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ESSAYS ON EQUITY ISSUANCE

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ABSTRACT

This thesis explores two issues regarding corporate equity issuance. The first chapter studies the timing of seasoned equity offerings (SEOs) at the firm level. Descriptive statistics formulated using US data from 1975 to 2004 show that when firms return to the equity market, they tend to do so shortly after their preceding public offerings. Moreover, first SEOs following IPOs are more likely to be issued sooner after the IPO than subsequent SEOs. With the aid of duration analysis, I examine the factors that drive the decision of SEOs. Results show that both first SEOs and follow-on SEOs can be attributed to extraordinary capital demands to satisfy growth, and the probability of issuing increases when the equity market and the firm idiosyncratic returns have been rising in the preceding year. Moreover, the economic effect of the aggregate factors is larger than that of the firm-specific factors. First SEOs and follow-on SEOs differ in two aspects. First, there is strong evidence that the probability of issuing first SEOs increases when the idiosyncratic return is expected to decrease in the coming year, while the evidence for follow-on SEOs is weak. Second, first SEOs seem to be driven more by aggregate timing and aggregate growth reasons (except for the pure primary offerings), while the decision of follow-on SEOs can be better explained by firm-specific growth demand. Taken together, the results are consistent with the notion that first SEOs suffer greater information asymmetry and therefore have stronger motive to follow market-wide trends and take advantage of windows of opportunity.

The second chapter investigates whether firms that issue equity, in public offerings or private placements, have increased secondary market liquidity. In particular, quote, trade, liquidity ratio, and price impact measures are examined. Results indicate that there is a considerable increase in liquidity for firms that conduct public offerings, yet virtually no change for private placement stocks. Regression analysis suggests that the underwriting effort makes the greatest contribution to the improvement of liquidity after public offerings. In addition, analysts also play an active role in reducing the relative effective spread and the price impacts of Nasdaq issuing stocks. By contrast, prestigious underwriters only have some influence on issuing stocks listed on NYSE and AMEX.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDIX

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Chapter 1

Timing of Seasoned Equity Offerings: A Duration Analysis

1.1 Introduction

Fama and French (2005) provide striking evidence that some firms frequently issue equity during mergers, through private placements and other forms of securities that result in subsequent increase of equity shares. In fact, a great number of firms also conduct multiple seasoned equity offerings over their life span. With a sample of 6,198 firms going public from 1975 to 2004, I find that 2,037 firms (33%) return to the public equity market at least once and 607 firms (10%) reissue more than once over the same time period. More interestingly, if firms decide to reissue, they tend to do so very quickly: 71% of the offerings are conducted within three years following the previous offerings.

Given that equity issuance is considered the most expensive among all corporate financing mechanisms, it is natural to ask why firms decide to reissue so quickly, and how they decide when to reissue.[1] In particular, do firms issue equity because they are growing fast and need the money desperately, or do they simply issue to time the market and take advantage of "windows of opportunity"?[2] What internal factors, such as firm and deal characteristics, and external factors, such as economic environment and stock

[1] Lee, Lockhead, Ritter, and Zhao (1996) report that direct costs of a seasoned equity offering average 7% of the total proceeds, compared to 2% for a debt financing. Altinkilic and Hansen (2000) document that equity issuance costs average 5%, much higher than the average 1% of debt issuance costs.
[2] On October 14, 1991, in an interview with a correspondent from *Investment Deals' Digest*, an underwriter helping COR Therapeutics's seasoned equity offering shortly after its IPO, said "It has got to be companies with a big move [in their share price] and companies with a good use for the cash [to do another deal so soon]." The article went on to say that five companies that had filed a secondary within one year after their IPOs all had experienced large price run-ups. Moreover, it also cautioned that "it looks like very little of the new capital being raised will reach the companies".

market conditions, are associated with the length of time between two consecutive offerings by the same firm?

At both the aggregate level and the firm level, I consider the growth and the timing hypotheses. Under the growth hypothesis, firms approach the equity market at a faster speed to satisfy financing needs. The capital demand can stem from either economy-wide expansions or firm-specific investment opportunities or both. The timing hypothesis posits that firms may attempt to follow market or firm-specific trends by issuing equity when both market returns and their own stock returns have surged. Conversely, they may want to postpone offerings if they think the market or the stock price will continue to climb up.

Ever since Baker and Wurgler (2000) show in their seminal paper that aggregate equity share can be used to predict future market returns, finance researchers have been debating on whether managers have the incentive and the ability to time the market component of the return.[3] The aggregate data does not seem to lack evidence that issuers cluster at times when the information between investors and firms is less asymmetric or when stocks are overvalued.[4] However, Baker, Ruback, and Wurgler (2005) caution that even though managers may only be able to predict the idiosyncratic returns, it may appear that they can also time the market because mispricings of individual stocks are highly correlated as a result of market-wide investor sentiment. Therefore, conducting the analysis at the aggregate level may not be sufficient to show that managers have better

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[3] See econometric critique from Butler, Grullon, and Weston (2005b), and rational theories proposed by Pastor and Veronesi (2005), Carlson, Fisher, and Giammarino (2006), and Lyandres, Sun, and Zhang (2005).

[4] In addition to Baker and Wurgler (2000), Bayless and Chaplinsky (1996), and Howe and Zhang (2005) provide evidence on seasoned equity offerings, and Lowry (2003) examine aggregate IPO volumes, among others.

knowledge about market conditions than other investors in the market. In this paper, I use the duration model that allows me to address the market timing hypothesis after controlling for firm-specific timing.

By properly modeling the time between two consecutive equity offerings, I test the four hypotheses in a unified framework and investigate their relative importance in explaining the timing decision of seasoned equity issuance. Because descriptive statistics show that the timing of first post-IPO seasoned offerings (hereon referred to as "first SEOs") differs from the timing of subsequent seasoned offerings (hereon referred to as "follow-on SEOs"), I separate them out in the analyses.

The main findings are as follows. First, the aggregate growth and the firm-specific growth hypotheses are strongly supported for both first SEOs and follow-on SEOs. In particular, when the economy is booming and firms have their own good investment opportunities, it is more likely firms will return to the equity market at a faster speed. Second, the evidence on timing the market and timing the firm-specific return is mixed. Consistent with the timing hypotheses, the probability of reissuing increases when market returns and stock abnormal returns are high in the past year. However, firms are not more likely to issue after the IPO when they expect the market return to fall in the coming year. For follow-on SEOs, the opposite effect is found: the market may continue to do well after firms issue equity. This finding is inconsistent with the notion that managers have the ability or incentive to time the offering at the market peak. Moreover, results indicate that timing the firm-specific return plays a very important role in the first offering after the IPO as reflected by the increased hazard ratio with lower future firm return, while more seasoned follow-on SEO issuers may or may not have the incentive to do so. Third, the decision to issue first SEOs is better explained by the aggregate timing and the aggregate growth hypotheses than the firm-growth hypothesis; conversely, follow-on SEOs are more likely to stem from firm growth needs than aggregate growth trends or managers' aggregate timing motives.

Apart from the main findings, I also find that the rebalancing need is less strong for follow-on SEOs than for first-SEOs. Notably, fewer fast issuers quote repaying debt as their purpose for reissuance. The hazard ratio does not increase as debt ratio increases. Moreover, venture-backed firms are more likely to come back to the market at a faster speed, as venture capitalists may push the offering in order to exit quickly. Last, I find that the timing motive is less strong for primary offerings.

In addition to the timing decision, it is also worthwhile investigating how investors react to fast offerings, namely, offerings conducted within a short period of time from preceding offerings, as opposed to slow offerings. If fast offerings stem from superb growth opportunities, they send good signals to investors. Consequently, we should see less negative reactions. On the other hand, if fast offerings are firms' attempts to time the market, investors should punish fast issuers with more negative returns. I find that investors react more negatively to announcements of fast offerings, supporting the timing hypothesis. I further distinguish market reactions to first SEOs from second SEOs. Investors seem to be indifferent about the two offerings if they are done within a short period of time, whereas follow-on SEOs incur greater discounts if firms wait too long to issue.

In a recent study, Leary and Roberts (2005) apply duration analysis to investigate corporate financing policies, including equity issuance. My paper complements their study in three ways. First, while Leary and Roberts examine firms' rebalancing decisions, namely, how long firms wait to rebalance their capital structure after corporate financing shocks, I concentrate on equity issuance only. More importantly, they only consider firm-specific factors in their analysis; whereas I go beyond firm-level analysis and account for broader economic and market conditions explicitly. Third, I distinguish first SEOs from follow-on SEOs and study the differences between the two. As mentioned earlier, not only do their time patterns look different, but investors also respond differently to first versus follow-on SEOs.

The remainder of the chapter proceeds as follows. In Section 1.2, I review the extant literature. Section 1.3 discusses possible explanations for the timing of seasoned equity offerings and potential differential market reactions to fast and slow issuers. Section 1.4 briefly introduces the duration analysis. Section 1.5 describes the data and sampling procedure, and reports the summary statistics. Section 1.6 presents the empirical results and discusses their implications. Section 1.7 concludes.

1.2 Literature Review

1.2.1 Stock Price Patterns Surrounding SEOs

After more than two decades of extensive studies on the public equity market, researchers have identified several important patterns regarding stock price changes around the time of SEO events. First, stock prices usually increase considerably in the months preceding firms issuance of additional shares. Second, stock prices drop by about 2-3% on average on the announcement day. Third, following equity issuance, returns to issuers' stocks are typically lower than returns to common benchmark portfolios.

Although these patterns have been clearly documented regardless of the sample periods, no consensus has been reached regarding the economic rationale behind these patterns.

1.2.1.1 Stock Price Run-up before SEOs

Marsh (1982) examines equity rights issues in the UK and documents substantial increases in share prices prior to rights offerings. The more direct evidence is obtained from Asquith and Mullins (1986) who examine the pre-issue price pattern of SEO stocks in the US. They report a mean of 33% above-market return during the two years prior to announcement day of the offering. Specifically, the cumulative excess return averages 40% for primary offerings, 21% for secondary offerings, and 42% for combined offerings. Moreover, the cumulative excess return from 11 months prior to the month of the issue is positively related to the drop of stock price on the announcement day. The latest evidence comes from Loughran and Ritter (1995) who report a raw buy-and-hold return of about 72% over the year before SEOs for a sample of 3,072 SEOs between 1970 to 1990.

In terms of the predictability of pre-issue superior performance, Marsh (1982) shows that the excess return (the firm-specific return) over the year before the issue is positively related to the probability of issuing equity when firms choose external financing. Jung, Kim, and Stulz (1996) confirm Marsh's finding with the US data and show that higher past 11-month cumulative excess return increases the US firms' likelihood of issuing equity versus debt.

1.2.1.2 Negative Market Reaction to SEO Announcements

Asquith and Mullins (1986) and Masulis and Korwar (1986) document a negative market reaction of about 2-3% to SEO announcements. Barclay and Litzenberger (1988) use intraday data to further examine the announcement day effect. This phenomenon is especially interesting, considering that public equity offering is the only security issuance mechanism that receives significantly negative price impact on the announcement day.

The extant literature provides a number of explanations, notably, information asymmetry, adverse selection, and timing. Ross (1977) and Leland and Pyle (1977) present signaling models to explain the negative price impact of equity offerings. They argue that public equity offerings signal to the market that managers possess bad private information about the firm's prospects, therefore resulting in declines of stock prices. In the same spirit, Myers and Majluf (1984) also assume that managers have better information than investors. Moreover, they argue that managers will not sell undervalued stocks for the benefit of existing shareholders. Accordingly, investors demand a discount on equity offerings. The timing theories will be discussed in detail in section 1.2.3.

1.2.1.3 Long-run Underperformance after SEOs

The evidence regarding the long-run underperformance is mixed. Earlier studies such as Loughran and Ritter (1995) and Spiess and Afflect-Graves (1995), which examine buy-and-hold returns, find that SEO firms perform worse than the common benchmark portfolios over the period of two to five years following the offering. In particular, Loughran and Ritter (1995) examine post-issue returns for a sample of 3,702 SEOs from 1970 to 1990 and find that issuers underperform their size-matched benchmark portfolios by 8% annually. A contemporaneous paper by Spiess and Afflect-Graves (1995) documents that the median five-year post-issue return of the match sample on size and industry exceeds that of their SEO sample by about 32%. However, this finding has been challenged by follow-on researchers.

Brav and Gompers (1997) report that SEO stocks do not underperform relative to small growth stocks which should be used as their benchmark because SEO firms tend to be small and growth firms. Later studies, for example Mitchell and Stafford (2000), employ the matching sample technique based on size and book-to-market ratio to minimize the sampling bias. Unfortunately, the matching sample technique can not fully fix the statistical problems associated with the buy-and-hold return. In other words, there is no perfect match, therefore it is likely that some important risk factors may be left out. Eckbo, Masulis, and Norli (2000) argue that the lower post-issue return is not surprising given that leverage has decreased after SEOs. Eckbo, Masulis, and Norli (2006) provide the latest evidence on this issue. Their regression results from multi-factor pricing models show that after controlling for liquidity risk and the momentum factor, there are no statistically significant abnormal returns to SEO stocks after equity offerings. Finally, Lyandres, Sun, and Zhang (2005) add a newly discovered investment factor into the model and find similar results.

1.2.2 SEO Underpricing

SEO underpricing is typically measured as the offer price relative to the closing price on the offer day, or the preceding day. Earlier studies that examine this variable do not find the SEO offer price differs significantly from the prevailing stock price. For instance, Eckbo and Masulis (1992) report that underpricing is only about 0.44% for firms that conduct SEOs between 1963 to 1981. Therefore, little attention has been paid to SEO underpricing until recently several papers simultaneously document a trend of increasing discounts over time (Altinkilic and Hansen, 2003; Corwin, 2003; Mola and Loughran, 2004). Assuming there is no additional information revealed on the offer day, SEO underpricing is puzzling. The extant literature provides several potential explanations. Among them, uncertainty, price pressure, short-selling, and the microstructure effect gain some empirical support.

Both Corwin (2003) and Altinkilic and Hansen (2003) find that Nasdaq issues typically experience larger underpricing than NYSE issues. The rise in the underpricing in the later periods is partly due to the increase in the proportion of young Nasdaq issues with greater price uncertainty. Corwin (2003) provides further evidence that underpricing is positively related to stock volatility. Along the same information line, Altinkilic and Hansen (2005) propose an alternative argument that SEO underpricing can be thought of as investors' reaction to the negative information revealed by underwriters.

The price pressure hypothesis treats underpricing, or the offer price discount, as a way of compensating the supply-side pressure exerted by the offering on the downward-sloping demand curve. Corwin (2003) finds that larger issue size leads to larger underpricing, consistent with the price pressure hypothesis.

Short-selling activity increases right before firms issue equity. There is also some speculation that short-selling causes SEO underpricing. Researchers have used the implementation of Rule 10b-21 to investigate this issue. Rule 10b-21 was enacted to curb short-selling activities before SEOs. Results on its effectiveness, however, are mixed.

Safieddine and Wilhelm (1996) find the underpricing is reduced after the implementation of the rule, whereas the evidence provided by Kim and Shin (2004) does not support it.

Finally, Corwin (2003) and Mola and Loughran (2004) investigate the microstructure effect on the SEO underpricing and both find strong evidence. Mola and Loughran (2004) demonstrate that offer prices cluster at integer numbers, and the price rounding is a significant determinant of SEO discounts. Corwin (2003) also finds that the offer price is often set at the bid quote for Nasdaq issues and the trade price for NYSE issues.

1.2.3 The Timing Theories

As mentioned in section 1.2.1, firms that conduct public equity offerings typically receive extraordinary returns to their stocks prior to offerings and experience declines afterwards. Given the interesting stock behaviors around equity offerings, researchers propose the influential timing theories. Moreover, timing theories also provide an explanation about the timing of seasoned equity offerings. In particular, firms may choose a certain time to issue equity so as to take advantage of the firm-specific component and/or the market component of stock returns.

1.2.3.1 Timing Firm-specific Returns

Firm-specific timing theories follow two different lines of arguments. The rational explanations assume that information asymmetry exists between investors and managers. Managers only choose public equity offerings when they think their stock is overvalued. As a result, investors perceive the news of equity offerings as bad signals from managers.

Myers and Majluf (1984) argue that firms time equity offerings to minimize the adverse selection cost resulting from investors' negative reaction. Korajczyk, Lucas, and McDonald (1992) build a dynamic model which predicts that equity offerings will cluster after more information becomes available publicly. They take earnings reports as an example of information release events in the empirical part of their study and find support for their theory. Bayless and Chaplinsky (1996) use three-day abnormal returns around the announcement day to proxy for information asymmetry and provide direct evidence that issuers time equity offerings to minimize adverse selection costs.

The other line of arguments assume irrational investor sentiment. They date back to Ritter (1991) and Loughran and Ritter (1995), in which they attribute the underperformance of IPO and SEO stocks to high investor sentiment at the time of equity issuances. Daniel, Hirshleifer, and Subrahmanyam (1998) develop the overconfidence hypothesis that formally relates the negative announcement effect and underperformance to a special cognitive bias: overconfidence. Specifically, they argue that investors tend to overweight private information and underweight public information, which leads to underreaction to new public information. Therefore, negative announcement day returns should be associated with long-run underperformance because investors underreact to the negative news of public equity offerings. The overconfidence hypothesis is supported by the empirical evidence found in Teoh, Welch, and Wong (1998). They report that larger pre-issue reported discretionary accruals are associated with greater long-run post-issue underperformance, suggesting that firms try to tap the equity market when investors are overly optimistic about their stocks.

Without relying on assumptions of irrationality, Carlson, Fisher, and Giammarino (2006) develop a real-options theory to explain the seemingly puzzling pattern surrounding SEOs. Their model endogenizes the required return. They demonstrate that post-issue low returns result from the exercise of a real options embedded in a potential project when the firm issue equity to fund the project. When the firm converts the real option into assets-in-place, the risk is lowered, so is the required return.

1.2.3.2 Timing Market Returns

At the aggregate level, there has been plenty of evidence that equity offerings cluster under favorable market conditions. Choe, Masulis, and Nanda (1993) examine the change of equity offering volume over business cycles and report that equity offering volume increases when the economy expands. In the IPO literature, Pagano, Panetta, and Zingales (1998) note that companies time their IPOs to take advantage of industry-wide overvaluations. Lowry and Schwert (2002) also document a strong positive correlation between initial returns and future IPO volumes, which they interpret as private companies believing they can raise more money when initial returns are high.

The term "timing the market" is first brought up by Baker and Wurgler (2000). They show that the ratio of aggregate equity issues to total new issues can predict future stock returns. Specifically, higher ratio indicates lower future return. Assuming that equity issuance is largely determined by corporate management, they interpret this negative relationship as managerial ability to time the market component of stock returns. Since then, some researchers have raised doubts about Baker and Wurgler's interpretation.

The first group of opponents question the validity of Baker and Wurgler's results on an econometric basis. Borrowing the term "pseudo market timing" from Schultz (2003), Butler, Grullon, and Weston (2005b) argue that the negative relationship between the equity share and future returns may be spurious. It is possible that equity share is only positively related to contemporary stock price level and not to future stock price level, but we see *ex post* that the equity share is negatively related to future price because stock prices exhibit contrarian patterns. In particular, they demonstrate that after excluding two major periods of unexpected market shocks, the Great Depression and the early 1970's Oil Crisis, the predictive ability of the equity share goes away. The pseudo market timing is essentially a special case of small sample bias problem. Baker, Taliaferro, and Wurgler (2004) correct this problem with simulation and find that pseudo timing can only explain a small proportion of the predictive ability of the equity share. However, as Eckbo, Masulis, and Norli (2006) point out, without properly accounting for the non-stationarity, we are still not sure how important pseudo market timing is in explaining the predictive power of equity share.

The second group of opponents argue that the fact that firms issue at market peaks does not necessarily imply the market is inefficient or investors are irrational. Instead, their approach relies on the assumption of rationality. For instance, Pastor and Veronesi (2005) show that IPO firms can optimally time market conditions, namely, expected market return, expected aggregate profitability, and prior uncertainty about the post-IPO average profitability. Their model generates the prediction that IPOs cluster at market peaks.

Finally, Baker, Ruback, and Wurgler (2005) provide an alternative explanation that even though managers may only be able to predict idiosyncratic returns, it may appear that they can also time the market because mispricings of individual stocks are highly correlated as a result of market-wide investor sentiment.

1.2.4 Seasoned Equity Offerings after the IPO

Researchers that investigate the SEO decision have focused on the choice between equity and debt. However, very few papers look at the SEO decision in terms of issuing or not issuing with the exception of Jegadeesh, Weinstein, and Welch (1993) and Harjoto and Garen (2003). Jegadeesh, Weinstein, and Welch (1993) investigate the relation between returns around IPOs and firms' subsequent decisions to raise additional capital through SEOs. They find that firms with larger underpricing are more likely to come back to the market again within three years following the IPO, consistent with their signaling hypothesis that good firms send signals to investors through larger underpricing. However, this effect is rather weak. In contrast, a high post-IPO abnormal return strongly increases the likelihood of subsequent offerings, consistent with their market-feedback hypothesis that issuers raise the money to expand because investors react positively to their IPO. Harjoto and Garen (2003) develop an agency model in which they suggest that IPO firms having experienced unexpected growth after public are more likely to come back to the equity market again shortly after their IPOs. Moreover, the unexpected growth shock is also positively related to the relative offer size. Finally, they document that the probability of issuing and the relative offer size decrease as the firm's risk increases.

1.3 Hypothesis Development

1.3.1 Possible Explanations for the Time between Two Consecutive Offerings

In this section, I develop hypotheses to explain the timing of SEOs. There exists a considerable body of literature on firms' decisions to issue new equity. I group them into two main categories and make analogous arguments to develop my growth hypotheses and timing hypotheses.

The growth hypotheses are related to firms' investment opportunities. Firms that expect great investment opportunities usually require external financing. The equity market is one place to raise funds if these firms can attract equity investors. Existing literature provides ample evidence that firms with good investment opportunities tend to have lower debt ratios and raise capital from the equity market rather than the debt market. At the aggregate level, Choe, Masulis, and Nanda (1993) find that the volume of equity offerings is higher in economic expansions than in recessions. At the industry level, Smith and Watts (1992) show that low-leverage firms have better investment opportunities than high-leverage firms. Gaver and Gaver (1993) confirm Smith and Watts' findings at the individual firm level. Further, Jung, Kim, and Stulz (1996) demonstrate that firms are more likely to choose to issue equity over debt when they can signal to investors that they have bright future prospects. By the same token, firms with superior investment opportunities tend to visit the equity market at a faster speed. When the economy booms, it is easier for firms to find investment opportunities. Apart from that, firms may also develop their own good projects and experience idiosyncratic growth shocks. Under these circumstances, firms are more likely to return to the equity market more frequently. If we assume that previous offerings are conducted when firms have good investment opportunities, firms are more likely to reissue when the good state persists. Thus, the growth hypotheses are stated as follows:

H1a: Firms are more likely to conduct subsequent offerings within a shorter period of time when economic conditions are favorable.

H1b: Firms are more likely to conduct subsequent offerings within a shorter period of time when they possess good investment opportunities.

The second set of arguments is labeled as the timing hypotheses. They also consist of two parts: timing the market and timing the firm-specific return. Researchers have been debating on whether managers have the ability to time the market component of the return. Most evidence comes from aggregate data analysis. For instance, Baker and Wurgler (2000) first document that high aggregate equity share is strongly related to low future stock returns. Lowry (2003) shows that aggregate IPO volume increases when investor sentiment is high and the market is overvalued. The timing the market hypothesis implies that firms would be more likely to reissue soon when they observe high stock market returns and expect a decline in the market. If the incentive to time the market is strong for IPO firms, seasoned firms are probably more likely to time their idiosyncratic stock return when they issue equity. Firm-specific timing can stem from information asymmetry or investor sentiment.[5] Whatever causes the differential in valuation, if managers think their stock price is overvalued, they would be more likely to issue equity to take this "window of opportunity". Graham and Harvey (2001) document that CFOs admit to trying to time their stock price, and that two-thirds who have

[5] There have been some attempts to distinguish between the two hypotheses. For instance, Howe and Zhang (2005) apply Lowry's (2003) approach and find information asymmetry is better supported in the SEO context. This paper does not aim to distinguish between these two arguments. I take the misvaluation as given.

considered issuing common stock report that “the amount by which our stock is undervalued or overvalued” was an important consideration. Firms may accelerate issuing if investors show enthusiasm to their stock and postpone issuing if investors are lethargic. On the other hand, the fear that the stock price is going to slump may also speed up the equity offering. To summarize, the timing hypotheses consist of timing both the overall market and firm-specific trends:

H2a: Firms are more likely to conduct subsequent offerings within a shorter period of time when market returns have been high, and less likely to do so when they expect market returns continue to rise.

H2b: Firms are more likely to conduct subsequent offerings within a shorter period of time when the idiosyncratic part of their stock return has been high, and less likely to do so when they expect their stock prices to run up more.

1.3.2 Market Reactions to Fast Offerings vs. Slow offerings

Market reactions to a seasoned offering are reflected in the announcement-day return, the underpricing or discount,[6] and possibly the issue-day return. Numerous studies have documented an average of -2% return to SEO announcements. Myers and Majluf (1984) interpret it as investors considering the SEO announcement as a bad signal that managers think the company’s stock is overvalued. If a firm can demonstrate that it is raising money for good reasons, it will help alleviate investors’ concerns. Jung, Kim, and Stulz (1996) find that SEO firms with a high Tobin’s Q have the announcement effect

[6] Corwin (2003), among others, shows that the underpricing measured as the percentage change of the closing price on the offer day relative to the offer price is similar to the discount measured as the percentage change of the offer price to the closing price on the day before the offer day. I consider underpricing here. Similar conclusions can be drawn to the discount.

insignificantly different from zero. Korajczyk, Lucas, and McDonald (1991) show that the announcement effect is less negative if the firm can reveal good information at the earnings announcement right before an SEO announcement. When a firm initiates another equity offering shortly after the previous one, it can signal to the market that the firm has discovered or created extremely good projects and is expecting to grow fast; conversely, it can signal to the market that managers think their stock is overvalued and they are attempting to time the market. In the former case, we would expect that investors react less unfavorably to fast offerings; while in the latter case, investors are likely to react more negatively to fast offerings.

A fast offering is conducted within a short period of time following the previous one. Hence, the two offerings are clustered. Do investors treat clustered offerings similarly? If a firm plans to issue additional shares within a short period of time, it may consider lowering the offer price in the second offering if the demand curve is downward sloping. As a result, the second offering will have a larger discount/underpricing. This is labeled as the "pricing pressure" hypothesis following Corwin (2003). In contrast, if the discount/underpricing stems from the uncertainty of stock valuation, we would expect the discount to be the same or smaller in the second round when the subsequent offering comes shortly after the first one. As in Altinkilic and Hansen (2003), I call this the "uncertainty" hypothesis.

1.4 Methodology

The central part of this paper is to examine the timing of seasoned equity offerings and investigate the impact of certain determinants on the length of time between two equity offerings. Duration analysis, which originated from survival analysis or analysis of failure time data, is a natural method to apply. Similar to a logit model that is widely used to study the probability of the occurrence of some event, a duration model studies the hazard, or instantaneous probability of the event. Moreover, with proper modifications, duration models have the advantage of accommodating for such features as time-dependent covariates, repeated events, unknown heterogeneity and censoring. Thus by modeling the time between two offerings properly, the duration model helps us understand the motivation behind equity issuance decision better.

The principal component of a duration model is the hazard function. It allows us to approximate the probability of exiting the initial state within an interval, conditional on having survived up to the starting time of the interval. In the context of SEO timing decisions, duration is the time elapsed until the next SEO occurs. The hazard function is defined as

$$h(t) = \lim_{m \to 0} \frac{\Pr\left(t \leq T < t + m \mid T \geq t\right)}{m},$$

where T measures the duration between two equity offerings. h(t) is the instantaneous rate of reissuing per unit time. h(t)*m is the probability that a firm will conduct an SEO in the next m units of time, conditional on not having done so up to time t.

Based on different assumptions, duration models have various specifications. The most commonly used is the Cox regression model. It is a semiparametric model and does not rely on the strict assumption of the distribution of the hazard h(t). The basic model has the form

$$h(t)=h_0(t)e^{\beta' X},$$

where $h_0(t)$ is the baseline hazard function left to be estimated, X is a vector of covariates, and β is the corresponding vector of unknown parameters. In the context of SEO timing decisions, X would include all the determinants of the hazard of the next SEO, which I outline in the section of hypothesis development. These determinants change over time, therefore they are considered as time-dependent covariates, denoted hereon as X(t).

Maximum partial likelihood estimation is employed to estimate β and the baseline hazard function. Let d_i denote the multiplicity of SEOs at t_i; that is, d_i is the size of the set D_i of firms that issue equity at t_i, $i = 1,2, ... ,k$. Let $R(t_i)$ denote the set of firms that have not issued until t_i.

The corresponding partial likelihood function is

$$L(\beta) = \prod_{i=1}^{k} \frac{e^{\beta' \sum_{l \in D_i} X_l(t_i)}}{\left[\sum_{j \in R(t_i)} e^{\beta' X_j(t_i)} \right]^{d_i}} .$$

Please refer to Appendix B for the derivation of the likelihood function.

1.5 Data and Variable Definitions

1.5.1 Data and Sampling Procedure

I obtain both initial public offerings and seasoned offerings from the Global New Issues database in Securities Data Company (SDC) from January 1, 1975 through December 31, 2004, excluding units, shelf, rights, and pure secondary offerings, offerings whose primary exchanges are not one of the three major exchanges (NYSE, AMEX, and Nasdaq), and offerings by financial companies (SIC code 6000-6999) and utilities (SIC code 4900-4949).[7] In order to collect additional data from the Center for Research in Security Prices (CRSP) and the Compustat database, I require the PERMNO, SIC code and Exchange code be available for each offering. Further, I convert those seasoned offerings whose offer date equals the first trading date in CRSP to IPOs, and correct offer dates whenever applicable.[8] The SDC IPO sample is supplemented by Jay Ritter's 1975-1984 IPO database. Finally, I match the IPO sample with the SEO sample using PERMNO. The final sample contains 6,198 IPOs (702 on NYSE, 5,152 on Nasdaq, and 244 on AMEX), and 2,856 SEOs (394 on NYSE, 2,328 on Nasdaq, and 134 on AMEX).

Table 1.1 reports the frequency of SEOs by firm and by industry. In the sample of 6,198 firms that go public between 1975 and 2004, 1,430 firms reissue equity only once, 449 firms reissue twice, 158 firms reissue at least three times, and the rest never issue. The largest number of offerings by a single firm is six over the entire sample period. The 10-industry classification is obtained from Kenneth French's website. Results show that both the IPO sample and the SEO sample consists of firms from a variety of industries, with a large concentration in manufacture and retail businesses.

[7] Prior studies have found that utility companies go to the public equity market more often than industrials (e.g. Smith, 1986; Asquith and Mullins, 1986). Utilities are highly regulated, and therefore differ from industrials in many aspects. For example, they have to get permission from regulatory authorities to issue new securities. This regulation reduces the information asymmetry between insiders and outsiders, limits managerial discretion, and makes it more difficult for utility firms to time the market.

[8] Seasoned offers sometimes take place after the stock markets have closed for that day, so the event day should actually be the day following the stated offer day in those cases. Following the recent practice by Safieddine and Wilhelm (1996), Corwin (2003), and others, I apply a volume-based method to correct for the offer date. If the trading volume on the day after the SDC offer date is more than twice the trading volume on the SDC offer date and more than twice the average daily volume over the previous 250 trading days, I use the day after the SDC offer date as the effective offer date. The correction results in a change for 39.4% of the sample.

1.5.2 Variable Definitions and Descriptive Statistics

1.5.2.1 The Duration Measure

In this section, I describe the duration measure, namely, the length of time between two consecutive offerings. It measures how fast a firm returns to the equity market. Table 1.2 provides the summary statistics of the duration measure. As seen in Panel A, the time between two consecutive offerings averages 2.7 years with a standard deviation of 2.8. I further separate first SEOs from other follow-on SEOs. The time from IPOs to first SEOs exhibits different distributions from the time between the subsequent SEOs. The mean and median of the former are smaller; but the standard deviation is larger. These results are verified in the untruncated sample that contains only issuers that cease to exist in the database by December 31, 2004. Panel B lists the frequency of the duration by the number of offerings. For the entire sample, 32% of the offerings come out within one year following the previous offering, 39% of the offerings are conducted between one year and three years from the previous offerings, indicating that firms tend to issue fast if they ever decide to issue again. First SEOs are more likely to be issued within one year after the IPO, whereas the follow-on SEOs are more likely to fall into the (1,3] interval. This can be seen more clearly in the histograms of the duration drawn in Figure 1.1. Again, the histogram of the time between IPOs and first SEOs looks a little different from that of the time between subsequent SEOs, but both are highly right-skewed. Howe and Zhang (2004) find that lagged IPO volume is positively associated with SEO volume, suggesting that hot IPO markets precede hot SEO markets. This may be partly due to newly public firms returning to the equity market shortly after the IPO.

Venture-capital-backed IPO firms are more likely to conduct SEOs sooner than non-venture-backed IPO firms, which is probably due to venture capitalists wanting to sell their shares in a secondary offering. The SEO sample contains combined (primary and secondary) offerings in which venture capitalists may also be the sellers. Therefore, it is worthwhile to see whether VC-backed IPOs conduct their first SEOs sooner than non-VC-backed IPOs. Summary statistics in panel A of Table 1.2 show that on average it takes a longer time for non-VC-backed IPO firms to reissue equities again (2.8 for non-VC-backed and 2.2 for VC-backed), and the difference is significant (t-stat=5.19). As seen in Part (c) and (d) of Figure 1.1, about 30% of non-VC-backed firms conduct their SEOs within one year following the IPO, whereas over 40% of VC-backed firms reissue within one year. Both results support the view that VC-backed firms are faster issuers than non VC-backed firms.

Figure 1.2 plots the yearly distribution of the duration. The *First SEO* sample consists of 2,037 first SEOs following IPOs, the *Follow-on SEO* sample consists of 819 other subsequent SEOs. For each sample, the mean and median duration across all the offerings occurring in each year are calculated and graphed respectively. At the first glance, the duration appears to trend upward. However, this seemingly upward trend is a mechanical result from the nature of the experiment. Early in the sample period, the firms we include in the sample tend to have smaller duration because there is only so much time they could wait if they decided to issue again. As we move along the time line, we allow longer and longer time for their waiting period. Nevertheless, the duration fluctuates greatly over time and the fluctuations coincide with the waves of equity issuance. In particular, during the hot issue time in the early 80s and the bubble period of the late 90s, the duration was relatively small. In contrast, the early 90s and the post-bubble period saw tremendous increases in the duration. This provides some preliminary evidence for the market timing hypothesis. Moreover, *first SEOs* tend to have shorter durations during hot periods and longer durations during cold periods than *follow-on SEOs*, implying that newly public firms are more likely to follow the market trend. Such phenomenon is especially evident around the time of the internet bubble when *first SEOs* have an extremely shorter duration and *follow-on SEOs* lengthen the duration substantially at the end of the bubble period.

As a way of controlling for the mechanical upward trend, I choose only the *First SEO* sample and plot the percentage of firms issuing within five years following the IPO along with the IPO volume in part (a) of Figure 1.3. The percentage of firms issuing within five years following the IPO does not seem to be correlated with the IPO volume (Pearson Correlation Coefficient = -0.07 with P-value of 0.72). The lack of correlation may be partly due to bad post-IPO performance of those firms that go public during hot issue periods. In part (b), the mean and median duration of those reissuing firms are negatively correlated with the IPO volume (Pearson Correlation Coefficient = -0.30 for both), and the correlations are marginally significant (P-value = 0.13 and 0.15 respectively). This indicates that firms going public during hot periods tend to be faster issuers.

1.5.2.2 Explanatory Variables

In this section, I introduce the explanatory variables to be used in the duration analysis. These proxy variables are derived from the hypotheses as discussed in Section 1.3.

The growth hypothesis contains the economy-wide component and the firm-specific component. The former is proxied by the growth rate of leading economic indicators. I obtain the indices of leading economic indicators from www.globalindicators.org. The logarithmic growth rate is computed using the three-month moving average of the indices, following Choe, Masulis, and Nanda (1993).[9] When economic conditions are anticipated to be good, that is, when the growth rate of leading economic indicators is high, we expect firms to have more investment opportunities. Hence, firms are more likely to return to the equity market. The firm-specific part of the growth story predicts that fast-growing firms tend to reissue equities quickly. Firm-specific growth is measured by sales growth and capital expenditure growth. Both past and future sales growth and capital expenditure growth are included. For a specific period (month or quarter), past growth measures are from the last fiscal period end before that, and future growth measures are from the first fiscal period end after that. Firms with high sales growth and capital expenditure growth are expected to have shorter durations between two offerings.

The timing hypothesis also consists of market-wide and firm-level components. The market-wide components include future and past aggregate stock market returns. Aggregate stock market returns are calculated using CRSP value-weighted monthly

[9] To make the aggregate growth variable comparable to firm-specific growth variables, I annualize it by multiplying it by 12 in the annual-monthly analysis.

returns.[10] I also include an individual firm's abnormal stock returns as the firm-level counterparts to aggregate stock returns. The abnormal return is firm's raw return subtracted by the same beta-decile return in CRSP.[11] For a specific period (month or quarter), future market (firm) return measures the cumulative market (abnormal) return 12 months after that period, and past market (firm) return is the cumulative market (abnormal) return 12 months before that period.

1.5.2.3 Control Variables

Apart from the main explanatory variables, several firm and deal characteristics are added into the analysis as control variables. Firm characteristics include firm size, cash ratio, debt ratio, and industry dummies. First, market value of equity is employed to control for firm size. However, whether large or small firms tend to issue fast is an empirical question. Second, I consider the effect of limited financial slack and debt capacity on a quick reissuance. The pecking order theory of Myers and Majluf (1984) predicts that firms only resort to public equity when they exhaust their internal funds and when debt financing is too costly because their financial risk is too high and creditors are unwilling to lend. Alternatively, as the traditional view of optimal capital structure suggests, the debt-equity ratio should not deviate from the optimal level too much, nor for too long.[12] Therefore, firms with relatively high debt ratios are more likely to issue new

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[10] I also use CRSP equal-weighted return for a robustness check.
[11] In the main analysis, I use beta-adjusted firm return. I also report the results of the duration analysis using size-adjusted firm return in the sensitivity analysis.
[12] Researchers have been debating on whether there exists an optimal capital structure for a firm as the traditional trade-off theory claims and whether firms make active efforts to adjust their leverage ratio toward a target level. The empirical evidence is mixed. Earlier work by Marsh (1982) show that corporate financing choices are consistent with having a target level of debt in mind. Recently, Hovakimian, Opler, and Titman (2001), and Leary and Roberts (2005) provide additional evidence that supports this view. On the other hand, Fama and French (2002) document that firms are slow in adjusting their leverage towards

equity because they may want to regain the optimal capital structure. Financial slack is proxied by firm's cash to assets ratio subtracted by its industry median. Debt capacity is measured by firm's debt ratio subtracted by its industry median.[13] Hence, firms with lower than optimal cash ratios or higher than optimal debt ratios would tend to accelerate equity issuance. The last group of firm characteristics control variables are industry dummies employed to capture any industry-specific variation.

Deal characteristics consist of offer size, floatation costs, underpricing in the previous offer, entry time, and whether or not the previous offer is venture backed. Firms that have already issued a large number of shares in prior offerings may wait longer to issue again because they simply do not need to raise more funds. I use the log of total proceeds in the previous offering to control for offer size. The probability of fast issuing will also decrease as floatation costs increase. I use the underwriter spread, measured as percent of proceeds in the previous offering, to proxy for the floatation costs.[14] Moreover, if the previous offering is backed by venture capitalists, they might prefer to sell their shares in an SEO, and speed up the equity issuance. Therefore, I include a dummy variable indicating prior VC-backed offering. Following Jegadeesh, Weinstein, and Welch's (1993) argument, I also include the underpricing of the previous offer. Larger underpricing implies the market reacts favorably to the previous offering, therefore it may increase the probability that firms will quickly reissue again. Finally, because the sample ends in December 31, 2004, the last offerings for all the firms that still exist in the

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its long run mean, while Baker and Wurgler (2002), and Welch (2004) simultaneously show that shocks to stock returns have a long lasting effect on capital structures.

[13] I choose industry medians, as opposed to industry means, because of the well-known skewness in these accounting variables. Industry classification follows Fama and French's 48-industry categories from Kenneth French's website.

[14] The underwriter spread varies considerably across deals. Butler, Grullon, and Weston (2005a) report that they can be as small as 1% for some issues and up to 10% for others.

CRSP/Compustat database on that day, the currently existing firms, are automatically censored. I include entry time, or the time of the previous offering, to mitigate the problem.

1.5.2.4 Summary Statistics

Table 1.3 contains the summary statistics of firm and deal characteristics. The entire sample of 2,856 seasoned offerings is split into 2,038 first SEOs in Panel A and 819 follow-on SEOs in Panel B. Both firm characteristics and deal characteristics are reported. Firm characteristics consist of market value, post-issue and pre-issue sales growth, post-issue and pre-issue capital expenditure growth, cash to assets ratio, and debt to assets ratio. Sales growth is measured as the percentage change in sales and capital expenditure growth is the percentage change in capital expenditures. Post-issue growth measures are from the first fiscal year after the offer day. Other accounting variables are from the last fiscal year before the offer day. I obtain these data from Compustat. Computation of these variables is described in detail in Appendix A. To avoid potential data errors and minimize the influence of extreme values, I winsorize the variables at 1% level except for market value. Deal characteristics consist of offer size, percentage of primary shares, underwriter spread, underpricing, pre-issue and post-issue return, issue-day return and filing-day return.[15] In addition to summary statistics of the sample, Table

[15] The majority of offerings are announced on the day firms file with SEC. Therefore, I use the filing-day return to approximate the announcement day return. As shown in table 3, the 3-day abnormal return around the filing day averages -2.2% in the sample, which is very close to the announcement-day abnormal return documented in prior literature (see Eckbo and Masulis, 1995). Filing dates are obtained from SDC, and if not available (mostly before 1983), they are supplemented by data generously provided by Susan Chaplinsky.

1.3 also reports summary statistics of firm characteristics for the median group based on Fama and French's 48-industry classification.

As seen in Panel A, first-SEO firms are about three times larger than their industry peers on average. These numbers should be taken with caution, since they may be largely driven by some extreme outliers. Indeed, the median of first-SEO firms is less than twice as large as the industry median. Growth variables are also highly-skewed for issue firms. Thus, the medians seem to be more appropriate for comparison purpose. Notably, first-SEO firms are expected to have substantially higher growth in sales (46% vs. 12%), and in capital expenditures (75% vs. 11%) for the year after the offer. They have also experienced larger than industry-median growth before the offer (27% vs. 11% in sales, and 34% vs. 7% in capital expenditure). The cash ratio is higher for first SEO issuers than other firms in the same industry (mean of 25% vs. 14%, median of 14% vs. 10%), which seems to violate the pecking order theory. However, it may be true that though issuing firms hold relatively larger cash reserves, they still need external financing because they are growing fast. First SEOs have slightly higher mean debt ratio (21% vs. 18%), but the median is lower (14% vs. 20%). If we take industry median debt ratio as the target capital structure, it is not clear whether issue firms significantly deviate from their targets and need rebalancing.

The 819 follow-on SEO issuers in Panel B exhibit similar firm characteristics as the first SEO issuers, although follow-on SEO issuers are almost double the size of first-SEO issuers. In terms of deal characteristics, follow-on SEOs tend to offer greater amount in dollar value, have larger portion of primary shares, slightly lower underwriter spread clustering at 5%. In terms of pricing, both first SEOs and follow-on SEOs are discounted at about 3% on average. For both first SEOs and follow-on SEOs, the pre-issue risk-adjusted return is about 50%, and the post-issue risk-adjusted return is about -10%, indicating both experience significant price run-up in the year prior to the offer but underperform in the year after the offer. While the announcement effect for both first SEOs and follow-on SEOs is at the same magnitude, first SEOs show larger negative return on the issue day.

1.6 Empirical Results

1.6.1 Univariate Tests

Table 1.4 gives the results of t-tests and Wilcoxon tests on whether fast offerings differ from slow offerings in terms of several important firm and deal characteristics. There are 2,037 SEOs in the first-SEO sample and 819 SEOs in the follow-on SEO sample. I divide each sample into terciles. In order to distinguish fast issuers from slow issuers, I discard the middle group. Those offerings whose durations fall into the smallest group are taken as fast offerings, and those offerings with the largest durations are grouped into slow offerings.

Firm characteristics consist of market value, post-issue and pre-issue sales growth, post-issue and pre-issue capital expenditure growth, cash ratios net of industry median, and debt ratios net of industry median. Panel A shows that for first SEOs, fast issuers tend to be larger than slow issuer in market value. Panel B verifies this result for follow-on SEOs, though the evidence is weaker.[16] Tests on growth variables generate significant results, suggesting that fast issuers experience much greater growth in both pre- and post-

[16] Wilcoxon test shows that fast follow-on issuers are larger than slow follow-on issuers at 10% significance level. t-test does not show that fast issuers differ significantly from slow issuers in size, but this may be due to extreme outliers in the sample.

issue periods. For example, the median post-issue sales growth for first fast issuers is 70% compared to 32% for first slow issuers; that for follow-on fast issuers is 66% vs. 30% for follow-on slow issuers. The exception is the Wilcoxon test on pre-issue capital expenditure growth which is not significant at 10% level. These results suggest that fast offerings are conducted by firms with better investment projects and high growth momentum. However, fast issuers hold larger industry-adjusted cash ratio (18% vs. 6% for first issuers, 14% vs. 5% for follow-on issuers) and lower industry-adjusted debt ratio (1% vs. 12% for first issuers, 2% vs. 8% for follow-on issuers) than slow issuers on average, implying that firms that reissue at a faster speed may not necessarily suffer financial constraints, everything else equal. In general, first SEOs and follow-on SEOs show similar results in the comparison of firm characteristics between fast issuers and slow issuers.

In terms of deal characteristics, there are a number of differences for first SEOs and follow-on SEOs when we compare fast issuers with slow issuers. First, first fast offerings are larger deals than first slow offerings, but follow-on fast offerings do not seem to differ from follow-on slow offerings in dollar value. Second, first fast offerings are not discounted significantly less than first slow offerings, whereas follow-on fast offerings have a mean of 2.3% underpricing, significantly smaller than the mean underpricing of 3.3% for follow-on slow offerings. Finally, pre-issue firm return is significantly higher for first fast issuers than for first slow issuers. The results on follow-on issuers are opposite and much weaker. More interestingly, in both cases, fast issuers have significantly negative mean and median abnormal returns following the issue, whereas slow issuers do not seem to experience afterward underperformance, which suggests faster issuers are more likely to issue because of timing incentive. Moreover, in both case, fast offerings consist of a lower proportion of primary shares and incur lower floatation costs than slow offering. McDaniel, Madura, and Akhigbe (1994) find that frequent issuers (those issue at least four times within ten years) tend to receive a less negative return on the announcement day because of less information asymmetry between issuers and investors. My result, however, does not suggest that investors react differently to fast issuers from slow issuers. In particular, the mean and the median of the issue-day return and the filing-day return of fast offerings are similar to those of slow offerings for both first and follow-on SEOs, although follow-on SEOs seem to have positive issue-day return on average while first-SEOs receive negative return.

1.6.2 The Purpose of SEOs for Fastest Issuers

As shown in Section 1.5.2.4, about a third of SEOs (925 out of 2856) are conducted within one year after the previous offering, regardless of whether the previous offering is an IPO or a seasoned issue. This result is surprising, given that equity issuance is usually the most expensive form of corporate financing choice. In order to further investigate this issue, I examine the news announcements of these fastest SEOs to see whether these issuers explicitly identify the purposes for raising public equity within such a short period of time. The news announcements are pulled out from LexisNexis Academic Database. Out of 925 fast SEOs, I find 654 news announcements with 513 for first SEOs and 141 for follow-on SEOs.

Table 1.5 tabulates the firm-reported purposes of fastest SEOs. Specifically, I group the news into 10 categories in the descending order of frequencies: general purposes, expansion or capital expenditure, working capital, debt repayment, possible (future) acquisitions,[17] research and development, mergers or acquisitions, financial flexibility, buyback, and others. One firm may claim several purposes at the same time. For example, in the SEO announcement issued on November 25, 2003, Open Solutions Inc. stated that it aimed to use the capital for possible acquisition, working capital, and general corporate purposes. Many firms (60%) choose general terms such as “general purposes”. A large proportion of firms also name expansion or capital expenditure (54%) and working capital (47%) as important purposes of their SEOs. Compared to follow-on SEOs, first-SEOs are more likely to be issued for general purposes, working capital, and M&A, but less likely for repaying debt. This is also consistent with previous evidence about debt ratio: follow-on SEOs have considerably higher debt ratios than industry median and therefore have more urgent rebalancing need. Finally, a small number of firms also mention that they want to increase their financial flexibility, or use the raised capital for other purposes such as buying back shares.

1.6.3 Duration Analysis

In this section, I apply duration analysis to investigate the determinants of the time between two consecutive offerings. First, to ensure a correct hazard model specification, I examine the survival function and the hazard function. The survival function is equal to one minus the cumulative probability of the duration. The hazard function characterizes the rate at which the event occurs after duration t, given that it has not occurred at least until t. The survival curve and the hazard curve are graphical

[17] In many cases, firms do not mention whether future acquisitions are acquiring firms or assets. It seems that the media uses this term without making any distinction, therefore we should interpret it with caution.

representations of the survival function and the hazard function. I choose Life-table method with one-year intervals to generate the survival curves and the hazard curves. The estimation functions are given in Appendix B. As seen in Figure 1.4, the survival curve and the hazard curve of the First SEO sample look different from the survival curve and the hazard curve of the Follow-on SEO sample. Further, results from all three tests reject the equivalence of the hazard functions for the two samples (Likelihood ratio test χ^2=10.5, Log-rank test χ^2= 16.7, and Wilcoxon test χ^2= 27.6). Hence, I conduct separate analyses for the two samples. Finally, the hazard curves are not monotonically increasing or decreasing. The irregular shape of the hazard curves makes me choose Cox's proportional hazard model that does not rely on any distributional assumption.

Table 1.6 gives detailed main results of the duration analysis. Model (1) contains all the control variables. Models (2) and (3) test the aggregate and the firm-specific growth hypotheses; models (4) and (5) investigate the impact of the aggregate and the firm-specific timing hypotheses respectively. Model (6) pulls all the variables together. *Hazard Impact*, which is transformed from the coefficient estimate as $(\exp(\beta)-1)\times 100\%$, is given in the table to facilitate the interpretation. Hazard impact represents the percentage change in the expected hazard rate for a one unit increase in the corresponding variable. For example, a positive 5% hazard impact indicates that a one unit increase in the corresponding variable increases the SEO hazard by 5%. For a dummy variable, hazard impact gives the percentage change in the hazard curve resulting from a change in state (from 0 to 1). Therefore, a negative 5% hazard impact implies the likelihood of an SEO, conditional on not having occurred up to that month, decreases by 5% if the dummy variable changes from 0 to 1.

1.6.3.1 Timing of First SEOs

Results on the timing decision of first SEOs are presented in Panel A of Table 1.6. For most of the variables, the statistical significance of the variables remains the same, but the hazard impacts are reduced slightly in model (6), the model that includes all the variables. Therefore I will focus on the results from model (6), and compare across models afterwards.

Model (6) shows that the first issuing hazard increases by a pronounced 6% when the economy is anticipated to grow by 1%. In addition to the predicted macro growth, firm-specific future growth in sales and in capital expenditure also has a significant impact on the SEO hazard. The economic effect, however, is rather small: a 1% increase in the estimated future growth results in a 0.05% increase in the hazard rate. Controlling for future growth, past sales growth does not seem to affect the issuing decision, and past capital expenditure growth has very weak impact, 0.01% at 10% significance level. These results indicate that firms make financing decisions based on future investment opportunities rather than on past growth. As for timing variables, the estimation provides strong evidence to support the firm-specific timing hypothesis whereas the evidence on market timing is inconclusive. Specifically, how the future market will do does not affect the first SEO hazard, although a 1% increase in *Past Market Return* increases the hazard by about 1.5%, indicating that firms choose to issue after market environment has been improving. In addition, a 1% increase in *Past Firm Return* also raises the hazard by 0.7%. The more compelling evidence on firm-specific timing comes from the significantly negative hazard impact ratio on *Future Firm Return*, which suggests that firms choose to issue equity at the time when they expect stock price is possibly going to drop over the next year. Taken together, the duration analysis shows that managers may know their firm better than investors and have the ability to time the offering. Although the probability of coming back to the equity market after IPO increases when market return is high, there is little evidence that managers choose to reissue because they are afraid the market is going to fall.

As a supplement to the main analysis, I discuss the estimation of control variables. The coefficients are all significant and consistent with predictions, except for *Market Value* for which we do not have a prediction. Results show that larger IPO firms in the sample tend to issue faster. A firm with a higher cash ratio relative to its industry peers is less likely to reissue equity more quickly because they can first rely on internal financing. Similarly, larger than optimal debt ratio accelerates the equity offering because these firms are more financially constrained. Moreover, deal characteristics also have large impacts on the timing decision of first SEOs. In particular, if a firm raised a large amount in the previous offering, it is less likely to revisit the equity market in the near future.[18] Further, involvement of venture capitalists in IPO deals accelerates the speed at which IPO firms come back to the equity market. In contrast, higher estimated floatation costs seem to deter firms from reissuing equity again. *Previous Underpricing* seems to adversely affect reissuing speed by 0.3%, which does not agree with the finding in Jegadeesh, Weinstein, and Welch (1993). Results here suggest that controlling for other factors, the more underpriced IPO firms are less likely to reissue soon after the IPO. Except for *Cash Ratio*, *Debt Ratio*, and *Previous Underpricing*, economic effects of the control variables are large.

[18] Surprisingly, using relative offer size to market value as an alternative measure produces the opposite sign.

Panel A also reports the duration analyses using only the set of variables for each single hypothesis. Schwarz Information Criteria (SIC) are presented to compare explanatory power across different models.[19] Model (5) that employs the firm-specific timing variables appear to be the most efficient model with SIC of 19,981. Moreover, results indicate that aggregate growth variable *Glead* in Model (2) does a better job than the set of firm-specific growth variables in explaining the timing decision of first SEOs (SIC equals to 20,263 and 20,266 respectively). Finally, Model (4) has a smaller SIC than model (3) (SIC equals to 20,258 and 20,266 respectively), implying that aggregate timing variables have a larger explanatory power than firm-specific growth variables.

1.6.3.2 Timing of Follow-on SEOs

Panel B of Table 1.6 contains the duration analysis on the time between consecutive follow-on SEOs.[20] When we compare model (6) in Panel B with model (6) in Panel A, several different results emerge. First, macroeconomic growth seems to have a larger impact on the timing decision of follow-on SEOs than on the timing decision of first SEOs: the hazard impact rises substantially from around 6% to nearly 9%. Further, the hazard impact of firm-specific growth also increases slightly, except for the insignificant *Past Sales Growth*. More interestingly, the market return following the offering seems to positively affect the issue hazard, which is inconsistent with the market

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[19] Schwarz (1978) Information Criterion is calculated as $-2\ln(L_n(k))/n+k*\ln(n)/n$, where $L_n(k)$is the value of the likelihood function taken at the maximum, n is the number of observations, and k is the number of parameters. The model with the smallest SIC is considered the best. Compared to other information criteria such as Akaike or Hannan-Quinn, SIC seems to work better based on both theoretical considerations and empirical simulation studies.

[20] In the estimation of the follow-on SEO sample, I pool all the offerings together and estimate them as a single model, assuming that multiple issues by the same firm are independent. However, firms that have short first durations may also tend to have short second durations. Such dependence may lead to biased estimations. Therefore, I add the previous duration as a covariate into the model. The coefficient estimates are insignificant in all cases, verifying the independence assumption.

timing hypothesis. As for control variables, two changes take place. First, whether a seasoned firm has a high debt ratio has insignificant effect on the reissue hazard. Moreover, higher floatation cost seems to encourage firms revisiting the equity market at a faster speed, which runs counter to our prediction.

There are a number of interesting results regarding the comparison of the single-hypothesis models. Once again, firm-specific timing variables are the most efficient set of explanatory variables with smallest SIC. However, unlike what we see in the case of first SEOs, the timing of follow-on SEOs seems to be better explained by firm-specific growth reasons than the overall trend of economic expansion or aggregate timing motive, as reflected by the smaller SIC of Model (3) than the SICs of Model (2) and Model (4). I will further discuss these interesting results after the sensitivity analyses.

1.6.3.3 Sensitivity Analyses

In order to check the robustness of the results, I also conduct some sensitivity analyses. One potential concern with any analysis that employs proxies is whether the proxies can capture the intended factors. Therefore, alternative measures of some proxies are employed in some of the sensitivity analyses below. Apart from that, I also conduct the analysis for certain subsamples to see whether the results vary.

I first rerun the analysis using size-adjusted firm returns. Table 1.7 shows that most of the results in Table 1.6 hold. However, Panel B shows that the coefficient on future firm return is no longer significant, suggesting that firms do not seem to take into account declining future return when they make the follow-on SEO decision. Therefore, for the follow-on SEO sample, the firm-specific timing hypothesis is only half supported using size-adjusted firm returns.

Next, I examine the timing decision of pure primary offerings only. The whole sample includes both primary offerings and combined offerings with some secondary shares. Because secondary shares are sold by third parties other than the firm and the proceeds are not collected by the company, the selling of these shares may be completely driven by shareholders' motive to time the market and firm-specific returns. Therefore I expect that growth hypotheses will be more strongly supported for pure primary offerings. Results presented in Table 1.8 support my conjecture. This can be seen from three aspects. First, the magnitude of the hazard impacts from growth variables increases considerably in the case of first-SEOs. The more compelling evidence is obtained when we compare the single-hypothesis models. Both the aggregate-growth model and the firm-growth model have smaller SIC than the aggregate-timing model in the case of first-SEOs, just the opposite as we see in the whole sample analysis. The last piece of evidence lies in Panel B, where we see the coefficient on future firm return is no longer significant. This weakens the evidence on firm-specific timing hypothesis for follow-on SEOs.

The third sensitivity analysis I run is to change the updating scheme from annual-monthly to quarterly. Under the quarterly specification, time-varying covariates in the duration model are all updated quarterly. To do this, I obtain the accounting variables from Compustat Quarterly Database. Return variables and the growth rate of leading economic indicators are updated quarterly as well. Results are shown in Table 1.9. Most of the results are verified with the quarterly data, with the exception that the past growth in sales rather than capital expenditure seems to have some influence on the timing decision of both first SEOs and second SEOs.

Additional to the reported results, I also rerun the analysis using CRSP equally-weighted market return, for the sample excluding the internet bubble period (1999-2000), and for the sample excluding penny issues with offer prices less than five dollar. The results remain qualitatively same as the main analysis shown in Table 1.6.

1.6.3.4 Discussion on the Difference in the Timing of First SEOs vs. Follow-on SEOs

The previous sections have shown that first SEOs seem to be driven more by aggregate timing and aggregate growth reasons except for pure primary offerings, while the timing of follow-on SEOs can be better explained by firm-specific growth demand. Moreover, the evidence on firm-specific timing for follow-on SEOs is weaker than that for first-SEOs. In this section, I attempt to explore the economic rationales behind these interesting findings.

Loughran, Ritter, and Rydqvist (1994) document that many firms choose to go public at market peaks. IPO Firms are usually young and unestablished firms. They are more likely to choose to go public when the overall economy is thriving and the equity market is hot, possibly because issuers face less risk under those circumstances. In a recent study, Chang, Dasgupta, and Hilary (2006) also find that highly information asymmetric firms, measured by less analyst coverage, depend more on favorable market conditions for their equity issuance decisions. The descriptive statistics in this study shows that most first SEOs are conducted within a short period following IPO. This suggests that when firms come back to the equity market the first time after IPO, they are still young firms. It is extremely hard for investors to value newly public firms without easy access to information. Moreover, there is a great deal of uncertainty with these young growth firms. Therefore, timing the aggregate market or following the trend becomes valuable. Timing firm-specific returns is also made easy because of the huge information asymmetry between investors and corporate insiders.

Unlike first SEO issuers, firms that issue follow-on SEOs tend to be established firms. They have been in the market for quite a while. By the time they undertake an equity offering, investors have come down their learning curves. The valuation is not as hard for newly public firms, and it is relatively easier for investors to discern high-quality firms with better investment opportunities. Therefore, these firms are more likely to issue because they have strong firm-specific demand for capital. Moreover, timing the firm-specific returns become more difficult for managers as a result of reduced information asymmetry. Howe and Zhang (2004) document that SEO cycles are not as evident as IPO cycles, which indicates that SEO decisions are less driven by aggregate factors relative to IPO decisions. The fact that most first SEOs are conducted within a short period following IPO suggests that first-SEO decisions may be more driven by aggregate timing factors compared to follow-on SEO decisions.

1.6.4 Market Reactions to First SEOs vs. Second SEOs

Table 1.10 compares the underpricing, issue-day return and filing-day return for first SEOs vs. second SEOs. The sample includes 1,214 first and second SEOs by 607 firms with more than one seasoned offering during the sample period. I first run the tests for the entire sample. Results are shown in Panel A. Both t-tests and Wilcoxon tests show that there is no difference in the underpricing between first SEOs and second SEOs. However, the three-day abnormal return around the issue day for first SEOs is lower. In particular, the mean and the median of the issue-day return are around -1% for first SEOs, while those for second SEOs are close to 0. By contrast, the three-day abnormal return around the filing day for first SEOs is less negative than follow-on SEOs. Results indicate that investors punish follow-on SEOs more on the announcement day, while giving favor to them on the offer day.

Next, I sort the sample into terciles on the duration between the first and second SEOs, and examine whether market reactions differ. The middle group is discarded. Fast offerings are offerings with shortest durations, and slow offerings are offerings with longest durations. If the two offerings are clustered, investor reactions to the first SEOs do not differ much from the second SEOs. On the contrary, when offerings are not clustered, both t test and Wilcoxon test show that second SEOs have higher underpricing, and hence larger discounts than first SEOs. While second SEOs still gain favor from investors around the issue day, the insignificant statistics suggest they are not punished more than first SEOs around the announcement day. In sum, the speed of SEOs does matter for investors. Investors appear to treat clustered offerings similarly, but differ in their reactions when firms wait too long to conduct follow-on SEOs. Results are more consistent with the uncertainty hypothesis rather than the pricing pressure interpretation.

1.7 Conclusions

This study explores the timing of corporate equity issuance and determinants of the timing decision. I first show that equity issuance is not a rare event for *all* firms. In fact, some firms visit the equity market more frequently than others. Moreover, if firms decide to issue in the equity market again, they tend to do so within a short period of time after the previous offering. When the equity issue market is hot, not only do we see the clustering across firms, but it is also more likely for one firm to reissue the equity soon.

Univariate tests indicate that fast issuers have been growing fast and are expecting better investment opportunities. Without the need to fund the promising projects, however, fast issuers do not seem to be financially constrained, as they have larger cash ratios and lower leverage. Interestingly, fast issuers experience significantly negative abnormal return in the year after the issue, while slow issuers do not seem to bear this adverse consequence. Prior to first seasoned offerings, fast issuers receive higher abnormal returns. On the contrary, before follow-on SEOs, slow issuers seem to be winners albeit with less significance. This seems to indicate that timing firm-specific return plays a more important role in the first-SEO decision. Last but not least, fast offerings have lower underwriter spreads and smaller proportion of primary shares.

With the aid of duration analyses, I further investigate factors that have potential impacts on the speed of equity issuance. Specifically, I examine two sets of hypotheses: the aggregate and firm-specific growth hypotheses and the timing the market and timing the firm-specific hypotheses. Results strongly support the growth hypotheses and provide some evidence on the timing as well. A firm is more likely to accelerate equity issuance when the overall economy is expanding or when the firm is expecting to grow rapidly by itself. In addition, the probability of going back to the equity market also increases when the stock market has been surging or the firm's own stock has received high abnormal returns. However, issuers do not seem to foresee the market falling when they issue or they do not care about it. First-time issuers following IPOs make decisions differently from follow-on issuers in several aspects. First, there is strong evidence on timing firm-specific part of the return for first-time issuers following IPOs, while the evidence is mixed for follow-on issuers. More interestingly, aggregate-timing hypothesis seems to explain the timing of first SEOs better than firm-growth hypothesis. On the other hand, follow-on SEOs are more driven by the need to fund firm-specific investment than market-timing motive, possibly because follow-on SEOs are more seasoned firms with less information asymmetry.

The last question addresses market reactions to fast offerings and slow offerings. On average, the announcement of fast offerings is greeted by a more negative return, implying that investors may have realized issuers' intention of initiating fast offerings to time the market. Moreover, when offerings are clustered, investors treat them similarly; whereas follow-on SEOs get larger discounts than first SEOs when offerings are not clustered. This finding agrees more with the notion that the SEO discount results from the uncertainty of stock valuation.

Table 1.1 Sample Statistics

This table presents the sample statistics. 6,198 firms go public between January 1975 and December 2004. IPO dates are obtained from SDC and Jay Ritter's 1975-1984 IPO database. 2,037 firms issue new shares after the IPO. Panel A reports the frequency of number of SEOs by a firm. Panel B shows the industry distribution. Panel C presents the year distribution. Financial firms (SIC=4900-4949) and Utility firms (SIC=6000-6999) are excluded from the sample.

Panel A: The Frequency of Number of SEOs by Firm

Number of SEOs	Number of Firms	Percentage
0	4161	67.13
1	1430	23.07
2	449	7.24
3	111	1.79
4	41	0.66
5	5	0.08
6	1	0.02
total	6198	100.00

Panel B: The Frequency of Number of SEOs and IPOs by Industry

Industry	**SEOs**		**IPOs**	
	Number of Offerings	Percentage	Number of Offerings	Percentage
Chemical	291	10.19	373	6.02
Durable	63	2.21	200	3.23
Manufacture	773	27.07	1670	26.94
Nondurable	92	3.22	276	4.45
Oil	94	3.29	197	3.18
Retail	984	34.45	2335	37.67
Telecom	119	4.17	295	4.76
Others	440	15.41	852	13.75
Total	2856	100.00	6198	100.00

Panel C: The Frequency of Number of SEOs and IPOs by Year

Year	SEOs		IPOs	
	Number of Offerings	Percentage	Number of Offerings	Percentage
1975			6	0.10
1976	1	0.04	22	0.35
1977	2	0.07	16	0.26
1978	2	0.07	18	0.29
1979	3	0.11	38	0.61
1980	23	0.81	78	1.26
1981	16	0.56	216	3.48
1982	36	1.26	75	1.21
1983	75	2.63	441	7.12
1984	21	0.74	187	3.02
1985	65	2.28	135	2.18
1986	91	3.19	270	4.36
1987	73	2.56	207	3.34
1988	32	1.12	81	1.31
1989	71	2.49	86	1.39
1990	47	1.65	103	1.66
1991	158	5.53	250	4.03
1992	118	4.13	342	5.52
1993	196	6.86	450	7.26
1994	150	5.25	364	5.87
1995	264	9.24	393	6.34
1996	319	11.17	604	9.75
1997	246	8.61	421	6.79
1998	150	5.25	244	3.94
1999	188	6.58	440	7.10
2000	199	6.97	349	5.63
2001	91	3.19	72	1.16
2002	70	2.45	66	1.06
2003	79	2.77	58	0.94
2004	70	2.45	166	2.68
Total	2856	100	6198	100.00

Table 1.2 Descriptive Statistics of *Duration* (in Years)

This table presents the summary statistics of the *Duration* which measures the length of time (years) between two offerings. The whole sample consists of 2,856 SEOs. Summary statistics of sub-samples are also reported in Panel A. The sample consists of 2,037 first SEOs and 819 follow-on SEOs. The duration between IPOs and first SEOs, and that between subsequent SEOs are examined separately. The first SEOs sample is further divided into two groups based on whether the IPO has venture capital involved. 1,052 IPOs are not VC-backed, and 948 are VC-backed. The untruncated sample contains 1,437 firms that were delisted before December 31, 2004. The duration between IPOs and follow-on SEOs is also examined. Panel B lists the frequency of the duration measure by number of offerings for the whole sample, IPO to first SEO, subsequent SEOs, the untruncated subsamples, and the duration between IPO and follow-on SEOs respectively.

Panel A: Summary Statistics

	N	Mean	Median	StdDev	Min	Max
All	2,856	2.7	1.7	2.8	0.2	23.5
IPO to First SEO	2,037	2.6	1.5	2.9	0.2	23.5
Non-VC-backed	1,052	2.8	1.7	3.1	0.2	22.0
VC-backed	948	2.2	1.3	2.4	0.2	17.2
SEO to SEO	819	2.8	2.0	2.6	0.2	19.0
Untruncated Sample	1,437	2.3	1.4	2.4	0.2	18.6
IPO to First SEO	1,080	2.2	1.4	2.4	0.2	18.6
SEO to SEO	357	2.4	1.7	2.2	0.2	11.8
IPO to Follow-on SEO	819	5.9	4.8	4.1	0.8	22.9

Panel B: Frequency of Duration

	Total	(0, 1]	(1, 3]	(3, 5]	(5, 10]	(10, 15]	(15, max]
All	2,856	925	1,108	434	291	78	20
		(32%)	(39%)	(15%)	(10%)	(3%)	(1%)
IPO to First SEO	2,037	715	767	275	205	61	14
		(35%)	(38%)	(14%)	(10%)	(3%)	(1%)
SEO to SEO	819	210	341	159	86	17	6
		(26%)	(42%)	(19%)	(11%)	(2%)	(1%)
Untruncated	1,437	537	573	184	112	28	3
		(37%)	(40%)	(13%)	(8%)	(2%)	(0%)
IPO to First SEO	1,080	420	425	130	79	23	3
		(39%)	(39%)	(12%)	(7%)	(2%)	(0%)
SEO to SEO	357	117	148	54	33	5	0
		(33%)	(41%)	(15%)	(9%)	(1%)	(0%)
IPO to Follow-on SEO	819	9	221	202	269	80	38
		(1%)	(27%)	(25%)	(33%)	(10%)	(5%)

Table 1.3 Summary Statistics of Firm and Deal Characteristics

Panel A of this table presents the summary statistics for the sample of 2,037 first SEOs. Panel B contains the summary statistics for 819 follow-on SEOs. Firm characteristics include *Market Value* measured as shares outstanding times price, *Post-issue* and *Pre-issue Sales Growth*, *Post-issue* and *Pre-issue Capital Expenditure Growth,* and *Cash Ratio,* and *Debt Ratio* scaled by assets. The post-issue measures are from the first fiscal year after the offerings, while the pre-issue measures are from the last fiscal year before the offerings. Other accounting variables are from the last fiscal year before the offerings. Except for market value, the upper and lower 1% of all other firm characteristics variables are winsorized. Fama and French 48-Industry medians of these measures are also reported. Deal characteristics include *Offer Size* measured as total proceeds, *%Primary Shares* measured as primary shares divided by total shares offered, *Underwriter spread*, *Underpricing* measured as the percentage change of closing price on the offer day to offer price, *Pre-issue Return* as the cumulative abnormal return from 365 days to one day before the offer day, *Post-issue Return* as the cumulative abnormal return from one day to 365 days after the offer day, *Issue-day Return* as the 3-day abnormal return around the issue day, and *Filing-day Return* as the 3-day abnormal return around the filing day.

Panel A: First SEOs (N =2,037)

Variables	N	Mean	Median	StdDev
Firm Characteristics				
Market Value (millions)	1,751	387	134	1,227
Post-issue Sales Growth (%)	1,849	96.0	46.0	192.9
Pre-issue Sales Growth (%)	1,370	94.6	26.7	265.7
Post-issue Capital Expenditure Growth (%)	1,810	191.6	74.5	414.1
Pre-issue Capital Expenditure Growth (%)	1,309	205.2	34.1	578.8
Cash Ratio (%)	1,798	25.4	14.1	26.7
Debt Ratio (%)	1,798	21.0	13.7	22.1
Industry Median				
Market Value (millions)	1,751	109	73	145
Post-issue Sales Growth (%)	1,849	11.8	11.7	6.8
Pre-issue Sales Growth (%)	1,370	11.1	11.0	6.8
Post-issue Capital Expenditure Growth (%)	1,810	10.6	11.2	15.2
Pre-issue Capital Expenditure Growth (%)	1,309	7.9	7.7	15.6
Cash Ratio (%)	1,798	13.9	9.8	11.3
Debt Ratio (%)	1,798	18.3	19.9	10.2
Deal Characteristics				
Offer Size (millions)	2,032	75	44	1,227
%Primary Shares	2,032	75.4	84.6	27.3
Underwriter Spread (%)	2,029	5.5	5.5	1.0
Underpricing (%)	2,031	3.2	1.2	16.9
Post-issue Return (1,365) (%)	2,007	-9.3	-9.7	59.8
Pre-issue Return (-365,-1) (%)	2,003	49.5	39.3	79.8
Issue-day Return (-1,1) (%)	2,008	-1.0	-1.1	8.5
Filing-day Return (-1,1) (%)	1,966	-2.6	-2.6	7.4

Panel B: Follow-on SEOs (N=819)				
Variables	N	Mean	Median	StdDev
Firm Characteristics				
Market Value (millions)	811	672	285	1523
Post-issue Sales Growth (%)	797	73.8	45.4	136.6
Pre-issue Sales Growth (%)	777	75.6	37.1	171.8
Post-issue Capital Expenditure Growth (%)	788	129.9	62.8	249.7
Pre-issue Capital Expenditure Growth (%)	766	140.6	43.6	387.4
Cash Ratio (%)	810	24.7	15.0	25.8
Debt Ratio (%)	810	20.7	15.7	20.3
Industry Median				
Market Value (millions)	811	117	79	161
Post-issue Sales Growth (%)	797	11.3	11.0	6.6
Pre-issue Sales Growth (%)	777	10.8	11.0	6.4
Post-issue Capital Expenditure Growth (%)	788	8.7	8.4	15.6
Pre-issue Capital Expenditure Growth (%)	766	8.0	7.7	16.0
Cash Ratio (%)	810	15.4	10.4	13.1
Debt Ratio (%)	810	18.3	19.1	10.5
Deal Characteristics				
Offer Size (millions)	819	105	64	166
%Primary Shares	819	85.8	100.0	25.6
Underwriter Spread (%)	817	5.0	5.0	0.9
Underpricing (%)	819	2.8	1.3	6.1
Post-issue Return (1,365) (%)	817	-11.8	-13.1	52.8
Pre-issue Return (-365,-1) (%)	817	47.5	38.6	58.6
Issue-day Return (-1,1) (%)	818	0.1	-0.1	7.1
Filing-day Return (-1,1) (%)	811	-2.2	-2.6	6.2

Table 1.4 Univariate Tests of Firm and Deal Characteristics for Fast vs. Slow Issuers

This table provides the test results on the difference between fast issuers and slow issuers in terms of firm and deal characteristics. Panel A contains the sample of 2,037 first SEOs and Panel B contains the sample of 819 follow-on SEOs. I divide the sample into terciles. The middle groups are discarded. Fast issuers have the smallest durations, and slow issuers have the largest durations. Firm characteristics include *Market Value* measured as shares outstanding times price, *Post-issue* and *Pre-issue Sales Growth*, *Post-issue* and *Pre-issue Capital Expenditure Growth*, and *Cash Ratio and Debt Ratio* scaled by assets. The post-issue measures are from the first fiscal year after the offerings, while the pre-issue measures are from the last fiscal year before the offerings. Other accounting variables are from the last fiscal year before the offerings. Except for market value, the upper and lower 1% of all other firm characteristics variables are winsorized. Deal characteristics include O*ffer Size* measured as total proceeds, *%Primary Shares* measured as primary shares divided by total shares offered, *Underwriter Spread*, *Underpricing* measured as the percentage change of closing price on the offer day to offer price, P*re-issue Return* as the cumulative abnormal return from 365 days to one day before the offer day, *Post-issue Return* as the cumulative abnormal return from one day to 365 days after the offer day, *Issue-day Return* as the 3-day abnormal return around the issue day, and *Filing-day Return* as the 3-day abnormal return around the filing day. P-values of two-tailed tests are given.

Panel A: First SEOs

	T test			Wilcoxon test		
Variables	Mean of Fast Issuers	Mean of Slow Issuers	p-value	Median of Fast Issuers	Median of Slow Issuers	p-value
Firm Characteristics						
Market Value (millions)	549	391	0.06	191	116	<0.01
Post-issue Sales Growth (%)	161.9	51.7	<0.01	69.8	32.2	<0.01
Pre-issue Sales Growth (%)	197.8	-37.4	<0.01	44.6	25.1	<0.01
Post-issue Capital Expenditure Growth (%)	308.7	131.7	<0.01	126.5	44.7	<0.01
Pre-issue Capital Expenditure Growth (%)	632.0	60.8	<0.01	54.8	19.9	0.18
Industry-adj. Cash Ratio (%)	17.9	6.4	<0.01	12.4	-0.1	<0.01
Industry-adj. Debt Ratio (%)	1.3	11.5	<0.01	-4.2	9.3	<0.01
Deal Characteristics						
Offer Size (millions)	102	62	<0.01	58	38	<0.01
%Primary Shares	65.7	83.1	<0.01	68.5	99.8	<0.01
Underwriter Spread (%)	5.3	5.6	<0.01	5.2	5.5	<0.01
Underpricing (%)	3.2	4.0	0.46	1.3	1.4	0.95
Post-issue Firm Return (%)	-7.5	3.9	<0.01	-1.8	2.0	0.04
Pre-issue Firm Return (%)	112.7	69.2	<0.01	84.5	61.3	<0.01
Issue-day Return (-1,1) (%)	-0.9	-0.9	0.96	-1.4	-0.6	0.56
Filing-day Return (-1,1) (%)	-2.5	-2.1	0.31	-2.6	-2.3	0.18

Panel B: Follow-on SEOs

	T test			Wilcoxon test		
Variables	Mean of Fast Issuers	Mean of Slow Issuers	p-value	Median of Fast Issuers	Median of Slow Issuers	p-value
Firm Characteristics						
Market Value (millions)	565	738	0.19	303	232	0.07
Post-issue Sales Growth (%)	99.1	50.9	<0.01	65.8	30.3	<0.01
Pre-issue Sales Growth (%)	123.7	36.8	<0.01	51.0	23.9	<0.01
Post-issue Capital Expenditure Growth (%)	182.8	103.5	<0.01	99.8	49.4	<0.01
Pre-issue Capital Expenditure Growth (%)	246.1	55.3	<0.01	73.7	10.8	<0.01
Industry-adj. Cash Ratio (%)	13.8	4.5	<0.01	9.6	-0.9	<0.01
Industry-adj. Debt Ratio (%)	2.3	8.0	0.01	-1.2	7.8	0.01
Deal Characteristics						
Offer Size (millions)	96	110	0.33	64	59	0.37
%Primary Shares	81.5	90.0	<0.01	96.6	100.0	<0.01
Underwriter Spread (%)	4.9	5.3	<0.01	5.0	5.3	<0.01
Underpricing (%)	2.3	3.3	0.02	1.3	1.6	0.11
Post-issue Firm Return (%)	-8.5	5.8	<0.01	-6.7	4.8	<0.01
Pre-issue Firm Return (%)	68.6	80.5	0.03	60.5	65.7	0.22
Issue-day Return (-1,1) (%)	0.5	0.4	0.95	0.5	-0.3	0.52
Filing-day Return (-1,1) (%)	-2.2	-2.0	0.66	-2.8	-2.0	0.46

Table 1.5 The Purposes of Fastest SEOs with Duration Less than One Year

The sample consists of 925 SEOs that are conducted within one year from previous offerings. Panel A reports the frequency of the news mentioning of capital-raising purposes in the following 10 categories. SEO announcements are retrieved from the Lexis-Nexis Academic database. The frequency for the whole sample, the first SEO sample, and the follow-on SEO sample is presented in the first, second, and third column respectively.

	Total	First SEOs	Follow-on SEOs
Total	925	715	210
Announce	654	513	141
General Purposes	390	317	73
	(60%)	(62%)	(52%)
Expansion or Capital Expenditure	353	275	78
	(54%)	(54%)	(55%)
Working Capital	309	251	58
	(47%)	(49%)	(41%)
Debt Repayment	217	162	55
	(33%)	(32%)	(39%)
Possible (future) Acquisitions	149	117	32
	(23%)	(23%)	(23%)
Research and Development	79	64	15
	(12%)	(12%)	(11%)
Mergers or Acquisitions	60	51	9
	(9%)	(10%)	(6%)
Financial Flexibility	11	9	2
	(2%)	(2%)	(1%)
Buyback	9	8	1
	(1%)	(2%)	(1%)
Others	9	8	1
	(1%)	(2%)	(1%)

Table 1.6 Duration Analysis of the Time between Two Consecutive Offerings: Annual-Monthly Specification

This table presents the main estimation results of the duration analysis. Panel A analyzes the time between IPOs and first SEOs, while Panel B analyzes the time between consecutive follow-on SEOs. Cox regression model with time-dependent covariates is specified as $h_i(t)=h_0(t)e^{X(t)\beta}$, where covariates are described as follows. For a specific month, *Glead* is the annualized logarithmatic growth rate of leading economic indicators. *Future Sales Growth* and *Future Capital Expenditure Growth* are from the first fiscal year after the month and *Past Sales Growth* and *Past Capital Expenditure Growth* are from the last fiscal year before the month. Therefore these firm-specific growth variables are in fact updated annually. *Future Market Return* is the cumulative monthly return of CRSP value-weighted portfolio in the following year after the month, and *Past Market Return* is the cumulative monthly return in the year before the month. Over the same investing horizons, *Future Firm Return* is the firm's future-year cumulative beta-adjusted monthly return and *Past Firm Return* is the firm's past-year cumulative abnormal return. *Glead* and return variables are updated monthly. *Industry-adj. Cash Ratio* is firm's cash ratio subtracted by its industry median. *Industry-adj. Debt Ratio* is firm's debt ratio subtracted by its industry median. *Market Value* is the log of shares outstanding times price. *Previous Offer Size* is measured as the log of total proceeds in the previous offering. *VC-backed Previous Issue* is dummy set to 1 if the previous offering is backed by VC. *Underwriter Spread* is the previous offering's gross spread. *Previous Underpricing* is underpricing to the previous offering. Underpricing is measured by the percentage change of closing price on the offer day to offer price. Industry dummies and entry time are also included in the analyses but not reported. Industry classification follows Kenneth French's 48 industries. Maximum partial likelihood estimation is employed to estimate β. Hazard impact is transformed from β as (exp(β)-1)x100%. Schwarz Information Criteria are provided in the last row.

Panel A: IPOs to First SEOs (N=5,538)

Variable	Predicted Sign	(1) Control	(2) Aggregate Growth	(3) Firm Growth	(4) Aggregate Timing	(5)Firm Timing	(6) All
Growth							
Glead	(+)		7.18***				6.05***
Future Sales Growth	(+)			0.06***			0.05***
Past Sales Growth	(+)			-0.02			-0.02
Future Capital Expenditure Growth	(+)			0.07***			0.05***
Past Capital Expenditure Growth	(+)			0.00			0.01*
Timing							
Future Market Return	(-)				0.02		0.25
Past Market Return	(+)				1.86***		1.51***
Future Firm Return	(-)					-0.11***	-0.12***
Past Firm Return	(+)					0.66***	0.65***
Control							
Industry-adj. Cash Ratio	(-)	-0.45***	-0.46***	-0.58***	-0.44***	-0.61***	-0.72***
Industry-adj. Debt Ratio	(+)	0.72***	0.72***	0.68***	0.72***	0.63***	0.55***
Market Value	(?)	102.39***	101.51***	97.43***	99.06***	77.1***	70.62***
Previous Offer Size	(-)	-59.22***	-59.04***	-58.65***	-57.77***	-53.71***	-51.10***
VC-backed Previous Issue	(+)	42.13***	41.86***	41.50***	43.29***	45.87***	45.51***
Underwriter Spread	(-)	-4.69	-5.29	-7.65*	-4.15	-10.01***	-11.86***
Previous Underpricing	(+)	-0.35***	-0.34***	-0.37***	-0.30**	-0.34***	-0.28**
Schwarz Information Criterion		20,323	20,263	20,266	20,258	19,981	19,848

***,**,* Significant at the 1%, 5%, and 10% level, respectively.

Panel B: SEOs to SEOs (N=2,003)

Variable	Predicted Sign	(1) Control	(2) Aggregate Growth	(3) Firm Growth	(4) Aggregate Timing	(5)Firm Timing	(6) All
Growth							
Glead	(+)		8.52***				8.86***
Future Sales Growth	(+)			0.07***			0.06**
Past Sales Growth	(+)			0.00			-0.01
Future Capital Expenditure Growth	(+)			0.10***			0.07***
Past Capital Expenditure Growth	(+)			0.03***			0.03***
Timing							
Future Market Return	(-)				0.33		0.91***
Past Market Return	(+)				1.31***		1.06***
Future Firm Return	(-)					-0.09**	-0.10**
Past Firm Return	(+)					0.97***	1.01***
Control							
Industry-adj. Cash Ratio	(-)	-0.26	-0.23	-0.52**	-0.23	-0.69***	-0.78***
Industry-adj. Debt Ratio	(+)	0.24	0.24	0.21	0.26	0.19	0.21
Market Value	(?)	95.46***	95.85***	89.60***	95.56***	60.05***	59.01***
Previous Offer Size	(-)	-45.08***	-45.21***	-45.98***	-43.57***	-42.44***	-40.81***
VC-backed Previous Issue	(+)	66.41***	69.36***	64.21***	67.57***	100.70***	97.40***
Underwriter Spread	(-)	36.58***	36.95***	28.81***	38.16***	16.75***	15.82***
Previous Underpricing	(+)	-1.28*	-1.32*	-1.28*	-1.25	-1.57**	-1.56**
Schwarz Information Criterion		10,814	10,772	10,769	10,798	10,520	10,425

***,**,* Significant at the 1%, 5%, and 10% level, respectively.

Table 1.7 Duration Analysis of the Time between Two Consecutive Offerings: Size-adjusted Returns

Panel A: IPOs to First SEOs (N=5,407)

Variable	Predicted Sign	(1) Control	(2) Aggregate Growth	(3) Firm Growth	(4) Aggregate Timing	(5)Firm Timing	(6) All
Growth							
Glead	(+)		7.23***				6.52***
Future Sales Growth	(+)			0.07***			0.06***
Past Sales Growth	(+)			-0.02			-0.01
Future Capital Expenditure Growth	(+)			0.05***			0.03***
Past Capital Expenditure Growth	(+)			0.00			0.01*
Timing							
Future Market Return	(-)				0.04		0.50***
Past Market Return	(+)				1.90***		1.49***
Future Firm Return	(-)					-0.07*	-0.08**
Past Firm Return	(+)					0.76***	0.77***
Control							
Industry-adj. Cash Ratio	(-)	-0.42***	-0.43***	-0.54***	-0.42***	-0.68***	-0.76***
Industry-adj. Debt Ratio	(+)	0.75***	0.75***	0.71***	0.75***	0.65***	0.56***
Market Value	(?)	103.50***	102.51***	98.94***	100.07***	71.97***	66.31***
Previous Offer Size	(-)	-59.38***	-59.20***	-58.96***	-57.87***	-52.25***	-49.80***
VC-backed Previous Issue	(+)	39.68***	39.33***	38.82***	40.77***	39.51***	37.52***
Underwriter Spread	(-)	-5.67	-6.39	-8.56*	-5.10	-12.61***	-14.63***
Previous Underpricing	(+)	-0.35***	-0.33***	-0.36***	-0.29**	-0.35***	-0.30**
Schwarz Information Criterion		20,123	20,062	20,076	20,055	19,639	19,510

***,**,* Significant at the 1%, 5%, and 10% level, respectively.

Panel B: SEOs to SEOs (N=2,000)

Variable	Predicted Sign	(1) Control	(2) Aggregate Growth	(3) Firm Growth	(4) Aggregate Timing	(5)Firm Timing	(6) All
Growth							
Glead	(+)		8.14***				8.94***
Future Sales Growth	(+)			0.06**			0.05**
Past Sales Growth	(+)			0.01			0.01
Future Capital Expenditure Growth	(+)			0.11***			0.07***
Past Capital Expenditure Growth	(+)			0.02			0.02
Timing							
Future Market Return	(-)				0.36		0.97***
Past Market Return	(+)				1.18***		0.82**
Future Firm Return	(-)					0.01	0.01
Past Firm Return	(+)					0.91***	0.95***
Control							
Industry-adj. Cash Ratio	(-)	0.22	0.25	0.00	0.26	-0.18	-0.24
Industry-adj. Debt Ratio	(+)	0.54**	0.53**	0.50**	0.57**	0.49**	0.50**
Market Value	(?)	92.00***	92.48***	87.09***	92.61***	59.48***	59.69***
Previous Offer Size	(-)	-50.67***	-50.76***	-51.49***	-49.66***	-48.14***	-47.12***
VC-backed Previous Issue	(+)	90.02***	92.51***	89.12***	90.79***	126.76***	123.50***
Underwriter Spread	(-)	23.6***	23.97***	17.98**	24.47***	7.35	6.94
Previous Underpricing	(+)	-1.90*	-1.91*	-1.80*	-1.86*	-2.22**	-2.05**
Schwarz Information Criterion		5,991	5,972	5,980	5,989	5,850	5,821

***,**,* Significant at the 1%, 5%, and 10% level, respectively.

Table 1.8 Duration Analysis of the Time between Two Consecutive Offerings: Pure Primary Offerings

Panel A: IPOs to SEOs (N=4,291)

Variable	Predicted Sign	(1) Control	(2) Aggregate Growth	(3) Firm Growth	(4) Aggregate Timing	(5)Firm Timing	(6) All
Growth							
Glead	(+)		8.63***				7.57***
Future Sales Growth	(+)			0.09***			0.07***
Past Sales Growth	(+)			0.00			-0.01
Future Capital Expenditure Growth	(+)			0.10***			0.07***
Past Capital Expenditure Growth	(+)			-0.01			0.00
Timing							
Future Market Return	(-)				-0.08		0.26
Past Market Return	(+)				1.86***		1.42***
Future Firm Return	(-)					-0.17***	-0.18***
Past Firm Return	(+)					0.74***	0.72***
Control							
Industry-adj. Cash Ratio	(-)	0.12	0.11	-0.10	0.14	-0.07	-0.25
Industry-adj. Debt Ratio	(+)	0.99***	1.00***	0.97***	0.99***	0.89***	0.84***
Market Value	(?)	81.96***	81.12***	76.67***	78.81***	60.82***	54.55***
Previous Offer Size	(-)	-57.05***	-56.90***	-56.32***	-55.37***	-51.20***	-48.17***
VC-backed Previous Issue	(+)	77.06***	77.09***	77.96***	77.37***	81.97***	81.85***
Underwriter Spread	(-)	-12.10*	-12.41*	-16.00***	-11.51*	-16.17***	-18.42***
Previous Underpricing	(+)	-0.75***	-0.74***	-0.73***	-0.69***	-0.72***	-0.64***
Schwarz Information Criterion		8,224	8,193	8,185	8,203	8,061	8,002

***,**,* Significant at the 1%, 5%, and 10% level, respectively.

Panel B: SEOs to SEOs (N=2,000)

Variable	Predicted Sign	(1) Control	(2) Aggregate Growth	(3) Firm Growth	(4) Aggregate Timing	(5)Firm Timing	(6) All
Growth							
Glead	(+)		8.14***				8.94***
Future Sales Growth	(+)			0.06**			0.05**
Past Sales Growth	(+)			0.01			0.01
Future Capital Expenditure Growth	(+)			0.11***			0.07***
Past Capital Expenditure Growth	(+)			0.02			0.02
Timing							
Future Market Return	(-)				0.36		0.97***
Past Market Return	(+)				1.18***		0.82**
Future Firm Return	(-)					0.01	0.01
Past Firm Return	(+)					0.91***	0.95***
Control							
Industry-adj. Cash Ratio	(-)	0.22	0.25	0.00	0.26	-0.18	-0.24
Industry-adj. Debt Ratio	(+)	0.54**	0.53**	0.50**	0.57**	0.49**	0.50**
Market Value	(?)	92.00***	92.48***	87.09***	92.61***	59.48***	59.69***
Previous Offer Size	(-)	-50.67***	-50.76***	-51.49***	-49.66***	-48.14***	-47.12***
VC-backed Previous Issue	(+)	90.02***	92.51***	89.12***	90.79***	126.76***	123.50***
Underwriter Spread	(-)	23.6***	23.97***	17.98**	24.47***	7.35	6.94
Previous Underpricing	(+)	-1.90*	-1.91*	-1.80*	-1.86*	-2.22**	-2.05**
Schwarz Information Criterion		5,991	5,972	5,980	5,989	5,850	5,821

***,**,* Significant at the 1%, 5%, and 10% level, respectively.

Table 1.9 Duration Analysis of the Time between Two Consecutive Offerings: Quarterly Specification

This table presents the estimation results of the duration analysis using the quarterly specification. Panel A analyzes the time between IPOs and first SEOs, while Panel B analyzes the time between consecutive follow-on SEOs. Cox regression model with time-dependent covariates is specified as $h_i(t)=h_0(t)e^{X(t)\beta}$, where covariates are described as follows. For a specific quarter, *Glead* is the sum of the monthly logarithmatic growth rate of leading economic indicators in that quarter. *Future Sales Growth* and *Future Capital Expenditure Growth* are from the first fiscal quarter after the current quarter and *Past Sales Growth* and *Past Capital Expenditure Growth* are from the current quarter. *Future Market Return* is the cumulative monthly return of CRSP value-weighted portfolio in the following year after the last month of the quarter, and *Past Market Return* is the cumulative monthly return in the year before the first month of the quarter. Over the same investing horizons, *Future Firm Return* is the firm's future-year cumulative beta-adjusted monthly return and *Past Firm Return* is the firm's past-year cumulative abnormal return. *Glead* and return variables are updated monthly. *Industry-adj. Cash Ratio* is firm's cash ratio subtracted by its industry median. *Industry-adj. Debt Ratio* is firm's debt ratio subtracted by its industry median. *Market Value* is the log of shares outstanding times price. *Previous Offer Size* is measured as the log of total proceeds in the previous offering. *VC-backed Previous Issue* is a dummy set to 1 if the previous offering is backed by VC. *Underwriter Spread* is the previous offering's gross spread. *Previous Underpricing* is underpricing to the previous offering. Underpricing is measured by the percentage change of closing price on the offer day to offer price. Industry dummies and entry time are also included in the analyses but not reported. Industry classification follows Kenneth French's 48 industries. Maximum partial likelihood estimation is employed to estimate β. Hazard impact is transformed from β as (exp(β)-1)x100%. Schwarz Information Criteria are provided in the last row.

Panel A: IPOs to SEOs (N=5,538)

Variable	Predicted Sign	(1) Control	(2) Aggregate Growth	(3) Firm Growth	(4) Aggregate Timing	(5)Firm Timing	(6) All
Growth							
Glead	(+)		32.21***				20.29***
Future Sales Growth	(+)			0.26***			0.21***
Past Sales Growth	(+)			0.29***			0.23***
Future Capital Expenditure Growth	(+)			0.11***			0.08***
Past Capital Expenditure Growth	(+)			0.00			-0.01
Timing							
Future Market Return	(-)				0.12		0.25
Past Market Return	(+)				1.94***		1.60***
Future Firm Return	(-)					-0.10***	-0.11***
Past Firm Return	(+)					0.52***	0.51***
Control							
Industry-adj. Cash Ratio	(-)	-0.39***	-0.41***	-0.45***	-0.37***	-0.49***	-0.53***
Industry-adj. Debt Ratio	(+)	0.52***	0.51***	0.50***	0.51***	0.46***	0.40***
Market Value	(?)	105.09***	104.47***	101.96***	101.51***	78.72***	73.80***
Previous Offer Size	(-)	-56.05***	-56.22***	-55.16***	-54.13***	-50.00***	-46.90***
VC-backed Previous Issue	(+)	33.2***	33.79***	33.01***	34.35***	37.17***	38.43***
Underwriter Spread	(-)	-2.18	-2.45	-4.31	-0.85	-6.94*	-6.90*
Previous Underpricing	(+)	-0.24***	-0.21***	-0.27***	-0.19**	-0.23***	-0.20**
Schwarz Information Criterion		26,543	26,502	26,472	26,454	26,206	26,066

***,**,* Significant at the 1%, 5%, and 10% level, respectively.

Panel B: SEOs to SEOs (N=2,003)

Variable	Predicted Sign	(1) Control	(2) Aggregate Growth	(3) Firm Growth	(4) Aggregate Timing	(5)Firm Timing	(6) All
Growth							
Glead	(+)		27.20***				27.21***
Future Sales Growth	(+)			0.17**			0.13**
Past Sales Growth	(+)			0.31***			0.26***
Future Capital Expenditure Growth	(+)			0.14***			0.11***
Past Capital Expenditure Growth	(+)			-0.04			-0.07
Timing							
Future Market Return	(-)				0.35		0.91***
Past Market Return	(+)				1.19***		0.95***
Future Firm Return	(-)					-0.12***	-0.13***
Past Firm Return	(+)					0.96***	1.02***
Control							
Industry-adj. Cash Ratio	(-)	-0.41*	-0.40*	-0.49**	-0.37*	-0.87***	-0.86***
Industry-adj. Debt Ratio	(+)	0.18	0.17	0.15	0.18	0.15	0.17
Market Value	(?)	91.75***	92.06***	89.54***	91.87***	56.21***	56.49***
Previous Offer Size	(-)	-40.73***	-41.08***	-40.93***	-38.94***	-37.5***	-35.13***
VC-backed Previous Issue	(+)	62.97***	64.14***	61.10**	63.20***	95.75***	93.13***
Underwriter Spread	(-)	38.95***	39.06***	35.38***	40.91***	18.17***	18.83***
Previous Underpricing	(+)	-1.04	-1.08	-1.03	-1.00	-1.28*	-1.23*
Schwarz Information Criterion		10,544	10,534	10,524	10,532	10,250	10,200

***,**,* Significant at the 1%, 5%, and 10% level, respectively.

Table 1.10 Market Reactions to First SEOs vs. Second SEOs

The sample contains the first and the second offerings by firms with at least two seasoned offerings. T tests and Wilcoxon tests are run to test whether differences exist between the first SEOs and the second SEOs. Panel A applies the tests to the whole sample of 1,214 observations. Panel B divides the sample into terciles based on the duration measure. Fast offerings are offerings with shortest durations, and slow offerings are offerings with longest durations. *Underpricing* is measured as percentage change of closing price on the offer day to offer price. *Issue-day Return* is the 3-day abnormal return around the issue day. *Filing-day Return* is the 3-day abnormal return around the filing day. P-values of two-tailed tests are reported.

Panel A: the Whole Sample

	T test			Wilcoxon test		
Variables	Mean of First	Mean of Second	p-value	Median of First	Median of Second	p-value
Underpricing	2.70	3.05	0.31	1.02	1.39	0.23
Issue-day Return (-1,1)	-0.96	0.11	0.01	-1.24	-0.06	0.01
Filing-day Return (-1,1)	-1.76	-2.32	0.14	-1.82	-2.62	0.07

Panel B: Sort on Duration

		T test			Wilcoxon test		
	Variables	Mean of First	Mean of Second	p-value	Median of First	Median of Second	p-value
Fast Offerings	Underpricing	3.21	2.54	0.16	1.12	1.30	0.61
	Issue-day Return (-1,1)	0.28	0.38	0.90	0.05	0.30	0.99
	Filing-day Return (-1,1)	-1.71	-2.60	0.18	-2.10	-2.99	0.13
Slow Offerings	Underpricing	2.34	3.50	0.04	0.83	1.55	0.04
	Issue-day Return (-1,1)	-1.41	-0.01	0.06	-1.56	-0.58	0.10
	Filing-day Return (-1,1)	-1.62	-1.80	0.79	-1.62	-2.05	0.50

Figure 1.1 Histograms of the Duration Measure

The figures plot the frequencies at which the length of time between two consecutive offerings (duration) falls on various numbers of years. Note all values greater than 20 are included in the last bin. Part (a) shows the histogram for the sample of 2,037 first SEOs. Part (b) shows the histogram for the sample of 819 follow-on SEOs. Part (c) shows the histogram for the sample of 1,052 first SEOs following non-venture-capital backed IPOs. Part (d) shows the histogram for the sample of 948 first SEOs following VC-backed IPOs.

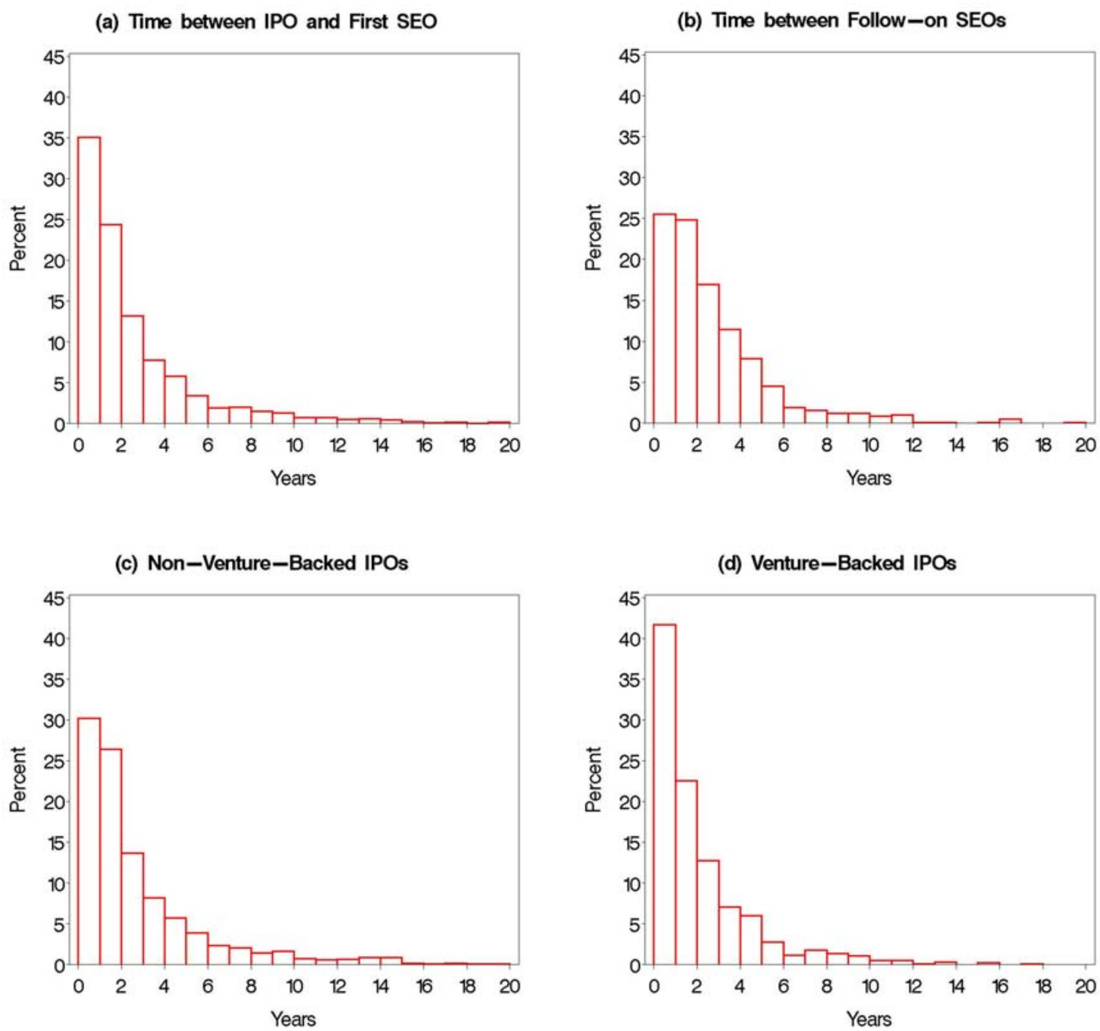
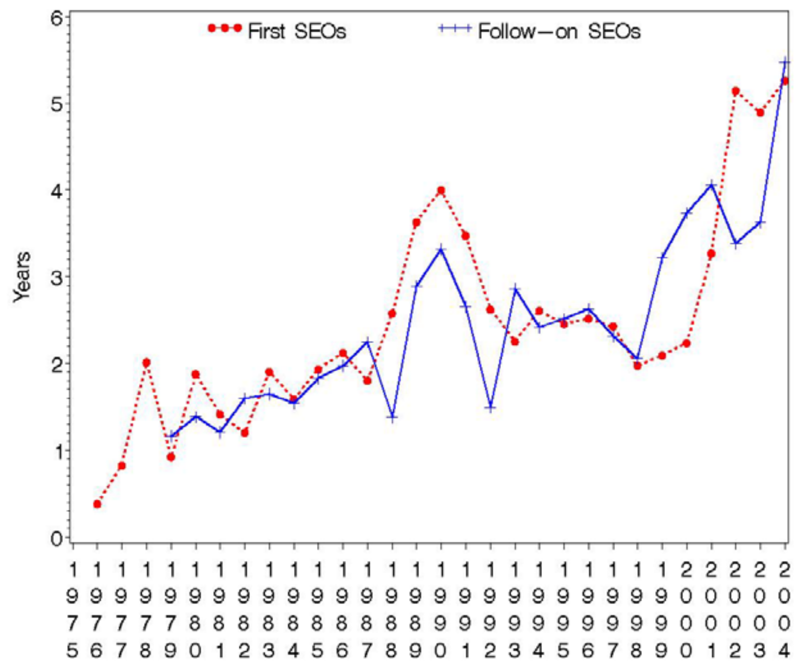


Figure 1.2 Duration over Time, 1976-2004

This figures plot the yearly distribution of the length of time between two consecutive offerings. The total sample consists of 2,856 SEOs from 1976-2004. The *First SEO* sample consists of 2,037 first SEOs, and the *Follow-on SEO* sample consists of 819 follow-on SEOs. For each sample, the mean and median of the duration measure across all the offerings occurring in each year are calculated and graphed respectively in Part (a) and Part (b).

(a) Mean of Duration over Time



(b) Median of Duration over Time

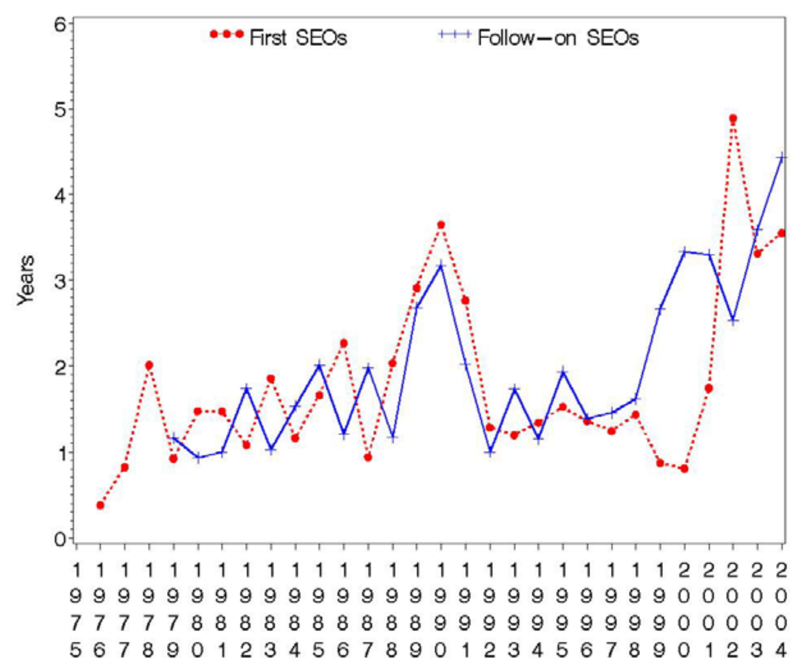


Figure 1.3 Duration of IPO Firms that Issue within 5 Years

The IPO sample consists of 5,493 IPOs from 1975 to 1999. The SEO sample consists of 2,037 first SEOs from 1976 to 2004. Bars represent the number of IPOs in each year. The percentage of IPO firms issuing within five years following the IPO is shown in part (a). The mean and median duration of these first SEOs are calculated and graphed respectively in part (b).

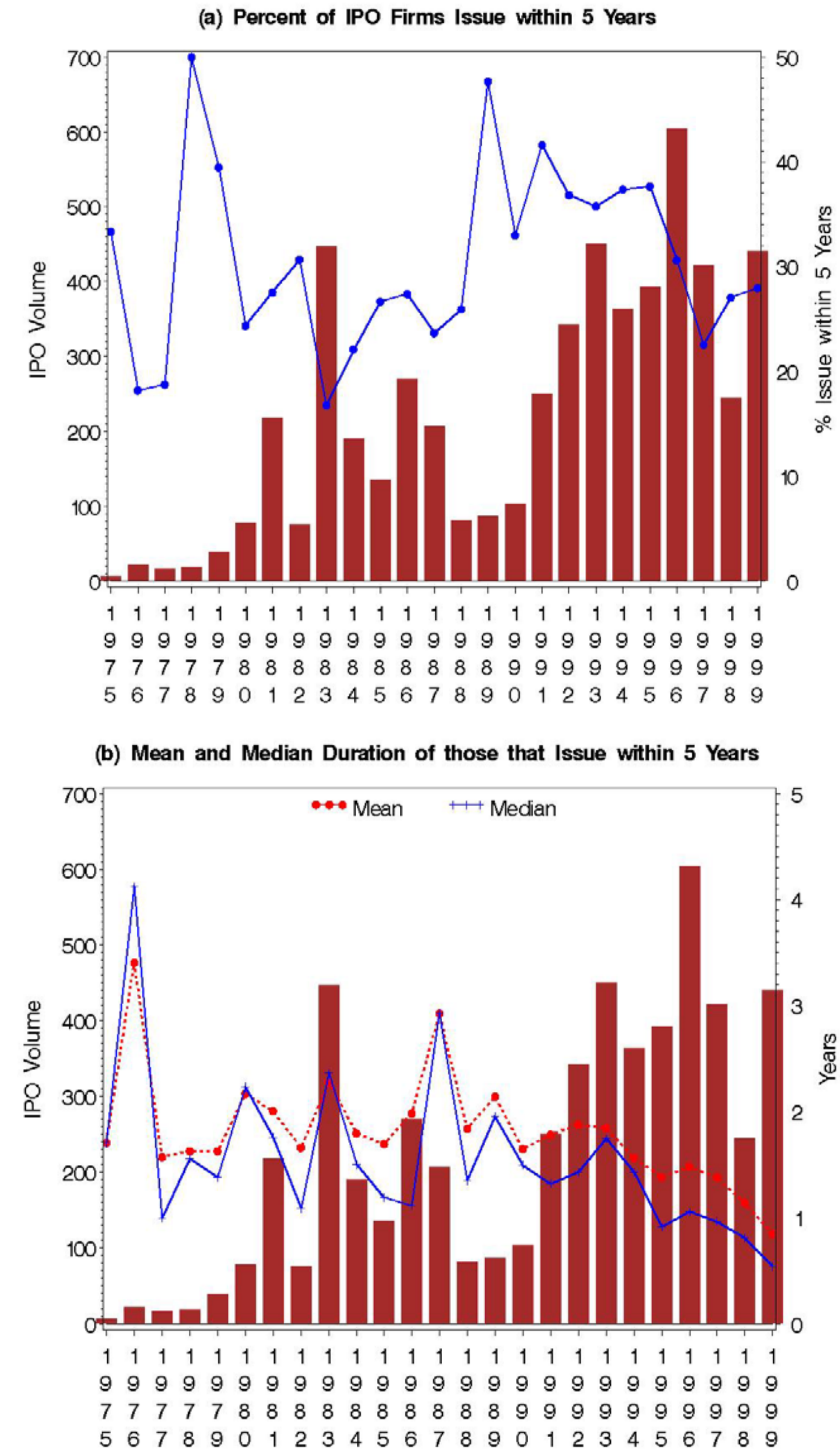
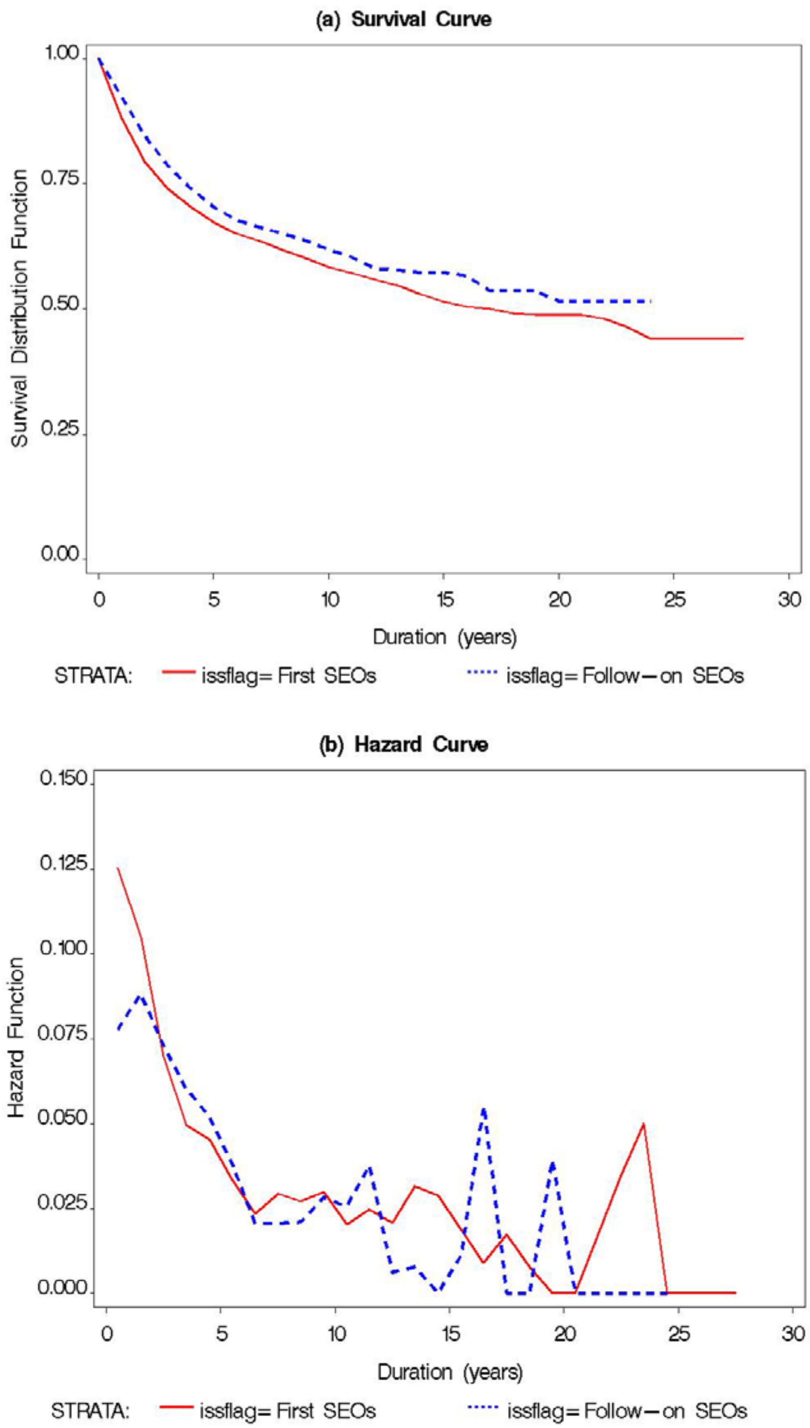


Figure 1.4 Survival Curves and Hazard Curves

The sample consists of 6,198 IPOs from 1975 to 2004, and subsequent 2,856 SEOs that are classified into 2,037 first SEOs and 819 follow-on SEOs. I use life-table method with one-year intervals to generate the survival curves and the hazard curves. Part (a) plots the survival curves. Part (b) plots the hazard curves.



Chapter 2

Liquidity Changes around Seasoned Equity Offerings and Private Placements

2.1 Introduction

Much of the literature on market microstructure has centered on finding a relation between market liquidity and firms' cost of capital (e.g., Amihud and Mendelson, 1986, 1988; Easley and O'Hara, 2004).[21] Theoretical and empirical work have led to the same conclusion: less liquid stocks have higher required returns. Hence, market microstructure can affect firms' cost of capital. However, regulators of securities markets can monitor only the overall market liquidity and are unlikely to optimize the firm-specific liquidity. Many suggestions have been raised regarding how firms can take a more proactive role in increasing the liquidity of their shares to lower the cost of capital. For example, Amihud and Mendelson (2000) suggest stock splits as one of several methods for a firm to reduce its cost of capital by increasing the liquidity of its stocks.

In this study, I first investigate whether a seasoned equity offering (SEO) is such a liquidity event.[22] Prior literature provides some evidence that on average, liquidity improves after an SEO (see Tripathy and Rao, 1992; Loderer, Peterson and Sheehan, 1997; Eckbo, Masulis and Norli, 2000).[23] I examine a broader set of liquidity measures,

[21] Amihud and Mendelson (1986, 1988) consider the liquidity premium as compensation for transaction costs, while Easley and O'Hara (2004) attribute the premium to information asymmetry that causes informed investors to better adjust to the new information at the expense of uninformed investors.

[22] Following the convention in the field, seasoned equity offerings in this paper refer to public offerings only.

[23] Using a sample of Nasdaq over-the-counter SEOs, Tripathy and Rao (1992) find that bid-ask spreads decrease in the pre-announcement period for large offerings, and the decrease only occurs on the offer date for small offerings. Loderer, Peterson and Sheehan (1997) show that bid-ask spreads of the Nasdaq stocks

including both single-trade measures and measures based on dynamic models. As Hasbrouck (2004) points out, the latter measures differ from the former and reflect different aspects of the liquidity. Further, my sample contains a large number (1,278) of SEOs from NYSE, AMEX, and Nasdaq. Consistent with the existing literature, I find that following an SEO, relative bid-ask spreads fall significantly. In addition, there is a substantial increase in the daily number of trades with the average trade size staying at the pre-SEO level. Compared with a matched sample, investors trade much more in the post-event period. Hence, trading volumes and turnover rates rise considerably. Two liquidity ratio measures also exhibit substantial changes as trading volumes increase. The smallest change, however, takes place in the price impact measures.

Despite prior evidence of changes in liquidity, limited attention has been paid to what factors are associated with such a change. A public offering usually results in more floating shares, which potentially arouses more interest and stimulates more trading among investors. The larger investor base and the larger trading volume subsequent to the SEO may help cut down unit inventory costs and order processing costs for market makers. However, Loderer, Peterson, and Sheehan (1997) point out that a new equity issue could depress the stock price and hurt the liquidity if the firm does not endeavor to recruit new investors. In the sample I examine here, although liquidity improves on average, there seems to be a considerable variation in changes of liquidity around SEOs. For some firms, liquidity actually worsens after the SEO. Therefore, I investigate next what determines changes in liquidity around SEOs. Both analysts and underwriters play important roles in a new public issue. Results show that the effective spread is lowered

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decrease substantially after the SEO. Eckbo, Masulis and Norli (2000) use monthly turnover as a measure of liquidity and find that average liquidity is higher in the five-year post-offering period than in the five-year pre-offering period.

and the permanent and temporary price impacts are attenuated as more analysts follow the Nasdaq issuing stock before the new issue. Compared to analysts' influence, underwriting effort has an even greater impact on the enhancement of liquidity after SEOs. Their influence on the liquidity of issuing stocks is weakened on NYSE and AMEX markets. Conversely, the hypothesis that reputable underwriters help issuing firms improve liquidity only receives support for NYSE and AMEX issuing stocks.

Compared to a large body of literature on seasoned equity offerings, private placements have received little attention from researchers, partly because they are less significant events and partly because the data are not easily available. To my knowledge, nobody has examined potential liquidity changes around private placements. In contrast to shares sold in public offerings, shares sold in private placements are less easy to resell because of regulatory restrictions. It is therefore not clear how the secondary market liquidity of a firm that has just undertaken a private placement would be affected by this event. However, stock ownership becomes more concentrated after the private placement, as shown in Wruck (1989). Prior studies have also demonstrated that an increase in ownership concentration reduces stock liquidity (Sarin, Shastri, and Shastri, 2000; Heflin and Shaw, 2000). It is possible that a stock would become less liquid after the private placement as a result of more concentrated ownership. However, empirical evidence does not show a sharp contrast between pre-event liquidity and post-event liquidity for private placement stocks. Neither do I see any statistically significant difference in the matching sample between the pre-event period and the post-event period.

This study fits into a broader area of linking capital structure with liquidity that has gained increasing interest in recent years. For example, Lesmond, O'Connor, and

Senbet (2002) argue that an increase in leverage will lead to a decrease in stock liquidity. Their model suggests that leverage-decreasing events such as an SEO may result in an increase in liquidity. Lipson and Mortal (2006) find that firms whose stocks are more liquid in the secondary market tend to have less debt. Moreover, these firms will choose equity over debt when raising new capital. Butler, Grullon and Weston (2005a) show that the investment banking fees firms pay in SEO deals are strongly influenced by their stock's liquidity in the secondary market prior to the offerings. On the other hand, Corwin (2003) finds that information asymmetry, measured by the bid-ask spread, cannot explain underpricing in seasoned issues.

My study contributes to the existing literature in two important aspects. First, I compare the liquidity change of public offerings with that of private placements. Moreover, I explore the reasons behind the change in liquidity when a firm changes its capital structure. The increase in liquidity after public offerings may be due to a combined advocating effort from underwriters and financial analysts that has raised investors' attention and encouraged greater participation. Unlike what happens to SEO firms, firms that have resorted to private equity market do not seem to experience a significant increase in secondary market liquidity. Therefore, when managers make financing decisions, they should not only take into account the direct costs and benefits, but the indirect costs and benefits such as the influence on market liquidity as well.

The rest of the chapter is organized as follows: Section 2.2 discusses the hypothesis development. Section 2.3 describes the data and reports the descriptive statistics. Section 2.4 presents the empirical results. The last section concludes and discusses future research.

2.2 Hypothesis Development

2.2.1 Liquidity Changes around SEOs and Private Placements

Reasons that market liquidity may improve after SEOs include (1) a larger number of shares outstanding, (2) more shareholders, and (3) smaller information asymmetry. A firm's stock would become more liquid as more shares flow into the market. More floating shares are likely to attract more investor clienteles and therefore diffuse stock ownership. Dispersed ownership is usually associated with greater liquidity, because it promotes trading activities and curtails dealers' potential losses from trading against informed investors. Previous empirical research provides ample evidence that supports this argument. For example, Benston and Hagerman (1974) find that the bid-ask spread is negatively related to the number of stockholders. Amihud, Mendelson and Uno (1999) demonstrate that a firm can increase its liquidity and stock price simply by increasing the number of its stockholders. Kothare (1997) compares the ownership structure after public offerings with that after rights offerings. She shows that public offerings, on average, lead to more diffuse ownership, whereas rights offerings lead to more concentrated ownership. Finally, after seasoned equity offerings, I expect that information asymmetry problems would be alleviated, because a great amount of information would be released along with the issue. For example, firms must register with the SEC and prepare prospectuses, and they may also voluntarily increase media exposure. All these will facilitate investors in obtaining information. Further, with the help of underwriters and analysts, investors would possibly have a better understanding about the information they obtain. Therefore, costs of information would most likely become less after the public offering.

Compared to an SEO, firms issue fewer shares in a private placement. Further, shares are distributed to a smaller number of private parties who are restricted from trading new shares in the secondary market within a certain period of time. Therefore, new shares from private placements are not counted as floating shares. Second, firms that conduct private placements tend to be under financial distress and are subject to large information asymmetry problems (e.g. Wu, 2003). Unfortunately, this problem cannot be resolved by private placements because issuers do not need to disclose information to the investing public. Consequently, information asymmetry will not be reduced via private placements. Third, ownership of a private placement stock becomes more concentrated as shown in Wruck (1989). The increase in ownership concentration is often associated with a reduction in liquidity (Sarin, Shastri and Shastri, 2000; Helflin and Shaw, 2000). Finally, the probability that market makers trade with informed traders may increase after the private placement as more sophisticated investors hold the stock. As a result, market makers would probably increase the bid-ask spread in the post-placement period. Taken together, these arguments suggest that private placements may lead to a deterioration of liquidity for issuing stocks, albeit with additional shares. In summary, I expect the following hypothesis to hold:

H1: Liquidity of a firm's stock will increase after the SEO, but decrease after the private placement.

2.2.2 Determinants of Changes in Liquidity after SEOs

Loderer, Peterson and Sheehan (1997) suggest that not all public offerings would result in a larger number of shareholders. A new stock issue could be detrimental to liquidity if a firm makes little effort to expand its investor clienteles. Assuming underwriters' marketing effort is rewarded partly in the form of the underwriter spread, they demonstrate that if firms pay a higher underwriter spread for the offering, the bid-ask spread would decline more after SEOs. Underwriters play an important role in public equity offerings. They help promote the selling of firms' new shares, and serve as market makers for a certain period of time after the offering, ready to buy or sell the stock with their own accounts or solicit other clients to do so. Moreover, the presence of prestigious underwriters can reduce the information disparity between issuing firms' managers and outside investors. Assuming that underwriters with good reputations can be more effective in certifying new issues, offerings by these underwriters would result in greater enhancement of the firm's stock liquidity. My second hypothesis is thus stated as follows:

H2: The more reputable the underwriter and the greater the underwriting effort, the larger the increase in stock liquidity after an SEO.

Analysts play an important role in disseminating information to the investing public and strengthening the investor relationship. Brennan and Subrahmanyam (1996) and Brennan and Tamarowski (2000) estimate the simultaneous relation between analyst following and the adverse selection component of the spread. They find that an increase in the number of analysts following a stock is associated with a decrease in the adverse selection cost of trading in its stock. In addition, Roulstone (2003) reports that analyst forecast dispersion is negatively related to liquidity, consistent with the notion that analysts provide public information. These studies examine the cross-sectional relation between the liquidity and analyst forecast characteristics. Similar arguments can be carried over to a setting when the information structure of a firm changes, such as in a public offering. As the quality of information about the firm improves during the offering process, more analysts would like to follow the firm, their forecast accuracy would increase and their opinions are more likely to converge (Lang and Lundholm, 1996). The increase in the number of analysts following the firm would further attract more investors into the market and hence induce more trading. To summarize, I form the third hypothesis:

H3: The more analysts following the issuing firm, the larger the increase in stock liquidity after an SEO.

2.3 Data Sources, Sample Selection and Variable Definitions

2.3.1 Data Sources and Sample Selection

The initial SEO sample contains all SEOs in the Securities Data Corporation (SDC) New Issues database over the period 1994-2002. For a firm to be included in the final sample, I impose the following criteria: (1) the offering is not a unit issue; (2) the offering is not a shelf registration; (3) the issuing firm is listed on either of the three exchanges: NYSE, Nasdaq, AMEX;[24] (4) proceeds are greater than $20 million; (5) the price of the offering is greater than $5; (6) the issuing firm is not a financial institution (SIC codes 6000-6999) or utility company (SIC codes 4900-4949); (7) the issuing firm has not conducted a seasoned equity offering within two years before this offering; (8) and the issuing firm has not undergone stock splits within the period of one year before and one year after the offering. I discard the stock-split firms to control for the confounding effects that stock splits may have on firms' liquidity. These criteria are commonly used in the previous literature. For each firm, I require that data are available

[24] I use the header exchange from CRSP to finalize the primary exchange of the issuing firm.

in the TAQ database and the Center for Research in Security Prices (CRSP) database for the event period from 250 trading days before the offer date to 250 trading days after the offer date.[25] The analysis is centered around the offer date because the deal and its price will be determined only on the offer date, although a firm may announce the deal a couple of months earlier.

The final SEO sample thus consists of 1,278 issues. Among these issues, 828 come from Nasdaq, 415 from NYSE, and 35 from AMEX. 535 of these SEOs are pure primary offerings, 215 are pure secondary offerings, and 528 are combined offerings.[26] Table 2.1 reports the descriptive statistics. Panel A shows the year distribution of the offerings. As can be seen, 1995-1997 are hot issue markets when the number of SEOs increases considerably. The average number of annual offerings during the period of 1995-1997 exceeds the rest of the years by 58%. The industry distribution of the sample is shown in Panel B. The industry classification follows Fama and French (1997). The sample contains issuing firms from a wide variety of industries, with retail businesses (28%) on top of the list, and manufacturing firms (26%) the second. Panel C provides the summary statistics of the basic firm and deal characteristics, including proceeds raised, number of shares offered, offer size, as well as market value of the issuing firm. *Market value* is measured on the trading day before the offer day (day (-1)). *Offer size* is measured in two ways: (1) proceeds divided by the market value on day (-1); (2) ratio of

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[25] Safieddine and Wilhelm (1996) note that trading for new issues usually starts on the next day. In order to pin down the event dates on which the new shares flow into the market, I use a volume-based adjustment method to correct for errors in SDC. If trading volume on the day after the SDC offer date is more than twice that on the SDC offer date and more than twice the average daily trading volume over the 250 trading days prior to the SDC offer date, then the day following the SDC offer date is used as the correct offer date. This correction applies to 60.4% of the sample.

[26] Types of offerings are classified according to two variables from SDC: the primary shares offered and the secondary shares offered. If the secondary shares offered are missing, the offer is taken as a pure primary offering; if the primary shares offered are missing, I identify the offer as a pure secondary offering; otherwise the offer is grouped into the category of combined offerings.

the number of shares offered to the shares outstanding of the firm on day (-1). In the sample, SEO firms raise about $123 million on average. The mean number of shares offered in the sample is 5 million. Two offer size measures average 27% and 28% respectively. The market value of these firms reaches $1 billion on average, with a large standard deviation of about $4 billion.

The private placement sample originally comes from Barclay, Holderness and Sheehan (2003), with the sample period ending in 1997.[27] Because I require data from the TAQ database, I select only those private placements conducted after 1994. I further exclude those deals done by financial firms and utility firms, as well as firms that have gone through stock splits during the period of one year before to one year after the transaction date. This leaves 105 private placements in the final sample. Among them, 90 come from Nasdaq, 5 from NYSE, and 10 from AMEX.

Table 2.2 presents the descriptive statistics of the private placement sample. Panel A shows the year distribution. The number of private placements fluctuates slightly over time. The industry distribution of the sample is shown in Panel C. Manufacturing (35%), chemical (23%), and retail businesses (13%) are the three big components. Panel C gives the summary statistics of the basic firm and deal characteristics, including proceeds raised, number of shares offered, offer size, as well as market values of the issuing firms. These measures are calculated in the same way as those in the SEO sample. On average, private placement firms raise about $10 million in proceeds, less than one tenth of the amount raised in SEOs. The mean number of shares offered in the sample is about two million shares, less than half the number of shares offered in SEOs. Two offer size measures average about 14% and 17% respectively. The market value of these firms is

[27] I thank the authors for generously providing me with their data.

also much smaller than that of SEO firms, approximately $76 million on average. In summary, compared to an SEO firm, a firm that conducts a private placement is usually a smaller-size firm and raises less money from a smaller-size deal.

2.3.2 Selection of the Matching Samples

In order to control for potential contaminating effects from market trends over time, I employ a matching sample technique. The matching sample is selected using the following procedure. First, I choose stocks from the CRSP monthly database that are not issued by financial or utility companies. For each offering, I exclude those firms that have issued or those that have gone through stock splits within one year before and one year after the offering date. The candidate firms are then narrowed down to firms listed on the same exchange as the sample firm. Finally, I choose the firm that has the market value closest to the sample firm in the month before the offer date. I also require that the matching firms have data available in both the CRSP database and the TAQ database for the period from 250 trading days before to 250 trading days after the offer date.

2.3.3 Variable Definitions

2.3.3.1 Measures of the Liquidity

To measure the liquidity of issuing stocks, I employ four sets of variables: quote, trade, ratio, and price impact measures. Some of these measures require intraday data. I filter the trade and quote data in a way similar to Lipson and Mortal (2006). Only BBO (best bid or offer)-eligible primary market quotes are used. Trades out of sequence, trades recorded before the opening or after the closing time, and trades with special settlement conditions are excluded. Furthermore, the first trade after the opening time is ignored in order to minimize the after-hour liquidity effect. Finally, to minimize the errors in the TAQ database, I require quotes and trades that satisfy the following conditions: (1) prices are non-negative; (2) quotes are positive on either bid or ask sides; (3) bid-ask spreads are non-negative and less than or equal to $5; (4) quote changes from the last quotes are less than or equal to 50%, trade price changes from the last prices are less than or equal to 50%, trade prices deviate from the quoted mid-points by less than or equal to 50%. I then apply the five-second rule proposed by Lee and Ready (1991) to merge the quote and trade data.

The quote measures include the following commonly seen variables:

1. Effective Spread: This is measured by absolute value of the difference between the trade price and the mid-point of the effective bid-ask quotes.[28]
2. Relative Effective Spread: I scale the effective spread by the trading price to obtain the relative version of the effective spread.
3. Depth: This is the average number of shares offered at the ask prices and the number of shares offered at the bid prices over all quotations during a day.

The trade measures consist of the variables that are related to trading:

1. Daily number of trades: This is the number of eligible trades counted during a day.
2. Average Trade Size: I use the daily average of the number of shares traded over all trades which occur during regular trading hours.
3. Annual Turnover: This is calculated as the ratio of daily trading volume to the number of shares outstanding multiplied by 250. [29,30]

[28] In the unreported results, I also examine quoted spread and relative quoted spread. Because many transactions actually take place inside the quoted spread, the quoted spread may overstate the real transaction cost incurred in a single trade. I present the more meaningful effective spread.

The ratio measures consist of the Amivest liquidity ratio and the illiquidity ratio proposed by Amihud (2002). The liquidity ratio is calculated as the daily volume divided by the absolute return. This measure comes from the intuition that in a liquid market, a large trading volume should result in a small price change. Similarly, the illiquidity ratio is computed as the ratio of the absolute return to the reported dollar volume. It captures the absolute return impact of a cumulative unsigned volume.

To estimate the price impact measures, I follow the methodology proposed by Sadka (2004).[31] Sadka's model, which is based on Glosten and Harris (1988), is adjusted for large trades. π_p and π_t stand for the permanent price impact and the transitory price impact respectively. The former measures informational costs of trading, while the latter measures non-informational costs such as costs of inventory and order processing.

Hasbrouck (2004) samples all these measures and calculates the correlations between them. He finds that the correlations between the quote and trade measures are relatively high, whereas the correlations between the price impact measures and other measures are low and hard to interpret. Therefore, he concludes that these measures may capture different aspects of liquidity. These measures can also be grouped in the following way: effective spreads represent the direct costs, price impact measures represent the indirect costs, and trading variables measure the speed of trading activities.

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[29] Since the sample includes NYSE, AMEX and Nasdaq firms, I follow previous studies to reconcile the difference between dealer markets and auction markets by dividing Nasdaq trading volume by two.

[30] The number of shares outstanding from the CRSP database (item SHROUT) is updated at best quarterly. Therefore, in order to get the shares outstanding as timely as possible, I use SHROUT(-1), the number of shares outstanding from the CRSP database on the trading day one day ahead of the event date, plus the primary shares offered from the SDC database, as the number of shares outstanding after the event date.

[31] Please refer to Appendix D for computing the price impact measures.

2.3.3.2 Other Variables

To test the second hypothesis, I employ a proxy for underwriter reputation and a proxy for underwriting effort. The underwriter reputation is constructed by following the approach in Megginson and Weiss (1991) and Butler, Grullon, and Weston (2005a) who use the market share of offerings completed by an underwriter within a certain year. First, I pull out the principal value issued by each underwriter from the entire SDC new issues database. Market share for each underwriter is calculated as the total principal value issued by each underwriter divided by the total principal amount of issues in that year. Issues that have multiple underwriters are allocated evenly to each underwriter. Therefore, an underwriter with a larger market share is more reputable.

Loderer, Peterson and Sheehan (1997) use underwriter gross spread as a measure of underwriting effort. However, the gross spread may be associated with other observable firm or deal characteristics related to the change in liquidity, but not to underwriting effort. For example, it has been widely documented that underwriter spread is negatively related to offer size (e.g. Smith, 1977; Eckbo and Masulis, 1991). Furthermore, Altinkilic and Hansen (2000) show that underwriters demand higher spreads for smaller and riskier issuers. Finally, Kim, Palia, and Saunders (2004) find that less profitable firms incur higher spreads in SEO deals. To eliminate these factors and get a cleaner measure of underwriting effort, I first run the regression of underwriter spread on the corresponding variables and use the residual as a measure of underwriting effort. The regression equation is specified as follows:

$$\text{UnderwriterSpread} = \alpha_0 + \alpha_1\text{OfferSize} + \alpha_2\text{FirmSize} + \alpha_3\text{ReturnVolatility} + \alpha_4\text{Profitability} + \varepsilon$$ [32]

[32] Offer size is the log of the proceeds. Firm size is measured as the log of market capitalization one day before the offering. Return volatility is the standard deviation of stock return in the pre-offering period.

I examine three characteristics of analyst forecasts around the issues: the number of analysts following the issuing firm, forecast accuracy, and forecast dispersion. I use analyst forecasts for the quarterly earnings in the IBES summary history database to obtain forecast accuracy and forecast dispersion. The accuracy measure is computed as the mean quarterly earnings surprise for the year before and the year after the offer date. The quarterly earnings surprise is the absolute value of the difference between the median earnings estimate and the actual earnings per share, normalized by the stock price at the end of the fiscal quarter.[33] The dispersion measure is computed as the average of the standard deviation of outstanding earnings forecasts over the last four quarters before the offer date and the next four quarters after the offer date. It is also normalized by the stock price. The last measure of analyst forecast, analyst following, is obtained from the IBES detailed database. For each issuing firm, I calculate the number of analysts that issue forecasts in the year before and the year after the offer date.

In addition, I examine some firm and deal characteristics that may be related to liquidity changes as control variables, namely, changes in the number of market makers, changes in the number of shareholders, and offer size. If there are more market makers dealing a stock, costs are likely to be lower as the competition among market markers intensifies. Moreover, an increase in the number of shareholders may lead to more trading, and improve the liquidity consequently. Finally, larger offer size can also be associated with greater increases in liquidity, because larger offer tends to attract new investors and induce more trading as more new shares flow into the market.

Profitability is calculated as the ratio of operating income (Compustat Item 13) over total assets (Compustat Item 6). Underwriting effort is estimated by UnderwriterSpread-(8.096-0.474*OfferSize-0.253*FirmSize+12.881*ReturnVolatility-0.003*Profitability). The regression results indicate all coefficients are statistically significant at 1% level. The adjusted-R^2 is 0.64.

[33] For robustness check, I use alternative normalizations based on the earnings and the book value of equity.

The final set of control variables are the common determinants of liquidity. There has been extensive literature on the determinants of the bid-ask spread. Although no agreement has been reached as to what constitutes the correct model, some important variables stand out. The most recent study by Stoll (2000) demonstrates that market value, stock price, trading volume, and return volatility of the stock are important factors that determine liquidity. Therefore, I consider in the regression analysis the change measures of these variables computed as the percentage change from the average pre-offering level to the average post-offering level.

2.4 Empirical Results

2.4.1 Changes in Liquidity

2.4.1.1 Statistical Significance

In order to show whether the liquidity of stocks changes significantly after their firms' new equity offerings, I run t-tests that compare the pre-event liquidity with the post-event liquidity for both the issuing firms and the matching firms.[34] The t-tests on the difference measures and the ratio measures are also conducted to see whether changes for the issuing firms differ significantly from changes for the matching firms. Results are detailed in Table 2.3.

Panel A of Table 2.3 reports t-test results for the SEOs and their matching sample. For nearly all the liquidity measures, except depth and average trade size, the tests for the SEO sample demonstrate significant increase in liquidity from the pre-event period to the

[34] The unreported Wilcoxon tests produce similar results as the t-tests.

post-event period.[35] By contrast, the tests for the matching sample do not exhibit much improvement in the liquidity measures, except for effective spread and the non-informational component of price impact π_t. There is even some evidence that liquidity worsens for the matching sample, as reflected in the decreasing average trade size and turnover rate. Notably, test results from the difference measures and the ratio measures show that compared to the matching sample, the liquidity of SEO stocks improves significantly in terms of relative effective spread, daily trade number, average trade size, turnover rate, and illiquidity ratio. For example, the average daily trade number of the SEO stocks increases by roughly 100 trades per day after the public offering, while that for the matching sample declines by about 10. Conversely, the average trade size for the SEO stocks stays at about the same level after the offering, but for the matching sample, the average trade size falls sharply by about 180 shares or 10%. Together, both of these results suggest that there is more trading for the SEO stocks after new shares flow into the market. The fact that effective spread and price impact measures decrease at about similar magnitude for the matching firms may reflect the market trend of declining bid-ask spreads over the sample period.[36] The fact that depth does not change much for both the SEO stocks and the matching stocks is perhaps due to the standardized quoting scheme in practice. In summary, controlling for market trends, the stocks of the SEO firms seem to experience favorable changes in liquidity.

Panel B of Table 2.3 reports the results for the private placement stocks and their matching sample. Compared to the SEO sample, the stocks of the firms that place private

[35] To save some space, only the results on illiquidity ratio are reported. The results on Amivest liquidity ratio are qualitatively the same.
[36] NYSE and Nasdaq implemented decimalization in 2001, which cut down on bid-ask spreads significantly (see e.g., Chakravarty, Wood and Van Ness, 2004).

equities seem to be less liquid. For example, in both the pre-event period and the post-event period, average relative effective spreads of the private placement stocks are more than twice those of the SEO stocks, while depths of the private placement stocks are much smaller.[37] Their investors tend to trade much less, but in slightly larger sizes. Consequently, annualized turnover rates are lower, but illiquidity ratios are higher for the private placement stocks. Finally, the private placement stocks have larger temporary impacts (π_t) than the SEO stocks. However, permanent price impacts (π_p) are smaller for the private placement stocks, which is inconsistent with other liquidity measures. Further, if π_p stands for costs of information, private placement stocks with larger information asymmetry should have larger π_p. I do not have a good explanation for this puzzling result.

As for changes in the liquidity measures around private placements, the t-tests provide very weak evidence that liquidity may improve slightly. There is an increase in the daily trade number and a drop in the transitory price impact at 5% significance level. However, the rest of the liquidity measures do not seem to change significantly. For the matching sample, there is no evidence at all that liquidity changes.[38] The t-tests on the ratio measure of Amihud's illiquidity ratio and the difference measure of daily trade number suggest that private placements may have some favorable influence on the trading of stocks in the secondary equity market.[39]

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[37] Note that the average effective spreads are slightly smaller for the private placement sample. This may be due to the fact that private placement stocks have lower price in general, as is manifested in the larger relative effective spreads.

[38] This result may be partly due to a small sample size, and partly due to no market-wide changes in liquidity during the sample period. Note that the private placement sample begins in 1994 and ends in 1997.

[39] There seems to be a sharp contrast between the results of the SEO sample and the private placement sample, with the caveat that the two samples are different in terms of both firm characteristics and the time periods they cover.

2.4.1.2 Economic Significance

To address the economic significance of the change in liquidity around the equity issuance, I analyze the annual savings that the reduction in spreads can bring to investors. The daily saving is calculated as the multiplication of the average daily volume and the decrease in the average effective spread. I then multiply the daily saving by 250, assuming 250 trading days in one year. If the average effective spread increases after the SEO, it actually leads to an annual cost. For the sample of 1,278 stocks, investors can save 0.7 million on average as a result of reduction in effective spreads, and 0.9 million if measured by bid-ask quotes. However, investors do not save more by investing in SEO stocks relative to matching stocks.

The enhancement in liquidity can benefit firms as well, in the form of lower cost of capital, which in turn will lead to higher stock price and the total market value. In the framework of Amihud and Mendelson (1986), the required compensation for a 1.5% (the mean relative effective spread before the SEO) is about 0.21*1.5%≈0.32% per month, and the required compensation for a 1% (the mean relative effective spread after the SEO) is about 0.21*1%=0.21%. Assume the stock distributes $1 dividend and the required net return is 1% per month, the simple dividend model suggests that stock price increases from $76 to $83, by more than 9%. This shows that companies can gain substantially with even a small increase in liquidity. Unlike SEO firms, matching firms may not see substantial increase in their stock prices as the average relative effective spread for the matching sample stays at about the same level.

2.4.2 Changes in Some Firm Characteristics

In Table 2.4, I investigate several important firm characteristics related to liquidity, including the number of analysts (analyst following), the number of market makers (applied to Nasdaq stocks only), and the number of shareholders. As in the previous section, four sets of t-tests are conducted to see whether these firm characteristics change from the pre-event period to the post-event period. Results are consistent with those found in the previous section. Sharp contrasts exist between SEO stocks and private placement stocks. For the SEO sample, the number of analysts grows significantly from an average of six analysts to about eight; the number of market makers increases from 13 to 17, and the number of shareholders expands by about one third.[40] These firm characteristics for the matching sample, however, do not seem to experience any substantial changes in both statistical terms and economic terms. Neither do private placement stocks nor their matching sample go through significant changes, except for a marginally significant (at 10% level) increase in the number of shareholders for the private placement sample.

2.4.3 What Determines Changes in Liquidity?

In this section, I conduct the regression analyses on the determinants of changes in liquidity around SEOs. The regression models are specified as follows:

[40] In unreported results, analyst forecast accuracy and forecast dispersion do not change much. The reason that analyst forecasts do not become more accurate or more agreeable to each other may be due to greater uncertainty around the time of SEOs. Therefore, the quality of information does not improve. Alternatively, analysts may be subject to the conflicts of interest and bias their forecasts more favorably to attract new investors, as shown in prior literature (e.g. Lin and McNichols, 1998; Michaely and Womack, 1999).

$$\Delta \text{RESPREAD} = \alpha_0 + \alpha_1 \text{AnalystFollowing} + \alpha_2 \text{UnderwriterReputation} + \alpha_3 \text{UnderwritingEffort} + \sum_{k=4}^{K} \alpha_k \text{ControlVariable}_k + \varepsilon$$

$$\Delta \pi_p = \beta_0 + \beta_1 \text{AnalystFollowing} + \beta_2 \text{UnderwriterReputation} + \beta_3 \text{UnderwritingEffort} + \sum_{k=4}^{K} \beta_k \text{ControlVariable}_k + \mu$$

$$\Delta \pi_t = \gamma_0 + \gamma_1 \text{AnalystFollowing} + \gamma_2 \text{UnderwriterReputation} + \gamma_3 \text{UnderwritingEffort} + \sum_{k=4}^{K} \gamma_k \text{ControlVariable}_k + \eta$$

The dependent variables in the three regression models are changes in the relative effective spread (Δ*RESPREAD*), changes in the permanent price impact ($\Delta\pi_p$), and changes in the temporary price impact ($\Delta\pi_t$) respectively. These change variables are calculated as the difference between the pre-event level and the post-event level divided by the pre-event level, so that positive values mean enhancement in liquidity. The independent variables include three interest variables: *Analyst Following* measured by the number of analysts following the issuer in the year prior to the issue,[41] *Underwriter Reputation* as individual underwriter's market share, and the estimated *Underwriting Effort*. Besides these three interest variables, I add several control variables into the regression models: changes in the number of market makers (Δ*MaketMakers*, applied to Nasdaq stocks only), changes in the number of shareholders (Δ*Shareholders*), *Offer Size*, changes in market value, changes in price, changes in return volatility and changes in trading volume.[42] The change variables are computed as percentage change from pre-event level to the post-event level. To eliminate extreme outliers, I winsorize all the variables at 1% level. Finally, year dummies are added into the regressions to control for variations over time.

[41] I use industry-mean and industry-median adjusted analyst following for robustness checks. The main results remain qualitatively same.

[42] The offer size used in table 4 is calculated as shares offered divided by shares outstanding on day (-1). The results hold when I use the alternative size measure, i.e., proceeds divided by the market value on day (-1).

2.4.3.1 Correlation between the Liquidity Change Measures and the Interest Variables

Before running the regressions, I first investigate the Pearson Correlation between the dependent variables and the interest variables. Because of the aforementioned reasons and the potential differences existing between Nasdaq stocks and NYSE&AMEX stocks, I separate them out. As shown in Table 2.5, the liquidity measures are highly positively correlated in both of the sub samples. For Nasdaq stocks, the correlation between the change in the relative effective spread and the change in permanent price impact is slightly higher than the correlation between the change in the relative effective spread and the change in temporary price impact (Pearson Correlation Coefficients equal to 0.70 and 0.69 respectively). On the contrary, for NYSE and AMEX, Δ*RESPREAD* is less correlated with $\Delta\pi_p$ than $\Delta\pi_t$ (Pearson Correlation Coefficients equal to 0.34 and 0.41 respectively). This may imply that transaction costs on Nasdaq are driven almost equally by permanent and temporary price impacts, while temporary price impact induced by inventory costs and order processing costs consist of a larger portion of transaction costs on NYSE and AMEX. Unlike stocks listed on NYSE and AMEX, many Nasdaq stocks tend to be small and growth stocks that suffer severe information asymmetry, therefore it is likely that information cost represented by permanent price impact plays a more important role.

Among the interest variables, the estimated *Underwriting Effort* seems to be highly positively correlated with the three liquidity change measures for stocks listed on all three exchanges, suggesting that liquidity will improve more if underwriters put more effort in promoting the issuing stocks. By contrast, though *Analyst Following* and

Underwriter Reputation are significantly correlated with the liquidity change variables for Nasdaq stocks, the correlation coefficients are reduced considerably in the case of NYSE&AMEX stocks. They are insignificantly related to the change in effective spreads. While the correlation between *Analyst Following* and the change in permanent price impact $\Delta\pi_p$ is still significant, the correlation between *Analyst Following* and the change in temporary price impact $\Delta\pi_t$ is rather weak. The simple correlation analysis also indicates that the importance of *Underwriter Reputation* in certifying the issuing stock is attenuated on NYSE and AMEX markets.

2.4.3.2 Regression Analyses

I now turn to the regression analyses. Table 2.6 presents the regression results. Note that two sets of regressions are run separately for Nasdaq stocks and NYSE/AMEX stocks because of different model specifications. Looking at the Nasdaq regressions, we see that analysts participate actively in making the stocks more liquid after the equity offering, consistent with the cross-sectional findings in Brennan and Tamarowski (2000). Specifically, the coefficients in all three regressions are significantly positive. However, the numbers are small. For example, one more analyst following the issuer leads to only 0.31% increase in the reduction of relative spreads, and 2.84% and 0.75% increase in the reduction of the permanent and temporary price impacts respectively. Along with analysts, underwriters also play a role of due diligence in facilitating sales of new shares. In particular, *Underwriting Effort* is positively associated with increases in liquidity, and the coefficients are large and all significant at 1% level. A 1% increase in the residual underwriter spread results in 12% more reduction of relative spreads. Results indicate that investment bankers exert strenuous efforts in marketing underwritten stocks, which verifies the evidence in Loderer, Peterson, and Sheehan (1997). Moreover, underwriting effort also has great impact on the change of price impact measures. A 1% increase in the estimated underwriter spread is associated with 46% and 15% more reduction in the permanent and temporary impacts respectively.[43] In sharp contrast, prestigious underwriters do not seem to help reduce the spread or ease the price impacts of Nasdaq issuing stocks.

Interestingly, the coefficients on Δ*Market Makers* in all three regressions are significantly positive, while the coefficients on ΔShareholders are insignificant except for the case of changes in the temporary price impact. The findings are consistent with Loderer et al's evidence on changes in quoted spreads, suggesting that more market makers dealing with the issuing stock lead to subsequently higher competition and lower transaction costs. However, increases in the number of shareholders do not lead to any favorable change in liquidity. The last row in Table 2.6 reports the adjusted R^2. The independent variables together explain 68% of changes in the spread and 55% of changes in the temporary impact, while they account for only 25% of changes in the permanent impact. Therefore, a significant portion of changes in permanent impact remain unexplained.

With respect to NYSE and AMEX stocks, I find that the role of analysts is weakened in making these issuing stocks more liquid. In particular, the coefficients on *Analyst Following* become less significant. Moreover, they are of smaller magnitude than those in the Nasdaq regressions, which suggests that analysts exert less influence on

[43] As a robustness check, I also obtain the standardized estimates which stand for the relative change of the dependent variable for a one standard deviation change of the independent variable. The standardized estimates on *Underwriting Effort* remain substantially larger than *Analyst Following* in all three cases.

cutting back both the direct transaction costs and the indirect price impacts of NYSE and AMEX issuing stocks. *Underwriting Effort* is still significantly associated with changes in all three liquidity measures at 1% level. The coefficients remain largest among all the interest variables. However, it decreases substantially from 12 to 5 in the first regression of $\Delta RESPREAD$, from 46 to 34 in the regression of $\Delta\pi_p$ and from 15 to 7 in the regression of $\Delta\pi_t$, implying that the importance of underwriting effort is also attenuated for NYSE and AMEX issuing stocks. This may be due to the fact that stocks listed on the major exchanges tend to be large and good-quality stocks that require fewer boosts from analysts and underwriters. Notably, the coefficients on *Underwriter Reputation* become all significantly positive in this set of regressions. Their economic effects are at the same level as those of *Analyst Following*. Taken together, the results indicate that prestigious underwriters may be actively involved in assisting NYSE and AMEX firms in cutting down their spreads and alleviating the price impacts. Finally, larger offer size weakens the reduction in spreads and the price impacts, inconsistent with the notion that larger floating shares induce trading and increase liquidity.

In summary, underwriting effort has the strongest influence on improving stocks' liquidity around the time of SEOs, as reflected by its large and positive effect on changes of both relative effective spreads and price impacts. With smaller magnitude, more analysts following the issuing firm also help disseminate information, boost trading, and improve liquidity subsequently. However, the economic effect of underwriting effort and analyst following is diminished considerably for stocks listed on NYSE and AMEX. By contrast, the certifying role of underwriter reputation seems to be more important for NYSE and AMEX issuing stocks.

2.5 Conclusions

This paper demonstrates that the stock of an SEO firm becomes more liquid in the year after the public offering, whereas the stock of a firm that just sold shares to private parties does not exhibit any significant change in liquidity around the event, either in terms of transaction costs or in terms of price impacts. Compared to the SEO sample, the private placement stocks are on average less liquid and their investors tend to trade less frequently, although their trades are larger in size. In addition, I find that the number of analysts following an SEO stock increases after the offering, yet the quality of analyst forecasts does not get better. The gain in liquidity is accompanied with considerable growth in the number of market makers for Nasdaq stocks, and the number of shareholders.

Results from the regression analysis attest to the importance of underwriters' effort in assisting cutback of the bid-ask spread and attenuation of the price impacts after SEOs. Additionally, there is clear evidence that analysts do a great job on Nasdaq in assisting firms to improve their stocks' liquidity and reduce their direct and indirect transaction costs. For stocks listed on NYSE and AMEX, analysts' influence becomes less significant. By contrast, the regression analysis shows that liquidity improves more for NYSE and AMEX stocks underwritten by more prestigious investment banks, while for stocks listed on Nasdaq, the presence of prestigious investment banks does not seem to promote the floatation of additional shares.

Table 2.1 Descriptive Statistics: the Sample of SEOs

The sample of SEOs is from 1994 to 2002. Panel A presents the sample by year, classified into three groups: pure primary offerings, pure secondary offerings, and both primary and secondary (combined) offerings. Panel B contains the industry distribution of the sample. Panel C shows the summary statistics. *Proceeds* is the amount of proceeds from SEOs denominated in million US dollars. *Shares Offered* is the number of shares issued in SEOs in millions. *Market Value* and *Shares Outstanding* are measured on the day before the public offering.

Panel A: SEO Sample by Year

Year	Primary	Secondary	Combined	Total	%
1994	51	29	44	124	10
1995	80	25	69	174	14
1996	83	26	80	189	15
1997	71	30	100	201	16
1998	33	27	51	111	9
1999	52	17	47	116	9
2000	59	10	49	118	9
2001	39	26	52	117	9
2002	67	25	36	128	10
Total	535	215	528	1278	100

Panel B: SEO Sample by Indusry

Industry	SEO	%
Chemical	143	11
Durable Goods	47	4
Manufacturing	330	26
Nodurable Goods	54	4
Oil	80	6
Retail	359	28
Telecom	83	6
Other	182	14
Total	1278	100

Panel C: Summary Statistics

Variable	Mean	Median	Q1	Q3	Std Dev
Proceeds($million)	123.0	66.6	41.4	117.7	209.1
Shares Offered (million share)	5.4	3.1	2.3	5.0	9.7
Proceeds/Market Value (%)	26.9	20.9	12.6	30.4	43.6
Shares Offered/Shares Outstanding (%)	27.7	21.5	12.9	31.3	44.9
Market Value($million)	1,070	345	163	752	4,033

Table 2.2 Descriptive Statistics: the Sample of Private Placements

The sample of private placements is from 1994 to1997. Panel A presents the sample by year. Panel B contains the industry distribution. Panel C shows the summary statistics. *Proceeds* is the amount of proceeds raised by private placements denominated in million US dollars. *Shares Offered* is the number of shares sold in private placements in millions. *Market Value* and *Shares Outstanding* are measured on the day before the private placement.

Panel A: Private Placements by Year

Year	PP	%
1994	28	27
1995	26	25
1996	22	21
1997	29	28
Total	105	100

Panel B: Private Placements by Industry

Industry	PP	%
Chemical	24	23
Durable Goods	1	1
Manufacturing	37	35
Nodurable Goods	4	4
Oil	1	1
Retail	14	13
Telecom	5	5
Other	19	18
Total	105	100

Panel B: Summary Statistics

Variable	Mean	Median	Q1	Q3	Std Dev
Proceeds($million)	9.6	6.2	2.4	9.9	19.4
Shares Offered (million share)	1.7	1.2	0.8	1.9	2.3
Proceeds/Market Value (%)	14.0	10.6	7.1	16.6	11.8
Shares Offered/Shares Outstanding (%)	17.3	13.0	8.5	20.0	13.5
Market Value($million)	75.7	42.8	27.1	83.1	93.3

Table 2.3 Changes of Liquidity Measures around SEOs and Private Placements

This table compares the liquidity measures in the pre-event period (-250, -3) with those in the post-event period (3, 250) for the issuing firms and the matching samples. Panel A examines the sample of SEOs, and Panel B examines the sample of private placements. The liquidity measures include *effective spread, relative effective spread, depth, daily trade number, average trade size, turnover, illiquidity ratio*, and *price impact measures* π_p and π_t. π_p and π_t are estimated over five 50-day periods. Other measures are daily measures. The mean values are computed cross-sectionally after the time series of the variables are first averaged over the two event periods. The means for the issuing sample are given in the first row and the means for the matching sample are given in the second row. t tests on the difference between the pre-event period and the post-event period are conducted for the issuing firms, the matching sample, the difference series and the ratio series. t statistics are given in the last column. ***,**,* represent significance levels of 1%, 5% and 10% respectively.

Panel A: SEOs and Matching Sample (N=1,278)

Variable		Pre-event Period [-250, -3]	Post-event Period [3, 250]	t
Effective Spread	SEO	0.23	0.20	-5.79***
	Match	0.21	0.18	-3.67***
	Difference			-1.24
	Ratio			-0.24
Relative Effective Spread (%)	SEO	1.53	1.06	-12.32***
	Match	1.41	1.40	-0.20
	Difference			-11.87***
	Ratio			-10.84***
Depth	SEO	2,155	2,158	0.02
	Match	2,288	2,367	0.44
	Difference			-0.35
	Ratio			1.09
Daily Trade Number	SEO	147	246	6.36***
	Match	210	197	-0.61
	Difference			5.33***
	Ratio			4.20***
Average Trade Size	SEO	1,645	1,618	-0.61
	Match	1,610	1,430	-4.79***
	Difference			3.21***
	Ratio			2.92***
Turnover	SEO	1.14	1.56	8.92***
	Match	1.11	1.00	-2.71***
	Difference			9.06***
	Ratio			1.78*
Illiquidity Ratio	SEO	0.29	0.08	-9.09***
	Match	0.25	0.31	1.60
	Difference			-6.45***
	Ratio			-7.70***
$\pi_p(x10^2)$	SEO	1.41	1.24	-3.09***
	Match	1.21	1.09	-1.61
	Difference			-0.65
	Ratio			-1.39
$\pi_t(x10)$	SEO	1.03	0.85	-5.70***
	Match	0.93	0.79	-4.35***
	Difference			-1.04
	Ratio			-1.02

Panel B: Private Placements and Matching Sample (N=105)				
Variable		Pre-event Period [-250, -3]	Post-event Period [3, 250]	t
Effective Spread	PP	0.22	0.19	-1.57
	Match	0.27	0.25	-1.01
	Difference			-0.23
	Ratio			0.68
Relative Effective Spread (%)	PP	4.12	3.79	-0.90
	Match	4.15	4.49	0.66
	Difference			-1.45
	Ratio			-1.27
Depth	PP	1,375	1,487	0.41
	Match	1,292	1,337	0.20
	Difference			0.33
	Ratio			0.37
Daily Trade Number	PP	35	52	2.39**
	Match	34	34	-0.01
	Difference			1.69*
	Ratio			1.33
Average Trade Size	PP	1,929	1,851	-0.67
	Match	1,899	1,759	-0.93
	Difference			0.35
	Ratio			0.08
Turnover	PP	0.93	1.05	1.19
	Match	0.81	0.74	-0.86
	Difference			1.55
	Ratio			1.41
Illiquidity Ratio	PP	2.12	2.81	0.74
	Match	2.38	3.07	0.85
	Difference			-0.00
	Ratio			-2.05**
$\pi_p(x10^2)$	PP	0.81	0.82	0.08
	Match	0.88	0.86	-0.07
	Difference			0.13
	Ratio			1.43
$\pi_t(x10)$	PP	1.11	0.92	-2.01**
	Match	1.32	1.15	-1.46
	Difference			-0.20
	Ratio			0.40

Table 2.4 Changes of Some Firm Characteristics around SEOs and Private Placements

This table compares some of the firm characteristics in the pre-event period (-250, 3) with those in the post-event period (3, 250) for the issuing firms and the matching samples. Panel A examines the sample of SEOs, and Panel B examines the sample of private placements. The firm characteristics include *analyst following* (number of analysts following the firm*), number of market makers and number of shareholders*. Analyst data are obtained from IBES. Number of market makers and number of shareholders are from CRSP and Compustat respectively. The means for the issuing sample are given in the first row and the means for the matching sample are given in the second row. t tests on the difference between the pre-event period and the post-event period are conducted for the issuing firms, the matching sample, the difference series and the ratio series. t statistics are given in the last column.

Panel A: SEOs and Matching Sample (N=1,278)

Variable		Pre-event Period [-250, -3]	Post-event Period [3, 250]	t
Analyst Following	SEO	6	8	5.79***
	Match	9	9	0.15
	Difference			5.26***
	Ratio			4.73***
Number of Market Makers	SEO	13	17	8.01***
	Match	15	15	0.99
	Difference			6.06***
	Ratio			4.98***
Number of Shareholders (in millions)	SEO	3.36	4.41	2.30**
	Match	5.48	6.02	0.93
	Difference			1.21
	Ratio			2.45***

Panel B: Private Placements and Matching Sample (N=105)

Variable		Pre-event Period [-250, -3]	Post-event Period [3, 250]	t
Analyst Following	PP	3	4	1.27
	Match	3	4	0.23
	Difference			1.42
	Ratio			0.77
Number of Market Makers	PP	13	14	1.11
	Match	12	12	-0.25
	Difference			0.97
	Ratio			1.03
Number of Shareholders (in millions)	PP	1.22	3.07	1.65*
	Match	3.80	5.05	0.60
	Difference			0.91
	Ratio			-0.04

***,**,* represent significance levels of 1%, 5% and 10% respectively.

Table 2.5 Correlation between the Liquidity Change Measures and the Interest Variables

This table reports the Pearson Correlation Coefficients between the liquidity change measures and the variables of interest. The liquidity change measures include changes in the relative effective spread (Δ*RESPREAD*), and changes in the permanent and temporary price impacts ($\Delta\pi_p$, $\Delta\pi_t$). These change variables are measured as the difference between the pre-event level and the post-event level relative to the pre-event level, of which positive values indicate an increase in liquidity. The variables of interest include *Analyst Following* measured as the number of analysts following the firm in the year right before the SEO, *Underwriter Reputation* measured as the percentage market share of an individual underwriter; and the estimated *Underwriter Effort* as the residual from the regression $\text{UnderwriterSpread} = \alpha_0 + \alpha_1\text{OfferSize} + \alpha_2\text{FirmSize} + \alpha_3\text{ReturnVolatility} + \alpha_4\text{Profitability} + \varepsilon$. Panel A consists of 828 stocks listed on Nasdaq, and Panel B contains 450 stocks listed on NYSE and AMEX. P-values are reported in the parentheses.

Panel A: Nasdaq (N=828)

	ΔRESPREAD	$\Delta\pi_p$	$\Delta\pi_t$	Analyst Following	Underwriter Reputation	Underwriting Effort
ΔRESPREAD	1	0.7043	0.6864	0.1652	0.1730	0.4573
		(0.0000)	(0.0000)	(0.0004)	(0.0002)	(0.0000)
$\Delta\pi_p$		1	0.6894	0.1574	0.2295	0.5092
			(0.0000)	(0.0008)	(0.0000)	(0.0000)
$\Delta\pi_t$			1	0.1619	0.1884	0.4066
				(0.0006)	(0.0000)	(0.0000)
Analyst Following				1	0.2412	0.0982
					(0.0000)	(0.0374)
Underwriter Reputation					1	0.2455
						(0.0000)
Underwriting Effort						1

Panel B: NYSE&AMEX (N=450)

	ΔRESPREAD	$\Delta\pi_p$	$\Delta\pi_t$	Analyst Following	Underwriter Reputation	Underwriting Effort
ΔRESPREAD	1	0.3387	0.4135	-0.0134	-0.0189	0.4169
		(0.0000)	(0.0000)	(0.6995)	(0.5874)	(0.0000)
$\Delta\pi_p$		1	0.5298	0.0980	0.0633	0.3680
			(0.0000)	(0.0048)	(0.0687)	(0.0000)
$\Delta\pi_t$			1	0.0542	0.0594	0.3359
				(0.1194)	(0.0874)	(0.0000)
Analyst Following				1	0.2199	0.0376
					(0.0000)	(0.2799)
Underwriter Reputation					1	0.0890
						(0.0104)
Underwriting Effort						1

Table 2.6 Determinants of Liquidity Changes around SEOs: Regression Analysis

This table presents the regression results. The dependent variables are changes in the relative effective spread (Δ*RESPREAD*), and changes in the permanent and temporary price impacts ($\Delta\pi_p$, $\Delta\pi_t$). These change variables are measured as the difference between the pre-event level and the post-event level relative to the pre-event level, of which positive values indicate an increase in liquidity. The independent variables include *Analyst Following* measured as the number of analysts following the firm in the year right before the SEO, *Underwriter Reputation* measured as the percentage market share of an individual underwriter; and the estimated *Underwriter Effort* as the residual from the regression $\text{UnderwriterSpread} = \alpha_0 + \alpha_1\text{OfferSize} + \alpha_2\text{FirmSize} + \alpha_3\text{ReturnVolatility} + \alpha_4\text{Profitability} + \varepsilon$. The control variables include changes in the number of market makers (Δ*Market Makers*), changes in the number of shareholders (Δ*Shareholders*), *Offer Size* measured as proceeds divided by market value on day (-1), changes in firm size (Δ*Market Value*), changes in price (Δ*Price*), changes in return volatility (Δ*Return Volatility*), and changes in trading volume (Δ*Volume*). These change variables are measured as percentage change from the pre-event level to the post-event level. Year dummies are also included in the regression. 828 stocks are from Nasdaq, and 450 stocks are from NYSE or AMEX. The regressions for NYSE and AMEX firms exclude ΔMarket Makers. t-statistics are given in the parentheses.

	Nasdaq (N=828)			NYSE&AMEX (N=450)		
	ΔRESPREAD	$\Delta\pi_p$	$\Delta\pi_t$	ΔRESPREAD	$\Delta\pi_p$	$\Delta\pi_t$
Intercept	16.68***	-56.12***	18.11***	20.41***	1.44	18.57***
	(5.23)	(-3.62)	(4.26)	(5.72)	(0.09)	(3.19)
Analyst Following	0.31*	2.84***	0.75***	0.23*	1.04	0.38*
	(1.73)	(3.22)	(3.10)	(1.65)	(1.56)	(1.65)
Underwriter Reputation	-0.06	-0.59	-0.04	0.47**	2.33**	0.77**
	(-0.38)	(-0.75)	(-0.16)	(2.21)	(2.35)	(2.25)
Underwriting Effort	12.27***	46.49***	15.26***	4.87***	33.56***	6.91***
	(11.96)	(9.33)	(11.15)	(3.91)	(5.73)	(3.39)
Δ Market Makers	0.26***	0.41***	0.38***			
	(12.32)	(3.94)	(13.28)			
Δ Shareholders†	-0.07	-0.32	-0.20**	0.07	0.02	0.08
	(-1.01)	(-0.97)	(-2.27)	(0.72)	(0.05)	(0.47)
Offer Size	-0.06	0.14	0.02	-0.10*	-0.81***	-0.21**
	(-1.10)	(0.56)	(0.23)	(-1.84)	(-3.19)	(-2.38)
Δ Market Value	-0.00	-0.05	0.01	0.03	0.24	0.06
	(-0.18)	(-0.44)	(0.20)	(0.76)	(1.41)	(1.08)
Δ Price	0.29***	-0.13	-0.26***	0.57***	0.32	0.30***
	(8.23)	(-0.74)	(-5.48)	(10.28)	(1.22)	(3.27)
Δ Return Volatility	-0.33***	0.03	-0.19***	-0.20***	-0.21	0.08*
	(-12.95)	(0.28)	(-5.53)	(-6.60)	(-1.47)	(1.70)
Δ Volume	0.03***	0.11***	0.02***	0.05***	0.29***	0.00
	(4.60)	(3.24)	(2.67)	(4.51)	(5.97)	(0.06)
adj. R^2	0.68	0.25	0.55	0.75	0.43	0.44

***,**,* represent the significance level of 1%, 5%, and 10% respectively.

† The coefficients on Δ Shareholders have been multiplied by 100.

Appendix A Variable Definitions

Firm Characteristics

Market Value = data25*data199

Sales Growth = (data12-lag(data12))/lag(data12)

Capital Expenditure Growth = (data128-lag(data128))/lag(data128)

Cash Ratio = data1/data6

Debt Ratio = (data9+data34)/data6

Deal Characteristics

Offer Size = Proceeds in millions

%Primary Shares = Primary shares / Total Shares offered

Underwriter Spread = Gross Spread from SDC

Underpricing = (Closing price on offer day - Offer price) / Offer price

Pre-issue Return (-365,-1) = Cumulative beta-adj. abnormal return from 365 days to one day before the offering

Post-issue Return (1,365) = Cumulative beta-adj. abnormal return from one day to 365 days after the offering

Issue-day Return (-1,1) = Cumulative abnormal return from one day before the offering to one day after

Filing-day Return (-1,1) = Cumulative abnormal return from one day before the filing day to one day after

*Abnormal return is measured by the individual stock return subtracted by the beta-decile or size-decile return in CRSP.

Note: Data# are obtained from Compustat Annual Database. Data# are different in Compustat Quarterly Database.

Appendix B Likelihood Function

Let d_i denote the multiplicity of SEOs at t_i; that is, d_i is the size of the set D_i of firms that issue equity at t_i, $i = 1,2, \ldots ,k$. Let R_i denote the set of firms that have not issued until t_i, $R_i^* = R_i \backslash D_i$ denote the set of firms that have not issued until t_i, neither at t_i. Let $S_l(t)$ be the survival function of the survival time T_l of the lth unit. The proportional hazard model yields $S_l(t) = S(t)^{w_l}$, where $w_l = e^{\beta' X(t)}$.

The probability that all units in D_i issue equity before those in R_i^* is $\Pr\left(\max_{l \in D_i} T_l < \min_{l \in R_i^*} T_l\right)$. Let the cumulative distribution function of $\max_{l \in D_i} T_l$ denoted by $G_1(t)$, and the cumulative distribution of $\min_{l \in R_i^*} T_l$ denoted by $G_2(t)$,

$$\Pr\left(\max_{l \in D_i} T_l < \min_{l \in R_i^*} T_l\right) = \int_0^t G_1(t) dG_2(t),$$

where

$$G_1(t) = \Pr\left(\max_{l \in D_i} T_l < t\right) = \prod_{l \in Di}\left(1 - S_l(t)\right) = \prod_{l \in Di}\left(1 - S(t)^{w_l}\right), \text{ and}$$

$$G_2(t) = \Pr\left(\min_{l \in R_i^*} T_l < t\right) = 1 - \prod_{l \in R_i^*} S_l(t) = 1 - \prod_{l \in R_i^*} S(t)^{w_l}.$$

Furthermore, using two substitutions $S(t)^{\sum_{l \in R_i^*} w_l} = e^{-u}$ and $\lambda_{ij} = \dfrac{w_j}{\sum_{l \in R_i^*} w_l}$,

$$\Pr\left(\max_{l \in D_i} T_l < \min_{l \in R_i^*} T_l\right) = \int_0^t \prod_{j \in D_i}\left\{1 - e^{-\lambda_{ij} t}\right\} e^{-t} dt.$$

Therefore, the ith term in the partial likelihood can be written as[44]

$$L_i(\beta) = \int_0^\infty \prod_{l \in D_i} \left[1 - \exp\left(-\frac{e^{\beta' X_l(t_i)}}{\sum_{j \in R_i^*} e^{\beta' X_j(t_i)}} t \right) \right] e^{-t} dt \,.$$

When d_i is small, this can be approximated by[45]

$$L_i(\beta) = \frac{e^{\beta' \sum_{l \in D_i} X_l(t_i)}}{\left[\sum_{j \in R_i} e^{\beta' X_j(t_i)} \right]^{d_i}} \,.$$

The corresponding partial likelihood function is

$$L(\beta) = \prod_{i=1}^{k} \frac{e^{\beta' \sum_{l \in D_i} X_l(t_i)}}{\left[\sum_{j \in R_i} e^{\beta' X_j(t_i)} \right]^{d_i}} \,.$$

Kalbfleisch and Prentice (2002) provide detailed expositions on the estimation procedure.

[44] DeLong, Guirguis, and So (1994) derive this computationally feasible expression.
[45] This approximation is referred to as Breslow approximation, first proposed in Breslow (1974).

Appendix C Life-Table Method

The life-table estimates are computed by counting the numbers of censored and uncensored observations that fall into each of the time intervals $[t_{i-1},t_i)$, $i = 1,2, \ldots ,k+1$, where $t_0=0$ and $t_{k+1}=\infty$. Let n_i be the number of units entering the interval $[t_{i-1},t_i)$, let d_i be the number of events occurring in the interval, and let w_i be the number of units censored in the interval. The conditional probability of an event in $[t_{i-1},t_i)$ is estimated by

$\hat{q}_i = \dfrac{d_i}{n_i - w_i/2}$, and its estimated standard error is $\hat{\sigma}(\hat{q}_i) = \sqrt{\dfrac{\hat{q}_i(1-\hat{q}_i)}{n_i - w_i/2}}$.

The estimate of the survival function at t_i is

$$\hat{S}(t_i) = 1 \text{ if } i = 0,\ \hat{S}(t_i) = \prod_{j=1}^{i-1}(1-\hat{q}_j) \text{ if } i > 0,$$

and its estimated standard error is

$$\hat{\sigma}\left(\hat{S}(t_i)\right) = \hat{S}(t_i)\sqrt{\sum_{j=1}^{i-1}\frac{\hat{q}_j}{(n_j - w_j/2)(1-\hat{q}_j)}}\,.$$

Let t_{mi} denote the midpoint of $[t_{i-1},t_i)$. The estimated hazard function at t_{mi} is

$$\hat{h}(t_{mi}) = \frac{2\hat{q}_i}{(t_i - t_{i-1})(2-\hat{q}_i)},$$

and its estimated standard error is

$$\hat{\sigma}\left(\hat{h}(t_{mi})\right) = \hat{h}(t_{mi})\sqrt{\frac{1-\left((t_i - t_{i-1})\hat{h}(t_{mi})/2\right)^2}{(n_i - w_i/2)\hat{q}_i}}\,.$$

Appendix D Price Impact Measures

To estimate the price impact, Sadka (2004) formulates the following procedure:

First, use a standard autoregressive process with five lags to get the order flow innovations ($\varepsilon_{\lambda,t}$), and then estimate the conditional expected sign of the order flow assuming a Markov chain model. The autoregressive process is specified as follows:

$$DV_t = \eta_0 + \sum_{j=1}^{5} \eta_j DV_{t-j} + \varepsilon_{\lambda,t}$$

where DV_t is the signed trade size, calculated as the product of the sign of the trade D_t and the size of the order flow V_t. The expected sign of the order flow is calculated as

$$E_{t-1}\left[D_t\right] = 1 - 2\Phi\left(E_{t-1}\left[DV_t\right] / \sigma_\varepsilon\right)$$

The unexpected sign is therefore $D_t - E_{t-1}[D_t]$, denoted as $\varepsilon_{\psi,t}$. Finally, use OLS to estimate the price impact function specified as follows:

$$\Delta p_t = \psi \varepsilon_{\psi,t} + \lambda \varepsilon_{\lambda,t} + \overline{\psi} \Delta D_t + \overline{\lambda} \Delta DV_t + y_t$$

After accounting for the non-linearity of price impact induced by large trades, the estimation function becomes

$$\Delta p_t = \psi \varepsilon_{\psi,t} + \lambda \varepsilon_{\lambda,t} + K_t \psi^k \varepsilon_{\psi,t} + K_t \lambda^k \varepsilon_{\lambda,t} + \overline{\psi} \Delta D_t + \overline{\lambda} \Delta DV_t + \overline{\psi}^k \Delta KD_t + \overline{\lambda}^k \Delta KDV_t + y_t$$

where K_t is the dummy variable set to 1 for trades equal or greater than 10,000 shares, and zero otherwise.[46] Estimator ψ represents the permanent fixed effect, $\overline{\psi}$ represents the transitory fixed effect, λ is the permanent variable cost, $\overline{\lambda}$ is the transitory variable cost. As Sadka pointed out, permanent price effects (ψ, λ) measure the informational costs of

[46] Sadka (2004) justifies the specification of the price impact function by the following argument: "my own experiments along with other studies…lead me to believe that the non-linearity of price impacts is mainly due to large trades."

trading, while transitory price effects ($\overline{\psi}$, $\overline{\lambda}$) measure the non-informational costs such as costs of inventory and order processing. The informational costs and the non-informational costs are thus calculated respectively as

$$\pi_p = \psi + \lambda \times Size$$
$$\pi_t = \overline{\psi} + \overline{\lambda} \times Size$$

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