SEO Timing, the Cost of Equity Capital, and Liquidity Risk

Ji-Chai Lin
Louisiana State University
filin@lsu.edu

YiLin Wu
National Taiwan University
yilinwu@ntu.edu.tw

Abstract: We use a parsimonious asset pricing model to capture time-varying risks surrounding seasoned equity offerings (SEOs) to shed further light on the debate of what causes the ability of firms to time SEOs to periods that are followed by low stock returns. Our results show that (1) managers do not know when the lowest cost of equity capital would occur until it passes, but they promptly file for SEOs right after it does; (2) the pre-filing decline in the cost of equity capital is largely due to market-wide improvements in risks and an additional decrease in SEO firms' liquidity risk; (3) their cost of equity capital rebounds but remains relatively low at issuance and thereafter for two to three years, largely due to liquidity risk staying low, relative to comparable non-issuers; (4) controlling for market risk and liquidity risk is sufficient to show no abnormal returns in the post-issue period; and (5) the SEO announcement return is less negative and investors demand a lower offer price discount on issuing firms that experience more post-issue liquidity risk reduction. Our findings are inconsistent with the behavioral explanation that managers time SEOs to exploit market inefficiency, and the investment-based explanation that SEOs allow issuing firms to convert growth options into assets in place, thus reducing their post-issue systematic risks. Rather, our findings suggest that, to minimize the cost of equity capital, issuing firms wait to file SEOs until market conditions and their liquidity environment have improved so that investors have minimal concerns of risks when buying their shares at SEOs.

Comments welcome

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Abstract

We use a parsimonious asset pricing model to capture time-varying risks surrounding seasoned equity offerings (SEOs) to shed further light on the debate of what causes the ability of firms to time SEOs to periods that are followed by low stock returns. Our results show that (1) managers do not know when the lowest cost of equity capital would occur until it passes, but they promptly file for SEOs right after it does; (2) the pre-filing decline in the cost of equity capital is largely due to market-wide improvements in risks and an additional decrease in SEO firms' liquidity risk; (3) their cost of equity capital rebounds but remains relatively low at issuance and thereafter for two to three years, largely due to liquidity risk staying low, relative to comparable non-issuers; (4) controlling for market risk and liquidity risk is sufficient to show no abnormal returns in the post-issue period; and (5) the SEO announcement return is less negative and investors demand a lower offer price discount on issuing firms that experience more post-issue liquidity risk reduction. Our findings are inconsistent with the behavioral explanation that managers time SEOs to exploit market inefficiency, and the investment-based explanation that SEOs allow issuing firms to convert growth options into assets in place, thus reducing their post-issue systematic risks. Rather, our findings suggest that, to minimize the cost of equity capital, issuing firms wait to file SEOs until market conditions and their liquidity environment have improved so that investors have minimal concerns of risks when buying their shares at SEOs.

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1. Introduction

It is well known that firms tend to issue equity when their stock prices are high, and that their long-run post-issue stock returns tend to be low. Loughran and Ritter (1995), Baker and Wurgler (2002), and Baker and Stein (2004) argue that these stylized facts imply that firms exploit a "window of opportunity" by selling shares at a seasoned equity offering (SEO) when their shares are overvalued, which is followed by market corrections. This behavioral explanation suggests that (1) equity markets can be inefficient; (2) managers have the ability to time SEOs to take advantage of temporary overpricing; and (3) the markets correct the mispricing over the long run, resulting in long-run post-issue underperformance.

As we will review the literature in section 2, many studies have challenged this behavioral explanation and proposed risk-based and investment-based explanations.[1] Eckbo, Masulis, and Norli (2007) survey existing studies and conclude that "The debate about what causes the apparent ability of firms to time their equity issues to periods that are followed by low market returns is still inconclusive." In this study we add to this debate by providing compelling evidence in contrast to the behavioral explanation and the investment-based explanation, and synthesizing our findings and analyses from existing studies to offer an alternative, rational explanation for the pattern of SEO timing and low post-issue stock returns.

Using Liu's (2006) liquidity-augmented CAPM (LCAPM), a parsimonious and seemingly powerful model,[2] to capture time-varying systematic risks, we show that (1) issuing firms' cost of equity capital steadily declines to the lowest point prior to SEO filing and then

[1] Eckbo, Masulis, and Norli (2000) suggest that SEOs reduce issuing firms' financial leverage. Brav, Geczy, and Gompers (2000) argue that low post-issue stock returns are related to size, B/M, and momentum effects; In addition, Eckbo and Norli (2005) suggest that SEOs also lead to lower liquidity risk. Carlson, Fisher, and Giammarino (2006) and Lyandres, Sun, and Zhang (2008) contend that SEOs allow issuing firms to convert (high risk) growth options into (relatively low risk) assets in place.

[2] We have also experimented with the asset pricing models with liquidity risk proposed by Pastor and Stambaugh (2003) and Acharya and Pedersen (2005). We choose Liu's (2006) LCAPM for its parsimonious property (with only two risk factors) and explanatory power in explaining the cross section of stock returns, as Liu (2006) demonstrates.

rebounds in the filing month, suggesting that managers do not know when the lowest cost of equity capital would occur until it passes, but they promptly file for SEOs right after it does; (2) the pre-filing decline in the cost of equity capital is largely due to market-wide improvements in risks and an additional decrease in SEO firms' liquidity risk, suggesting that both market conditions and issuing firms' liquidity environment are important factors for SEO filing decisions; (3) issuing firms' cost of equity capital rebounds but remains relatively low at issuance and thereafter for two to three years, largely due to liquidity risk staying low, compared to their matched non-issuers; (4) controlling for market risk and liquidity risk is sufficient to show no abnormal returns in the post-issue period, implying that equity markets are efficient in pricing issuing firms' shares;[3] and (5) the markets react less negatively to SEO announcements by (and investors demand less offering price discounts on) issuing firms that exhibit more liquidity risk reduction.[4]

Our analysis suggests that liquidity risk reduction during the SEO process is attributable in part to good pre-filing stock performance, more analyst coverage, and an increased presence of institutional investors prior to SEO filing.[5] These factors contribute to attract more investors to issuing firms, and make them more transparent and enhance their investor recognition (Merton (1987)). Consequently, issuing firms are less sensitive to shocks to market liquidity, which lead investors to require a lower liquidity risk premium at and after the SEOs.

[3] Consistent with our finding, Eckbo, Masulis, and Norli (2000), Brav, Geczy, and Gompers (2000), Eckbo and Norli (2005), and Lyandres, Sun, and Zhang (2008) use models with four or five risk factors and find no post-issue underperformance. Nevertheless, our study suggests that Liu's (2006) two factors seem sufficient in explaining the dynamics of asset pricing during the SEO process.

[4] Since information asymmetry and information quality are important elements of the liquidity environment, our finding is consistent with Lee and Masulis (2009), who show that as the quality of issuing firms' financial accounting improves, SEO underwriting spreads and the negative announcement return decrease.

[5] Chemmanur, He and Hu (2009) show that institutional investors are better informed and play an information production role, instead of a manipulative trading role, during the SEO process.

As DeAngelo, DeAngelo, and Stulz (2010) point out, firms conduct SEOs mainly to resolve a near-term need for capital because "most issuers would have run out of cash by the year after the SEO had they not received the offer proceeds." Amihud, Mendelson, and Pedersen (2005) survey the literature and summarize the evidence that liquidity and liquidity risk are important determinants of security value; and thus Amihud and Mendelson (1988) argue that, to maximize current shareholder wealth, managers should take stock liquidity into consideration when making corporate financing decisions. Furthermore, Butler, Grullon, and Weston (2005) find that the cost of raising equity capital (total investment banking fees) is significantly lower for firms with more liquid stocks. Thus, based on our findings and the analyses of the above studies, we posit that, given that they have a need for capital, issuing firms wait to file SEOs until market conditions and their liquidity environment have improved so that investors have minimal concerns of risks when buying their shares at SEOs.

We compare and contrast our SEO timing hypothesis to existing theories in section 2. Section 3 describes our selection of SEO sample firms and their matched firms and section 4 discusses our methods in dealing with time-varying risks. Section 5 presents our main results. Section 6 identifies potential factors that may cause SEO firms to have lower liquidity risk. Section 7 addresses whether equity markets price the liquidity risk reduction in SEO announcement returns and in offering price discounts. Finally, section 8 contains our concluding remarks.

2. Hypothesis and literature review

We hypothesize that issuing firms wait to file SEOs until market conditions and their liquidity environment have improved so that investors have minimal concerns of risks when

buying their shares at SEOs. This SEO timing hypothesis emphasizes that, instead of exploiting market inefficiency, managers learn from the markets to time their SEOs in order to minimize the rate of return required by investors at offerings. Our hypothesis links SEO timing and issuing firms' low post-issue stock returns to the dynamics of their cost of equity capital.

Closely related to our hypothesis is Pástor and Veronesi (2005), who develop a model of optimal IPO timing to tie IPO waves to improvements in market conditions and declines in expected market returns. In line with their model, our hypothesis suggests that firms time their SEOs in response to time variation in market conditions as well. However, unlike IPO firms, which have yet to establish their liquidity environment, our hypothesis posits that SEO firms also consider improvements in their liquidity environment in SEO timing.

Also closely related to our study is Eckbo and Norli (2005), who show that, along with the Fama-French (1993) three factors and Carhart's (1997) momentum factor,[6] liquidity risk also plays a part in determining post-issue stock returns. Basically, they suggest that SEOs lead to more share turnovers and result in lower liquidity risk in the post-issue period. We extend their findings to show that declines in liquidity risk start well before equity issuance, and our hypothesis suggests that the liquidity risk improvement is an important condition that leads to SEOs.

Our SEO timing hypothesis is complementary to the adverse selection theories of Korajczyk, Lucas, and McDonald (1991), Choe, Masulis, and Nanda (1993), and Bayless and Chaplinsky (1996). Korajczyk et al. (1991) argue that firms time their SEOs after information releases, such as earnings and dividend announcements, because they reduce information asymmetry. Low information asymmetry mitigates the adverse selection problem, and results in

[6] Brav, Geczy, and Gompers (2000) show that SEO firm returns can be priced by Fama-French three factors plus Carhart's (1997) momentum factor.

less severe price drops at SEO announcements. Choe, Masulis and Nanda (1993) suggest that firms tend to issue SEOs during economic expansions in which announcing SEOs has a less adverse selection effect on stock price. Bayless and Chaplinsky (1996) present evidence that SEO announcement effects tend to be lower in hot markets than in cold markets, and suggest that equity offerings cluster in periods in which firms could issue equity at favorable terms. Thus, these three studies generally argue that firms time SEOs to minimize SEO announcement effects due to adverse selection.

The focus of our study differs from theirs—while also examining whether improvements in liquidity risk during the SEO process provide additional benefit to issuing firms in mitigating negative announcement effects, our analysis focuses on the dynamics of issuing firms' cost of equity capital embedded in their stock prices before, at, and after SEOs, which leads us to hypothesize that firms time SEOs to minimize the required rate of return on new equity raised.[7] Thus, our hypothesis deals with the issue of maximizing the SEO offering price, rather than merely minimizing the extent of stock price drop at the SEO announcement.

It is conceivable that, in periods with lower information asymmetry, issuing firms' liquidity risk would be lower as well. However, contrary to Easley and O'Hara's (2004) assertion that investors require higher returns on stocks with more information asymmetry, Duarte and Young (2009) show that it is liquidity effects unrelated to information asymmetry that help explain the cross-section of expected stock returns. Thus, our hypothesis based on minimizing the required rate of return seems more direct and sensible in explaining SEO timing and low post-issue expected stock returns than one based on minimizing information asymmetry.

[7] Holding cash flows constant, minimizing the required rate of return is equivalent to maximize the stock price level, which is not the same as minimizing the price drop at SEO announcements suggested by the adverse selection models.

Lucas and McDonald (1990) model equity issuance decisions and argue that if waiting is not costly and if projects are long-lived, undervalued firms would delay an offering until the undervaluation is corrected; but firms with temporarily overpriced stocks would issue equity immediately, as in Myers and Majluf (1984). Unlike their models in which managers use their private information to take advantage of new investors in SEO timing, our hypothesis suggests that firms time SEOs to periods in which new investors have minimal concerns of risks, including buying overvalued stocks. Furthermore, as we will show, inconsistent with their models, there is virtually no overvaluation at issuance and no market corrections afterwards.

Eckbo, Masulis, and Norli (2000) argue that an equity offering lowers the firm's financial leverage, which reduces its stock's sensitivities to macroeconomic risks and reduces its stock's expected return as well. While their hypothesis focuses on risk reduction induced by SEOs, our timing hypothesis emphasizes risk reduction before SEO filing as an important condition for SEOs. Furthermore, if changes in leverage induced by SEOs have any effect, they should affect market risk as well. However, inconsistent with their hypothesis, our analyses in section 5 reveal that issuing firms and their matched non-issuers have qualitatively the same market betas before and after SEOs.

Carlson, Fisher, and Giammarino (2006) and Lyandres, Sun, and Zhang (2008) argue that SEOs allow issuing firms to finance investments that convert growth options into assets in place. Since these new assets are less risky than the options they replace, they predict that the risks and expected returns of SEO firms must decrease in the post-issue period. However, to the extent that market betas reflect asset risk of SEO firms, our finding of no significant differences in market betas between SEO firms and comparable non-issuing firms implies that no discernible changes in asset risk accompany the SEOs. Furthermore, we add the investment factor proposed by

Lyandres et al. (2008) to Liu's LCAPM, and find that including their investment factor does not change our inferences on market betas and liquidity betas and that there are no changes in investment betas following SEOs.[8] Recently, Li and Zhang (2010) similarly show that liquidity factor dominates investment factor in explaining expected stock returns. Thus, our findings suggest that the investment-based hypothesis cannot explain SEO timing and low post-issue stock returns.

Lease, Masulis, and Page (1991) study the effects of SEOs on stock liquidity and find that trading volume increases and bid-ask spread decreases following the SEOs, suggesting that SEOs improve stock liquidity. Similarly, Denis and Kadlec (1994) report that "equity offerings are associated with significant increases in share turnover, number of trades per day, and the fraction of days with trades." Eckbo, Masulis, and Norli (2000) and Eckbo and Norli (2005) also observe significant increases in share turnover after the SEOs. While it is understandable that a public offering that significantly increases the firm's shares outstanding and expands its investor base could lead to post-issue increases in trading and improvements in liquidity, what amazes us from examining both Amihud's (2002) price impact measure and Liu's (2006) non-trading illiquidity measure from three years before to three years after SEOs is that improvements in the issuing firms' liquidity largely occur before the SEO filing. Our findings are consistent with Tripathy and Rao (1992), who observe declines in bid-ask spreads of Nasdaq SEO firms in the pre-announcement period and suggest that resolution of information asymmetry (due to information-gathering efforts of Nasdaq dealers during the underwriting process) begins well before the SEO announcement date.

[8] Loughran and Ritter (1997) report that SEO firms have a similar level of (capital expenditures + R&D)/assets in the years preceding and after SEOs, suggesting no time-varying investments surrounding SEOs.

Furthermore, we find that while the issuing firms' stock liquidity continues to improve from the filing month to the offering month and then stabilizes afterwards, their liquidity risk (after a steady decline) starts to reverse and turn higher in the filing month. The rebound in liquidity risk suggests that investors appear to heighten their sensitivity to shocks to market liquidity (as reflected in stock prices) once firms announce SEOs, even though they add additional trading (and thus more liquidity) at and after the offering.

In sum, our hypothesis contributes a simple answer to the issue (raised by Eckbo, Masulis, and Norli (2007)) of what causes the apparent ability of SEO firms to time their equity issues to periods that are followed by low market returns: the ability of issuing firms (and their underwriters) to wait to issue SEOs until market conditions and their liquidity environment have improved.

Our hypothesis is different from the behavioral explanation that firms time SEOs to exploit market inefficiency (and earn positive alphas), as proposed by Loughran and Ritter (1995), Baker and Wurgler (2002), and Baker and Stein (2004). Instead of timing alphas, our hypothesis argues that, in markets with time-varying risks, issuing firms time betas (i.e., time their SEOs to periods of low betas) to obtain equity capital with a low required rate of return. In the sections that follow, we will explain how we reach this inference, starting from the data we use in analysis.

3. Data

3.1. Selection of sample and control firms

We describe our sample selection process as follows. To be included in our initial SEO sample, a firm must: (1) have a firm commitment, non-shelf registered offering undertaken

during the sample period from January 1982 to December 2006, and have a non-missing filing date in the Thomson SDC Platinum database, (2) have four-digit SIC codes outside the intervals 6000–6999 (financial companies),[9] (3) be listed on the NYSE, Nasdaq, or Amex, and have data for at least 24 monthly returns available on the CRSP files during the three-year period prior to SEO filing and at least 24 monthly returns during the three-year period after SEO issuance, (4) be incorporated in the U.S. according to Compustat, and (5) offer only pure primary or combinations of primary and secondary issuances, but pure secondary offerings are excluded.[10] This procedure creates an initial sample of 5,374 SEOs over the 1982–2006 period.

To assess whether the timing opportunities and the lower post-issue abnormal stock returns are unique to SEO firms, we create a control sample of comparable, non-issuing firms. Like Brav, Geczy, and Gompers (2000) and Gibson, Safieddine, and Sonti (2004), we match each SEO issuer with a non-issuing firm that has a similar size (equity market capitalization), return momentum, and book-to-market equity ratio prior to the SEO announcement date. In addition, Eckbo, Masulis, and Norli (2000) show that SEO issuers exhibit higher stock liquidity than risk-matched non-issuers before and after SEOs. Butler, Grullon, and Weston (2005) show that the cost of raising equity capital is inversely related to stock liquidity. Amihud, Mendelson, and Pedersen (2005) suggest that stock illiquidity raises the required rate of returns. Thus, we also take stock liquidity into consideration in selecting a matched firm for each SEO firm.

Specifically, at the end of each quarter, starting from March 31, 1981 to December 31, 2006, we first sort all NYSE, Amex, and Nasdaq firms by their market equity into five size groups (the size breakpoints are the NYSE market equity quintiles in that quarter). Within each

[9] Similar to Brav, Geczy, and Gompers (2000), Eckbo, Masulis, and Norli (2000), and Lyandres, Sun, and Zhang (2008), we include utilities (SIC 4,910-4,949) in our sample.
[10] Here and throughout the paper, SEO proceeds refer to cash raised by the firm and not by stockholders who simultaneously sell shares.

size group, we further sort firms by their preceding six-month returns into five groups (the return breakpoints are NYSE return quintiles in that size group), resulting in a total of 25 portfolios. We calculate the preceding six-month return through the end of the month before quarter end. For sorting on six-month return momentum, we require that each firm has at least three monthly returns (out of the preceding six) available on CRSP. Then, within each size/momentum portfolio, firms are further sorted by their book-to-market equity ratio into five groups (again the breakpoints are NYSE BE/ME quintiles in that portfolio). Following Fama and French (1993), we compute BE/ME using ME at the end of the previous year and BE at the last fiscal year end in the previous year. This procedure forms 125 size/momentum/BM-sorted portfolios for each quarter.

Next, we match a non-issuing firm with each SEO issuer from the same size/momentum/BM portfolio as the SEO firm in the quarter prior to the SEO announcement. The matching criteria are that a non-issuing firm must: (1) have at least 24 monthly returns during the three years prior to the SEO filing and at least 24 monthly returns during the three years after the SEO issuance, (2) not have any SEO during the event period from three years before the SEO filing to three years after the SEO issuance (since we measure three years of pre-filing and post-issuance stock performance), (3) have not been selected as a matched firm for any other sample firm during the event period (to avoid possible bias in test statistics due to dependence from the same matched firm), and (4) have a pre-SEO liquidity measure, *PreLM12*, closest to that of the SEO firm. The *PreLM12* is Liu's (2006) liquidity measure: the standardized turnover-adjusted number of days with zero trading volume over a 12-month period estimated over months -18 to -7. We find significant liquidity improvements prior to the SEO filing, particularly over months -6 to -1, which is the reason for this time frame. By using this

procedure, we are able to individually match 5,312 SEOs, or 98.8% of the SEOs in the initial sample, with a non-duplicate control firm. Finally, to avoid unduly influences of low-price stocks on illiquidity and liquidity risk and to avoid other potential problems associated with low-priced stocks (Kothari and Warner (2007)), we eliminate 174 firms with an offer price of less than three dollars.[11] Thus, our final sample consists of 5,138 SEOs over the 1982-2006 period.[12]

3.2. Sample firm characteristics

Table 1 reports summary statistics of firm characteristics for our SEO sample and control sample prior to SEO filing. The average issuing firm has a firm size (market value of equity) of about $1.5 billion, a B/M (ratio of book equity to market equity) of 0.64, and a stock price of $23.01 per share. Consistent with the SEO literature, the firm has a significant stock price run-up of 43.3% over a six month period prior to the SEO filing. On average (and on the median), their firm size, B/M, stock liquidity, and stock price level are similar to those of their counterparts. While issuing firms have a higher pre-filing average six-month stock return, the median of their differences is insignificantly different from zero. Thus, our matching procedure performs quite well in selecting non-issuers with firm characteristics comparable to those of issuing firms.[13]

Table 2 reports summary statistics of offering characteristics. In terms of offering size, the average SEO gross proceeds are $111.9 million, which represent about 42.0% of the book value of assets measured at the previous fiscal year end, and the average block size accounts for

[11] The results of including low-priced stocks (not reported) are similar to the results presented in this paper and are available upon request.
[12] There are 5,138 SEOs conducted by 3,046 industrial firms. Among them, 1,943 firms (63.8%) have one SEO, 627 firms (20.6%) have two SEOs, and 476 firms (15.6%) have more than two SEOs over the 1982–2006 period.
[13] More importantly, as we will show in section 5, the matched non-issuers also have a very similar risk profile as that of issuing firms before SEO filing. The matched firms thus provide a good benchmark for us to assess whether SEOs are associated with changes in risks for issuing firms. If they are, the post-issue risk profile of SEO firms should differ from that of their matched firms.

14.2% of the outstanding shares. The mean offer price is $24.9, which is close to 2.3 times of per share book value of assets at the previous fiscal year end. The average investment banking fee is around 5.4% of the gross proceeds and the average (Winsorized) offering price discount is 3.5%,[14] relative to the closing price on the day before the offering. In our sample, the sum of mean (median) investment banking fees and the offering price discount is about 8.9% (7.4%). Thus, in line with previous empirical studies, our data also show that SEO flotation costs are non-trivial. The mean (median) number of days between the SEO filing date and the actual issuing date is about 115 (35) days for our sample of SEOs.

The main focus of our paper is on the embedded cost of equity capital in the stock price at and after the SEOs. The cost of equity capital should be determined by the firms' systematic risks, which could be time-varying. In addition, we also examine whether changes in systematic risks can affect the secondary market's reaction to the SEO announcements and investors' demand in the primary market for the offering price discount. We turn next to our methods for capturing time-varying risks.

4. Methodology

Eckbo, Masulis, and Norli (2000, 2007), Brav, Geczy, and Gompers (2000), Eckbo and Norli (2005), and Lyandres, Sun, and Zhang (2008) have used various factor models to explain post-issue stock returns. In general, they find that the Fama-French three factor model is inadequate, but that extended models, adding Carhart's (1997) momentum factor, Pastor and Stambaugh's (2003) liquidity factor, Eckbo and Norli's (2005) turnover factor, and Lyandres,

[14] We Winsorize the offering price discounts of our sample SEOs at 1% and 99% to mitigate the problem associated with outliers. Without the Winsorization, the average price discount for an offering is 4.0%. See Altinkili and Hansen (2003) and Corwin (2003) for discussions on the SEO pricing discount. For example, Corwin (2003) reports that in the 1980's, the average SEO pricing discount is 1.15 percent, while in the 1990-1998, it averaged 2.92 percent. He observes a rise in the average discount of SEOs.

Sun, and Zhang's (2008) investment factor, produce zero abnormal returns. Their results suggest that there is no long-run underperformance following SEOs.

Further, Eckbo, Masulis, and Norli (2000) employ a model with six macro factors to illustrate that equity raised in SEOs lowers issuing firms' financial leverage and thus reduces their exposures to macroeconomic risks. Consistent with their hypothesis that lower systematic risks lead investors to require lower returns, they also find no abnormal returns in the post-issue period.

However, as Eckbo, Masulis, and Norli (2007) note, "the proper interpretation of the low long-run returns following security issuances remains an unsettled issue." To help resolve the issue, in this study we use a recently developed model, which is more parsimonious than the ones used by the previous studies mentioned above and seemingly powerful in explaining the cross section of stock returns. The model is Liu's (2006) liquidity-augmented CAPM (LCAPM), which has only two risk factors—market risk and liquidity risk. Consistent with recent research showing that liquidity risk plays an important role in asset pricing,[15] Liu (2006) demonstrates that the two-factor LCAPM can resolve asset pricing anomalies associated with firm size, book-to-market, cash-flow-to-price, earnings-to-price, dividend yield, and long-run contrarian investment. Furthermore, Lin, et al. (2010) show that Liu's LCAPM can also explain the neglected firm effect found by Arbel and Strebel (1982) and the price delay premium documented by Hou and Moskowitz (2005).

As we will show below, Liu's simple yet seemingly powerful model provides a foundation that allows us to measure abnormal returns and to pinpoint the time and the time span

[15] See, e.g., Amihud (2002), Eckbo and Norli (2002), Pastor and Stambaugh (2003), Acharya and Pedersen (2005), Eckbo and Norli (2005), Sadka (2006), Liu (2006), Bekaert, Harvey, and Lundblad (2007), Korajczyk and Sadka (2008), and Watanabe and Watanabe (2008).

of changes in the two systematic risks during the event period for both the SEO sample and the control sample, thus permitting us to differentiate SEO timing theories proposed in the extant literature. We next describe Liu's LCAPM.

4.1. Liu's liquidity-augmented CAPM

Liu (2006) argues that conventional liquidity measures, such as trading volume, share turnover, bid-ask spread, and the price-impact measures of Amihud (2002) and Pastor and Stambaugh (2003), have certain drawbacks.[16] He proposes a new liquidity measure, *LM12*, the standardized turnover-adjusted number of days with zero trading volume over the prior 12 months.[17] As Lin, Singh, and Yu (2009) note, Liu's *LM12* captures the notion that the greater incidence of no trading implies higher latent trading costs and that non-trading reflects illiquidity. In asset-pricing tests, Liu demonstrates that while it is highly correlated with conventional liquidity measures, *LM12* can better capture the liquidity premium in asset pricing.

To capture shocks to market liquidity, Liu constructs a liquidity factor, *LIQ*, as the return difference between a low-liquidity portfolio (containing stocks with high *LM12*) and a high-liquidity portfolio (containing stocks with low *LM12*). The construction is similar to Fama and

[16] Specifically, the conventional liquidity measures (1) fail to capture the multi-dimensional properties of liquidity, (2) do not reflect the illiquidity of non-trading, and (3) fail to take into consideration the endogeneity of the trading decision as a function of trading costs.

[17] Specifically, Liu (2006) formulates *LM12* as

$$LM12 = [\textit{Number of zero daily volumes in prior } 12 \textit{ months} + \frac{1/(12 - \textit{month turnover})}{\textit{Deflator}}] \times \frac{21 \times 12}{\textit{NoTD}},$$

where "12-month turnover" is the stock's turnover in the prior 12 months, calculated as the sum of daily turnover over the prior 12 months; daily turnover is the ratio of the number of shares traded on a day to the number of shares outstanding at the end of the day, *NoTD* is the total number of the trading days in the market over the prior 12 months, and *Deflator* is chosen such that $0 < \frac{1/(12 - \textit{month turnover})}{\textit{Deflator}} < 1$ for all sample stocks (for example, Liu chooses a deflator of 11,000 in constructing his *LM12*). Liu (2006) notes that "*LMx* uses the pure number of zero daily trading volumes over the prior x months to identify the least liquid stocks, but it relies on turnover to distinguish the most liquid among frequently traded stocks as classified by the pure number of zero trading volumes."

French's (1993) size factor (*SMB*), and B/M factor (*HML*). *LIQ* is significantly negatively correlated to the return on the CRSP value-weighted market portfolio, with a correlation close to -0.7. This suggests that large shocks to market illiquidity tend to be associated with large declines in the market index, which reflects the fact that liquidity could decline considerably or even disappear in bad markets. Consequently, investors require a higher liquidity risk premium in bad markets.

With *LIQ*, Liu (2006) develops the LCAPM in which the risk premium on stock *i* at time *t* can be expressed as

$$E(R_{i,t}) - r_{f,t} = \beta_{m,i}[E(R_{m,t}) - r_{f,t}] + \beta_{liq,i}E(LIQ_t),$$

where $E(R_{m,t})$ is the expected return of the market portfolio at time *t*; $E(LIQ_t)$ is the expected value of the mimicking liquidity factor, *LIQ*; and $\beta_{m,i}$ and $\beta_{liq,i}$ are firm *i*'s market and liquidity betas, respectively. Thus, only the two beta risks matter in determining stock *i*'s expected return.

4.2. Time-varying risks

The literature has shown that aggregate equity issuances tend to increase with market liquidity. While Bayless and Chaplinsky (1996) interpret the association as evidence that issuers time SEOs to periods with lower levels of asymmetric information, Baker and Stein (2004) view high market liquidity as a positive sentiment indicator. Eckbo, Masulis, and Norli (2000) and Eckbo and Norli (2005) show that share turnovers increase significantly following SEOs. These studies imply that liquidity is time-varying surrounding the SEO event, and that as information asymmetry decreases and turnover increases, issuing firms likely become less sensitive to shocks to market illiquidity.

Furthermore, Eckbo, Masulis, and Norli (2000) argue that equity capital raised in an SEO lowers the firm's financial leverage, which reduces its stock's sensitivities to systematic risks. Also, Carlson, Fisher, and Giammarino (2006) argue that an SEO can alter the firm's risks because the equity capital raised allows the firm to convert growth options into assets in place, which are less risky. These studies suggest that market risk of issuing firms likely becomes smaller as well.

The reasoning for time-varying risks raises important questions. If there are changes in issuing firms' risks, when do the changes occur, before or after the SEOs? Are the changes gradual or instantaneous upon the issuance? Can the changes in the cost of equity capital induced by changes in systematic risks be related to SEO timing and lower post-issue stock returns?

To address these questions, we apply Liu's (2006) LCAPM and use Ball and Kothari's (1989) estimation approach to infer changes in systematic risks surrounding SEOs. We construct the model in event month *t* as:

$$r_{it} - r_{ft} = \alpha_t + \beta_{m,t}(r_{mt,i} - r_{ft,i}) + \beta_{l,t} LIQ_{t,i} + \varepsilon_{it}, \text{ for } i=1, 2, \ldots, n, \quad (1)$$

where $r_{it} - r_{ft}$, $r_{mt,i} - r_{ft,i}$, and $LIQ_{t,i}$ are firm *i*'s excess return and its corresponding market excess return and market liquidity premium in event month *t*, respectively; and the parameters, α_t, $\beta_{m,t}$, and $\beta_{l,t}$, respectively, reflect the representative measures of abnormal return, market risk, and liquidity risk of the *n* sample firms in event month *t* over month -36 to month -1 prior to the SEO filing and month +1 to month +36 after the SEO issuance.

Notice that since different firms engage in an SEO at different calendar times, their corresponding market excess returns and market liquidity premiums are likely to be different across firms in event month *t*. Equation (1) assumes the *n* sample firms have a common

sensitivity to changes in market excess returns in event month *t*, which can be captured by their representative market beta, $\beta_{m,t}$, and a common sensitivity to changes in market liquidity premium, which can be captured by their representative liquidity beta, $\beta_{l,t}$. Under this assumption, in any given event month *t*, differences in excess returns due to systematic risks among the *n* sample firms can be explained by differences in their corresponding market excess return, $(r_{mt,i} - r_{ft,i})$, and market liquidity premium, $LIQ_{t,i}$. The error term, ε_{it}, in Eq. (1) reflects the idiosyncratic effects on firm *i*'s excess return in event month *t*.

The model in Eq. (1) allows us to infer SEO firms' (and separately their matched non-issuers') representative market risk, $\beta_{m,t}$, and representative liquidity risk, $\beta_{l,t}$, in each event month *t*. By estimating the model month by month, we would be able to see how issuing firms' systematic risks shift surrounding the SEO event, relative to their matched non-issuers.

In a similar vein, we compare the dynamics of SEO firms' systematic risks to those of their matched counterparts by estimating the following equation,

$$r_{it} - r_{bit} = \alpha_t + \beta_{m,t}(r_{mt,i} - r_{ft,i}) + \beta_{l,t} LIQ_{t,i} + \varepsilon_{it}, \text{ for } i=1, 2, \ldots, n, \quad (2)$$

where r_{it} is the return of firm *i* and r_{bit} the return of its matched firm in event month *t*. In Eq. (2), the parameters, α_t, $\beta_{m,t}$, and $\beta_{l,t}$, respectively, capture issuing firms' abnormal return, excess market risk, and excess liquidity risk, relative to their benchmarks, in event month *t*. We rely on the model in Eq. (2) to control for possible market-wide shifts in market risk and liquidity risk, which might not be related to SEOs. To see if SEO firms' performance differs from that of their matched firms in the post-issue period, we test whether the average of α_t from month +1 to month +36 after the SEO issuance (month 0) is significantly different from zero.

In addition to the models in Eq. (1) and (2), which allow us to examine the dynamics of SEO firms' common systematic risks during the SEO process, we also construct the following time-series model to examine changes in each individual firm *i*'s risks from before to after the SEOs:

$$r_{it} - r_{ft} = \alpha_{i,0} + \alpha_{i,1} D_t + (\beta_{im,0} + \beta_{im,1} D_t)(r_{mt,i} - r_{ft,i}) + (\beta_{il,0} + \beta_{il,1} D_t) LIQ_{t,i} + \varepsilon_{it}, \quad (3)$$

where $D_t = 1$ if *t* is in the post-SEO period, and $D_t = 0$ if *t* is in the pre-SEO period; $\beta_{im,0}$ and $\beta_{il,0}$ are firm *i*'s pre-SEO market risk and liquidity risk, respectively; $\beta_{im,1}$ and $\beta_{il,1}$ are the differences between its post- and pre-SEO market and liquidity risks, respectively; $\alpha_{i,0}$ is its pre-SEO abnormal return; and $\alpha_{i,1}$ is the difference between its post- and pre-SEO abnormal return. We run the model in Eq. (3) for each firm for *t* from month -36 to month -1 prior to the SEO filing and from month +1 to month +36 after the SEO issuance.

Like Eq. (2), to control for market-wide movements in risks, we use the match-adjusted returns in the time-series model below:

$$r_{it} - r_{bit} = \alpha_{i,0} + \alpha_{i,1} D_t + (\beta_{im,0} + \beta_{im,1} D_t)(r_{mt,i} - r_{ft,i}) + (\beta_{il,0} + \beta_{il,1} D_t) LIQ_{t,i} + \varepsilon_{it}. \quad (4)$$

To see if there is post-issue underperformance, we examine whether the average of $\alpha_{i,0} + \alpha_{i,1}$ across the SEO sample firms is significantly different from zero. In sum, the time-series models in Eq. (3) and (4) provide a robustness check on the estimation results from the cross-sectional models in Eq. (1) and (2).

5. Empirical results

5.1. Estimates of representative market beta, liquidity beta, and abnormal returns

Figure 1 depicts the month-by-month results from the estimation of Eq. (1) for the SEO firms and their matched firms in each event month during the pre-SEO period from month -36 to the SEO filing month and during the post-SEO period from the SEO issuance month to month +36. Table 3 presents statistical analyses on the estimates to assess whether there are significant shifts in systematic risks surrounding the SEOs. The figure and our tests indicate a number of results that could be related to SEO timing and post-issue stock performance.

First, Fig. 1 shows a steady decline in market beta starting from month -6 for both SEO firms and their matched firms. Specifically, Table 3 shows that the SEO firms' representative market beta is 1.107 in month -6, which then gradually falls to 0.744 in month -1 and to 0.797 in the filing month. We use Chow tests to examine whether the representative beta in any given event month during the pre-filing (post-offering) period is significantly different from that in the filing (offering) month. We also perform Chow tests to examine whether the beta estimate in the offering month is significantly different from that in the filing month. The tests show that issuing firms' representative market beta of 0.797 in the filing month is significantly lower than that in month -6 but is not significantly different from that in month -1. We also use the match-adjusted model in Eq. (2) to compare issuing firms' representative market risk to that of their matched firms, and Table 3 shows that, except for month -12, there are no significant differences between the two samples throughout the SEO process. This finding suggests that the pre-SEO decline in issuing firms' representative market betas is largely due to market-wide improvements in market risk (e.g., economic improvements could reduce business risk for SEO firms and for their

matched non-issuers as well). The movements in market risk provide a first hint that firms time their SEOs when investors generally require a lower market risk premium.

Second, SEO firms' representative market beta of 0.869 in the offering month is not significantly different from that in the filing month. After the offering, the representative market betas of SEO firms and their matched non-issuers fluctuate around their mean of 1.03 (specifically, 1.027 and 1.031, respectively, as reported in Panel A of Table 4). To see whether there is a difference in the average risk estimates between the pre- and the post-SEO periods, we regress the month-by-month market betas on a post-SEO dummy variable, which equals one for the post-offering months from month +1 to month +36 and zero for the pre-filing months from month -36 to month -1. The results, as reported in Panel B of Table 4, show that the pre-SEO average market risk is not significantly different from that of the post-SEO period for both the SEO firms and their matched firms. The results suggest that whatever causes SEO firms to have lower post-issue stock returns, it is not market risk.

Third, there is also evidence of a steady pre-filing decline in liquidity risk for both SEO firms and their matched non-issuers. The decline in liquidity risk starts around month -6, and SEO firms show a more significant decline than their matched firms. Panel B of Table 3 shows that the SEO firms' representative liquidity beta is 0.044 in month -6, which is significantly higher than their matched non-issuers' representative liquidity beta of -0.169 in that month. The SEO firms' representative liquidity beta then sharply declines to -0.647 a month prior to the SEO filing, much lower than their counterparts' decline to -0.270 in month -1. In the filing month, SEO firms' liquidity beta rebounds to -0.305, which is insignificantly different from their matched firms' liquidity beta of -0.385. It seems that a sharp decline and then a rebound in liquidity risk prompts issuing firms to file for SEOs.

Fourth, it is evident that after the offering, SEO firms face a significantly lower liquidity risk than their counterparts. Panel B of Table 3 shows that SEO firms' representative liquidity beta remains low at -0.286 in the offering month, and after which it fluctuates around the post-offering mean of -0.217, while their matched firms' representative liquidity beta gradually increases to the post-offering mean of -0.084, as reported in Panel A of Table 4. Panel C of Table 4 shows that SEO firms' average liquidity risk is lower during the post-SEO period, compared to the pre-SEO period. In contrast, there is no significant difference in the average liquidity beta between the pre- and the post-SEO period for the matched non-issuers. These results imply that of the two risks in Liu's (2006) LCAPM, liquidity risk is the one that causes post-issue expected stock returns for SEO firms to decrease.

Fifth, according to Fig. 1, SEO firms exhibit an impressive increase in abnormal returns prior to filing, which is consistent with the pre-SEO price run-up suggested in the literature. Because one of our matching criteria is pre-SEO return momentum, the matched firms also show significant abnormal returns, but to a lesser extent, during the pre-filing months. Intriguingly, SEO firms' abnormal returns abruptly decline toward zero in the filing month and further down to zero in the offering month. Thereafter, the estimates of alphas for both SEO firms and their matched non-issuers level off around zero. In fact, Panel A of Table 4 reports that the average monthly abnormal return during the three years after the SEOs is -0.056% and 0.027% for SEO firms and their matched firms, respectively. Both are not significantly different from zero. The small magnitude and non-significance of post-issue abnormal return from Liu's (2006) two-factor model are comparable to -0.05% (*p*-value of 0.749) by Eckbo, Masulis and Norli (2000) using a five-factor model; -0.03% (*p*-value of 0.812) by Eckbo and Norli (2005) using a five-factor model; and -0.08% (*t*-value of -0.72) by Lyandres, Sun, and Zhang (2008) using a four-

factor model. The results suggest that controlling for market and liquidity risks is sufficient to show that SEO firms have no post-issue underperformance.

Sixth, more importantly, Liu's (2006) model allows us to link both SEO timing and lower post-issue stock returns to the dynamics of issuing firms' cost of equity capital. We put together SEO firms' (and their matched non-issuers') representative market and liquidity betas in each event month from the model in Eq. (1) and estimate their representative cost of equity capital by annualizing the following expected monthly return in each event month *t*:

$$E(r_{it}) = r_{ft} + \beta_{m,t}E(r_{mt,i} - r_{ft,i}) + \beta_{l,t}E(LIQ_{t,i}).$$

To represent r_{ft}, $E(r_{mt,i} - r_{ft,i})$, and $E(LIQ_{t,i})$, we use the unconditional monthly means of r_{ft}, $r_{mt,i} - r_{ft,i}$, and $LIQ_{t,i}$ over the period 1964-2008, which are 0.463%, 0.368%, and 0.682%, respectively. Figure 2 illustrates that SEO timing associates with a decline in the cost of equity capital. Specifically, our estimations show that issuing firms' representative cost of equity capital declines from 11.3% per annum in month -6 to 3.6% per annum a month prior to filing, which then rebounds to 6.8% per annum in the filing month, and to 7.3% in the offering month. Like their liquidity beta, SEO firms' cost of equity capital remains low during the post-offering period, fluctuating around the post-offering mean of 8.6% per annum, which is lower than the 9.8% for their matched firms during the same period.

In summary, the results provide evidence that issuing firms wait to file SEOs until after their cost of equity capital falls to its lowest level and then starts to rebound. The evidence is more in line with the view that managers time SEOs by following the improvements in market conditions and in their stocks' liquidity environment in order to minimize their firms' cost of equity capital rather than the view that managers possess private information and exploit market

inefficiency in SEO timing. The lower post-issue stock returns are largely due to investors requiring a lower liquidity risk premium on SEO firms.

5.2. Time-series results

Table 5 reports the averages of time-series results of pre-filing and post-offering market betas, liquidity betas, and abnormal returns from the estimation of the model in Eq. (3) for each of the 5,138 SEO sample firms. Table 5 also reports the averages of excess market betas, excess liquidity betas, and excess abnormal returns from the match-adjusted model in Eq. (4). We expect the cross-sectional averages of the estimates from the time-series models in Eq. (3) and (4) should be close to the time-series averages of the estimates from the cross-sectional models in Eq. (1) and (2), respectively.

The results presented in Table 5 generally support our expectation. Nevertheless, it is worth pointing out that SEO firms' average post-issue abnormal returns, estimated by the averages of $\alpha_{i,0} + \alpha_{i,1}$ across the 5,138 SEO sample firms, are 0.019% from the model in Eq. (3) and -0.056% from the match-adjusted model in Eq. (4). Both are not significantly different from zero, which corroborate our earlier inference of no post-SEO abnormal returns.

Furthermore, the averages of the time-series estimates of SEO firms' pre-filing excess market betas and their post-SEO changes in excess market betas are 0.014 and -0.009, respectively; both are not significantly different from zero. The findings confirm that there are virtually no differences in market betas between the SEO sample firms and their matched non-issuers throughout the SEO process.

Also, the average of SEO firms' pre-filing excess liquidity beta is an insignificant 0.026, suggesting again that there is no significant difference in pre-filing liquidity beta between issuing

firms and their matched non-issuers. Since issuing firms and their matched non-issuers have similar pre-filing market betas and pre-filing liquidity betas, the findings confirm that the matching procedure creates a control sample that has a similar risk profile as that of our SEO sample before SEO filing.

Given our findings from the cross-sectional regression analyses reported in Tables 3 and 4, we expect time-series regression analyses to yield a significant post-issue change in liquidity risk for issuing firms. As expected, the average of the SEO firms' post-issue changes in excess liquidity beta is a significant -0.166. The finding suggests that, compared to their matched non-issuers, SEO firms experience a significant reduction in liquidity risk in the post-issue period. In sum, the evidence validates our earlier inference that lower liquidity risk is the reason why SEO firms have lower post-issue expected stock returns.[18]

5.3. Discussion

Our findings from both cross-sectional and time-series regression analyses permit us to assess relative importance of the risk-based, investment-based, and behavior-based explanations proposed in the extant literature on why SEO firms tend to have relatively low post-issue stock returns.

First, we find that managers do not know when the lowest cost of equity capital would occur until it passes, and that when they know, they promptly file SEOs. We also find that, consistent with Eckbo, Masulis and Norli (2000), Brav, Geczy, and Gompers (2000), Eckbo and Norli (2005), and Lyandres, Sun, and Zhang (2008), SEO firms on average have insignificant

[18] In this paper we report the results from Liu's (2006) two factor model. For robustness checks, we find that the key results in Section 4 hold if we add Liu's liquidity factor to the Fama-French three factor model (1993) or the Carhart (1997) four-factor model. The results also hold if we apply Petersen's (2009) two-way-clustering panel data model (clustered by firm identifier and SEOs year), or other models to account for the non-independence of standard errors.

abnormal returns in the post-issue period. These two findings are inconsistent with the behavioral explanation that managers time SEOs to exploit market inefficiency and that the market corrects the mispricing subsequently, as proposed by Loughran and Ritter (1995), Baker and Wurgler (2002), and Baker and Stein (2004).

Second, Eckbo, Masulis, and Norli (2000) hypothesize that SEOs lower issuing firms' financial leverage, which in turn reduces their systematic risks and post-issue expected stock returns. If financial leverage reduction has a significant effect on systematic risks, it should at least reduce issuing firms' post-issue market risk, relative to that of their matched non-issuers. However, we find that issuing firms' market risk is not significantly different from that of their matched non-issuers prior to or following SEOs. Thus, our finding is inconsistent with Eckbo, Masulis, and Norli's (2000) hypothesis.

Third, Carlson, Fisher, and Giammarino (2006) and Lyandres, Sun, and Zhang (2008) argue that issuing firms' lower post-issue stock returns are due to their increases in investments following SEOs, which convert growth options into assets in place and thus lower their systematic risks and expected stock returns. If changes in asset risk for SEO firms induced by more investments following SEOs are substantial, their market risk should be able to capture the changes. However, we find that it is lower liquidity risk that leads to low post-issue expected stock returns and that market risk plays no role. Thus, our findings are inconsistent with Carlson, Fisher, and Giammarino's (2006) and Lyandres, Sun, and Zhang's (2008) investment-based hypothesis.

To further illustrate our point, we add Lyandres, Sun, and Zhang's (2008) investment factor, *INV*, to Liu's (2006) LCAPM as specified in our Eqs. (3) and (4), re-run the analyses, and report the regression results in Panel B of Table 5. The results show that adding *INV* does not

change our inferences on market risk and liquidity risk, and that, like comparable non-issuers, issuing firms' average post-issue investment beta is not significantly different from their average pre-issue investment beta. In fact, in the match-adjusted regression, both issuing firms' average pre-issue excess investment beta and their average post-issue change in excess investment beta are insignificant. The results imply that investment-induced changes in systematic risks appear to be minor and cannot explain why issuing firms have lower post-issue stock returns.

Fourth, Eckbo and Norli (2005) argue that, in addition to firm size, B/M, and return momentum, liquidity risk also plays a part in determining post-issue stock returns. While in line with their findings, our results show that issuing firms' liquidity risk reduction in the post-issue period plays the key role, instead of just a part, for their lower post-issue stock returns, relative to comparable non-issuers. More importantly, we show that declines in liquidity risk start well before equity issuance, which leads us to hypothesize that liquidity risk improvement is an important condition that leads to SEOs.

In the next section, we address what factors may contribute to issuing firms' liquidity risk reduction during the SEO process. In section 7, we further examine whether the market prices issuing firms' liquidity risk reduction at SEO announcements and at issuance.

6. Identifying factors that may lower SEO firms' liquidity risk

Firms, which are more sensitive to shocks to market liquidity, face higher liquidity risk. We consider three potential factors—liquidity, analyst coverage, and institutional investors—that may contribute to lowering SEO firms' sensitivities to shocks to market liquidity. We expect that liquidity improvement and more analyst coverage could make SEO firms more transparent and increase their investor recognition (Mehran and Stulz (2007)). Furthermore, an increase in

institutional investors, who are perceived as informed (Chemmanur, He, and Hu (2009)), can certify that issuing firms have higher investment quality. Consequently, when shocks to market liquidity occur, it could be easier for SEO firms than other firms to attract investors and arbitragers to step up and absorb the shocks, thus lowering their liquidity risk. We provide evidence below that SEO firms tend to have higher stock liquidity, attract more analyst coverage, and have more institutional investors than their matched firms at and after SEOs.

6.1. Liquidity

There are at least two reasons for why SEO firms may have higher stock liquidity. First, based on their abnormal returns, as shown in Panel C of Fig. 1, one can argue that issuing firms have extremely good performance prior to SEO filing. Their good performance could attract investors' attention. Second, underwriting is a lucrative business for investment banks. To compete and earn underwriting businesses, investment banks are likely to ask their sell-side analysts to do more reports on issuing firms (Mola and Guidolin (2009)). The more the information is available, the more the investors know the firms. Consequently, liquidity trading on SEO firms could increase.

Thus, the combination of good performance plus more analyst coverage implies that issuing firms have higher stock liquidity. Indeed, Fig. 3 demonstrates a very steady and visible liquidity improvement prior to SEO filing. The demonstration is based on Liu's (2006) *LM1*, the standardized turnover-adjusted number of days with zero trading volume over one month, and Amihud's (2002) illiquidity measure (*IM*). Following Amihud (2002), *IM* in each event month, is Winsorized at 1% and 99% to mitigate problems with outliers. While *LM1* emphasizes trading discontinuity, *IM* reflects the price impact of trades. Both measures have a close relation to the

(latent) costs of trading. As expected, we obtain similar results from these two liquidity measures. Both measures show that about a year prior to SEO filing, issuing firms start to have higher stock liquidity than their matched firms, and that the liquidity gap between the two samples widens as time approaches the filing month. The liquidity improvement of SEO firms stays for at least three years after the SEOs.

Table 6 provides detailed analyses on the liquidity measures for issuing firms and for their matched non-issuers, and shows that the differences in liquidity between the two samples are significant from month -6 and afterwards. It is reasonable to expect that SEOs improve stock liquidity since they substantially increase the number of shares outstanding and expand their investor base. What is important is that most of the liquidity improvement during the SEO process occurs prior to filing. Such liquidity improvement could lower liquidity risk, and lead investors to require a lower liquidity risk premium at and after SEOs.

However, there is a visible difference between issuing firms' liquidity risk in Panel B of Fig. 1, which rebounds from the lowest point in the filing month and stabilizes thereafter, and their liquidity in Fig. 3, which shows no rebound phenomenon in the filing month but continues to improve from the filing month to the offering month. This difference suggests that investors' sensitivity to liquidity shocks (as reflected in stock prices) appears to heighten once firms announce SEOs, even though they add additional trading (and thus more liquidity) at and after the offering.

6.2. Analyst coverage

As mentioned earlier, we expect that investment banks ask their analysts to provide more coverage on issuing firms. Using analyst following and EPS forecast reports included in the

I/B/E/S data set, Table 7 shows that the average SEO firm has six analysts, who make about 9.2 reports on the firm in month -12 during which the corresponding figures are seven and 10.5 for the average matched firm. However, the number of analysts following the SEO firm increases gradually to 8.2 in the filing month and further to 9.9 in the offering month at which point it significantly outnumbers the matched firm's 7.6 analysts. The SEO firm also has significantly more analyst reports than the matched firm, 15.8 versus 11.6, in the offering month. Afterwards, the average SEO firm continues to attract more analyst coverage than the average matched firm.

Once again, the trend of increasing information production on issuing firms starts months before filing. Greater analyst coverage makes issuing firms more transparent and attracts more liquidity traders to the firms, which could contribute to lowering their liquidity risk at and after the SEOs.

6.3. Institutional investors

Using the quarterly information from CDA/Spectrum Institutional 13(f) filings, Table 8 reports the number of institutional investors and their equity ownership in the average SEO firm and the average matched firm. There are about 71 institutional investors who own around 38.8% of the average issuing firm four quarters prior to SEO filing. The numbers are significantly lower than the average matched firm's 87 institutional investors and their 40.5% of equity ownership during the same quarter, and the results are similar for quarter -3. However, the institutional ownership of SEO firms gradually increases, relative to that of their matched firms; and the differences between the two samples become marginally non-significant in quarter -2.

Interestingly, during the post-issue period, both the number of institutional investors and the institutional ownership of SEO firms are significantly higher than those of their matched

firms. Given the idea that institutional investors represent "smart money" (Gibson, Safieddine, and Sonti (2004) and Chemmanur, He, and Hu (2009)), the gradual increase of their presence implies gradual improvements in issuing firms' investment quality. With higher investment quality, it is easier to attract investors and arbitragers to absorb shocks to market liquidity, thus lowering shareholders' liquidity risk.

6.4. Cross-sectional analysis

To further link the post-issue reduction in liquidity risk to the increases in stock liquidity, analyst coverage, and institutional investors' presence, we run cross-sectional regressions and report the results in Table 9. The first two columns of Table 9 employ the estimate of the post-issue reduction in liquidity risk, $\beta_{il,1}$, from Eq. (3) as the dependent variable, and the remaining two columns employ the estimate of the post-issue reduction in liquidity risk in match-adjusted Eq. (4) as the dependent variable. In the regressions, we control for firm characteristics (*firm size*, *BE/ME*, and *exchange listing*), SEO issuing size (*Block size*), and market condition (*Hot* and *Cold*).[19]

Indeed, the results show that issuing firms—which exhibit more pre-filing improvements in stock liquidity, attract more institutional investors, and receive more analyst coverage prior to SEO filing—show more post-issue liquidity risk reduction. There is also evidence that pre-filing abnormal returns contribute to the post-issue liquidity risk reduction. In addition, the results show that the post-issue liquidity risk reduction is greater for firms with a higher pre-filing

[19] To characterize market conditions, we follow Helwege and Liang (2004) and Yung, Colak, and Wang (2008) and divide SEO issuance months into three categories: 'hot', 'normal', or 'cold.' The hot (cold) months contain the top (bottom) quartile of the months in which most (least) SEOs are issued, and the normal months contain the rest of the SEO issuance months. The number of SEOs in each month is determined by the three-month centered moving average of the number of SEOs for each month in the sample.

liquidity risk, for smaller firms, for firms with lower B/M (i.e., growth firms), and for firms listed on the Nasdaq.

In sum, the regression results reinforce the idea that issuing firms' post-issue liquidity risk reduction associates with their pre-filing improvements in liquidity environment.

7. Reducing the negative SEO announcement effect and the offering price discount

In this section, we explore whether liquidity risk reduction, which lowers issuing firms' cost of equity capital, could also favorably impact SEO contracting terms and reduce flotation costs. Specifically, we examine whether the market prices the post-issue liquidity risk reduction in the announcement return and in the offering price discount.

7.1. Cross-sectional analysis of the SEO announcement return

We examine two measures of the SEO announcement effect. The first one is the cumulative abnormal returns over day -3 to day 1 relative to the SEO announcement (day 0), based on the market model with the CRSP equally-weighted market index and an estimation period from day -260 through day -11. The second measure is based on the match-adjusted cumulative abnormal returns, defined as: $CAR(-3,1) = \prod_{t=-3}^{t=1}(1+r_{it}) - \prod_{t=-3}^{t=1}(1+r_{bit})$, where r_{it} is the return of firm i, and r_{bit} is the return of its matched firm in event day t.

For our sample of 5,138 SEOs, the average market model *CAR*(-3,1) is -2.25% with a *t*-value of -22.5 and the match-adjusted *CAR*(-3,1) is -1.73%, with a *t*-value of -13.01.[20] Thus,

[20] For comparison, we also estimate the three-day *CAR* from day -1 to day +1. The market-model *CAR* (-1,1) is -2.04%, which is very close to -1.87% reported by D'Mello, Schlingemann, and Subramaniam (2005), whose sample period is close to ours.

consistent with earlier studies (see, e.g., Eckbo, Masulis, and Norli (2007) for a review), our results also show that the market reacts negatively to SEO announcements.

Table 10 presents the results of the cross-sectional analysis on *CAR*(-3,1). The announcement return has a negative relation to both the pre-filing liquidity risk and the post-issue liquidity risk reduction, controlling for firm characteristics and market conditions. The evidence indicates that, holding other things constant, issuing firms that have a higher pre-filing liquidity risk ($\beta_{li,0}$) tend to experience a larger negative announcement effect. However, the announcement effect is less negative for those firms that show more post-issue liquidity risk reduction ($\beta_{li,1}$). This finding implies that investors price the post-issue liquidity risk reduction in the announcement return.

Issuing firms that have more pre-filing improvements in stock liquidity, and that attract more institutional investors and receive more analyst coverage prior to SEO filing, also experience a less negative announcement effect. Overall, the regression results suggest that the pre-filing improvements in liquidity environment allow issuing firms to mitigate the negative SEO announcement effect.

7.2. Cross-sectional analysis of the SEO offering price discount

Following Corwin (2003), we measure the offering price discount by $\ln(P_{-1} / P_0)$, where P_{-1} is the closing price the day before the offer, and P_0 is the offering price. Similar to Altinkili and Hansen (2003) and Brophy, Ouimet and Sialm (2009), we Winsorize the offering price discount at 1% at both tails. As shown in Table 2, the average discount in our sample is about

3.5%, which is similar to those observed by Altinkili and Hansen (2003), Corwin (2003), and Chemmanur, He, and Hu (2009).

Consistent with the above studies, Table 11 shows that the offering price discount has a positive relation to price volatility (estimated according to Altinkili and Hansen (2003)), but a negative relation to underwriter reputation (estimated according to Loughran and Ritter (2004)). This finding suggests that investors in the SEO market are concerned about risk, and that they require a higher offering price discount on firms with higher price variability. However, a lead underwriter with a higher reputation is able to alleviate investors' concerns in buying SEO shares, resulting in a lower offering price discount. There is also evidence that attracting more institutional investors prior to SEO filing allows issuing firms to reduce the discount on the offering price.

Furthermore, Table 11 shows that the offering price discount has a positive relation to both the post-issue liquidity beta ($\beta_{il,0} + \beta_{il,1}$ from the model in (3)) and the post-issue stock liquidity measured by the average of *LM1* from month +1 to month +36. This result implies that, for issuing firms that have a lower post-issue liquidity risk and a higher post-issue stock liquidity, investors in the SEO market are less concerned and require a lower discount on the offering price.

Thus, the evidence suggests that lower liquidity risk not only allows issuing firms to raise equity with a lower required rate of return, but also allows them to mitigate the negative SEO announcement effect and reduce the offering price discount at issuance.

8. Conclusion

We have used a parsimonious model, based on Liu's (2006) Liquidity-augmented CAPM (LCAPM), to capture time-varying risks in the periods surroundings the SEO filing and issuance

to shed further light on the debate of what causes the ability of firms to time SEOs to periods that are followed by low stock returns. We summarize our five main findings and from which we draw implications for advancing the debate as follows:

First, we find that issuing firms' cost of equity capital steadily declines to its lowest point prior to SEO filing. The pre-filing declines in the cost of equity are largely due to market-wide reductions in both market and liquidity risks, starting about six months prior to SEO filing, and an additional pre-filing reduction in issuing firms' liquidity risk.

Second, SEO firms' cost of equity capital rebounds but stays relatively low in the filing month, and it remains relatively low at issuance and thereafter for two to three years, largely due to liquidity risk staying low, relative to comparable non-issuers. We find no significant differences in market beta between SEO firms and comparable non-issuers during both the pre-filing period and the post-issue period.

Third, controlling for market risk and liquidity risk is sufficient to show no post-issue abnormal returns.

Taken together, these three findings imply that managers do not know when the lowest cost of equity occurs until it passes, and that when they know, they promptly file for SEOs. Also, there are no mispricing at SEOs and no market corrections afterwards. Thus, the evidence is in contrast to the behavioral explanation that managers time SEOs to exploit market inefficiency, as proposed by Loughran and Ritter (1995), Baker and Wurgler (2002), and Baker and Stein (2004). Furthermore, our finding that it is liquidity risk that makes issuing firms' post-issue expected stock return different from that of comparable non-issuers and that market risk plays no role is inconsistent with Eckbo, Masulis, and Norli's (2000) financial leverage reduction

hypothesis and the investment-based hypothesis proposed by Carlson, Fisher, and Giammarino (2006) and Lyandres, Sun, and Zhang (2008).

Fourth, SEO firms generally experience significant positive abnormal returns during the pre-filing period. In a cross-sectional analysis, we find that issuing firms with a higher pre-filing stock performance show more liquidity risk reduction in the post-issue period. Moreover, issuing firms that attract more institutional investors and receive more analyst coverage prior to SEO filing also show more post-issue liquidity risk reduction.

This finding implies that when encountering shocks to market liquidity in the post-issue period, those issuing firms that improve their investment environment more prior to SEO filing are able to attract more traders and arbitragers to mitigate the impacts of the shocks. Consequently, investors face lower liquidity risk and require a lower liquidity risk premium during the post-issue period.

Fifth, we find that the market prices the post-issue liquidity risk reduction in the SEO announcement return, and that investors in the SEO market demand a lower offering price discount on firms with lower post-issue liquidity risk.

The finding confirms that, indeed, investors are concerned with liquidity risk, and that issuing firms benefit from improvements in their liquidity environment during the SEO process. The benefits include raising equity at a lower required rate of return, and with lower flotation costs.

Based on our findings, we hypothesize that, given that they have a need for capital, issuing firms wait to file SEOs until market conditions and their liquidity environment have improved so that investors have minimal concerns of risks when buying their shares at SEOs. Instead of timing alphas (as the behavioral explanation suggests), our hypothesis suggests that, in

markets with time-varying risks, issuing firms time betas (i.e., time their SEOs to periods of low betas) to obtain equity capital with a low required rate of return. Thus, our SEO timing hypothesis is in line with Pástor and Veronesi's (2005) optimal IPO timing model—both emphasizing the importance of responding to time-varying market conditions in corporate financing decisions. It is also in line with Amihud and Mendelson's (1988) suggestion that, to maximize current shareholder wealth, managers should take stock liquidity into consideration when making corporate financing decisions.

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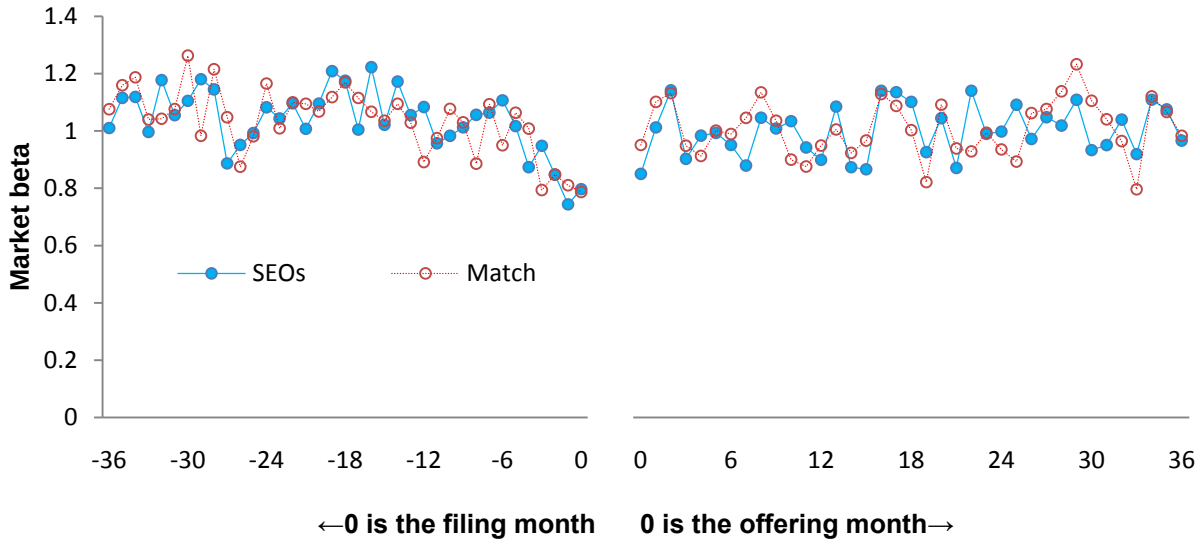
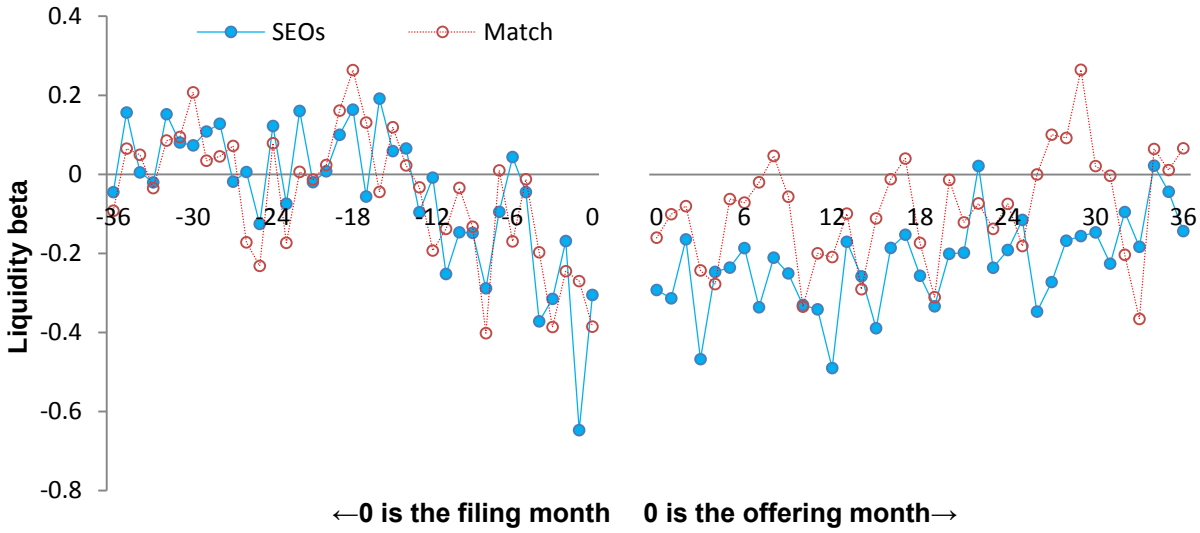
Figure 1. Plots of issuing firms' and their matched non-issuers' representative market betas, liquidity betas, and abnormal returns surrounding the SEOs

We first estimate issuing firms' (and separately their matched firms') representative market beta, liquidity beta, and abnormal return, i.e., $\beta_{m,t}$, $\beta_{l,t}$, and α_t, in each event month t from the cross-sectional regression model, $r_{it} - r_{ft} = \alpha_t + \beta_{m,t}(r_{mt,i} - r_{ft,i}) + \beta_{l,t}LIQ_{t,i} + \varepsilon_{it}$, for $i=1, 2, \ldots, n$, during the pre-SEO period from month -36 to the SEO filing month and during the post-SEO period from the SEO issuance month to month +36. Then, we plot both samples' estimates of $\beta_{m,t}$, $\beta_{l,t}$, and α_t in panel A, B, and C, respectively. For each issuing firm, we choose a comparable non-issuer, matched by firm size, return momentum, B/M, and pre-SEO liquidity.

Panel A: The plot of $\beta_{m,t}$



Panel B: The plot of $\beta_{l,t}$



Panel C: The plot of α_t

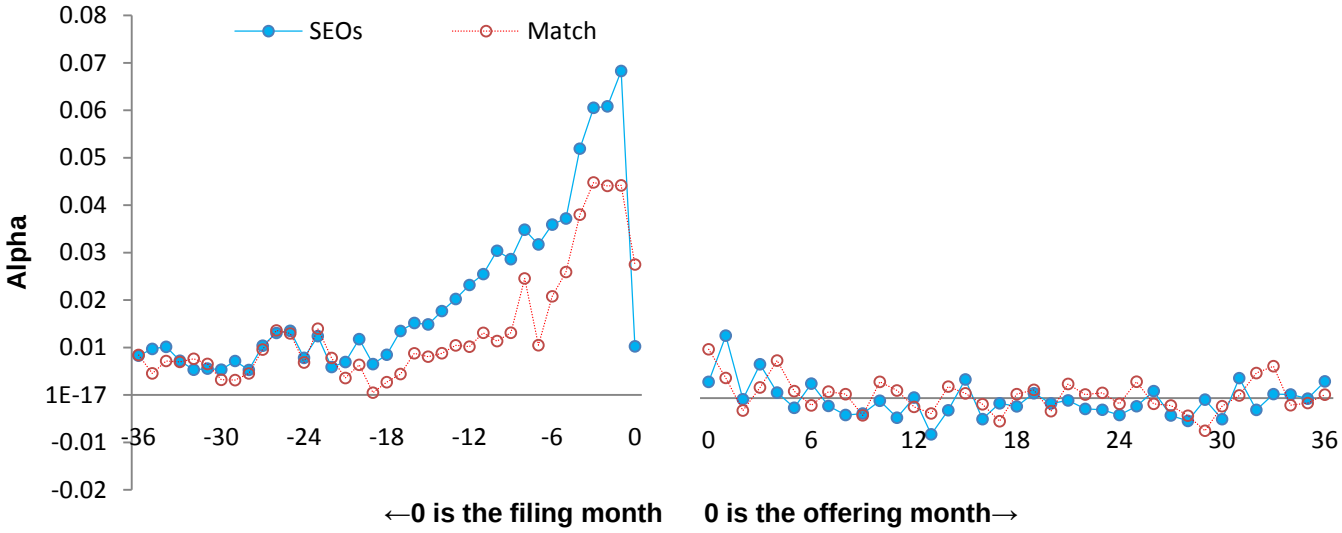


Figure 2. Issuing firms' and their matched firms' representative cost of equity capital surrounding the SEOs

This figure plots the annualized estimate of issuing firms' (and their matched non-issuers') representative cost of equity capital in each event month *t*:

$$E(r_{it}) = r_{ft} + \beta_{m,t}E(r_{mt,i} - r_{ft,i}) + \beta_{l,t}E(LIQ_{t,i}).$$

We estimate issuing firms' (and separately matched firms') $\beta_{m,t}$ and $\beta_{l,t}$ in each event month *t* from the cross-sectional regression model, $r_{it} - r_{ft} = \alpha_t + \beta_{m,t}(r_{mt,i} - r_{ft,i}) + \beta_{l,t}LIQ_{t,i} + \varepsilon_{it}$, for *i=1, 2, …, n*, from month -36 to 0 relative to a SEO's filing month (month 0) and month 0 to +36 relative to a SEO's offering month (month 0). For each issuing firm, we choose a comparable non-issuer, matched by firm size, return momentum, B/M, and pre-SEO liquidity. Then, we use the unconditional monthly means of r_{ft}, $r_{mt,i} - r_{ft,i}$, and $LIQ_{t,i}$ over the period 1964–2008 to proxy for r_{ft}, $E(r_{mt,i} - r_{ft,i})$, and $E(LIQ_{t,i})$, respectively, to compute SEO firms' (and matched non-issuers') representative cost of equity capital per annum.

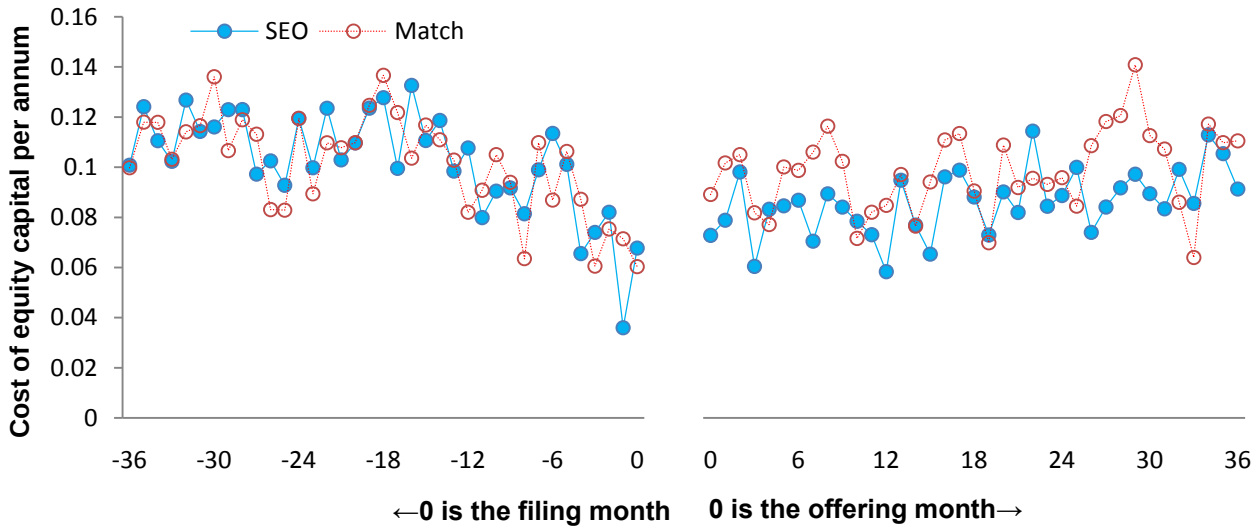
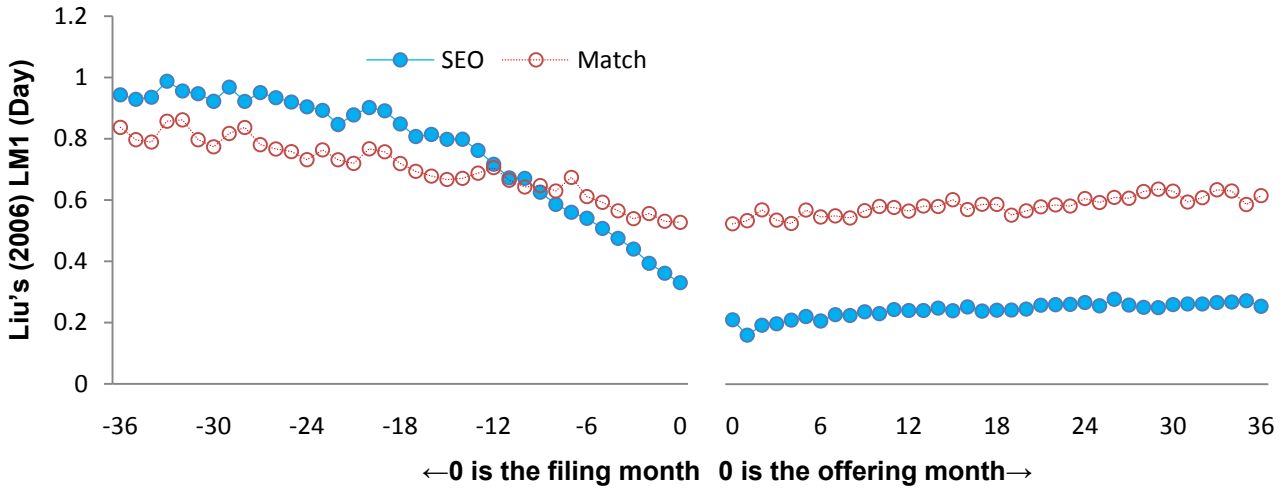


Figure 3. Illiquidity measures for issuing firms and their matched non-issuers surrounding the SEOs

This figure plots issuing firms' (and matched non-issuers') averages of Liu's (2006) *LM1* (standardized turnover-adjusted number of zero daily trading volumes over one month) and Amihud's (2002) illiquidity measure (*IM*) in each event month from months -36 to 0 relative to a SEO's filing month and from month 0 to months +36 relative to a SEO's issuance month. For each issuing firm, we choose a comparable non-issuer, matched by firm size, return momentum, B/M, and pre-SEO liquidity. *IM* in each event month is Winsorized at 1% and 99% to mitigate problems with outliers.

Panel A: Liu's (2006) *LM1*



Panel B: Amihud's (2002) *IM*

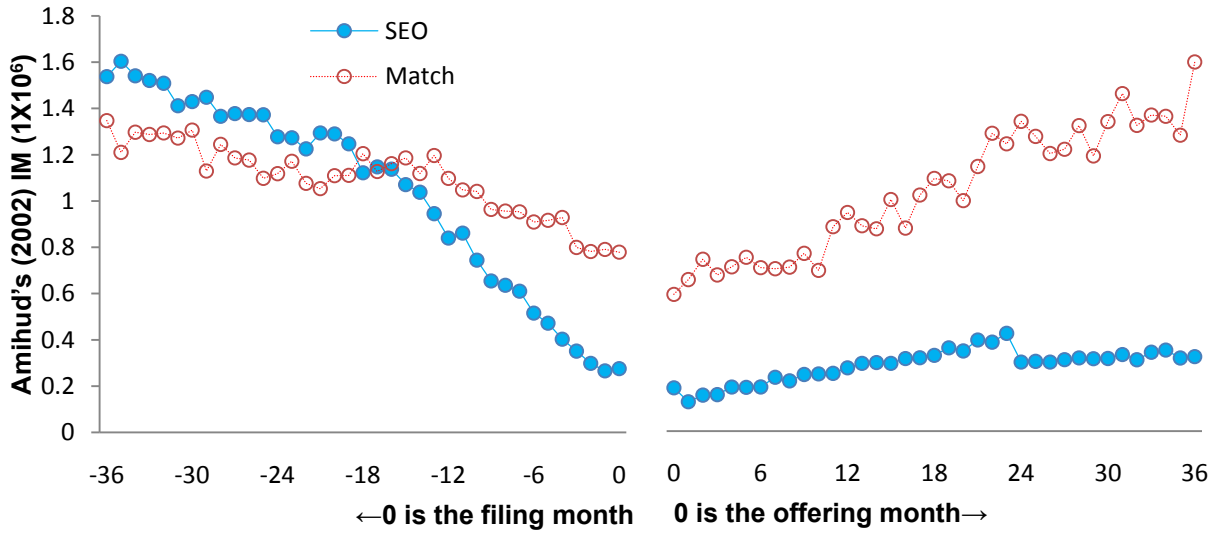


Table 1. SEO firms' and their matched non-issuers' firm characteristics, 1982-2006

This table reports the average and the median of firm characteristics for 5,138 SEO issuers and their matched non-issuers, matched on firm size, return momentum, B/M, and pre-SEO liquidity during the 1982–2006 period. The last column shows the *p*-value for the *t*-test (Kruskal-Wallis test) on the mean (median) of the differences between the issuers and their matched non-issuers. The *Size* is the equity market capitalization measured in the quarter prior to the SEO announcement, *Momentum* is the preceding six-month stock return calculated through the end of the month before announcement quarter end, *B/M* uses market value of equity at the end of the previous year and book value of equity at the last fiscal year end in the previous year, *Pre-SEO liquidity* is Liu's (2006) *LM12*: the standardized turnover-adjusted number of days with zero trading volume over a 12-month period estimated over months -18 to -7, and *Price* is the closing price or bid/ask average from the CRSP one day prior to SEO announcement.

	Issuers	Matched	Issuers vs. Matched
	Mean (Median)	Mean (Median)	[*p*-value] [*p*-value]
Size (Million $)	1468.00	1485.65	[0.890]
	(364.3)	(357.5)	[0.324]
Momentum	0.433	0.347	[0.000]
	(0.241)	(0.234)	[0.104]
B/M	0.637	0.549	[0.347]
	(0.468)	(0.462)	[0.972]
Pre-SEO liquidity	7.950	7.214	[0.215]
	(0.143)	(0.139)	[0.270]
Price	23.012	22.978	[0.983]
	(19.250)	(19.928)	[0.131]

Table 2. Offering characteristics of SEOs, 1982-2006

This table reports summary statistics of offering characteristics for the 5,138 SEOs in our sample during the 1982–2006 period. The SEO offering characteristics are collected from the SDC database; *Block size* is defined as shares offered/(shares offered + outstanding shares), where outstanding shares are measured on the announcement date or, if unreported, at the end of the quarter prior to the announcement. P_{-1}/P_0 is offering price discount, where P_{-1} is the share price one day prior to the issuance date and P_0 the offering price; offering price discount is Winsorized at 1% in either tail.

	Mean	Median	Std. deviation
Gross proceeds ($millions)	111.940	53.10	209.299
Gross proceeds/Total asset$_{y-1}$ (%)	41.967	17.70	69.963
Block size (%)	14.198	12.253	10.027
Offer price	24.942	21.500	17.389
Offer price/Per share book value of assets $_{y-1}$	2.344	0.998	7.707
Investment banking fees (%)	5.428	5.501	1.983
P_1/P_0	1.029	1.011	0.062
P_{-1}/P_0	1.035	1.019	0.063
Days between filing date and issuance date	115.24	35.00	259.89

Table 3. Issuing firms' and their matched non-issuers' representative market betas and liquidity betas surrounding SEO filing and issuance

We estimate issuing firms' representative market beta, $\beta_{m,t}$, and representative liquidity beta, $\beta_{l,t}$, for each event month *t* surrounding SEO filing and issuance from the cross-sectional regression model: $r_{it} - r_{ft} = \alpha_t + \beta_{m,t}(r_{mt,i} - r_{ft,i}) + \beta_{l,t} LIQ_{t,i} + \varepsilon_{it}$, for *i=1, 2, …, n*. We perform Chow tests and use superscripts *, **, and *** to indicate whether the pre-filing (post-issue) beta estimate in a given month differs significantly from that in the filing month (offering month) at the 10%, 5%, and 1% levels, respectively. We also perform Chow tests and use superscripts *, **, and *** to indicate whether the beta estimate in the offering month is significantly different from that in the filing month. We run the same model and do the same tests for the matched non-issuers. To obtain issuing firms' excess representative market beta and excess representative liquidity beta in each event month *t*, we run the match-adjusted model: $r_{it} - r_{bit} = \alpha_t + \beta_{m,t}(r_{mt,i} - r_{ft,i}) + \beta_{l,t} LIQ_{t,i} + \varepsilon_{it}$, where r_{it} is the return of issuing firm *i* and r_{bit} the return of its matched firm in event month *t*, and do the same Chow tests. Each *p*-value in the bracket indicates whether the excess beta estimate is significantly different from zero.

	Pre-filing month					Filing month	Offering month	Post-offering month				
	-12	-9	-6	-3	-1	0	0	+1	+3	+6	+9	+12
Panel A: The estimates of representative market beta, $\beta_{m,t}$												
SEO firms	1.084**	1.012**	1.107***	0.948	0.744	0.797	0.869	1.034*	0.922	0.972	1.031	0.919
Matched Firms	0.892	1.030**	0.950	0.794	0.811	0.787	0.972	1.126	0.969	1.011	1.058	0.970
Excess beta	0.192	-0.018	0.157	0.154	-0.067	0.010	-0.108	-0.080	-0.051	-0.039	-0.030	-0.047
[p-value] Excess beta=0	[0.081]	[0.860]	[0.144]	[0.192]	[0.607]	[0.925]	[0.296]	[0.425]	[0.604]	[0.664]	[0.758]	[0.627]
Panel B: The estimates of representative liquidity beta, $\beta_{l,t}$												
SEO firms	-0.008***	-0.148	0.044***	-0.315	-0.647***	-0.305	-0.286	-0.307	-0.458	-0.182	-0.245	-0.480*
Matched firms	-0.193*	-0.132**	-0.169*	-0.386	-0.270	-0.385	-0.156**	-0.098	-0.238	-0.070	-0.055	-0.204
Excess beta	0.185	-0.016	0.213	0.071	-0.377***	0.080	-0.137	-0.195	-0.234	-0.107	-0.171	-0.271
[p-value] Excess beta=0	[0.098]	[0.881]	[0.045]	[0.525]	[0.001]	[0.416]	[0.172]	[0.064]	[0.026]	[0.243]	[0.081]	[0.005]

Table 4. Cross-sectional estimates of issuers' and their matched non-issuers' pre- and post-SEO representative abnormal returns and betas

This table provides summary statistics for the month-by-month estimates of issuers' and their matched non-issuers' representative alpha and betas, estimated from the cross-sectional regression model: $r_{it} - r_{ft} = \alpha_t + \beta_{m,t}(r_{mt,i} - r_{ft,i}) + \beta_{l,t} LIQ_{t,i} + \varepsilon_{it}$, for *i=1, 2, …, n*. In Panel A, we test whether issuers' and their matched non-issuers' average representative alpha and betas estimated over the pre-SEO filing period from month -36 to month -1 are significantly different from zero, and do the same over the post-SEO offering period from month +1 to month +36. In Panel B (C), we run a time-series regression of $\beta_{m,t}$ ($\beta_{l,t}$) on a dummy variable, D_t, which equals one for the post-SEO offering months and zero for the pre-SEO filing months. In brackets are the *t*-values and the *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Statistics with *p*-values of .10 or lower are highlighted.

Panel A: Time-series averages of cross-sectional regression coefficients

	SEO firms	Matched firms	Match -adjusted	SEO Firms	Matched firms	Match -adjusted
	Pre-filing (months -36 to -1)			Post-issuance (months +1 to +36)		
α_t	**0.020*****	**0.013*****	**0.007*****	-0.001	0.000	-0.001
	[7.02]	[6.52]	[6.06]	[-0.90]	[0.51]	[-1.23]
$\beta_{m,t}$	**1.045*****	**1.040*****	0.005	**1.027*****	**1.031*****	-0.004
	[59.40]	[56.72]	[0.29]	[70.91]	[61.58]	[-0.23]
$\beta_{l,t}$	-0.037	-0.042	0.005	**-0.217*****	**-0.084*****	**-0.133*****
	[-1.25]	[-1.60]	[0.24]	[-11.64]	[-3.71]	[-5.75]

Panel B: Time-series regression of representative market beta, $\beta_{m,t}$, on the post-issue dummy variable, D_t

	SEO Firms	Matched firms	Match -adjusted
Intercept	**1.045*****	**1.040*****	0.011
	[64.84]	[59.23]	[0.66]
D_t	-0.017	-0.009	-0.012
	[-0.76]	[-0.36]	[-0.52]

Panel C: Time-series regression of representative liquidity beta, $\beta_{l,t}$, on the post-issue dummy variable, D_t

	SEO firms	Matched firms	Match -adjusted
Intercept	-0.037	**-0.042***	0.011
	[-1.49]	[-1.71]	[0.50]
D_t	**-0.181*****	-0.043	**-0.144*****
	[-5.19]	[-1.23]	[-4.46]

Table 5. Time-series estimates of issuers' and their matched non-issuers' pre- and post-SEO abnormal returns and betas

Panel A uses the following model to examine changes in each individual firm *i*'s risks from before to after the SEOs: $r_{it} - r_{ft} = \alpha_{i,0} + \alpha_{i,1}D_t + (\beta_{im,0} + \beta_{im,1}D_t)(r_{mt,i} - r_{ft,i}) + (\beta_{il,0} + \beta_{il,1}D_t)LIQ_{t,i} + \varepsilon_{it}$, where $D_t = 1$ if *t* is in the post-offering period, and $D_t = 0$ if *t* is in the pre-filing period; $\beta_{im,0}$ and $\beta_{il,0}$ are firm *i*'s pre-SEO market risk and liquidity risk, respectively; $\beta_{im,1}$ and $\beta_{il,1}$ are the differences between its post- and pre-SEO market risk and liquidity risk, respectively; $\alpha_{i,0}$ is its pre-SEO abnormal return; and $\alpha_{i,1}$ is the difference between its post- and pre-SEO abnormal return. We run the regression for each SEO firm for *t* from month -36 to month -1 prior to SEO filing and from month +1 to month +36 after SEO issuance. To control for market-wide movements in risks, we use the match-adjusted returns in regression:

$$r_{it} - r_{bit} = \alpha_{i,0} + \alpha_{i,1}D_t + (\beta_{im,0} + \beta_{im,1}D_t)(r_{mt,i} - r_{ft,i}) + (\beta_{il,0} + \beta_{il,1}D_t)LIQ_{t,i} + \varepsilon_{it}.$$

In Panel B, we add to Liu's (2006) LCAPM the investment factor (*INV*), proposed by Lyandres, Sun, and Zhang (2008). They construct *INV* by buying long the bottom 30% investment-to-assets stocks and selling short the top 30% investment-to-assets stocks. We report the cross-sectional average of each regression coefficient and test whether it is significantly different from zero. In brackets are the *t*-values and the *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. To see whether there is post-issue underperformance, we examine whether the average of $\alpha_{i,0} + \alpha_{i,1}$ across each is significantly different from zero.

Panel A: Results based on Liu's (2006) LCAPM

	α_0	α_1	$\beta_{m,0}$	$\beta_{m,1}$	$\beta_{l.0}$	$\beta_{l,1}$	$\alpha_0 + \alpha_1$
SEO firms	0.019***	-0.019***	1.123***	-0.065***	0.012	-0.262***	0.000
	[43.19]	[-32.42]	[64.40]	[-2.84]	[0.60]	[-10.24]	[0.48]
Matched firms	0.012***	-0.011***	1.119***	-0.064***	-0.009	-0.099***	0.001
	[26.81]	[-18.80]	[65.00]	[-2.79]	[-0.48]	[-3.79]	[0.89]
Match-adjusted	0.007***	-0.008***	0.014	-0.009	0.026	-0.166***	-0.001
	[12.95]	[-10.02]	[0.63]	[-0.30]	[1.01]	[-4.77]	[-1.03]

Panel B: Results based on Liu's LCAPM plus Lyandres, Sun, and Zhang's (2008) investment factor (*INV*)

	α_0	α_1	$\beta_{m,0}$	$\beta_{m,1}$	$\beta_{l.0}$	$\beta_{l,1}$	INV_0	INV_1	$\alpha_0 + \alpha_1$
SEO firms	0.019***	-0.019***	1.134***	-0.078***	0.040*	-0.263***	-0.068**	-0.001	0.000
	[40.18]	[-27.65]	[64.84]	[-3.40]	[1.93]	[-9.83]	[-2.03]	[-0.01]	[1.65]
Matched firms	0.012***	-0.011***	1.116***	-0.067***	0.005	-0.087***	-0.137***	0.073	0.001
	[27.49]	[-16.80]	[64.45]	[-2.96]	[0.25]	[-3.26]	[-4.01]	[1.57]	[1.75]
Match-adjusted	0.006***	-0.007***	0.021	-0.012	0.034	-0.176***	0.028	-0.025	-0.001
	[10.46]	[-8.45]	[0.93]	[-0.40]	[1.28]	[-4.85]	[0.62]	[-0.42]	[-1.24]

Table 6. Stock liquidity of issuing firms and their matched firms surrounding SEO filing and issuance

This table reports issuing firms' (and their matched firms') averages for Liu's *LM1* in Panel A and Amihud's illiquidity measure (*IM*) in Panel B at pre-filing months -12, -9, -6, -3, and -1, SEO filing month, SEO issuance month, and post-issue months +1, +3, +6, +9, and +12. This Table also reports the average excess (match-adjusted) *LM1* and *IM*. The *IM* in each event month is Winsorized at 1% and 99% to mitigate problems with outliers. For each issuing firm, we choose a comparable non-issuer, matched by firm size, return momentum, B/M, and pre-SEO liquidity. Superscripts *, **, and *** indicate whether the pre-filing (post-issue) average illiquidity in a given month differs significantly from that in the filing month (offering month) at the 10%, 5%, and 1% levels, respectively. We also test whether the average illiquidity in the offering month is significantly different from that in the filing month. Each *p*-value in the bracket indicates whether the match-adjusted estimate is significantly different from zero.

	Pre-filing months					Filing month	Offering month	Post-offering months				
	-12	-9	-6	-3	-1	0	0	+1	+3	+6	+9	+12
Panel A: Liu's (2006) *LM1*												
SEO firms	0.717***	0.625***	0.540***	0.440***	0.361	0.333	0.211***	0.161**	0.198	0.207	0.237	0.241
Matched firms	0.705***	0.647***	0.611*	0.539	0.531	0.527	0.525	0.535	0.537	0.548	0.568	0.567
Excess *LM1*	0.011***	-0.021***	-0.071***	-0.099***	-0.170	-0.197	-0.314***	-0.375*	-0.339	-0.340	-0.331	-0.326
[p-value] Excess *LM1*=0	[0.640]	[0.320]	[0.003]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: Amihud's (2002) *IM* ($1x10^6$)												
SEO firms	0.840***	0.655***	0.515***	0.351***	0.266	0.276	0.179***	0.122***	0.151**	0.183	0.235***	0.262***
Matched firms	1.098***	0.964*	0.909	0.799	0.791	0.779	0.566**	0.627	0.646	0.677**	0.736***	0.905***
Excess *IM*	-0.258**	-0.309*	-0.394	-0.448	-0.525	-0.484	-0.387	-0.506***	-0.495**	-0.494**	-0.501**	-0.643***
[p-value] Excess *IM* =0	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Table 7. Number of analyst coverage and analyst reports surrounding SEO filing and issuance

This table reports the averages of the number of analysts following (*# Analysts*) in Panel A and the number of analyst earnings forecast reports (*# Reports*) in Panel B at pre-filing months -12, -9, -6, -3, and -1, and SEO filing month; and SEO issuance month and post-issue months +1, +3, +6, +9, and +12. We obtain data on the analyst following and EPS forecast reports from the I/B/E/S data set. We use superscripts *, **, and *** to indicate whether the pre-filing (post-issue) natural logarithm of one plus the number of analysts following and natural logarithm of one plus the number of analyst earnings forecast reports in a given month differ significantly from that in the filing month (offering month) at the 10%, 5%, and 1% levels, respectively. We also test whether the measure in the offering month is significantly different from that in the filing month. Each *p*-value in the bracket indicates whether the match-adjusted estimate is significantly different from zero.

	Pre-filing months					Filing month	Offering month	Post-offering months				
	-12	-9	-6	-3	-1	0	0	+1	+3	+6	+9	+12
Panel A: Number of analysts following (*# Analysts*)												
SEO firms	6.04***	6.15***	6.51***	7.21**	7.72	8.19	9.86***	9.57	9.11	9.92	10.25	10.71
Matched firms	7.05**	7.19*	7.68	7.95	7.82	7.98	7.58	9.12***	8.19	8.35	8.75**	8.89***
Excess *# Analysts*	-1.01**	-1.05**	-1.17***	-0.74*	-0.10	0.20	2.27***	0.49***	0.92**	1.61	1.50	1.86
[p-value] Excess *# Analysts* =0	[0.003]	[0.005]	[0.001]	[0.047]	[0.803]	[0.593]	[0.000]	[0.264]	[0.025]	[0.000]	[0.001]	[0.000]
Panel B: Number of analyst earnings forecast reports *(# Reports*)												
SEO firms	9.17***	9.48***	10.06***	11.33**	12.02	12.46	15.83***	15.43	13.90***	14.88	15.43	15.95
Matched firms	10.52**	10.74**	11.29	11.69	11.66	11.84	11.56	13.28***	12.16	12.58*	13.08***	13.16***
Excess *# Reports*	-1.34***	-1.22***	-1.20***	-0.36*	0.36	0.74	4.27***	2.15***	1.78***	2.31**	2.34**	2.78*
[p-value] Excess *# Reports* =0	[0.002]	[0.005]	[0.005]	[0.424]	[0.436]	[0.106]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Table 8. Number of institutional investors and institutional ownership surrounding the SEOs

This table reports the average number of institutional investors *(# Inst*) in Panel A and the average institutional ownership (*Instown*) in Panel B surround the SEOs. We obtain the institutional information from CDA/Spectrum Institutional 13(f) filings. Since the filing is on a quarterly basis, we put it under pre-filing quarter -1 if the information is available within months -3 to -1 prior to SEO filing, quarter -2 if it is available within months -4 to -6, and so on. Similarly, we put it under post-offering quarter +1 if the information is available within months +1 to +3 after SEO issuance, and so on. We use superscripts *, **, and *** to indicate whether the pre-filing (post-offering) mean measure of natural logarithm of one plus the number of 13f institutions or institutional ownership in a given quarter differs significantly from that in quarter -1 (+1) relative to SEO filing (issuance) at the 10%, 5%, and 1% levels, respectively. We also test whether the mean measure in quarter -1 differs significantly from that in quarter +1. Each *p*-value in the bracket indicates whether the match-adjusted estimate is significantly different from zero.

	Pre-filing quarters				Post-offering quarters			
	-4	-3	-2	-1	+1	+2	+3	+4
Panel A: Number of 13f institutions *(# Inst*)								
SEO firms	70.92***	73.97***	77.31**	82.37	100.82***	103.12	104.93	106.57**
Matched firms	87.08**	88.99	90.65	93.79	100.58**	101.77	103.79	105.19
Excess *# Inst*	-15.95**	-14.91	-13.32	-11.39	0.31***	1.44	1.19	1.47
[p-value] Excess *# Inst* =0	[0.000]	[0.000]	[0.000]	[0.000]	[0.850]	[0.383]	[0.470]	[0.380]
Panel B: Institutional ownership (*Instown*) (%)								
SEO firms	38.76***	40.15***	41.39**	43.06	52.21***	52.43	52.93	52.94
Matched firms	40.47***	41.35*	41.91	42.69	44.62***	44.86	45.35	45.64
Excess *Instown*	-1.71***	-1.20**	-0.52	0.37	7.59***	7.60	7.61	7.30
[p-value] Excess *Instown* =0	[0.002]	[0.028]	[0.318]	[0.469]	[0.000]	[0.000]	[0.000]	[0.000]

Table 9. Cross-sectional analysis of the post-issue liquidity risk reduction

The dependent variable is $\beta_{il,1}$, the post-issue liquidity risk reduction, from the time-series model (or the match-adjusted model) reported in Panel A of Table 5. The explanatory variables $\alpha_{i,0}$ and $\beta_{il,0}$ are firm *i*'s pre-SEO abnormal return and pre-SEO liquidity beta, respectively, from the time-series model (or the match-adjusted model). $\Delta\text{Ln}(LM1)_{-6,-1}$ is the natural logarithm of Liu's (2006) *LM1* in the pre-filing month -1 minus that in month -6; $\Delta\text{Ln}(1+\#Inst)_{q-3,q-1}$, $\Delta\text{Ln}(1+\#Reports)_{q-3,q-1}$, and $\Delta\text{Ln}(1+\#Analysts)_{q-3,q-1}$ are the natural logarithms of one plus the number of 13f institutions, analyst reports, and analysts, respectively, in quarter -1 minus that in quarter -3; $\Delta Instown_{q-3,q-1}$ is the change in institutional ownership over the same period. *Block size* is defined as shares offered/(shares offered + pre-SEO outstanding shares); Ln(*CAP)* is the natural logarithm of market value of equity measured in December prior to SEO announcement; *BE/ME* is book-to-market equity ratio measured on the fiscal year prior to SEO announcement. The *Hot* (*Cold*) is a dummy variable that equals one for SEOs issued in hot (cold) markets and zero otherwise; *Exchd* equals one for firms in the NASDAQ exchange and zero otherwise. In parentheses are the *t*-values. Superscripts *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Post-issue reduction in liquidity beta ($\beta_{il,1}$)		Match-adjusted post-issue reduction in liquidity beta ($\beta_{il,1}$)	
	(1)	(2)	(3)	(4)
Intercept	-0.697***	-0.696***	0.026	0.026
	(-5.04)	(-5.03)	(0.33)	(0.34)
Pre-SEO abnormal return ($\alpha_{i,0}$)	-1.757*	-1.739*	-1.227*	-1.292*
	(-1.89)	(-1.87)	(-1.74)	(-1.85)
Pre-SEO liquidity beta ($\beta_{il,0}$)	-0.889***	-0.889***	-0.892***	-0.892***
	(-43.52)	(-43.51)	(-34.04)	(-33.99)
$\Delta\text{Ln}(LM1)_{-6,-1}$	0.035**	0.034**	0.051**	0.051**
	(2.11)	(2.05)	(2.22)	(2.30)
$\Delta\text{Ln}(1+\#Inst)_{q-3,q-1}$	-0.160***	-0.165***	-0.092*	-0.095**
	(-3.07)	(-2.97)	(-1.92)	(-2.00)
$\Delta Instown_{q-3,q-1}$	-0.004**	-0.004**	-0.002*	-0.002**
	(-2.03)	(-2.04)	(-1.95)	(-2.06)
$\Delta\text{Ln}(1+\#Reports)_{q-3,q-1}$	-0.003*		-0.009*	
	(-1.72)		(-1.68)	
$\Delta\text{Ln}(1+\#Analysts)_{q-3,q-1}$		-0.022*		-0.022*
		(-1.84)		(-1.67)
Block size (%)	0.003	0.004	-0.004	-0.004
	(1.22)	(1.22)	(-0.98)	(-0.97)
Ln*(CAP)*	0.051***	0.051***	0.093***	0.093**
	(2.99)	(2.98)	(2.57)	(2.56)
BE/ME	0.156***	0.156***	-0.088*	-0.087*
	(4.34)	(4.31)	(-1.70)	(-1.67)
Hot	0.157***	0.158***	0.071	0.070
	(3.48)	(3.49)	(0.97)	(0.96)
Cold	0.157**	0.156**	0.111	0.113
	(2.20)	(2.19)	(0.92)	(0.93)
Exchd	-0.201***	-0.201***	-0.210***	-0.213***
	(-4.14)	(-4.15)	(-2.94)	(-2.98)
No.	3,968	3,598	3,968	3,598
Adj R-squared	0.452	0.452	0.453	0.454

Table 10. Cross-sectional analysis of SEO announcement returns

This table reports the relation between the SEO announcement returns and the post-issue liquidity risk reduction. In model (1) and (2), the dependent variable is the market model CAR(-3,1) and the explanatory variables $\alpha_{i,0}$, $\beta_{il,0}$, and $\beta_{il,1}$ are estimated from Eq. (3) reported in Panel A of Table 5. In model (3) and (4), the dependent variable is match-adjusted *CAR*(-3,1) and the explanatory variables $\alpha_{i,0}$, $\beta_{il,0}$, and $\beta_{il,1}$ are estimated from the match-adjusted Eq. (4) also reported in Panel A of Table 5. Ln(*LM1*)$_{-1}$ is the logarithm of Liu's (2006) *LM1* one month prior to SEO filing; ΔLn(*LM1*)$_{-6,-1}$ is the logarithm of Liu's (2006) *LM1* in the pre-filing month -1 minus that in month -6; ΔLn(1+#*Inst*)$_{q-3,q-1}$, ΔLn(1+#*Reports*)$_{q-3,q-1}$, and ΔLn(1+#*Analysts*)$_{q-3,q-1}$ are the logarithm of one plus the number of 13f institutions, analyst reports, and analysts, respectively, in quarter -1 minus that in quarter -3; Δ*Instown* $_{q-3,q-1}$ is the change in institutional ownership over the same period. *Volatility* is the standard deviation of daily abnormal returns over the 200 days ending one month before the filing. Other explanatory variables are defined in Table 9. In parentheses are the *t*-values. Superscripts *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
Intercept	-1.245**	-1.344**	-0.250	-0.229
	(-1.98)	(-2.18)	(-0.88)	(-0.81)
Pre-SEO abnormal return ($\alpha_{i,0}$)	-12.482***	-11.771***	-28.590***	-29.294***
	(-3.01)	(-2.97)	(-4.26)	(-4.37)
Pre-SEO liquidity beta ($\beta_{il,0}$)	-0.296***	-0.388***	-0.372***	-0.399***
	(-2.67)	(-2.91)	(-3.13)	(-3.38)
Reduction in liquidity beta ($\beta_{il,1}$)	-0.070**	-0.111*	-0.041*	-0.089**
	(-2.31)	(-1.84)	(-1.82)	(-2.08)
Ln(*LM1*)$_{-1}$	0.145*	0.150**	0.029	0.027
	(1.89)	(2.04)	(0.22)	(0.20)
ΔLn(*LM1*)$_{-6,-1}$	-0.010*	-0.008**	-0.089	-0.084
	(-1.82)	(-1.97)	(-0.76)	(0.72)
ΔLn(1+#*Inst*)$_{q-3,q-1}$	0.647**	0.632**	0.291**	0.243**
	(2.42)	(2.48)	(2.12)	(1.98)
Δ*Instown*$_{q-3,q-1}$	0.010*	0.010*	0.013	0.012
	(1.77)	(1.78)	(1.62)	(1.56)
ΔLn(1+#*Reports*)$_{q-3,q-1}$	0.174*		0.077	
	(1.69)		(1.11)	
ΔLn(1+#*Analysts*)$_{q-3,q-1}$		0.136*		0.039*
		(1.91)		(1.93)
*Volatility**100	-0.493***	-0.504***	-0.237***	-0.247***
	(-6.44)	(-6.73)	(-4.60)	(-4.81)
Block size (%)	-0.023*	-0.026**	-0.050***	-0.052***
	(-1.81)	(-2.18)	(-3.11)	(-3.27)
Ln(CAP)	0.257***	0.271***	0.528***	0.538***
	(3.33)	(3.55)	(2.64)	(2.69)
BE/ME	0.093	0.159	0.196	0.184
	(0.59)	(1.06)	(1.32)	(1.25)
Hot	0.239	0.233	-0.569	-0.557
	(1.21)	(1.24)	(-0.74)	(-0.94)
Cold	-0.589*	-0.583**	0.030	0.048
	(-1.90)	(-1.96)	(0.07)	(0.11)
Exchd	0.129	0.143	-0.357	-0.354
	(0.59)	(0.68)	(-1.35)	(-1.34)
Adj R-squared	0.034	0.033	0.016	0.017

Table 11. Cross-sectional analysis of SEO offer discounts

The dependent variable is ln(P_{-1}/P_0), the logarithm of the ratio of the closing price the day before the offer to the offer price, and is winsorized at 1% at both tails. The explanatory variables $\alpha_{i,0}$ and $\beta_{il,0}$ + $\beta_{il,1}$, are estimated from the time-series model in Eq. (3). The Ln($LM1$)$_{+1,\,+36}$ is the logarithm of the average of Liu's (2006) *LM1* from months +1 to +36 relative to the offering month. The *Underwriter reputation* is the lead bank's average reputation based on Loughran and Ritter (2004). The *Volatility* is the issuer's standard deviation of daily market-adjusted returns over the 200 days ending one month before the offer. Other explanatory variables are defined in Tables 9 and 10. In parentheses are the *t*-values. Superscripts *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. For both regressions, the *p*-value for the significance of the regression equation is of 0.000 or lower.

	ln(P_{-1}/P_0)	
	(1)	(2)
Intercept	-0.026	-0.097
	(-0.05)	(-0.21)
Pre-SEO abnormal return ($\alpha_{i,0}$)	-0.843	-0.484
	(-0.40)	(-0.25)
Post-SEO liquidity beta ($\beta_{il,0} + \beta_{il,1}$)	0.150***	0.133***
	(2.60)	(2.90)
Ln($LM1$)$_{+1,\,+36}$	0.151**	0.155***
	(2.43)	(2.83)
ΔLn($LM1$)$_{-6,-1}$	0.363*	0.344*
	(1.83)	(1.80)
ΔLn(1+#*Inst*)$_{q-3,q-1}$	-0.473***	-0.448***
	(-2.81)	(-2.86)
Δ*Instown*$_{q-3,q-1}$	-0.009*	-0.010**
	(-1.86)	(-2.18)
ΔLn(1+#*Reports*)$_{q-3,q-1}$	-0.072	
	(-1.75)	
ΔLn(1+#*Analysts*)$_{q-3,q-1}$		-0.125*
		(-1.79)
Underwriter Reputation	-0.307***	-0.303***
	(-6.23)	(-6.60)
*Volatility*100*	0.683***	0.681***
	(14.39)	(15.44)
Block size (%)	0.056***	0.056***
	(7.24)	(7.81)
Ln*(CAP)*	0.262***	0.268***
	(4.94)	(5.46)
BE/ME	-0.062	-0.067
	(-0.53)	(-0.61)
Hot	0.560***	0.559***
	(4.69)	(5.03)
Cold	-0.317*	-0.286
	(-1.69)	(-1.64)
Exchd	0.401***	0.436***
	(2.96)	(3.47)
No.	3,968	3,598
Adj R-squared	0.163	0.168