Offer pricing of Australian industrial IPOs

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Abstract

In this paper we examine the setting of offer prices for Australian industrial initial public offers (IPOs) by fixed price offers. Our investigation focuses on the associations between offer prices and both market prices and accounting based measures of intrinsic value. Fixed-price offers are less likely to be influenced by the canvassing of market demand when compared to the US setting, where book builds are typically used. We conclude that while Australian industrial IPOs are *underpriced*, they are not systematically *undervalued*. Contrary to research undertaken by Purnanandam and Swaminathan (2002) in the US 'book-build' setting, we do not conclude that Australian IPOs are systematically *overvalued*. As part of our analysis, we develop an empirical model of offer prices based on interviews with several leading Australian stockbrokers involved in setting them. Finally, using the ratio of offer price to intrinsic value measure, we find some evidence that undervaluation is positively related to underpricing.

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1. Introduction

In this paper we examine the setting of offer prices for fixed-priced industrial IPOs. The underpricing of initial public offers (IPOs) is a puzzle that has been the focus of a substantial theoretical and empirical literature. Ritter and Welch (2002) review this literature and examine the extent of underpricing for a large sample of US IPOs from 1980 to 2001. They document average first-day returns of 18.8% and find that while about 16 percent of the IPOs have a first-day return of exactly zero, approximately 70 percent end the first day of trading at a closing price greater than the offer price. For Australian industrial IPOs, Lee, Taylor and Walter (1996) find median raw underpricing of 10% and market index adjusted underpricing of 5.42%, while Da Silva Rosa, Velayuthen and Walter (2003) and How, Lam and Yeo (2002) report median raw underpricing of 12% and 15% respectively.[1]

Ritter and Welch (2002) contend that 'the solution to the underpricing puzzle has to lie in focusing on the setting of the offer price, where the normal interplay of supply and demand is suppressed by the underwriter.' (page 1803) Our investigation focuses on the associations between offer prices and both market prices and accounting based measures of intrinsic value.[2] Further, in accordance with Loughran, Ritter and Rydquist's (1994, p. 191) suggestion that it would be useful for future research into initial public offers to

[1] These authors find that estimates of underpricing are less severe using alternative measures that capture the wealth loss to the vendor.

[2] We restrict our analysis to industrial IPOs, since the valuation methods that we use require that forecasts of earnings and dividends be available. Discounted cash flow analysis is more appropriate for resource companies as earnings streams are more difficult to assess. Resource companies are different to industrials, mainly because of the problems associated with the valuation of commodity deposits. Geologists' reports are important in terms of assessing the amount of deposit and the number of years the deposit is expected to generate an income.

address the question of how the offer price is set, we develop a model based on brokers claims as to how offer prices are set.

IPO underpricing is generally defined as the difference between closing price on the first day of trading and offer price. This definition assumes that the market is efficient (unbiased) with respect to determining fair value on the first day of trading. However, Purnanandam and Swaminathan (2002) (hereafter P&S) argue that long-run market value may be a better indicator of the share's 'true', or intrinsic, value. They state that an 'alternate view of underpricing (in an inefficient market) is that issuers underprice IPOs with respect to some maximum price they could have charged given the observed demand in the pre-market but not necessarily with respect to the long-run fair value.' (P&S, 2002, page 1)[3] Essentially, P&S argue that while IPOs may be underpriced, they are not necessarily *undervalued*. Indeed, for a large sample of US IPO firms, they find that IPOs are systematically *overvalued* at the offer relative to fundamentals, and that first-day returns indicate that they become even more overvalued in the aftermarket.

P&S use the (offer) price-to-value (P/V) ratio to examine whether IPOs are systematically under- or overvalued with respect to intrinsic value (V). Intrinsic value is estimated using the comparable multiples approach. We re-examine this issue in the Australian, fixed-price setting, where offer prices are less likely to be influenced by the canvassing of market demand when compared to the US setting. To ensure that our

[3] Lee, Myers and Swaminathan (1999, page 1694) conjecture that a realistic depiction of the relation between price and value is one of 'continuous convergence rather than static equality'. That is, in settings such as the initial valuation of IPOs, where intrinsic values are difficult to measure and trading costs are

results are not a function of the inability of comparable firm multiples to correctly capture fair value, we measure intrinsic value in several ways. In addition to industry P/E multiples based on forecast earnings, we use a residual income valuation model and two long run, market-based measures of value.

Our results confirm that Australian industrial IPOs tend to be underpriced relative to first-day market prices. When intrinsic values are calculated using a residual income valuation model, Australian industrial offer prices tend to be overvalued. However, this result is not robust to alternative methods of estimating intrinsic value (e.g. P/E multiples). Indeed, when we use P/E based estimates, approximately half of our sample offer prices are undervalued. This result is contrary to that found by P&S in the US. Finally, we do not find that offer prices are systematically over- or undervalued relative to market values at the end of one year.

A further contribution of our study involves the derivation of an empirical model of offer prices for Australian, fixed-price IPOs. This model captures the factors that brokers consider when setting offer prices for Australian industrial IPOs. We use this model to establish intrinsic value for a P/V ratio that is included in an established model of underpricing and find that the divergence of offer price and value (from the issuer's perspective) is not reflected in day one market prices. Finally, we test different specifications of the underpricing model by including P/Vs where value is measured from

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significant, 'the process by which price adjusts to intrinsic value requires time, and price does not always perfectly reflect intrinsic value.'

the investor's perspective. Inclusion of P/V based on either an industry P/E multiple or the two period residual income model contributes to the explanation of underpricing.

The remainder of the paper is organized as follows. The next section overviews the Australian institutional setting, where fixed-price rather than book-build methods remain dominant. Our empirical analysis of offer prices relative to market prices and accounting based intrinsic value measures is included in section 3, while section 4 develops a model of offer prices and tests the explanatory power of P/V ratios for underpricing. Section 5 concludes.

2. Australian institutional setting

There are several important differences between Australian and US IPOs. The majority of Australian firms favour fixed-priced offers whereas the book-building approach is used almost exclusively in the US. Under the fixed-price approach, the offer price is set and quoted in the prospectus. On the other hand, book-build IPOs involves canvassing market demand before setting the final offer price.[4] US IPOs are promoted to regular clients or specific investors who specialise in IPOs, while information on new Australian issues is widely disseminated to the general public. That is, Australian IPOs are 'public offers' whereas US IPOs are akin to 'private placements'.

[4] While there is no explicit issue specific canvassing of demand with fixed-price offers, it may be the case that informal price testing occurs routinely under the fixed-price process. Jenkinson and Ljungqvist (2001) acknowledge this possibility and question whether it is possible to induce investors to reveal this information informally.

Initial public offers are listed on the full board of the Australian Stock Exchange (ASX). This is in contrast to the US, where IPOs typically trade on the over-the-counter market. A final difference relates to the inclusion of earnings forecasts in Australian prospectuses. Section 710 of the Corporations Law sets out the general disclosure test for determining the required contents of a prospectus. Prospectuses are required to contain all the information that investors and their professional advisers would reasonably require to make an informed assessment. Forecasts of earnings and dividends, while not specifically required, are examples of this type of information.[5] Further, it is a condition of admission to the official list of ASX that a prospectus be issued and lodged with the Australian Securities and Investments Commission (ASIC). ASIC Practice Note 67 requires that a prospectus should contain a forecast of earnings when the directors consider that they have a reasonable basis on which to develop the forecast.[6] While the ASX does not generally impose specific prospectus disclosure requirements in addition to those required by the Corporations Law, the quality and standard of disclosure may be a factor influencing ASX's discretion to admit the entity in question.

3. Empirical analysis of offer prices

A substantial number of theoretical explanations for short-run underpricing have been proposed in the literature. The majority of these theories assume that first-day market

[5] Prior to the CLERP Act, s 1022 required a prospectus to contain all information that investors and their professional advisers would reasonably require, and reasonably expect to find, in the prospectus. This requirement had the effect of expanding the disclosure test to include certain types of information merely because it has been included historically or is contained in other prospectuses.

[6] When forecasts are provided, the prospectus must state the assumptions made when preparing the forecast. The stated preference of the ASIC is for forecasts based on the entity's financial year. However, if a forecast can only be reasonably made for part of a year, the financial year constraint is not enforced. The prospectus should also contain an outline of the risks that the forecast would not be achieved and an explanation of how the forecast was calculated.

price is an unbiased measure of value, and therefore that the offer is underpriced relative to intrinsic value. However, contrary to the predictions of traditional asymmetric information theories, P&S find that IPOs are systematically *overvalued* relative to fundamentals, and the most overvalued IPOs rather than the most undervalued earn the highest first-day return. Indeed, they conclude that their results are broadly consistent with some behavioural theories that do not assume unbiased first-day market prices.[7]

In this section, we examine offer prices relative to both first-day closing prices and several other measures of intrinsic value. Our investigation centres on the question of whether Australian fixed-price industrial IPOs are systematically under- or over valued.

3.1 Sample and data

The sample period January 1995 to December 1998 is used for examining issues related to underpricing and under- or overvaluation, and for developing our empirical model of offer prices. 120 fixed-price and 9 book-build industrial IPOs are identified by examining prospectuses lodged with the ASIC over this period.[8, 9] We are particularly concerned with setting offer prices in a fixed-price setting, and therefore do not include

[7] In particular, P&S propose that their results are consistent with a behavioural theory of investor psychology and security market under- and overreactions put forward by Daniel, Hirshleifer and Subrahmanyam (1998). These authors propose that investor overconfidence initially causes stock prices to overreact to information. Consistent with the IPO setting, they argue that overconfidence induced mispricing will be most prevalent in securities that are difficult to value, or where feedback on future fundamentals is slow to arrive.

[8] The prospectuses investigated are identified from the Connect4 Australian Company Prospectuses File. This database contains an electronic copy of the majority of prospectuses lodged with the ASIC.

[9] 38 trusts are not included in our sample since Weate (1991, p. 127) highlights that the legal nature and structure of unit trusts are very different to ordinary shares and property trusts exhibit different tax structures.

the book-build IPOs in our sample. Further exclusions from this initial sample are detailed below.

	1995	1996	1997	1998	Total
Industrial IPO prospectuses lodged	26	28	40	35	129
Less, Book-build IPOs	3	0	2	4	9
Fixed-price industrial IPO	23	28	38	31	120
Exclusions					
No dividend forecast	5	0	3	4	12
No earnings forecast	5	7	7	10	29
Negative industry median P/E ratio	0	0	5	3	8
Final sample	13	21	23	14	71

Forecasts of both earnings and dividends are required to estimate intrinsic value. This requirement resulted in 41 firms being deleted from the sample.[10] A further eight sample firms are excluded because the relevant industry median P/E ratios are negative. These firms are all from the telecommunications and healthcare and biotechnology industries. To the extent that disclosure decisions and misvaluation are endogenous, and/or current period accrual accounting results are a poor indicator of future performance, then the generalizability of our results is reduced.

Table 1 shows descriptive statistics for our final sample of 71 fixed-price, industrial IPOs, as well as summary measures for the industry level inputs to our valuation models over the 1995 and 1998 sample period. 53 (75%) of the 71 sample IPOs shown in table 1 were underwritten. Firms in the industry category 'miscellaneous industrials' make up the highest proportion of our final sample, with a total of twenty-three firms. Betas, P/E and

ROE ratios exhibit considerable variation across industries. However, while ROEs are relatively stable over the sample time period, quarterly P/Es and betas exhibit considerable time-series variation as indicated by standard deviations. The highest P/E multiples of 15.2 are for the alcohol and tobacco and paper and packaging industries, while the lowest (7.4) are for developers and contractors and miscellaneous industrials.

Much of the data required for our analysis was hand collected from prospectuses. Aspect Financial Pty Ltd supplied industry median P/E ratios, market capitalisations, and ROE. Industry Scholes-Williams betas were obtained from the Australian Graduate School of Management (AGSM). Industry classifications used by both Aspect Financial and the AGSM are the standard 24 industry sectors utilized by the Australian Stock Exchange. Market prices and accumulation indices were extracted from the SIRCA Core Research Database. Risk free rates were collected from the Australian Financial Review.

3.2 Measures of intrinsic value

We use several measures of intrinsic value in an attempt to capture the 'true' value of IPO firms. These include intrinsic values calculated using P/E multiples and several permutations of the residual income Edwards-Bell-Ohlson model (hereafter referred to as the EBO model). Our final measures of intrinsic value, adjusted market values one and three years after list date, draw on the standard academic view that a security's price is the best available estimate of intrinsic value (see Lee, Myers and Swaminathan, 1999). While it is possible that first-day prices for IPOs are mispriced, market values after one

[10] IPOs not providing forecasts differ from sample firms in that they are less likely to be underwritten, and they have lower mean and median leverage than the final sample.

and three years of trading are expected to be unbiased. However, a limitation of these market measures is the considerable scope for new information to become available following listing. While none of these measures is expected to capture intrinsic value without error, we propose that examining a variety of imperfect measures is preferable to analysing just one of them.

3.2.1 Price to earnings (P/E) intrinsic value

Our first measure of intrinsic value involves the comparable firm multiples approach used by P&S. Kim and Ritter (1999) identify the 'comparable firms approach' as the predominant method of setting initial bid price ranges by US investment bankers. They define the typical implementation of the P/E version of the comparable firms approach as:

"capitalizing the earnings per share (EPS) of the firm under consideration at the average or median price-earnings (P/E) ratio of comparable publicly traded firms."

The issues that need to be considered when choosing comparable firms include the number of comparable firms, matching criteria, and whether the comparables are recent IPOs or established companies. Ideally, a large number of recent IPO comparable firms would be chosen on the basis of several relevant matching criteria. However, this is not possible empirically due to the limited availability of highly comparable recent IPO firms. The most frequently used matching factor is industry, sometimes in conjunction with one or more of size, growth and profitability. For example, Kim and Ritter (1999) use five recently floated comparable firms chosen on the basis of industry. An alternative

approach was taken by P&S when they chose just one non-IPO comparable firm on the basis of industry, size and profitability. Alford (1992) recommends the use of more than one comparable firm to diversify away the effect of firm-specific differences between the IPO and comparable firms.

The advantages of using recent IPOs as comparable firms include the incorporation of possible, unidentified valuation factors particular to IPO firms, and a reduction in potential problems related to industry classifications attributable to many newly listed companies having a single line of business. On the other hand, use of recent IPOs as comparable firms ignores many potential comparables and requires sufficient numbers of recent IPOs. The use of other factors in addition to industry can further lower the number of comparable firms available for analysis. This is particularly problematic in the Australian setting. For example, How, Lam and Yeo (2002) choose comparable firms on the basis of industry, size and growth measures and are unable to find more than two or three suitable established firms for each IPO in their sample.

Given a relatively small Australian stock market, we focus on industry as the sole criteria for selecting comparable firms. Alford (1992) finds that selecting comparable firms by industry is relatively effective, and that using size in addition to industry membership does not improve the accuracy of the P/E valuation method. We follow the common industry practice of using the simple multiples approach to estimating value using industry median P/E ratios. Specifically, our P/E value estimate is calculated by multiplying one year ahead forecast earnings per share obtained from the prospectus by

the median P/E ratio for the firm's industry group.[11] Kim and Ritter (1999) support the use of IPO firm earnings forecasts rather than using its historical earnings. They find that P/E multiples using IPO firm forecast earnings result in much more accurate valuations than multiples using the IPO's historical earnings. Indeed, their results suggest that the use of earnings forecasts over historical earnings is more important than choosing the most appropriate comparable firms.

Recent research by Lee, Taylor and Taylor (2000) provides evidence that the reliability of management earnings forecasts in this context is 'not especially accurate', with median absolute forecast error being 3.18% of issue size (14.31% of forecast earnings). Further, these authors find that the majority of management earnings forecasts are pessimistic rather than optimistic, indicating a conservative bias. We expect that stockbrokers might make an ex ante assessment of forecast accuracy and adjust P/E multiple based valuations accordingly. However, we are unable to estimate the magnitude of these adjustments using publicly available information. While we could check *ex post* forecast accuracy using earnings realisations, it is not obvious that these would be highly correlated with brokers' *ex ante* assessments of accuracy.

3.2.2 Residual income (EBO) intrinsic value

In addition to the comparable firms multiples approach used by P&S, we use a discounted residual income approach sometimes referred to as the Edwards-Bell-Ohlson valuation technique (the EBO model). The EBO model has been shown to be a superior method of

[11] Following Kim and Ritter (1999), these comparable P/E ratios are based on historical rather than forecast earnings. A limitation of applying historical multiples to forecast earnings is that it will tend to understate

measuring the intrinsic value of a firm in terms of accounting numbers (for example, see Dechow, Hutton and Sloan 1999). Further, Frankel and Lee (1996) evaluate the EBO model using nearly twenty-five thousand firm years across twenty countries from 1987 to 1994. Their findings indicate that the intrinsic value calculated by the model is effective in explaining cross-sectional prices.

Ohlson (1995) demonstrates that when the assumption of clean surplus accounting is used,[12] a firm's intrinsic value equals the book value of equity plus the present value of the expected future residual income; where residual income is the difference between accounting earnings and a charge for the cost of equity capital. Intrinsic value is thus comprised of two separate components: the existing book value or capital invested and earnings above that required by investors.[13] The EBO model is a residual income model developed from Ohlson's (1995) framework. We use two forms of this model to calculate the intrinsic value of each IPO firm in our sample. Specifically, EBO intrinsic value at the time of the prospectus ($\hat{V}_t$) is calculated as:[14]

$$\hat{V}_t^1 = B_t + \frac{(FROE_t - r_e)}{(1 + r_e)} B_t + \frac{(FROE_t - r_e)}{(1 + r_e) r_e} B_t \qquad (1)$$

valuations for firms with declining earnings and overstate valuations for growth firms.

[12] Clean surplus accounting requires that all gains and losses affecting book value are included in earnings.

[13] Wealth creation for shareholders will only occur when the return on equity (*ROE*) exceeds the cost of equity (r_e). When return on equity equals the cost of equity, abnormal earnings are zero and intrinsic value equals book value.

[14] See Lee (1996) for a derivation of this finite-horizon EBO valuation equation, and a discussion of implementation issues.

$$\hat{V}_t^2 = B_t + \sum_{i=1}^{T} \frac{(FROE_{t+i} - r_e)}{(1+r_e)^i} B_{t+i-1} + \frac{(FROE_{t+T+1} - r_e)}{(1+r_e)^T \, r_e} B_{t+T} \quad (2)$$

Equation (1) represents a two-period expansion of the residual income model with the forecasted ROE from the prospectus ($FROE_{t+1}$) assumed to be earned in perpetuity (see Frankel and Lee, 1998). Equation (2) assumes that forecasted ROE reverts to a pre-specified level, in our case industry median ROE, over *T* periods. We use both five and twelve year expansions of this form of the EBO model since while Lee, Myers and Swaminathan (1999) show that the predictive ability of the EBO model is improved when a twelve-year mean reversion is applied, we are unsure that this will be the case for Australian IPOs. Return on equity beyond the five (twelve) years is considered in perpetuity to provide the terminal value for the calculation of intrinsic value. This procedure implicitly assumes no value-relevant growth in cash flows after year five (twelve).[15]

The primary components of these empirical models are forecast return on equity (*FROE*), book value per share (*B*), and cost of capital (r_e). Forecast return on equity for period *t+1* ($FROE_{t+1}$) is based on the management earnings forecast provided in the prospectus, and is calculated as forecast earnings per share divided by book value of equity per share at the time of the prospectus adjusted for full subscription. Forecast earnings per share are

[15] Our sample of Australian IPOs is expected to differ from Lee, Myers and Swaminathan's sample of established US firms in terms of their underlying economics and accounting. Dechow, Hutton and Sloan (1999) find that the rate of mean reversion is decreasing in the quality of earnings, increasing in the dividend payout ratio, and correlated across firms in the same industry. Given that IPO firms are likely to have higher than average levels of operating accruals (see Teoh and Wong, 2002) and lower dividend payout policies than established firms, it is unclear whether a shorter or longer reversion period will be required when compared to Lee, Myers and Swaminathan's sample.

after abnormal items and tax, but before extraordinary items.[16] Subsequent period return on equity is calculated as follows:[17]

$$FROE_{t+2} = FROE_{t+1} - \left(\frac{FROE_{t+1} - industry\ \ median\ \ ROE}{T} \right)$$

Book value per share at time t (B_t) is calculated as total shareholders' equity divided by the number of shares outstanding; both are based on the assumption of full subscription.[18] Future book values per share (B_{t+i}) are calculated based on the assumption of clean surplus accounting as:

$$B_{t+i} = B_{t+i-1} + EPS_{t+i} - DIV_{t+i}$$

where EPS_{t+i} equals forecast earnings per share, and DIV_{t+i} equals forecast dividends per share to ordinary shareholders. Forecast earnings per share are estimated by multiplying B_{t+i-1} by $FROE_{t+i}$ calculated as shown above. Forecast dividends per share beyond $t+1$ are estimated by multiplying forecast earnings per share by the prospectus dividend payout ratio (k).[19]

[16] For firms that provide part year forecast profits, those profits are annualised for the calculation of forecast earnings per share.

[17] The median industry return on equity is taken for the year previous to that in which the company has lodged its prospectus, since this is the industry median return on equity available when the IPO floats. A constant median return on equity over five (twelve) years is assumed.

[18] The value of the firm to the investor is considered to be the post-issue value, as it is this value and not the pre-issue value that the investor is acquiring an interest in. Further, in Australia "all shares must be sold (or taken up by the underwriter) prior to trading commencing on the stock exchange" (Lee, Taylor and Walter, 1996).

[19] We implicitly assume that this payout rate remains constant. As with management forecasts of earnings, dividend forecasts are susceptible to manipulation by management. However, Brown, Clarke and How (2000) find that dividend forecasts are substantially more accurate and less biased than their earnings counterparts. This is expected, given that management has considerable discretion over the amount of

Cost of capital (r_e) is calculated using the capital asset pricing model:

$$r_e = R_f + \beta_i (R_m - R_f)$$

Initial public offers do not generally exhibit prior share price data and ultimately the estimation of a firm specific cost of capital from historical data is not possible. We use industry Scholes-Williams betas to proxy for firm-specific betas. By varying risk according to industry, our approach is consistent with the industry-based discount rates used by Frankel and Lee (1998) and Lee, Myers and Swaminathan (1999). We use a risk-free rate based on the 90-day bank bill acceptance rate and a six percent market premium. The risk free rate is measured at the beginning of the quarter in which the prospectus is lodged.

3.2.3 Adjusted future market value

Our final category of intrinsic value measures comprises two market-based computations. Market values one year and three years out from the listing date were adjusted for dividend payments, bonus and rights issues and capital returns. Dividend cash flows were compounded at r_e and added to the end of period market value. The end of period, adjusted market value was then discounted to listing date. The discount rate used was the corresponding return on the Small Industrials Accumulation Index for the period.[20]

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dividends to distribute. We are unable to accurately estimate the magnitude of any adjustments resulting from *ex ante* assessments of dividend forecast reliability using publicly available information.

[20] We use the small industrials index as this is the one most likely to contain firms of similar size and industry as the sample IPOs.

3.3 Results

Panel A of Table 2 shows that offer prices for our sample of 71 fixed-price industrial IPOs range between 20c and $2.90, with a mean and median both equal to $1.00. These statistics are similar to those of How, Lam and Yeo (2002) for their 1993 to 2000 sample period. Shares offered for listing must have a minimum issue price of 20 cents. Offer prices for our sample are quite low when compared with offer prices for US IPOs. For example, Kim and Ritter (1999) report a mean (median) offer price of US$12.30 (US$12.50). Graph 1 shows a frequency histogram of offer prices for the sample. Offer prices display a high degree of 'stickiness' at twenty cents, fifty cents and the one dollar levels. 61 of our sample IPOs actually listed on the ASX and had data available from SIRCA. Distributional statistics for offer prices and first-day closing market prices for this sub-sample are also shown in Panel A. First-day closing prices tend to be higher than offer prices, with a mean (median) of $1.18 ($1.05).

3.3.1 Underpricing

Panel B shows average raw and market index adjusted underpricing for our sample. The mean raw underpricing of 11.87% is less than the 18.1% underpricing found by Ritter and Welch (2002) in the US for their 1995-1998 sub-period. The extent of raw underpricing for our sample is also lower than that found by Lee, Taylor and Walter (1996), How, Lam and Yeo (2002), and Da Silva Rosa, Velayuthen and Walter (2003). However, mean and median market index adjusted underpricing of 9.49% and 6.04% is similar to that found by Lee, Taylor and Walter (1996) for Australian industrial IPOs

between 1976 and 1989. Adjusting first-day returns for changes in market values between the setting of offer prices and list dates is more important in Australia since the market can change considerably in the two month gap that generally exists between prospectus registration and list dates. The mean (median) number of days between prospectus registration and exchange listing for our sample is 58.6 (52). This is slightly longer than that found by Lee, Taylor and Walter. The percentage of our sample that is underpriced (i.e. yield a positive first-day return) is over 80%, regardless of whether raw or market index adjusted returns are considered.

3.3.2 Intrinsic values

As can be seen from Panel C of Table 2, median observations of our intrinsic value measures tend to be lower than both offer and first-day market prices. Mean values are generally higher than medians, with mean adjusted market values one and three years after listing both higher than offer and first-day closing prices. P/E intrinsic value is higher than EBO intrinsic value, regardless of which permutation of this model is used to calculate intrinsic value. P/E based intrinsic values range between 2c and $4.40 and exhibit greater dispersion than either EBO intrinsic values or offer prices.[21] Attrition in our sample due to 14 of our 61 listed firms delisting causes a survival bias, particularly in relation to market values after three years. Caution should therefore be exercised when interpreting results for this measure. In particular, the majority of these IPOs were taken

[21] Both intrinsic value and P/E value are based on one year ahead earnings forecasts obtained from the prospectus.

over, and since their market values showed no indication of imminent failure at the time of delisting,[22] this measure of intrinsic value is likely to be overly conservative.

We examine the sensitivity of our EBO based measures to the way that we calculate the cost of capital by replacing the Scholes-Williams industry betas with constant betas of 1 and 1.5, using alternative risk-free rates, allowing the risk-premia to vary over time, and using an assumed cost of capital of 12% for all IPO firms. The two and five year expansions of the model are relatively insensitive to changes in the cost of capital compared to the twelve-year expansion. Mean (median) EBO intrinsic values for this permutation of the model range between 60c and 83c (52c and 74c) depending upon what assumptions are made when calculating the cost of capital. In all cases these intrinsic values are lower than those obtained from the P/E model.[23]

3.3.3 Tests of under/over valuation

Offer price to intrinsic value (P/V) ratios are shown in Panel D of Table 2. A P/V ratio of greater than one indicates overvaluation, while a P/V less than one represents undervaluation. Statistical significance is tested using Wilcoxson rank tests (t-tests) for median (mean) equal to one. Contrary to the results found by P&S in the US, median P/V ratios for P/E intrinsic value are not significantly different to one. Results for t-tests for mean equal to one show the ratio of offer price to P/E intrinsic value is significant

[22] Indeed, Zingales (1995) posits that it is easier for potential acquirers to spot a potential takeover target when it is public.

[23] Lee, Myers and Swaminathan (1999) find that value estimates based on short-term risk free rates outperform those based on long-term rates. We trialed three alternative risk-free rates - 180 day bank bill rates, and five and ten year bill rates. However, they did not make a significant difference to the EBO measure. Arbarbanell and Bernard (1995) and Frankel and Lee (1998) find that the choice of r_e has little effect on their analysis.

(p=0.043). However, the distribution of this ratio (and all other ratios shown here) is positively skewed. An examination of individual P/E intrinsic values indicates approximately equal numbers of under- and overvalued IPOs in our sample. It is likely that this difference in results is due to differences in the way that offer prices are set in Australia relative to the US. A thorough investigation of how offer prices are set in Australia is contained in section 4 and the appendix to this paper. Briefly, the use of comparable P/E multiples is core to this process and it is therefore not entirely surprising that offer prices for Australian industrial IPOs are not significantly different to P/E based measures of intrinsic value.

The remainder of the results in Panel D indicate that only those intrinsic values based on the EBO model and the three-year market based measure yield a P/V ratio that is significantly different to one. All of these indicate systematic over- rather than undervaluation. As stated above, the result related to our three-year market based measure of intrinsic value should be interpreted cautiously due to the impact of survival bias and additional post-listing information on this measure. Further, the one-year market based P/V ratio is not significantly different to one, indicating that offer prices are not systematically overvalued when compared to market prices one year after listing.

The issue of which of our intrinsic value measures is the most accurate indicator of 'true' value is unclear. EBO based valuation relies on several assumptions that may not translate well in the relatively uncertain IPO setting. For example, the dividend payout ratio indicated in the prospectus is assumed to continue indefinitely, while ROE is based

on prospectus earnings forecasts that are assumed to either continue in perpetuity or regress towards industry medians over several years. On the other hand, adjusted market values one year after listing assume that the market has efficiently incorporated all relevant information about the IPO firm into price at that stage. That is, any initial mispricing is assumed to have dissipated over the course of the first year. Further, this measure relies on the assumption that no important new information released during the course of the first year of trading has resulted in the year-end price diverging from intrinsic value at the time of listing.

Overall, our evidence is mixed and somewhat contrary to that of P&S. We cannot unreservedly conclude that Australian industrial IPOs are systematically overvalued, although we can conclude that they are *not* systematically undervalued.

3.3.4 Correlations

We examine correlations between offer prices, market prices and intrinsic measures of value. It is clear from the first row of Table 3 that offer prices are very closely correlated with first-day market prices, much more so than with any of our measures of intrinsic value. However, the direction of the relation between offer prices and first-day closing prices is unclear. It may be that stockbrokers informally solicit information about expected market demand when setting offer prices in the Australian, fixed-price setting. Or it may be that first-day market activity is pre-empted to a large extent by opening (offer) prices. Market prices (adjusted for dividends, other capitalization changes and the

small industrials accumulation index) exhibit a declining association with offer prices as time progresses from list date to three years after.

Both offer prices and first-day market prices are significantly positively correlated with all of our measures of intrinsic value. None of these intrinsic value measures stands out as being a superior indicator of offer or first-day market prices. With the exception of Pearson correlations with the three-year market based measure, which are influenced by a few firms that do either exceptionally well or exceptionally badly within the first three years of listing, correlations between each of our intrinsic value measures and offer and first-day prices are in the order of .637 to .772.

4. Offer price model

The next stage of our analysis of offer prices involves developing an empirical model of offer prices based on interviews with stockbrokers involved in setting them and a review of related prior literature. Details are contained in an appendix to this paper. Our offer price model is:

$$OFFER = \beta_0 + \beta_1 PE + \beta_2 SIZE + \beta_3 RETAINED + \beta_4 GROWTH + \beta_5 LEV + \beta_6 UWRITE + \varepsilon \qquad (1)$$

Where offer price (OFFER) is as reported in the prospectus and is the full amount the prospective investor pays for obtaining one share in the company undertaking the offer. P/E intrinsic value (PE) is an estimate of price per share obtained by multiplying one year ahead forecast earnings per share for the IPO firm by the median P/E ratio for the firm's

industry group. We measure firm size (SIZE) relative to industry median market capitalisation:

$$Relative\ size_i = \frac{Total\ number\ of\ shares\ \text{x}\ offer\ price\ for\ firm\ i}{Industry\ median\ market\ capitalisation}$$

Total number of shares includes those retained by the original owners, and is based on the assumption of full subscription.[24] The ratio of retained ownership (RETAINED) is calculated as:

$$\text{Re}tained\ ownership = \frac{Number\ of\ shares\ held\ by\ original\ owners}{Total\ number\ of\ shares\ on\ issue}$$

The total number of shares on issue is based on full subscription and includes those held by the original owners. This ratio captures the percentage of shares not held by outsiders following the initial public offer. We measure growth prospects (GROWTH) as one minus the ratio of book value of ordinary shareholders equity per share to offer price. We measure leverage (LEV) as total liabilities to total assets, using amounts provided in the pro-forma balance sheet contained in the prospectus. Pro-forma amounts are used, as it is the value of the company post-issue rather than pre-issue that the investor is acquiring an interest in. We capture whether an issue is underwritten (UWRITE) using a dichotomous variable with a value of one if the offer is underwritten and zero otherwise.

4.1 Explanatory power of the model

[24] Industry median market capitalisation is taken at the end of the quarter prior to the quarter in which the prospectus is dated, thus ensuring that the market capitalisation of the floating company is not included in the industry median measure. Industry median market capitalisations are used rather than means as they are less susceptible to extreme observations.

Table 4 presents results for ordinary least squares regressions for our offer price model.[25] As expected, offer price is significantly positively correlated with P/E intrinsic value. Relative firm size and growth prospects are significantly positively related to offer price, indicating the importance of adjusting for differences in IPO firm size relative to other listed firms in its industry as well as its growth prospects.[26] However, the level of retained ownership, leverage and whether the issue is underwritten are not significant at conventional levels.

While the explanatory power of our model (.683) is high, it does not fully capture the fundamental analysis of stockbrokers. This is due, at least in part, to limitations associated with our proxies for some of the firm and industry specific factors. For example, our P/E measure is based on management forecasts of earnings. To the extent that brokers pricing the offer consider these to be unreliable, we expect that they would make appropriate adjustments that we are unable to capture. A further explanation for the less than perfect explanatory power of our model is that brokers do not price offers according to a rigid formula. They apply cognitive decision-making processes that will vary across individual brokers, across firms and across time. As such our model can only explain the 'core' elements of the pricing process and cannot be expected to account for all variation.

[25] One outlier, Aristocrat Leisure, was identified by the analysis of residuals and excluded. This firm had the highest sample offer price. Aristocrat's $2.90 offer price was about 15% higher than the next highest ($2.53). Another observation, Bank of Western Australia Limited, was excluded on the basis of its leverage ratio of 95% reflecting industry specific factors. Mean and median leverage for the sample firms is 40%. Our final sample for these tests consists of 69 IPOs.

[26] Firm size is positively skewed due to a few very large IPOs in the sample. Our results are insensitive to logging relative size to overcome positive skewness in this variable.

Sensitivity tests on the sub-sample of IPO firms that listed on the Australian Stock Exchange support those shown in table 4, thus indicating that the reported results are not driven by withdrawn offers. Further sensitivity tests were conducted using alternative measures of retained ownership and leverage. Some of the stockbrokers interviewed indicated that firms with either very high or very low retained ownership are the ones most likely to have a discount applied. Therefore, alternative measures for retained ownership involved partitioning the retained ownership measure into percentiles and quartiles. Dichotomous measures of the impact of retained ownership were then coded, with a value of one given to those firms in the lowest and highest percentiles (quartiles) and a value of zero given to all others. The alternative measure of leverage involved measuring IPO leverage relative to median industry leverage ratios obtained from Aspect Financial Pty Ltd. Industry factors can impact on leverage, as some industries have different capital expenditure requirements or volatile profits and it is prudent for these companies have lower gearing. Results using these alternative measures of retained ownership and leverage remained insignificant.

In other untabulated results, we found that the inclusion of a dummy variable identifying the five sample firms issuing options with the shares was insignificant in all models. We also tested for the potential impact of a hot issues phenomenon on pricing by including a dummy variable coded one for the high issue years of 1996 and 1997 or zero for the relatively lower issue years of 1995 and 1998. The year dummy was insignificant (p = .499).

To test the robustness of our results to possible scale effects, we estimate an alternate specification of our model. Easton and Sommers (2000) and Barth and Clinch (1999) discuss the issue of 'scale' effects which occur when price per share is used as the dependent variable in price levels regressions. It is possible that the magnitude or scale of our dependent variable reflects no more than the choice by management of the number of shares to issue. Therefore, we rerun our regressions using total assets as a deflator to mitigate the scale effects. The tenor of our results is unchanged.

4.2 Is the P/V ratio related to underpricing?[27]

A final question relates to whether the extent of over- or undervaluation for an IPO is related to underpricing. If offer prices are systematically biased away from value, we expect that the relative amount of under- or overvaluation would be related to first day market returns. Given the mean and median offer prices for our sample period were $1, it is possible that offer prices are biased because firms target a $1 per share offer price. We address this issue by testing the incremental contribution of relative under- or overvaluation using an established model of underpricing. In particular, we extend Lee, Taylor and Walter's (1996) model of cross-sectional variation in market index adjusted underpricing by including the P/V ratio as an indicator of the extent of under- or overvaluation. P/V ratios are calculated using predicted values from our offer price model as well as with measures of fair value based on information that is available to

[27] Thanks to one of our referees on this paper for suggesting we investigate this aspect of offer pricing.

investors prior to listing (P/E and EBO).[28] [29] The sample for these regressions is the 61 of our sample firms that listed on the ASX, less one outlier.

Our results vary according to which measure of intrinsic value is included in the P/V ratio. The first specification of the model shown in table 5 indicates that adjusted market price at the end of day one is not systematically related to the divergence between actual offer price and what our offer price model predicts that it should be. While our model uses fundamentals to generate predictions of actual offer prices that are not substantively different to actual offer prices, unexplained offer price is not related to underpricing.[30] The P/Vs using PE intrinsic value and EBO intrinsic value with the 2-year expansion method of calculation are significantly related to first day market adjusted returns. For these two models, the results are consistent with the P&S prediction that the more undervalued the IPO, the greater the extent of underpricing.[31] The explanatory power for underpricing is highest for these two models.[32] The intrinsic values measured by EBO with the longer expansions of 5 and 12 years are unrelated to underpricing.

[28] The difference between actual and predicted offer price can be captured by the residuals from the offer price regression model shown in table 4. However, we use the P/V ratio of offer price to the offer price model intrinsic value in table 5 to facilitate comparison with the other regressions presented in table 5. These alternate measures of the difference between actual and predicted offer price yield essentially the same results.

[29] We do not use our market-based measures of fair value in these tests since they are not available to investors at the time of listing.

[30] Unreported results from our ongoing research into this model show that it predicts offer prices with a low degree of error. Predicted offer prices are highly correlated with actual offer prices ($r = 0.845$, $p<.01$), the median forecast error is -1 percent and the hypothesis that the mean forecast error is equal to zero is supported using a *t*-test ($p = 0.131$). These results suggest that the observed offer prices for our sample are unbiased, or that any bias is insignificant.

[31] How, Lam and Yeo (2002) also conclude that the lower the P/V ratio, the greater the extent to which the firm is underpriced. Their results are sensitive to the number of comparable firms used and which price multiple is applied to determine intrinsic value. They found that the price to book multiple was significant while the P/E multiple was insignificant. This result is puzzling given the well documented use of the P/E multiple by market participants.

[32] Our results show there is little to differentiate between these two specifications, thus lending support to Ohlson's (2002) conclusion that book value per share is an unnecessary valuation attribute for equity.

The insignificant P/V ratio based on the offer price model that formulates the way offer prices are set and the significance of the P/Vs based on P/E and the short horizon EBO in the underpricing models appears to be indicative of market participants using a more simple model to establish market price than issuers use to set offer price. Perhaps market participants consider that the incremental costs of a more complex model do not exceed the benefits. We conclude that the greatest potential for investors to gain from a stagging strategy would be founded on identifying IPOs with low P/V ratios (using the P/E multiple to determine value) rather than modelling the offer price with the fundamentals used by brokers.

With respect to the Lee et al (1996) variables included in the table 5 models, we find several of our results are different to theirs. These differences are most likely explained by sample time period differences. Their 1976 to 1989 sample contains seven years where the nominal annual returns on the market were greater than 20% and three years of negative returns.[33] Market returns over our sample period were more stable, with nominal returns predominantly in the 10-20% range. Higher average annual inflation over the Lee et al (1996) sample time resulted in lower average annual real returns than were found in our sample.[34] Further, our firms tend to have a longer operating history than those in their earlier sample.

Without the inclusion of book value, the EBO model effectively results in value calculated as capitalised forecast earnings, so is unlikely to produce valuations that vary much from those based on P/E multiples.

[33] Annual performance of Australian shares including dividends, 1900 – 2002, http://www.asx.com.au/markets/pdf/shareperformance-1900to2002.pdf [Online] Accessed 14/01/04

5. Conclusions

While a significant body of research has examined the first-day underpricing of IPOs, this empirical phenomenon remains a puzzle. Recent US research by P&S incorporates a novel approach to investigating this issue. They use the (offer) price-to-value (P/V) ratio to examine whether IPOs are systematically under- or overvalued with respect to intrinsic value using the comparable multiples approach. We re-examine this issue in the Australian, fixed-price setting, where offer prices are less likely to be influenced by the canvassing of market demand when compared to the US setting. Our investigation focuses on the associations between offer prices and both market prices and measures of intrinsic value.

Overall, our evidence is mixed and somewhat contrary to that of P&S. We cannot unreservedly conclude that Australian industrial IPOs are systematically *overvalued*, although we can conclude that they are underpriced and are not systematically *undervalued*. That is, while they may be set lower than initial market price, they are not significantly lower than their intrinsic value. Offer prices are very closely correlated with first-day market prices, much more so than with any of our measures of intrinsic value. Both offer prices and first-day market prices are significantly positively correlated with all of our measures of intrinsic value.

To further investigate the underpricing puzzle, we investigate the setting of offer prices. The model of offer prices developed in this paper captures the approach used by

[34] Inflation data were obtained from the Reserve Bank of Australia website, http://www.rba.gov.au/Statistics/Bulletin/G01hist.xls [Online] Accessed 14/01/04

Australian stockbrokers when pricing fixed-price industrial IPOs. Our results indicate that price-earnings multiples are the primary measures used for determining offer prices. One year ahead forecasts of earnings per share obtained from the prospectus are used in estimates of value based on industry median P/E multiples. Further, our results highlight the importance of considering other relevant factors in addition to P/E multiples when using comparable firms analysis. In particular, the size of the IPO firm relative to its industry median and expected growth are important determinants of offer price.

Finally, we investigate the role of under- or over valuation in the underpricing phenomenon. Our results are mixed and vary according to which measure of intrinsic value is used. One interpretation of these results is that investors use different models to determine the value of an IPO than issuers use to determine value for establishing an offer price. Given the divergence of our significant underpricing variables compared to those of Lee, Taylor and Walter (1996), further research is needed to clarify if these variables are influenced by the sample time period used in a study. Further analysis of the intrinsic value of issues relative to offer price would allow stronger conclusions to be drawn on the subject of potential bias in offer prices.

Appendix

Interviews with three leading Australian stockbrokers involved in setting offer prices[35] confirmed that, as in the US, the comparable firms approach is used extensively for setting offer prices of industrial IPOs.[36] The stockbrokers identified price-earnings as the main multiple examined. The stockbrokers indicated that earnings forecasts rather than historical earnings are used when valuing the company, as valuation in the market is on the basis of projected earnings. Discounts or premiums are then applied to adjust for differences between the IPO firm and comparable companies. Comparable companies are those of approximately the same size and within the same industry. Adjustments relate to the additional risk associated with the company being an IPO *per se*, the level of retained ownership, and differences in firm size, growth prospects, leverage and underwriters. The remainder of this section summarises the interview discussion and prior research related to each of these factors.

Relative size

Interviews with stockbrokers highlighted that the total market capitalisation of the floating company relative to those already listed is important when conducting comparable firms analysis to determine the offer price. If the floating company is smaller (larger) than the industry average, then a discount (premium) may need to be applied to

[35] Leading stockbrokers are identified from the Greenwich survey, which surveys company executives and their preferences for equity capital markets and underwriting services. After being given a brief description of the study and its aims, each stockbroker was asked about the procedure involved in setting offer price and what factors are generally taken into consideration in this process. Follow-up questions were used to clarify responses and encourage elaboration. The brokers we interviewed handled 10 of the 71 IPOs included in our sample.

take into consideration the relative difference in size.[37] Although not specifically mentioned by stockbrokers, we expect that adjustments for firm size are related to risk. Small firms are more risky than larger firms are. Indeed, Chan and Chen (1991) find that smaller firms are more susceptible to value declines due to poor performance, and are less likely to survive adverse economic conditions. Following the indications of stockbrokers, we measure firm size relative to industry median market capitalisation.

Retained ownership

All stockbrokers interviewed consider retained ownership to be important when determining offer price. Leland and Pyle (1977) demonstrate that the level of retained ownership signals the quality of a firm's projects to the market, with greater retained ownership signalling higher quality projects. In support of this theory, How and Low (1993) find that higher fractional retained ownership is associated with higher firm value (measured as market value post listing or total firm assets). *Prima facie*, we therefore expect that a high (low) amount of retained ownership will result in a premium (discount) being applied when determining offer price. However, Grinblatt and Hwang (1989) and Zheng, Ogden and Jen (2002) predict greater underpricing when retained ownership is high, either as a complementary signal of value, or to increase liquidity. That is, higher retained ownership will result in the application of a discount rather than a premium to offer price. In support of Zheng, Ogden and Jen's theory, the stockbrokers interviewed stated that liquidity may be a problem if too little of the firm is being floated. On the

[36] A possible explanation for the preference for the comparable firms approach to valuation is that it avoids the issue of determining an appropriate discount rate.

[37] Stockbrokers also indicated that institutional investors concentrate on the top one hundred listed firms. Therefore, to attract interest for the floating company, a discount needs to be applied to smaller firms.

other hand, the perceived level of risk by investors will be high if a sufficient vendor holding is not kept. If the vendor plans to retain a significant percentage of the company after the floatation, a discount may be applied to ensure that the portion being sold is not under-subscribed; thus ensuring that the remaining portion will be worth more over the long term. The expected direction of the relation between retained ownership and offer price is therefore unclear.

Growth prospects

The stockbrokers interviewed consider the growth prospects of the floating company to be important. A company with favourable growth prospects is likely to have a premium applied, whereas a company without favourable growth prospects requires an incentive such as a discount to attract investors. In support of this, Boatsman and Baskin (1981) find that more accurate predictions using P/E multiples are achieved when the ten-year average growth rate of earnings is considered in addition to industry. In addition, How Izan and Monroe (1995) find that growth options represent an average of 28.27 percent of offer price for Australian IPOs.

Leverage

Leverage was considered to be an important factor for determining offer price by two of the three stockbrokers interviewed. Higher leverage is associated with increased financial risk. We therefore expect that higher (lower) leverage will result in a discount (premium) being applied to compensate for higher (lower) financial risk.

Underwriter

In Australia, in contrast with several other jurisdictions, the use of an underwriter is optional. Underwriters set the offer price and agree to take up any shortfall in the demand for shares. How, Izan and Monroe (1995) view the underwriter's function as lending credibility. The underwriting relationship implies that the issue is priced 'correctly' to reflect information about the firm. More risky issues are less likely to be underwritten since underwriters will be reluctant to handle risky issues, as issue failure would impact on reputational capital. This implies that a discount will be applied to issues that are not underwritten, due to the increased risk associated with these issues.

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Table 1
Descriptive statistics for sample of 71 industrial IPOs between 1995 and 1998.

PANEL A: Data for sample firms

	Mean	*Med.*	*Std. Dev.*	*Min.*	*Max.*
Net proceeds of offer ($'000)	40,675	12,000	74,607	1,050	437,711
Retained ownership (%)	56	60	24	0	98
Total assets ($'000)[a]	234,703	32,152	1,188,489	2,058	9,979,000
Growth (%)	30	28	34	-54	94
Forecast earnings per share ($)	0.10	0.09	0.06	0.01	0.25
Forecast dividend per share ($)	0.05	0.04	0.04	0.00	0.17
Book value per share ($)	0.62	0.49	0.49	0.07	2.72
Cost of capital (%)	13.00	13.67	1.94	6.96	16.79

PANEL B: Industry level inputs to valuation models for 1995-1998

	Sample IPOs	**Industry median P/E**		**Industry median ROE (%)**		**Industry Scholes-Williams Betas**	
Industry	***#***	***Mean***	***Std. Dev***	***Mean***	***Std. Dev***	***Mean***	***Std. Dev***
Infrastructure & Utilities	3	10.87	5.59	5.58	0.03	0.69	0.14
Developers & Contractors	11	7.40	1.83	15.70	0.02	1.04	0.11
Building Materials	3	12.63	1.94	8.85	0.02	0.79	0.13
Alcohol & Tobacco	3	15.18	3.62	11.01	0.01	0.76	0.34
Food & Household	1	13.32	1.85	8.80	0.01	0.82	0.07
Chemicals	2	13.31	2.02	11.77	0.01	1.14	0.10
Engineering	1	9.15	0.97	12.76	0.01	1.01	0.09
Paper & Packaging	1	15.20	2.17	8.55	0.03	0.93	0.13
Retail	7	10.33	1.68	14.37	0.03	0.69	0.09
Transport	1	11.53	2.03	12.68	0.01	0.77	0.19
Media	6	13.33	2.40	11.53	0.01	1.23	0.24
Banks & Finance	2	12.19	2.26	14.75	0.01	0.99	0.25
Insurance	1	12.58	1.97	10.44	0.04	1.05	0.29
Miscellaneous Industrials	23	7.39	0.53	11.15	0.02	1.28	0.23
Tourism and Leisure	6	11.51	2.51	7.87	0.01	0.95	0.09
	71						

[a] Deletion of the only bank in our sample, Bank of Western Australia Ltd, results in mean total assets reducing to $95,499,000.

Table 2
Distributional statistics relating to offer price, market prices and intrinsic values for sample of 71 industrial IPO firms between 1995 and 1998.

	Mean	*Med.*	*Min.*	*Max.*	*No.*
Panel A: Offer and first-day closing prices ($)					
Offer price full sample	1.00	1.00	0.20	2.90	71
Offer price listed firms	1.02	1.00	0.20	2.53	61
First-day closing price	1.18	1.05	0.17	3.30	61
Panel B: Measures of underpricing (%)					
Unadjusted underpricing [a]	11.87	8.89	-18.00	55.88	61
Market index adjusted underpricing [a]	9.49	6.04	-23.30	62.98	61
Time to listing (days)	58.6	52.0	18.0	144.0	61
Panel C: Intrinsic value measures ($)					
P/E intrinsic value	1.05	0.86	0.02	4.40	71
EBO intrinsic value 2-year expansion	0.80	0.74	0.02	2.25	71
EBO intrinsic value 5-year expansion	0.66	0.59	0.13	2.54	71
EBO intrinsic value 12-year expansion	0.81	0.69	0.09	2.48	71
Adjusted market value 1 year after list date	1.23	0.99	0.15	3.33	59
Adjusted market value 3 years after list date	1.33	0.63	0.05	8.82	47

Panel D: Offer price to intrinsic value (P/V) ratios (numbers parenthesis indicate t-test (Wilcoxon) p-values)

	Mean	*Med.*	
P/E intrinsic value	1.55	1.03	71
	(0.043)	(0.582)	
EBO intrinsic value 2-year expansion	1.76	1.15	71
	(0.004)	(<0.001)	
EBO intrinsic value 5-year expansion	1.70	1.40	71
	(<0.001)	(<0.001)	
EBO intrinsic value 12-year expansion	1.44	1.16	71
	(<0.001)	(<0.001)	
Adjusted market value 1 year after list date	1.16	0.90	59
	(0.468)	(0.170)	
Adjusted market value 3 years after list date	1.88	1.23	47
	(0.003)	(0.009)	

[a] t-tests that the mean returns equal zero are significant at <0.001%.
Offer price is the full amount payable for one share as indicated in the prospectus of the IPO firm.
First-day closing price is the last traded price on the day of listing.
P/E intrinsic value is an estimate of intrinsic value per share obtained by multiplying one year ahead forecast earnings per share for the IPO firm by the median P/E ratio for the firm's industry group.
EBO intrinsic value two-year expansion is an estimate of intrinsic value per share based on a two-year expansion of the EBO residual income model with a one-year ahead forecast of earnings assumed to be earned in perpetuity. The discount rate used is a CAPM cost of capital calculated using a 6% risk premium, and with the industry beta and risk free rate (90 day bill) taken at the beginning of the prospectus year.
EBO intrinsic value five-year expansion is an estimate of intrinsic value per share based on a five-year expansion of the EBO residual income model with ROE calculated based on a one-year ahead forecast of earnings that is assumed to fade to the industry median ROE over five years and then remain at that rate in perpetuity. The discount rate used is a CAPM cost of capital calculated using a 6% risk premium, and with the industry beta and risk free rate (90 day bill) taken at the beginning of the prospectus year.
EBO intrinsic value twelve-year expansion is an estimate of intrinsic value per share based on a twelve-year expansion of the EBO residual income model with ROE calculated based on a one-year ahead forecast of earnings that is assumed to fade to the industry median ROE over twelve years and then remain at that rate in perpetuity. The discount rate used is a CAPM cost of capital calculated using a 6% risk premium, and with the industry beta and risk free rate (90 day bill) taken at the beginning of the prospectus year.
Unadjusted underpricing is calculated as first-day closing price minus offer price, all divided by offer price.
Market index adjusted underpricing is 'unadjusted underpricing' *less* the difference in the small industrials accumulation index value between the prospectus registration date and the listing date, all divided by the small industrials accumulation index value on the prospectus registration date.
Time to listing is the time between prospectus registration and exchange listing (days).
Adjusted market value 1 year after list date is the last traded price on the one year anniversary of listing, adjusted for the change in the small industrials accumulation index as well as dividends and other capitalization changes. The assumed rate of return on dividends is industry median ROE.
Adjusted market value 3 years after list date is the last traded price on the three year anniversary of listing, adjusted for the change in the small industrials accumulation index as well as dividends and other capitalization changes. The assumed rate of return on dividends is industry median ROE.

Table 3
Pearson (Spearman) correlations for sample of 71 industrial IPO firms between 1995 and 1998.

	First-day price	P/E value	EBO 2-year	EBO 5-year	EBO 12-year	MV after 1 year	MV after 3 years
Offer price	.970** (.979)**	.746** (.725)**	.759** (.762)**	.648** (.663)**	.637** (.720)**	.692** (.740)**	.325* (.669)**
First-day closing price		.735** (.714)**	.748** (.732)**	.659** (.641)**	.664** (.694)**	.733** (.772)**	.319* (.668)**
P/E intrinsic value			.888** (.896)**	.764** (.716)**	.740** (.801)**	.473** (.558)**	.287 (.558)**
EBO 2-year expansion				.769** (.804)**	.827** (.906)**	.573** (.636)**	.330* (.683)**
EBO 5-year expansion					.790** (.826)**	.433** (.516)**	.163 (.544)**
EBO 12-year expansion						.565** (.661)**	.476** (.661)**
Market value after 1 year							.509** (.822)**

* = significant at < 5% (two-tailed), ** = significant at < 1% (two-tailed)

Offer price is the full amount payable for one share as indicated in the prospectus of the IPO firm.
First-day closing price is the last traded price on the day of listing.
P/E intrinsic value is an estimate of intrinsic value per share obtained by multiplying one year ahead forecast earnings per share for the IPO firm by the median P/E ratio for the firm's industry group.
EBO intrinsic value two-year expansion is an estimate of intrinsic value per share based on a two-year expansion of the EBO residual income model with a one-year ahead forecast of earnings assumed to be earned in perpetuity. The discount rate used is a CAPM cost of capital calculated using a 6% risk premium, and with the industry beta and risk free rate (90 day bill) taken at the beginning of the prospectus year.
EBO intrinsic value five-year expansion is an estimate of intrinsic value per share based on a five-year expansion of the EBO residual income model with ROE calculated based on a one-year ahead forecast of earnings that is assumed to fade to the industry median ROE over five years and then remain at that rate in perpetuity. The discount rate used is a CAPM cost of capital calculated using a 6% risk premium, and with the industry beta and risk free rate (90 day bill) taken at the beginning of the prospectus year.
EBO intrinsic value twelve-year expansion is an estimate of intrinsic value per share based on a twelve-year expansion of the EBO residual income model with ROE calculated based on a one-year ahead forecast of earnings that is assumed to fade to the industry median ROE over twelve years and then remain at that rate in perpetuity. The discount rate used is a CAPM cost of capital calculated using a 6% risk premium, and with the industry beta and risk free rate (90 day bill) taken at the beginning of the prospectus year.
Adjusted market value 1 year after list date is the last traded price on the one year anniversary of listing, adjusted for the change in the small industrials accumulation index as well as dividends and other capitalization changes. The assumed rate of return on dividends is industry median ROE.
Adjusted market value 3 years after list date is the last traded price on the three year anniversary of listing, adjusted for the change in the small industrials accumulation index as well as dividends and other capitalization changes. The assumed rate of return on dividends is industry median ROE.

Table 4
Ordinary least squares regression model explaining offer price for sample of 69 industrial IPO firms between 1995 and 1998.

Variable	***Pred. sign***	
Constant	?	0.327 (2.232)*
P/E intrinsic value (PE)	+	0.527 (10.104)**
Relative size (SIZE)	+	0.039 (3.813)**
Retained ownership (RETAINED)	?	-0.185 (-1.142)
Growth prospects (GROWTH)	+	0.407 (3.285)**
Leverage (LEV)	-	-0.253 (-1.427)
Underwriter (UWRITE)	+	0.111 (1.195)
N		69
Adjusted R^2		.683
F-statistic		25.445**
Kolmogorov-Smirnov test statistic (normality of residuals)		1.227

* = significant at < 5% (two-tailed), ** = significant at < 1% (two-tailed)

P/E intrinsic value is an estimate of price per share obtained by multiplying one year ahead forecast earnings per share for the IPO firm by the median P/E ratio for the firm's industry group.
Relative size is the relative market capitalisation of the floating firm to other listed companies in the same industry taken at the end of the quarter prior to the lodgement of the prospectus.
Retained ownership is the ratio of the number of shares held by the original owners to the total number of shares on issue assuming full subscription.
Growth prospect are measured as one minus the ratio of book value of ordinary shareholders equity per share to offer price.
Leverage is measured as total liabilities to total assets and is the pro-forma balance sheet amount based on the assumption of full subscription.
Underwriter is a dichotomous variable where a value of 1 signifies the offer is underwritten and 0 otherwise.

Table 5
Ordinary least squares regression analysis of cross-sectional variation in market index adjusted underpricing for sample of 60 listed industrial IPO firms between 1995 and 1998.

Variable	***Pred. sign***					
Constant	?	-0.406	-0.294	-0.292	-0.376	-0.356
		(-1.240)	(-1.020)	(-0.996)	(-1.252)	(-1.217)
Offer price to offer price model intrinsic value	-	0.022	-	-	-	-
		(0.477)				
Offer price to P/E intrinsic value	-	-	-0.0135	-	-	-
			(-4.292)**			
Offer price to EBO intrinsic Value 2-year expansion	-	-	-	-0.016	-	-
				(-3.397)**		
Offer price to EBO intrinsic Value 5-year expansion	-	-	-	-	-0.001	-
					(-0.013)	
Offer price to EBO intrinsic Value 12-year expansion	-	-	-	-	-	-0.031
						(-1.275)
Issue size	-	0.061	0.0622	0.064	0.062	0.066
		(2.840)**	(3.035)**	(3.082)**	(2.677)*	(2.962)**
Firm size	-	-0.037	-0.042	-0.042	-0.038	-0.039
		(-1.888)*	(-2.239)*	(-2.260)*	(-1.921)	(-1.988)
Operating history	-	0.014	0.010	0.009	0.013	0.009
		(2.556)**	(2.197)*	(1.909)	(2.522)*	(1.689)
Time to listing	-	-0.001	-0.001	-0.001	-0.001	-0.001
		(-0.634)	(-0.665)	(-0.902)	(-0.788)	(-0.956)
Growth	+	-0.009	-0.005	-0.006	-0.013	0.001
		(-0.119)	(-0.061)	(-0.086)	(-0.136)	(0.017)
Retained ownership	+	0.118	0.127	0.131	0.121	0.135
		(1.321)	(1.476)	(1.529)	(1.275)	(1.443)
Adjusted R^2		.158	.209	.205	.154	.175
F-statistic		2.579*	3.226**	3.176**	2.537*	2.791**

* = significant at < 5% (two-tailed), ** = significant at < 1% (two-tailed)

Market index adjusted underpricing is 'unadjusted underpricing' *less* the difference in the small industrials accumulation index value between the prospectus registration date and the listing date, all divided by the small industrials accumulation index value on the prospectus registration date.
Offer price model intrinsic value is the offer price predicted by the offer price regression model shown in Table 4.
P/E intrinsic value is an estimate of intrinsic value per share obtained by multiplying one year ahead forecast earnings per share for the IPO firm by the median P/E ratio for the firm's industry group.
EBO intrinsic value two-year expansion is an estimate of intrinsic value per share based on a two-year expansion of the EBO residual income model with a one-year ahead forecast of earnings assumed to be earned in perpetuity. The discount rate used is a CAPM cost of capital calculated using a 6% risk premium, and with the industry beta and risk free rate (90 day bill) taken at the beginning of the prospectus year.
EBO intrinsic value five-year expansion is an estimate of intrinsic value per share based on a five-year expansion of the EBO residual income model with ROE calculated based on a one-year ahead forecast of earnings that is assumed to fade to the industry median ROE over five years and then remain at that rate in perpetuity. The discount rate used is a CAPM cost of capital calculated using a 6% risk premium, and with the industry beta and risk free rate (90 day bill) taken at the beginning of the prospectus year.
EBO intrinsic value twelve-year expansion is an estimate of intrinsic value per share based on a twelve-year expansion of the EBO residual income model with ROE calculated based on a one-year ahead forecast

of earnings that is assumed to fade to the industry median ROE over twelve years and then remain at that rate in perpetuity. The discount rate used is a CAPM cost of capital calculated using a 6% risk premium, and with the industry beta and risk free rate (90 day bill) taken at the beginning of the prospectus year.
Issue size is the natural logarithm of equity issue size.
Firm size is the natural logarithm of total assets.
Operating history is the length of prior operating history (years).
Time to listing is the time between prospectus registration and exchange listing (days).
Growth is measured as one minus the ratio of book value of ordinary shareholders equity per share to offer price.
Retained ownership is the ratio of the number of shares held by the original owners to the total number of shares on issue assuming full subscription.

Graph 1 - Offer prices for estimation sample