Expected and realised returns for Singaporean IPOs: Initial and long-run analysis

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Abstract

We analyse initial and long-run returns for all Singapore IPOs made between 1 July 1973 and 31 December 1992. Initial returns are found to be around 30 percent. However, after rationing and application costs are taken into account initial returns are insignificantly different from the risk-free rate of return, a result consistent with the predictions of the model of Rock (1986). Initial returns are positively related to the level of oversubscription and retained ownership, although the economic significance of the latter is weak. In contrast to many other international studies of IPOs, the long-run average returns for Singaporean IPOs are insignificantly different from an efficient market expectation. While long-run returns for individual companies show considerable variation, these returns are not predictable using information available at the IPO date. We further investigate the large oversubscription rates which are a peculiar feature of the Singapore IPO market, and argue that they are consistent with demand expansion by informed investors. Our estimates of the minimum price that a rational issuer would set in an IPO are below the actual issue price for all issues, given what we regard as reasonable limits on uninformed demand.

JEL classification: G14; G24; G32

Keywords: Initial public offers; Underpricing; Long-run returns; Expected returns

1. Introduction

This paper provides further evidence on the underpricing of initial public offers (IPOs) in Singapore, as well as long-run returns for the first three years of listing.

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A major advantage of studying IPOs in Singapore is that information is available on the process used to ration shares when an issue is oversubscribed (Koh and Walter, 1989). Further, the allocation process is even-handed, unlike those countries where allocations may systematically favour certain investor groups. Because the rationing process in Singapore is unbiased (all investors who apply for the same number of shares have an equal chance of receiving shares), total demand for an issue is unconstrained by expectations of preferential treatment of certain investors. In those countries where allocations may be biased, total demand is dampened because potential investors who are not on the 'favoured' client list of the issuer or underwriter would not waste their resources by applying for shares they do not expect to get.  

Singapore is also an interesting market to study because, as we describe in more detail below, the listing requirements that a potential applicant to the Stock Exchange of Singapore Limited (SES) must comply with are quite different to those in many other countries, including the United States. A company seeking listing in Singapore must have an established history of profitable operations and must demonstrate a degree of national interest in its activities. Also, the contractual mechanisms used in the flotation process are systematically different to those which operate in the United States.

In this paper we initially test whether the results reported by Koh and Walter (1989) for IPOs up to June 1987, which support the Rock (1986) model of 'underpricing' as an expected equilibrium result, extend to IPOs made between July 1987 and December 1992. We also consider whether potential signalling mechanisms such as retained ownership (e.g. Leland and Pyle, 1977) and underwriter reputation (Baron, 1982) significantly reduce initial 'underpricing'. Unlike Koh and Walter (1989), we extend our analysis to long-run returns. We examine whether long-run returns for IPO firms are related to initial 'underpricing' and especially whether long-run returns are abnormally poor, as has been reported for other countries in several recent studies, (e.g. Ritter, 1991; Keloharju, 1993; Loughran et al., 1994; Lee et al., 1996). Finally, we consider whether the high oversubscription levels which are frequently evident in Singapore IPOs, are consistent with 'speculative bubble' or 'fad' explanations, or whether these are better described as informed demand expansion following ex ante rational price setting in the prospectus.

Our results confirm the explanatory power of the model of Rock (1986) beyond the period examined by Koh and Walter (1989). Specifically, we show that the actual price used in an IPO is consistent with ex ante rational price setting by issuers, because this price exceeds the "full subscription price" (Rock, 1986), the price at which uninformed demand alone would fully subscribe the issue. Further,  

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1 In these countries an IPO which is 'open' to the public is probably not capable of being sold to the clients of the underwriter, and is thus more likely to have winners' curse attributes.
when the probability of receiving shares in an IPO is incorporated into the analysis, 'underpricing' is insignificantly different from the risk-free rate of return. The winners' curse is strongly evident. Informed demand is far more responsive to (subsequently revealed) 'underpricing' than uninformed demand, thereby crowding out small investors, whom we assume approximate Rock's uninformed group. Our results are robust for subcategories of IPOs constructed by issue size and underwriter reputation.

Although we find some support for a signalling role for retained ownership as suggested by Leland and Pyle (1977), the explanatory power of this variable is economically low. Given that retained ownership can be observed at the time of the issue, this result is to be expected in an efficient market. In contrast, our proxy for fluctuations in informed demand has high explanatory power. This variable is only observable ex post.

Our long-run results are consistent with efficient capital market expectations. While the IPOs we study have considerable variation in their individual one-year, two-year and three-year market adjusted returns, the average of these market-adjusted post-listing returns is insignificantly different from zero. It is important to note that we study all IPOs made on the SES between its formation in 1973 and 31 December 1992, so that these long-run results are not caused by a bias in our sample selection. The abnormally poor returns documented in several international long-run studies are not encountered in Singapore. Further, we find no variables which are capable of providing economically significant predictions of these long-run returns. Suggestions that initial 'underpricing' is driven by 'fad' or 'speculative bubble' arguments are rejected.

Section 2 of the paper describes the institutional setting for IPOs in Singapore, while Section 3 describes the sample and our tests of initial 'underpricing'. Long-run return evidence is contained in Section 4, and Section 5 summarises the paper.

2. Institutional arrangements and prior evidence

Loughran et al. (1994) suggest differences in the contractual mechanisms used and the composition of firms going public as factors which help explain short-run 'underpricing' and long-run returns. They also argue that initial 'underpricing' is positively related to the degree of government interference in the process, the risk of the firms going public and the length of time in advance of the actual issue that the issuer is committed to an offer price. Auctions of shares are found to effectively eliminate 'underpricing'.

Because the Singaporean IPO process is described in some detail in Koh and

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2 For recent evidence on how 'universal' poor returns are, see Loughran et al. (1994).
Walter (1989), we merely point out the main attributes of this market. First, new issue arrangements constitute a fair game for investors. All applicants for a particular number of shares in an IPO have an equal probability of receiving an allocation. Underwriters do not selectively allocate shares to preferred clients when an issue is oversubscribed, and details of the rationing process (which is conducted by way of a public ballot) are publicly disclosed. Hence, demand is not dampened by a bias in allocation to preferred clients. Rationing of shares is, however, pervasive. Raw initial 'underpricing' is substantial and has averaged around 30 percent. Second, share issues follow the general principles of British law and thus the offer price must be set and stated in the prospectus prior to a formal invitation to the public to apply for shares. The elapsed time between fixing an offer price for inclusion in the prospectus and the listing of the shares averages four to five weeks. Third, listing rules of the SES require a minimum percentage of shares to be owned by shareholders holding between 500 and 10,000 shares, causing issuing companies to favour smaller investors over larger investors in the allocation process. However, while small investors have an increased probability of receiving shares relative to larger investors, there is no bias within a particular application strategy, i.e., all investors who apply for 1,000 shares (or any other number) are treated equally.

Some other important aspects of the SES procedures and listing rules which are relevant to this paper were not described by Koh and Walter (1989). The first of these relates directly to the composition and risk of the group of firms approaching the IPO market in Singapore. The 'general criteria' section of the SES listing manual refers to track record, future prospects, past and future dividends, financial position and liquidity, asset backing and price earnings ratios, and, among others, directors and management. Firms must have a minimum operating history of five years, with profits at least in the last three years. Profits and earnings per share should be increasing.

The 'future prospects' section refers to a preference for the applicant being engaged in an industry with prospects for growth and expansion, (i.e., "If profits are expected to substantially decline, it may be a factor against the listing of the company"). Past and future dividends are also deemed relevant (i.e., the "ability of the company to pay a reasonable dividend for the financial year following listing").

The 'financial position and liquidity section' of the listing rules requires a healthy financial position with no shortfall in working capital, and a debt–equity
ratio in line with that prevailing in the industry concerned, while the ‘asset backing and price earnings’ section requires that net tangible assets per share be greater than the par value per share. Intangible assets thus cannot exceed accumulated profits and reserves. Any surplus from revaluation of plant and equipment is not to be included or used in calculating net tangible assets per share. This section also states that ‘while the SES will not be concerned with determining the issue price, the company and its underwriter should justify and explain the basis for arriving at the price earnings multiple used in arriving at the issue price’.

It appears that the PE ratio is of special interest to the SES in its vetting of listing applicants. Directors and management need to display continuity and requisite expertise, while the character and integrity of the directors is stated as a relevant criterion for any listing application. Also, chain listings [where more than 50 percent of the shares of one (listed) company are held by an applicant for listing] are generally not allowed. Finally, the SES is also concerned with vulnerability or exposure to specific business risks, which are described as an important feature of the listing application.

In summary, the SES imposes quite stringent requirements on firms seeking listing in relation to past performance and expected future prospects. The requirement that firms have an established history of profitable operations means that the risk of firms seeking listing will be relatively low. It is also worth noting that there have been no mining or exploration company IPOs in Singapore.

3. Data and results: Initial ‘underpricing’

3.1. Data sources

Details of all new issues since the incorporation of the SES in 1973 until 31 December 1992 were collected from the monthly SES journals. One hundred and thirty-two issues were found. Koh and Walter (1989) studied the first 70 of these, which were made between 1 July 1973 and 30 June 1987. This paper reports initial underpricing evidence for the 62 more recent IPOs made between 1 July 1987 and 31 December 1992, though our long-run evidence is for all 132 issues.

The Company files held at the SES library were searched to extract details of the allocation procedures used, as well as other relevant information in relation to the issue. Other data were collected as follows. First day trading prices (high, low and last sale) were extracted from SES daily trading summaries. The issue price per share, the number of shares issued, the underwriter and the key dates (prospectus date and applications open date) were collected from the prospectus of each company. Other variables collected from the prospectus included details of

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4 Asset revaluations are allowed under Singaporean accounting rules.
prior and forecast earnings, the prospective PE (price to earnings) and NTA (net tangible assets) per share ratios, the number of material contracts, the age of the company, the proportion of the issue reserved for private placement, details of the most recent profit and loss and balance sheet, the underwriting commission and the proportion of the issue retained by the issuer. The risk-free rate of return and the prime rate of interest prevailing during the listing lag (i.e., applications closing date to listing date) were extracted from relevant publications at the Monetary Authority of Singapore (MAS).

Daily (adjusted for changes in the basis of capitalisation) share prices for three years subsequent to listing were purchased from the Financial Databases at the National University of Singapore (NUS) and Nanyang Technological University (NTU). In cases where the relevant price data were not available electronically they were collected from SES daily price quotation sheets. As the Financial Databases contained (at the time this research was completed) daily prices up to 31 December 1993, some of our IPOs have less than three years of prices available. We also obtained details of the market index (Straits Times Industrial Index) over the entire period of interest from the Financial Database at NUS.

3.2. Evidence of ‘underpricing’

Raw ‘underpricing’ for 62 SES IPOs made between 1 July 1987 and 31 December 1992 is reported in Fig. 1. The returns \( X_{i,s} \) in Fig. 1 are calculated as follows:

\[
X_{i,s} = \ln \left( \frac{P_i * N_s - I_{i,s} - FC}{S_i * N_s} \right) - R_i,
\]

where \( X_{i,s} \) = return for issue \( i \) and strategy \( s \) measured from applications – close to the initial-listing date, \( P_i \) = last sale price for issue \( i \) on the first day of trading, \( N_s \) = number of shares applied for in strategy \( s \), \( I_{i,s} \) = interest cost associated with the application for issue \( i \) and strategy \( s \), \( FC \) = fixed cost of the application, \( R_i \) = natural log of one plus the risk-free rate of return over the period from the application – close date to the listing date for issue \( i \), and \( S_i \) = subscription price for issue \( i \) as per the prospectus.

Note that the average continuously compounded return of approximately 22 percent [with associated \( t \)-statistics (on the null hypothesis that the mean is zero) of approximately 6.2] is the return for an investor who faced no rationing. The discontinuity evident in Fig. 1 for the application strategy of apply for 1,000

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5 Specifically, there is no electronic record of share prices available prior to January 1975 (14 IPOs were made between the establishment of the SES in July 1973 and January 1975) and some prices were missing due to data corruption.

6 It should be noted no adjustment for dividends is made in either the daily share prices or the Straits Times Industrial Index.

7 This calculation is the same as that in Koh and Walter (1989, p. 254).
Fig. 1. Raw returns with no rationing for 62 IPOs made between July 1987 and December 1992 on the SES.

shares is caused by one issue which limited the maximum size of an application to 1,000 shares. The inclusion of application costs produce some (slight) economies of scale in application size, as is evident in Fig. 1. However, Fig. 1 also assumes

Fig. 2. Rationing adjusted returns for 62 IPOs made between July 1987 and December 1992 on the SES.
no rationing, which is typical of papers which document IPO ‘underpricing’. Given that the average rate of oversubscription for these 62 IPOs is 54.9 times, rationing is pervasive and should be explicitly considered.

Fig. 2 shows rationing adjusted returns, which are calculated using the following:

\[ X_{i,s} = \ln \left[ \frac{P_i \times A_{i,s} + S_i (N_i - A_{i,s}) - I_{i,s} - FC}{S_i \times N_i} \right] - R_i \] (2)

where \( A_{i,s} \) = the allocation received in issue \( i \) for strategy \( s \), and the other terms are as previously defined.

The incorporation of the probability of receiving an allocation, which is based on the actual methods used in each of the issues, dramatically changes the view of initial ‘underpricing’. Raw returns are generally below one percent, and are insignificantly different from the risk-free rate of return. It is important to note that two factors contribute to obtaining these greatly reduced returns, namely rationing per se and systematic differences in the probability of receiving shares in ‘underpriced’ and ‘overpriced’ issues, (i.e., the winners’ curse). We return to this issue in Section 3.4.3.

In only one case (for an application for 1 lot of 1,000 shares where the expected return is 3.5 percent) is the expected return after transactions costs significantly greater than the risk-free rate of return. The Koh and Walter (1989) result, which shows that the empirical predictions of the Rock (1986) model are verified for the Singapore IPO market, is thus replicated for the more recent sample of IPOs.

‘Underpricing’ for the combined sample 8 is also reported in Table 1.9 Raw returns are calculated as:

\[ R_i = \frac{P_i - S_i}{S_i} \] (3)

where \( P_i \) = the last sale price on the first day of listing, \( S_i \) = the issue price.

Also reported in Table 1 is a series of variables which have been suggested as potential explanators of cross-sectional differences in initial ‘underpricing’. Rock (1986) suggests that uninformed investors face a winners’ curse in IPOs because informed investors will withdraw from the process if an issue is ‘overpriced’. Notice that while the mean initial return is 31.39 percent, the minimum is -29.00 percent. Nineteen of the 128 issues were ‘overpriced’. The oversubscription rate is a direct measure of the total demand for the issue. Providing uninformed demand is reasonably uniform, the oversubscription rate is suggested

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8 The sample size in Table 1 is 128 because four issues do not have details of the allocation process used to ration shares available. These four all come from the IPOs made in the period prior to July 1987, i.e., they were included in the Koh and Walter (1989) sample period.

9 Koh and Walter (1989) did not test alternative explanations of initial underpricing (nor did they study long-run returns) so this paper uses the entire set of Singapore IPOs for this test.

10 The underpricing plotted in Fig. 1 is the continuously compounded return, whereas in Table 1 it is expressed as an arithmetic return.
Table 1
Summary statistics for 128 IPOs on the Stock Exchange of Singapore made between 1 July 1973 and 31 December 1992

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Max.</th>
<th>Q3</th>
<th>Median</th>
<th>Q1</th>
<th>Min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>'Underpricing'</td>
<td>31.392</td>
<td>41.287</td>
<td>196.923</td>
<td>46.667</td>
<td>19.024</td>
<td>3.723</td>
<td>-29.00</td>
</tr>
<tr>
<td>Oversubscription</td>
<td>42.534</td>
<td>84.00</td>
<td>783.0</td>
<td>44.35</td>
<td>14.1</td>
<td>3.750</td>
<td>1.00</td>
</tr>
<tr>
<td>Age (years)</td>
<td>17.526</td>
<td>17.709</td>
<td>153.0</td>
<td>20.0</td>
<td>13.5</td>
<td>9.500</td>
<td>0.090</td>
</tr>
<tr>
<td>Retained ownership</td>
<td>68.727</td>
<td>13.247</td>
<td>90.909</td>
<td>75.000</td>
<td>74.465</td>
<td>64.852</td>
<td>3.970</td>
</tr>
<tr>
<td>Time to listing (days)</td>
<td>16.078</td>
<td>6.693</td>
<td>59.0</td>
<td>18.0</td>
<td>15.0</td>
<td>13.0</td>
<td>6.0</td>
</tr>
<tr>
<td>No. of material contracts</td>
<td>6.477</td>
<td>6.051</td>
<td>46.0</td>
<td>8.0</td>
<td>5.0</td>
<td>2.5</td>
<td>1.0</td>
</tr>
<tr>
<td>PE difference</td>
<td>75.490</td>
<td>108.974</td>
<td>434.0</td>
<td>120.144</td>
<td>63.201</td>
<td>-2.603</td>
<td>-94.14</td>
</tr>
<tr>
<td>Log of issue size</td>
<td>16.613</td>
<td>1.177</td>
<td>20.030</td>
<td>17.382</td>
<td>16.570</td>
<td>15.656</td>
<td>14.221</td>
</tr>
<tr>
<td>Log of total assets</td>
<td>17.840</td>
<td>1.324</td>
<td>22.698</td>
<td>18.687</td>
<td>17.758</td>
<td>16.852</td>
<td>15.530</td>
</tr>
<tr>
<td>Growth options</td>
<td>0.316</td>
<td>0.232</td>
<td>0.886</td>
<td>0.470</td>
<td>0.312</td>
<td>0.121</td>
<td>0.000</td>
</tr>
</tbody>
</table>

a 'Underpricing' is measured as the last sale on the first day of listing minus the subscription price, divided by the subscription price and is expressed as a percent. Oversubscription is the total pool of application money received from public, divided by the shares available for public subscription. Issues which are undersubscribed are assigned an oversubscription ratio of one. Age is the length of the firms' prior operating history. Retained ownership is the proportion of the issued capital of the firm retained by the owners after taking into account the shares being issued in the IPO. Time to listing is the elapsed time in days between the prospectus registration date and the listing date. The number of material contracts is a direct count of the number of such contracts which are disclosed in the prospectus. A company is required to disclose all material contracts under the provisions of the companies legislation. PE difference is the product of the earnings per share of the firm and the difference between the average market PE in the three month period prior to the float and the PE used in determining the issue price, this then being divided by the issue price. Log of the issue size is the natural logarithm of the issue proceeds. Log of total assets is the natural log of the total assets of the firm, after the proceeds of the issue have been received. Growth options is one minus the proportion of the issue price represented by assets-in-place.

as a proxy for informed demand. Following Rock, we expect that the higher the level of informed demand the higher will be the initial ‘underpricing’. The average level of oversubscription is 42.5 times, while the maximum is a staggering 783 times. Seventeen issues were undersubscribed (seven of these were overpriced), and hence the unsold shares were taken up by the underwriter (we define this to be an oversubscription level of unity).

Beatty and Ritter (1986) extend Rock’s analysis to show that ‘underpricing’ is related to ex ante uncertainty. We proxy ex ante uncertainty with:

1. the age of the firm (where the expectation is that older firms have more information available, lower ex ante uncertainty, and hence lower ‘underpricing’),
2. the number of material contracts mentioned in the prospectus (where a larger number is associated with greater uncertainty and greater expected ‘underpricing’), and
3. firm size (where larger firms have lower ex ante uncertainty and an expectation of lower ‘underpricing’). Size is measured as the natural logarithm of the issue...
proceeds (Log of issue size) and as the natural log of total assets of the issuer (Log of total assets). Both measures assume successful completion of the issue.

Singapore IPOs have an average age of 17.5 years, which is considerably above the minimum age of 5 years required by SES listing rules. Average total assets are approximately S$56 million and average issue proceeds are S$16.4 million. It goes almost without saying that IPOs in Singapore are typically smaller than those studied in United States-based research papers.

The time (in days) between prospectus registration and listing may proxy for informed demand (Lee et al., 1996), given that ‘underpriced’ issues will sell more quickly because informed investor demand will be stronger for such issues. For Singapore IPOs we find an average listing lag of 16 days, though for Singaporean IPOs we use the time between the prospectus registration date and the applications open date as our proxy.

Leland and Pyle (1977) argue that issuers can signal the quality of an IPO by retaining a relatively large stake. Singapore IPOs have average retained ownership of 68.7 percent, with more than half of the sample retaining at least 74.5 percent. While Gale and Stiglitz (1989) point out that this signal is weakened by the possibility of the owner selling off a part of the ownership in the post-listing period, the SES listing rules require that directors and promoters of a company issue a statement in the prospectus setting out whether ‘‘the promoters and directors... have any intention to realise or sell any part of their interest in the issue within a period of one year after the securities of the Company are admitted to the Official List’’ [Section 701 (14)]. Hence the Gale and Stiglitz criticism of the signalling role of retained ownership is less forceful than in situations where no similar undertaking is required. Following Leland and Pyle (1977) we expect ‘underpricing’ will be negatively related to retained ownership.

Table 1 also reports a calculation for the proportion of the issue price represented by growth options, as opposed to assets-in-place. Lee et al. (1996) argue that this variable may be a better proxy for ex ante uncertainty than those suggested by Beatty and Ritter (1986). Our evidence indicates that Singapore IPO issue prices are predominantly represented by assets-in-place.

The final variable in Table 1 is our proxy for a possible upper limit on the price-earnings (PE) multiple used in determining the issue price for a Singapore IPO. While the SES rules do not impose a maximum value for the PE, firms are required to justify the implied PE. Thus, some pressure to maintain PEs within ‘normal’ bounds exists. Our PE proxy \((\text{PEDIFF})\) is measured as follows:

\[
\text{PEDIFF}_i = \frac{\text{EPS}_i \left( \text{PE}_{\text{MARKET}} - \text{PE}_i \right)}{S_i} 
\]  

(4)

where \(\text{EPS}_i\) = current earnings per share for issue \(i\), \(\text{PE}_{\text{MARKET}}\) = the average PE for industrial companies listed on the SES in the three month period prior to the issue, \(\text{PE}_i\) = the PE of the issue \(i\), and \(S_i\) is as previously defined.

\(\text{PEDIFF}\) is thus the expected ‘underpricing’ return which would prevail if the company traded at the average market PE multiple on the first day of trading.
Table 2
Multivariate regressions of various explainers of ‘underpricing’ for 128 IPOs made on the Stock Exchange of Singapore between January 1973 and December 1992

<table>
<thead>
<tr>
<th>Variable</th>
<th>Regression 1</th>
<th>Regression 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>t-statistic</td>
</tr>
<tr>
<td>Intercept</td>
<td>147.315</td>
<td>3.259 **</td>
</tr>
<tr>
<td>Oversubscription</td>
<td>0.299</td>
<td>6.031 **</td>
</tr>
<tr>
<td>Age of the firm</td>
<td>0.140</td>
<td>0.616</td>
</tr>
<tr>
<td>Ret. ownership</td>
<td>-0.689</td>
<td>-2.519 **</td>
</tr>
<tr>
<td>Time to listing</td>
<td>-0.410</td>
<td>-1.062</td>
</tr>
<tr>
<td>No. of contracts</td>
<td>-0.340</td>
<td>-0.882</td>
</tr>
<tr>
<td>PE difference</td>
<td>0.039</td>
<td>1.308</td>
</tr>
<tr>
<td>Size of the issue</td>
<td>-4.687</td>
<td>-2.012 *</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.4217</td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>14.228 **</td>
<td></td>
</tr>
</tbody>
</table>

*a* Adjusted for heteroscedasticity using the White (1980) procedure.

*b* The dependent variable ‘underpricing’ is measured as the last sale on the first day of listing minus the subscription price, divided by the subscription price and is expressed as a percent. Oversubscription is the total pool of application money received from the public, divided by the shares available for public subscription. Issues which are undersubscribed are assigned an oversubscription ratio of one. Age is the length of the firm’s prior operating history. Retained ownership is the proportion of the issued capital of the firm retained by the owners after taking into account the shares being issued in the IPO. Time to listing is the elapsed time in days between the prospectus registration date and the listing date. The number of material contracts is a direct count of the number of such contracts which are disclosed in the prospectus. A company is required to disclose all material contracts under the provisions of the companies legislation. PE difference is the product of the earnings per share of the firm and the difference between the average market PE in the three month period prior to the float and the PE used in determining the issue price, this then being divided by the issue price. Log of the issue size is the natural logarithm of the issue proceeds.

* Significant at 0.01.

* Significant at 0.05.

3.3. Cross-sectional variation in ‘underpricing’

While the previous rationing adjusted returns provide clear support for the predictions of the model of Rock (1986), several other explanations of ‘underpricing’ exist in the theoretical and empirical literature. Table 2 reports multivariate regressions which are designed to test whether these alternative explanations are supported in the IPO market in Singapore.

We argue that the oversubscription rate is a proxy for informed demand, particularly if uninformed demand is relatively inelastic with respect to expected

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11 We also conducted univariate regressions. The results (not reported) are in all cases consistent with the multivariate analysis. These are available on request to the authors.

12 The *t*-statistics in Table 2 have been adjusted using the White (1980) heteroscedasticity adjustment.
'underpricing'. We explore the issue of elasticity of demand among different classes of investors in more detail below, but note that our estimates are consistent with small (who we argue to be uninformed) investors having far less pronounced abilities to 'pick the bargains'. Oversubscription levels have a significant positive (as expected) coefficient with a t-statistic of approximately 6.0. The Singapore IPO market can thus be regarded as displaying considerable sensitivity to expected 'underpricing' by dramatically increasing demand for 'underpriced' issues.

Our regressions provide only limited support for the ex ante uncertainty arguments of Beatty and Ritter (1986), at least presuming our proxies are valid measures of this construct. Older firms are slightly more 'underpriced', while firms with a large number of material contracts are less 'underpriced'. Both results are opposite to those suggested by Beatty and Ritter. However, the inverse relationship between our size measure and 'underpricing' is consistent with the theory, and these coefficients are statistically significant. However, given the variety of associations which have been demonstrated between size and various firm attributes, we are reluctant to suggest that this result provides strong support for an ex ante uncertainty argument.

Our results do however provide support for the signalling role of retained ownership in the manner suggested by Leland and Pyle (1977). We have noted above that the credibility of retained ownership as a signal in Singapore is more compelling, because directors and promoters are required to state (in the prospectus) any intentions they have to dispose or reduce their ownership in the firm during the initial 12 month post-listing period. It is important to note that the explanatory power of the univariate regression (not reported) which uses retained ownership is quite low (just over 5 percent). If this were not the case a low cost predictor of 'underpricing', available ex ante to market participants, would exist. A publicly available signal should not be capable of predicting economically significant investment strategies in an efficient market. \(^{13}\) It is also relevant to note that the independent variable in these regressions is not adjusted for the effects of rationing.

For Australian IPOs, Lee et al. (1996) find the time which elapses between the registration of the prospectus and the listing date to be significantly negatively associated with 'underpricing'. A negative relationship exists for Singapore IPOs, however this is not significant. Finally, note that our proxy for institutional 'pressure' to keep PE ratios within 'defendable' levels is insignificant at conventional levels.

\(^{13}\) Beatty and Ritter (1986) make a similar point with respect to their 'observable' proxies for ex ante uncertainty.
3.4. Additional analysis

3.4.1. Demand expansion

We repeated the experiment contained in table 2 and table 3 of Koh and Walter (1989) for those IPOs made after the cut-off date for their study, i.e., June 1987. Our results are contained in Tables 3 and 4 below. We are concerned with three related issues, i.e., the level of investor responsiveness, rational pricing of an issue by the company and underwriter, and oversubscription levels.

Fifty-three of the 62 IPOs made between July 1987 and December 1992 provide sufficient disclosure of the allocation method used to ration shares to allow us to calculate the subscription level achieved within categories of application sizes. This level of subscription is then used as the dependent variable in four regressions where the initial return is the independent variable. The regression coefficients are estimates of how responsive investors in various classes (small, medium/small, medium and large) are to actual underpricing. If the small investor group is less informed than larger investor groups, the theory predicts their demand will be less responsive to actual underpricing. Larger investors are argued to expand their demand for ‘underpriced’ issues and to withdraw from ‘overpriced’ issues, thus creating the winners’ curse for small (uninformed) investors.

The evidence in Table 3 is even stronger than that reported in Koh and Walter (1989). While small investors expand their demand by 4.9 percent for each one percent of underpricing, they are far less responsive than the large investors (each one percent of underpricing is associated with a 304 percent increase in demand). When the sample is divided into the most underpriced and least underpriced groups, further evidence of the winners’ curse is evident. In the most underpriced group, small investor demand increases insignificantly, while large investors expand demand by 563 percent (t-statistic 5.153). Small investors are crowded out of the most underpriced issues in a way predicted by Rock (1986). Demand expansion in all investor categories except the medium/small group is insignificantly different from zero in the least ‘underpriced’ issues.

These regression results can be used to estimate a subscription price which is sufficiently low to ensure that uninformed demand alone would fill the entire issue. This price is called the ‘full subscription price’ in Rock (1986). In Rock’s model it would not be rational for an issuer to set an issue price below the ‘full subscription price’. Given that oversubscription is pervasive in Singapore it is important to establish that issue prices are not set so low as to ensure that the issue

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14 For the nine issues where we could not perform this test, five were undersubscribed, two allowed applications for 1000 shares only, and two firms did not provide sufficient detail on the rationing process.

15 For the six issues which were overpriced for which we can also reconstruct the demand schedule, the estimated coefficients for demand expansion are negative (i.e., demand contracts) for all four investor categories, though these are not significant.
would be fully subscribed by uninformed investors. We conduct the same test of
issue pricing rationality described and reported in Koh and Walter (1989 pp.
262–263). Our sample size for this test is 58, i.e., the 53 issues which allow us to
reconstruct the demand patterns used above, plus the five issues which were
undersubscribed (which by definition failed to attract sufficient uninformed in-
vestors to fully subscribe the issue).

If demand by uninformed investors (initially we use the strictest definition by
using applications for 1,000 shares as our proxy for uninformed demand), is less
than the full size of the issue, then the full subscription price must be less than the
actual issue price. This is the case for 32 of the 58 issues. For the remaining 26
issues we estimate the full subscription price using the method described in Koh
and Walter (though employing the regression estimates from Table 4). Briefly, we
allow our definition of an uninformed investor to include those applying for an
increasingly larger number of shares, until we reach a critical application size
which produces a full subscription price below the actual issue price. These critical
levels of uninformed demand are reported in Table 4.

Table 4 reveals that all 58 issues are rationally priced providing uninformed
demand extends to investors applying for up to 50,000 shares. Such a definition is
necessary in only four cases. These four issues involve Singapore dollar applica-
tions ranging between $30,000 and $100,000. Fifty-four issues are consistent with
the Rock model when uninformed demand is defined as up to 10,000 shares (this
involves an investment of less than $15,000). In summary, the issue prices set in
Singapore IPOs are consistent with rational issuer behaviour. While some issues
have been grossly underpriced (ex post) and these have led to dramatic expansion
in demand by large investors, several issues have been overpriced (nine out of the
most recent 62 issues were overpriced). In order to attract uninformed investors,
IPOs on average have to be priced at a discount. Note however, that this discount
is not large enough to produce an issue price lower than the estimated full
subscription price.

3.4.2. Underwriter and size effects

Figs. 3 and 4 subdivide the results in Fig. 2. Fig. 3 divides the sample based on
the underwriter, while Fig. 4 further investigates the association between initial
returns and issue size. Baron (1982) and Booth and Smith (1986) argue that
underwriters signal issue quality by pledging reputation capital (i.e.,
certification). 16 The Baron model predicts that high reputation underwriters
should price issues ‘closer to the line’ because they have greater valuation skills
and greater reputation capital at stake in competing for subsequent underwriting
assignments. Singapore IPO underwriting is dominated by the Development Bank

---

16 However, Muscarella and Vetsuypens (1989) find no evidence of underwriters possessing any
informational advantage of the type suggested by certification arguments.
Table 3
Regression results for four regressions that employ the initial listing day returns as the independent variable and subscription level achieved within various subcategories of the total application pool as the dependent variable for 53 new issues made between July 1987 and December 1992 on the Stock Exchange of Singapore for which sufficient data exist to split total applications into various subcategories based on application size.

<table>
<thead>
<tr>
<th>Demand by investors applying for</th>
<th>1,000 shares (i.e. small investors)</th>
<th>2,000 to 99,000 shares (i.e., medium/small investors)</th>
<th>100,000 to 249,000 shares (i.e. medium investors)</th>
<th>250,000 shares or more (i.e., large investors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All issues (N = 53)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated coefficient</td>
<td>4.929</td>
<td>7.417</td>
<td>17.853</td>
<td>303.937</td>
</tr>
<tr>
<td>t-statistic</td>
<td>2.941 **</td>
<td>4.914 **</td>
<td>3.858 **</td>
<td>6.098 **</td>
</tr>
<tr>
<td>R² (adjusted)</td>
<td>0.091</td>
<td>0.308</td>
<td>0.211</td>
<td>0.410</td>
</tr>
<tr>
<td>t-statistic on difference</td>
<td>11.321 **</td>
<td>11.330 **</td>
<td>10.305 **</td>
<td></td>
</tr>
<tr>
<td>Most underpriced issues (N = 27)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated coefficient</td>
<td>0.827</td>
<td>4.075</td>
<td>4.985</td>
<td>563.71</td>
</tr>
<tr>
<td>t-statistic</td>
<td>0.167</td>
<td>1.133</td>
<td>0.459</td>
<td>5.153 **</td>
</tr>
<tr>
<td>R² (adjusted)</td>
<td>-0.040</td>
<td>0.011</td>
<td>-0.033</td>
<td>0.506</td>
</tr>
<tr>
<td>t-statistic on difference</td>
<td>9.481 **</td>
<td>9.539 **</td>
<td>8.948 **</td>
<td></td>
</tr>
<tr>
<td>Least underpriced issues (N = 26)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated coefficient</td>
<td>1.691</td>
<td>5.207</td>
<td>12.831</td>
<td>52.317</td>
</tr>
<tr>
<td>t-statistic</td>
<td>1.240</td>
<td>2.234 *</td>
<td>1.790</td>
<td>1.270</td>
</tr>
<tr>
<td>R² (adjusted)</td>
<td>0.020</td>
<td>0.133</td>
<td>0.078</td>
<td>0.023</td>
</tr>
<tr>
<td>t-statistic on difference</td>
<td>2.288 *</td>
<td>2.082 *</td>
<td>1.570</td>
<td></td>
</tr>
</tbody>
</table>

* Significant at 0.05.
** Significant at 0.01.

of Singapore Limited (DBS) and a group of three companies comprising United Chase Merchant Bankers Limited, Singapore International Merchant Bank Limited and Wardley Limited. While other issues may be underwritten by high quality underwriters, these other underwriters have a relatively small stake in the IPO business. The results depicted in Fig. 3 [which are similar to those in Koh and
Table 4
Number of issues where uninformed demand alone fully subscribes the issue for alternative levels of uninformed demand (in lots of 1,000 shares) for 58 issues made between July 1987 and December 1992 on the Stock Exchange of Singapore

<table>
<thead>
<tr>
<th>Initial level of uninformed demand in lots of 1,000 shares</th>
<th>Number of issues where uninformed demand alone fully subscribes the issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45 $^a$</td>
</tr>
<tr>
<td>2</td>
<td>48</td>
</tr>
<tr>
<td>10</td>
<td>54</td>
</tr>
<tr>
<td>50</td>
<td>58 $^b$</td>
</tr>
</tbody>
</table>

$^a$ Using the strictest definition of uninformed demand allowed by our data produces 45 (out of 58) cases which are consistent with rational issuer pricing behaviour.

$^b$ All 58 issues are characterised by rational issuer pricing behaviour if uninformed demand includes applications up to 50,000 shares.

Walter (1989)] are not consistent with Baron’s predictions. Underwriters of lower prestige have lower rationing adjusted returns than DBS, which is the most prestigious underwriter. Note that the overwhelming majority of the rationing adjusted returns are insignificantly different from the risk-free rate of return, as they were for the overall sample, once rationing was incorporated into the analysis. Only in the case of a strategy of applying for 1,000 shares for issues

Fig. 3. Rationing adjusted returns split by underwriter for 62 IPOs made between July 1987 and December 1992 on the SES.
underwritten by the DBS is the return of 3.0 percent significantly different from the risk-free return (t-statistic 2.300).

Fig. 4 summarises rationing adjusted returns for small, medium and large issues. This grouping can only take place after the composition of the ranking attribute is known for all firms in the sample, so this sub-partitioning cannot be regarded as an implementable strategy. If size proxies for information availability, the expectation is that larger firms, about which there is lower uncertainty, will be less 'underpriced' than small firms. They are not; large firms are generally more 'underpriced' than the medium sized group of IPOs and small firms are generally the least underpriced. Again, the results in Fig. 4, with only three exceptions (a strategy of applying for 1,000, 2,000 and 3,000 shares in small companies have t-statistics of 2.985, 2.733 and 2.139 respectively), depict payoffs which are insignificantly different from the predictions of Rock's model.

### 3.4.3. Probability of an allocation

Fig. 5 demonstrates the winners' curse in another way, by plotting the probability of an allocation for various application strategies for the 62 recent IPOs, for the 10 'overpriced' IPOs and for the 52 'underpriced' issues. In drawing these subcategories ex post identification is used. Fig. 5 indicates that:

1. there is a systematic preference for small applications, perhaps to ensure that the spread of shareholdings required by the SES listing rules is achieved,
2. the probability of a small investor receiving shares in an ‘overpriced’ issue (0.838) is 2.35 times the probability of receiving shares in an ‘underpriced’ issue (0.357),
3. while large investors (as modelled here) have a higher probability of receiving ‘overpriced’ issues (0.545) than ‘underpriced’ issues (0.108), they are far less likely to apply for (and receive) ‘overpriced’ issues,
4. while the allocation patterns adopted by issuers show considerable variation, it seems better to apply for say 500,000 or 501,000 shares than to apply for 499,000 shares, as evidenced by discontinuities in the plots, and
5. the patterns and relationships for these recent IPOs are very similar to those in Koh and Walter (1989).

4. Long-run returns

4.1. Method

In order to gain a better understanding of IPO pricing we turn our attention to an analysis of how these firms perform in the first 750 days (150 weeks or approximately 3 years) post-listing. This issue is important in the Singapore context because it has been suggested that a high level of oversubscription, which means excess demand for the issue, may manifest itself as abnormally good...
post-listing behaviour in the short-term (while the excess demand is absorbed), followed by abnormally poor longer term returns. Such explanations are referred to as ‘fads’ or ‘speculative bubbles’, whereby temporary overvaluation occurs due to over-optimism on the part of investors (Aggarwal and Rivoli, 1990). These explanations imply that markets are inefficient.

Our sample for the long-run analysis is 132, four more than for the initial return analysis. This is because the four issues studied by Koh and Walter (1989) for which allocation details could not be determined nevertheless have post-listing share prices available. Our return results are based on two measures, namely raw wealth relatives (RWR) and adjusted wealth relatives (AWR), in which we use the market index as the benchmark portfolio. 17 Three weighting schemes are employed. First, we assume an equal investment in each IPO (and the market index) using the last sale price on the listing day to determine the number of shares acquired. Second, we assume an acquisition of one percent of the new issue. Poorly (above average) performing firms become less (more) important because their value-weights to the portfolio of IPOs are reduced (increased). Third, we assume an investment in one percent of the issued capital of the company. The implications in relation to portfolio results are similar to those mentioned above for the second weighting scheme. We calculate post-listing returns for the IPO portfolio for 750 days, though some firms have less than 750 days of data available. The raw wealth relative (RWR) is defined in Eq. (5). For each initial investment scheme the RWR measures the value of the portfolio of IPO at each time interval relative to the initial investment. When a firm drops out due to lack of data, the averaging takes place over the remaining (n) firms.

\[
RWR_{t,s} = \frac{\sum_{i=1}^{n}(P_{i,t} + K_{i,t}) \cdot N_{i,s}}{\sum_{i=1}^{n}(P_{i,1} \cdot N_{i,s})} \quad \text{for } t = 1, \ldots, 750 \text{ and } s = 1, 2, 3,
\]

where \( P_{i,t} \) = the price of security \( i \) in period \( t \), \( K_{i,t} \) = the value of any capitalisation change for security \( i \) in period \( t \), \( n \) = the number of firms in the portfolio of IPOs (\( n \) ranges from 132 to 103) and \( N_{i,s} \) = the number of shares acquired in firm \( i \) in weighting scheme \( s \).

The index wealth relative is similarly defined in Eq. (6) below. The initial investment in each IPO firm for each weighting scheme is also invested in the

17 Our method is equivalent to using the zero-one version of the market model. To the extent that the systematic risk of an IPO exceeds one our wealth relatives will be overstated (understated) if the market index rose (fell) during the post-listing period we examine (i.e., up to 750 days).
market index, and the IWR at each time period measures the performance of the index relative to the initial index investment.

\[ IWR_{t,s} = \frac{\sum_{i=1}^{n} (I_{i,t} \ast M_{i,s})}{\sum_{i=1}^{n} (I_{i,1} \ast M_{i,s})} \quad \text{for} \quad t = 1, \ldots, 750 \text{ and } s = 1, 2, 3, \]  

where \( M_{i,s} \) = the number of index ‘contracts’ acquired equivalent to the same initial investment in firm \( i \) for weighting scheme \( s \).

The adjusted wealth relative (AWR) measures the performance of the IPO firms for the three investment schemes relative to the performance of the index control, as defined in Eq. (7).

\[ AWR_{t,s} = \frac{\sum_{i=1}^{n} (P_{i,s} + K_{i,s}) \ast N_{i,s}}{\sum_{i=1}^{n} (I_{i,1}) \ast M_{i,s}} \quad \text{for} \quad t = 1, \ldots, 750 \text{ and } s = 1, 2, 3. \]  

It should be noted that these wealth relatives are not adjusted for dividends, the reason being that a suitable dividend-adjusted market index does not exist for the SES.

In summary, our long-run measures are based on a buy and hold strategy which is initiated at the last sale on the first day of listing for each IPO. Three weighting schemes are employed. Our control portfolio is the market index. Each time an IPO is listed we assume the same initial investment (implied for the firm by the three weighting schemes) is also made in the index.

4.2. Long-run evidence

The raw wealth relatives (RWR) are plotted in Fig. 6 and the adjusted wealth relatives (AWR) are plotted in Fig. 7 for the three investment strategies described above.

From Fig. 6 the 750 day raw wealth relatives for the three weighting schemes are 1.253, 1.402 and 1.469 respectively for equal investment, one percent of the issue, and one percent of the capital. These wealth relatives are equivalent to annual continuously compounded returns of 7.81, 11.92 and 13.68 percent respectively. However, these returns are unadjusted for market movements (and risk). When an adjustment is made for the market return the wealth relatives, plotted in Fig. 7, are 1.033, 1.194 and 1.254 respectively (continuously compounded returns of 1.09, 6.09 and 7.84 percent). That the weighting schemes which involve greater investment in the larger companies produce slightly higher returns, means that large firms have long-run performance which is better than small firms. This is in the opposite direction to the frequently encountered size anomaly. What is also clearly evident from these results is that there is no evidence of the abnormally poor long-run returns that have been widely documented in several previous
Fig. 6. Raw wealth relatives for 132 IPOs made between January 1973 and December 1992 on the SES.
Fig. 7. Market adjusted wealth relatives for 132 IPOs made between January 1973 and December 1992 on the SES.
international studies [e.g. Ritter (1991), Levis (1993), Keloharju (1993), Lee et al. (1996) and the summary in Loughran et al. (1994)].

There were no instances of an IPO firm dropping out of the sample because the company failed or was taken over in the period for which we have daily price data. Daily data were available until 31 December 1993, which means that IPOs made in 1991 and 1992 have fewer than 750 days of daily data available. We make no reinvestment assumption for these firms, and simply average the returns over the remaining sample when we have less than 750 days of data, as shown in Eq. (5).

It is clear in Figs. 6 and 7 that there are some unusually large drops in the value of the size weighted portfolio around day 480, and that there is a large drop in the equal weighted portfolio around day 440. The former is caused by the large drop in the price of SIA (Singapore International Airlines Limited) during the October 1987 share market crash. SIA was listed in December 1985, exactly 480 days (excluding weekends) prior to the October 1987 crash. SIA is the largest listed company on the SES during our study period, and the price drop for its shares from $14.40 to $8.70 between October 16 and 20, was far greater than the drop in the market index, causing the value weighted portfolio wealth relatives to display a sudden drop. The decline in the equally weighted wealth relative at day 440 is caused by one company (Venture Manufacturing (S) Limited which was listed in April 1992), dropping out of the sample because of insufficient data. Venture Manufacturing had an issue price of 40 cents, a first day listing price of 37 cents, but rose to $3.80 over the next 440 days.

The wealth relatives in Figs. 6 and 7 are of course portfolio averages, and it is necessary to consider the distribution of these and the statistical significance of these averages in reaching conclusions on long-run performance. Distributional statistics for the 250, 500 and 750 day market-adjusted wealth relatives (equal weights) are contained in Table 5.

From Table 5, it is clear that there is considerable dispersion in individual firm long-run performance. For example, the mean 750 day index-adjusted wealth

<table>
<thead>
<tr>
<th>Statistic</th>
<th>250 day wealth relative</th>
<th>500 day wealth relative</th>
<th>750 day wealth relative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.073</td>
<td>0.992</td>
<td>1.008</td>
</tr>
<tr>
<td>Std. deviation</td>
<td>0.436</td>
<td>0.449</td>
<td>0.550</td>
</tr>
<tr>
<td>Maximum</td>
<td>3.861</td>
<td>2.818</td>
<td>2.951</td>
</tr>
<tr>
<td>Quartile 3</td>
<td>1.268</td>
<td>1.250</td>
<td>1.228</td>
</tr>
<tr>
<td>Median</td>
<td>0.967</td>
<td>0.880</td>
<td>0.860</td>
</tr>
<tr>
<td>Quartile 1</td>
<td>0.801</td>
<td>0.664</td>
<td>0.650</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.515</td>
<td>0.277</td>
<td>0.259</td>
</tr>
<tr>
<td>Number of IPOs</td>
<td>132</td>
<td>118</td>
<td>107</td>
</tr>
</tbody>
</table>
relative is 1.008, however the range is 0.259 to 2.951, and the standard deviation is 0.550. Similar large variation exits in the 250 and 500 day wealth relatives. It is also worth noting that while the average wealth relatives are close to unity, the medians suggest that more than one-half of the IPOs have long-run returns below the index control. Statistical tests on the means are thus warranted.

We calculated t-statistics for the daily wealth relatives as a test of the significance of these long-run results. These are not reported in detail, though the following summarises this analysis. In all three weighting schemes the number of positive t-statistics significantly exceeds (binomial test based on expected equal proportions) the number of negative t-statistics for the Fig. 6 (i.e., no index control) results. However, once the index adjustment is included (Fig. 7) the number of positive and negative t-statistics are insignificantly different in each of the three weighting schemes. When the t-statistics were ranked and the analysis was repeated for those which were significantly positive and negative (greater/less than 1.96) similar conclusions are reached, i.e., positive significant t-statistics exceed negative significant t-statistics for the Fig. 6 results, but not for the Fig. 7 results. Finally we calculated the means and standard errors for the t-statistics for the three Figs. 6 and 7 weighting schemes. The mean is significantly greater than zero for the Fig. 6 results, but not so for the Fig. 7 results. In summary, Singapore IPOs have index adjusted wealth relatives which are insignificantly different to those expected in an efficient market. None of these results suggest abnormally poor post-listing performance for Singaporean IPOs, as frequently encountered elsewhere. However, as a cautionary issue, note that our wealth relatives are not adjusted for systematic risk.

4.3. Long-run wealth relatives and initial returns

We are also interested in the relationship, if any, between initial underpricing and variables which can be related to initial underpricing either by theory or institutional practices peculiar to the SES, and the long-run wealth relatives for these firms. For the purpose of these tests, the sample size is reduced to 128, as there are four companies where the allocation methods could not be determined. We estimated a multiple regression, and present the results in Table 6. We have also added an additional variable (the square of underpricing) into this analysis, which is suggested by the theoretical model of Rajan and Servaes (1993). Rajan and Servaes’ model predicts a curvilinear relationship between initial ‘underpricing’ and subsequent long-run returns as a result of an interaction between ‘market

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18 Fig. 7 results are the portfolio wealth relatives, as defined in Eq. (7). Thus the summations are performed in the numerator and denominator prior to the division. The Table 5 results are the distributional statistics for the individual security wealth relatives, that is the divisions are performed prior to an average being calculated.
Table 6
Multiple regression results for long-run market adjusted wealth relatives for 128 IPOs made on the Stock Exchange of Singapore between July 1973 and December 1992 for holding periods of 250, 500 and 750 days

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-statistic</th>
<th>Coefficient</th>
<th>t-statistic</th>
<th>Coefficient</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.357</td>
<td>1.871 *</td>
<td>0.756</td>
<td>0.913</td>
<td>0.365</td>
<td>0.377</td>
</tr>
<tr>
<td>‘Underpricing’</td>
<td>-0.002</td>
<td>-0.888</td>
<td>0.000</td>
<td>0.015</td>
<td>0.001</td>
<td>0.240</td>
</tr>
<tr>
<td>Oversubscription</td>
<td>-0.001</td>
<td>-2.198 *</td>
<td>-0.001</td>
<td>-1.637</td>
<td>-0.000</td>
<td>-0.122</td>
</tr>
<tr>
<td>Time to listing</td>
<td>0.000</td>
<td>0.086</td>
<td>0.004</td>
<td>0.612</td>
<td>0.007</td>
<td>0.816</td>
</tr>
<tr>
<td>Ret. ownership</td>
<td>0.002</td>
<td>0.705</td>
<td>0.000</td>
<td>0.146</td>
<td>0.004</td>
<td>1.185</td>
</tr>
<tr>
<td>Growth options</td>
<td>0.166</td>
<td>1.064</td>
<td>0.003</td>
<td>0.021</td>
<td>-0.082</td>
<td>-0.353</td>
</tr>
<tr>
<td>Size of the issue</td>
<td>-0.026</td>
<td>-0.678</td>
<td>0.010</td>
<td>0.205</td>
<td>0.019</td>
<td>0.346</td>
</tr>
<tr>
<td>Sq. underpricing</td>
<td>0.000</td>
<td>0.897</td>
<td>0.000</td>
<td>0.022</td>
<td>-0.000</td>
<td>-0.761</td>
</tr>
<tr>
<td>F-statistic</td>
<td>0.815</td>
<td>0.252</td>
<td>0.556</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>-0.0103</td>
<td>-0.0486</td>
<td>-0.0314</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of IPOs</td>
<td>128</td>
<td>114</td>
<td>103</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Adjusted for heteroscedasticity using the White (1980) procedure.

The dependent variable is the market index adjusted wealth relative for the firm for holding periods of 250, 500 and 750 days respectively. ‘Underpricing’ is measured as the last sale on the first day of listing minus the subscription price, divided by the subscription price and is expressed as a percent. Oversubscription is the total pool of application money received from the public, divided by the shares available for public subscription. Issues which are undersubscribed are assigned an oversubscription ratio of one. Time to listing is the elapsed time in days between the prospectus registration date and the listing date. Retained ownership is the proportion of the issued capital of the firm retained by the owners after taking into account the shares being issued in the IPO. Growth options is one minus the proportion of the issue price represented by assets-in-place. Size of the issue is the natural logarithm of the issue proceeds.

* Significant at 0.01.
* Significant at 0.05.

feedback risk’ and ‘investor sentiment’.\(^{19}\) Lee et al. (1996) find this variable to have statistical significance, though not economic significance, for Australian IPOs.

All t-statistics in Table 6 have been adjusted using the White (1980) procedure. The only significant coefficients are the 250 day oversubscription coefficient and the 750 day retained ownership coefficient. The significant negative association between post-listing performance and oversubscription levels are consistent with one or both of the following propositions;
1. those issues which are relatively heavily oversubscribed perform abnormally poorly in the post-listing period, and / or

\(^{19}\)Rajan and Servaes (1993) define market feedback risk as the condition that leads to ‘‘(seemingly) irrational market-wide phenomena ... which vary over time; more specifically that the fraction of investors who chase trends (also called positive feedback traders) varies over time’’ and investor sentiment as ‘‘the propensity to overpay for the stocks of certain industries at times’’. 
2. those issues which are relatively poorly subscribed perform abnormally well in the post-listing period.

The former explanation is consistent with 'fad' or 'speculative bubble' phenomena. In order to determine whether this association is best described as a 'fad', we split the sample of firms into quartiles based on the level of oversubscription. While we do not report these results in detail they are not consistent with 'fad' explanations. In the three sets of regressions (i.e., the market adjusted wealth relatives for 250 days, 500 days and 750 days respectively are used as the independent variable) the t-statistic on the coefficient for the most oversubscribed group was the least negative in two cases, and the second least negative in the third set of regressions. 20 A 'fad' explanation suggests they should be the most negative. We view these results as suggestive of a joint effect due to the most undersubscribed issues doing abnormally well in the post-listing period, and the second most heavily subscribed group doing poorly, thereby resulting in significantly negative coefficients for oversubscription in the Table 6 results.

Given that the various regressions reported in Table 6 all have insignificant F-statistics and low (generally negative) adjusted $R^2$ statistics, we do not place much importance on the significant coefficient for retained ownership. The absence of such a relationship in the 250 and 500 day returns reinforces the need for a cautionary interpretation of this result. Further, the economic significance of these models must be regarded as extremely low. Remember also that these results might reflect a failure to control for systematic risk in post-listing return measures. Finally we note that the regression estimates do not constitute a fair game test of efficiency. Only after the distribution of the oversubscription levels are known for the whole sample can we estimate this relationship. This result can't then be used as a retrospective investment strategy in IPOs which were listed up to 19.5 years previously.

5. Conclusions

This paper provides further evidence on the pricing of initial public offers (IPOs) in Singapore. First, we show that the results provided by Koh and Walter (1989) for IPOs up to June 1987, which are supportive of the Rock (1986) model of 'underpricing' as an expected equilibrium result, also extend to IPOs made in the subsequent period between July 1987 and December 1992. We also demonstrate a highly significant economic and statistical relationship between a proxy for

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20 The t-statistics for the coefficient for oversubscription in the 250 day market adjusted wealth relative regression are $-1.518$, $1.158$, $-1.750$ and $-1.348$ respectively for quartiles of firms ranked on oversubscription levels, where the first quartile are the least oversubscribed group of firms. The corresponding figures for the 500 day period are $-1.230$, $0.091$, $-1.911$ and $-0.760$. Finally the 750 day t-statistics are, again in the same order, $-0.990$, $-0.077$, $-1.136$ and $-0.177$. 
informed demand and underpricing, as suggested by the asymmetric information model of Rock (1986). This proxy, the oversubscription rate for the IPO, is only observable ex post, in contrast to retained ownership and many of the proxies suggested for ex ante uncertainty. While retained ownership, suggested in the signalling model of Leland and Pyle (1977), is statistically significantly related to underpricing, the economic significance of this relationship is low. We find no evidence to support the Beatty and Ritter (1986) ex ante uncertainty arguments, though our proxies for ex ante uncertainty are noisy.

We extend the analysis of Singaporean IPOs to show that the long-run returns for these firms are not related to initial 'underpricing'. We demonstrate that these long-run returns are not abnormally poor, as has been reported in several recent studies, (e.g. Ritter, 1991; Keloharju, 1993; Loughran et al., 1994; Lee et al., 1996). While we document considerable variation in individual firm long-run performance, we show that the average long-run returns are consistent with efficient market expectations.

Finally we show that the high oversubscription levels, which are frequently evident in Singapore IPOs, are not associated with a 'speculative bubble' or 'fad' explanation. We argue that oversubscription is better described as informed demand expansion following ex ante rational price setting in the prospectus in a market setting where investor demand for an IPO is not constrained by bias in the allocation methods used by issuers or underwriters.

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References


