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Underpricing, Stock Allocation, Ownership Structure and Post-Listing Liquidity of Newly Listed Firms

by

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ABSTRACT

This study investigates the relationships between underpricing, ownership structure and post-listing liquidity of Initial Public Offerings (IPOs). It is argued that increasing the degree of underpricing induces both broader investor participation and creates a more diffuse ownership structure. These two factors in turn are positively associated with the level of post-listing trading, and therefore offer an explanation of how underpricing can influence liquidity. Our results indicate that underpricing is related to the shareholder distribution formed after the allocation process. Moreover, it is positively associated to post-listing liquidity. These relationships are robust and possess a high degree of statistical and economic significance.

Keywords: Allocation process; Initial public offerings; Ownership structures; Post-listing liquidity; Underpricing.

JEL classification: G24, G32

1. Introduction

In a company's life cycle an initial public offering (IPO) normally occurs at the stage where its equity funding demands can no longer be satisfied by a single investor or a group of proprietary investors. The ownership structure, previously concentrated in the hands of a few people, expands to include a larger number of outside investors. This change in post-listing ownership structure enables the trading of the company's shares to become more liquid.

Companies usually aim to maximise the liquidity of their shares after an IPO because high liquidity ensures that they can raise additional equity funding at more favourable terms due to the reduction in transaction costs (Amihud and Mendelson, 1986; Ibbotson and Ritter, 1995). Liquidity is also crucial because it induces further public issues, which improve the size and efficiency of the overall share market and create in essence a "snowball" effect (Subrahmanyam and Titman, 1999). Moreover, if the initial owners wish to retain control, they can promote share liquidity by creating a dispersed ownership structure, which engenders an effective mechanism to impede future hostile takeovers (Shleifer and Vishny, 1986).

Achieving liquidity may entail additional costs. It can be argued that, *ceteris paribus*, a concentrated ownership structure actually confers more value than a dispersed one.[1] This is because large-block shareholders can actively monitor and participate in the company's activities to reduce agency costs. It is possible also, that in commercial practice, some companies value highly the benefits of concentrated ownership. This results in their deliberate arrangements to forfeit liquidity.[2] Alternatively, achieving liquidity may involve a significant cost for the issuer because when a company goes public it must induce participation from a broad and diverse base of new investors. This paper proposes that this cost is reflected through the degree of underpricing of each IPO.

The phenomenon of underpricing, which refers to the abnormal returns experienced during the initial trading period of an IPO, has been extensively documented.[3] While most of the research on IPO underpricing has focused on explaining the causes of this phenomenon, very few studies have investigated the determinants of after-listing liquidity. However, liquidity among other issues is discussed to some extent in Miller and Reilly (1987), Schultz and Zaman (1994) and Hanley (1993). More recently Reese (1998) shows that there is a

[1] See Jensen and Meckling (1976), Demsetz and Lehn (1985), Shleifer and Vishny (1986) and, Burkart, Gromb and Panunzi (1997) among others.
[2] Bolton and von Thadden (1998) present a model that analyses the costs and benefits derived from ownership concentration.
[3] See Ibbotson and Ritter (1995) for an extensive review of the literature on IPO underpricing.

positive relationship between underpricing and post-listing liquidity (measured by trading volumes of IPO shares), and this remains significant for nearly three years after the listing date. By accounting for "investor interest", which is determined by the frequency of newspaper citations for each IPO prior to and post listing, he suggests that the level of investor interest is important in determining both the final offer price and liquidity.

Our study considers the relationship between underpricing and post-listing liquidity. In contrast to Reese (1998), we argue that this relationship is determined by the impact of ownership structure formed after the allocation process and just prior to listing. In particular, an IPO-company seeking a liquid secondary market for its shares must attract a large number of smaller shareholders, which creates a more dispersed ownership structure. However, being information-disadvantaged, smaller investors incur some adverse selection costs, and therefore require a higher degree of underpricing to induce them to invest. Alternatively, an IPO-company may desire a concentrated ownership structure to promote the benefits of monitoring and reduced agency costs, but at the expense of liquidity. In this case, only a small degree of underpricing is required to achieve complete participation, as large shareholders possess superior information about the company's true value. Thus, the consequence of such selection of ownership structure is that the liquidity after the listing date is determined by the extent to which an IPO-company's shares are priced at a discount to their expected fair value.[4]

In order to test this argument, we investigate the cross-sectional variation in the post-listing liquidity of IPOs and the influences of the underpricing and ownership structure of new issues. By using the models developed in this study, the issuer of a particular IPO is able to forecast the level of liquidity after the float. All variables employed in the models can be estimated *ex-ante* using currently available internal or external information. This helps issuers to set the appropriate level of underpricing to achieve the desired level of liquidity. Moreover, these models enable the prediction of future liquidity in terms of trading volume and bid-ask spread. Thus, on the one hand, original owners can determine the strategies and timing of further equity raising or relinquishing of control. On the other hand, if owners aim to retain control, underpricing can be used as a mechanism to hedge against hostile takeover, as it may induce a broad and equally distributed ownership structure.

[4] Brennan and Franks (1997) observe that firms' ownership structures after listing are relatively stable. This explains why the relationship between underpricing and liquidity is positive for a long period of time as found in Reese (1998).

The remainder of this paper is organised as follows. Section 2 presents detailed arguments of how IPO-underpricing, ownership structure and post-listing liquidity are inter-related. The methodology is discussed in Section 3. Section 4 contains the sample selection procedure and some descriptive statistics. Empirical results are presented in Section 5, while Section 6 provides conclusions and proposals for further research.

2. Development OF Hypotheses

2.1 Ownership Structure and Liquidity

In general, there is agreement that the liquidity of a security is positively related to the breadth and diversity of its shareholder base. For instance, Demsetz (1968) defines illiquidity as the absence of continuous trading, which is characterised by a degree of mismatch between available buyers and sellers at a given point in time, and this mismatch is dependent upon the number of shareholders. Bhide (1993) argues that liquidity may be enhanced when the ownership structure is more diffuse, in the sense that there is a larger proportion of smaller shareholders. Holmström and Tirole (1993) clarify this notion by making a distinction between long-term investors and short-term liquidity traders; the degree of diffusion refers to the latter's shareholding. Moreover, they argue that when ownership structure is concentrated with long-term investors, the liquidity of a company will be impaired because liquidity traders who possess relatively less information will either reduce their trading frequency or increase transaction premiums to reduce potential loss. Consistent with this argument, Amihud and Mendelson (1986) find a positive correlation between bid-ask spread and the level of ownership concentration.

However, according to Jensen and Meckling (1976) and Shleifer and Vishny (1986), achieving liquidity through a broad and diffuse shareholder base also imposes significant disadvantages on the company. When ownership is diffuse, small shareholdings reduce the marginal benefit of collecting information and monitoring the company's activities.[5] Even if sufficient information is obtained, the spread of ownership creates a serious collective action problem, which prevents shareholders from effectively correcting possible management activities that are divergent from shareholders' interests. Concentrated ownership encourages active investor monitoring and control as lower liquidity raises the exit barrier. More recently, Kahn and Winton (1998, p. 122) propose that concentration levels should be

[5] The term "monitoring" refers to the activity of shareholders in discovering, correcting or appraising management's activities to help reduce agency costs and promote firm value.

higher in relatively "transparent" industries rather than industries where information is harder to obtain and the effects of intervention may be more uncertain. Therefore, for some IPO-companies, liquidity may be forfeited so that the benefits of control and monitoring are enhanced.[6]

One can dispute the validity of the trade-off principle between liquidity and control. For instance, Holmström and Tirole (1993) argue that a liquid market can also monitor the company's performance through the price-discovery mechanism. If a company is owned by a large number of smaller investors, who are supposedly uninformed, a speculator can incur a cost to collect and monitor information that confers advantages when trading on the market. Subsequently, this private information will be manifested in the market by moving the share price to approach its true value. In the model developed by Holmström and Tirole (1993), higher liquidity quickly results in less biased, albeit information deficient, price-discovery. In practice, if the company's shares are liquid, poor management performance will be reflected in the share price, making the company vulnerable to hostile takeover. In contrast, if a company's ownership structure is very concentrated, corrective actions from large shareholders may not be efficient, as they may be subjective in judging management performance. Therefore, it is asserted that a liquid share market corrects management mistakes more quickly and efficiently than monitoring through a number of large-block shareholders.[7]

This argument again raises the question of why every company does not go public and reduce block-ownership if liquidity confers such universal benefits. One explanation is that achieving and maintaining liquidity imposes some indirect costs on the company. These costs include the cost of compensating small shareholders who are informationally disadvantaged and lose money on average by investing in IPOs. In order to create a shareholder base that is both broader and more evenly distributed, it is proposed that underpricing can be used in a company float as the compensation mechanism, which ultimately improves post-listing liquidity.

[6] Wruck (1989) provides some empirical evidence showing that such a trade-off may be worthwhile. In her study of private equity sales that are usually accompanied by an increased ownership concentration, the share values of the selling companies increased by an average of 4.5%.
[7] Supporting evidence can be found in Burkart *et al*. (1997) and Maug (1998).

2.2 Underpricing and ownership structure

Several explanations of IPO underpricing rely upon the theoretical foundation of information asymmetries which exist between different participants in the offer (e.g. offerors, underwriters, investors, etc.). Rock (1986, p. 205) argues that investors are divided into 'informed' and 'uninformed' groups. Intuitively, informed investors who incur costs to collect information would be likely to participate more often in 'good' issues (i.e. those with a higher degree of underpricing). The lack of information causes uninformed investors to receive a lower allocation of underpriced as opposed to overpriced new issues. As a consequence, uninformed investors are likely to lower their valuation of any new issue because they have no information to confirm its true value. Collectively, uninformed investors withdraw from the market unless the issue price is sufficiently low to compensate them for this disadvantage.

However, a shortcoming of Rock's model is not considering the advantage that accrues to the issuer from uninformed investors' participation. A number of studies clarify this issue by asserting that as 'uninformed investors' are most likely to be the smaller investors, it is crucial to the issue's success to attract a certain proportion of such investors.[8] One reason is that regulations in many countries require a significant degree of spread of ownership in any float to reduce the disadvantages to retail investors. Bhide (1993) further clarifies that this regulation differs from country to country. Policies in the US, UK and Australia aim at promoting liquidity and hence require more participation from retail investors than those in Germany and Japan, where policies favour the benefits of monitoring through concentrated ownership structure.

Another reason is proposed by Chowdhry and Sherman (1996). They argue that favouring small investors may increase the underwriter's expected revenues from the issue. They propose that a large base of small (uninformed) shareholders reduces the possibility of information spillover during the pre-listing stage. Information spillover refers to the potential leakage of 'bad' information before trading commences. Therefore, the allocation of shares favours small shareholders. Similarly, Mello and Parsons (1998) provide a theoretical argument that the optimal strategy to improve a firm's value in the going public process should start with selling dispersed shareholdings to small and passive investors in the IPO, while the marketing of potentially controlling blocks should occur at the subsequent sales or equity issues.

[8] See Koh and Walter (1989), Ibbotson and Ritter (1995) and Brennan and Franks (1997).

Whether this strategy of developing a dispersed shareholder distribution is achieved depends significantly upon setting the right issue price. Booth and Chua's (1996) theoretical model corroborates this view by arguing that underpricing is used by the investment banker managing an issue as a method to compensate investors for the costs of collecting information. The rationale for this method is that the investment banker has limited marketing capacity and cannot market all the information regarding the firm's true value to all investors, but only to its most regular institutional customers. However, these investors do not readily relay this information to other investors without being financially rewarded. As the required investor base grows, the difficulty for each additional investor to gain access to this information escalates. Since investors must incur additional costs to collect the necessary information, higher underpricing is required to induce more participation.

Similarly, Brennan and Franks (1997) argue that underpricing is first used to ensure over-subscription. When this is achieved, underwriters and the owners have discretion in the share allocation process. In particular, they would be likely to discriminate against applicants for large numbers of shares to ensure that company insiders are protected against hostile change of control. Their empirical results show that greater underpricing is associated with smaller blocks of shares being held by new investors. There exist however, some theoretical models that argue that the allocation process will usually discriminate against smaller investors (Stoughton and Zechner, 1998; Benveniste and Spindt, 1989, among others). However, these models focus mainly on book-building IPOs and lack empirical confirmation.

Combined with the argument that liquidity is determined by ownership structure, we propose that a positive relationship exists between liquidity and underpricing. The latter has been previously investigated empirically by Miller and Reilly (1987). They find a statistically significant difference in trading volumes between underpriced and overpriced offers, and this lasts for their entire observation period of 21 days. Reese (1998) confirms this relationship over a longer period of up to 3 years. In this study, we focus on the first 30 days after commencement of trading. This period has been chosen because, once a level of liquidity is established for a company, it is likely to remain stable (Aggarwal and Rivoli, 1990).

2.3 Hypotheses

We argue that underpricing can affect liquidity in two distinct ways. First, a higher degree of IPO underpricing promotes general interest from potential investors and leads to a broader spread of new investors post-listing. Secondly, underpricing may result in over-subscription,

which allows the issuer to discriminate against larger applicants in order to ensure that the ownership structure of new shareholders is more evenly distributed. Subsequently, both the wider breadth and greater diffusion promote an active secondary market for an IPO after its initial trading. Formally, we can state the following hypotheses:

H_1: The level of underpricing is positively related to the breadth of shareholder distribution formed after the allocation process, and negatively related to the inequality of shareholder distribution amongst the new investors.

H_2: The level of post-listing liquidity is positively influenced by the breadth of shareholder distribution, and negatively influenced by the inequality of shareholder distribution amongst the new investors.

H_3: A positive relationship exists between the degree of underpricing and the level of post-listing liquidity.

3. Research Methodology

3.1 Measures of Underpricing

Consistent with previous studies, such as Ibbotson and Ritter (1995), market adjusted returns are calculated using the following formula:

$$MAR_i = \frac{P_i - O_i}{O_i} - \frac{M_i^1 - M_i^0}{M_i^0}. \qquad (1)$$

where MAR_i is the market-adjusted return of company *i* at the end of the listing date, P_i is the closing price on the first trading day, O_i is the offer price provided by the prospectus. Similar to How, Izan and Monroe (1995), M_i^1 is the closing value of a selected market index on that date, and M_i^0 is the closing value of the index on the day prior to listing.[9] The All Industrials Accumulation Index is used to adjust for market movements, as all IPOs in the sample are industrial companies.

[9] The market index value on the day prior to listing is used as a proxy for the actual closing date of the issue as it is common for Australian IPOs to close their books before the closing date specified in the prospectus. How and Low (1993) found insignificant differences in market adjusted returns after adjustment was made using either closing date or the date prior to listing. Hence, this latter procedure is used here.

3.2 Measures of ownership structure

The difficulty that confronts studies of ownership structure is the lack of a single, agreed measure of the degree of shareholders' concentration. This ambiguity is the result of the fact that the ownership structure of a company consists of a distribution of values that reflects the size of shareholdings of its investors. Using a single measure in the form of an average or proportion may not be sufficient to describe distributions with varying shapes. Therefore, we propose that a firm's ownership structure can be described by reference to two distinct dimensions simultaneously. These are the breadth and equality of shareholder distribution.[10]

Breadth of shareholder distribution reflects the size and diversity of the outside-investor base of an IPO after all of the shares on offer have been allocated to the subscribers. Obviously, IPOs with large issue size usually involve large numbers of investors. We measure the breadth of shareholder distribution as the number of new investors ($NUMINV_i$) divided by the dollar amount of shares offered ($OFFERSIZE_i$), which is equivalent to the inverse of the average shareholding size:

$$BREADTH_i = \frac{NUMINV_i}{OFFERSIZE_i}. \qquad (2)$$

The use of the breadth of shareholder distribution may not adequately describe some of the forms of variation in the ownership structure of the new investors. For example, let two IPOs A and B, each issue $1,000,000 worth of shares to 1,000 shareholders. If the breadth of shareholder distribution was used as the only measure of ownership structure, the ownership structure of these two companies would appear identical. However, company A might have 10 owners holding $900,000 worth of shares, while the other 990 shareholders possess only $100,000 worth of shares. In contrast, company B could have an equal distribution of shares amongst its owners so each of them would hold $1,000 worth of shares. Therefore, to capture any disproportion in distribution, we suggest that another dimension, the equality of shareholder distribution, should also be considered.

The equality of shareholder distribution refers to the difference in the proportions of ownership possessed by outside investors.[11] Prior research in this area has attempted to

[10] All variables designed to measure ownership structure presented in this section do not include the proportion of the original shareholders (offerors) in their calculation, as this study is only interested in the shareholding distribution of outsiders.

[11] The ownership of the original owners (offerors) is excluded in calculating this variable for the reasons mentioned earlier.

measure this difference by using various methods of categorising the shareholders according to the size of their shareholding. In particular, Sarin, Shastri and Shastri (1996) divide the shareholder base in two, one comprising institutions (larger investors), the other retail investors. A potential shortcoming of this measure is that it ignores the possibility of non-institutional investors who may hold large proportions of the company.

Share distribution data, which clearly distinguish between institutional and retail investors, are not available in Australia. Shareholders with more than 100,000 shares are identified and we denote these as 'institutional investors'. With adjustment for the original owners' shareholding, this variable is calculated as follows

$$INSTITUTION_i = \frac{\sum_{k=1}^{n} INSTITUTIONSIZE_{i,k} - RETENTION_i}{OFFERSIZE_i}, \qquad (3)$$

where $INSTITUTIONSIZE_{i,k}$ is the holding amount of investor *k* who has at least 100,000 shares of company *i*, *n* is the number of investors with at least 100,000 shares, and $RETENTION_i$ is the total number of shares retained by the original owners (offerors) of company *i*.

Wruck (1989) defines block shareholders as those who hold more than 5 percent of a company's issued capital. We follow this definition to calculate the variable *BLOCK*, which represents block shareholders[12]

$$BLOCK_i = \frac{\sum_{k=1}^{m} BLOCKSIZE_{i,k} - RETENTION_i}{OFFSIZE_i}, \qquad (4)$$

where $BLOCKSIZE_{i,k}$ is the number of shares held by investor *k* who has at least 5 percent ownership of company *i*, and *m* is the total number of such investors.

In addition, the Australian Stock Exchange (ASX) requires every listed company to disclose its ownership structure by providing shareholding details of its 20 largest shareholders. We use this aggregate figure as another proxy for the inequality of shareholder distribution. This is calculated as:

[12] The Australian Stock Exchange also defines these investors with at least 5% ownership as substantial shareholders.

$$TOP20_i = \frac{\sum_{k=1}^{20} TOP20SIZE_{i,k} - RETENTION_i}{OFFERSIZE_i}, \quad (5)$$

where $TOP20SIZE_{i,k}$ is the holding amount of investor *k* who is one of the largest 20 investors of company *i*.

A limitation of the above measures lies in choosing the cut-off values employed. Moreover, these measures are sensitive to changes in the upper tail of the shareholder distribution, but to a large extent ignore the remainder of the distribution. To correct for this problem, we employ another measure of shareholder inequality, namely the Gini-coefficient (Gini, 1912). Applied to ownership structure, the Gini-coefficient shows the expected (average) difference between the values of equity holdings of any two individual investors drawn independently from the shareholder distribution, divided by the mean value of shareholding.

Compared to the other proxies proposed above, the Gini-coefficient may be a more appropriate measure of inequality, because it reflects changes in all quantiles of a shareholder distribution and is especially sensitive to variation in the middle quantiles.[13] A problem with calculating the Gini-coefficient is that the data on the distribution of shareholders available from the ASX is discontinuous. To overcome this problem, we approximate the true Gini-coefficient by deriving a "discrete" Lorenz curve for each IPO using all the ranges of shareholdings reported by the company and then calculate the area under the curve.[14]

3.3 Measures of Liquidity

In this study, liquidity is measured using two proxies, trading turnover and the bid-ask spread. Trading turnover refers to the number of shares in a company that changes hands during a trading day relative to the total number of that company's shares. This measure reflects how actively the company's shares are traded, independently of the size of issued capital. Note that there is a potential pitfall in using trading turnover figure, as it can be excessively high during the first few days of trading. When an IPO is underpriced, the volume of trades is usually high because informed traders undertake continuous buying and

[13] The Gini-coefficient of a particular distribution is twice the area between the Lorenz curve representing that distribution and the diagonal line connecting the origin, (0,0) with the point (1,1) in the plane.
[14] The data regarding the shareholders distribution are obtained from company announcements. Those are provided as a listing requirement by the ASX. Details of Gini-coefficient approximation can be found in the Appendix.

selling activities until the price reaches a "true value" as perceived by the market. Moreover, there is also substantial evidence of traders "flip" in IPOs (i.e. selling an initial share allocation by an investor immediately on listing) in order to capture instantaneous profits from IPO underpricing (Krigman, Shaw and Womack, 1999). As a result, volumes from the first day of trading are usually significantly higher than those over the long run.[15]

When using trading turnover, the volume figures for the first four days are excluded. To decide this, we carried out a sequential *t*-test on the average turnover of all IPOs each day for the initial 30 days of trading. Consistent with Miller and Reilly (1987), our results indicate that volumes in the first four days are significantly higher than those on subsequent days.[16] After this initial four days, trading turnover appears to be stable, which is consistent with Aggarwal and Rivoli (1990) and, Miller and Reilly (1987). Hence trading turnover is calculated as a proxy for share price liquidity as follows

$$TURNOVER_i = \frac{\sum_{d=5}^{30} VOLUME_{i,d}}{26 \times ISSUEDCAPITAL_i}, \qquad (6)$$

where *d* is the number of days after listing for company *i,* $VOLUME_{i,d}$ is the number of shares that are traded during day *d*, $ISSUEDCAPITAL_i$ is the total number of listed shares that are tradable.[17]

We also use the bid-ask spread to measure liquidity. This proxy may be a potentially biased measure since it tends to be "sticky" as traders do not adjust their estimation of the bid-ask spread as quickly as the market changes (Reese, 1998). For the purpose of consistency, we employ the same time horizon used in calculating trading turnover to calculate the average bid-ask spread based on the daily closing bid and ask figures as follows:

[15] Krigman *et al*. (1999) report that median trading turnover of US IPOs is 33%, while in Miller and Reilly (1987), this figure is about 22% for the initial day of trading. Both studies found that this initial trading frenzy quickly dissipates after 5 to 10 days.

[16] The difficulty of calculating the turnover of a company for a longer time horizon is due to the lack of data on the number of its outstanding shares listed on the ASX. This figure changes dramatically when the company starts adding new shares or splitting shares or paying share dividends. Thirty days is the maximum time period when none of these adjustments has occurred.

[17] This figure excludes shares that are under escrow agreements, which cannot be traded.

$$BIDASK_i = \frac{1}{26}\sum_{d=5}^{30}\frac{ASK_{i,d} - BID_{i,d}}{(ASK_{i,d} + BID_{i,d})/2}. \quad (7)$$

3.4 Regression Analyses

We employ univariate OLS regressions to test Hypothesis 1 and Hypothesis 2. Hypothesis 3, which concerns the relationship between underpricing and liquidity, is tested using a multivariate regression as it is aimed not only at confirming this relationship, but also at developing models that explain the post-listing liquidity. A number of control variables are employed in the construction of these models.

First, if liquidity is measured by bid-ask spread, a number of additional variables should be considered. According to Lee, Mucklow and Ready (1993), market traders are discouraged from buying and selling shares in companies with a concentrated ownership structure for fear of being information-disadvantaged. In the situation of an IPO, this component of information asymmetry could be represented by the degree of underpricing, which it is argued increases the dispersion of ownership structure. In addition, for a company with a high level of financial risk and lack of disclosure, the adverse selection effect should be multiplied further as information-disadvantaged parties are even more hesitant to trade. To indicate the level of financial risk, the volatility of share price (i.e. the standard deviation of daily returns) is employed, while the number of company announcements is used as an approximation for the degree of information availability to traders.[18] Finally, the industry for each IPO is included as an explanatory variable to capture the variation in adverse selection effects across firms. Dummy variables are used to classify the 13 categories of industries ($INDUM_{i,j}$). Details are provided in Table 1.[19] By incorporating these additional explanatory variables, the regression model can be stated as

$$BIDASK_i = \alpha + \beta_1 MAR_i + \beta_2 RISK_i + \beta_3 ANN_i + \sum_{j=1}^{13-1}\gamma_j INDUM_{i,j} + \varepsilon_i, \quad (8)$$

where the error term, ε_i, is assumed to be normally distributed with zero mean and constant variance; $RISK_i$ is the standard deviation of daily share returns; and the number of

[18] It should be noted that there are superior techniques to quantify the level of information disclosed to the public, such as ranking the importance and substance of news items. However, the complexity in designing those procedures is beyond the scope and data constraints of this study.

[19] This categorisation is primarily based on ASX classifications of principal company activities.

announcements made by company *i* (ANN_i) are calculated from day 5 to day 30 after the commencement of trading in order to be consistent with the calculation of liquidity measures.

Second, an alternative proxy for liquidity is trading turnover. A problem with this measure is that the total number of listed shares includes the holdings of original owners who often wish to retain their shares for a minimum period of 12 months (Lee, Taylor and Walter, 1996). Barclay and Holderness (1989) also assert that large-block shareholders cannot easily dispose of their shares into the market through open trading on the exchange without losing value. As a result, the original owners often do not or cannot immediately participate in trading activities, but rather choose to sell off their holdings through later rights issues or public issues. Therefore, the trading turnover figure may be distorted, as it is likely to show companies with higher retained ownership as having low liquidity, even though their shares may be actively traded amongst the new investors. Reese (1998) overcomes this problem by using retained ownership as a control variable, obtained by subtracting from one the ratio of the number of shares issued to new investors over the total number of shares on listing.

Trading turnover of a company may increase as more information regarding the company becomes available. Numerous studies have found trading turnover to be influenced by the frequency and substance of company announcements. It is also possible that the market is not efficient in responding to new information regarding IPOs and that large trading volumes are the result of over- or under-reaction every time some new information arrives. Moreover, for investors who cannot obtain an allocation in the offer, purchasing post-listing is the only alternative to satisfy their demand for shares. The implication is that for newly established industries in which there is unsatisfied investor demand and investor access is low, trading activity is likely to surpass that of more mature industries (Mauer and Senbet, 1992).

In summary, if trading turnover is a proxy of liquidity, additional control variables should include retained ownership ($RETA_i$), the number of company announcements and industry classification. The last two control variables are defined as before (see equation (8)). Accordingly, the regression model of liquidity can be expressed as follows

$$TURNOVER_i = \alpha + \beta_1 MAR_i + \beta_2 RETA_i + \beta_3 ANN_i + \sum_{j=1}^{13-1} \gamma_j INDUM_{i,j} + \varepsilon_i . \qquad (9)$$

4. Data

The sample consists of 113 Australian IPOs covering the period from January 1996 to June 1999 (See Panel A of Table 1). The data set used is compiled from the *Connect 4*, *Securities Industry Research Centre of Asia-Pacific* (SIRCA), *Bourse Data* and *Bloomberg* databases. Consistent with Ritter (1984), the sample excludes IPOs of mining companies, property trusts and convertible notes (which often come in the form of stapled securities). For each IPO, information on issue size (i.e. the number of shares available for subscription), listing date, offer price and pre-issue capital structure are collected. The predominant marketing method for Australian IPOs is fixed-price offerings. In our sample, there are only four book-building IPOs. Daily closing, bid and ask prices and volume are obtained for each IPO for the initial 30 days of trading.

[INSERT TABLE 1 HERE]

Information regarding the ownership structure is obtained from the official company announcements lodged with the ASX prior to listing. Prices and volumes are corrected for share splits and execution of attached options. A company may issue restricted (escrow) securities, which contractually cannot be traded for the period of 12 or 24 months. These are subtracted from the shareholding details and are therefore excluded from the calculations of the equality of ownership distribution.

[INSERT TABLE 2 HERE]

Table 2 shows that the price-discovery process is essentially completed within the first day of trading. The mean first-day return of 23.41 percent is significantly higher than zero at the 1 percent level of significance, while subsequent returns are not significantly different from zero. This average first day return is within the range reported by previous work on Australian IPOs, such as Finn and Higham (1988) and Lee *et al*. (1996).

[INSERT TABLE 3 HERE]

Table 3 reports ownership structures of all IPOs in the sample. On average, each IPO in the sample is able to attract about 150 investors for each 1 million dollars' worth of shares issued to the public. However, this figure can fluctuate widely (from 11 to 608), and this probably reflects the substantial diversity in the motives of going public – that is, aiming at creating liquid post-listing trading or merely maximising the gross proceeds from the issues.

The summary statistics also show a significant degree of inequality in the distribution of shareholders. For example, block shareholders, who possess at least 5 percent ownership, take up on average 45.23 percent of the total number of shares. Again, this figure can fluctuate from 0 percent to nearly 100 percent. It should be noted that all these measures are raw descriptive statistics of inequality in the shareholder distribution (Table 3) and have not been adjusted for the retention of shares of the original owners as specified in formulae 3 to 5. The level of retention can be as high as 51.70 percent of the total number of shares listed. If retained ownership is excluded from the calculation of the measures of inequality, the distribution of new shareholders is on average much more evenly distributed.

[INSERT TABLE 4 HERE]

The descriptive statistics show that trading of Australian IPOs' shares during the first few trading days is significantly less active compared to US IPOs. Average trading turnover during the first trading day of Australian IPOs is only 4.7% of total shares offered (see Table 4) compared to the same measure of 33% as reported by Krigman, Shaw and Womack (1999) with their sample of US IPOs. However, the level of trading activities of Australian IPOs during the first four days after their listing dates is still exceptionally higher than the subsequent days. After day 4, there is no significant difference in trading activity from one day to another, a result similar to the observation by Miller and Reilly (1987). This justifies the use of the specified time horizon (from day 5 to day 30) in calculating the post-listing trading volume. A statistical summary of post-listing trading volume is presented in Table 5.

[INSERT TABLE 5 HERE]

5. Discussion of Results

5.1 Preliminary Results

We divide the sample of IPOs into underpriced (91 observations) and overpriced groups (22 observations) and compare not only trading characteristics but also the difference in ownership structure between these groups. The results are reported in Table 6.

[INSERT TABLE 6 HERE]

An underpriced company is likely, on average, to have a higher breadth of shareholder base and lower concentration of large outside investors compared to an overpriced company. Liquidity is also higher for underpriced IPOs since their average bid-ask spread is lower and trading turnover higher than overpriced IPOs. Most of these differences are statistically significant with the only exception being the Gini-coefficient.

5.2 Univariate Regression Results

5.2.1 Hypothesis 1

By categorising the sample into underpriced and overpriced IPOs, the previous section has shown that there is a substantial difference in ownership structure between these two groups. Univariate results from running five OLS regressions (Table 7) provide further corroborating evidence on the relationship between underpricing and the ownership structure of IPOs. The positive sign of the coefficient and significant *p*-value reject the null hypothesis that there is no positive relationship between underpricing and the breadth of the shareholder base. The results imply that an increase in underpricing of 100 percent is, on average, likely to attract a further 66 shareholders for every 1 million dollars worth of shares issued to the public.

Residuals of the first two univariate regressions displayed in Table 7 indicate that there is a possible violation of the assumption of homoscedasticity.[20] To correct this, a logarithmic transformation of the explanatory variable is used, in which $LOGMAR_i = \ell n(1 + MAR_i)$.[21]

Table 7 shows that if the dependent variable is the percentage of shareholders with at least 100,000 shares (with adjustments made to exclude the original shareholders), the relationship is significant at the 10 percent level if a logarithmic transformation is applied to the measure of underpricing. Based on the sign of the coefficient, this result can be interpreted that if underpricing of an IPO is increased, it is likely that the distribution of new shareholders becomes less concentrated. Similar findings are obtained when the dependent variable is the proportion of shares held by block shareholders (investors who have at least 5 percent ownership of a company). A more significant relationship is obtained when the proxy used is the proportion of shares held by the largest 20 shareholders.

[20] The actual plotting of the residuals shows a funnel pattern as underpricing increases. Further, White's (1980) test confirms this finding. Results can be provided upon request.
[21] This transformation is also theoretically consistent with Booth and Chua (1996) who predict a non-linear relationship between the underpricing and the number of investors participating in an issue.

[INSERT TABLE 7 HERE]

Consistent with Brennan and Franks (1997), these results imply that underpricing is a factor that helps to attract outside investors, and when over-subscription occurs, the allocation process favours smaller investors and discourages the formation of controlling blocks. In contrast, these results do not support the theoretical models in Stoughton and Zechner (1997) and Benveniste and Spindt (1989), which predict that large shareholders are favoured in the allocation process. A possible explanation is that our study, similar to Brennan and Franks (1997), employs a sample consisting mostly of fixed-priced offerings, which are predominant in Australia and the UK, while US studies focus on book-building and auction as methods of pricing and allocating shares.

Using the first three proxies alone may not prove the reliability of the relationship since they focus on the upper part of the shareholder distribution. The Gini-coefficient, which as an indicator of inequality is more sensitive to variation in the mid-range of the distribution, is also used as the dependent variable. The results of univariate regressions of the Gini coefficient and underpricing provide further evidence in support of the hypothesis that the greater the underpricing the more dispersed is the distribution of new shareholders. Note that the Gini-coefficient rejects the above relationship when the logarithmic transformation of underpricing is used. This is possibly due to the different focus of the Gini-coefficient compared to the other proxies. In summary, by using the four alternative measures of inequality, underpricing is found to have significant influence on new shareholders' ownership structure.

5.2.2 Hypothesis 2

Our results also show a strong, significant and positive, relationship between the breadth of shareholder base and liquidity. This result empirically supports the model of Bolton and von Thadden (1998), which proposes that if *ex ante* dispersion of ownership structure is achieved, it may be very difficult for a controlling block to be formed over the long term. When trading turnover is used as the dependent variable, the coefficient is positive and the *p*-value is highly significant. The relationship can be interpreted as: if an IPO increases the breadth of its shareholder base by attracting one additional investor for every $1,000 worth of shares, the trading turnover would improve by an additional 0.56 percent (see Table 8).

If the square root of the bid-ask spread is used as the dependent variable, the coefficient is negative and the *p*-value is also significant. This transformation is used to adjust for the possible error of misspecified functional form of the regression, which is detected by the presence of positive first-order auto-correlation of error terms in the original regression (this problem is not found if trading turnover is used). The interpretation of the coefficient should therefore be adjusted to reflect this transformation. In this case, increasing the breadth of the shareholder base by attracting one additional investor for every $1,000 worth of shares on issue would reduce the bid-ask spread by 2.91 percent.

Table 8 also indicates a strong positive relationship between the inequality of shareholder distribution and liquidity. When trading turnover is used as the dependent variable (as a proxy for liquidity), the coefficients are positive and the *p*-values are highly significant for all four proxies for the inequality of shareholder distribution. For example, if an IPO increases the total percentage of all block shareholders (who possess at least 5 percent ownership) by one percent, its daily trading turnover would decline by 0.005 percent (see Table 8).

[INSERT TABLE 8 HERE]

If the square root of the bid-ask spread is used as the dependent variable, the coefficient is positive and the *t*-statistic significant for all four proxies of inequality of shareholder distribution. Again, the transformation of bid-ask spread is necessary to avoid misspecified functional form. Given the transformation, Table 8 indicates that a one percent increase in the Gini-coefficient would increase the bid-ask spread by 1.04 percent (after readjusting for the square-root transformation)

5.3 Multivariate Regression Results

Combining the results of the first two hypotheses, this study has found evidence supporting the argument that underpricing affects ownership structure, which in turn determines after-listing liquidity. Therefore, it is inferred that there exist a positive relationship between the degree of IPO underpricing and their level of post-listing liquidity.

[INSERT TABLE 9 HERE]

Two models of bid-ask spread, one that includes industry dummy variables and another that does not, are presented in Table 9. When the bid-ask spread is used as a proxy for liquidity, all the coefficients of the explanatory variables of the model (not including the coefficients of

the industry dummy variables) are significantly different from zero. By adding industry categorisation into the model, the results indicate that the coefficients of some industry variables such as banking and finance (dummy 6), miscellaneous industrial (dummy 7) and building and construction (dummy 2) are significant at 5% level

With or without the dummy variables, the null hypothesis that there is no relationship between underpricing and liquidity is strongly rejected. Model 1, as defined by equation 8, indicates that, *ceteris paribus*, a one percent increase in the level of underpricing would reduce the bid-ask spread by 6.81 percent (see Table 9). The statistical significance of the model is strong with the adjusted R^2 of 0.544 indicating that 54.4 percent of all cross-sectional variation within the bid-ask spread is explained by underpricing, share volatility and frequency of announcements.

[INSERT TABLE 10 HERE]

To ensure that the relationship between underpricing and liquidity is robust and reliable, trading volume is used also used as the dependent variable in the regression. Similar to the models of the bid-ask spread, underpricing is found to have a strong influence on the level of liquidity, which further supports hypothesis 3. The model predicts that, *ceteris paribus,* if underpricing is increased by one percent, liquidity (trading turnover) will improve by 0.53 percent (see Table 10).

[INSERT TABLE 11 HERE]

Liquidity is negatively related to retained ownership and positively related to frequency of announcement. Newly established industries such as Internet and high technology (dummy 11) have significantly higher trading turnover while established industries such as banking and finance (dummy 6) have significantly lower trading turnover compared to the omitted industry (i.e. miscellaneous services). This result shows that the level of trading turnover of IPOs varies across industries and underscores the importance of controlling for these differences. Table 11 shows the Peason's correlation matrix between different independent variables. It indicates that none of the correlations is significant and thus we conclude that multicollinearity is not present among the employed explanatory variables. In summary, the relationship between liquidity and underpricing is robust and highly significant.

6. Conclusion and Implications

This paper examines the relationship between the degree of underpricing of an IPO, its ownership structure after the share allocation and the ensuing level of post-listing liquidity. We find that the level of underpricing is positively related to the breadth of shareholding formed after the allocation process and negatively affected by the inequality of shareholding distribution amongst outside investors who participate in the issue. When a company is underpriced, it is likely, on average, to have a higher breadth of shareholder base and lower concentration of large outside investors compared to an overpriced company. Ownership structure helps explain the variations in the level of liquidity after trading commences. Liquidity is higher for underpriced IPOs since their average bid-ask spread is lower and trading turnover higher than overpriced IPOs. Therefore, we conclude that a positive relationship exists between the degree of underpricing of an IPO and its post-listing liquidity.

When bid-ask spread is used in the model of liquidity, we find it to be negatively related to the level of underpricing and the frequency of announcements, while positively associated with share volatility. On the other hand, if trading turnover is used as the proxy for liquidity, the results indicate that this factor is positively related to underpricing and the frequency of announcements, while negatively related to the proportion of retained ownership. Both models achieve relatively high predicting power indicating that the relationship between underpricing and liquidity is not only robust but also statistically and economically significant. Our results further corroborate the findings of Miller and Reilly (1987), Schultz and Zaman (1994), Hanley (1993) and Reese (1998).

Further, this study provides some empirical evidence that ownership structure plays a vital role in forming the relationship between underpricing and liquidity. By underpricing an IPO, a company may achieve a broader and more equal ownership structure after the allocation process. This implies that large investors are more likely to be discriminated against in the allocation process. This result is consistent with Brennan and Franks (1997) and Booth and Chua (1996).

A number of practical implications can also be inferred. It is possible that for any given IPO, post-float liquidity could be predicted *ex-ante* using currently available internal and external information. Hence, issuers can select an appropriate range of underpricing levels to achieve a desired level of liquidity. Moreover, these models enable the prediction of future liquidity so that the original owners could determine the strategies and timing of further equity rising. In

addition, if original owners aim to retain control, underpricing could be used as a mechanism to prevent hostile takeover by inducing a broader ownership structure.

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APPENDIX: CALCULATING THE GINI--COEFFICIENT

The Gini-coefficient of a particular distribution is twice the area between the Lorenz curve representing that distribution and the diagonal line running from (0, 0) to (1, 1). The table below depicts how the distribution of shareholders is reported to the ASX. In order to calculate the Gini-coefficient, the Lorenz curve for such a discreet distribution is constructed. This is accomplished by first subtracting the holdings of the original shareholders from the distribution since the purpose of this exercise is to calculate the Gini-coefficient of the new investor base only. Then, a plot of the cumulative percentage of the number of investors against the cumulative percentage of shareholding is obtained. The area under the curve is calculated by aggregating 5 geometric areas formed by the turning points. Gini-coefficient is one minus twice of that area. The following example calculates the Gini-coefficients of Cable-Wireless Optus (CWO) and CDS Technologies (CDX).

Code		***Range of holdings of individual outside shareholders***					***Gini***
		0 to 1,000	***1,000 to 5,000***	***5,000 to 1,0000***	***10,000 to 100,000***	***More than 100,000***	
CWO	No. of shareholders	15,674	41,994	7,418	4,118	481	0.850
	Cumulative %	22%	83%	93%	99%	100%	
	No. of shares (in thousands)	7,837	104,985	556,350	329,841	528,962	
	Cumulative %	0%	10%	16%	48%	100%	
CDX	No. of shareholders	6	529	6	7	0	0.203
	Cumulative %	1%	98%	99%	100%	100%	
	No. of shares (in thousands)	1,377	1,065	41	255	0	
	Cumulative %	0%	78%	81%	100%	100%	

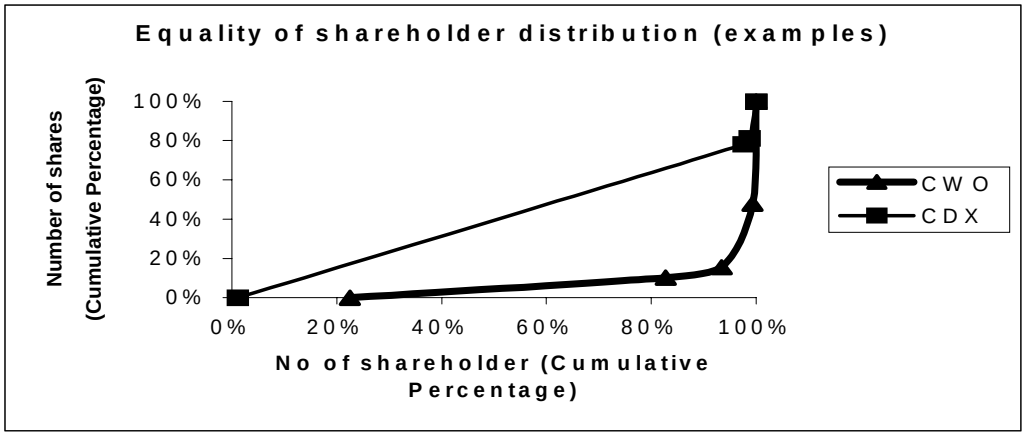

Table 1. Sample selection and classification

PANEL A. Sample selection based on prospectus applications lodged with the ASX.

Period	Total number of applications	Exclusions				Sample size
		Withdrawn applications	Mining firms	Property trusts and investment funds	Stapled securities or missing data	
Jan 1996 – Dec 1996	81	6	30	18	3	24
Jan 1997 – Dec 1997	86	10	25	11	5	35
Jan 1998 – Dec 1998	53	2	5	10	4	32
Jan 1999 – Jun 1999	33	2	2	5	2	22
Total	253	20	62	44	14	113

PANEL B. Dummy variables used for industry classification.

Industry	Number of IPOs	Variable name
Alcohol & Tobacco	7	$INDUM_1$
Building and Construction	6	$INDUM_2$
Energy & Infrastructure	6	$INDUM_3$
Food & Household Goods	6	$INDUM_4$
Health & Biotechnology	12	$INDUM_5$
Banking and Finance	8	$INDUM_6$
Miscellaneous Industrial	11	$INDUM_7$
Retail & Packaging	7	$INDUM_8$
Telecommunications	12	$INDUM_9$
Tourism, Entertainment & Media	8	$INDUM_{10}$
Internet & High Technology	11	$INDUM_{11}$
Computer and Office Services	9	$INDUM_{12}$
Miscellaneous Services	10	$INDUM_{13}$
Total	113	

Note: This categorisation is based primarily on the official classification of industries and sub-industries specified by the Australian Stock Exchange. However, some industries have a very small number of IPOs. Therefore, we merge some related industries that have less than 5 IPOs to become one category.

Table 2. Summary statistics of daily unadjusted returns for the IPO sample

Day	Average Daily Return (%)	Median Return (%)	Standard Deviation	Minimum	Maximum	Skewness
1	23.41 (5.35)*	10.00	46.94	-50.00	370.00	4.20
2	1.66 (1.88)	0.00	9.45	-20.00	37.14	1.50
3	-0.26 (-0.63)	0.00	4.57	-14.28	20.83	0.70
4	-0.36 (-0.75)	0.00	5.24	-13.63	28.00	1.55
5	0.06 (0.14)	0.00	4.27	-10.85	19.56	1.14

Note: Figures in brackets present *t*-statistics, testing whether average daily returns equal zero

* significant at the 5% level for a two-tail test.

Table 3. Summary statistics of the ownership structure for the IPO sample

Variable (N = 113)	Mean	Median	Standard Deviation	Min	Max	Skewness
Breadth of shareholder base						
Average number of investors (for every $1 million worth of shares offered to the market)	149.83	118.84	126.41	11.10	608.05	1.47
Equality of shareholder base [a]						
Proportion of shares held by shareholders with at least 100,000 shares (%)	70.79	73.24	19.19	4.87	99.27	-0.84
Proportion of shares held by shareholders with at least 5% of total shares (%)	45.23	45.57	24.34	0.00	97.19	-0.09
Proportion of shares held by the top 20 shareholders (%)	66.91	70.29	19.85	15.34	99.29	-0.63
Gini coefficient	0.59	0.61	0.19	0.08	0.94	-0.41
Retention of ownership						
Proportion of shares retained by the original owners (%)	51.70	55.36	27.29	0.00	99.27	-0.61

[a] These are raw descriptive statistics of the equality of shareholder base and have not excluded the original shareholders, as specified by the formulae 3 to 5.

Table 4. Daily liquidity characteristics after trading commences for all IPOs

Day *(after commencement of trading)*	Trading turnover (%)		Bid-ask spread (%)	
	Mean	***p*-value** [a]	**Mean**	***p*-value** [a]
1	4.76		3.05	
2	2.30	0.001	3.15	0.223
3	1.20	0.007	2.89	0.567
4	0.79	0.060	3.01	0.761
5	0.71	0.540	3.14	0.856
6	0.92	0.482	3.04	0.888
7	0.53	0.189	2.94	0.863
8	0.46	0.432	2.96	0.920
9	0.61	0.165	3.35	0.393
10	0.42	0.078	2.99	0.519
15	0.33	0.273	3.13	0.763
20	0.25	0.215	3.33	0.711
25	0.30	0.413	3.36	0.637
30	0.22	0.182	3.48	0.775

Note: Trading turnover is defined as the total daily trading volume divided by the total amount of listed shares. Bid-ask spread is defined as the difference between daily closing bid and ask quotes divided by the mid-point of bid and ask quotes.

[a] Based on the 2-tailed *t*-tests for mean differences assuming unequal variances between trading volumes (or bid–ask spreads) of that day and the day specified in the upper row.

Table 5. Summary statistics of liquidity for the IPO sample

Proxy for liquidity	Mean	Median	Standard Deviation	Min	Max	Skewness
Average trading turnover (%) [a]	0.37	0.24	0.38	0.00	1.86	1.86
Average bid-ask spread (%) [b]	3.30	2.32	3.24	0.19	22.02	2.81

[a] Average trading turnover is defined as the average daily trading volume as a percentage of the total amount of listed shares, for the period day 5 to day 30 after the commencement of trading (see formula 6).

[b] Average bid-ask spread is defined as the average difference between daily closing bid and ask quotes as a percentage of the mid-point between these quotes, for the period of day 5 to day 30 after the commencement of trading (see formula 7).

Table 6. Difference between underpriced and overpriced IPOs

Variable	Underpriced IPOs (N_1 = 91)		Overpriced IPOs (N_2 = 22)		*t*-statistic[a] (*p*-value)
	Mean	Standard deviation	Mean	Standard deviation	
Ownership structure					
Breadth of shareholder base (average number of investors for every $1 million worth of shares offered to the market)	168.83	152.03	117.12	92.94	1.52 (0.065)
Proportion of shares held by investors with at least 100,000 shares (%)	17.29	18.35	27.33	19.46	-2.28 (0.012)
Proportion of shares held by investors with at least 5% of total issued shares (%)	-8.61 [b]	20.92	2.07	17.82	-2.21 (0.015)
Proportion of shares held by the top 20 investors (%)	14.51	16.06	24.68	16.90	-2.64 (0.005)
Gini-coefficient	0.58	0.20	0.61	0.15	-0.66 (0.256)
Level of liquidity					
Average bid-ask spread (%)	2.82	3.02	5.24	3.56	-3.23 (0.001)
Average trading turnover (%)	0.38	0.37	0.23	0.22	1.82 (0.036)

[a] Based on one-sided *t*-test (two independent samples, equal variances) for mean difference between the two groups of underpriced and overpriced IPOs. The degrees of freedom (*d.f.*) equal to 111 (*d.f.*= N_1+N_2-2).

[b] Negative figures are possible since we adjust these proportions for the original owners' retained shares in each IPO to estimate the concentration of shareholdings of outside investor (see formulae 3 to 5). Therefore, this particular negative figure basically means that for many companies there are no outside investors with at least 5% ownership.

Table 7. Univariate regression results for Hypothesis 1

	Independent variable			
	MAR_i		$LOGMAR_i$	
Dependent variable	**Estimated coefficient**	***p*-value**	**Estimated coefficient**	***p*-value**
Breadth of shareholders (average number of investors for every $1 million worth of shares offered to the market)	65.58	0.01	98.76	0.01
Proportion of shares held by investors with at least 100,000 shares	-0.05	0.17	-0.12	0.06
Proportion shares held by investors with at least 5% ownership	-0.05	0.18	-0.11	0.10
Proportion of shares held by the top 20 investors	-0.06	0.10	-0.11	0.05
Gini-coefficient	-0.07	0.06	-0.09	0.14

Note: MAR_i is the market adjusted initial return for company *i* as specified in formula 1, $LOGMAR_i$ is the natural logarithmic transformation of MAR_i.

Table 8. Univariate regression results for Hypothesis 2

	Dependent variable			
	Trading turnover		*Bid-ask spread*	
Independent variable	**Estimated coefficient**	***p*-value**	**Estimated coefficient**	***p*-value**
Breadth of shareholders (Average number of investors for every $1 million worth of shares offered to the market)	5.59	0.01	-53.94	0.07
Proportion of shares held by investors with at least 100,000 shares	-0.005	0.00	0.078	0.03
Proportion of shares held by investors with at least 5% ownership	-0.005	0.00	0.082	0.07
Proportion of shares held by the top 20 investors	-0.007	0.00	0.056	0.05
Gini-coefficient	-0.004	0.01	0.102	0.00

Note: Trading turnover is the average of daily trading volumes as a percentage of the total number of listed shares for the period from day 5 to day 30 after the commencement of trading for an IPO (see formula 6). Bid-ask spread is square root transformation of the actual bid-ask spread, defined as the average of daily difference between bid and ask quotes as a percentage of the mid-price (see formula 7) for the period from day 5 to day 30 after the commencement of trading.

Table 9. Multivariate models with bid-ask spread as dependent variable

Results	**Model 1**		**Model 2**	
Independent variables	***Coefficient***	**p-*value***	***Coefficient***	**p-*value***
Constant	0.1467	0.000	0.1205	0.000
Market adjusted initial return	-0.0681	0.000	-0.0595	0.000
Risk (volatility of share prices)	1.4514	0.000	1.5309	0.000
Frequency of announcements	-0.0036	0.000	-0.0041	0.000
Industry dummy 1			0.0364	0.136
Industry dummy 2			0.0505	0.049
Industry dummy 3			-0.0010	0.967
Industry dummy 4			0.0270	0.289
Industry dummy 5			0.0300	0.170
Industry dummy 6			0.0572	0.022
Industry dummy 7			0.0471	0.028
Industry dummy 8			0.0265	0.276
Industry dummy 9			0.0112	0.620
Industry dummy 10			0.0217	0.357
Industry dummy 11			0.0080	0.715
Industry dummy 12			0.0092	0.692
Diagnostics				
Adjusted R^2	0.544		0.554	
F-statistic	45.483	0.000	10.273	0.000
White's test	6.167	0.405	19.793	0.345

Note: The dependent variable is average bid-ask spread, defined as the average difference between daily closing bid and ask quotes as a percentage of the mid-point between these quotes for the *i*-th company, for the period of day 5 to day 30 after the commencement of trading (see formula 7). The regressions are based on the following equation:

$$BIDASK_i = a + b_1 MAR_i + b_2 RISK_i + b_3 ANN_i + \sum_{j=1}^{13-1} c_j INDUM_{i,j} + \varepsilon_i$$

where MAR_i is market-adjusted initial return (underpricing), $RISK_i$ is the volatility of share price (standard deviation of daily returns); ANN_i is and the number of announcements made by company *i,* calculated from day 5 to day 30 after the commencement of trading. In Model 2, the dummies $INDUM_{i,j}$ are controlled variables for the *j*-th industry effect, as classified in Table 1.

Table 10. Multivariate models with trading turnover as dependent variable

Results	**Model 1**		**Model 2**	
Independent variables	***Coefficient***	**p-*value***	***Coefficient***	**p-*value***
Constant	0.0032	0.000	0.0040	0.000
Market adjusted initial return	0.0053	0.000	0.0047	0.000
Retained ownership	-0.0037	0.000	-0.0040	0.000
Frequency of announcements	0.0002	0.003	0.0002	0.000
Industry dummy 1			-0.0016	0.172
Industry dummy 2			-0.0019	0.135
Industry dummy 3			-0.0012	0.338
Industry dummy 4			-0.0008	0.504
Industry dummy 5			-0.0004	0.674
Industry dummy 6			-0.0025	0.045
Industry dummy 7			-0.0027	0.013
Industry dummy 8			-0.0021	0.087
Industry dummy 9			-0.0009	0.405
Industry dummy 10			0.0006	0.593
Industry dummy 11			0.0024	0.027
Industry dummy 12			-0.0001	0.934
Diagnostics				
Adjusted R^2	0.425		0.532	
F-statistic	28.636	0.000	9.487	0.000
White's test statistic	17.648*	0.039*	23.597	0.169

Note: The dependent variable is average trading turnover, defined as the average of the daily trading volume as a percentage of the total amount of listed shares for the *i*-th company, for the period day 5 to day 30 after the commencement of trading (see formula 6). The regressions are based on the following equation:

$$TURNOVER_i = a' + b_1' MAR_i + b_2' RETA_i + b_3' ANN_i + \sum_{j=1}^{13-1} c_j' INDUM_{i,j} + \varepsilon_i$$

where MAR_i is market-adjusted initial return (underpricing); $RETA_i$ is the level of ownership retained by the original owners; ANN_i is and the number of announcements made by company *i,* calculated from day 5 to day 30 after the commencement of trading. In Model 2, the dummies $INDUM_{i,j}$ are controlled variables for the *j*-th industry effect, as classified in Table 1.

* The null hypothesis of homoscedasticity is rejected at 5% level of significance (*p*-value=0.039). Consequently, the *p*-values for the coefficients reported in Model 1 are based on the standard errors adjusted for heteroscedasticity using White's heteroscedasticity-consistent covariance matrix .

Table 11. Pearson's correlation matrix

	Market adjusted initial return	***Retained ownership***	***Risk (Volatility of share prices)***	***Frequency of announcements***
Market adjusted initial return	1			
Retained ownership	0.109	1		
Risk (Volatility of share prices)	0.044	-0.166	1	
Frequency of announcements	0.084	0.039	-0.144	1