Explaining Mispricing of Initial Public Offerings

Beat Reber[a*] and Caroline Fong[b]

[a]*Nottingham University Business School, Nottingham, NG8 1BB, UK*
[b]*Singapore Exchange, Singapore 068804, Singapore*

This study examines the relative importance of underpricing as a signal of firm value, underwriter certification, subscription levels of shares on offer, and uncertainty surrounding firm value on mispricing of initial public offerings. A sample of 100 Singaporean initial public offerings (IPOs) during the period 1998-2000 indicates that subscription levels of shares on offer have the most significant impact on mispricing. This is followed by offer price, market value and trading volume in IPO shares on the first day of trading, and uncertainty surrounding firm value. Underwriter reputation appears to be only marginally influential, while equity market conditions and industry sector effects seem to be irrelevant in explaining mispricing. Singaporean IPOs have been selected because this is only one of a few markets whose unique institutional characteristics and data availability allows for such a test.

Keywords: Initial Public Offerings (IPOs), Mispricing, Singapore

JEL: G10

[*] Corresponding author:
Dr Beat Reber, Nottingham University Business School, Jubilee Campus, Wollaton Road, Nottingham, United Kingdom, NG8 1BB, Tel: +44 (0) 115 8466970, Fax: +44 (0) 115 8466667, Email: Beat.Reber@nottingham.ac.uk

Explaining Mispricing of Initial Public Offerings

Abstract

This study examines the relative importance of underpricing as a signal of firm value, underwriter certification, subscription levels of shares on offer, and uncertainty surrounding firm value on mispricing of initial public offerings. A sample of 100 Singaporean initial public offerings (IPOs) during the period 1998-2000 indicates that subscription levels of shares on offer have the most significant impact on mispricing. This is followed by offer price, market value and trading volume in IPO shares on the first day of trading, and uncertainty surrounding firm value. Underwriter reputation appears to be only marginally influential, while equity market conditions and industry sector effects seem to be irrelevant in explaining mispricing. Singaporean IPOs have been selected because this is only one of a few markets whose unique institutional characteristics and data availability allows for such a test.

Keywords: Initial Public Offerings (IPOs), Mispricing, Singapore

JEL: G10

Explaining Mispricing of Initial Public Offerings

I. Introduction

This study examines the relative importance of underpricing as a signal of firm value, underwriter certification, subscription levels of shares on offer, and uncertainty surrounding firm value in explaining mispricing of initial public offerings. Mispricing of initial public offerings is measured as the difference between the offer price and market price at the end of the first day of trading. Initial public offerings (IPOs) represent a group of shares about which relatively little is known when they appear on the market (Anderson et al., 1995; Draho, 2004, Jenkinson and Ljungqvist, 2001). Information asymmetry surrounding firm value leaves the IPO market subject to the classic 'lemons' or 'adverse selection' problem (Akerlof, 1970). To overcome the problem associated with such informational asymmetries, signals are transmitted between the sellers of the company and market participants (Spence, 1973). Underpricing by issuers has been thought of as a costly and difficult to imitate signal to convey firm quality to would-be investors, who cannot easily distinguish between good and bad IPOs (Allan and Faulhaber, 1989; Grinblatt and Hwang, 1989; Welch, 1989).

Another explanation of underpricing and the persistence of the phenomenon across capital markets and time periods (e.g., Loughran et al., 1994) is based on information asymmetry and the resulting agency conflicts between issuer and underwriter (Baron

and Holmström, 1980; Baron, 1982). Costly selling efforts of underwriters are reduced if the offer price of IPOs is set below the anticipated market value. Underwriters could induce issuers to agree to a lower offer price if IPO firms cannot observe the marketing and distribution efforts, which results in underpricing due to agency conflicts.

An alternative explanation of underpricing concentrates on information asymmetry between informed and uninformed investors. Uninformed investors receive disproportionately large share allocations in overpriced offers because informed investors subscribe only selectively to underpriced IPOs. Underpricing is necessary to compensate uninformed investors for this winner's curse adverse selection bias and to induce them to participate in the IPO market (Rock, 1986). Higher levels of uncertainty about firm value amplify underpricing (Beatty and Ritter, 1986), but uncertainty as such without the initial market imperfection would not warrant underpricing. This implies that increases in ex ante uncertainty surrounding IPO value necessitates higher underpricing and hence there may be variations in mispricing across different equity market conditions and industry sectors (Helwege and Liang, 2004; Ibbotson, 1975; Ljungqvist, 1997; Ritter, 1984).

As predicted by the information asymmetry theory, empirical evidence shows persistent average initial return between offer price and market value (e.g., Loughran et al., 1994). Notwithstanding some of the inconsistencies of some theoretical models and the joint hypothesis problem in IPO theory testing, a large literature has developed to test the theory. Anderson et al. (1995), Draho (2004), and Jenkinson and Ljungqvist (2001) provide excellent reviews of studies. The aim of this study is to extend the

discussion to the relative importance of elements of the theory thought to be involved in explaining mispricing of initial public offerings.

Six elements are considered here. The first is underpricing used by issuers to signal firm value to outside investors, while controlling for equity retained by pre-flotation owners, and variance in unspanned firm cash flows (Grinblatt and Hwang, 1989). The second is mispricing and the persistence of the phenomenon as a result of a principal-agent problem between issuers and investment banks along with the certification role of underwriters (Baron and Holmström, 1980; Baron, 1982). The third explains mispricing as a result of a winner's curse adverse selection problem, whereby underpricing is necessary to compensate uninformed investors for a bias in being allocated a higher proportion of overpriced offerings and to induce them to participate in the IPO market (Rock, 1986). The fourth examines underpricing as a function of uncertainty surrounding IPO firm value (Beatty and Ritter, 1986; Ritter, 1984). This is followed by an examination of equity market conditions (Ibbotson, 1975; Ljungqvist, 1997; Ritter, 1984) and industry sector effects on mispricing (Ritter, 1984; Helwege and Liang, 2004).

Prior research provides little evidence about the likely optimal combination of elements in the theory and their relative importance in explaining mispricing of initial public offerings. One reason is that previous studies have examined certain elements of the information asymmetry theory but rarely simultaneously. Such separation of theory testing is artificial since there appears to be no single, universally valid explanation of IPO mispricing at hand (Anderson et al., 1995). Given the various explanations for

mispricing, one wonders which ones come closest. A key omission in the current IPO literature would appear to be a test that simultaneously examines the relative importance of different elements of the information asymmetry theory in explaining mispricing of IPOs. Singaporean IPOs have been selected because this is only one of a few markets whose unique institutional characteristics and data availability allows for such a test.

The remainder of this paper comprises four sections. The next section reviews the theoretical and empirical literature in order to establish the linkages between information asymmetry and mispricing. Following that the data is described, variables are defined and models specified. Estimation results of the relative importance of mispricing explanations are then presented and analysed. In ascending order of their relative importance are subscription levels of shares on offer, offer price, market value and trading volume in IPO shares on the first day of trading, and uncertainty surrounding firm value. A final section offers conclusions and directions for further research.

II. Mispricing of initial public offerings

Past research on initial public offerings suggest that mispricing and the persistence of the phenomenon can be explained by information asymmetry on firm value between issuers, professional advisers involved in the flotation process, and different investor segments. This section reviews each area briefly to justify the selection of variables

that will be used in the empirical tests later in this paper. The main motivation of the study, which is to compare the relative importance of variables measuring different aspects of information asymmetry surrounding firm value in explaining persistent mispricing, is justified by the absence of prior comparative studies.

It is not unreasonable to assume that firm insiders have better information about the present value and risk of future cash flows than outside investors do (Akerlof, 1970; Wilson, 1980). Underpricing can be used as signal to transmit 'true' firm value to potential buyers of IPO shares. A body of literature that has contributed to this theory includes the studies of Grinblatt and Hwang (1989), Allan and Faulhaber (1989), and Welch (1989). This block of material is derived from Spence's (1973) seminal work on signalling in the context of the labour market. Signalling by firm insiders to potential buyers can help to overcome the 'lemons' or 'adverse selection' problem (Akerlof, 1970). Insiders of high-quality firms can convey information on firm value to potential buyers by employing observable, costly, and difficult to imitate signals. Underpricing is used to signal firm quality to potential buyers who are unable to distinguish between high and low quality firms. A large initial return is designed to leave a good impression with investors (Ibbotson, 1975) and firms can obtain a higher price in subsequent seasoned equity issues. High quality firms increase their underpricing to signal their value with the knowledge that they will be able to recoup their signalling costs in staged equity financing, while low quality firms are unable to recoup these costs in subsequent seasoned issues. This drives a wedge between the signalling costs of high and low quality issuers.

The model of Grinblatt and Hwang (1989) is probably the closest in form and notation to that of Leland and Pyle (1977). Grinblatt and Hwang (1989) use the retention rate of pre-flotation firm owners and underpricing to jointly signal unobservable firm value to potential buyers. The signalling costs consist of forgone proceeds and holding of a personal, undiversified investment portfolio by pre-flotation owners. In contrast, the signalling benefits of high-value firms come from owners who sell their remaining stake at a higher price in subsequent seasoned equity issues, while simultaneously achieve personal investment portfolio diversification. This is an extension of Leland and Pyle's (1977) seminal study on the well-known insight that firm owners can reveal their knowledge about high firm value by retaining a larger equity stake in the IPO firm since holding an undiversified personal investment portfolio is costlier to owners of high-variance firms than to those of low-variance firms (Downes and Heinkel, 1982; Krinsky and Rotenberg, 1989). Grinblatt and Hwang's (1989) model has several testable implications, including:

(i) Given *RET*, *V* is positively related to *UP*; and

(ii) given σ^2, *V* is positively related to *UP*.

Here, *RET* is the percentage of equity retained by pre-IPO owners, *V* is firm value, *UP* is underpricing, and σ^2 is the variance of unspanned firm cash flows. The empirical findings have been mixed. Using Singaporean data, Firth and Liau-Tan (1997) and Koh et al. (1992) find support, while Lam's (1999) findings reject Grinblatt and Hwang's (1989) signalling model. Similar to Lam (1999), Michaely and Shaw (1994) and James

and Wier (1990) cannot corroborate Grinblatt and Hwang's (1989) model using US data.

In addition to underpricing, firm owners can also adopt alternative means of signalling firm value to overcome a 'lemons' or 'adverse selection' problem (Akerlof, 1970). Alternative signals can include selecting reputable professional advisers involved in the flotation process such as underwriters (Booth and Smith, 1986). Therefore, unless underpricing is the most cost-effective way to persuade potential buyers of IPO firm value, the existence of alternative signals reduces the credibility of underpricing as a signal of firm value. However, the relative impact of such signals awaits investigation.

In order to avoid the potential problem of market imperfections and market failure (Akerlof, 1970), investment banks often act as intermediary between issuers and investors in IPO markets. This could lead to agency problems and is reflected in a block of material introduced by Baron and Holmström (1980) and Baron (1982). Problems arise whenever investment banks have private information about investor demand of IPOs prior to signing the underwriting contract. Underwriters may induce issuers to accept a relatively low offer price, which attracts more investors and reduces the required selling effort and hence IPO failure. If distribution effort cannot be verified and observed by issuers (principal), a moral hazard situation arises when investment banks act as the issuer's agent in an IPO. It is not unreasonable to conclude that this principal-agent framework not only helps to explain initial return, but also the persistence of the phenomenon across capital markets and time periods (Ibbotson et al.,

1994), as well as main and junior markets (Dawson, 1984, 1987; Hameed and Lim, 1998; Saunders and Lim, 1990; Tan and Wong, 1997; Tan et al., 1999; Firth, 1998; Wong and Chiang, 1986).

Principal-agent induced underpricing (Baron and Holmström, 1980; Baron, 1982) has mixed support in the empirical literature. Muscarella and Vetsuypens (1989) examine self-marketed IPOs of investment banks where agency conflicts are not an issue because the bank is both underwriter and issuer. The study does not report a significant difference between underpricing of self-marketed and other IPOs. Another testable implication of principal-agent induced underpricing is that larger offerings require greater distribution efforts by underwriters and hence these IPOs are associated with higher initial return (Michaely and Shaw, 1994).

An investment bank's ability to carry out an intermediary function as an underwriter relies on its reputation capital with IPO firms and investors. Investment banks and underwriters that cannot be trusted will not be able to survive. Only reputable investment banks and underwriters will attract strong interest from IPO firms and investors alike. There has been some evidence that underwriters who underprice too much loose business from issuers, while if investment banks who underprice too little loose business from investors (Beatty and Ritter, 1986; Dunbar, 2000; James, 1992).

Reputation capital is important because of a certification benefit. Underwriter certification is another mechanism to resolve market failure caused by an adverse selection problem. The involvement of investment banks, underwriters and their

reputation as an intermediary helps to verify that IPOs are 'accurately' priced. This block of material relating to reputation certification has been introduced by a number of studies (Beatty and Welch, 1996; Benveniste et al., 2003; Booth and Smith, 1986; Carter and Manaster, 1990; Chemmanur and Fulgheri, 1994; Habib and Ljungqvist, 2001; Megginson and Weiss, 1991; Titman and Trueman, 1986).

Testable implications relating to mispricing and reputation rely on identification of appropriate proxies to measure reputation. Reputation capital has been based on tombstone rankings (Carter and Manaster, 1990), market share of all IPO proceeds (Megginson and Weiss, 1991; Dunbar, 2000), and bulge bracket banks (Johnson and Miller, 1988). The empirical literature reports mixed findings between investment bank reputation and initial return. Some studies report a negative relationship (Logue, 1973; Beatty, 1989; Firth and Smith, 1992; Jegadesh et al., 1993; Gompers, 1996; Ling and Ryngaert, 1997); others report a positive association (Keasey and Short, 1992; Michaely and Shaw, 1995; Beatty and Welch, 1996), while still others report no statistically significant findings (Holland and Horton, 1993; Garfinkel, 1993).

With the recent liberalisation in the banking and finance industry in Singapore (Tan, 2005), coupled with the competition among underwriters in the last years, investment banks have to pitch and impress IPO firms with their expertise and competitive pricing. Therefore, what remains to be tested is whether the most reputable investment bank, the Development Bank of Singapore, and issue size has a positive or negative association with IPO mispricing in line with the principal-agent argument of underpricing or certification role respectively.

Underpricing cannot only be explained as a signal of firm value to overcome information asymmetry between firm insiders and outside investors, or a principal-agent conflict between issuers and underwriters. An alternative explanation of average underpricing is Rock's (1986) winner's curse adverse selection model. Asymmetric information between two distinct investor segments surrounding the value of the shares on offer can lead to underpricing. Informed investors draw on their superior knowledge about firm value and hence apply only for underpriced IPOs. In contrast, uninformed investors are unable to distinguish between issuer quality and apply indiscriminately for all IPOs. Therefore, share allocation of overpriced offerings is biased towards uninformed investors who will eventually withdraw from the IPO market. This is the winner's curse adverse selection problem. In order to compensate uninformed investors for the winner's curse adverse selection problem and to induce them to participate in the IPO market so that all offers can be fully absorbed, Rock (1986) argues that IPOs have to be underpriced. However, Rock's (1986) model with its underlying assumptions and inconsistencies has not remained unchallenged (e.g., Keasey and Short, 1992). This includes the inability to distinguish between informed and uninformed investors in practice and unavailability of primary market data to conduct tests.

Notwithstanding some of its critiques, Rock's (1986) model has a number of testable implications. Countries that have been employing fixed-price rather than book-building mechanisms and provide support for the presence of a winner's curse and underpricing explanation include the UK (Levis, 1990), Finland (Keloharju, 1993), Israel (Amihud et al., 2003) and Singapore (Koh and Walter, 1989). Studies from these markets report

that initial return of IPOs tends to the risk-free rate of return when ration-adjusted. However, this finding has not been supported in the Hong Kong market (McGuinness, 1993).

In Singapore when looking at regulatory framework and offering methods, institutional investors have been classified as being informed, whereas retail investors as being uninformed investors (Lam and Yap, 1998; Eng and Aw, 2000). Following the argument of Koh and Walter (1989) that initial return tends to the risk-free rate when ration-adjusted, Lee et al. (1996) find that initial return is positively correlated with the level of oversubscription with IPO shares on offer. Oversubscription is used as a proxy for the level of informed demand in IPO shares, especially if uninformed demand is relatively inelastic with respect to anticipated 'underpricing' (Lee et al., 1996). It remains to be tested if Lee et al.'s (1996) initial findings can be corroborated with a different data set and what the relative impact on mispricing is.

Another testable implication of Rock (1986) that has found some support includes the notion that underpricing should decrease as heterogeneity of information on the shares offered diminishes (Michaely and Shaw, 1994). However, not all studies have corroborated this finding (Tinic, 1988; Jenkinson, 1990). Furthermore, initial return can be reduced by selecting a reputable underwriter whose stamp of approval can reduce information asymmetry. Therefore, more reputable underwriters are more likely associated with less risky offerings and hence underprice less (Carter and Manaster, 1990; Booth and Smith, 1986). There are studies who find support for this notion (Habib and Ljungqvist, 2001; Michaely and Shaw, 1994; Megginson and Weiss, 1991),

but also findings that cannot corroborate this argument (Beatty and Welch, 1996; James and Wier, 1990; McGuinness, 1992).

The information asymmetry theory surrounding firm value implies that greater uncertainty amplifies IPO mispricing (Beatty and Ritter, 1986; Ritter, 1984). However, uncertainty without the initial market imperfection would not warrant persistent average underpricing as such. There is a large block of empirical studies that documents a positive relationship between initial return and proxy measures for uncertainty. Jenkinson and Ljungqvist (2001) categorize uncertainty and their corresponding proxy measures into: (1) issuing firm attributes, (2) offer characteristics, (3) prospectus disclosure, (4) third-party certification, and (5) after-market characteristics. It is not unreasonable to assume that the importance of uncertainty varies, depending on the various stages of the flotation process. For example, proxy measures of uncertainty that relate to attributes of the issuing firm (category one) ignore the information released during the pricing stage (category two), whereas after-market characteristics (category five) releases information to the market that was not available before flotation.

Significant relationships between initial return and issuing attributes include firm age (e.g., Lee et al., 1996; Garfinkel, 1993), sales (e.g., Jegadesh et al., 1993; Levis, 1990), and earnings (e.g., Keasey and Short, 1992). Statistically significant associations relating to offering characteristics include proxy measures such as offer price (e.g., Brennan and Hughes, 1991; Tinic, 1988), and underwriting fee (e.g., Habib and Ljungqvist, 2001; Keasey and McGuinness, 1992). Important proxies for uncertainty and direct disclosure include number of risk factors (e.g., Beatty and Welch, 1996),

number of uses of proceeds (e.g., Beatty and Ritter, 1986), and disclosure of an earnings forecast (e.g., Clarkson and Merkley, 1994). Significant associations between mispricing and certification variables include underwriter reputation (e.g., Megginson and Weiss, 1991; Carter and Manaster, 1990), venture backed IPOs (e.g., Lin and Smith, 1998; Megginson and Weiss, 1991), and established credit relationships (e.g., James and Wier, 1990; Slovin and Young, 1990). After-market variables as proxy measure for uncertainty that have a significant association with mispricing include the standard deviation of daily after-market returns (e.g., Ritter, 1984, 1987; Wasserfallen and Wittleder, 1994), and daily trading volume in the early aftermarket (e.g., Miller and Reilly, 1987). The ratio of sell-initiated large-block trading volume to total volume traded on the first day has become known as the 'flipping ratio' as an indicator of sentiment of institutions towards IPOs (Krigman et al., 1999). Previous studies have not distinguished between the relative importance of proxy measures belonging to these different categories of uncertainty. The unique data availability in Singapore allows for a direct test of the relative importance of different uncertainty measures.

A block of studies has examined the impact of equity market conditions in explaining IPO mispricing (e.g., Ibbotson, 1975; Ljungqvist, 1997; Ritter, 1984). Both, IPO volume and extent of underpricing tends to vary across time and markets. A noticeable feature is persistent average initial return that appear to be positively autocorrelated (Ibbotson et al., 1994), implying predictability of mispricing. This is a worrying feature from an efficient markets viewpoint, but evidence seems to suggest that average underpricing is positively related to buoyant stock markets such as in the US (Reilly, 1977), UK (Davis and Yeomans, 1976), and Hong Kong (McGuinness,

1992). Although not necessarily very convincing, explanations for this link include that buoyant equity markets and economic upsurges are good times for IPOs and hence issuers may become more tolerant towards underpricing, or greater underpricing must be offered to investors in line with Rock's (1986) argument that markets are capable to fully absorb all new issues on offer. The relative impact of such influences awaits investigation.

High IPO activity is often a consequence of industry-specific hot issue markets (Ritter, 1984; Helwege and Liang, 2004). IPOs by similar firms tend to cluster together with one or a few industries accounting for a relatively high number of firms coming to the market at the same time. Examples include IPOs from the Internet sector in the 1990s, natural resources sector in the 1980s, and biotechnology firms in the 1980s and 1990s. Competitive interaction could give rise to an industry-specific hot IPO market. Firms may have no choice but to go public to raise capital to be able to compete with companies in the same industry sector that have already gone public. This may lead to distinct differences in underpricing across industry sectors. It remains to be tested whether an industry sector effect contributes to the variation in mispricing and what the relative impact is.

Past research has four implications for the current study. First, some reassessment of the models that have been used is necessary in order to explore the effects of including multiple sets of variables. Second, it is unclear whether the recent liberalisation in the banking and finance sector with more competition among underwriters contributes to an increase or decrease in mispricing of reputable investment banks. Third, the impact of

uncertainty at different stages of the IPO and the impact on mispricing await more detailed investigation. In particular, recent evidence indicates that flipping (Krigman et al., 1999) is associated with initial return. The importance of the link between mispricing, level of subscription in IPO shares and flipping (or stagging) warrants a more detailed analysis. In fact, purchase and rapid sale of IPOs has been a popular investment strategy (Lofthouse, 1994: 136-141; Vaitilingam, 2001: 50, 81-84). This short-term investment strategy is recommended because of persistent, positive, average 'first-day' initial returns (Ritter, 1991; Levis, 1993; Affleck-Graves et al., 1996). Flipping (or stagging) is more precisely defined as investing in IPOs in anticipation of an early premium, with immediate profit taking if that anticipation is realized. This can happen within minutes of dealing commencing in the secondary market (Barry and Jennings, 1993). Finally, the relative importance of different explanations of mispricing has been largely ignored and deserves examination. The unique institutional characteristics and data availability in Singapore allows for such a test.

III. Sample, variables and models

Sample

The population examined in this study is IPOs at the Singapore Exchange in the period 1998-2000. The unique data availability and institutional arrangements for IPOs in Singapore allow for a test of the relative importance of different aspects of the information asymmetry theory in explaining mispricing of initial public offerings. A

key feature of the Singaporean market is publicly available data on IPO oversubscription and rationing (Eng and Aw, 2000; Koh and Walter, 1989; Lam and Yap, 1998; Lee et al., 1999). This allows a direct test of the theory which is not possible in other capital markets. The 1998-2000 time period is unique since the primary market seemed lacklustre after the Asian crisis in 1997, hence placing emphasis on firms and underwriters in their actions in an attempt to avoid the classic 'lemons' or 'adverse selection' problem (Akerlof, 1970). The IPO market started picking up in 1999 with a surge of firms coming to the market in 2000, followed by a stagnant period after the September 11 incident in the US.

IPOs have been identified from the Singapore Exchange. IPOs that have been selected meet four requirements: (1) the IPO firm is a Singapore based operation; (2) the IPO is offered and trading in Singapore dollars (S$); (3) the issue is a single-unit offer; and (4) listing transfers from the Main Board to SESDAQ and vice versa are excluded.

Out of a population of 166 IPOs, 100 flotation prospectuses were available with a total proceeds of S$3,295.8m. Table 1 shows that the IPOs in the sample come from a variety of industries, 60% of the issues were made on the Main Board, representing 89% of the proceeds raised.

[insert Table 1 about here]

Variable definitions and data sources

Table 2 lists, and provides summary statistics for the 14 basic variables used in this study for the 100 IPOs in the sample.

[insert Table 2 about here]

The average initial return for the three-year sample period 1998-2000 is 18% and therefore lower than average initial return reported in Firth (1998), Dawson (1984, 1987) and Wong and Chiang (1986). In the current study, initial return or mispricing (*MP*) is measured as the natural logarithm of the ratio of closing share price at the end of the fist day of trading and offer price. Share prices are obtained from the Singapore Exchange and Datastream. The ratio, day-one market price to offer price, is highly non-normal and exhibits substantial positive skewness. To counteract this and consequently improve the distributional characteristics of the error terms in estimated regression models the natural logarithm of the ratio is used as the dependent variable. The independent variables attempt to explain the variation around mispricing. They can be grouped under six headings, underpricing as a signal of firm value, the principal-agent conflict and underwriter certification, a winner's curse adverse selection problem, uncertainty surrounding IPO value, equity market conditions, and industry sector effect.

Underpricing as a signal of firm value

The first block of independent variables tests underpricing as a signal of firm value. First, for any given level of equity retained (*RET*), firm value (*V*) is predicted to be positively related to mispricing (*MP*). Equity retention (*RET*) by pre-issue shareholders has been seen as a credible signal of firm value to outside investors (Leland and Pyle, 1977). Downes and Heinkel's (1982) and Krinsky and Rotenberg's (1989) transformation ($ALPHA = RET + \ln[1-RET]$) is used for consistency with earlier literature. *ALPHA* becomes increasingly negative as *RET* increases. Therefore, the predicted regression coefficient on *ALPHA* is negative. Second, for any given level of σ^2, the variance of unspanned firm cash flows, firm value (*V*) is anticipated to be positively associated with mispricing (*MP*). The offer price (*OP*) signals the variance of the firm's cash flows. A lower offer price, ceteris paribus, signals a higher variance in cash flows. Given a higher variance and the resulting uncertainty, a negative association between offer price and mispricing is anticipated. Both *RET* and *OP* has been collected from the flotation prospectus.

Mispricing and the persistence of the phenomenon as a function of principal-agent conflict and underwriter certification

The underwriter reputation variable *UWR* captures two competing explanations about mispricing and the direction of the relationship with underwriter reputation. On one hand, the principal-agent problem helps not only to explain average initial return in IPOs, but also the persistence of the phenomenon. In this case, the underwriter (agent)

can take advantage of its status and induce IPO firms (principal) to agree to a lower price. This is because of informational asymmetry between the issuing firm and its underwriter. IPO firms have less information available on the demand of shares. Also, marketing and distribution efforts by the underwriter are unobservable. On the other hand, underwriter reputation captures the 'stamp of approval' effect of external advisers. Reputable underwriters help reducing *ex ante* uncertainty about an IPO and hence mispricing. A zero-one dummy variable measures underwriter reputation *UWR*. Reputation is based on the number of IPOs brought to the market during the sample period. The dummy variable *UWR* is coded one to reflect IPOs brought to the market by the Development Bank of Singapore Ltd., the most reputable underwriter with just over 40% of the market share. Because of the two competing explanations it is unclear whether the direction of association between mispricing and underwriter reputation *UWR* is positive or negative.

Underpricing as a function of a winner's curse adverse selection problem

Oversubscription (*SUBS*) is used as a proxy for the level of demand by informed investors and measures the number of times IPOs have been oversubscribed. The argument that underpricing tends to the risk-free rate when ration-adjusted implies that demand, reflected in the level of subscription (*SUBS*), is positively related to initial return. Data on subscription levels have been obtained from the Singapore Exchange.

Mispricing as a function of uncertainty surrounding IPO value

Four variables capture uncertainty surrounding the valuation of shares at different stages of an IPO. The first variable, *PROF* represents earnings immediately prior to flotation and reflects uncertainty based on historic firm performance. A second variable, offer price (*OP*) relates to offering characteristics. Third-party certification is reflected in underwriter reputation (*UWR*). The fourth uncertainty measure, *MMKT*, captures the different disclosure requirements in the flotation prospectus between Main Board and SESDAQ. A dummy variable *MMKT* is coded one if the IPO is made on the Main Board, while SESDAQ offerings are coded zero. The fifth and last measure to reflect uncertainty captures after-market characteristics, measured as the volume of shares traded on the first day of trading in the secondary market divided by the number of shares offered in the IPO (*VOL*). This is equal to the flipping ratio, but here looks at an aggregate number of all trades conducted which may include stagging or underwriter price support. *VOL* has received limited attention in the Singapore context so far and its relative importance is unknown. *PROF*, *OP*, *UWR*, and *MMKT* are expected to be negatively related with mispricing, whereas a positive association is predicted between *VOL* and initial return. Data on *VOL* have been obtained from the Singapore Exchange, whereas the remaining variables have been collected from the flotation prospectus.

Mispricing as a function of equity market conditions

The return on the equity market index (*RIDX*) captures buoyant stock markets that have been found to be positively associated with average initial return. The logarithm of the return on the equity market index on the first day of trading is used. A positive association between *RIDX* and mispricing is anticipated.

Mispricing as a function of industry sector effect

Four zero-one dummy variables test for industry sector specific differences in explaining mispricing of IPOs. The manufacturing, services, construction and commerce sector have been selected on the basis that they have had the highest concentration of IPOs during the sample period. The dummy variables are coded one if IPOs come from these sectors, else zero. It is not clear whether a certain industry sector has a positive or negative impact on mispricing.

Models

The focus of this study is on the impact and relative importance of underpricing as a signal of firm value, the principal-agent conflict and underwriter certification, a winner's curse adverse selection problem, uncertainty surrounding IPO value, equity

market conditions, and industry sector effect on mispricing. For estimation purposes, the variables are introduced block by block. Seven models are initially estimated:

Model 1: Underpricing as a signal of firm quality:

$$\ln(MP) = f\left(ALPHA^{\#}, \ln(OP), \ln(V)\right) + \varepsilon \quad (1)$$

Model 2: Mispricing and the persistence of the phenomenon as a result of principal-agent conflict and underwriter certification:

$$\ln(MP) = f\left(ALPHA^{\#}, \ln(OP), \ln(V), UWR\right) + \varepsilon \quad (2)$$

Model 3: Mispricing as a result of a winner's curse adverse selection problem in the IPO market:

$$\ln(MP) = f\left(ALPHA^{\#}, \ln(OP), \ln(V), SUBS\right) + \varepsilon \quad (3)$$

Model 4: Mispricing as a function of uncertainty surrounding IPO value:

$$\ln(MP) = f\left(ALPHA^{\#}, \ln(OP), \ln(V), UWR, \ln(PROF), MMKT, \ln(VOL)\right) + \varepsilon \quad (4)$$

Model 5: Mispricing as a function of equity market conditions:

$$\ln(MP) = f\left(ALPHA^{\#}, \ln(OP), \ln(V), \ln(RIDX)\right) + \varepsilon \quad (5)$$

Model 6: Mispricing as a function of an industry sector effect:

$$\ln(MP) = f\left(ALPHA^{\#}, \ln(OP), \ln(V), INDM, INDS, INDCT, INDCM\right) + \varepsilon \quad (6)$$

Model 7: Mispricing as a function of signalling firm value, principal-agent conflict and underwriter certification, winner's curse adverse selection problem, uncertainty surrounding IPO value, equity market conditions, and industry sector effect:

$$\ln(MP) = f\begin{pmatrix} ALPHA^{\#}, \ln(OP), \ln(V), UWR, SUBS, \ln(PROF), MMKT, \\ \ln(VOL), \ln(RIDX), INDM, INDS, INDCT, INDCM \end{pmatrix} + \varepsilon \qquad (7)$$

In all models:

ln(*MP*) : Mispricing (or underpricing) is measured as the ratio of closing share price at the end of the first day of trading and offer price in the primary market. ln(·) indicates use of natural logarithm.

$ALPHA^{\#}$: *RET*+ln(1-*RET*), where *RET* is the proportion of equity retained by pre-issue shareholders immediately after flotation (Downes and Heinkel, 1982; Krinsky and Rotenberg, 1989). # indicates use of natural logarithm.

ln(*OP*) : Offer price of share in the primary market.

ln(*V*) : Firm value measured as the market value at the end of the first day of trading.

UWR : Underwriter reputation, measured by a zero-one dummy variable coded one if the Development Bank of Singapore Ltd. has underwritten the IPO, else coded zero.

SUBS : Subscription level of how many times an IPO has been oversubscribed.

ln(*PROF*) : Earnings per share in the accounting period immediately before IPO.

MMKT : Separation of Main Board and SESDAQ, measured by a zero-one dummy variable, coded one for a Main Board IPO, else coded zero.

ln(*VOL*) : Number of shares traded on the first day of trading divided by the total number of shares offered in the IPO.

ln(*RIDX*) : The return on the equity market index on the first day of trading of an IPO, measured as the increase between opening and closing index level.

INDM : Manufacturing sector dummy variable, coded one if an IPO is in the manufacturing sector, else coded zero.

INDS : Services sector dummy variable, coded one if an IPO is in the services sector, else coded zero.

INDCT : Construction sector dummy variable, coded one if an IPO is in the construction sector, else coded zero.

INDCM : Commerce sector dummy variable, coded one if an IPO is in the commerce sector, else coded zero.

The basic model, *Model 1*, tests whether signalling actions taken by firm owners have an impact on mispricing. The subsequent models consider the sensitivity of the results in *Model 1* to inclusion of possible omitted blocks of variables. *Model 2* examines the impact of a principal-agent conflict and certification role through underwriter reputation on mispricing. *Model 3* looks at the winner's curse adverse selection in the IPO market, while *Model 4* tests the impact of uncertainty surrounding offerings on mispiricing. The impact of equity market conditions are tested in *Model 5*. *Model 6* examines industry sector effects on mispricing. *Model 7* includes all variables. Two further models are presented in this study. *Model 8* is a parsimonious model selected on the basis of regression diagnostic tests. It is therefore a best model. *Model*

9 is the same model as *Model 8*, but standardized regression coefficients have been estimated to make clearer the relative importance of the independent variables.

The models are estimated using Ordinary Least Square (OLS) regression analysis. The performance of a model is measured by the adjusted R^2, Akaike (*AIC*) and Schwarz (*SC*) criteria. All three measures punish the inclusion of additional independent variables, and hence favour parsimonious models. However, the three measures differ in the extent to which they penalize an increase in the number of independent variables. Ideally, a preferred model shows an improvement in all three measures. Higher adjusted R^2 indicate better explanatory power of the model, while the lower the values for *AIC* and *SC*, the better the estimated model (Verbeek, 2000).

As stated earlier, the nature of the error terms in the regression analysis led to the use of logarithmic data transformations for the dependent variable *MP* and six independent variables (*APLHA*, *OP*, *V*, *PROF*, *VOL*, *RIDX*). The remaining independent variables are dummy variables or have zero values and hence a logarithmic transformation is not feasible. Data transformation of the dependent variable and six independent variables resulted in regression models that produced well-behaved regression residuals. Jarque-Bera statistics indicated that normality could not be rejected (Verbeek, 2000). However, White's test for heteroskedasticity (Verbeek, 2000) showed that homoskedasticity could be rejected. Therefore, *t*-statistics in Table 3 and Table 5 have been calculated based on White's (1980) heteroskedasticity consistant standard errors and covariances.

IV. Findings

Table 3 presents the results of *Model 1* to *Model 8*. The bracketed figures below coefficient values are White's (1980) heteroskedasticity adjusted *t*-statistics. The second column in the table indicates the expected sign of the coefficients suggested by previous studies. The expected sign for a_1, the coefficient on the *ALPHA* variable deserves comment. *ALPHA* is designed to reflect the proportion of equity retained by pre-flotation owners. High retention seems to create a positive signal to investors about firm value, hence reduce *ex ante* uncertainty and level of mispricing. However, the *ALPHA* variable, used here for consistency with earlier studies (Downes and Heinkel, 1982; Krinsky and Rotenberg, 1989), is a non-linear function of the proportion of equity retained. *ALPHA* becomes increasingly negative as the proportion of equity retained increases.

[insert Table 3 about here]

Underpricing as a signal of firm value

Model 1 tests underpricing as a signal of firm value. The coefficients on equity retained by pre issue owners (*ALPHA*), the proxy measure for the variance in unspanned firm cash flows, offer price (*OP*), and firm value (*V*) have the predicted association with mispricing (*MP*) and are statistically significant at the 5%, 1%, and 1%, respectively.

This is then the base case model against which other models are to be compared. The low adjusted R^2 is explicable by the fact that other key variables are missing from the regression equation.

Mispricing and the persistence of the phenomenon as a result of principal-agent conflicts and underwriter certification

In *Model 2*, the variable *UWR* is added to allow for the impact of underwriter reputation on mispricing. The coefficient on underwriter reputation, a_4, is positive and statistically significant at the 1% level. This positive relationship seems to support the notion that more prestigious underwriters can induce issuers to agree to a lower offer price in line with the principal-agent conflict. While the coefficient on offer price (a_2) has retained its significance level at 1%, the statistical significance level of the coefficients on *ALPHA* (a_1) and *V* (a_3) has diminished to the 10% and 5%, respectively. *Model 2* outperforms *Model 1* in terms of all three performance measures.

Underpricing as a result of a winner's curse adverse selection problem

In *Model 3*, the level of subscription (*SUBS*) is added to the basic *Model 1*. The coefficient on the level of subscription (a_5) is, as predicted, positive and statistically significant at the 1% level. The average oversubscription level of the 35 overpriced and 65 underpriced offerings in the sample is 10.96 and 79.75 times, respectively. An independent samples *t*-test shows that the difference in the mean between over- and

underpriced IPOs is statistically significant (*t*-statistic 6.7659, $p < 0.01$). Overall, *Model 3* outperforms *Model 2* and *Model 1* in terms all three model performance measures. Therefore, *Model 3* is to be preferred to either of its predecessors.

Mispricing as a function of uncertainty surrounding IPO value

In *Model 4*, a block of variables is simultaneously added to allow for the impact of uncertainty surrounding IPO value at different stages of the flotation process. While the coefficient on earnings (*PROF*) is statistically significant at the 5% level, contrary to expectations it has a positive sign. This is surprising since it was not unreasonably to assume that higher earnings should result in lower ex ante uncertainty and hence reduced initial return. As anticipated, the coefficient on offer price (*OP*) is negative and statistically significant at the 1% level. In contrast to expectation, the coefficient on *UWR* is positive, but statistically insignificant, implying that underwriter reputation can not reduce ex ante uncertainty and hence initial return. The coefficient on the separation of market variable *MMKT* that captures different disclosure requirements is statistically significant at the 1% level, and has the predicted negative sign. Finally, after-market trading volume (*VOL*) on the first day of trading is, as predicted, positive and statistically significant at the 1% level. The average trading volume of the 35 overpriced and 65 underpriced offerings in the sample is 27.99% and 51.40%, respectively. Indeed, an independent samples *t*-test indicates that the difference between flipping of over- and underpriced offerings is statistically significant (*t*-statistic 3.0701, $p < 0.01$). This implies that issues that are underpriced result in heavily trading

in the secondary market. *Model 4* outperforms *Model 2*, *Model 1*, but not *Model 3*. Overall, *Model 3* is the preferred model out of the four models estimated so far.

Equity market conditions

In *Model 5*, the *RIDX* variable is added to capture the effects of equity market conditions on initial return. The coefficient on a_9 is, as expected positive, but statistically insignificant. *Model* 5 underperforms all preceding models in terms of the adjusted R^2, Akaike info (*AIC*) and Schwarz (*SC*) criteria, with the exception of the basic model, *Model 1*. Overall, *Model 3* is still the preferred model.

Mispricing and industry sector effect

In *Model 6*, a block of variables is added to *Model 1* to test for an industry sector effect on mispricing. All coefficients on *INDM*, *INDS*, *INDCT*, and *INDCM* are statistically insignificant at the 10%. This implies an absence of an industry sector effect on mispricing. The absence of statistical significance for this block of variables has lead to a diminish in model performance. *Model 6* performs worse than its predecessors *Model 5*, *Model 4*, *Model 3*, and *Model 2* in terms of all performance measures. The case between *Model 6* and *Model 1* is not clear cut. Model 6 outperforms Model 1 in terms of the adjusted R^2, but not in terms of the Akaike (*AIC*) and Scharz (*SC*) criterion. Overall, *Model 3* is still preferred model.

Mispricing and the relative importance of alternative explanations

Model 7 includes all independent variables under consideration. The impact on overall measures of model performance is once again ambiguous. The statistically significant performance of offer price (*OP*), firm value (*V*), level of subscription (*SUBS*), earnings (*PROF*), disclosure requirements between Main Board and SESDAQ (*MMKT*), volume of trading in shares on the first day of listing (*VOL*) has been maintained throughout the models. The significance of equity retained (*ALPHA*) and underwriter reputation (*UWR*) has diminished, while equity market conditions (*RIDX*) and industry dummy variables (*INDM*, *INDS*, *INDCT*, *INDCM*) have never achieved statistical significance. Table 4 provides some evidence of statistically significant correlations between independent variables. However, the correlations and Variance Inflation Factor (VIF) do not suggest a significant block of variables with individual significance being masked by multicollinearity.

[insert Table 4 about here]

Model 7 is simply a means to an end. A process of variable testing, and deletion where appropriate, results in a more parsimonious representation, *Model 8*, the preferred model in this study with the best overall performance measures. Two variables (*OP*, *V*) that represent signalling by firm owners are statistically significant, as does the winner's curse explanation (*SUBS*) and four out of the five uncertainty proxies (*OP*, *PROF*,

MMKT, *VOL*). Particular attention was given to the case for including underwriter reputation (*UWR*) because of its marginal significance in *Model 8* (*p*-value of *t*-statistic is 11%), and the statistically significant appearance in *Model 2*. Variable deletion tests (*F-test* and Log likelihood test) indicated that *UWR* could not be safely dropped.

Table 5 shows a further model, *Model 9* utilizes the same variables as *Model 8*, but uses standardized variables.

[insert Table 5 about here]

The coefficients can be interpreted as measuring the response of the dependent variable in units of standard deviation to one standard deviation movement in a particular independent variable, all others being held constant. The coefficient on subscription level of shares (*SUBS*) is the largest, followed by offer price (*OP*), firm value (*V*), volume in shares traded on the first day of listing (*VOL*), disclosure requirements between markets (*MMKT*), historic earnings (*PROF*), and underwriter reputation (*UWR*).

V. Conclusion

Using a sample of 100 Singaporean initial public offerings in the period 1998-2000, this study explains underpricing as a signal of firm value, principal-agent conflict and

underwriter certification, winner's curse adverse selection problem between different investor segments, uncertainty surrounding IPO value, equity market conditions and industry sector effect. Consistent with the theory of asymmetrically informed primary market participants, this study finds average initial return of 18%.

The evidence suggests that underpricing as a signal of firm value is inconclusive. Underpricing is positively related to firm value, while controlling for equity retained by pre-issue owners and the variance of anticipated firm cash flows (*Model 1*, Table 3). However, while controlling for underwriter reputation, the level of subscription in IPO shares, and uncertainty surrounding post-issue firm value, the statistical significance of equity retained diminishes (*Model 8*, Table 3). One possible explanation is that firms have used alternative signals such as underwriter reputation as a more cost-effective signal to transmit firm value to outside investors. Alternatively, a more conclusive test of underpricing as a signal of firm value should examine firm value of signalling firms with that of non-signalling and pooling firms. This would involve examining the link between underpricing, staged financing and firm value (Jain, 1997). However, this test was not feasible for the current study because of the recent sample period and hence absence of information on subsequent seasoned offerings. In addition to the mixed empirical findings of underpricing as a signal of firm value, a conceptual limitation of Grinblatt and Hwang's (1989) model is that 'underpricing' per se is only observable from an ex post perspective and hence does not qualify as a signal in Spence's (1973) context. However, it could be argued that experienced, informed financial analysts could identify underpriced IPOs from an ex ante perspective which would validate 'underpricing' as an observable signal.

The evidence suggests that underwriter reputation is positive, but only marginally related with mispricing (*Model 9*, Table 5). This may indicate some support for a principal-agent conflict in that more reputable underwriters can induce issuers to agree to a lower offer price. Alternatively, issuers may become more tolerant to lower offer prices in lacklustre markets with the hiring of a prestigious underwriter, especially if it means getting coverage by a prominent investment bank as an intermediary in the IPO market.

The evidence suggests a strong statistically significant relationship between IPO subscription levels which is used as a proxy for the level of informed demand (Lee et al., 1996) and mispricing (*Model 9*, Table 5). The oversubscription levels between under- and overpriced offerings is statistically significant. Also, the mean level of oversubscription is higher for SESDAQ and lower for the Main Board which has more stringent disclosure requirements.

The evidence strongly suggests that in contrast to expectations, historical earnings as issuing firm attributes to proxy for uncertainty are positively associated with return (*Model 9*, Table 5). This positive relationship suggests that the market may perceive reported earnings as overestimated and hence uncertainty increases. Offer price and direct disclosure in the flotation prospectus are, as anticipated, inversely related to mispricing, while the certification role of underwriter reputation does not result in lower mispricing. As predicted, flipping as a proxy for after-market uncertainty increases the level of mispricing, while uncertainty represented by offer characteristics (offer price)

has the most influential impact on mispricing within the block of variables that measure uncertainty.

The evidence suggests that the variation in mispricing cannot be explained by equity market conditions and industry sector effect (*Model 7* and *Model 8*, Table 3). Notwithstanding the joint hypothesis problem of proxy measures in theory testing, there is no single unique explanation of mispricing of unseasoned equity offerings, rather a combination of different factors. Overall, the importance of subscription levels on mispricing is clear from the results (*Model 9*, Table 5). The results also indicate a statistically significant negative correlation between subscription levels and disclosure requirements of Main Board offerings, and a strong positive correlation between subscription levels and flipping of IPOs in the secondary market (Table 3). This seems to imply that having found IPOs that are underpriced, investor demand is high which leads to rationing in the primary market and then subsequent flipping (stagging) in the secondary market. The level of flipping may signify the extent to which investors disagree about the value of an IPO.

The findings in this study have important implications for the IPO research agenda. The positive and marginal association between underwriter reputation and mispricing deserves further investigation. It may be that the underwriting contract and the compensation structure, especially fixed fee versus variable compensation, may better explain the variation in mispricing. A relatively low fixed fee may be compensated with a relatively higher underpricing. Also, future research should investigate investor segmentation that leads to oversubscription and subsequent flipping in the secondary

market in more detail. Unique data availability in Singapore has indicated a link between mispricing, subscription levels, disclosure requirements, and flipping in the secondary market. The results of this study suggest that this is a productive avenue of future research.

Acknowledgements

The views expressed in this paper are not necessarily shared by the authors' respective institution and employer. The authors would like to thank [names and affiliation removed to enable double anonymous peer review] for their comments on earlier drafts of this paper.

References

Affleck-Graves, J., Hedge, S., Miller, S.E. (1996) Conditional price trends in the aftermarket for initial public offerings, *Financial Management*, **25(4)**, 25-40.

Akerlof, G.A. (1970) The market for 'Lemons': Quality uncertainty and the market mechanism, *Quarterly Journal of Economics*, **84(3)**, 488-500.

Allen, F., Faulhaber, G. (1989) Signaling by underpricing in the IPO market, *Journal of Financial Economics*, **23(2)**, 303-323.

Amihud, Y., Hauser, S., Kirsh, A. (2003) Allocations, Adverse Selection and Cascades in IPOs: Evidence from the Tel Aviv Stock Exchange, *Journal of Financial Economics*, **68**, 137-158.

Anderson, S.C., Beard, T.R., Born, J.A. (1995) *Initial Public Offerings*. Kluwer Academic Publishers, Boston, Dordrecht, London.

Baron, D.P. (1982) A Model of the Demand for Investment Banking Advising and Distribution Services for New Issues, *The Journal of Finance*, **37**, 955-976.

Baron, D.P., Holmström, B. (1980) The Investment Banking Contract for New Issues under Asymmetric Information: Delegation and the Incentive Problem, *The Journal of Finance*, **35**, 1115-1138.

Barry, C.B., Jennings, R.H. (1993) The opening performance of initial public offerings of common-stock, *Financial Management*, **22(1)**, 54-63.

Beatty, R. (1989) Auditor reputation and the pricing of initial public offerings, *The Accounting Review*, **64**, 693-709.

Beatty, R.P., Ritter, J.R. (1986) Auditor reputation and the pricing of initial public offerings, *Accounting Review*, **64**, 693-709.

Beatty, R.P., Welch, I. (1996) Issuer Expenses and Legal Liability in Initial Public Offerings, *Journal of Law and Economics*, **39**, 545-602.

Benveniste, L., Ljungqvist, A., Wilhelm, W., Yu, X. (2003) Evidence of Information Spillovers in the Production of Investment Banking Services, *The Journal of Finance*, **58**, 577-608.

Booth, J.R., Smith, R. (1986) Capital raising, Underwriting and the Certification Hypothesis, *Journal of Financial Economics*, **15**, 261-281.

Brennan, M.J., Hughes, P.J. (1991) Stock prices and supply of information, *The Journal of Finance*, **46**, 1665-1692.

Carter, R.B., Manaster, S. (1990) Initial Public Offerings and Underwriter Reputation, *The Journal of Finance*, **45**, 1045-1067.

Chemmanur, T., Fulghieri, P. (1994) Investment Bank Reputation, Information Production, and Financial Intermediation, *The Journal of Finance*, **49**, 57-79.

Clarkson, P.M., Merkley, J. (1994) Ex ante uncertainty and the underpricing of initial public offerings: Further Canadian evidence, *Canadian Journal of Administrative Sciences*, **11**, 54-67.

Davis, E.W., Yeomans, K.A. (1976) Market discount on new issues of equity: The influence of firm size, method of issue and market volatility, *Journal of Business Finance and Accounting*, **3**, 27-42.

Dawson, S.M. (1984) Underpricing new share issues: Is Singapore an immature market?, *Singapore Management Review*, **6**, 1-9.

Dawson, S.M. (1987) Secondary stock market performance of initial public offers, Hong Kong, Singapore and Malaysia: 1978-1984, *Journal of Business Finance and Accounting*, **14**, 65-76.

Downes, D., Heinkel, R. (1982) Signaling and the Valuation of Unseasoned New Issues, *The Journal of Finance*, **37**, 1-10.

Draho, J. (2004) *The IPO Decision: Why and How Companies Go Public*. Edward Elgar Publishing Limited, Cheltenham (UK), Northampton (MA, USA).

Dunbar, C. (2000) Factors affecting investment bank initial public offering market share, *Journal of Financial Economics*, **55**, 3-41.

Eng, L.L., Aw, H.S. (2000) An analysis of factors affecting investor demand for initial public offerings in Singapore, *Multinational Finance Journal*, **4(1)**, 133-153.

Firth, M. (1998) IPO profit forecasts and their role in signalling firm value and explaining post-listing returns, *Applied Financial Economics*, **8**, 29-39.

Firth, M., Liau-Tan, C.K. (1997) Signalling Models and the Valuation of New Issues: An Examination of IPOs in Singapore, *Pacific-Basin Finance Journal*, **5**, 511-526.

Firth, M., Smith, A. (1992) The selection of auditor firms by companies in the new issues market, *Applied Economics*, **24**, 247-255.

Garfinkel, J.A. (1993) IPO underpricing, insider selling and subsequent equity offerings: Is underpricing a signal of quality, *Financial Management*, **22(1)**, 74-83.

Gompers, P. (1996) Grandstanding in the venture capital industry, *Journal of Financial Economics,* **42**, 133-156.

Grinblatt, M., Hwang, C. (1989) Signalling and the Pricing of New Issues, *The Journal of Finance*, **44(2)**, 393-420.

Habib, M.A., Ljungqvist, A.P. (2001) Underpricing and entrepreneurial wealth losses in IPOs: Theory and evidence, *Review of Financial Studies*, **14**, 433-458.

Hameed, A., Lim., H. (1998) Underpricing and firm quality in initial public offerings: Evidence from Sinapore, *Journal of Business Finance and Accounting*, **25(3)**, 455-468.

Helwege, J., Liang, N. (2004) Initial public offerings in hot and cold markets, *Journal of Financial and Quantitative Analysis*, **39(4)**, 541-569.

Holland, K.M., Horton, J.G. (1993) Initial Public Offerings on the Unlisted Securities Market: The Impact of Professional Advisers, *Accounting and Business Research*, **24(93)**, 19-34.

Ibbotson, R.G. (1975) Price performance of common stock new issues, *Journal of Financial Economics*, **2(3)**, 235-272.

Ibbotson, R.G., Ritter, J.R., Sindelar, J.L. (1994) The market's problems with the pricing of initial public offerings, *Journal of Applied Corporate Finance*, **7**, 66-74.

Jain, B.A. (1997) Tests of adverse selection models in the new issues market. *Omega – International Journal of Management Science*, **25(3)**, 365-376.

James, C. (1992) Relationship-specific assets and the pricing of underwriter services, *The Journal of Finance*, **47**, 1865-1885.

James, C., Wier, P. (1990) Borrowing Relationships, Intermediation and the Cost of Issuing Public Securities, *Journal of Financial Economics*, **28**, 149-171.

Jegadeesh, N., Weinstein, M., Welch, I. (1993) An empirical investigation of IPO returns and subsequent equity offerings, *Journal of Financial Economics*, **34**, 153-175.

Jenkinson, T., Ljungqvist, A. (2001) *Going Public: The Theory and Evidence on How Companies Raise Equity Finance*, Second Edition. Oxford University Press, Oxford.

Jenkinson, T.J. (1990) Initial public offerings in the United Kingdom, the United States, an Japan, *Journal of the Japanese and International Economies*, **4**, 428-449.

Johnson, J., Miller, R. (1988) Investment Banker Prestige and the Underpricing of Initial Public Offerings, *Financial Management*, Summer, 19-29.

Keasey, K., McGuinness, P. (1992) An empirical investigation of the role of signalling in the valuation of unseasoned equity issues, *Accounting and Business Research*, **22(86)**, 133-142.

Kelohatju, M. (1993) The Winner's Curse, Legal Liability, and the Long-Run Price Performance of Initial Public Offerings in Finland, *Journal of Financial Economics*, **34**, 251-277.

Koh, F., Lim, J., Chin, N. (1992) The Signalling Process in Initial Public Offerings, *Asia Pacific Journal of Management*, **9**, 151-165.

Koh, F., Walter, T. (1989) A direct test of Rock's Model of the Pricing of Unseasoned Issues, *Journal of Financial Economics*, **23**, 251-272.

Krigman, L., Shaw, W.H., Womack, K.L. (1999) The persistence of IPO mispricing and the predictive power of flipping, *The Journal of Finance*, **54**, 1015-1044.

Krinsky, I., Rotenberg, W. (1989) Signalling and the valuation of unseasoned new issues revisited, *Journal of Financial and Quantitative Analysis*, **24(2)**, 257-266.

Lam, S.S. (1991) Underpricing of initial public offerings in Singapore: A discriminating test of the information-signalling hypothesis, Asia-Pacific Journal of Management, **8(2)**, 175-184.

Lam, S.S., Yap, W. (1998) Pricing system and the initial public offerings market: A case of Singapore, *International Review of Economics and Finance*, **7(3)**, 293-313.

Lee, P., Taylor, S., Walter, T. (1999) IPO underpricing explanations: Implications from Investor Application and Allocation Schedules, *Journal of Financial and Quantitative Analysis,* **34**, 425-444.

Lee, P.J., Taylor, S., Walter, T. (1996) Expected and realised returns for Singaporean IPOs: Initial and long-run analysis, *Pacific-Basin Finance Journal*, **4**, 153-180.

Lee, P.J., Taylor, S.L., Walter, T.S. (1996) Australian IPO pricing in the short and long run, *Journal of Banking and Finance*, **20(7)**, 1189-1210.

Leland, H., Pyle, D. (1977) Informational Asymmetries, Financial Structure, and Financial Intermediation, *The Journal of Finance*, **32**, 371-387.

Levis, M. (1990) The Winner's Curse Problem, Interest Costs, and the Underpricing of Initial Public Offerings, *Economic Journal*, **100**, 76-89.

Levis, M. (1993) The long-run performance of initial public offerings: the UK experience 1980-88, *Financial Management,* **22(1)**, 28-41.

Lin, T.H., Smith, R.L. (1998) Insider reputation and selling decisions: The unwinding of venture capital investments during equity IPOs, *Journal of Corporate Finance,* **4**, 241-263.

Ling, D., Ryngaert, M. (1997) Valuation uncertainty, institutional involvement, and the underpricing of IPOs: The case of REITs, *Journal of Financial Economics,* **43(3)**, 433-456.

Ljungqvist, A.P. (1997) Pricing initial public offerings: Further evidence from Germany, *European Economic Review*, **41**, 1309-1320.

Lofthouse, S. (1994) *Equity Investment Management: How to Select Stocks and Markets*. John Wiley and Sons, Chichester.

Logue, D. (1973) On the pricing of unseasoned equity issues: 1965-1969, *Journal of Financial and Quantitative Analysis*, **8**, 91-103.

Loughran, T., Ritter, J., Rydqvist, K. (1994) Initial Public Offerings: International Insights, *Pacific-Basin Finance Journal*, **2**, 165-199.

McGuinness, P. (1992) An examination of the underpricing of initial public offerings in Hong Kong: 1980-90, *Journal of Business Finance and Accounting*, **19**, 165-186.

McGuinness, P. (1993) Investor- and Issuer-Related perspectives of IPO Underpricing, *Omega – International Journal of Management Sciences*, **21**, 377-392.

Megginson, W., Weiss, K.A. (1991) Venture Capitalist Certification in Initial Public Offerings, *The Journal of Finance*, **46**, 879-903.

Michaely, R., Shaw, W.H. (1994) The Pricing of Initial Public Offerings: Tests of Adverse-Selection and Signaling Theories, *Review of Financial Studies*, **7**, 279-319.

Michaely, R., Shaw, W.H. (1995) Does the choice of auditor convey quality in an initial public offering, *Financial Management*, **24(4)**, 15-30.

Miller, R.E., Reilly, F.K. (1987) An examination of mispricing, returns, and uncertainty for initial public offerings, *Financial Management*, **16**, 33-38.

Muscarella, C.J., Vetsuypens, M.R. (1989) A Simple Test of Baron's Model of IPO Underpricing, *Journal of Financial Economics*, **24**, 125-135.

Reilly, F.K. (1977) New issues revisited, *Financial Management*, **6**, 28-42.

Ritter, J.R. (1984) The 'hot issue' market of 1980, *Journal of Financial Economics*, **19(2)**, 269-281.

Ritter, J.R. (1984) The Hot Issue Market of 1980, *Journal of Business*, **57**, 215-240.

Ritter, J.R. (1987) The costs of going public, *Journal of Financial Economics*, **19**, 269-282.

Ritter, J.R. (1991) The long-run performance of initial public offerings, *The Journal of Finance*, **46(1)**, 3-27.

Rock, K. (1986) Why New Issues are Underpriced, *Journal of Financial Economics*, **15(1/2)**, 187-212.

Saunders, A., Lim., J. (1990) Underpricing and the new issue process in Singapore, *Journal of Banking and Finance*, **14**, 291-309.

Slovin, M.B., Young, J.E. (1990) Bank lending and initial public offerings, *Journal of Banking and Finance*, **14**, 729-740.

Spence, A. (1973) Job market signalling, *Quarterly Journal of Economics*, **87**, 355-379.

Tan, C.H. (2005) *Financial Markets & Institutions in Singapore*, Singapore University Press.

Tan, R.S.K., Eng, L.L., Khoo, A. (1999) The effects of offering method and trading location on the pricing of IPOs in Singapore, *Applied Financial Economics*, **9**, 491-499.

Tan, R.S.K., Wong, S.S. (1997) Initial and aftermarket performance of initial public offerings in Singapore, *International Journal of Management*, **14(1)**, 92-102.

Tinic, S.M. (1988) Anatomy of initial public offerings of common stock, *The Journal of Finance*, **43**, 789-822.

Titman, S., Trueman, B. (1996) Information Quality and the Valuation of New Issues, *Journal of Accounting and Economics*, **8**, 159-172.

Vaitilingam, R. (2001) *The Financial Times Guide to Using the Financial Pages*, fourth edition. Pearson Education Limited, Harlow, London.

Verbeek, M. (2000) *A Guide to Modern Economics*. Wiley, Chichester.

Wasserfallen, W., Wittleder, C. (1994) Pricing initial public offerings: Evidence from Germany, *European Economic Review*, **38**, 1505-1517.

Welch, I. (1989) Seasoned Offerings, Imitation Costs, and the Underpricing of Initial Public Offerings, *The Journal of Finance*, **44(2)**, 421-449.

White, H. (1980) Using least squares to approximate unknown regression functions, *International Economic Review*, **21**, 149-170.

Wilson, C. (1980) The nature of equilibrium in markets with adverse selection, *Bell Journal of Economics*, **11**, 108-130.

Wong, K.A., Chiang, H.L. (1986) Pricing of new issues in Singapore, *AsiaPacific Journal of Management*, **4**, 1-10.

Table 1. Distribution on full sample and sub-samples of initial public offerings on the Main Board and SESDAQ across industry sectors during the three year period 1998-2000

	Full sample				Main Board				SESDAQ			
Industry sector	IPO No.	%	IPO proceeds	%	IPO No.	%	IPO proceeds	%	IPO No.	%	IPO proceeds	%
Manufacturing	40	40%	S$1,201.4m	36%	22	37%	S$1,005.4m	34%	18	45%	S$196.0m	56%
Services	20	20%	S$438.3m	13%	11	18%	S$354.7m	12%	9	23%	S$83.6m	24%
Construction	18	18%	S$290.5m	9%	11	18%	S$244.6m	8%	7	18%	S$46.0m	13%
Commerce	12	12%	S$149.2m	5%	7	12%	S$130.5m	4%	5	13%	S$18.7m	5%
Finance	2	2%	S$349.9m	11%	2	3%	S$349.9m	12%	0	0%	S$0.0m	0%
Hotel and Restaurant	2	2%	S$259.6m	8%	1	2%	S$255.0m	9%	1	3%	S$4.6m	1%
Properties	1	1%	S$257.5m	8%	1	2%	S$257.5m	9%	0	0%	S$0.0m	0%
Transportation	5	5%	S$349.4m	11%	5	8%	S$349.4m	12%	0	0%	S$0.0m	0%
Total	100	100%	S$3,295.8m	100%	60	100%	S$2,947.0m	100%	40	100%	S$348.8m	100%

Table 2. Descriptive statistics on the full sample of 100 initial public offerings on the Main Board and SESDAQ across industry sectors during the three year period 1998-2000

Definition	Variable	Unit of measurement	Mean	Median	Std. Dev.
Mispricing (initial return, or underpricing)	*MP*	%	17.9876	9.1390	28.6977
Proportion of equity retained by pre-issue owners	*RET*	%	72.5093	73.0000	6.6129
Offer price	*OP*	S$	0.3736	0.2800	0.2673
Market value of IPO firm at the end of the first day of trading	*V*	S$million	35.2099	17.0400	67.9467
Underwriter reputation (coded one if reputable, else zero)	*UWR*	zero-one dummy	0.41000	0.0000	0.4943
Subscription level for shares in IPO	*SUBS*	times oversubscribed	55.6733	20.3500	73.1248
Earnings in the accounting period before IPO, based on number of shares outstanding after IPO	*PROF*	S$	0.0314	0.0258	0.0270
Separation of Main Board and SESDAQ IPOs (coded one if Main Board, else zero)	*MMKT*	zero-one dummy	0.6000	1.0000	0.4924
Number of shares traded divided by the number of shares offered in IPO on first day of trading	*VOL*	%	83.2382	69.0454	56.7291
Return on equity market index	*RIDX*	%	-0.1935	-0.1686	1.8906
Manufacturing sector (coded one if manufacturing, else coded zero)	*INDM*	zero-one dummy	0.4100	0.0000	0.4943
Services sector (coded one if services, else coded zero)	*INDS*	zero-one dummy	0.1900	0.0000	0.3943
Construction sector (coded one if construction, else coded zero)	*INDCT*	zero-one dummy	0.1800	0.0000	0.3861
Commerce sector (coded one if commerce, else coded zero)	*INDCM*	zero-one dummy	0.1200	0.0000	0.3266

Table 3. Ordinary least squares (OLS) regression analysis on mispricing, based on a three-year (1998-2000) sample of 100 initial public offerings on the Main Board and SESDAQ

The dependent variable is mispricing (*MP*) and defined as the ratio of closing share price after the first day of trading divided by the offer price. The independent variables and their regression coefficients in parentheses for *Model 1* to *Model 8* are as follows: *ALPHA* = *RET*+ln(1-*RET*), where *RET* is the proportion of equity retained by pre-issue owners (a_1), *OP* = offer price (a_2), *V* = market value of IPO firm at the end of the first day of trading (a_3), *UWR* = underwriter reputation dummy variable, coded one if reputable, else zero (a_4), *SUBS* = subscription level for shares in IPO (a_5), *PROF* = earnings in the accounting period before IPO, based on number of shares outstanding after the IPO (a_6), *MMKT* = zero-one dummy variable separating IPOs from Main Board and SESDAQ, coded one for Main Board IPOs, else zero (a_7), *VOL* = number of shares traded divided by the number of shares offered in IPO on the first day of trading (a_8), *RIDX* = return on equity market index on the first day of trading of an IPO (a_9), *INDM* = zero-one dummy variable for manufacturing industry sector, coded one if manufacturing IPO, else zero (a_{10}), *INDS* = zero-one dummy variable for services industry sector, coded one if services IPO, else zero (a_{11}), *INDCT* = zero-one dummy variable for construction industry sector, coded one if construction IPO, else zero (a_{12}), *INDCM* = zero-one dummy variable for commerce industry sector, coded one if commerce IPO, else zero (a_{13}). Empty cells indicate variables not part of the model specification. The expected sign, *E*(sign), shows the hypothesised direction of the regression coefficient with mispricing (+ve and –ve indicates a positive and negative relationship, respectively).

ln(·) and # indicates use of natural logarithm. *t*-statistics are reported under the coefficients in parentheses and based on White's (1980) heteroskedasticity consistent standard errors and covariances. Two-tailed statistics with significance at the 1%, 5% and 10% levels are denoted with ***, ** and *, respectively.

Model 1: $\ln(MP_i) = a_0 + a_1 ALPHA_i^{\#} + a_2 \ln(OP_i) + a_3 \ln(V_i) + \varepsilon_i$ where IPO $i = 1,2,..,100$

Model 2: $\ln(MP_i) = a_0 + a_1 ALPHA_i^{\#} + a_2 \ln(OP_i) + a_3 \ln(V_i) + a_4 UWR_i + \varepsilon_i$

Model 3: $\ln(MP_i) = a_0 + a_1 ALPHA_i^{\#} + a_2 \ln(OP_i) + a_3 \ln(V_i) + a_5 SUBS_i + \varepsilon_i$

Model 4: $\ln(MP_i) = a_0 + a_1 ALPHA_i^{\#} + a_2 \ln(OP_i) + a_3 \ln(V_i) + a_4 UWR_i + a_6 \ln(PROF_i) + a_7 MMKT_i + a_8 \ln(VOL_i) + \varepsilon_i$

Model 5: $\ln(MP_i) = a_0 + a_1 ALPHA_i^{\#} + a_2 \ln(OP_i) + a_3 \ln(V_i) + a_9 \ln(RIDX_i) + \varepsilon_i$

Model 6: $\ln(MP_i) = a_0 + a_1 ALPHA_i^{\#} + a_2 \ln(OP_i) + a_3 \ln(V_i) + a_{10} INDM_i + a_{11} INDS_i + a_{12} INDCT_i + a_{13} INDCM_i + \varepsilon_i$

Model 7: $\ln(MP_i) = a_0 + a_1 ALPHA_i^{\#} + a_2 \ln(OP_i) + a_3 \ln(V_i) + a_4 UWR_i + a_5 SUBS_i + a_6 \ln(PROF_i) + a_7 MMKT_i + a_8 \ln(VOL_i) + a_9 \ln(RIDX_i) + a_{10} INDM_i + a_{11} INDS_i + a_{12} INDCT_i + a_{13} INDCM_i + \varepsilon_i$

Coefficient	*E*(sign)	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*	*Model 8*
a_0		-0.7319 (-3.2068) ***	-0.6389 (-2.8635) ***	-0.6102 (-4.2192) ***	-0.2338 (-1.2516)	-0.7260 (-3.2544) ***	-0.7180 (-2.5766) **	-0.3692 (-2.5445) **	-0.2808 (-2.6015) **
a_1	-ve	-0.4545 (-2.4117) **	-0.3405 (-1.8136) *	-0.2226 (-1.8227) *	-0.0653 (-0.4767)	-0.4731 (-2.5967) **	-0.5148 (-2.5791) **	-0.0601 (-0.5784)	
a_2	-ve	-0.2555 (-3.3962) ***	-0.2555 (-3.5038) ***	-0.2002 (-4.3256) ***	-0.2831 (-4.7986) ***	-0.2502 (-3.3599) ***	-0.2570 (-3.2760) ***	-0.2534 (-5.3024) ***	-0.2358 (-5.3725) ***
a_3	+ve	0.1198 (3.4393) ***	0.0872 (2.4285) **	0.0936 (3.7660) ***	0.1689 (4.7067) ***	0.1177 (3.2834) ***	0.1114 (2.8661) ***	0.1409 (4.6738) ***	0.1279 (4.5130) ***
a_4	+ve / -ve		0.1679 (2.8569) ***		0.0550 (1.4218)			0.0439 (1.3412)	0.0499 (1.6051)
a_5	+ve			0.0028 (8.7280) ***				0.0018 (6.2056) ***	0.0019 (6.8161) ***
a_6	-ve				0.0691 (2.2782) **			0.0501 (2.0728) **	0.0467 (2.0660) **
a_7	-ve				-0.1979 (-3.8244) ***			-0.1252 (-3.0141) ***	-0.1240 (-2.9897) ***
a_8	+ve				0.2075 (8.1475) ***			0.1401 (6.3352) ***	0.1364 (6.5093) ***
a_9	+ve					2.1518 (1.5598)		0.3307 (0.4784)	
a_{10}	+ve / -ve						0.0411 (0.3816)	0.0333 (0.8258)	
a_{11}	+ve / -ve						-0.0864 (-0.7967)	0.0086 (0.1993)	
a_{12}	+ve / -ve						-0.0957 (-0.8253)	-0.0286 (-0.6019)	
a_{13}	+ve / -ve						-0.0851 (-0.6818)	0.0579 (1.1616)	

F-statistic	7.0253 ***	7.9757 ***	47.2354 ***	25.4702 ***	5.9562 ***	3.8167 ***	31.0376 ***	58.0373 ***
R^2	0.1800	0.2514	0.6654	0.6596	0.2005	0.2250	0.8243	0.8154
adjusted R^2	0.1544	0.2199	0.6513	0.6337	0.1668	0.1661	0.7977	0.8013
Akaike (*AIC*)	0.2126	0.1416	-0.6637	-0.5866	0.2073	0.2362	-1.1279	-1.1982
Schwarz (*SC*)	0.3169	0.2718	-0.5335	-0.3782	0.3376	0.4446	-0.7632	-0.9898
Observations	n = 100	n = 100	n = 100	n = 100	n = 100	n = 100	n = 100	n = 100

Table 4. Bivariate correlation between mispricing, signalling actions taken by firm owners, principal-agent conflict and certification role, winner's curse adverse selection, uncertainty surrounding offerings, equity market conditions and industry sector effects, based on a three-year (1998-2000) sample of 100 initial public offerings on the Main Board and SESDAQ

Mispricing (*MP*) is the ratio of closing share price after the first day of trading divided by the offer price. *ALPHA* = *RET*+ln(1-*RET*), where *RET* is the proportion of equity retained by pre-issue owners, *OP* = offer price, *V* = market value of IPO firm at the end of the first day of trading, *UWR* = underwriter reputation dummy variable, coded one if reputable, else zero, *SUBS* = subscription level for shares in IPO, *PROF* = earnings in the accounting period before IPO, based on number of shares outstanding after the IPO, *MMKT* = zero-one dummy variable separating IPOs from Main Board and SESDAQ, coded one for Main Board IPOs, else zero, *VOL* = number of shares traded divided by the number of shares offered in IPO on the first day of trading, *RIDX* = return on equity market index on the first day of trading of an IPO, *INDM* = zero-one dummy variable for manufacturing industry sector, coded one if manufacturing IPO, else zero, *INDS* = zero-one dummy variable for services industry sector, coded one if services IPO, else zero, *INDCT* = zero-one dummy variable for construction industry sector, coded one if construction IPO, else zero, *INDCM* = zero-one dummy variable for commerce industry sector, coded one if commerce IPO, else zero.

ρ denotes the bi-variate correlation coefficient. ln(·) and # indicates use of natural logarithm. Two-tailed *t*-statistics with significance at the 1% and 5% levels are denoted with ** and *, respectively. *n* = number of observations.

		ln(*MP*)	*ALPHA*#	ln(*OP*)	ln(*V*)	*UWR*	*SUBS*	ln(*PROF*)	*MMKT*	ln(*VOL*)	ln(*RIDX*)	*INDM*	*INDS*	*INDCT*	*INDCM*
ln(*MP*)	ρ	1.0000													
	n	100													
ALPHA#	ρ	-0.1901	1.0000												
	n	100	100												
ln(*OP*)	ρ	-0.2540 *	0.1278	1.0000											
	n	100	100	100											
ln(*V*)	ρ	-0.0083	0.2469 *	0.6929 **	1.0000										
	n	100	100	100	100										
UWR	ρ	0.2950 **	-0.0439	0.2248 *	0.3169 **	1.0000									
	n	100	100	100	100	100									
SUBS	ρ	0.7607 **	-0.1877	-0.0975	-0.0355	0.1777	1.0000								
	n	100	100	100	100	100	100								
ln(*PROF*)	ρ	-0.0542	0.1962	0.4371 **	0.2576 **	0.0569	-0.0063	1.0000							
	n	100	100	100	100	100	100	100							
MMKT	ρ	-0.3535 **	0.3706 **	0.2398 *	0.5412 **	-0.1494	-0.3126 **	0.1660	1.0000						
	n	100	100	100	100	100	100	100	100						
ln(*VOL*)	ρ	0.6906 **	-0.1643	-0.2211 *	-0.1706	0.1328	0.4911 **	-0.1361	-0.3579 **	1.0000					

	n	100	100	100	100	100	100	100	100	100								
ln(*RIDX*)	*ρ*	0.1431	0.1228	-0.0194	0.0271	-0.0738	0.1532	0.0852	0.0523	0.1160	1.0000							
	n	100	100	100	100	100	100	100	100	100	100							
INDM	*ρ*	0.1108	0.0926	0.1307	0.0955	0.0664	0.1250	-0.0056	-0.0833	0.0057	0.0753	1.0000						
	n	100	100	100	100	100	100	100	100	100	100	100						
INDS	*ρ*	-0.0890	-0.1534	0.2036 *	0.0101	-0.0102	-0.1495	-0.0133	-0.0510	0.1093	0.0022	-0.3572 **	1.0000					
	n	100	100	100	100	100	100	100	100	100	100	100	100					
INDCT	*ρ*	-0.0303	0.0708	-0.2495 *	-0.1238	-0.1260	-0.0145	-0.0449	0.0106	0.0131	0.0875	-0.3825 **	-0.2343 *	1.0000				
	n	100	100	100	100	100	100	100	100	100	100	100	100	100				
INDCM	*ρ*	-0.0833	-0.0893	-0.1060	-0.2156 *	-0.0576	-0.0529	0.0582	-0.0126	-0.1720	-0.1177	-0.3015 **	-0.1846	-0.1730	1.0000			
	n	100	100	100	100	100	100	100	100	100	100	100	100	100	100			

Table 5. Ordinary least squares (OLS) regression analysis on mispricing, based on a three-year (1998-2000) sample of 100 initial public offerings on the Main Board and SESDAQ, with standardized coefficients

This model is the same as *Model 8* in Table 3, but standardized regression coefficients are reported for *Model 9*. The dependent variable is mispricing (*MP*) and defined as the ratio of closing share price after the first day of trading divided by the offer price. The independent variables and their regression coefficients in parentheses are as follows: *ALPHA* = *RET*+ln(1-*RET*), where *RET* is the proportion of equity retained by pre-issue owners (a_1), *OP* = offer price (a_2), *V* = market value of IPO firm at the end of the first day of trading (a_3), *UWR* = underwriter reputation dummy variable, coded one if reputable, else zero (a_4), *SUBS* = subscription level for shares in IPO (a_5), *PROF* = earnings in the accounting period before IPO, based on number of shares outstanding after the IPO (a_6), *MMKT* = zero-one dummy variable separating IPOs from Main Board and SESDAQ, coded one for Main Board IPOs, else zero (a_7), *VOL* = number of shares traded divided by the number of shares offered in IPO on the first day of trading (a_8), *RIDX* = return on equity market index on the first day of trading of an IPO (a_9), *INDM* = zero-one dummy variable for manufacturing industry sector, coded one if manufacturing IPO, else zero (a_{10}), *INDS* = zero-one dummy variable for services industry sector, coded one if services IPO, else zero (a_{11}), *INDCT* = zero-one dummy variable for construction industry sector, coded one if construction IPO, else zero (a_{12}), *INDCM* = zero-one dummy variable for commerce industry sector, coded one if commerce IPO, else zero (a_{13}). Empty cells indicate variables not part of the model specification. The expected sign, *E*(sign), shows the hypothesised direction of the regression coefficient with mispricing (+ve and –ve indicates a positive and negative relationship, respectively).

ln(·) and # indicates use of natural logarithm. *t*-statistics are reported under the coefficients in parentheses and based on White's (1980) heteroskedasticity consistent standard errors and covariances. Two-tailed statistics with significance at the 1%, 5% and 10% levels are denoted with ***, ** and *, respectively. *Rank* indicates the relative size of the standardized regression coefficients in ascending order.

The same as Model 8, but standardized regression coefficients [a]			
Coefficient [a]	*E*(sign)	*Model 9*	*Rank*
a_0		-0.2808	
		(-2.6015) **	
a_1	-ve		
a_2	-ve	-0.4512	2
		(-5.3725) ***	
a_3	+ve	0.4419	3
		(4.5130) ***	

a_4	+ve / -ve	0.0860 (1.6051)		7
a_5	+ve	0.4740 (6.8161)	***	1
a_6	-ve	0.1117 (2.0660)	**	6
a_7	-ve	-0.2128 (-2.9897)	***	5
a_8	+ve	0.3611 (6.5093)	***	4
a_9	+ve			
a_{10}	+ve / -ve			
a_{11}	+ve / -ve			
a_{12}	+ve / -ve			
a_{13}	+ve / -ve			
F-statistic		58.0373	***	
R^2		0.8154		
adjusted R^2		0.8013		
Akaike (*AIC*)		-1.1982		
Schwarz (*SC*)		-0.9898		
Observations		n = 100		