serve as a good instrumental variable for directors' share sale at the IPO for VC-backed firms. According to prior studies (e.g., Gompers & Lerner, 2001), VC funds usually enter their exit period 7 to 8 years after their founding. In the first 7 or 8 years, VC funds actively make investments and build up the firms and after that they actively seek to exit their investment and distribute cash back to their limited partner investors (Da Rin, Hellmann & Puri, 2012). Therefore, compared with VC funds younger than 7 or 8 years, older VC funds have higher motivations to exit their investments. This may serve as a good instrumental variable since the pressure that old VC funds have is correlated with VC's share sale at the IPO but has little to do with the quality of the IPO firm. The doubt comes that if the VC fund anticipates its exit by selling equity shares at the IPO and may reduce its value-adding activities to the focal firms, VC fund age is then correlated with the IPO firm quality. This is not true in my case since prior studies (e.g.,

Draho, 2004) suggest that the IPO market has high volatility and it may only take a few months for a hot market to change into a cold market. It depends on market condition if any insiders are allowed by underwriters to sell secondary shares at the IPO (Draho, 2004). Therefore, even if old VC funds plan to sell shares at the IPO, they are not sure if the market condition allows them to do so, which means VC funds would not reduce their value-adding activities to the focal the IPO firms even if they plan to sell shares at the IPO. In addition, prior studies (e.g., Da Rin, Hellmann & Puri, 2012; Gompers & Lerner, 2001) suggest that VC firms usually hold substantial shares post-IPO, at least within one year, even if they sell part of their shares at the IPO. As a result, a large part of VCs' interest is still vested in the focal IPO firm post-IPO, VC firms would not reduce value-adding activities prior to the IPO. Note that although more experienced or older VC firms may be able to choose higher quality investments, VC experience effect is a firm-level variable rather than a fund-level factor. Many VC firms have multiple, simultaneous VC funds of different ages (Da Rin, Hellmann & Puri, 2012). Different aged VC funds do not have different levels of experience since they belong to the same VC firm. That is, VC firm age as a proxy of experience may be correlated with the quality of the investment but VC fund age is not.

In my sample, there are 427 VC-backed firms (66%) out of 651 firms. In these 427 VC-backed firms, there are 348 unique VC firms, 868 unique VC funds, and 1,120 VC investments. To test if VC funds older than 8 years are more likely to sell shares at IPO, I create a dummy variable to indicate if a VC fund is older than 8 years and younger than 15 years[3] and use this dummy variable to predict the likelihood of its share sales at

[3] 1,012 out of 1.120 (90.36%) VC funds are younger than 15 years. 236 (21.07%) VC funds are between 8 and 15 years.

the IPO on the VC fund level. After controlling for VC firm age, the IPO firm fixed effect, and VC firm fixed effect, the dummy variable is significant in predicting VC fund's likelihood of share sales at IPO (results not reported here). To instrument for directors' share sales at IPO on the firm level, I constructed a variable: the number of VC funds aged between 8 and 15 each IPO firm has. Since on the fund level, the VC funds aged between 8 and 15 are more likely to sell shares at the IPO, it is reasonable to expect the more VC funds aged between 8 and 15 an IPO firm has, the more likely these VC funds will sell shares at the IPO and, therefore, the more likely I observe directors' share sales[4]. I test the correlation between the number of VC funds aged between 8 and 15 and the likelihood of directors' share sales at the IPO for VC-backed firms ($r=.2$; $p<.001$). In addition, the number of VC funds aged between 8 and 15 each IPO firm does not significantly in predict the dependent variable: the likelihood of the CEO's share sale at the IPO in the sample of VC-backed firm. Therefore it qualifies as an instrumental variable. As suggested, VC funds aged between 8 and 15 are more likely to sell shares and partially exit at the IPO due to exit pressure, which is unrelated to the IPO firm quality. In addition, I create another instrumental variable by constructing the number of IPOs whose VC funds aged between 8 and 15 years and sold shares at IPO in the 3 months preceding the focal IPO to instrument for directors' share sale dummy. Presumably, following a social comparison logic, the more VC funds aged between 8 and 15 years who sold shares at the IPO partially to exit their investment in the 3 months prior to the focal firm, the more legitimate it will be for focal directors to do the same thing. In addition, the share sales at the IPO of other firms' VC funds have little to do

[4] In most cases, VCs sit on the board of directors of the IPO firm.

with the focal firm's quality. Therefore, theoretically, the number of IPOs whose VC funds aged between 8 and 15 who sold shares at the IPO in the 3 months preceding the focal IPO could serve as an instrumental variable for the directors' share sale of the focal firm. Empirically, this number is significantly correlated with focal directors' share sale at the IPO for the VC-backed firms (r=.24; p< .001) and for the full sample (r=.16; p< .001) and does not significantly predict the dependent variable: the likelihood of focal CEO's share sales at the IPO neither in VC-backed firms nor in full sample. Because my dependent variable and endogenous variable are both dummy variables, I adopted a treatment-effect model based on maximum likelihood estimation and report the results in Table 3.

Insert Table 3 about here

In Table 3, Models 1 through 3 are for VC-backed sample and Models 4 through 6 are for non-VC-backed sample. In all the first stage models (Models 1 and 4), the dependent variable is the endogenous variable: directors' equity share sale dummy. The dependent variable in all the second stage models (Models 2 and 5) is CEOs' equity share sale dummy. In Models 1, I use the number of VC funds aged 8-15 (β=.5; p< .001) and the number of IPOs whose VC funds aged 8-15 and sold shares at IPO in 3 months preceding the focal IPO (β=.28; p< .001) to instrument for focal firm's directors' equity share sale and find them significant. Accordingly, directors' share sale dummy is significant (β=.26; p< .001) in the second stage Model 2. In Model 3, I report results from a Probit estimator for comparison and directors' share sale dummy is significant in both models. Although CEO equity share value proportion is not significant in Model 3, it is significant (β=.52; p< .05) in Model 2. Founder status is not significant in either Model 2

or 3 and I discuss the possible reasons in the discussion section. For non-VC-backed sample, I did the similar analysis. Model 4 is the first stage and my instrument variable is significant (β=.18; $p< .01$). In Model 5, the director equity share sale variable is positive and significant (β=.58; $p< .001$). Model 6 is the results from a Probit estimator. As you can see, Model 5 and Model 6 are very similar, supporting the robustness of the results.

Overall, above results provide evidence to support my hypotheses although some hypotheses only hold for a certain subgroup. Specifically, Hypothesis 1, which states that the proportion of equity share value to CEO whole cumulative interest stake in the firm is positively related to the likelihood CEO equity share sale at the IPO, is supported. This finding suggests that CEOs are more likely to sell equity shares when they have high concerns for loss aversion. It also predicts the percent of shares sold, i.e, the degree of share sales. Hypothesis 2a, states that founder CEOs are more likely to sell shares at the IPO and is supported. Further analysis finds that this result only holds for non VC-backed firms and as such the results in Table 2 are largely driven by non VC-backed firms. These results may suggest that founders in VC-backed and non-VC-backed firms have significantly different amounts of personal wealth outside the focal firm. Founder CEOs in VC-backed firms have more personal wealth outside the focal firms and hence have less wealth constraints than founder CEOs in non-VC-backed firms. Or alternatively, non-VC directors exert weaker oversight on founder CEOs, which makes it more likely for founder CEOs to be able to sell equity shares at the IPO. In contrast, VCs can impose stronger oversight on CEOs and CEO's founder status does not render them privilege. Both explanations are feasible and because of the data constraint, I cannot tease them apart in this study.

Hypothesis 2b, which states a positive moderating effect of CEO founder status on the relationship between CEO equity share value proportion and the likelihood of CEO equity share sale at the IPO, provides further support. Hypothesis 2b is only significant for some range of CEO equity share value proportion. As suggested, the negative-slope part of Figure 2 implies that founders behave more like non-founders when their equity share value proportion is high. This may suggest that those founders have more personal wealth outside the focal firm and hence do not have wealth constraints as much. Or they have stewardship toward the focal firms and hence do not want to sell equity shares for the fear of the negative signal. This is not theorized in this study but deserves more investigation in the future.

Hypothesis 3a, which states that the directors' equity share sale at the IPO is positively associated with the CEOs' equity share sale, is significant across both samples, VC-backed firms and non VC-backed firms. When directors also sell equity shares at the IPO, the oversight from the board becomes weaker and therefore CEOs have a higher likelihood to sell equity shares as well. Also, directors may not concern the negative signal associated with CEO equity share sale at the IPO. Hypothesis 3b, stating a positive moderating effect of directors' equity share sale at the IPO on the relationship between CEO equity share value proportion and the likelihood of CEOs' equity share sale at the IPO, is supported. This result suggests that when CEOs have the same proportion of equity share value, CEOs whose directors sell equity shares have a higher bargaining power and hence a higher likelihood of selling equity shares at the IPO. Overall, these results are consistent with my hypotheses.

DISCUSSION & CONCLUSION

Prior studies on managerial equity ownership, mostly in compensation literature, have focused on the relationship between executive compensation and firm performance or strategic risk taking such as R&D expenditure, long-term debt, and mergers and acquisitions (e.g., Barkema & Gomez-Mejia, 1998; Devers et al., 2008; Finkelstein & Hambrick, 1988). However, the link between managerial equity ownership and firm performance or strategic risk taking is not direct, is of unclear timing, and is subject to the influence of numerous external forces (Tosi, Werner, Katz & Gomez-Mejia, 2000). Prior studies suggest that researchers are more likely to be able to observe the influence of managerial equity ownership by focusing on more proximal outcomes associated with equity holding, rather than on distal outcomes such as performance and strategic risk taking (Devers et al., 2008). In addition, prior studies have not considered the role of active risk management by agents (Martin, Gomez-Jejia, & Wiseman, in press). An implicit assumption in prior research is that the agent is passive and does not have the ability to manage actively the risk exposure to their equity share ownership (Martin, Gomez-Jejia, & Wiseman, in press). In this study, I examined the influence of CEO managerial equity holding on a proximal and individual level behavior: CEO equity share sale at the IPO. Direct examination of such a proximal and active risk management behavior of CEOs helps provide a better understanding of the effect of CEO managerial equity ownership, which provides a micro-foundation for studies on higher levels such as strategic risk taking and firm performance.

My findings elucidate the influence of CEO managerial equity ownership, CEO wealth constraint, and board actions on CEO individual risk behavior by demonstrating:

(1) the proportion of equity share value in the CEO's whole cumulative interest stake with the firm is positively associated with the likelihood of the CEO equity share sale at the IPO; (2) founder CEOs are more likely to sell shares, and the above relationship in (1) is stronger when the CEO is a founder; (3) board members' share sale is positively associated with CEO share sale, and the above relationship in (1) is stronger when board members also sell shares at the IPO. This paper makes contributions to the literature in several ways.

First, although BAM suggests that compensation mix affects how a CEO frames a problem and in turn his or her risk bearing and risk taking behavior, prior studies have not examined how the allocation between cash and share compensation affects CEO risk bearing and loss aversion. Although the calculation of CEO equity share value proportion includes equity shares that not only come from compensation, the findings have significant implication for share compensation. This paper contributes to BAM by demonstrating that the proportion of equity share ownership value in CEO's whole cumulative interest stake with the firm affects CEO risk bearing and loss aversion. The higher the proportion of share ownership value, the more concerns for loss aversion CEOs have and the more likely CEOs are to sell part of their equity shares to avoid possible losses due to later share price fluctuation. My finding provides evidence that CEOs are loss averse and the loss aversion is affected by wealth constraints. This finding supports the loss aversion argument proposed by BAM and extends BAM by suggesting that the proportion of share ownership value in the CEO's whole cumulative interest stake with the firm affects the degree of loss aversion and accordingly risk behavior.

Second, this paper contributes to a model of person-pay interaction by incorporating CEO founder status into consideration. Although a model of person-pay interaction provides insights on the contingencies under which pay effect varies, it ignores how personal wealth constraint influences the effect of pay on executives. Founder status is a proxy for wealth constraint. Founders usually have a higher percentage of personal wealth vested in the focal firm. The same equity share value proportion can have different effects on CEOs who have different percentages of personal wealth invested in the focal firm. This paper suggests that the CEO's founder status strengthens the relationship between the proportion of equity share value and the likelihood of CEO share sale at the IPO. As suggested, founders usually provide a significant proportion of financing to their firm in the early stage and do not have a good opportunity to exit until the IPO (Prowse, 1998; Wasserman, 2012). Compared with non-founder CEOs, founder CEOs may have less personal wealth outside the focal firm due to the above reasons. Therefore, the same equity share value proportion means more concerns of loss aversion for founder CEOs. In addition, founders largely prefer equity share ownership to cash and count on the equity share ownership to repay their hard work for the firm (Wasserman, 2012). Founder CEOs are also suggested to have more emotional attachment to share ownership, which can increase their loss aversion and, in turn, the likelihood of selling equity shares at the IPO. In addition, this finding also contributes to BAM. BAM suggests performance history, board monitoring, and performance target difficulty are macro-level factors that affect the agents' risk bearing and loss aversion; it gives inadequate attention to agents' differences at the individual level. This paper extends BAM by suggesting that certain individual characteristics such

as wealth constraint affects risk bearing and loss aversion, which is ignored in the original BAM formulation.

My findings on CEO founder status suggest that in non-VC-backed firms, the main effect of CEO founder status is significant, which means founder CEOs are more likely to sell equity shares at the IPO. In my argument, founder status may capture two characteristics: less personal wealth outside the focal firm and founder privilege. I find that the main effect of founder status is only significant in non-VC-backed firms. I offer two possible explanations for this finding. One is that founders in VC-backed firms may have more personal wealth outside the focal firm than founders in non-VC-backed firms and, thus, have lower loss aversion. Therefore, the difference between founder CEOs and non-founder CEOs in VC-backed firms does not make a difference to their likelihood of share sales. The other explanation is that VC directors are more vigilant at monitoring. It is possible that VC's fiduciary responsibility to their limited partners provides additional incentives to monitor CEOs so that even founder CEOs do not have privilege when it comes to share sales at the IPO. While I cannot distinguish between these theories, to the best of my knowledge, this heterogeneity of founders has not been noted in the literature.

Third, the impact of board equity share sale at the IPO on the likelihood of CEOs' equity share sale is significant across both VC-backed firms and non VC-backed firms. As suggested, when board members sell equity shares at the IPO, they are either not concerned with the negative signal or less effective in preventing the CEO from doing the same thing, and therefore CEOs are more likely to sell equity shares at the IPO. Although board action is suggested to affect CEO risk behavior (Devers et al., 2008), share sale action of the board examined in this study has not been studied in prior literature and is

found to affect significantly the CEO's share sale behavior at the IPO. It is possible that this phenomenon is driven by unobservable firm quality. Specifically, it may be that board members and CEO's share sale at the IPO are both driven by private firm quality information and therefore it is not the board members' share sale but instead the firm quality that causes the CEO's share sale. To address this possibility, I adopt an instrumental variable approach and use VC fund age and non-focal VCs' equity share sales to instrument for board members' share sale (see Tables 3). Board members' equity share sale at the IPO remains significant in the instrumental variable analysis, which provides support for the argument that board members' equity share sale causes the CEO's equity share sale at the IPO. When board members need to sell equity shares at the IPO, they either do not monitor the CEO's equity share sale or their oversight on the CEO becomes weak. The instrumental variable analysis suggests that VC funds sell equity shares at the IPO due to exit pressure, which is unrelated to firm quality. I find that the results follow a similar pattern for non-VC-backed firms and cautiously suggest that board members' equity share sale at the IPO is largely driven by reasons unrelated to firm quality. These findings suggest a causal relationship between the board members' equity share sale and the CEO equity share sale, extending prior research on the effect of board actions on CEO risk behavior by identifying the importance of board members' equity share sale behavior at the IPO (e.g., Devers et al., 2008). These findings contribute to a model of person-pay interaction by suggesting that the effect of pay on executives may be significantly contingent on board governance, indicating that when board oversight weakens, managerial behavior driven by loss aversion derived from managerial equity share ownership is more likely to occur. Given that loss aversion-driven managerial

behavior may not be consistent with shareholders' interest, the above finding suggests that the incentive alignment effect of managerial equity share ownership partially depends on board governance. Although some prior studies suggest a substitute relationship between board governance and incentive alignment such as managerial equity share ownership (e.g., Beatty & Zajac, 1994), this paper suggests a more complex relationship between board governance and managerial equity share ownership. Namely, in some cases these two governance forces complement each other. It is important for future research to identify conditions under which board governance and managerial equity share incentive alignment work as substitution or complement.

This study has a number of limitations. The first is the nature of the measure of CEO founder status. As in prior studies in the literature, I do not have comprehensive measures of CEO wealth. Hence I am unable to distinguish completely the loss aversion and CEOs' privilege derived from their founder status. Although I controlled other related factors as much as possible and advanced the methods of prior studies by splitting my sample into VC-backed and non-VC-backed firms, it would be ideal if future research can collect detailed information on CEO personal wealth and identify research contexts able to tease apart loss aversion and founder privilege. Second, this study only focuses on the computer software industry. Future studies may include other industries to test the generalizability of the results. The arguments made in this study are believed to hold for other industries, and it is hoped future research will be able to confirm these results empirically across new empirical settings.

To conclude, by using 651 U.S. software IPOs from 1990 to 2011, I find that the proportion of equity share value in the CEO's whole cumulative interest stake in the firm

is positively associated with the likelihood of CEO equity share sale at the IPO and this relationship is enhanced when the CEO is a founder and when board members also sell equity shares at the IPO. In addition, founder CEOs are more likely to sell shares at the IPO. When board members sell equity shares at the IPO, CEOs are more likely to sell shares.

Table 1: Descriptive Statistics and Correlations

	Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	Likelihood of CEO stock sale at IPO	0.26	0.44	1.00																							
2	CEO stock value proportion	0.87	0.15	0.03	1.00																						
3	CEO founder status	0.44	0.50	0.21	0.11	1.00																					
4	Director stock sale dummy	0.34	0.47	0.52	-0.08	0.05	1.00																				
5	Chairman	0.52	0.50	0.11	0.11	0.31	0.02	1.00																			
6	CEO firm tenure	6.12	4.76	0.30	-0.28	0.39	0.19	0.24	1.00																		
7	CEO age	45.37	7.48	-0.03	-0.22	-0.15	0.02	0.02	0.12	1.00																	
8	CEO annual cash compensation	0.31	0.37	0.15	-0.34	0.06	0.11	0.03	0.28	0.14	1.00																
9	Prior entrepreneurial experience	0.16	0.37	0.01	0.09	0.15	-0.06	0.09	-0.05	-0.01	0.00	1.00															
10	CEO pre-IPO stock ownership	0.20	0.22	0.25	0.25	0.34	0.03	0.32	0.42	-0.04	0.01	0.09	1.00														
11	Board size	6.03	1.65	-0.09	-0.02	-0.12	0.01	0.00	-0.15	0.07	0.12	0.03	-0.34	1.00													
12	Inside director proportion	0.33	0.19	0.13	0.06	0.16	0.03	0.08	0.22	-0.01	-0.11	0.02	0.45	-0.44	1.00												
13	Pre-IPO total assets (log)	2.56	1.33	0.09	-0.06	0.03	0.14	0.01	0.22	0.10	0.37	-0.01	-0.15	0.30	-0.28	1.00											
14	Pre-IPO sales (log)	2.74	1.30	0.22	-0.20	0.01	0.27	0.05	0.39	0.13	0.41	-0.07	0.00	0.17	-0.11	0.77	1.00										
15	Firm age	8.30	5.58	0.19	-0.33	-0.04	0.20	0.10	0.60	0.22	0.22	-0.12	0.16	-0.03	0.10	0.28	0.47	1.00									
16	Post-IPO sales (log)	3.69	1.21	0.14	0.02	0.01	0.16	-0.01	0.17	-0.01	0.28	-0.02	-0.09	0.21	-0.20	0.71	0.75	0.22	1.00								
17	Offer price/book value	7.17	0.31	-0.06	-0.01	-0.03	-0.05	-0.06	-0.02	0.00	0.01	-0.02	-0.02	-0.01	0.00	0.02	0.03	-0.01	0.04	1.00							
18	IPO proceeds (log)	3.44	0.85	0.07	0.22	0.00	0.11	-0.02	0.02	-0.05	0.28	0.02	-0.25	0.30	-0.37	0.67	0.45	0.05	0.63	0.00	1.00						
19	Number of IPOs in 3 preceding months (market)	146.02	57.55	0.00	0.03	0.03	-0.03	0.09	-0.01	-0.01	-0.25	-0.03	0.15	-0.20	0.23	-0.35	-0.23	-0.02	-0.21	-0.02	-0.35	1.00					
20	Number of IPOs in 3 preceding months (software)	19.93	12.32	-0.20	0.22	0.04	-0.23	0.05	-0.13	-0.06	-0.21	-0.01	0.04	-0.09	0.08	-0.25	-0.29	-0.12	-0.14	0.00	-0.05	0.63	1.00				
21	Underwriter prestige	7.24	2.04	0.12	0.17	0.05	0.17	-0.05	0.05	-0.13	0.21	-0.04	-0.20	0.23	-0.31	0.59	0.44	0.07	0.61	0.01	0.73	-0.20	-0.03	1.00			
22	VC-back dummy	0.65	0.48	-0.03	0.05	0.01	0.08	-0.04	-0.12	-0.10	0.00	-0.02	-0.38	0.15	-0.36	0.23	0.10	-0.08	0.22	-0.01	0.29	-0.05	-0.02	0.44	1.00		
23	1990-1998 period	0.60	0.49	0.24	-0.16	-0.01	0.25	0.03	0.14	0.06	-0.18	-0.12	0.23	-0.29	0.33	-0.31	-0.07	0.09	-0.22	-0.02	-0.52	0.52	-0.01	-0.31	-0.18	1.00	
24	1999-2000 period	0.25	0.43	-0.26	0.25	0.02	-0.31	-0.03	-0.21	-0.14	-0.04	0.01	-0.16	0.11	-0.17	0.05	-0.17	-0.20	0.05	0.01	0.31	-0.07	0.45	0.24	0.18	-0.71	1.00
	N=651																										

Table 2: Probit and Tobit Models Predicting CEO Equity Share Sales at IPO

	1	2	3	4	5	6
VARIABLES	Likelihood of share sale			Percent of share sale		
CEO share value proportion		0.52**	0.40+		0.11+	0.08
		(0.198)	(0.205)		(0.059)	(0.059)
CEO founder status		0.11**	0.11**		0.03**	0.04**
		(0.039)	(0.039)		(0.013)	(0.013)
Director stock sale		0.32***	0.32***		0.11***	0.11***
		(0.040)	(0.040)		(0.013)	(0.013)
CEO share value proportion × CEO founder status			-0.15			-0.14
			(0.242)			(0.083)
CEO share value proportion × Director stock sale			0.33			0.03
			(0.242)			(0.073)
Chairman	0.02	-0.01	-0.01	0.00	-0.00	-0.00
	(0.036)	(0.036)	(0.036)	(0.013)	(0.012)	(0.012)
CEO firm tenure	0.01*	0.01	0.01	0.00+	0.00	0.00
	(0.005)	(0.005)	(0.005)	(0.002)	(0.002)	(0.002)
CEO age	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
CEO annual cash compensation	0.07+	0.15**	0.13*	0.02	0.03+	0.02
	(0.045)	(0.059)	(0.060)	(0.015)	(0.017)	(0.017)
Prior entrepreneurial experience	0.06	0.04	0.05	0.02	0.01	0.01
	(0.051)	(0.049)	(0.050)	(0.015)	(0.014)	(0.014)
CEO pre-IPO stock ownership	0.30**	0.13	0.15	0.07*	0.03	0.04
	(0.102)	(0.114)	(0.118)	(0.033)	(0.033)	(0.033)
Board size	-0.00	-0.02	-0.02	-0.00	-0.01+	-0.01+
	(0.012)	(0.013)	(0.013)	(0.004)	(0.004)	(0.004)
Inside director proportion	0.09	-0.05	-0.06	0.02	-0.03	-0.03
	(0.107)	(0.099)	(0.099)	(0.038)	(0.033)	(0.032)
Pre-IPO total assets (log)	-0.07*	-0.04	-0.04	-0.03**	-0.02*	-0.02*
	(0.030)	(0.028)	(0.028)	(0.011)	(0.010)	(0.010)
Pre-IPO sales (log)	0.07*	0.03	0.03	0.03*	0.01	0.01
	(0.031)	(0.031)	(0.032)	(0.012)	(0.012)	(0.011)
Firm age	0.00	0.00	0.00	0.00	0.00	0.00
	(0.004)	(0.004)	(0.004)	(0.002)	(0.001)	(0.001)
Post-IPO sales (log)	-0.03	-0.00	0.00	-0.01	0.00	0.00
	(0.027)	(0.025)	(0.025)	(0.010)	(0.009)	(0.009)
Offer price/book value	-0.06+	-0.04	-0.04	-0.01**	-0.00	-0.00
	(0.033)	(0.032)	(0.030)	(0.004)	(0.004)	(0.004)
IPO proceeds (log)	0.15***	0.06	0.07	0.05***	0.02	0.02+
	(0.038)	(0.040)	(0.041)	(0.014)	(0.014)	(0.014)
# of IPOs in 3 preceding months (market)	0.00	0.00	0.00	-0.00	0.00	0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
# of IPOs in 3 preceding months (software)	-0.01***	-0.01***	-0.01***	-0.00**	-0.00*	-0.00**
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Underwriter prestige	0.02+	0.01	0.01	0.01*	0.01	0.01
	(0.013)	(0.014)	(0.014)	(0.005)	(0.005)	(0.005)
VC-backed	0.02	-0.03	-0.03	-0.00	-0.02	-0.02
	(0.042)	(0.042)	(0.043)	(0.016)	(0.014)	(0.014)
1990-1998 period	0.27***	0.17*	0.17*	0.11***	0.05*	0.06*
	(0.056)	(0.066)	(0.067)	(0.026)	(0.027)	(0.027)
1999-2000 period	-0.00	0.02	0.03	-0.01	-0.02	-0.01
	(0.074)	(0.081)	(0.082)	(0.027)	(0.026)	(0.026)
Constant				-0.20**	-0.11	-0.11
				(0.075)	(0.070)	(0.069)
Observations	651	651	651	651	651	651
df_m	20	23	25	20	23	25
chi2	110.4	207.8	225.4			
ll	-279.7	-226.9	-225.6	-28.40	23.24	24.76
r2_p	0.246	0.388	0.391	0.750	1.205	1.218

Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 3: Instrumental variable analysis

	VC-backed			Non-VC-backed		
	1	2	3	4	5	6
VARIABLES	Director sale IV 1 stage	CEO sale IV 2 stage	CEO sale Probit	Director sale IV 1 stage	CEO sale IV 2 stage	CEO sale Probit
# of VC funds aged 8-15 years	0.50***					
	(0.101)					
# of VC funds 8-15 that sold stocks in prior 3 months	0.28***					
	(0.086)					
# of Non-CEO or Non-VC director sale in prior 3 months				0.18**		
				(0.056)		
CEO share value proportion	0.94	0.52*	0.31	-0.32	0.29+	0.74*
	(0.989)	(0.215)	(0.249)	(0.855)	(0.166)	(0.299)
CEO founder status	0.02	0.04	0.04	0.38	0.13*	0.25***
	(0.213)	(0.046)	(0.046)	(0.269)	(0.054)	(0.076)
Director share sale		0.26***	0.26***		0.58***	0.68***
		(0.075)	(0.063)		(0.119)	(0.083)
Chairman	0.10	-0.04	-0.03	-0.12	0.03	0.04
	(0.185)	(0.039)	(0.043)	(0.240)	(0.049)	(0.049)
CEO firm tenure	0.04	0.02*	0.02**	-0.05+	0.00	-0.00
	(0.030)	(0.007)	(0.006)	(0.031)	(0.007)	(0.007)
CEO age	-0.00	-0.00+	-0.00	0.01	0.00	0.00
	(0.013)	(0.003)	(0.003)	(0.015)	(0.003)	(0.003)
CEO annual cash compensation	0.07	0.14*	0.10	0.31	0.12	0.21+
	(0.285)	(0.058)	(0.067)	(0.350)	(0.080)	(0.107)
Prior entrepreneurial experience	0.17	-0.01	-0.01	-0.27	0.09	0.14
	(0.239)	(0.049)	(0.050)	(0.354)	(0.062)	(0.112)
CEO pre-IPO equity ownership pct	0.62	0.35*	0.25	-0.26	0.12	0.07
	(0.709)	(0.163)	(0.188)	(0.559)	(0.114)	(0.129)
Board size	-0.03	-0.01	-0.03+	-0.04	0.01	-0.00
	(0.068)	(0.013)	(0.017)	(0.070)	(0.014)	(0.017)
Inside director proportion	-0.47	0.05	-0.15	0.47	0.11	0.07
	(0.645)	(0.134)	(0.125)	(0.610)	(0.124)	(0.126)
Pre-IPO total assets (log)	-0.30	-0.05+	-0.08+	-0.28+	-0.03	-0.04
	(0.185)	(0.030)	(0.042)	(0.151)	(0.031)	(0.035)
Pre-IPO total sales (log)	0.36*	0.04	0.06	0.25	0.02	0.07
	(0.181)	(0.029)	(0.040)	(0.202)	(0.041)	(0.046)
Firm age	0.03	-0.00	-0.00	0.04+	0.00	0.01
	(0.022)	(0.005)	(0.005)	(0.021)	(0.005)	(0.005)
Post-IPO total sales (log)	-0.25	-0.03	-0.03	-0.06	0.01	-0.03
	(0.177)	(0.028)	(0.034)	(0.157)	(0.029)	(0.038)
Offer price/book value	-0.39	-0.02	-0.02	-0.49	-0.00	-0.11
	(0.681)	(0.049)	(0.023)	(0.592)	(0.116)	(0.119)
IPO proceeds (log)	0.60**	0.07	0.09+	0.70**	0.06	0.05
	(0.231)	(0.044)	(0.049)	(0.261)	(0.051)	(0.068)
# of IPOs in 3 prior months (market)	-0.00*	0.00	0.00	-0.01	0.00+	0.00*
	(0.002)	(0.001)	(0.000)	(0.004)	(0.001)	(0.001)
# of IPOs in 3 prior months (software)	-0.04**	-0.01***	-0.01**	-0.03	-0.01+	-0.01*
	(0.013)	(0.002)	(0.003)	(0.021)	(0.003)	(0.004)
Underwriter prestige	-0.12	0.01	0.02	0.08	-0.01	0.00
	(0.081)	(0.018)	(0.022)	(0.083)	(0.016)	(0.019)
1990-1998 period	1.58***	0.26**	0.21**	0.67	0.02	0.02
	(0.376)	(0.080)	(0.079)	(0.507)	(0.102)	(0.165)
1999-2000 period	-0.07	0.12	0.05	0.49	-0.01	-0.11
	(0.519)	(0.076)	(0.092)	(0.567)	(0.109)	(0.091)
Constant	0.11	-0.26		-0.10	-0.79	
	(5.026)	(0.445)		(4.411)	(0.859)	
Observations	427	427	427	224	224	224
df_m	22	22	22	22	22	22
chi2	212.1	212.1	138.6	150.4	150.4	94.35
ll	-312.2	-312.2	-146.7	-157.3	-157.3	-60.57
r2_p	.	.	0.387	.	.	0.538

Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Figure 1: Conceptual Model

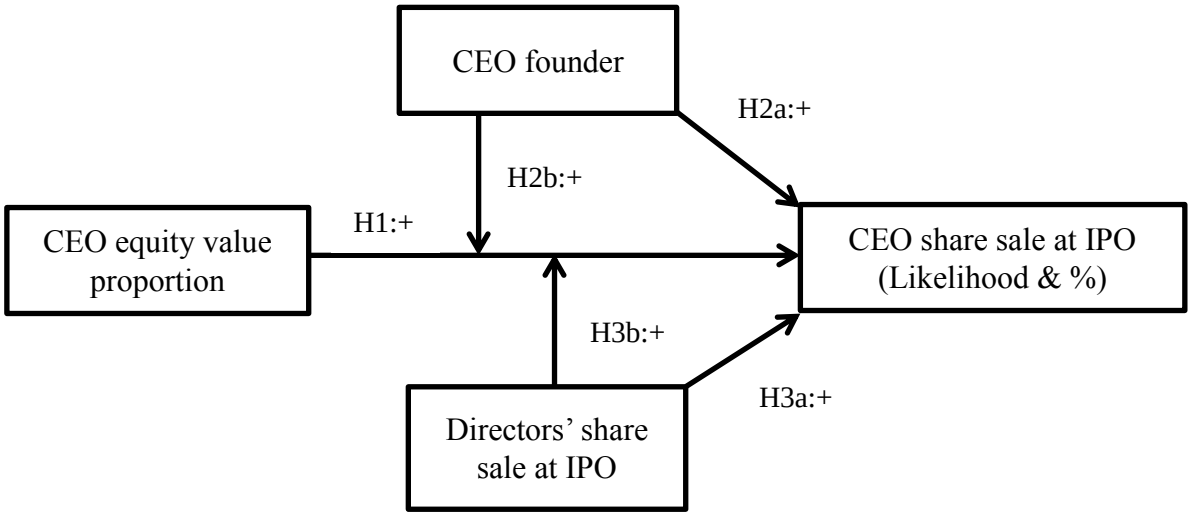


Figure 2: Interaction of CEO equity value proportion and founder status

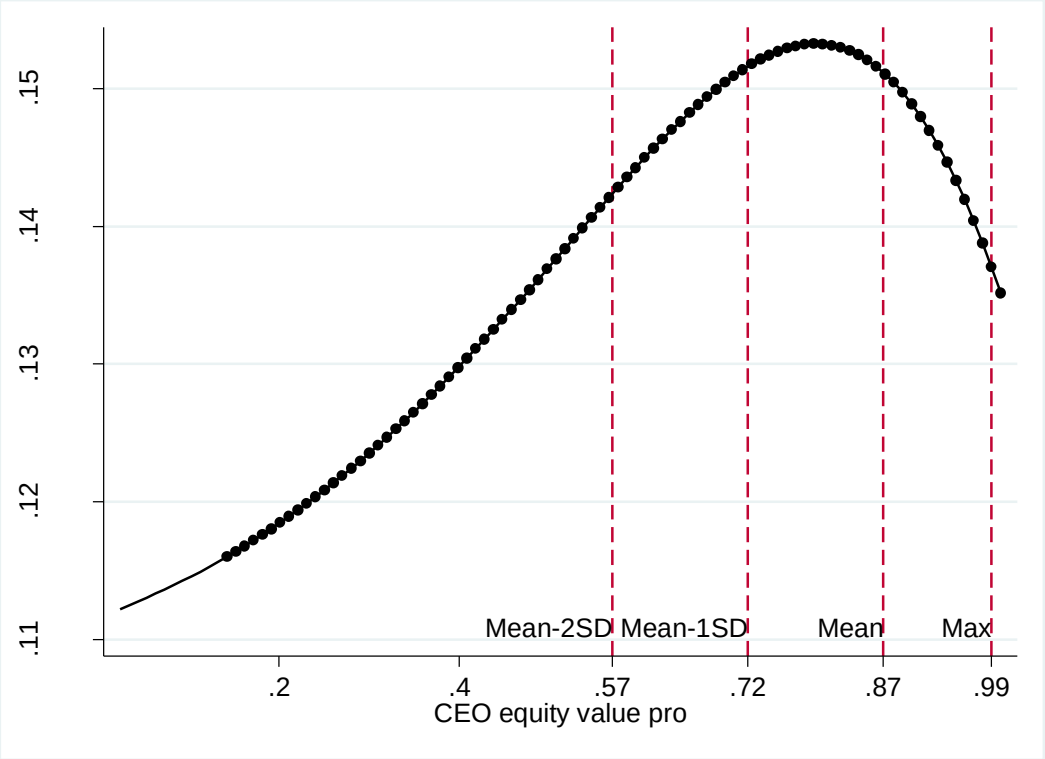
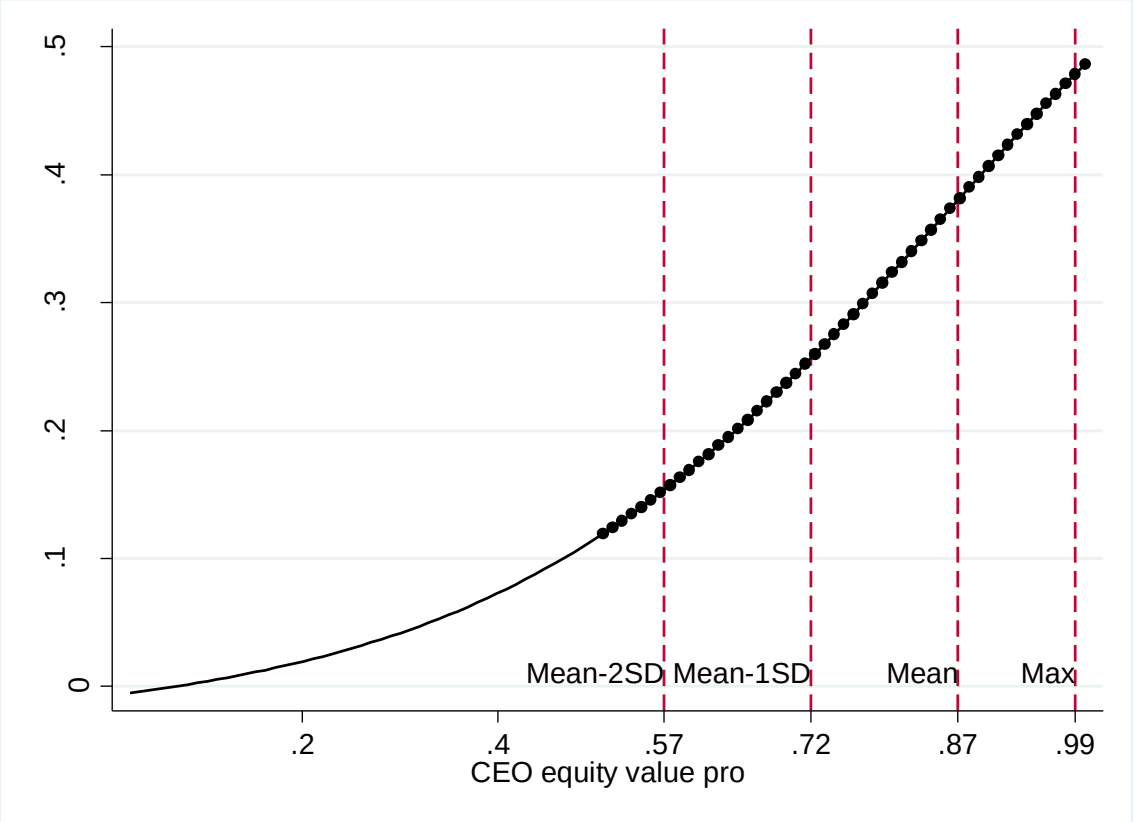


Figure 3: Interaction of CEO equity value proportion and board member share sales



CHAPTER 3: ESSAY 2

How insiders' secondary share sales at the IPO impact the IPO underpricing: Bargaining

ABSTRACT

In my first essay, I find that insiders often sell secondary shares at the IPO to diversify their portfolios. In this essay, I examine how insiders' secondary share sales at the IPO affect underpricing. Although insiders' secondary share sales at the IPO are usually interpreted as a negative signal, I find that IPO firms can actually gain benefit when insiders sell secondary shares at the IPO. Specifically, I find that outside directors can bargain for a higher offer price when they sell secondary shares and as a result such sales lead to a lower underpricing. That is, IPO firms can leave less money on the table when outside directors sell secondary shares. I find that the results are primarily driven by sales by outside directors (VC and other institutional investors) as opposed to managers. This suggests that the bargaining mechanism plays an important role in predicting both pre-IPO offer price revision and IPO underpricing, or alternatively, that the market correctly ascribes alternative motives to management secondary share sales.

INTRODUCTION

Prior studies have mixed findings on how insiders' secondary share sales at the IPO impact IPO underpricing, or the difference between the closing stock price at the end of first day of trading and the offer price. Some studies do not find any significant effects. Some other studies find a negative association. In explaining the negative association, there are two possible mechanisms. Some studies suggest that insiders' secondary share sales at the IPO are a negative signal and investors will pay less for the issues with secondary shares to compensate for risks. However, this paper suggests that insiders bargain for a higher offer price when they intend to sell secondary shares at the IPO and thereby result in a lower underpricing. This paper also disaggregates insider groups into outside and inside directors – a distinction generally missing in the literature, Ljungqvist & Wilhelm (2003) notwithstanding. This paper finds that secondary share sales by outside directors are significantly associated with upward pre-IPO offer price revision and lower underpricing, while sales by insiders are not.

IPOs provide a short window of opportunity for existing shareholders to liquidate some of their holdings. Prior to IPO, it is difficult for shareholders to sell their shares as there is no liquid market. These shareholders generally agree to a six-month lock-up period post-IPO in which they agree not to sell their shares. However, they have an opportunity to sell shares at the IPO in what is called secondary share selling.

Because of the severe information asymmetry between IPO firms and investors, secondary share sales at the IPO by insiders are usually interpreted as a negative signal by investors. The reasons are as follows: first, compared with outside investors, insiders have more private information of the IPO firm and, hence, are likely to take advantage of

the information asymmetry. For example, insiders may know some negative information about the firm which is not available to investors and hence sell shares at the IPO to reduce their interest stakes in the firm (Leland & Pyle, 1977). Second, a reduction in insider ownership may reduce the alignment of incentives between managers and shareholders (Jensen & Meckling, 1976). Therefore, investors may interpret secondary share sales at the IPO as either a signal of poor quality or an increased likelihood of post-IPO moral hazard. In either case, secondary share sales by insiders are interpreted as a negative signal.

In addition to the factors that impact the first day close stock price as mentioned above, factors that affect offer price also need to be considered when studying underpricing. There are several reasons why underwriters want to underprice the IPO shares. First, underwriters may underprice the IPO shares as a mechanism to transfer benefits to their loyal institutional investors (Loughran & Ritter, 2002). Institutional investors can then buy IPO shares from underwriters at a lower price and sell the shares at a higher price on the first trading day. By doing so, underwriters strengthen their relationships with their loyal institutional investors. Second, if underwriters underprice the IPO shares, they reduce risk in that they may not need to use other measures to stabilize share prices after the issues (Baron, 1982). Therefore, underwriters may seek to underprice the IPO shares independent of insiders' motivations. In contrast, underpricing is not in the interest of pre-IPO shareholders since underpricing leaves money on the table and reduces IPO proceeds. Therefore, underwriters and the IPO firm's interests conflict with each other regarding underpricing and the IPO offer price is the result of the bargaining between the IPO firm and underwriters.

Many factors may affect how hard insiders will bargain with underwriters on offer price and one important factor is whether insiders plan to sell secondary shares at the IPO. All else being equal, insiders have stronger incentives to bargain for a higher offer price when they intend to sell secondary shares at the IPO so that they can gain more benefits. And the strength of insiders' bargaining power may increase with the number of shares they intend to sell. Through the analysis of 620 U.S. IPOs from computer software industry, this paper provides evidence for bargaining mechanism. In addition, this paper finds that different insiders influence underpricing differentially. More specifically, secondary share sales by outside directors are significantly associated with upward pre-IPO offer price revision and lower IPO underpricing.

THEORY AND HYPOTHESES

Insiders' secondary share sales at the IPO are usually interpreted as a negative signal. An IPO is characterized by information asymmetry between potential investors and insiders (Carter & Manaster, 1990; Leland & Pyle, 1977; Stuart, Hoang, & Hybels, 1999). Insiders have access to extensive information regarding the internal operation of the firm, its economic potential, and the industriousness of its management and employees (Cohen & Dean, 2005; Leland & Pyle, 1977). In contrast, public investors have relatively limited knowledge of the firm and a variety of factors leave substantial scope for the provision of less than perfect information to potential investors (Downes & Heinkel, 1982). First, organizations are a complex combination of strategy, technology, employees, products, and capital. Some valuable information is difficult, if not

impossible to convey to public investors. Second, information received by public investors is screened by insiders, who tend to misrepresent the firm favorably to themselves (Downes & Heinkel, 1982). Third, although the SEC requires IPO firms to disclose information to public investors, in no way can it be guaranteed that all the material information is disclosed.

As a result potential investors tend to ignore certain information released by the IPO firm because it is tainted by incentives for misrepresentation or omission (Riley, 1979; Spence, 1976) and these investors will be particularly responsive to valid signals of value (Downes & Heinkel, 1982; Spence, 1976). As suggested by Podolny (1994), when the quality or value of commodities potentially exchanged is difficult to discern, actors cannot compare exchange opportunities by focusing on the commodities themselves. Consequently, investors will rely on signals of economic value that they perceive as more genuine, and disregard those factors deemed suspicious or manipulable. To qualify as a credible signal, an action must be costly to mimic for low quality players (Spence, 1976). For insiders of high quality firms, holding shares of the firm is less risky since the firm's prospects are good. In contrast, the costs and risks of holding the shares of a poor quality firm are higher. Hence, insiders' secondary share sales at the IPO signal to outsiders that holding the firm's shares is risky and costly. This line of argument is consistent with prior studies and is widely adopted to explain how public investors perceive insiders' secondary share sales at IPO (e.g., Jain & Kini, 1994; Junkunc & Eckhardt, 2009).

In addition to the private information view, agency theory also suggests that secondary share sales by insiders are negatively perceived by investors (Jensen & Meckling, 1976). Stock ownership aligns the interests of shareholders and management

and this alignment strengthens as ownership increases. Secondary share sales by insiders reduce ownership and may, therefore, lead to a divergence of interests. That implies that even if insiders' secondary share sales at the IPO are not driven by negative private information, less motivated managers may lead to less valuable firms. Therefore, insiders' secondary share sales at the IPO may lead to investors' lower willingness to pay for the concern of negative signal and possibly lower underpricing.

However, there are other reasons to expect a higher underpricing. Underwriters have incentives to underprice IPO shares. Underwriters, as intermediaries, advise the issuers on pricing the issue, both at the time of issuing a preliminary prospectus that includes a file price range, and at the pricing meeting when the final offer price is set. If underwriters receive compensation from both the issuer (the gross spread) and investors, they have an incentive to recommend a lower offer price than if the compensation was merely the gross spread. In the process of book building, underwriters can decide to whom to allocate shares if there is excess demand. In practice, underwriters allocate shares to investors largely on the basis of past and future commission business on other trades. If the compensation underwriters receive from investors is significantly higher than the one they receive from the issuing firms, they are greatly incentivized to underprice the shares. For example, Credit Suisse First Boston (CSFB) received commission business equal to as much as 65% of the profits that some investors received from certain hot IPOs, such as the December 1999 IPO of VA Linux. The VA Linus IPO was priced at $30 per share, with a 7% gross spread equal to $2.10 per share. For an investor who was allocated shares at $30, and who then sold at the closing market price of $239.25, the capital gains would have amounted to $209.25 per share. If the investor

then traded shares to generate commissions of one-half of this profit, the total underwriter compensation per share was $2.10 plus $104.625, or $106.725. Therefore, underwriters have an incentive to underprice IPOs if they receive commissions in return for leaving money on the table. This mechanism is also documented in prior studies (e.g., Loughran & Ritter, 2004).

Underwriters have additional incentives to underprice the IPO shares. In a firm commitment deal, underwriters pledge to sell through the shares in the offering or else purchase them.[5] With greater underpricing, underwriters reduce the likelihood of under-subscription, which would force them to purchase the shares of the offering. In addition, with greater underpricing, underwriters face less pressure to conduct price stabilization post-IPO (Logue et al., 2002). When the stock price declines below the offer price, underwriters usually need to take measures to stabilize the stock price, which could be costly and capital-intensive. With greater underpricing, the probability of underwriters need to stabilize post-IPO stock price is lower.

After a company has decided to go public and has engaged an underwriter, it files a preliminary prospectus with the SEC that contains, among other things, the terms of the offering. The anticipated offer price is stated in the form of an offer range, in which minimum and maximum prices are given; the expected offer price is the midpoint of this range. The setting of the offer range is prescribed by the SEC's Regulation S-K only in that it must be a 'bona fide estimate' of the final offer price. The time from the filing of the preliminary prospectus to the final offer date is called the 'waiting period', during which the underwriter acquires information about the demand for the issue from regular

[5] This is in contrast to a "best effort" deal where no such guarantee of selling the entire offering is made. Firm commitment deals are much more common (Jenkinson & Ljungqvist, 2002).

investors through nonbinding indications of interest. Regular investors are those that are actively involved on an ongoing basis in purchasing shares of firms going public. If demand for the issue is greater than expected, the final offer price will be set higher than the expected offer price disclosed in the preliminary prospectus. Alternatively, if demand is low, the final offer price will be below the expected offer price.

Although the information underwriters acquire during the waiting period affects the IPO offer price revision, some other important factors also affect this process. One important factor is the insiders' secondary share sales. Per principal-agent theory, insiders who wish to sell secondary shares will work harder to ensure a higher offer price. These insiders, the agents, will increase their monitoring when their stake in the transaction is large. Therefore, we would expect underpricing to decrease with the amount of secondary share selling. That is, when insiders intend to sell secondary shares at the IPO, they have more interests involved and hence have more incentives to monitor underwriters and bargain for a higher offer price during the waiting period (Habid & Ljungqvist, 2001).

If secondary selling incentivizes insiders to bargain for a higher offer price, we should see offer that price revision in waiting period is significantly associated with insiders' secondary share sales. Therefore, I have the following prediction:

H1: Insiders' secondary share sales at the IPO are positively associated with the pre-IPO offer price revision in the waiting period.

From the above, we know the negative signal argument suggests that investors will pay a lower first day closing price to compensate for the risks when the issue includes insiders' secondary share sales. It follows that all else being equal the first day closing price will be lower if the issue includes insiders' secondary share sales.

Meanwhile, insiders will bargain for a higher offer price when they intend to sell secondary shares at the IPO. As underpricing is the difference between the first day closing price and the offer price, this suggests lower underpricing. Therefore, I have the following prediction:

H2: Insiders' secondary share sales at the IPO are negatively associated with IPO underpricing.

METHODOLOGY

Data

My sample includes 633 U.S. IPOs issued from 1990 to 2011 in three sectors of the computer software industry: computer programming services (SIC 7371), computer software (SIC 7372), and computer integrated systems design (SIC 7373). I constructed the sample IPO firms from the Securities Data Corporation (SDC) Global New Issues database. Following prior research (Chen, Hambrick & Pollock, 2008; Pollock & Rindova, 2003; Ritter, 1991), I exclude any spin-off or equity carve-out IPOs to ensure that the sample firms were only independent entrepreneurial firms. I also exclude foreign firms issuing stocks in the US market. Firm characteristics, issue characteristics, secondary sales by insiders, and pre-IPO financial data were drawn from IPO firms' prospectuses (424B form) and SDC dataset. These prospectuses are available from SEC Edgar online service. Post-IPO performance data were drawn from *COMPUSTAT* database.

Dependent Variables

IPO underpricing is this paper's dependent variable and is calculated as (closing price-offer price)/offer price. To test the bargaining mechanism, this paper adopts price revision as a dependent variable.

Independent Variables

Fraction of shares sold by all insiders relative to pre-IPO outstanding shares. This variable is calculated as the ratio of the number of secondary shares sold by all insiders divided by the total number of pre-IPO outstanding shares. This variable measures the proportion of pre-IPO outstanding shares sold by all insiders.

Fraction of shares sold by CEO relative to firm pre-IPO outstanding shares. This variable is calculated as the ratio of the number of shares sold by a CEO divided by the total number of pre-IPO outstanding shares of the firm. This variable measures the proportion of shares sold by a CEO to the total number of firm pre-IPO outstanding shares.

Fraction of shares sold by non-CEO executives relative to firm pre-IPO outstanding shares. This variable is calculated as the ratio of the number of shares sold by non-CEO executives divided by the total number of pre-IPO outstanding shares of the firm. This variable measures the proportion of shares sold by non-CEO executives to the total number of firm pre-IPO outstanding shares.

Fraction of shares sold by director executives relative to firm pre-IPO outstanding shares. This variable is calculated as the ratio of the number of shares sold by director executives divided by the total number of pre-IPO outstanding shares of the firm. This variable measures the proportion of shares sold by director executives to the total number of firm pre-IPO outstanding shares.

Fraction of shares sold by non-director executives relative to firm pre-IPO outstanding shares. This variable is calculated as the ratio of the number of shares sold by non-director executives divided by the total number of pre-IPO outstanding shares of the firm. This variable measures the proportion of shares sold by non-director executives to the total number of firm pre-IPO outstanding shares.

Fraction of shares sold by outside directors relative to firm pre-IPO outstanding shares. This variable is calculated as the ratio of the number of shares sold by outside directors divided by the total number of pre-IPO outstanding shares of the firm. This variable measures the proportion of shares sold by outside directors to the total number of firm pre-IPO outstanding shares.

Control Variables

Firm characteristics. To control for other alternative explanations, I include the following variables in my regression: (1) Logged value of Pre-IPO total assets; (2) Logged value of Pre-IPO total sales; (3) Firm age; (4) Board size. It refers to the number of directors.

IPO characteristics. I include the following IPO characteristics in my regression: (1) Logged value of IPO proceeds. This variable measures the size of the IPO. (2) Syndicate size. Syndicate size refers to the number of underwriters. (3) Overhang. This variable is calculated as the ratio of the shares retained by all insiders divided by shares filed (including primary and secondary shares) (Bradley & Jordan, 2002). (4) Average underpricing in the 30 days preceding the focal IPO in the same industry. In price revision regression, I control for the issuers' contemporaries in the primary market. For example, if other firms subject to a common valuation factor exhibited aggressive

positive price revisions, an issuing firm may infer that investors revealed positive information about the valuation factor and increase its offer price in response. More specifically, I define an issuer's contemporaries as firms in the same industry completing an IPO in 30 days preceding the focal IPO and control for their average underpricing. This approach has been used in prior studies (e.g., Benveniste, Busaba, & Wilhelm, 2002; Benveniste & Spindt, 1989).

Underwriter prestige. Underwriters are important players during the IPO process (Carter & Manaster, 1990). Underwriter prestige data can be constructed in the spirit of the methodology of Cater and Manaster (1990). The online data are constructed by Jay Ritter and extensively used in finance literature (e.g. Ljungqvist & Wilhelm, 2003; Loughran & Ritter, 2004).

VC. The variable of VC is a dummy variable that indicates if the IPO firm is backed by any venture capital firm. The variable is coded as 1 if the IPO firm is backed by a venture capital firm; 0 otherwise. The data were drawn from the SDC database and I also collected the relevant information from IPO firms' prospectuses to validate the SDC data.

InvPrice. Following prior studies (e.g., Tinic, 1988), this paper uses this variable to proxy for issuer risk and it is equal to the reciprocal of the filing midpoint.

Price revision. When predicting IPO underpricing, I include price revision as one control variable. Price revision is measured as the percentage difference between the offer price and the midpoint of the filing price: (offer price – midpoint of the initial filing price)/midpoint of the initial filing price *100%.

Year dummies. Following prior studies (Loughran & Ritter, 2004; Ljungqvist & Wilhelm, 2003), this paper creates dummies for years preceding internet bubble period, internet bubble years, and years post-bubble.

RESULTS

Table 1 reports descriptive statistics and correlations. From Table 1, we can see that the average IPO underpricing of the sample firms is 0.42. The average percent sold by insiders is around 2%. An average IPO has more than 14 underwriters. An average firm is less than 10 years old. About 70% of sample firms are VC-backed. 25% of the sample firms did their IPOs during the bubble period (1999-2000) and 15% did their IPOs after the bubble period (2001-2011) and 60% of firms did their IPOs during the pre-bubble period (1990-1998).

Table 2 reports the results that examine how secondary sales by insiders impact price revision. Standard errors are adjusted for the bias caused by time clustering of observations[6]. Model 1 in Table 2 is a baseline model, including all control variables. In Model 2, the coefficient of the fraction sold by outside directors is positive and marginally significant (β=29.93; $p < .1$), suggesting that the higher the percentage of shares outside directors sell, the higher the offer price revision is. In Models 2, I did not consider the endogeneity of underwriter prestige. Self-selection bias may cause the coefficients estimated for the effect of underwriter prestige on the extent of price

[6] According to Ljungqvist and Wilhelm (2003), when many companies go public at the same point in time, it is questionable whether their residuals are cross-sectionally independent. Thus, we replace the i.i.d. assumption with the weaker assumption that observations are independent for companies at different points in time, but not necessarily for companies going public in the same month, and adjust the variance estimator accordingly.

revisions in Model 2 to be biased. If firms with the most (or the least) potential to receive upward price revision choose the top underwriters, the positive correlation between underwriter prestige and price revisions may not be causal but a by-product of the selection behavior of such firms. I therefore estimate a 2SLS version of Model 2 that explicitly treats underwriter choice as endogenous (Habib & Ljungqvist, 2001; Ljungqvist & Wilhelm, 2003). The first stage, Model 3, relates underwriter prestige to all independent regressors in Model 2 and two additional variables added to ensure identification: A dummy equaling one if the issue is VC-backed and the log of the intended offer size, in millions of dollars (Ljungqvist & Wilhelm, 2003). The rationale for the instruments is as follows. Venture capitalists are repeat players in the IPO market and can develop long-term relationships with top-tier underwriters, and thereby increase the chances that such underwriters will underwrite a given IPO. This idea is consistent with Megginson and Weiss's (1991) finding that VC-backed IPOs are underwritten by more prestigious underwriters. With regard to offer size, a given degree of percentage underpricing translates into a larger wealth loss to the owners, the larger the deal. This in turn creates an incentive to choose a top-tier underwriter in an attempt to reduce the degree of underpricing. From Model 3, we can see that more prestigious underwriters are chosen by VC-backed and bigger firms, those filing larger offers.

Using the predicted underwriter prestige from Model 3 as an instrument, Models 5 provides consistent estimates of the effect of outside directors' secondary share sales on price revisions. In Model 5, the coefficient of the fraction sold by outside directors is positive and marginally significant (β=31.83; $p< .1$), consistent with the finding in Model 2. This finding suggests that secondary sales by outside directors are associated with

either more upward price revision or less downward price revision. These findings are consistent with the bargaining mechanism.

Table 3 reports the results that examine the impact of secondary share sales by insiders on underpricing. Similar to Table 2, Table 3 also includes results that consider the endogeneity of underwriter choice in Models 2 and 4, which are the second stage regressions. In Models 1, the coefficient of the fraction sold by executives is negative and marginally significant (β=-1.12; $p< .1$), suggesting that the more secondary shares sold by executives, the lower the underpricing. Similarly, the coefficient of the fraction sold by outside directors is negative and marginally significant (β=-.53; $p< .1$), suggesting that the more secondary shares sold by outside directors, the lower the underpricing. I used the predicted underwriter prestige in Model 2 and get the same results. Furthermore, I split insiders into CEO, inside directors, and outside directors and report results in Model 3 and 4. In Model 3, the coefficient of the fraction sold by inside directors is negative and marginally significant (β=-.93; $p< .1$) and similarly for outside directors (β=-.54; $p< .1$), suggesting that the more secondary shares sold by directors, the lower the underpricing. As a further robustness check, I use the dollar value of secondary shares sold by insiders to replace the fraction they sold in Table 2 and 3 and obtain very similar results.

DISCUSSION

This paper finds that insiders' secondary share sales at the IPO are significantly associated with IPO underpricing and suggests that bargaining mechanism impacts IPO underpricing. More specifically, this paper finds that secondary share sales at the IPO by

outside directors are significantly associated with offer price revision. In addition, this paper finds that secondary share sales by outside directors are significantly associated with lower underpricing.

Stock ownership is adopted to align the interests of managers and shareholders. Selling part the stock holding of the firm can usually be used by outside investors to make inferences about the firm. The signaling effect of the share sales by insiders becomes stronger when there is severe information asymmetry. Suggested by agency theory (Jensen & Meckling, 1976) and signaling theory (Leland & Pyle, 1977), secondary share sales at IPO by insiders are interpreted as a negative signal and mean higher risks for investors. To compensate for the high risks, investors pay less for the issues with secondary shares, which suggests a lower underpricing.

When insiders intend to sell secondary shares at the IPO, they have more incentives to bargain for a higher offer price since they can get more benefits from the sales. Interestingly, I find that only secondary share sales by outside directors are associated with price revision. It does not mean CEOs and non-CEO executives lack the incentives to bargain for a high offer price. It may be that only outside directors have the capability to bargain successfully for a higher offer price when they intend to sell shares. As we know, outside directors are usually venture capital firms and other institutional investors. Compared with outside directors, CEOs and non-CEO executives have less experience of working with underwriters and stock market. As professional investors, outside directors may repeatedly work with underwriters and hence have more bargaining power. To favor the possible future cooperation with these professional investors, investment banks underwriting the issue may tend to bargain less with outside directors

when these outside directors request a higher offer price. Prior studies have documented that venture capital firms and investment banks oftentimes work on a mutually beneficial basis so that they can keep working with each other on multiple deals. For example, venture capital firms can choose an investment bank with whom they have a good working relationship to underwrite other IPO firms they invest. In contrast, the cooperation between underwriter and CEO or non-CEO executives is more likely to be a one-time deal, which weakens the bargaining power of CEO and other executives.

This paper has limitations. When I test the bargaining mechanism, I argue that when insiders intend to sell secondary shares at IPO, they will bargain hard with underwriters for a higher offer price. Empirically, I test if the insiders' secondary share sales are significantly associated with pre-IPO offer price revision during the waiting period. However, I cannot observe the timing of the bargaining. Offer price revision may occur prior to bargaining or in its absence altogether. That is, the offer price revision may not be the result of the bargaining and it may be the reason why insiders decided to sell secondary shares, which is an example of reverse causality. To test empirically the direction of the causality, I can do the following. In the preliminary prospectus IPO firms filed with SEC, there is information about the estimated offer price range and insiders' planned secondary sales. Also, in the final prospectus, there is information about the final offer price and insiders' actual secondary share sales. One test I can do is to examine if insiders increased the number of secondary shares from the planned sales in the preliminary prospectus to the actual sales in the final prospectus and determine if this increase is accompanied with an upward offer price revision. If the increase is significantly associated with an upward offer price revision, it is more likely that insiders

made changes to their secondary share sales in response to the offer price revision, that is, offer price revision may cause the changes of insiders' secondary share sales. If the number of secondary sales remains the same in both prospectuses but the offer price experienced an upward revision or a less downward revision, it is more likely that insiders' bargaining is working in the process. Of course, these two possibilities may exist simultaneously, in some cases, an upward offer price revision occurs because of insiders' bargaining and in other cases, insiders decided to sell secondary shares after they see an upward offer price revision. Although this is not a perfect test that can help infer the causality, it helps my hypothesis of bargaining mechanism closer to a causal relationship. A second limitation of this study is that I argue that investors will pay less for the issues with insiders' secondary share sales at the IPO in response to the associated negative signal. However, I cannot directly test this prediction. The second limitation of this paper is that I use the percentage change of pre-IPO offer price revision as my dependent variable when I test the bargaining mechanism. Although the percent change can already give us some good insights on how significant insiders' secondary share sales at IPO impact pre-IPO offer price revision, I can also see the dollar value changes as dependent variable. For insiders, it is more intuitive to see how many more dollars they can earn if they can successfully bargain $1 higher than the planned offer price. It is also good to have as a robustness check using dollar value change as a dependent variable.

To improve further the robustness of this paper, there is some work that this paper can do. First, this paper examines how insiders' secondary share sales at the IPO impact IPO underpricing as my overall research question. An alternative empirical strategy to my current one is to use a matched sample strategy. That is, I can construct a control

sample of IPOs without insiders' secondary share sales at the IPO and match it with ones with secondary share sales as closely as possible by some important characteristics such as offering size and year (Megginson & Weiss, 1991). By comparing the IPO underpricing between two groups, I can check the robustness of my current findings.

Table 1: Correlations

		Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	Underpricing	0.42	0.70	1.00																									
2	Price revision (pct)	11.36	30.39	0.59	1.00																								
3	Pct sold by insiders	2.04	4.14	-0.15	-0.05	1.00																							
4	Value of insider sale (million)	2.75	10.82	-0.15	-0.04	0.78	1.00																						
5	Pct sold by CEO	0.58	1.61	-0.08	-0.02	0.56	0.47	1.00																					
6	Value of CEO sale (million)	0.70	2.57	-0.08	-0.01	0.47	0.73	0.72	1.00																				
7	Pct sold by non-CEO executives	0.50	1.51	-0.09	-0.02	0.55	0.46	0.37	0.35	1.00																			
8	Value of non-CEO executive sale (million)	0.65	2.71	-0.10	-0.01	0.45	0.71	0.30	0.59	0.72	1.00																		
9	Pct sold by director executives	0.90	2.33	-0.10	-0.02	0.64	0.52	0.86	0.65	0.74	0.52	1.00																	
10	Value of director executive sale (million)	1.12	4.62	-0.10	0.00	0.52	0.78	0.64	0.92	0.54	0.77	0.73	1.00																
11	Pct sold by non-director executives	0.17	0.71	-0.06	-0.02	0.33	0.34	0.25	0.25	0.55	0.50	0.22	0.21	1.00															
12	Value of non-director executive sale (million)	0.23	1.11	-0.07	-0.03	0.30	0.50	0.20	0.39	0.44	0.67	0.18	0.36	0.80	1.00														
13	Pct sold by outside directors	0.97	3.10	-0.11	-0.05	0.78	0.57	0.05	0.07	0.05	0.07	0.04	0.07	0.05	0.07	1.00													
14	Value of outside director sale (million)	1.40	7.60	-0.12	-0.04	0.64	0.74	0.06	0.24	0.08	0.26	0.06	0.26	0.09	0.18	0.82	1.00												
15	Underwriter prestige	7.24	2.05	0.25	0.25	0.03	0.17	0.01	0.14	0.03	0.15	0.02	0.16	0.03	0.12	0.02	0.09	1.00											
16	Underpricing in last month	0.44	0.47	0.48	0.36	-0.22	-0.23	-0.11	-0.13	-0.11	-0.14	-0.12	-0.14	-0.11	-0.15	-0.18	-0.15	0.17	1.00										
17	# of underwriters	14.83	10.50	-0.04	0.06	0.20	0.21	0.23	0.24	0.12	0.15	0.22	0.25	0.03	0.04	0.10	0.08	0.25	-0.07	1.00									
18	Total sale pre-IPO log	2.74	1.29	-0.12	-0.06	0.19	0.33	0.10	0.25	0.08	0.23	0.10	0.26	0.07	0.19	0.16	0.23	0.44	-0.09	0.19	1.00								
19	Total asset pre-IPO log	2.57	1.34	0.07	0.08	0.05	0.19	-0.02	0.14	-0.02	0.13	-0.03	0.14	-0.01	0.12	0.09	0.17	0.59	0.04	0.13	0.77	1.00							
20	Firm age	9.29	5.61	-0.17	-0.16	0.21	0.24	0.20	0.21	0.14	0.17	0.21	0.21	0.07	0.12	0.11	0.14	0.07	-0.10	0.14	0.47	0.27	1.00						
21	Overhang	4.39	5.86	0.12	0.09	-0.05	0.15	-0.02	0.24	-0.02	0.19	-0.02	0.22	0.00	0.15	-0.05	0.04	0.20	0.03	0.06	0.13	0.19	-0.01	1.00					
22	VC dummy	0.69	0.46	0.17	0.17	-0.11	-0.10	-0.12	-0.10	-0.10	-0.09	-0.12	-0.10	-0.07	-0.07	-0.05	-0.05	0.41	0.08	0.10	0.04	0.17	-0.14	0.07	1.00				
23	IPO proceeds log	3.44	0.85	0.32	0.37	0.05	0.22	-0.05	0.15	0.00	0.16	-0.04	0.16	0.00	0.13	0.09	0.20	0.74	0.26	0.11	0.45	0.67	0.05	0.17	0.25	1.00			
24	InvPrice	0.10	0.04	-0.14	-0.11	-0.16	-0.26	-0.08	-0.19	-0.11	-0.20	-0.09	-0.20	-0.09	-0.17	-0.12	-0.17	-0.72	-0.10	-0.33	-0.44	-0.55	-0.12	-0.17	-0.29	-0.71	1.00		
25	1999-2000 dummy	0.25	0.44	0.46	0.24	-0.25	-0.28	-0.18	-0.20	-0.15	-0.18	-0.18	-0.20	-0.14	-0.18	-0.17	-0.18	0.25	0.72	-0.06	-0.16	0.05	-0.19	0.05	0.18	0.31	-0.21	1.00	
26	2001-2011 dummy	0.15	0.35	-0.12	-0.15	0.02	0.09	-0.09	0.00	-0.07	0.03	-0.10	-0.02	-0.02	0.11	0.10	0.15	0.13	-0.20	-0.32	0.32	0.37	0.12	-0.01	0.00	0.35	-0.07	-0.24	1.00

Table 2: OLS predicting price revision[7]

	1	2	3	4	5
VARIABLES	Offer price revision		Underwriter prestige	Offer price revision	
% sold by CEO		47.59	2.66		37.67
		(40.231)	(2.809)		(41.557)
% sold by executives		26.81	4.85+		-55.50
		(44.250)	(2.487)		(40.430)
% sold by outside directors		29.93+	-3.43**		31.83+
		(19.358)	(1.309)		(19.282)
Underwriter prestige	3.81***	3.77***			
	(0.717)	(0.724)			
Underwriter prestige (predicted)				12.89***	13.00***
				(1.081)	(1.110)
Underpricing in one month before	26.54***	26.74***	-0.21	27.30***	27.50***
	(5.575)	(5.604)	(0.162)	(4.992)	(5.007)
# of underwriters	0.01	-0.01	0.02*	-0.33*	-0.35**
	(0.114)	(0.117)	(0.006)	(0.125)	(0.127)
Total sales 1 year before	-3.98*	-4.16*	0.16+	-5.21**	-5.32**
	(1.907)	(1.912)	(0.082)	(1.869)	(1.876)
Total asset 1 year before	2.99	3.14	0.15+	-3.17	-3.22
	(2.484)	(2.497)	(0.083)	(2.299)	(2.333)
Firm age	-7.60***	-7.93***	-0.03	-5.21**	-5.19**
	(1.928)	(1.962)	(0.106)	(1.820)	(1.858)
Overhang	0.14	0.16	0.02**	-0.09	-0.08
	(0.132)	(0.136)	(0.007)	(0.107)	(0.109)
1999-2000 dummy	-13.68**	-13.04*	0.21	-24.36***	-24.27***
	(4.963)	(5.030)	(0.175)	(4.733)	(4.863)
Post-2000 dummy	-9.39*	-9.25*	-0.55**	-12.74**	-13.07**
	(4.052)	(4.125)	(0.186)	(3.912)	(3.957)
VC-backed dummy			1.00***		
			(0.115)		
IPO proceeds			1.33***		
			(0.112)		
Constant	-4.64	-4.33	1.07**	-47.78***	-48.34***
	(3.925)	(3.973)	(0.363)	(5.275)	(5.420)
Observations	621	621	622	621	621
R-squared	0.225	0.227	0.621	0.328	0.330

Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05, + p<0.1; One-tail

[7] Price revision is calculated as the percentage: (offer price-original filed price)/original filed price * 100%; Overhang refers to the ration that shares retained by insiders divided by shares filed (including primary and secondary shares). Bradley and Jordan (2002) first document the importance of this measure

Table 3: OLS predicting underpricing[8]

	1	2	3	4
VARIABLES	Underpricing			
% sold by CEO	-0.29	-0.23		
	(0.647)	(0.651)		
% sold by executives	-1.12+	-1.01+		
	(0.772)	(0.773)		
% sold by inside directors			-0.93*	-0.85*
			(0.449)	(0.452)
% sold by non-director executives			1.14	1.23
			(1.450)	(1.472)
% sold by outside directors	-0.53+	-0.54+	-0.54+	-0.55+
	(0.337)	(0.335)	(0.343)	(0.341)
Underwriter prestige	0.00		0.00	
	(0.012)		(0.012)	
Underwriter prestige (predicted)		-0.03		-0.03
		(0.025)		(0.025)
# of directors	-0.02*	-0.02+	-0.02*	-0.02+
	(0.012)	(0.013)	(0.012)	(0.013)
Offer price revision	0.01***	0.01***	0.01***	0.01***
	(0.002)	(0.002)	(0.002)	(0.002)
Overhang	0.01*	0.01*	0.01*	0.01*
	(0.003)	(0.003)	(0.003)	(0.003)
InvPrice	0.01	-0.59	0.04	-0.56
	(0.726)	(0.827)	(0.729)	(0.829)
Underpricing in one month before	0.19*	0.18*	0.19*	0.18*
	(0.086)	(0.086)	(0.086)	(0.086)
Total asset 1 year before	-0.01	0.01	-0.01	0.01
	(0.033)	(0.035)	(0.033)	(0.035)
Firm age	-0.00	-0.00	-0.00	-0.00
	(0.004)	(0.004)	(0.004)	(0.004)
1999-2000 dummy	0.38***	0.40***	0.38***	0.40***
	(0.103)	(0.098)	(0.103)	(0.098)
Post-2000 dummy	0.08	0.08	0.07	0.08
	(0.058)	(0.057)	(0.058)	(0.057)
Constant	0.28	0.51*	0.27	0.51*
	(0.175)	(0.215)	(0.176)	(0.215)
Observations	608	608	608	608
R-squared	0.479	0.479	0.479	0.480

Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05, + p<0.1; One-tail

[8] InvPrice refers is a proxy for issuer risk, equal to the reciprocal of the original filed price. Tinic (1988) first uses this measure of risk.

CHAPTER 4: ESSAY 3

The Relationship Between Insiders' Secondary Share Sales at IPO and Post-IPO Performances: An Exploratory Analysis

ABSTRACT

This paper investigates whether insiders' secondary share sales at the IPO impact a variety of performance measures post-IPO and the contingencies under which any impact may vary. Through the analysis of 500 IPOs of the U.S. computer software industry, I find that the percentage of secondary shares in an offering is associated with a slower post-IPO R&D growth. This effect is more negative for small firms. I adopt an instrumental variable approach to address the potential endogeneity issues and get the robust results. The causal relationship supports the hypothesis that equity ownership has an incentive alignment effect, though this effect varies under different contingencies.

INTRODUCTION

Equity ownership, as a corporate governance mechanism, has been of research interest for a long time. Although many studies have examined the relationship between corporate governance including equity ownership and firm performance, the evidence has been inconclusive overall (for reviews, see Dalton, Daily, Certo, & Roengpitya, 2003; Dalton, Daily, Ellstrand, & Johnson, 1998; Dalton, Johnson, & Ellstrand, 1999). Specifically, two primary explanations have been offered to explain the link between equity ownership and firm performance. One stream draws on agency theory (Jensen & Meckling, 1976) and argues that equity ownership impacts incentives alignment and hence firm performance. This suggests a causal relationship between equity ownership and firm performance. A second stream draws on signaling theory (Leland & Pyle, 1977) to argue that insiders possess private information of the firm. Thus a reduction of insiders' equity ownership in the firm is indicative of poor quality and is a negative signal of a firm's future potential. Thus, insiders' equity ownership reduction is a symptom of poor performance, though not a cause. Prior work struggles to tease these theories apart (e.g., Jain & Kini, 1994) but has not reached a conclusion yet. Given the high popularity of equity ownership used in aligning incentives in practice and the mixed explanations offered in the literature, it can assist in understanding managerial actions and designing appropriate corporate governance mechanisms if we can tease the above two explanations apart. In addition, although previous studies have directly examine the organizational consequences of equity ownership on strategic choices (Amihud & Lev, 1981; Baysinger, Kosnik, & Turk, 1991; Sanders & Carpenter, 1998; Sanders & Hambrick, 2007) and economic performance (Core, Holthausen, & Larcker, 1999; Dalton, Daily, Ellstrand &

Johnson, 1998; Hermalin & Weisbach, 1998), little research has examined the contingencies under which the effectiveness of equity ownership may vary. To fill this gap, I explore the relationship between equity ownership and performance variations. Specifically, I examine the relationship between insiders' secondary share sales at the IPO and firm performance and the contingency under which the relationship varies. In general, I find that insiders' secondary share selling is associated with a slower post-IPO R&D growth and this effect is weaker for large firms. I test my theory with data gathered in 500 U.S. software IPOs from 1990 to 2011.

Equity ownership puts insiders' personal wealth contingent on firm future performance, providing incentives to insiders. When firm performance and stock price go up, insiders incur an increase of personal wealth and vice versa. This mechanism is suggested by agency theory (Jensen & Meckling, 1976) and is frequently drawn as the rationale why equity ownership can mitigate agency behavior, although lacking strong empirical evidence. Given the fact that equity ownership has become the dominant logic in compensation design in the past two decades (Beatty & Zajac, 1994), especially in small entrepreneurial firms (Kim & Nofsinger, 2007; Wasserman, 2006), it is important to investigate if equity ownership really matters for insider effort and firm performance. In addition, if equity ownership truly has significant impacts on insider effort and insider effort really matters for the firm performance as well, the effect of equity ownership may vary under different contingencies. That is, firm performance may differentially rely on insiders' effort, or, the sensitivity of firm performance to insider effort may be different in different situations.

An IPO is a good context to investigate these questions. An IPO provides insiders an opportunity to sell equity shares (known as secondary shares) along with newly issued shares to the public on the IPO date. By selling equity shares at the IPO, insiders can change their equity ownership in the firm and these sales may affect incentive alignment. There are other advantages to studying IPO firms. First, they are generally comparable to each other. They are usually at an early stage in their development, need to raise financial capital, and in order to go public they must receive at least an acceptable evaluation from an underwriter. Second, whether insiders can sell secondary shares at the IPO is partly dependent on external market condition at time of the IPO and, as such, is partly exogenous. This allows me to adopt an instrumental variable approach to separate signaling and treatment effects. Lastly, secondary share sales are common, and this makes the study feasible.

This exploratory study makes several contributions to the literature. First, the mechanism between equity ownership change and firm performance has served as the basis for many prior studies on CEO compensation, agency behavior, managerial incentives, and board governance and also as the rationale for its high popularity in practice. However, current research struggles to identify the mechanism and the results are thus far inconclusive (Dalton, Daily, Certo, & Roengpitya, 2003). This study provides the evidence that insiders' secondary share sales are related to changes in firm performance, especially post-IPO R&D growth.

Second, this paper identifies one important contingency of equity ownership: firm size. Although I elaborate on the logic that the same compensation may have different impacts on different CEOs (Wowak & Hambrick, 2010), I identify an important

contingency of equity ownership, firm size. This finding means that all firms do not benefit equally from equity ownership in aligning incentives. Instead, incentive alignment effects of equity ownership are nuanced, and the size or maturity of the firm must be taken into consideration. Prior studies ignored the differential impacts of equity ownership in different types of firms. This paper finds that post-IPO R&D growth of small firms is more negatively related to insiders' secondary share sales at the IPO. This finding suggests that equity ownership is not uniformly beneficial to all firms. This finding has implications for management incentive design and corporate governance studies.

HYPOTHESES

Prior studies on corporate governance heavily draw on agency theory to investigate stakeholders' behavior (Beatty & Zajac, 1994; Tosi & Gomez-Mejia, 1989; Westphal & Zajac, 1994). Agency-based studies highlight the risk differential between principals and agents (Jensen & Meckling, 1976; Ross, 1973). This stream of literature suggests that principals can diversify their wealth by spreading capital across different firms and thus are more risk neutral. In contrast, agents have already invested most of their human capital in one firm and receive compensation from the same firm and thus are more risk averse. This risk differential raises the possibility of interest conflicts between agents and principals. Therefore, agency-based studies suggest that self-interested agents choose actions that maximize their personal utility (i.e., value), which may cause harm to shareholders (Jensen & Meckling, 1976; Ross, 1973).

To mitigate the conflict of interest between agents and principals, agency-based studies prescribe two different ways. First, a firm's board of directors, whose fiduciary duty is to monitor agents on behalf of shareholders, provide oversight on the agent. However, these monitoring mechanisms are usually difficult to implement, owing to their high cost and the unobservability of agent behaviors. Second, equity ownership can tie agents' personal wealth closely to firm performance. This mechanism has been adopted by many firms to align the interests of agents and principals and becomes the dominant logic in compensation design (Eisenhardt, 1988; Henderson & Fredrickson, 1996; Tosi, Werner, Katz, & Gomez-Meijia, 2000; Welbourne, Balkin, & Gomez-Mejia, 1995).

Equity ownership often places substantial amounts of personal wealth at risk by tying them closely to firm performance (Denis, Denis, & Sarin, 1999; Jensen & Murphy, 1990). The rationale is that directly linking personal wealth to firm performance through equity can motivate agents to act congruently with the interests of shareholders. With equity shares in hand, an agent's interest is more aligned with that of the firm and hence the agent is more likely to work hard for the firm. On the spectrum of equity ownership, when it goes from zero to one, an agent who has no ownership gradually turns into an owner who owns the complete ownership of the firm; simultaneously, agency wanes and stewardship grows (Wasserman, 2006). Therefore, the amount of equity shares held by an agent may largely be a proxy for his/her effort put into the firm.

A significant equity ownership change may take place at the time of the IPO. An IPO provides an opportunity for insiders to sell part of their equity holdings (known as secondary shares) of the firm along with the newly issued (primary) shares to the public on the IPO date. Through the sales, insiders can lower their equity holding and thus affect

incentive alignment. When insiders decrease their equity shares of the firm, their financial interest is less aligned with that of the firm and they may lower their willingness to work hard for the firm. Based on agency theory, we may expect the decrease of insider effort following their equity share sales at the IPO if incentive alignment mechanism really works and hence firm performance changes. This raises the question whether performance and investment change post-IPO and whether this change can be causally related to insiders' equity share sales at the IPO. As a baseline hypothesis, I have the following prediction:

H1: Secondary share sales at the IPO are negatively associated with firm post-IPO performance.

Firm Size

The extent that equity ownership impacts firm outcomes is also dependent on the size of the firm. Specifically, large firms have more mature routines and institutionalized firm policies (Cyert & March, 1963) on many fronts such as R&D and investment. The more formal organizational structure or routines within the firm suggests that may firm decisions may be less dependent on any single person within the organization, including the CEO. In contrast, smaller firms are likely to have more immature bureaucracies which lead to greater influence of individuals. When insiders sell part of their equity shares at the IPO and decrease their efforts, the performance of small firms may change. Given the above argument, I have the following prediction:

H2: Firm size weakens the negative relationship between insiders' secondary share sales at the IPO and post-IPO performance.

METHODOLOGY

Data

My sample includes 500 U.S. IPOs issued from 1990 to 2011 in three sectors of the computer software industry: computer programming services (SIC 7371), computer software (SIC 7372), and computer integrated systems design (SIC 7373). I constructed the sample of IPO firms from the SDC Global New Issues database. Following prior research (Chen, Hambrick & Pollock, 2008; Pollock & Rindova, 2003; Ritter, 1991), I exclude any spin-off or equity carve-out IPOs to ensure that the sample firms are only independent entrepreneurial firms. I also excluded foreign firms issuing shares in the U.S. market. Firm characteristics, pre-IPO financial data, IPO-related data and upper echelons biographical data are drawn from the IPO firms' prospectuses (424B form), SDC, and COMPUSTAT database. These prospectuses are available from the SEC Edgar online service and ThomsonONE database.

Dependent Variable

I tested a variety of different dependent variables in this study and all of them are in one year post-IPO: Sales, sales growth rate, R&D expenditure, R&D expenditure growth rate, capital expenditure, asset turnover, operating return on assets, and operating cash flow deflated by total assets. The performance data are drawn from COMPUSTAT.

Independent Variables

Dummy if the IPO firms sell any secondary shares at the IPO. I adopted a dummy variable to indicate if an IPO firm sells any secondary shares at the IPO. It is coded as 1 if an IPO firm sells; 0 otherwise.

Percentage of secondary shares in the offering. This variable is calculated as the percentage of secondary shares relative to all the shares in the offering.

Percentage of shares sold by the CEO relative to the firm pre-IPO outstanding shares. This variable is calculated as the ratio of the number of shares sold by the CEO divided by the total number of pre-IPO outstanding shares of the firm.

Percentage of shares sold by the non-CEO executives relative to the firm pre-IPO outstanding shares. This variable is calculated as the ratio of the number of shares sold by non-CEO executives divided by the total number of pre-IPO outstanding shares of the firm.

Percentage of shares sold by outside directors relative to the firm pre-IPO outstanding shares. This variable is calculated as the ratio of the number of secondary shares sold by all outside directors divided by the total number of pre-IPO outstanding shares. Outside directors are generally VCs and other institutional investors.

Firm size. I use pre-IPO firm's total assets to measure firm size. Firm size data are drawn from the SDC.

Control Variables

Firm characteristics. Firm-related variables such as firm age, the log value of sales prior to the IPO, and the log value of R&D expenditure one year prior to the IPO are included in the regression to control for firm size effects and firm quality (Bloom & Milkovich, 1998).

IPO characteristics. To control for IPO-related factors, I include the following variables: (1) Log value of IPO proceeds. This variable measures the size of the IPO. (2) Offer price/book value measures how profitable the share sale is at the IPO. Presumably,

the higher the ratio, the more profitable the share sale is and the more likely the focal CEO sells some equity shares.

Underwriter prestige. Underwriters are important players during the IPO process (Carter & Manaster, 1990). Underwriter prestige data can be constructed in the spirit of the methodology of Cater and Manaster (1990) and are available online at http://bear.warrington.ufl.edu/ritter/ipodata.htm. The online data are constructed by Jay Ritter and extensively used in the finance literature (e.g. Ljungqvist & Wilhelm, 2003; Loughran & Ritter, 2004).

VC. The variable of VC is a dummy variable that indicates if the IPO firm is backed by any venture capital firm. The variable is coded as 1 if the IPO firm is backed by a venture capital firm; 0 otherwise. The data were drawn from the SDC database and I collected the relevant information from IPO firms' prospectuses and VentureXpert database to validate the SDC data.

Year period dummy. Because my sample includes IPOs covering 1990-2011, I create year period dummies to control for possible year effects. According to prior studies (e.g., Loughran & Ritter, 2004), the IPO market followed relative stable patterns in the periods 1990-1998, 1999-2000, and post-2000, respectively. In my analysis, I create three dummy variables to indicate these time periods.

Method of Analysis

In this study, I attempt to test a causal relationship between secondary share sales at the IPO and post-IPO performance. Therefore, I must address endogeneity. Specifically, there may be a common factor that drives both secondary share sales at the IPO and post-IPO performance. In particular, when firm quality is poor in the first place

pre-IPO, insiders are more likely to sell equity shares at the IPO to decrease their exposure to the poor quality firm; we are also more likely to observe a poor post-IPO performance. If this is the case, unobserved firm quality is the common cause for both insiders' secondary share sales at the IPO and poor post-IPO performance. Then the relationship between insiders secondary share sales at the IPO and poor post-IPO performance is simply a correlation rather than a causal relationship. To address this endogeneity, I adopt an instrumental variable approach. The desirable instrumental variable should be correlated with insiders' secondary share sales at the IPO but uncorrelated with post-IPO performance or unobserved firm quality. The instrumental variable I adopt in this study is the number of IPOs in the 2 months preceding the focal IPO. The number of IPOs in the 2 months preceding the focal IPO is an indicator of market hotness. The more IPOs, the hotter the IPO market is. A hot market leads insiders to expect a higher stock price in the future, which renders them less likely to sell shares at the IPO. As such, the number of IPOs in the 2 months preceding the focal IPO is supposed to be correlated with insiders' share sales at the IPO. However, prior studies (e.g., Draho, 2004) suggest that the IPO market has high volatility and it may only take a few months for a hot market to change into a cold market. In addition, there is no evidence showing that IPO firms can exactly time their IPO. Therefore, market hotness has little to do with firm quality or post-IPO firm performance.

RESULTS

Table 1 reports descriptive statistics and Table 2 reports correlations. From Table 1, we can see that 49% of the sample firms sold secondary shares at the IPO. On average,

11.81% of the offerings consist of secondary shares. In each offering including secondary shares, the CEO sells 1% of the firm pre-IPO outstanding shares, non-CEO executives sell 1%, and outside directors sell 2.8%. Alternatively, CEOs sell 4.5% of their own pre-IPO holdings, non-CEO executives sell 6.6%, and outside directors sell 9.2%. Sample firms are generally young and around 8 years. 65% of the sample firms are VC-backed firms.

Insert Table 1 and 2 about here

To explore the relationship between secondary share sales and post-IPO performance, I tested different combinations of independent variables and dependent variables and summarize all the results in Table 3. The dependent variables I tested include: sales, sales growth rate, R&D expenditure, R&D growth rate, capital expenditure, asset turnover, operating return on asset, and operating cash flow deflated by total asset. From the results based on regular OLS in Table 3, one can see that I obtain the most consistent results when I use R&D growth rate in one year post-IPO as dependent variable. When the dummy whether IPO firms sell any secondary shares and the percentage of secondary shares in the offering serve as independent variables separately, they are only significant in predicting post-IPO R&D growth rate. When I use other firm performance variables, I obtain no significant results. This suggests that among the outcome measures, only post-IPO R&D growth rate may be significantly affected by secondary share sales at the IPO. Next, rather than look at all the insiders as a group, I split them into three subgroups: CEO, non-CEO executives, and outside directors to explore which insider is significantly associated with post-IPO outcomes.

Insert Table 3 and 4 about here

In Table 4, I report the results using post-IPO R&D growth rate as the dependent variable. Model 1 includes control variables and serves as a baseline model. In Model 2, the dummy if the IPO firm sells any secondary shares at the IPO is negative and significant (β=-.5, $p<0.01$), suggesting that compared with IPO firms that do not sell secondary shares at IPO, firms with secondary shares experience a slower post-IPO R&D growth rate. Similarly, in Model 3, the percentage of shares in the offering is negative and significant (β=-.02, $p<0.01$), suggesting that when the proportion of secondary shares in the offering is high, the firm experiences a slower post-IPO R&D growth rate. In a robustness check, I run Model 3 in the subgroup of firms that include secondary shares in the offering, the percentage of shares in the offering is negative and marginally significant (β=-.02, $p<0.1$) (not reported here). In Model 4, the percentage of shares sold by non-CEO executives relative to the firm pre-IPO outstanding shares is negative and significant (β=-13.58, $p<0.05$) and similarly the percentage of shares sold by outside directors is negative and significant (β=-5.86, $p<0.01$), suggesting that the secondary share sales by non-CEO executives and outside directors are significantly associated with a slower post-IPO R&D growth rate. Similarly, in another robustness check, I run Model 4 in the subgroup of firms that include secondary shares in their offering, the percentage sold by non-CEO executives is negative and marginally significant (β=-10.98, $p<0.1$); the percentage sold by outside directors is negative and significant (β=-5.99, $p<0.05$). These results suggest that the findings in Table 4 are robust.

As mentioned above, the results in Table 4 may suffer from endogeneity issues. Specifically, the relationship between secondary share sales and post-IPO R&D growth

rate may be simply a correlation instead of a causal relationship. To address this potential endogeneity, I adopted an instrumental variable approach. It is a difficult task to find appropriate instrumental variables. In this study, the instrumental variable I tentatively adopted is the number of IPOs in 2 months preceding the focal IPO. I report the instrumental analysis in Table 5. Model 1 is the first stage, using the number of IPOs in the 2 months preceding the focal IPO to predict the likelihood of an offering including secondary shares. As you can see, the number of IPOs in 2 months preceding the focal IPO is negative and significant (β=-.00, $p<0.05$), suggesting that the more IPOs in 2 months prior to IPO, the less likely the focal firm includes any secondary shares. Model 2 is the second stage and the dummy if the focal firm includes any secondary shares is negative and marginally significant (β=-7.02, $p<0.1$). This result is consistent with the results in Table 4. In addition, Model 3 is the first stage predicting the percentage of secondary shares in an offering. Similarly, the number of IPOs in 2 months preceding the focal IPO is negative and significant (β=-0.06, $p<0.001$). Model 4 is the second stage and the percentage of secondary shares in an offering is negative and significant (β=-.10, $p<0.05$). The result is also consistent with the results in regular OLS in Table 4.

Insert Table 5 about here

To test the interaction terms, I follow Dahl and Sorenson (2012) to generate the predicted percentage of secondary shares in an offering from the first stage of the instrumental analysis in Model 3 Table 5. Using the predicted percentage, I generate the interaction terms with pre-IPO total asset. I tested the interaction terms in Table 6. Model 1 includes control variables. Model 2 includes the interaction of the percentage of secondary shares in an offering and pre-IPO total assets. Results in Model 2 are based on

an OLS regression and show that the percentage is negative and significant (β=-.05, p<0.01) and the interaction is positive and significant (β=.01, p<0.05). In Model 3, I use the predicted percentage of secondary shares in an offering from the first stage of instrumental variable analysis in Model 3 as my independent variable and created the interaction terms. In Model 3, the predicted percentage is negative and significant (β=-.24, p<0.01) and the interaction is positive and significant (β=.02, p<0.05). These results suggest that a high percentage of secondary shares in an offering is associated with slower post-IPO R&D growth but this relationship is weaker for firms with more total assets, i.e., larger firms. Therefore, the results suggest that when insiders sell more secondary shares in an offering, their effort decrease has a smaller impact on large firms.

Insert Table 6 about here

In summary, insiders' secondary share sales have a significant negative impact on post-IPO R&D growth rate and this negative effect is weaker for large firms.

DISCUSSION & CONCLUSION

Although prior studies heavily draw on agency theory to examine agency behavior, many of these studies focus on large public firms and ignore how equity ownership functions in small entrepreneurial firms. In addition, because of the limitation of the research context, it is hard for prior studies to draw a causal inference between equity ownership and managerial behavior or firm performance. This study focuses on small entrepreneurial firms and examines how equity ownership changes influence firm outcomes in the IPO context. In addition, this study adopted an instrumental variable

approach to address the endogeneity issue and tries to identify a causal relationship. Furthermore, prior studies largely ignore the contingencies under which the effect of equity ownership varies. Without this knowledge, equity ownership may not be able to be taken advantage to its fullest extent. This paper identified one important contingency: firm size.

My findings elucidate the influence of insiders secondary share sales at the IPO, and firm size on post-IPO R&D growth rate by demonstrating: (1) there is a negative relationship between insiders' secondary share sales and post-IPO R&D growth rate; (2) the relationship is less negative for large firms. These findings contribute to agency-based studies and entrepreneurship literature in several ways.

First, prior studies largely ignore how equity ownership impacts firm outcomes in small entrepreneurial firms. Many prior studies focus on large public firms and the evidence about its impact on firm performance is weak. In addition, many prior studies cannot draw a causal inference between equity ownership and firm outcomes because of many intervening factors associated with the research context. This study focused on small entrepreneurial IPO firms and adopted an instrumental variable approach to draw a causal inference. The findings suggest that equity ownership does have an incentive alignment effect, specifically, the higher the percentage of secondary shares in an IPO, the slower the post-IPO R&D growth rate. I also explored other outcome measures and found no significant results. This finding suggests that other outcomes may be less sensitive to insiders' secondary share sales at least in one year post-IPO. R&D growth is the one that is significantly affected. This may be because compared to other outcomes, R&D expenditure is more under the control of insiders. When insiders decide to cut R&D,

they can immediately lower R&D expenditures. In contrast, sales are based on contracts in many cases and hence cannot easily be changed in a short period of time. Therefore, sales growth or decrease is less sensitive to insiders' intent.

Another possible reason about the findings on R&D growth is that insiders turn to other sources of innovation instead of internal R&D after they decrease their interest stake in the firm. Firms can get innovations either from internal R&D development or external acquisition. It may not be that insiders lower their commitment to the firm after they sell part of the secondary shares but they choose different sources of innovation. They may become more inclined to find external sources of innovation rather than internal R&D. I need to collect data on external acquisition in one year post-IPO to test the idea if they gain innovation from external environment.

Second, this paper also finds that the alignment effect of equity ownership varies with firm size. Specifically, the negative impact of insiders' secondary share sales at the IPO on post-IPO R&D growth is smaller for large firms. This finding suggests that compared with large firms, small firms rely more on insiders' decision to grow R&D. As suggested above, this may be because at the time of the IPO, small firms may be still in their early stage of development; their R&D has not been routinized or does not have long-term plans and still heavily relies on insiders' short-term decisions. When insiders sell part of their secondary shares, they lower their commitment to the firm and an immediate consequence is that they slow down their R&D expenditure. In general, this finding suggests that in small firms, R&D expenditure decision has a shorter distance to insiders and, thus, is more significantly affected by insiders.

To conclude, by using 500 U.S. software IPOs from 1990 to 2011, I find that there is a negative relationship between the percentage of secondary shares in an IPO and post-IPO R&D growth. In addition, this relationship is less negative for large firms.

Table 1: Descriptive Statistics

	Variables	Mean	SD
1	Sale (1y)	3.69	1.21
2	Sale growth rate (1y)	1.72	7.82
3	Sale growth rate (1y)/(-1y)	-2.45	92.41
4	R&D expenditure (1y)	2.24	1.00
5	R&D growth rate (1y)	1.34	2.19
6	R&D growth rate(1y)/(-1y)	-1.58	108.69
7	Dummy if firm sells secondary shares	0.49	0.50
8	% of secondary shares in all issuing	11.81	15.80
9	% sold by CEO relative to firm	0.01	0.02
10	% sold by non-CEO execs relative to firm	0.01	0.01
11	% sold by outside directors relative to firm	0.01	0.04
12	% sold by CEO relative to own holding	0.02	0.05
13	% sold by non-CEO execs relative to own holding	0.03	0.08
14	% sold by outside directors relative to own holding	0.05	0.10
15	# IPOs in 2 months pre-IPO	120.47	51.59
16	Pre-IPO RD growth rate (-1y)	0.32	1.00
17	Firm pre-IPO total assets (-1y)	2.56	1.33
18	Firm pre-IPO total sales (-1y)	2.74	1.30
19	Firm pre-IPO R&D expenditure (-1y)	1.51	0.85
20	Firm age	8.30	5.58
21	Offer price/book value	7.17	0.31
22	IPO proceeds	3.44	0.85
23	Underwriter prestige	7.24	2.04
24	VC dummy	0.65	0.48
25	90-98 period dummy	0.60	0.49
26	99-00 period dummy	0.25	0.43

Table 2: Correlations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	sale (1y)	1.00																									
2	sale growth rate (1y)	-0.26	1.00																								
3	sale growth rate (1y)/(-1y)	0.04	-0.05	1.00																							
4	rd expenditure (1y)	0.62	-0.16	0.06	1.00																						
5	rd growth rate (1y)	-0.12	0.07	0.04	-0.15	1.00																					
6	rd growth rate(1y)/(-1y)	-0.01	0.01	0.00	0.02	-0.05	1.00																				
7	dummy if firm sells secondary shares	0.24	-0.14	0.04	-0.03	-0.06	0.01	1.00																			
8	% of secondary shares in all issuing	0.23	-0.12	0.03	-0.01	-0.07	0.04	0.77	1.00																		
9	% sold by CEO relative to firm	0.04	-0.06	0.01	-0.10	0.11	-0.04	0.37	0.40	1.00																	
10	% sold by non-ceo execs relative to firm	0.05	-0.05	0.02	-0.04	-0.03	0.01	0.34	0.34	0.39	1.00																
11	% sold by outside directors relative to firm	0.08	-0.07	0.01	-0.04	-0.09	0.00	0.40	0.51	0.07	0.06	1.00															
12	% sold by CEO relative to own holding	0.10	-0.08	0.02	-0.04	0.01	-0.05	0.49	0.53	0.70	0.50	0.17	1.00														
13	% sold by non-ceo execs relative to own holding	0.08	-0.05	0.02	-0.01	-0.02	0.01	0.39	0.35	0.29	0.48	0.13	0.44	1.00													
14	% sold by outside directors relative to own holding	0.11	-0.08	0.01	-0.02	-0.04	-0.02	0.46	0.55	0.15	0.16	0.65	0.28	0.19	1.00												
15	#IPOs in 2 months pre-IPO	-0.19	0.10	0.01	-0.15	0.19	-0.03	-0.07	-0.13	-0.03	-0.01	-0.13	-0.09	-0.03	-0.16	1.00											
16	Pre-IPO RD growth rate (-1y)	0.22	-0.02	0.02	0.45	-0.22	0.02	-0.11	-0.09	-0.10	-0.08	-0.04	-0.10	-0.07	-0.07	-0.01	1.00										
17	Firm pre-IPO total assets (-1y)	0.71	-0.28	0.03	0.59	-0.25	-0.01	0.15	0.19	-0.03	-0.01	0.09	0.05	0.05	0.10	-0.29	0.19	1.00									
18	Firm pre-IPO total sales (-1y)	0.75	-0.30	0.00	0.36	-0.21	-0.03	0.35	0.34	0.11	0.09	0.16	0.17	0.11	0.20	-0.26	-0.06	0.77	1.00								
19	Firm pre-IPO R&D expenditure (-1y)	0.52	-0.18	0.00	0.78	-0.38	0.02	0.05	0.06	-0.11	-0.02	0.01	0.00	0.01	0.02	-0.25	0.14	0.69	0.56	1.00							
20	Firm age	0.22	-0.15	-0.02	0.03	-0.06	-0.05	0.27	0.26	0.20	0.15	0.11	0.18	0.15	0.18	-0.06	-0.18	0.28	0.47	0.17	1.00						
21	Offer price/book value	0.04	0.04	0.00	0.04	0.00	-0.01	-0.03	-0.02	-0.07	-0.05	-0.08	-0.06	-0.02	-0.04	-0.03	0.01	0.02	0.03	0.04	-0.01	1.00					
22	IPO proceeds	0.63	-0.18	0.10	0.66	-0.22	-0.01	0.11	0.14	-0.05	0.00	0.09	0.05	0.02	0.09	-0.26	0.34	0.67	0.45	0.55	0.05	0.00	1.00				
23	Underwriter prestige	0.61	-0.20	0.13	0.65	-0.17	0.01	0.19	0.18	0.01	0.05	0.04	0.09	0.07	0.07	-0.15	0.30	0.59	0.44	0.51	0.07	0.01	0.73	1.00			
24	VC dummy	0.22	-0.11	-0.02	0.37	-0.13	0.03	0.06	0.02	-0.12	-0.08	0.05	-0.05	-0.04	0.07	-0.03	0.16	0.23	0.10	0.26	-0.08	-0.01	0.29	0.44	1.00		
25	90-98 period dummy	-0.22	0.01	-0.05	-0.35	0.12	-0.02	0.35	0.30	0.22	0.18	0.12	0.21	0.16	0.15	0.33	-0.22	-0.31	-0.07	-0.29	0.09	-0.02	-0.52	-0.31	-0.18	1.00	
26	99-00 period dummy	0.05	0.02	0.05	0.27	-0.01	0.02	-0.39	-0.36	-0.18	-0.15	-0.21	-0.23	-0.16	-0.23	0.14	0.28	0.05	-0.17	0.05	-0.20	0.01	0.31	0.24	0.18	-0.71	1.00
	n=500; 1y: one year post-IPO; -1y: one year pre-IPO;																										

Table 3: Results Summary (DVs are in one year post-IPO)

Note	IV \ DV	Sales	Sales growth rate	RD	RD growth rate	Capital expenditure	Asset turnover	Operating return on assets	Operating cash flows deflated by total assets
add separately	Dummy if firm sells secondary shares	NS	NS	NS	Negative	Negative	NS	NS	NS
add separately	% of secondary shares in all shares sold at IPO	Marginally negative (One tail)	NS	Marginally negative	Negative	Negative	NS	NS	NS
add to regression simultaneously	% sold by CEO relative to all firm shares	NS	Negative	NS	NS	Negative	NS	NS	NS
	% sold by Non-CEO executives relative to all firm shares	NS	NS	NS	Negative	NS	NS	NS	NS
	% sold by outside directors relative to all firm shares	Negative	NS	Marginally negative	Negative	Negative	NS	NS	NS
add to regression simultaneously	% sold by CEO relative to own holding	Marginally negative (One tail)	Marginally negative	NS	NS	Negative	Positive	NS	NS
	% sold by Non-CEO executives relative to own holding	NS	NS	NS	NS	NS	Negative	NS	NS
	% sold by outside directors relative to own holding	Negative	NS	NS	NS	NS	NS	NS	NS

Table 4: OLS results (Post-IPO R&D growth rate as dependent variable)

	1	2	3	4
Variables	Post-IPO RD growth rate (1y)			
Dummy if firm sells secondary shares		-0.50**		
		(0.192)		
% of secondary shares in issuing			-0.02**	
			(0.006)	
% sold by CEO relative to all firm shares				11.08
				(12.379)
% sold by non-CEO executives relative to all firm shares				-13.58*
				(5.807)
% sold by outside directors relative to all firm shares				-5.86**
				(1.961)
Pre-IPO RD growth rate (-1y)	-0.53***	-0.55***	-0.55***	-0.54***
	(0.156)	(0.157)	(0.159)	(0.157)
Firm pre-IPO total assets (-1y)	0.32	0.31	0.32	0.32
	(0.204)	(0.202)	(0.202)	(0.202)
Firm pre-IPO total sales (-1y)	-0.19	-0.13	-0.14	-0.16
	(0.130)	(0.126)	(0.128)	(0.129)
Firm pre-IPO R&D expenditure (-1y)	-1.20***	-1.26***	-1.26***	-1.22***
	(0.291)	(0.293)	(0.299)	(0.293)
Firm age	-0.01	-0.01	-0.01	-0.01
	(0.017)	(0.016)	(0.016)	(0.017)
Offer price/book value	0.11	0.10	0.11	0.09
	(0.093)	(0.096)	(0.097)	(0.111)
IPO proceeds	0.06	0.12	0.15	0.16
	(0.250)	(0.244)	(0.253)	(0.261)
Underwriter prestige	0.09	0.11	0.11	0.07
	(0.114)	(0.114)	(0.113)	(0.119)
VC dummy	-0.33	-0.32	-0.34	-0.29
	(0.271)	(0.267)	(0.269)	(0.292)
90-98 period dummy	0.38	0.56*	0.56*	0.46+
	(0.253)	(0.258)	(0.277)	(0.262)
99-00 period dummy	0.48*	0.39+	0.39+	0.42*
	(0.212)	(0.213)	(0.208)	(0.207)
Constant	1.34	1.19	1.03	1.32
	(1.100)	(1.085)	(1.114)	(1.170)
Observations	500	500	500	500
R-squared	0.201	0.209	0.211	0.219
df_m	11	12	12	14
Ll	-1047	-1044	-1044	-1041

Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05, + p<0.1; Two-tailed test

Table 5: Instrumental variable analysis (2SLS)

	(1)	(2)	(3)	(4)
	1st stage	2nd stage	1st stage	2nd stage
	Dummy if firm sells secondary shares	Post-IPO RD growth rate (1y)	% of secondary shares in issuing	Post-IPO RD growth rate (1y)
# of IPOs in 2 months preceding IPO	-0.00*		-0.06***	
	(0.000)		(0.014)	
Dummy if firm sells secondary shares		-7.02+		
		(5.127)		
% of secondary shares in issuing				-0.10*
				(0.054)
Pre-IPO RD growth rate (-1y)	-0.03*	-0.74**	-1.08*	-0.63***
	(0.014)	(0.261)	(0.483)	(0.188)
Firm pre-IPO total assets (-1y)	-0.03	0.14	-0.29	0.32
	(0.030)	(0.269)	(0.847)	(0.203)
Firm pre-IPO total sales (-1y)	0.12***	0.67	3.03***	0.12
	(0.026)	(0.621)	(0.680)	(0.180)
Firm pre-IPO R&D expenditure (-1y)	-0.13***	-2.14*	-4.26***	-1.61***
	(0.034)	(0.841)	(1.230)	(0.417)
Firm age	0.01	0.03	0.25+	0.01
	(0.004)	(0.042)	(0.152)	(0.020)
Offer price/book value	-0.04*	-0.13	-0.64	0.07
	(0.018)	(0.240)	(0.622)	(0.129)
IPO proceeds	0.13**	0.96	5.84***	0.61
	(0.042)	(0.750)	(1.298)	(0.386)
Underwriter prestige	0.04**	0.38	0.90+	0.18
	(0.016)	(0.261)	(0.458)	(0.131)
VC dummy	0.04	-0.08	-0.17	-0.36
	(0.049)	(0.403)	(1.680)	(0.298)
90-98 period dummy	0.42***	2.87	16.33***	1.48*
	(0.074)	(1.924)	(2.385)	(0.698)
99-00 period dummy	-0.13	-0.91	-0.72	-0.06
	(0.081)	(1.140)	(2.215)	(0.402)
Constant	-0.23	-0.71	-15.15*	-0.53
	(0.196)	(2.246)	(6.338)	(1.491)
Observations	500	500	500	500
R-squared	0.355	-1.220	0.324	-0.037
df_m	12	12	12	12
ll	-253.1	-1303	-2004	-1112

Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05, + p<0.1; One-tailed test

Table 6: Test of interaction (OLS)

	1	2	3
VARIABLES	Post-IPO RD growth rate (1y)		
% of secondary shares in issuing		-0.05**	
		(0.019)	
% of secondary shares in issuing * Pre-IPO total asset		0.01*	
		(0.005)	
% of secondary shares in issuing (predicted)			-0.24**
			(0.090)
% of secondary shares in issuing (predicted) * Pre-IPO total asset			0.02*
			(0.008)
Pre-IPO RD growth rate (-1y)	-0.53***	-0.56***	-0.63***
	(0.156)	(0.162)	(0.180)
Firm pre-IPO total assets (-1y)	0.32	0.29	0.02
	(0.204)	(0.199)	(0.187)
Firm pre-IPO total sales (-1y)	-0.19	-0.18	0.45+
	(0.130)	(0.133)	(0.242)
Firm pre-IPO R&D expenditure (-1y)	-1.20***	-1.33***	-1.89***
	(0.291)	(0.306)	(0.470)
Firm age	-0.01	-0.01	0.03+
	(0.017)	(0.016)	(0.020)
Offer price/book value	0.11	0.10	-0.05
	(0.093)	(0.090)	(0.115)
IPO proceeds	0.06	0.14	1.11*
	(0.250)	(0.251)	(0.509)
Underwriter prestige	0.09	0.13	0.28+
	(0.114)	(0.116)	(0.144)
VC dummy	-0.33	-0.30	-0.07
	(0.271)	(0.260)	(0.218)
90-98 period dummy	0.38	0.66*	2.49**
	(0.253)	(0.276)	(0.940)
99-00 period dummy	0.48*	0.42*	-0.67
	(0.212)	(0.203)	(0.543)
Constant	1.34	1.11	-1.59
	(1.100)	(1.088)	(1.569)
Observations	500	500	500
R-squared	0.201	0.218	0.226
df_m	11	13	13
Ll	-1047	-1042	-1039

Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

CHAPTER 5: CONCLUSION

In this three-essay dissertation, to tease apart several theories such as agency theory, signaling theory and risk aversion, I examine the antecedents and performance consequences of insiders' secondary share sales at the IPO. Managerial equity ownership has been widely adopted in practice. Whether and to what extent managerial equity ownership affects executive actions and organization outcomes have been an important research question. Although prior studies provided some insights, the findings have been inconsistent or inconclusive at best (Devers, McNamara, Wiseman, and Arrfelt, 2008; Wowak and Hambrick, 2010). This dissertation contributes to this stream of research by investigating how equity ownership affects one particular action: insiders' secondary share sales at the IPO and the associated short- and long-term performance outcomes.

Theoretical Contributions

The first contribution of the dissertation is that insiders' secondary share sales are not significantly associated with poor post-IPO performance. This finding does not provide support either to agency theory or signaling theory. The finding is more consistent with risk aversion. Therefore, insiders' secondary share sales are not necessarily a negative signal and traditional wisdom may over-emphasize its possible negative consequences. The selling is mostly driven by a wealth diversification motive. Even if insiders sell part of their shares at the IPO, such sales do not necessarily lower their commitment to the firm. At least, most of the outcomes are not significantly influenced by insiders' secondary share sales at the IPO.

The second theoretical contribution of the dissertation is in identifying the contingencies under which the effect of the risk component of equity ownership varies.

Equity ownership not only aligns CEO interest and firm interest but also creates risk for CEOs (Devers, McNamara, Wiseman and Arrfelt, 2008). Although prior studies identified some contingencies under which the risk effect of equity ownership varies (Wowak and Hambrick, 2010) such as CEO social psychological characteristics, this dissertation identifies CEO founder status as another important contingency and extends beyond CEO characteristics to include board actions as another contingency. Specifically, the same amount of equity ownership implies higher risks for founder CEOs since founders usually have a greater share of their wealth invested in the firm. Therefore, founder CEOs behave differently than non-founder CEOs even with similar equity ownership. Furthermore, CEO behavior driven by equity ownership is also contingent on external governance. Different from studies with a focus on board composition (see a review in Daily, Dalton & Cannella, 2003), this dissertation focuses on how board actions affect CEO behavior. Specifically, since insiders' share sales at IPO may be interpreted as a negative signal by the market, when board members engage in share sales, it implies a weakened CEO oversight. (Perhaps because board members are less morally powerful to prevent the CEO from doing the same thing). Therefore, it will be easier for CEOs to sell shares when board members do as well. In summary, the impact of equity ownership on CEO behavior is contingent on CEO founder status and board actions.

The third contribution of the dissertation is in finding the value that IPO firms can capture when insiders sell shares at the IPO. Although it is widely documented in theories and anecdotal evidence that insiders' share sales at the IPO are interpreted as a negative signal by the market, this dissertation finds that IPO firms can actually raise more proceeds when insiders sell shares at IPO because insiders are motivated to bargain for a

higher offer price. As such, shareholders may benefit when insiders sell shares at the IPO. Furthermore, this dissertation finds that not all insiders have the same effect when they sell shares. That is, only outside directors (VCs and other institutional investors) can bargain for a higher offer price while CEOs cannot. This finding suggests that outside directors have more bargaining power over underwriters compared with CEOs. This may be because outside directors are institutional investors, who have repeated business relationships with underwriters. To gain future business opportunities from these institutions, underwriters are willing to work for their interests. In contrast, CEOs, as individuals, usually do not have opportunities to bring multiple firms to their IPOs or have future business opportunities with underwriters, which renders CEOs less powerful in bargaining with underwriters. These findings provide insights on the role of outside directors in the IPO process and the value they can create for the IPO firms when they sell shares at IPO.

The fourth contribution is in identifying the contingencies under which the incentive alignment effect of equity ownership varies. Although prior studies suggest that equity ownership can align insiders' interest and firm interest (Jensen and Meckling, 1976), they largely ignore the contingencies under which the alignment effect varies. This dissertation identifies one contingency: firm size. Specifically, this dissertation finds that the percentage of secondary shares in an offering is associated with slower post-IPO R&D growth and the relationship is stronger for smaller firms. This may be because smaller firms are likely to have more immature bureaucracies which lead to greater influence of individuals. This finding suggests that the equity ownership has differential incentive-aligning effects in firms of different sizes.

The fifth contribution is the empirical contribution that this dissertation adopted an instrumental variable approach to address potential endogeneity issues. Because of the limitations of data, sample, and research context, prior studies have difficulty in identifying causal relationships. By adopting an instrumental variable approach, this dissertation tries to identify a causal relationship between the change of equity ownership and future firm performance outcomes. It is important to do so because private information gained by a CEO can result in both equity ownership changes and performance variations, suggesting a simple correlation instead of a causal relationship. This dissertation provides a solid empirical basis for future studies on equity ownership.

Taken together, this dissertation contributes to the research on equity ownership by examining the antecedents and consequences of secondary share sales at the IPO. The key finding of this dissertation is that when the proportion of the dollar value of equity ownership in the CEO's whole interest stake in the firm is high, the CEO is more likely to sell part of the shares to reduce risks. This relationship is stronger when the CEO is the founder. CEOs are also more likely to sell shares when board members sell shares. Furthermore, outside directors' share sales at the IPO are significantly associated with upward offer price revision and as a result IPO firms can raise more proceeds through having a lower underpricing. Lastly, insiders' share sales at the IPO are associated with lower post-IPO R&D growth and this relationship is less negative for large firms.

Future Research

This dissertation opens new and promising research opportunities for future research. First, this dissertation identifies a CEO's wealth constraint as a contingency for equity ownership and suggests that the risk component of equity ownership becomes

enlarged when a CEO faces a wealth constraint. Although I tried to control for wealth-related variables as much as possible, the CEO founder status used in this dissertation is an imperfect proxy for wealth constraints. This is a limitation of my data. It would be better if future research could collect detailed information of the CEO's personal wealth and further test if the wealth constraints play a role in influencing equity ownership's incentive alignment.

Second, this dissertation identifies board actions as another important contingency for CEOs' shares sales. It is interesting if future research can reveal the process through which board members and CEOs bargain to sell shares at the IPO. What I observe in this dissertation is the result that board members' share selling behavior influences CEOs' share sales. The bargaining process is unobservable through the data this dissertation collected. However, it will inform us more about the governance dynamics between board members and CEOs if we can know more about the bargaining process. Given that board members and managerial equity are two widely adopted governance mechanisms in practice, thorough knowledge of the bargaining between the board and CEO can help us have a better understanding of how board governance interacts with equity ownership in governing CEOs.

Third, this dissertation finds that the negative impact of insiders' share sales at the IPO is less severe for large firms. However firm size is a crude proxy for more mature and routinized support for R&D, as it may capture other factors as well. Given my current data, I cannot identify if some other, unobserved factor is at play. Future research can take a step further to examine what particular factors associated with large firms matter in this context.

In conclusion, this dissertation advances our knowledge on equity ownership, corporate governance, institutional investors including VCs, and founders and contributes to top executive, corporate governance, and entrepreneurship literatures.

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