

Does broader ownership increase liquidity of IPOs through initial return?

TeWhan Hahn
Auburn University at Montgomery

ABSTRACT

Booth and Chua (1996) suggested underpricing is used to generate broader ownership and the broader ownership in turn boosts after-market liquidity of IPOs. Subsequent IPO studies show higher initial return boosts after-market liquidity. They also show broader ownership increases after-market liquidity. However, these results are implied in the general liquidity literature already and therefore are not the direct supporting evidence of Booth and Chua (1996)'s conjecture. This study formulates regression models where initial return, ownership structure, and interaction term between them are included as key independent variables. If the interaction term is shown to significantly increase liquidity, it will be a direct supporting evidence of Booth and Chua (1996)'s conjecture. The results of this study show that when higher initial return and broader ownership structure boost after-market liquidity of IPOs, they do so independently rather than jointly.

Keywords: liquidity, ownership structure, initial return

Copyright statement: Authors retain the copyright to the manuscripts published in AABRI journals. Please see the AABRI Copyright Policy at <http://www.aabri.com/copyright.html>

INTRODUCTION

Liquidity of IPO shares in the after-market has been suggested as one of the important considerations to participants in the IPO. Aggarwal, Krigman, and Womack (2002) implies that the analyst coverage induced by initial underpricing leads to higher liquidity that in turn allows insiders of the IPO firms to sell their retained shares on more favorable terms at the lockup expiration. In relation to this, Cao, Field, and Hanka (2004) find that insider selling at lockup expiration does not impair liquidity. Boot, Gopalan, Thakor (2006) suggest that higher liquidity lowers cost of capital and hence increases firm value. Butler, Grullon, and Weston (2005) show that high liquidity decreases issue costs in the future equity offerings.

If high liquidity is indeed valuable to participants in the IPO, those participants may try to increase liquidity of IPO shares. While if IPO firms intentionally underprice the IPO issue to increase liquidity is more agreeable, how underpricing the issue can increase after-market liquidity begs for more explanation. One of the popular ways to understand how underpricing increases after-market liquidity is presented by Booth and Chua (1996). They suggest: 1) IPO firms underprice the issue to achieve oversubscription. 2) The oversubscription leads to broad initial ownership. 3) The broad ownership then increases after-market liquidity. Two representative empirical studies, Pham, Kalev, and Steen (2003) and Zheng and Li (2008), tested Booth and Chua (1996)'s conjecture. Both studies show that in ownership structure regression, initial return broadens ownership structure and in after-market liquidity regression, broader ownership increases after-market liquidity.

While the results of Pham, Kalev, and Steen (2003) and Zheng and Li (2008) are generally considered to support Booth and Chua (1996)'s conjecture, they are not exactly the evidence supporting Booth and Chua (1996)'s conjecture because both studies ran two separate regressions where in ownership structure regression, higher initial return is shown to broaden ownership structure and in after-market liquidity regression, broader ownership is shown to increase after-market liquidity. To be able to more exactly test if Booth and Chua (1996)'s conjecture is supported by data, anyone should run after-market liquidity regression with initial return, ownership structure, and their interaction term in place as key independent variables. Then to test Booth and Chua's conjecture, among these three key independent variables, the interaction term should be shown to significantly increase after-market liquidity. This is essential because what Booth and Chua (1996) conjecture is not simply initial return facilitating broader ownership and broader ownership increasing after-market liquidity independently. Rather, the most important point in Booth and Chua (1996)'s conjecture is that the part of ownership structure variable (i.e., ownership dispersion) that's increased by initial return should increase after-market liquidity. In other words, whether the part of ownership structure that's not affected by initial return would increase after-market liquidity or not is a secondary importance.

In fact, it is not surprising to find that ownership structure affects after-market liquidity of IPOs because general liquidity literature shows similar findings between liquidity and ownership structure. For example, at least two ownership structure variables were shown to significantly affect liquidity. First, Demsetz (1968), Benston and Hagerman (1974) and Jacoby and Zheng (2010) show the number of shareholders and liquidity are positively correlated. Second, Blume and Keim (2012) report that the number of institutional investors and liquidity are positively correlated. Although the ownership structure variables used are different between these two groups of studies, a positive relationship between ownership dispersion and liquidity is evident in the literature.

Another issue in Pham et al. (2003) and Zheng and Li (2008) in testing Booth and Chua (1996)'s conjecture is the ownership structure variables used. They used institutional ownership percent but Blume and Keim (2012) suggests that the number of institutional investors explain liquidity better. Accordingly, this study uses the number of institutional investors as one of the ownership structure variables rather than the percentage of institutional ownership.

Therefore, it is fair to say that the essence of Booth and Chua (1996)'s conjecture has not been rigorously investigated yet: statistical significance of initial return's interaction with ownership in affecting after-market liquidity. This study fills the gap. This study investigates whether the part of ownership structure variable (i.e., ownership dispersion) that's correlated with initial return (i.e., interaction term between initial return and ownership structure variable) indeed increases after-market liquidity of IPOs. Therefore, this study contributes to the better understanding of how initial return interacts with ownership structure to affect after-market liquidity.

In the model explaining the after-market liquidity of IPOs, this study includes two control variables of liquidity, past trading volume and return volatility. Ellul and Pagano (2006) surveyed empirical literature on liquidity and found these two are important factors affecting liquidity. Some IPO characteristic variables that are considered to affect liquidity are also included in the model. However, the current study's focus is if the interaction term of initial return and ownership structure is a significant explanatory variable of after-market liquidity of IPOs. The current study uses two different ownership structure variables. The first is the number of shareholders and the second is the number of institutional investors.

The next section explains the empirical approach, the variables, and data. Then the empirical results section and the conclusion section follow.

EMPIRICAL APPROACH, VARIABLES, AND DATA

In the IPO literature, it is well established that higher initial return and broader ownership structure significantly increase after-market liquidity of IPO shares. However, the effects of initial return and ownership structure on after-market liquidity have been rather independently tested and their interaction effect on after-market liquidity as argued in Booth and Chua (1996) has not been tested yet. Therefore, it could be said that the IPO literature provides evidence in support for Booth and Chua (1996)'s conjecture only in a loose sense. This study argues that testing the interaction effect of initial return and ownership structure on after-market liquidity is a more direct test of Booth and Chua (1996)'s conjecture.

The two ownership structure variables this study uses are 1) number of shareholders and 2) number of institutional investors. The reason why ownership structure variables can be correlated with after-market liquidity is rather intuitive, i.e., ownership structure may affect the information production in a manner explained below.

First, shareholders as investors produce information by analyzing earnings calls, business news, and consumer reviews etc. For example, there are a lot of free sources of earnings calls, review videos, blogs, investment and business forums, websites providing information produced by investors and shareholders. Shareholders may not directly produce information about IPO firms, but even in that case, a broader shareholder base can increase liquidity according to Holmstrom and Tirole (1993). They suggest that a broader base of investors or shareholders is necessary to motivate informed investors to produce information. Because informed traders can get their compensation for monitoring and producing information about the firm by engaging in

profitable trading, the IPO firm who wants to see more information to be produced, should attract large enough number of uninformed investors to participate in the trades. Therefore, a larger number of shareholders could mean increased after-market liquidity of IPOs. In a similar context, Booth and Chua (1996) also suggest that a broader shareholder base can result in higher liquidity of IPOs. Chia, Lim, and Goh (2020) provide empirical support of this conjecture. They report that a broader shareholder base decreases information asymmetry and increases liquidity (i.e., price impact).

Second, it is well known that institutions have research groups equipped with various skills and access to resources. This means that more institutional investors investing in IPOs may lead to more information being produced about the value of the IPO firms and an increase in after-market liquidity. Cornelli and Goldreich (2001) conjecture that institutional investors express their interest in IPOs during the book-building process of the offering and help underwriters in setting the final offer price. In addition, Kahn and Winton (2002) suggest that institutional investors may invest in IPO firms with the goal of creating trading profits by acting on the information they produce in the after-market.

In the empirical model of current study, after-market (il)liquidity measures of IPOs are regressed on initial return, ownership structure variables, and the interaction terms between them, where IPO characteristics and trading volume and volatility are controlled for. IPO characteristics used in the model include \ln (market capitalization), percent of primary shares in the IPO issue, underwriter rank, venture-backed IPO dummy, \ln (1 + firm age), tech industry dummy, and number of analysts covering the IPO firm at the end of immediate quarter after the IPO.

Independent Variables

The first set of independent variables are based on empirical literature on major factors influencing liquidity. Following Ellul and Pagano (2006), trading volume and return volatility in the immediate previous quarter before the IPO are included as controls for liquidity.

The second set of independent variables are IPO Characteristics that reflect information available about the firm and therefore can influence after-market liquidity. First, the natural log of market capitalization as a firm size proxy is included because it is often considered the information available about the firm and therefore can affect liquidity. Market capitalization is calculated as the IPO offer price times number of shares outstanding at the time of IPO. Second, the percentage of primary shares in the offering is included to control the liquidity effect of the percentage of shares floating because liquidity can be affected by the percentage of shares available for trading. The percentage of primary shares in the offering is calculated as the number of shares newly issued divided by the total shares offered. Third, \log of (1 + firm age) is included as an additional control for available information.

The third set of independent variables are information certifiers or producers and tech industry membership. First, prestige underwriters (Carter and Manaster (1990); Gompers 1996; Carter, Dark, Singh (1998)) and venture capitalists (Aggarwal et al. (2002); Bradley and Jordan (2002); Loughran and Ritter (2004)) are considered certifiers of information on the IPOs.

Therefore, this study includes underwriter rank and venture backed issue dummy as control variables. Underwriter rank data were from Jay Ritter's web site and venture backed dummy is defined as having a value of one if the issue was backed by a venture capital firm and a value of zero otherwise. Next, since the tech industry membership can affect liquidity, tech

industry dummy was included, and tech industry data were from Jay Ritter's web site. Lastly, the number of analysts is the number of analysts covering the IPO by the end of the immediate quarter after the IPO. Analysts have expert knowledge in industries (Boni and Womack (2006) and Chan and Hameed (2006)) and they produce firm specific information as well (Park and Stice (2000) and Forbes, Huijgen, and Plantinga (2004). This study expects that larger number of analysts increases after-market liquidity of IPOs. Therefore, the number of analysts is included in the empirical model. In support of this idea, Roulstone (2003) reports that more number of analysts following increases liquidity as well.

The fourth set of independent variables are three key independent variables. Initial return (IR) is the first key independent variables and calculated as (First trading day closing price – offer price)/offer price. Among others, Hahn, Ligon, and Rhodes (2013) shows that in general, initial return significantly boosts after-market liquidity. The number of shareholders (NSH) and the number of institutional investors (NI) are two additional key independent variables. The number of shareholders is the total number of shareholders at the first reporting date following the offering. Number of institutional investors is the number of institutional investors having equity ownership in the IPO by the end of immediate quarter after the IPO. To test whether ownership structure affects after-market liquidity through initial return, this study includes interactions terms between ownership structure variables and initial return (i.e., IR x NSH and IR x NI respectively).

Dependent Variables

In liquidity literature, bid ask spread-based measures and price impact related measures are often considered the two most popularly used liquidity measures. This study uses the following three liquidity measures of IPOs in the after-market as dependent variables: two spread based liquidity measures, average proportional realized spread (RS), average proportional quoted spread (QS), and one price impact-based liquidity measure, Price Impact (PI) by Brennan and Subrahmanyam (1996) (i.e., price sensitivity to order flows defined in Kyle (1985) divided by average price times the number of shares outstanding). RS is calculated as twice the absolute value of the difference between the most recent transaction price and the quote midpoint prevailing after the trade divided by that quote midpoint. QS is calculated as the difference between the quoted ask price and the quoted bid price divided by the quote midpoint. The wider the spreads (RS or QS) are, the lower the liquidity. The bigger the PI is the lower the liquidity. In other words, these three measures capture illiquidity.

In estimating QS and RS, intraday minute-by-minute trades and quotes for the first four weeks from the IPO date from the Trade and Quotes database (TAQ) was used. The estimation process followed the one used by Cao et al. (2004). PI was estimated using the same intra-day data and Brennan and Subrahmanyam's (1996) implementation of the Glosten and Harris (1988) method was used. A more detailed description of the estimation process of three (il)liquidity measures can be found in Hahn, Ligon, and Rhodes (2013).

Empirical Model

Building upon the construction of variables explained in the previous sections, this study uses the following empirical model in linear regression with robust standard errors.

$$\begin{aligned}
 \text{(il)Liquidity}_i &= \beta_0 + \beta_1 \text{ Average Volume} + \beta_2 \text{ Variance of Returns} \\
 &+ \beta_3 \ln(\text{Market Capitalization}) + \beta_4 \text{ Percent of Primary Shares} \\
 &+ \beta_5 \text{ Underwriter Rank} + \beta_6 \text{ Venture Backed Dummy} \\
 &+ \beta_7 \ln(1 + \text{Firm Age}) + \beta_8 \text{ Tech Industry Dummy} + \beta_9 \text{ Number of Analysts} \\
 &+ \beta_{10} \text{ Initial Return (IR)} + \beta_{11} \text{ Number of Shareholders (NSH)} \\
 &+ \beta_{12} \text{ IR} \times \text{NSH} + \beta_{13} \text{ Number of Institutions (NI)} + \beta_{14} \text{ IR} \times \text{NI} + \varepsilon_i
 \end{aligned}$$

The key independent variables are initial return, the number of shareholders, the number of institutions, and two interaction terms, IR x NSH and IR x NI. If β_{10} is negative and significant, it means that higher initial return independently increases after-market liquidity. If β_{11} is negative and significant, it means that a broader shareholder base independently increases after-market liquidity. If β_{13} is negative and significant, it means that a greater number of institutional investors independently increases after-market liquidity. If β_{12} is negative and significant, it means that initial return and a broader shareholder base jointly increases after-market liquidity. If β_{14} is negative and significant, it means that initial return and a greater number of institutional investors jointly increases after-market liquidity.

Data

Data includes newly issued common stocks listed on the Nasdaq during the period from 2001 to 2009. IPO company name, IPO offer date, IPO offer price, number of shares outstanding, whether the IPOs are venture capital backed, and number of shares offered are extracted from Thomson Financial's SDC (Security Data Company) database. In addition, daily trading volume and daily returns are extracted for the first 4 weeks of trading from the Center for Research in Security Prices U.S. Stock Database (CRSP) and Compustat. Intraday minute-by-minute trades and quotes on Nasdaq are from the NYSE's Trade and Quotes database (TAQ).

As in the other IPO studies, foreign IPOs, closed-end funds, and REITs (Real Estate Investment trusts) were excluded. Also eliminated are IPO firms with no valid data from either CRSP or TAQ, IPO firms that change exchange listings or went through mergers or acquisitions within one year after the offerings, and IPOs with an offer price less than \$5. The number of analysts covering IPOs was from the I.B.E.S. database. 641 IPOs survived this filtration process and remained in the sample.

The key independent variables are initial return, number of shareholders at the first reporting date following the offering, the number of institutional investors holding equity ownership in the IPO. The number of shareholders was from Compustat, number of institutional investors for IPOs was from 13F filings compiled by Thomson Reuters.

EMPIRICAL RESULTS

Summary statistics on the variables used in the empirical analysis are presented in table 1. Three (il)liquidity measures, RS, QS, and PI have mean values 1.13%, 1.54%, and 27.52

respectively. The standard deviation, minimum and maximum values of three (il)liquidity measures show quite a variation to be explained.

The correlation between (il)liquidity variables and independent variables is presented in table 2. The percentage of primary shares and venture-backed dummy are statistically significant and positively correlated with all the (il)liquidity variables. All other independent variables show inconsistency in the manner they correlate with liquidity measures, either in the sign of the correlation or in the statistical significance: log of market cap is statistically significantly and negatively correlated with spread based (il)liquidity variables (i.e., RS and QS) but is statistically significantly and positively correlated with price impact (il)liquidity variable (i.e., PI). Three key independent variables, initial return, number of shareholders, and number of institutions are negatively correlated with spread based liquidity variables, RS and QS (i.e., they are increasing spread based (il)liquidity) but positively correlated with price-impact based (il)liquidity variable, price impact measure (i.e., they are decreasing price-impact based liquidity).

Regression Results

The regression results of the liquidity measures on initial return and ownership structure variables are presented in table 3. All the variables including interaction terms are checked on multicollinearity by VIF (Variance Inflation Factors). Most variables have VIF values less than 3 and no variable exhibits VIF value higher than 5, indicating no serious multicollinearity. In table 3, the models explain significant percent of the variation in liquidity variables witnessed in r-squares of 37.98%, 42.19%, and 15.92% for regressions of RS, QS, and Price Impact respectively.

In RS regression, variance of returns is positively correlated with RS and is statistically significant. Ln (market cap) is negatively correlated with RS, and it is statistically significant, meaning IPOs with larger market cap experience lower proportional spread, i.e., higher liquidity. Venture-backed dummy is positively correlated with RS and is statistically significant, meaning that IPOs backed by venture capital firms tend to have higher proportional spread, i.e., lower liquidity. The number of analysts decreases RS. Initial return, the number of shareholders, and the number of institutions all significantly decrease RS, meaning they increase liquidity.

In QS regression, log of market cap is negatively correlated with QS, and it is statistically significant. This means IPOs with a larger market cap experience lower QS, i.e., higher liquidity. Underwriter rank and log of firm age are two additional issue characteristic variables that have negative signs and are statistically significant, implying that IPOs which have been around longer and use more reputable underwriters tend to have lower quoted spread, i.e., higher liquidity. Venture-backed dummy is positively correlated with QS, and it is statistically significant, meaning that IPOs backed by venture capital firms tend to have higher QS, i.e., lower liquidity. Initial return, number of shareholders, and number of institutions all significantly decrease QS, meaning they increase liquidity. Two ownership structure variables, the number of shareholders and the number of institutions, are statistically significant and negatively correlated with QS, implying that broader ownership boosts liquidity.

In PI regression, the percentage of primary shares and tech dummy are positively correlated with price impact measure, and they are statistically significant. Initial return is positively correlated with PI (price impact measure), meaning higher initial return decreases liquidity. However, log of market cap and number of analysts are negatively correlated with price impact measure, and they are statistically significant, meaning greater number of analysts

significantly increases liquidity.

Most importantly, as explained in the previous sections, to be able to test whether ownership structure affects liquidity through initial return, the coefficients of the two interaction terms, IR x NSH and IR x NI, should be examined. If the coefficients of these interaction terms are negative and significant, then it will be evidence that a broader ownership increases liquidity through initial return. The results show that the interaction term between initial return and number of shareholders (IR x NSH) increases RS and QS, meaning that broader ownership decreases liquidity. In contrast, in the PI regression, the same interaction term has a negative sign and statistically significant, meaning broader ownership increases liquidity. Next, the interaction term between initial return and number of institutional investors (IR x NI) increases all three liquidity measures and they are statistically significant, meaning it decreases liquidity regardless of the liquidity measures used. Therefore, this is evidence against ownership structure increasing liquidity through initial return. Overall, this study finds weak evidence for ownership structure increasing liquidity through initial return.

CONCLUSION

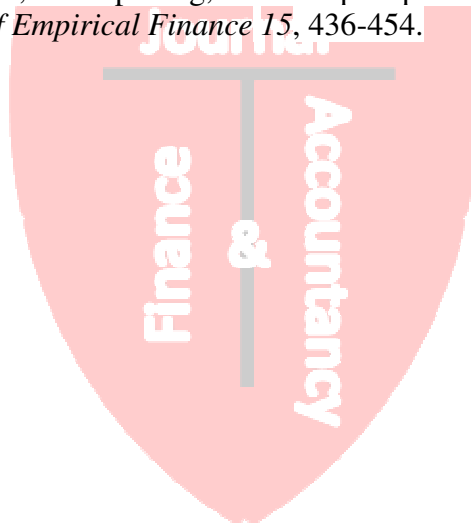
This study finds evidence that broader ownership structure mostly increases after-market liquidity of IPOs independently when they do rather than through the interaction with the initial return. The two ownership structure variables used were the number of shareholders and number of institutional investors. For liquidity measures, this study used two spread-based measures, Average Proportional Realized Spread (RS) and Average Proportional Quoted Spread (QS), and one price sensitivity to order flows measure, price impact measure (PI). In all three (il)liquidity measures, higher value means low liquidity.

The results suggest that when spread based liquidity measures are used as (il)liquidity measure in regression, higher initial return and broader ownership significantly increase liquidity, although they do not when price impact measure is used as liquidity measure in regression. More importantly, interaction terms between initial return and ownership structure variables mostly show positive signs in liquidity regressions, meaning they are decreasing liquidity. Therefore, this study's results suggest that higher initial return and broader ownership increase liquidity independently rather than jointly, evidence against the conjecture presented in Booth and Chua (1996) and the empirical results presented in Zheng and Li (2008).

REFERENCES

- Aggrawal, R.K., L. Krigman, and K.L. Womack, 2002, Strategic IPO underpricing, information momentum, and lockup expiration selling, *Journal of Financial Economics* 66, 105-137.
- Benston, G.J., Hagerman, R.L., 1978, Risk, volume and spread, *Financial Analysts Journal* 34, 46-49.
- Blume, Marshall E. and Keim, Donald B., Institutional Investors and Stock Market Liquidity: Trends and Relationships (August 21, 2012). Available at SSRN: <https://ssrn.com/abstract=2147757> or <http://dx.doi.org/10.2139/ssrn.2147757>
- Boni, L., & Womack, K. L., 2006, Analysts, industries, and price momentum, *Journal of Financial and Quantitative Analysis* 41, 85-109.
- Booth, J.R. and L. Chua, 1996, Ownership dispersion, costly information and IPO underpricing, *Journal of Financial Economics* 41, 291-310.
- Boot, A.W.A., Gopalan, R., Thakor, A., 2006, The entrepreneur's choice between private and public ownership, *Journal of Finance* 61, 803-836.
- Bradley, D. J. and B.D. Jordan, 2002, Partial adjustment to public information and IPO underpricing, *Journal of Financial and Quantitative Analysis* 37, 595-616.
- Brennan, M.J., Subrahmanyam, A., 1996, Market microstructure and asset pricing: on the compensation for illiquidity in stock returns, *Journal of Financial Economics* 41, 441-464.
- Butler, A.W., Grullon, G., Weston, J., 2005, Stock market liquidity and the cost of raising capital, *Journal of Financial and Quantitative Analysis* 40, 331-348.
- Cao, C., Field, L.C., Hanka, G., 2004, Does insider trading impair market liquidity? Evidence from IPO lockup expirations, *Journal of Financial and Quantitative Analysis* 39, 25-46.
- Carter, R.B. and S. Manaster, 1990, Initial public offerings and underwriter reputation, *Journal of Finance* 53, 285-311.
- Carter, R.B., F.H. Dark, and A.K. Singh, 1998, Underwriter reputation, initial returns, and the long-run performance of IPO stocks, *Journal of Finance* 53, 285-311.
- Chan, K., & Hameed, A., 2006, Stock price synchronicity and analyst coverage in emerging markets, *Journal of Financial Economics* 80, 115-147.
- Chia, Y. E., Lim, K. P., & Goh, K. L., 2020, More shareholders, higher liquidity? Evidence from an emerging stock market. *Emerging Markets Review* 44, 100696
- Cornelli, F. and D. Goldreich, 2001, Bookbuilding and strategic allocation, *Journal of Finance* 56, 2337-2370.
- Demsetz, H., 1968, The cost of transacting, *The Quarterly Journal of Economics* 82, 33-53.
- Ellul, A., Pagano, M., 2006, IPO underpricing and after-market liquidity, *Review of Financial Studies* 19, 381-421.
- Forbes, William Patrick and Huijgen, Carel A. and Plantinga, Auke, Using Analysts' Earnings Forecasts for Country/Industry-Based Asset Allocation (June 2004). Available at SSRN: <https://ssrn.com/abstract=567121> or <http://dx.doi.org/10.2139/ssrn.567121>
- Glosten, L., Harris, L., 1988, Estimating the components of the bid-ask spread, *Journal of Financial Economics* 21, 123-142.
- Gompers, P. A. , 1996, Grandstanding in the venture capital industry, *Journal of Financial Economics* 42, 133-156.
- Hahn, T., J.A. Ligon, and H. Rhodes, 2013, Liquidity and initial public offering underpricing, *Journal of Banking and Finance* 37, 4973-4988.

- Holmström, B., & Tirole, J., 1993, Market Liquidity and Performance Monitoring, *Journal of Political Economy* 101, 678-709.
- Jacoby, G., & Zheng, S. X., 2010, Ownership dispersion and market liquidity, *International Review of Financial Analysis* 19, 81-88.
- Kahn, C., and A. Winton, 2002, Ownership structure, speculation, and shareholder intervention, *Journal of Finance* 53, 99-129.
- Kyle, A., 1985, Continuous auctions and insider trading, *Econometrica* 53, 1315-1335.
- Loughran, T. and J.R. Ritter, 2004, Why has IPO underpricing changed over time? *Financial Management* 33, 5-38.
- Park, C. W., & Stice, E. K., 2000, Analyst forecasting ability and the stock price reaction to forecast revisions, *Review of Accounting Studies* 5, 259-272.
- Pham, P.K., Kalev, P.S., Steen, A.B., 2003, Underpricing, stock allocation, ownership structure, and post-listing liquidity of newly listed firms, *Journal of Banking & Finance* 27, 919-947.
- Roulstone, D. T., 2003, Analyst following and market liquidity, *Contemporary Accounting Research* 20, 552-578.
- Zheng, S. X., and Li, M., 2008, Underpricing, ownership dispersion, and aftermarket liquidity of IPO stocks, *Journal of Empirical Finance* 15, 436-454.



APPENDIX

Table 1
Summary Statistics

Variable	N	Mean	STD	Min	Max
<i>(il)Liquidity Measures:</i>					
RS	641	0.0113	0.0063	0.0011	0.0631
QS	641	0.0154	0.0085	0.0009	0.0534
PI	641	27.5185	60.0502	-325.4431	1001.4740
<i>Control Variables for Liquidity:</i>					
Avg. Vol	641	7.7520	13.7196	0.1125	298.5290
Var of Ret	641	0.3439	0.5596	0.0009	5.2457
<i>IPO Characteristics:</i>					
Market Cap	641	761212	1608326	12577	21700000
% of Primary Shares	641	0.9114	0.1686	0.0284	1.0000
Underwriter Rank	641	7.1981	2.4348	0	9
Venture Backed %	641	0.4299	0.4951	0	1
Firm Age	641	12.5755	19.6558	0	165
Tech Industry Dummy	641	0.3310	0.4707	0	1
No of Analysts	641	29.2687	24.2251	1	273
Initial Return	641	0.27693	0.61874	-0.9834	13.04167
<i>Ownership Structure Variables:</i>					
No of Shareholders (thousands)	641	1.3831	4.7388	0.001	74
No of Institutions	641	2.3347	2.0374	0	29

Variable Definitions:

- average proportional realized spread (RS): twice the absolute value of the difference between the most recent transaction price and the quote midpoint prevailing after the trade divided by that quote midpoint.
- average proportional quoted spread (QS): the difference between the quoted ask price and the quoted bid price divided by the quote midpoint.
- price impact (PI): price sensitivity to order flows defined in Kyle (1985) divided by average price times the number of shares outstanding.
- average trading volume: average trading volume of the stock market in the immediate previous quarter before the IPO.
- variance of return: return variance of the stock market in the immediate previous quarter before the IPO.
- market capitalization: market capitalization of the IPO at offer price.
- percentage of primary shares in the offering: the number of shares newly issued divided by the total shares offered.
- firm age: IPO firm's years from the year it was founded.
- underwriter rank: Lead underwriters rank compiled by Jay Ritter's web site.
- venture backed dummy: having a value of one if the issue was backed by a venture capital firm and a value of zero otherwise.
- tech industry dummy: dummy having one if the IPO firm belongs to tech industry and data were from Jay Ritter's web site.
- number of analysts: the number of analysts covering the IPO by the end of the immediate quarter after the IPO.
- initial return: (first trading day closing price – offer price)/offer price.
- number of shareholders: the total number of shareholders at the first reporting date following the offering.
- number of institutional investors: number of institutional investors having equity ownership in the IPO by the end of immediate quarter after the IPO.

Table 2
Correlation between ownership structure, initial return, and after-market liquidity

	RS	QS	PI
RS	1		
QS	0.8250***	1	
PI	-0.0347	-0.0091***	1
Avg Vol	-0.3508***	-0.4048***	0.1527***
Var of Ret	0.1486***	-0.0566	0.2419***
Ln (Market Cap)	-0.5142***	-0.6004***	0.3543***
% of Primary Shares	0.1390***	0.0880***	0.0936***
Underwriter Rank	-0.0908***	-0.1720***	0.0738**
Venture Backed dummy	0.2413***	0.2204***	0.0602*
Ln (1 + Firm Age)	-0.1188***	-0.1012***	-0.0833**
Tech Industry Dummy	-0.0044	-0.0736	0.2364***
No of Analysts	-0.3074***	-0.2210	0.0528***
Initial Return	-0.1647***	-0.2744***	0.3811***
No of Shareholders	-0.1163***	-0.1330	0.0370
No of Institutions	-0.4742***	-0.4861***	0.1608***

* indicates statistical significance at 10% level. ** indicates statistical significance at 5% level. *** indicates statistical significance at 1% level.

Variable Definitions:

- average proportional realized spread (RS): twice the absolute value of the difference between the most recent transaction price and the quote midpoint prevailing after the trade divided by that quote midpoint.
- average proportional quoted spread (QS): the difference between the quoted ask price and the quoted bid price divided by the quote midpoint.
- price impact (PI): price sensitivity to order flows defined in Kyle (1985) divided by average price times the number of shares outstanding.
- average trading volume: average trading volume of the stock market in the immediate previous quarter before the IPO.
- variance of return: return variance of the stock market in the immediate previous quarter before the IPO.
- market capitalization: market capitalization of the IPO at offer price.
- percentage of primary shares in the offering: the number of shares newly issued divided by the total shares offered.
- firm age: IPO firm's years from the year it was founded.
- underwriter rank: Lead underwriters rank compiled by Jay Ritter's web site.
- venture backed dummy: having a value of one if the issue was backed by a venture capital firm and a value of zero otherwise.
- tech industry dummy: dummy having one if the IPO firm belongs to tech industry and data were from Jay Ritter's web site.
- number of analysts: the number of analysts covering the IPO by the end of the immediate quarter after the IPO.
- initial return: (first trading day closing price – offer price)/offer price.
- number of shareholders: the total number of shareholders at the first reporting date following the offering.
- number of institutional investors: number of institutional investors having equity ownership in the IPO by the end of immediate quarter after the IPO.

Table 3
After-market liquidity as a function of ownership structure

	RS		QS		PI	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
<i>Control for Liquidity:</i>						
Avg. Vol	-0.00002	0.00002	-0.00004	0.00003	0.00679	0.00471
Var of Ret	0.00195***	0.00034	0.00033	0.00049	0.09725	0.08284
<i>Issue Characteristic:</i>						
Ln (Market Cap)	-0.00256***	0.00032	-0.00396***	0.00045	-0.23529***	0.08386
% of Primary Shares	0.00071	0.00144	0.00079	0.00162	0.41209***	0.12184
Underwriter Rank	-0.00006	0.00007	-0.00019**	0.0001	0.00951	0.01549
Venture Backed Dummy	0.00149***	0.00046	0.00246***	0.00058	-0.07173	0.07952
Ln (1 + Firm Age)	-0.00025	0.00019	-0.00044*	0.00025	0.00612	0.02773
Tech Industry Dummy	-0.00002	0.00039	-0.00010	0.00060	0.15079**	0.07394
No of Analysts	-0.00019**	0.00009	-0.00001	0.00014	-0.06907***	0.01843
Initial Return (IR)	-0.00171**	0.00071	-0.00297***	0.00098	0.46871***	0.16641
<i>Ownership Variables:</i>						
No of Shareholders (NSH)	-0.00010***	0.00003	-0.00015***	0.00005	0.00309	0.00541
IR x NSH	0.00003	0.00002	0.00005*	0.00003	-0.00952***	0.00356
No of Institutions (NI)	-0.00003**	0.00001	-0.00004**	0.00002	0.00113	0.00155
IR x NI	0.00003**	0.00001	0.00005**	0.00002	0.00052	0.00263
Constant	0.04531***	0.00387	0.06925***	0.00559	3.08117	1.0534
N	641		641		641	
Adj. R-Square	37.98%		42.19%		15.92%	

* indicates statistical significance at 10% level. ** indicates statistical significance at 5% level. *** indicates statistical significance at 1% level.

Variable Definitions:

- average proportional realized spread (RS): twice the absolute value of the difference between the most recent transaction price and the quote midpoint prevailing after the trade divided by that quote midpoint.
- average proportional quoted spread (QS): the difference between the quoted ask price and the quoted bid price divided by the quote midpoint.
- price impact (PI): price sensitivity to order flows defined in Kyle (1985) divided by average price times the number of shares outstanding.
- average trading volume: average trading volume of the stock market in the immediate previous quarter before the IPO.
- variance of return: return variance of the stock market in the immediate previous quarter before the IPO.
- market capitalization: market capitalization of the IPO at offer price.
- percentage of primary shares in the offering: the number of shares newly issued divided by the total shares offered.
- firm age: IPO firm's years from the year it was founded.
- underwriter rank: Lead underwriters rank compiled by Jay Ritter's web site.
- venture backed dummy: having a value of one if the issue was backed by a venture capital firm and a value of zero otherwise.
- tech industry dummy: dummy having one if the IPO firm belongs to tech industry and data were from Jay Ritter's web site.
- number of analysts: the number of analysts covering the IPO by the end of the immediate quarter after the IPO.
- initial return: (first trading day closing price – offer price)/offer price.
- number of shareholders: the total number of shareholders at the first reporting date following the offering.
- number of institutional investors: number of institutional investors having equity ownership in the IPO by the end of immediate quarter after the IPO.