

# The pricing and performance of initial public offerings in Australia, 1996-2007: A comparison of ordinary, venture capital and private equity-backed issues

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**Abstract:** This paper examines the pricing and performance of ordinary, venture capital and private equity-backed initial public offerings in the Australian stock market from June 1996 to May 2007. Headline underpricing, underpricing issuer loss, underpricing loss by market value, and underpricing loss by issue price are used to measure underpricing. Cumulative buy-and-hold abnormal returns with equal and value-weighted market indexes, market and book-to-market value quintile adjustments and the Fama-French three-factor model used to compare performance. The measures of underpricing indicate that venture capital and private equity-backed issues are less underpriced than ordinary issues. Further, all three forms of issuance outperform the nominal performance benchmarks. However, there is no statistically significant difference in the risk-adjusted performance of initial public offerings, regardless of backing.

*JEL classification:* C12; C23; G24; G32

*Keywords:* initial public offerings, venture capital, private equity, underpricing, abnormal returns

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## 1. Introduction

Following the events of September 11, 2001 and the lower level of initial public offerings (IPO) in 2002, IPO activity in Australia has continued to trend upwards, as shown in Figure 1 (Deloitte 2006). Building on a background of strong domestic equity returns, an inundation of cash flows from superannuation (pension) funds, the T3 effect (the sale by the Commonwealth Government of its remaining stake in Telstra, Australia's leading telecommunications and information services company) and an extended resources boom, the number and value of IPOs in Australia has continued to grow. In fact, equity raised during the early 2000s has easily doubled that raised during the 1999-2000 dot-com boom, IPO capital collections for each of the three financial years since 2004-05 has bypassed \$10 billion, and by 2004 Australia ranked fourth in the world – after the US, Japan and China – for the total

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number of completed IPOs (Ernst and Young 2005). This frenetic level of activity is set to continue with the resources boom continuing into 2007-2008 (six of the top ten IPOs are in the energy or materials sector) and a record 226 IPOs listed or are set to list on the market, up 34% from 2006/07.

<FIGURE 1 HERE>

At the same time, there has been considerable growth in venture capital (VC) and private equity (PE) markets in Australia and their share of IPO activity through investment exits. For example, in 2000-01 VC-backed IPOs amounted to A\$171 million; by 2003-04 this had grown to \$1,460 million. Private equity has also had a role to play with A\$21.7 billion invested by PE managers through the purchase of 32 listed companies in 2006, equating to about 1.4% of the total value of the Australian Stock Exchange (ASX). In time (typically seven to ten years), many of these return to the public market with "...approximately 25% of all sales of private equity investments via public offering on the ASX thereby returning the business to the listed market, usually with a more solid and profitable outlook" (APEVCAL 2006). In fact, for the first time in 2004, a significant number of PE-backed IPOs took place, demonstrating the maturing of the market (Ernst & Young 2005). By 2006, when 71 new companies listed on the ASX, eleven were the result of early-stage investors (including VC and PE) exiting their investments (PriceWaterhouseCoopers 2007). The Australian Private Equity and Venture Capital Association Limited (2006) suggests these and other changes result from the consistently high returns delivered by private equity managers, continuing growth in the global debt market allowing private equity managers (and other borrowers) to be able to borrow more, and the escalation of available funds from superannuation savings for all categories of investment.

Disturbingly, the strong performance of the Australian IPO market, as elsewhere, is often accompanied by lacklustre aftermarket price performance, at least at the market level. In 2004, for example, only 44% of all IPOs during 2003-04 were trading at or above their issue price. This was 9% lower when compared to the previous year. In the following year, the percentage of IPOs trading above issue price fell to 51% down 5%. By December 2005, four of the seven largest IPOs to list in 2005-06 were trading below their issue price, including Macquarie Capital Alliance (-11%), Babcock and Brown Capital (-20%), Alinta Infrastructure (-3%) and Challenger Infrastructure (-7%), (Deloitte, 2005). Moreover, all too often a small

number of outliers can strongly affect average performance. For instance, the average return increased from 11% in 2004-05 to 24% in 2005-2006. However, as in previous years this was biased by a few small-capitalisation resource IPOs that experienced substantial returns (Deloitte 2006). Following earlier trends, the share price performance of the ten largest IPOs of 2005-06 was again disappointing with half trading below their issue price. Overall, the observed average performance was -2%, significantly lower than the overall market average of 24%, with 75% of all funds raised by floats in excess of \$100m only achieving a return of less than 10%.

The purpose of this paper is to consider one of the more salient features of the contemporary Australian IPO market – the growth of VC and PE-backed IPOs – within the context of the long-established focus on IPO pricing and performance. Although a substantial amount of research of this type exists in the United States and elsewhere, Australian studies concerning the pricing and performance of IPOs, not just VC and PE-backed firms, are scarce and limited in scope. This paper first aims to increase the depth of Australian research by examining the pricing and performance of initial public offers during the period June 1996 to May 2007. Then paper then extends this work by considering the differentials in pricing and performance, if any, for VC and PE firms.

The remainder of the paper is structured as follows. Section 2 provides a brief literature review. Section 3 explains the data methodology employed in the analysis. The results are dealt with in Section 4. The paper ends with some concluding remarks in the final section.

## **2. Review of the literature**

One of the more puzzling phenomena in finance is the underpricing of new stock issues. Various explanations are given, including information asymmetry, signalling relationships, cyclical behaviour and third-party certification. Foremost among these, the information asymmetry hypothesis sees underpricing as an equilibrium occurrence when investors are disproportionately informed. Since uninformed investors face the consequences of poor judgement when other investors are better informed, underpricing arises to compensate uninformed investors for the risk of ending up with a less successful IPO.

Underpricing is clearly a concern for entrepreneurs, venture capitalists and private equity investors, since it reduces the amount received by going public. However, it is argued that the

extent of the entrepreneurs' concerns is limited to the influence on their net wealth. Costly action, such as employing reputable underwriters, is undertaken only where advantageous. In general, as the proportion of the company going public escalates, the existing investors in the firm attempt to reduce underpricing at an increasing rate. When informed investors believe an issue is overpriced, they discard the investment opportunity and seek issues elsewhere that are not overpriced.

An alternative rationale for underpricing is that the value of an issue depends on market demand and the underwriter's selling efforts. In general, the underwriter is typically aware of demand levels, more so than the issuer. As such, the issue price is set below its 'true value' to increase interest. Similarly, the issuer is more informed than potential investors. In an attempt to resolve problems with asymmetric information, the underwriter signals the true value of the firm by underpricing the securities and acquires a percentage of the shares. The retention of shares comes as a signalling device to the market – the higher the withholding, the higher the return expected.

Other work draws attention to the signalling relationship between the issuer's fractional holding of the firm's equity and the expected future cash flows. In response to these and other theoretical developments, a body of empirical research has arisen, largely in the US, concluding that IPOs are indeed underpriced [see, most recently, Ibbotson et al. (1994), Megginson and Weiss (1991), Hunt-McCool et al. (1996), Habib and Ljungqvist (1998; 2001), Francis and Hasan (2001), Bradley and Jordan (2002), Loughran and Ritter (1995; 2002)]. Finn and Higham (1988), Lee et al. (1996) and How et al. (1995) find similar evidence in Australian markets.

Now consider venture capital investments. Most VC organisations raise funds in limited partnerships with finite lifetimes. In the Australian context, "...venture capital organizations provide high risk capital for new or young businesses with prospects of rapid growth and high rates of return. The ultimate goal of this type of investment is to accelerate the growth of these businesses" (ABS 2001: 11). Being repeat players and regularly having to raise new funds, venture capitalists face reputational risk. There is then great pressure for young VC firms to establish a reputation in the market and to raise new funds in order to remain operational.

The literature available in the past three decades on venture capitalist funds, the monitoring processes and the effect of having VC financing on a firm's performance in US markets is

considerable. In general, venture capitalists often hold a strong equity position in the companies they finance, and bring to bear substantial influence on management (Barry et al. 1990). As venture capitalists are closely involved in the management and supervision of their investment companies, there is also a tendency to choose small, young firms with problems with information asymmetry.

Dietz (2002), for instance, argues that entrepreneurs are confronted by a trade-off between the higher costs associated with venture financing compared to bank financing and the increase in firm value due to advising. Although the costs associated with venture capitalist financing are greater than with bank finance, only risk-seeking entrepreneurs will desire VC. Accordingly, Engel (2002) shows that the decline in financial constraints due to the capital injections, monitoring and services the venture capitalist provides positively impacts on the performance of VC-backed firms. Megginson and Weiss (1991) and Barry et al. (1990) provide evidence that VC-backed firms tend to go public earlier than non VC-backed firms because venture capitalists verify the value of the offering. Gompers (1996, p. 153) concludes, "...venture capitalists repeatedly bring companies to the IPO market and ... commit not to offer overpriced shares".

An IPO changes many features of a firm, but nothing more than the ownership structure. Considerable changes continue to occur as a result of the greater dispersion of shareholdings (Brennan and Franks 1997; Mikkelsen et al. 1997), have a weighty effect on managerial incentives (Zingales 1995) and influence the underpricing and underperformance of an issue (Jain and Kimi 1994; Booth and Chua 1996; Pham et al. (2003). Studies have shown that pre-IPO ownership has an effect on the pricing and costs of an issue – the smaller the proportion of pre-IPO shareholdings by management, the lower the incentive to control total issuing costs. More specifically, major decisions in the IPO process tend to favour management in firms not wholly owned before going public.

As a result, firms can suffer agency problems even before going public. Ljungqvist and Wilhelm (2003), for instance, interpret underpricing as evidence of agency costs because CEOs are required to represent pre-IPO shareholders when negotiating issue prices with underwriters. According to Habib and Ljungqvist (2001) the negative impact of underpricing on pre-IPO owners' wealth may be minimal when a smaller proportion of shares is offered to the public, or when underpricing is deliberately used as a promotional tool to reduce other

marketing costs, such as underwriting fees. That is, instead of outlaying funds to promote the issue, the underwriter uses underpricing as the issue's main source of marketing. Loughran and Ritter (2002) point out that while underpricing is an opportunity cost as the ownership of pre-IPO shareholders is diluted, it is associated with an increase in the value of the retained shares.

Empirical studies generally support the value of VC financing. Gompers (1995) examines the staging and monitoring of VC investments. Gompers (1995) finds that in the lead up to an IPO venture-backed firms receive more financing and a greater number of financing rounds than venture-backed firms going bankrupt. Gompers (1995) adds that this supports the argument that VCs are better able to identify successful and unsuccessful projects through their monitoring techniques. Klausner and Litvak (2001), hypothesise that VCs can dramatically alter the professionalism of the firms in which they invest. A survey conducted by Hellman and Puri (2000) on the evolution of undeveloped, privately held, high-technology firms in Silicon Valley gives support. Lerner (1994) finds that venture capitalists time their initial public offerings so that firms are taken to market at the optimal time. A study by Megginson and Weiss (1991) in the US shows that the occurrence of underpricing in VC-backed IPOs is far less than that which takes place in non VC-backed issues. Megginson and Weiss relate this to the reputation effect, as VCs who continually take firms to the market can credibly risk their reputation that these firms are not over priced.

In addition, VCs have the ability to attract high quality analysts to the entities going public, decreasing the level of irregular information at the time of offering. Barry et al. (1990) and Megginson and Weiss (1991) concluded from their results that VC-backing supports the quality of the IPO, leading to less underpricing. However, Habib and Ljungqvist (1999) found that the VC-backed firms in Megginson and Weiss' study issued 36 percent more shares than the other firms. This suggests that VC-backed firms are motivated to take on costly procedures in order to reduce underpricing. While VC-backed firms suffer the same wealth-loss as non-VC backed firms when the number of shares is considered, underpricing is reduced by actions taken by VC-backed firms to signal quality, rather than through VC certification.

In terms of performance, most of the extant work concurs with Moonchul and Ritter (1999) that post-IPO firms in the US generally underperform since investors are overly optimistic

about their potential when listed. In terms of the aftermarket performance of VC and PE-backed IPOs, Barry et al. (1990) argues that because venture capitalists hold a strong equity position in the companies they finance and influence, their role in the success of IPOs should not be underestimated. Moreover, there is a tendency for venture capitalists to choose small, young firms where information asymmetry problems exist. For this reason, venture capitalists are able to identify successful projects through superior monitoring techniques, in addition to having the ability to attract high quality analysts to the entities going public, decreasing the level of irregular information at the time of offering and increasing aftermarket performance.

Francis and Hasan (2001) find that the initial day returns for VC-backed issues are higher than other issues. However, they attribute this to the deliberate underpricing that characterises issues brought to the market by VCs. Lee et al. (1996) found the average underperformance of VC and PE-backed issues in the market. Conversely, Brav and Gompers (1997) conclude that although VC-backed issues outperformed non-VC backed issues; underperformance is not caused by an IPO effect. This is in line with Loughran and Ritter's (1995) conclusion that underperformance is not a trait of IPOs but rather a result of IPO firms being small with low book-to-market values.

### **3. Empirical methodology**

A review of the extant literature on the pricing and performance of ordinary and VC and PE-backed IPOs suggests two broad hypotheses. First, in terms of underpricing, VC and PE-backed IPOs suffer less from underpricing than ordinary IPOs. Second, VC and PE-backed firms should outperform ordinary IPO firms post-listing. In order to test the first hypothesis, four complementary measures of underpricing are calculated: headline underpricing, underpricing issuer loss, underpricing loss by market value, and underpricing loss by issue price. To test the second hypothesis, average cumulative buy-and-hold abnormal returns are calculated and performance measures from pooled Fama-French three-factor regressions are estimated.

#### *3.1 Sample selection and data sources*

A list of all 1,500 IPOs undertaken during the period 1 June 1996 to 31 May 2007 is obtained from the Australian Stock Exchange (ASX). Initially, the firm's prospectus is checked to determine if venture capital (VC) or private equity (PE) backing was present prior to the IPO.

For example, if the prospectus shows that a venture capitalist was a director or shareholder at the time the prospectus was issued, then the firm is VC-backed. However, due to the potential limitations of published information, all 1,500 firms were contacted via electronic mail (addressed to either the chief executive officer or the company secretary) enquiring about the presence of VC or PE activity in the firm prior to its release on the market.

From the 1,500 companies, 281 replies were received (a response rate of 18.7%). This compares well with an optimal sample size of 306 for a 95% confidence interval. The sample comprises 182 (65%) ordinary firms, 54 (19%) VC-backed firms, and 45 (16%) PE-backed firms. Sixteen firms are excluded because of missing or abnormal data. Although the data set is not exhaustive, and may not necessarily comprise a pure random sample, the firms are spread over each of the years in the sample period and so meaningful results can still be drawn for the population. Regarding post-IPO performance, 91 firms only listed in 2006 and 2007. Since these firms have only two years of post-IPO data, and given they have not delisted, the strategy taken is to allow these firms to phase out as their data ends. Following Ritter (1991), Loughran and Ritter (1995), Brav and Gompers (1997), Carter *et al.* (1998) and Gompers and Lerner (1999), delisted firms are excluded from the performance analysis.

The requisite data is collected from various sources. Daily stock prices and the market index represent ASX historical data. The issue price, secondary shares (shares already issued prior to the firm going public) and primary shares (new shares offered in the initial public offer) and the proportion of shares retained by the firm are from the company's prospectus. Information on the market value and book-to-market value are from the Aspect Huntley database.

### *3.2 Measures of underpricing*

The four underpricing measures used in this study are adapted from Habib and Ljungqvist (1999) and Silva Rosa *et al.* (2003). First, headline underpricing (*UPH*) is a traditional measure of underpricing:

$$UPH = \frac{(P_c - P_i)}{P_i} \quad (1)$$

where  $P_c$  is the closing price on the first day of trading and  $P_i$  is the issue price of the firm's stock. Second, underpricing issuer loss (*UPIL*) determines the loss to the issuer per share:



$$UPIL = (1 - \text{Retained ownership}) \times \frac{(P_c - P_i)}{P_i} \quad (2)$$

where retained ownership is the portion of ownership of the firm retained (or the proportion of shares held by the board) and all other variables are as previously defined. Third, underpricing loss by market value (*UPLMV*) is the underpricing loss standardised by the firm's market value:

$$UPLMV = \frac{(P_c - P_i) \times (\text{Secondary shares} + \text{Retained ownership} \times \text{Primary shares})}{P_c \times \text{Total shares}} \quad (3)$$

where secondary shares is the number of shares held by pre-IPO shareholders, primary shares is the number of new shares offered in the IPO and total shares is the total shares on issue for the post-IPO firm. Finally, underpricing loss by issue price (*UPLIP*) shows the loss to the issuer standardised by the value of the firm based on the issue price

$$UPLIP = \frac{(P_c - P_i) \times (\text{Secondary shares} + \text{Retained ownership} \times \text{Primary shares})}{P_i \times \text{Total shares}} \quad (4)$$

where all variables are as previously defined.

The four underpricing measures in Equations (1)-(4) are calculated for each firm in the sample. The mean and median values for the all IPOs, ordinary IPOs, VC-backed IPOs, PE-backed IPOs are also compiled. Finally, a value-weighted measure of each underpricing measures is calculated using:

$$\sum_i (\text{Total shares}_i \times UP_i) / \sum_i \text{Total shares}_i \quad (5)$$

where  $UP_i$  is respectively *UPSTD*, *UPIL*, *UPLMV* and *UPLIP*. This measure of underpricing takes into account a firm's size relative to the level of underpricing.

The following numerical example provides an illustration. Consider XYZ Ltd, a company with 1 million shares on issue prior to floatation. The company is offering 5 million new shares and 50,000 existing shares to the public at A\$2.00 per share. On its initial day of trade, the closing price is \$2.30 per share so headline underpricing (*UPH*) is 15.0%. *UPIL* adjusts the headline underpricing measure for retained ownership. In this case, the firm's existing owners retain 0.95 million shares of total issued capital of 6 million shares (15.8%), so *UPIL* is 12.6%.

The measure of the wealth lost to the firm divided by the market value of the firm after listing is *UPLMV*. The wealth loss to the firm comprises two parts. First, the firm loses 30¢ per share on the 50,000 shares sold (\$15,000). Secondly, the firm bears a 15.8% share of the loss on the 5 million shares sold at \$2.00 instead of their ‘true’ value of \$2.30 per share. This amounts to an additional  $30¢ \times 5,000,000 \times 0.158 = \$237,000$ . Thus, the total loss to the firm is \$252,000. When this is expressed as a proportion of the market value of the firm after listing ( $\$2.30 \times 6 \text{ million} = \$13.8 \text{ million}$ ), the *UPLMV* is 1.83%. *UPLIP* scales the loss to the firm (\$252,000) by the value of the firm implied at issue ( $\$2.00 \times 6 \text{ million} = \$12 \text{ million}$ ) and is 2.1%.

### 3.3 Measures of IPO performance – Cumulative abnormal returns

The excess return of an IPO is calculated for 24 months starting the month after the stock has listed. In common with Fama and French (1993; 1996), Brav and Gompers (1997), Lyon *et al.* (1999) and Silva Rosa *et al.* (2003), excess return is measured in six ways, with equal and value-weighted measures using market index and market/book-to-market value quintile adjustments.

Returns are defined as *CBHAR* (cumulative buy-and-hold abnormal returns) where the starting price for each company is its last price for the month of listing. The buy-and-hold return for each month up to 24 months is calculated. The *CBHAR* are then calculated by subtracting the return for the control: namely, the index, market value quintiles or book-to-market quintiles.

$$CHBAR = \left( \frac{r_{m-1} - r_m}{r_m} \right) - \text{Control} \quad (6)$$

The monthly control return is determined in the same way as the company returns. After the *CHBARs* are found for each firm, an average *CHBAR* (based on the *CHBAR* of each of the three controls) is calculated for that month for the 24-month observation period.

For the index control, the value used in the return calculation is the index itself. The value used for the return calculation of the market value and book-to-market value quintiles is the average adjusted share return of the quintile that the IPO belongs according to its market value and book-to-market value. Because of data constraints, market value and book-to-market values are only available on an end-of-year basis. Consequently, monthly market

values and book-to-market values were interpolated from the end-of-year figures. The market value and book-to-market quintiles are formed on a month-end basis. This allows firms to move from one quintile to another over time.

Paired-sample  $t$ -statistics are calculated for each monthly  $CBHAR$  as there are two samples that have been matched or ‘paired’, namely the stock return and the control (market index, market cap and book-to-market values). First, the  $BHAR$  (buy-and-hold abnormal return) for month  $n$  is computed as  $CBHAR_n - CBHAR_{n-1}$ . The  $t$ -statistic for  $BHAR$  is:

$$BHAR_{-t_{month}} = \frac{\text{Average } BHAR}{\sigma(BHAR)/\sqrt{n}} \quad (7)$$

where average  $BHAR$  is the sample mean of each month’s  $BHAR$  and  $\sigma(BHAR)$  is the cross-sectional standard deviation of abnormal returns for the sample of  $n$  firms. The  $t$ -statistic for each month’s  $CBHAR$  is then calculated as:

$$CBHAR_{-t_{month}} = \frac{\sum_{month=0}^n BHAR_{-t_{month}}}{\sqrt{n}} \quad (8)$$

The size of  $n$  changes each month owing to the staggered listing of firms. Adjustments are made for  $n$  so that only firms with returns actually available for a particular month are included.

A value-weighted measure can be applied to underperforming IPOs as well as those generating excess returns. The first step taken to calculate value-weighted measures is to find the market value of all IPOs each month. The factor  $f$  for each IPO in its initial month of trade is:

$$f = \frac{\text{IPO market value}}{\text{Control value}} \quad (9)$$

The factor  $f$  can be thought of as the number of ‘shares’ in the index (or market or book-to-market quintile) that can be purchased, such that the value invested in the index is the same as the market capitalisation of the IPO (Silva Rosa *et al.* 2003). As before, the control value for the index is the index itself; in market value and book-to-market value quintile calculations it is the market value of the quintile the IPO fits into for that particular month. The fixed factor  $f$  is then multiplied with the control value over the following 24 months, producing twenty-four

values (one per month) for each IPO. For the case of market value and book-to-market quintiles, each firm has five  $f$ -values (corresponding to each of the quintiles). Following this, the product of the  $f$ -values and the control values are summed for a given month giving  $\sum(f \times \text{Control values})$ . The value-weighted return is then calculated as one minus the total market value of all IPOs in the sample for a given month.

### 3.4 Measures of IPO performance – Fama-French three-factor model

Recent work claims that multifactor asset pricing models can explain many pricing anomalies found in the literature (Brav and Gompers 1997). For instance, Fama and French (1996) argue that the ‘value’ strategies in Lakonishok *et al.* (1994) and the ‘buying losers-selling winners’ strategy of DeBondt and Thaler (1985; 1987) are consistent with their three-factor asset pricing model. In line with the models specified by Fama and French (1996), Brav and Gompers (1997), Barber and Lyon (1996) and Silva Rosa *et al.* (2003), regression estimates are calculated for all sampled IPOs with more than ten monthly returns. The regression equation is specified as:

$$R_{it} = \alpha_{it} + \beta_{it}RMRF_t + \gamma_{it}SMB_t + \delta_{it}HML_t + \varepsilon_{it} \quad (10)$$

where  $R_{it}$  is the monthly return of the  $i$ th IPO for the  $t$ th month less the 90-day bank-accepted bill rate;  $RMRF_t$  is the value-weighted portfolio return less the 90-day bank bill rate;  $SMB_t$  (small-minus-big) is the difference in returns of a value-weighted portfolio of small and big stocks;  $HML_t$  (high-minus-low) is the difference in returns of a value-weighted portfolio of high and low book-to-market stocks,  $\alpha$  (alpha),  $\beta$  (beta),  $\gamma$  (gamma) and  $\delta$  (delta) are parameters to be estimated, and  $\varepsilon$  is the error term. A positive value for the intercept  $\alpha$  indicates that after controlling for market, size and book-to-market factors in returns, the IPO has performed better than the norm.

In order to determine  $HML_t$  and  $SMB_t$ , all of the firms in the portfolio are ranked on a monthly basis according to their market value (MV) as at the end of the previous month. The median firm is then used to determine the split point, sectioning the portfolio into two groups: small (S) and big (B). In a similar manner, firms within the portfolio were ranked by their book-to-market equity (BE/MV). For this analysis, book value is defined as the book value of shareholders’ equity. The portfolio is then divided into three BE/MV groups based on pre-determined break points: the bottom 30% (Low), the middle 40% (Medium) and the top 30%

(High). In order to establish the appropriate break points, negative book value firms were excluded. The intersection of the two ME groups and the three BE/MV groups resulted in the construction of six portfolios covering all possible combinations. These are small market value with low book value (S/L); small market value with medium book value (S/M); small market value with high book value (S/H); big market value with low book value (B/L); big market value with medium book value (B/M); and big market value with high book value (B/H). Each portfolio contains all firms with the labelled attributes.

The *SMB* variable is then determined by taking the difference between the average of the returns on the three small-stock portfolios (S/L, S/M and S/H) and the average of the returns on the three big-stock portfolios (B/L, B/M and B/H) on a monthly basis. Similarly, monthly figures for *HML* are formed from the difference in average returns of the two high-book-to-market-equity portfolios (S/H and B/H) and the low-book-to-market-equity portfolios (S/L and B/L). As defined, the corresponding coefficients beta, gamma and delta take values on a scale of 0 to 1: beta = one (zero) would be a high (low) market risk portfolio; gamma = one (zero) would be a small (large) cap portfolio; and delta = one (zero) would be a portfolio with a high (low) price/book ratio.

## **4. Empirical results**

### *4.1 Measures of underpricing*

Table 1 provides the headline underpricing (*UPH*), underpricing issuer loss (*UPIL*), underpricing loss by market value (*UPLMV*), and underpricing loss by issue price (*UPLIP*) measures for the sample of IPOs by category (ordinary, venture capital, and private equity). First, all IPOs are underpriced, on average, by 57.8% in terms of *UPH*. However, since the median level of underpricing is only 7.5% it is clear that underpricing is relatively low overall. Moreover, since the value-weighted mean underpricing is high at 81.8%, there is some indication firms with a higher market capitalisation are disproportionately underpriced. Second, *UPIL* has a mean value of 47.4%. That is, investors holding share equity prior to the firm's initial public offer have collectively made a loss of 47.4% of their stock's share price. Once again, the observed median score for *UPIL* is comparatively lower at 5%. Since the value-weighted *UPIL* is again higher at 65.3% it is again obvious that larger firms had higher levels of loss.

<TABLE 1 HERE>

An interesting observation arises with the measure of underpricing that measures the wealth loss to the firm (*UPLMV*). Unlike *UPH* and *UPIL*, *UPLMV* is -11.1% (overpriced). In the case of a negative *UPLMV*, each of the 72 firms with a negative loss did not suffer from any underpricing, rather they performed poorly on their first day of trade. Consider, for example, Extract Resources Ltd. which suffered a massive price decline on the first day of trade (29 August 2003), with prices falling from the issue price of \$0.20 to \$0.01 at close. This resulted in a *UPLMV* of -1024.32%. Karmel Sonix Ltd followed this with a ‘loss’ of -887.85%. After standardising by issue price (*UPLIP*), the entire sample shows an average underpricing of 35.4%; when value-weighted an average underpricing of 52.2% is found. For all four measures of underpricing (*UPH*, *UPIL*, *UPLMV* and *UPLIP*) the null hypothesis that the mean is zero is rejected at the .01 level. We conclude Australian IPOs between 1996 and 2007 are underpriced in headline (57.8%), issuer loss (47.4%) and issuer price (35.4%) terms, but slightly overpriced in terms of market value lost (-11.1%).

Consider now the differences between ordinary, VC-backed and PE-backed IPOs. In terms of headline underpricing (*UPH*), VC-backed IPOs are less underpriced (32.1%) than either PE-backed (39.6%) or ordinary (70.7%) IPOs. This supports the hypothesis that VC-backed firms are fairly priced. This broadly holds when the measure of underpricing is adjusted for the proportion of shares retained by the issuer is taken into account, though PE-backed firms are now less underpriced (20.2%) than their VC-backed counterparts (28.9%). This should reflect the willingness of PE investors to retain a smaller proportion of ownership in the listed entity. The null hypothesis that the mean is zero is rejected for *UPH* and *UPIL* at the .01 level for ordinary IPOs and at the .10 level for VC-backed and PE-backed IPOs. We conclude that VC-backed and PE-backed Australian IPOs suffer less from underpricing than ordinary IPOs, and that when the proportion of ownership retained is taken account, PE-backed IPOs are less underpriced than VC-backed IPOs.

<TABLE 2 HERE>

However, a different picture emerges when the loss is standardised by market value (*UPLMV*) and the issuer price (*UPLIP*). In this case, neither of the mean underpricing measures is significantly different from zero for PE-backed IPOs and we may conclude these are fairly priced in the Australian market. For *UPLMV*, ordinary IPOs are moderately overpriced

(13.7%) and VC-backed IPOs slightly underpriced (7.3%) and both statistics are significantly different from zero at the .10 level or higher. In terms of *UPLIP*, the differences are again significant at the .10 level with ordinary IPOs underpriced by 39.7% and VC-backed IPOs by 27.8%. Table 2 provides the results of tests of differences in variances and means between VC-backed and ordinary IPOs and PE-backed and ordinary IPOs. In all cases, the variances significantly differ. However, the mean underpricing for VC-backed IPOs is only significantly less than ordinary IPOs for *UPH*, *UPIL* and *UPLMV*, while the underpricing for PE-backed IPO is significantly less underpriced than ordinary IPOs only in terms of *UPIL*. On balance, we conclude that IPOs in Australia from 1996–2007, regardless of backing, are on average underpriced, but while strong evidence exists that VC-backed issues are less underpriced than ordinary issues, the evidence for a lower level of PE-backed IPO underpricing is weak.

#### *4.2 Measures of IPO performance – Cumulative abnormal returns*

Table 2 presents the two-year equal and value-weighted abnormal returns for the IPOs included in the sample by category of backing. The mean monthly equally weighted *CBHAR* against the index is 0.01% over the whole sample. Intriguingly the corresponding value-weighted *CBHAR* (*VCBHAR*) for all IPOs is -1780.9%, identifying the phenomenal underperformance of IPOs to the market over the observed horizon. One inference is that the market index had a strong negative influence on IPO performance during the sample period. For example, 46 of the 132 monthly returns on the All Ordinaries are negative, with the other returns never exceeding 7.1% with a mean return of 0.75%. As a result, the *f* values calculated for each of the IPOs based on the market control are primarily below zero. Those firms that floated in a month where negative returns were recorded, acquired negative (*f x Control value*) for the remainder of its ‘life’ during the study.

<TABLE 3 HERE>

The *CBHAR* for the sample benchmarked against market value and book-to-market value are 0.70% and 0.68% respectively. The corresponding *t*-statistics (not shown) for the *CBHAR*s benchmarked against market quintiles and book-to-market quintiles fall within the rejection region at the 5% level of significance and are thus significant. The long-run equal-weighted *CBHAR* for the ordinary backed sample against the index is -0.3% (insignificant). Market quintile and book quintile *CBHAR* are 0.34% and 0.31% (both just significant). The value weighted results express similar results as found for the whole sample except for the market

value quintile score which performed quite differently. All three measures for the ordinary sample moved in the same direction to these corresponding *CBHARs*, at 768.3%, -1.20% and 281.6%.

The results for the VC backed portfolio suggest that the portfolio performs better against all three benchmarks, even though the returns are still relatively low. Monthly returns of the VC-backed sample against the All Ordinaries Index, market value quintiles and book-to-market quintiles, all display a fluctuating trend in *CBHARs* during the 24-month period. The 24-month equal weighted cumulative buy-and-hold returns for the VC sample against the index is 2.14% and significant. Similarly, returns against market quintiles and book-to-market quintiles were 2.8% and 2.74% respectively, again both significant. As shown in Table 2, the *CBHARs* for the VC-backed firms are higher than any other sample. This is also evident in the value-weighted equivalent when tested against the index, market and book-to-market quintiles with returns of 1227%, 833% and 635% respectively. These extraordinarily large returns are partly attributable to a number of large cap firms experiencing substantial returns. The results suggest that if an investor invested in only VC-backed firms from 1996 to 2006 they would have made a positive return over a 24-month period. These results differ to Silva Rosa *et al.* (2003) who concluded that investors would have made a negative return if they had invested in Australian VC-backed firms from 1991 to 1999.

<TABLE 4 HERE>

The final group to consider is the PE sample, which performed in a comparable manner to the VC sample. The 24-month cumulative buy-and-hold abnormal returns against the: index is 1.91% (insignificant), market value quintiles are 2.48% (insignificant) and book-to-market quintiles is 2.52% (insignificant). It is surprising to see that these results are insignificant. Although these results suggest that PE performance is statistically insignificant, there is no denying (like for the VC sample) that if capital were invested in PE firms during the observation period, positive returns would result. Yet again, the value-weighted figures imply that larger firms performed substantially better than smaller firms. Smaller firms were able to drag down the value weighted *CBHAR* averages from 1133%, 1114% and 699% (index, market, book-to-market) to their equal weighted equivalents of 2.14%, 2.8% and 2.74% respectively.



Table 4 provides tests of differences in the variances and mean CBHAR for VC-backed and ordinary IPOs and PE-backed and ordinary IPOs. All tests for equal variances reject the null hypothesis. Likewise, all tests that the mean abnormal return for VC/PE-backed IPOs are greater than ordinary IPOs reject the null hypothesis and we may conclude that VC-backed and PE-backed IPOs significantly outperform their counterparts, by three times for index returns and up to nine times for market and book-to-market value returns. In turn, VC-backed IPOs marginal outperform PE-backed IPOs.

#### *4.3 Measures of IPO performance – Fama-French three-factor model*

Table 5.4 provides the estimated coefficients, *t*-values and *p*-values for the Fama and French pooled regression. As shown, alpha is positive but insignificant. This indicates that, after controlling for market, size and book-to-market factors in returns, IPOs have not performed better than expected. The coefficient for the market factor (beta) is positive, greater than unity and significant at the .01 level. Similarly, the coefficients for the small-minus-big and high-minus-low factors are also positive and significant at the .01 and .10 levels, respectively. These results are "...consistent with the proposition that there are at least two factors that are priced in the long-run returns of IPOs", (Silva Rosa *et al.* 2003, p.15). The adjusted R<sup>2</sup> of the regression is relatively low at 4.61%.

<TABLE 5 HERE>

The regression outputs for the sub samples of ordinary, VC-backed and PE-backed IPOs provide similar results. In no instance is the coefficient signifying superior risk-adjusted performance (alpha) significantly different from zero. This provides similar results on the risk-adjusted performance of IPOs to Silva Rosa *et al.* (2003) for 333 Australian IPOs over the period 1991–1999. The betas are all significant, with ordinary IPOs and PE-backed displaying higher market risk than VC-backed IPOs. For PE-backed IPOs particularly, this would indicate that some of their performance is associated with higher levels of market risk. The gamma values are also significant and highest for VC-backed IPOs followed by PE-backed IPOs signifying that part of the superior nominal performance of these IPOs can be attributed to their small size characteristics. Finally, the values for delta are highest for VC-backed IPOs and lowest for PE-backed IPOs indicating differences in performance associated with high (low) book-to-market values. In all three categories, most return variation is explained by the market, followed by size and lastly book value. However, the total

percentage of variation in returns explained by the three-factor model is never more than 6.7 percent.

## **5. Concluding remarks**

This paper examines the pricing and performance of ordinary, venture capital and private equity-backed initial public offerings in the Australian stock market from June 1996 to May 2007. Headline underpricing, underpricing issuer loss, underpricing loss by market value, and underpricing loss by issue price are used to measure underpricing. Cumulative buy-and-hold abnormal returns with equal and value-weighted market indexes, market and book-to-market value quintile adjustments and the Fama-French three-factor model used to compare performance.

In terms of underpricing, the results indicate that Australian IPOs are generally underpriced and that VC-backed and PE-backed IPOs are less underpriced than their ordinary counterparts. All four measures of underpricing — standard or ‘headline’ underpricing, underpricing loss to the issuer and underpricing standardised by market value and issue price — provide some evidence that venture capital and private equity-backed issues are less underpriced than ordinary issues. However, the evidence presented of a lower level of underpricing is most strong for VC-backed IPOs. These findings support comparatively recent evidence of IPO underpricing generally in the US Habib and Ljungqvist (2001), Francis and Hasan (2001), Bradley and Jordan (2002), Loughran and Ritter (2002) along with the conjecture that venture capitalists have an incentive and means available to prevent underpricing.

In terms of post-IPO performance, the nominal performance benchmarks provide abundant evidence that IPOs outperform in terms of abnormal returns and that VC and PE-backed IPOs outperform ordinary IPOs. This supports work by Brav and Gompers (1997), amongst others, who concluded that VC-backed samples outperformed non-VC firms in the US. However, it lies counter to the only related Australia works by Lee *et al.* (1996) and Silva Rosa *et al.* (2003). One possibility is that both of these studies draw upon much earlier sample periods and that it is only relatively recently that venture capital and private equity-backed firms have begun to play a much larger role in the Australian market. However, analysis of the risk-adjusted performance of VC and PE-backed IPOs — indeed all IPOs — indicates no

abnormal returns over a two-year horizon, suggesting that the superior long-run performance of IPOs mostly relates to their high level of market risk and very low book-to-market values for PE-backed firms and their small size attributes for VC-backed firms.

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Figure 1. Summary of IPO activity, 2000-2006

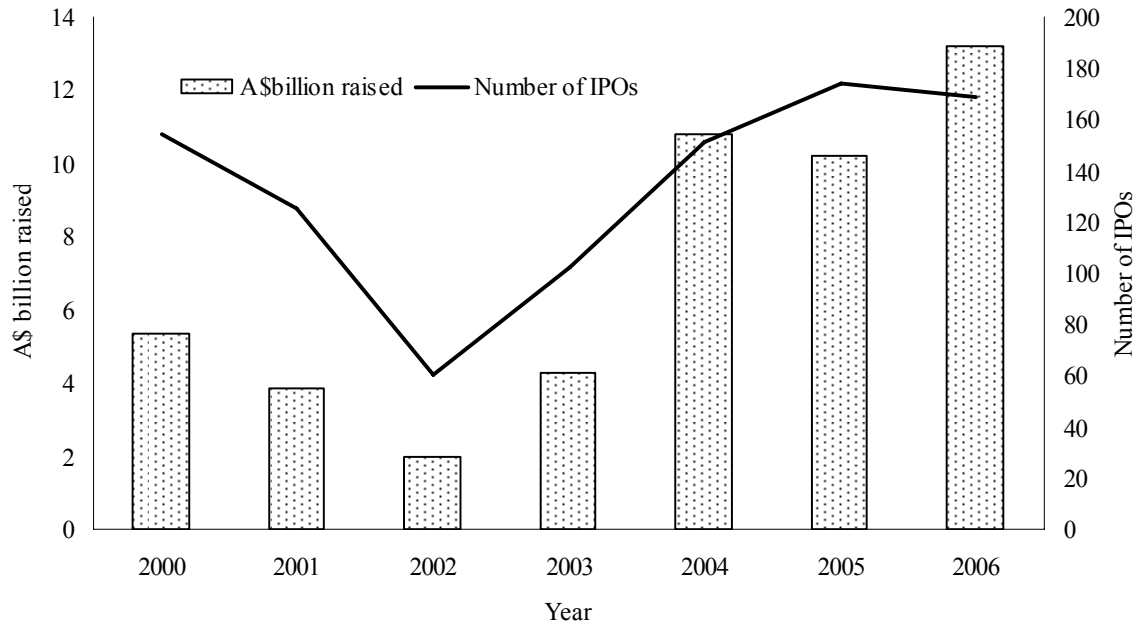


Table 1. Measures of IPO underpricing by category

Category	Underpricing	UPH	UPIL	UPLMV	UPLIP
All IPOs	Mean	0.578	0.474	-0.111	0.354
	Median	0.075	0.050	0.017	0.017
	<i>t</i> -statistic	4.155	3.885	-1.700	3.818
	<i>p</i> -value	<0.001	0.001	0.090	0.001
	Value-weighted	0.818	0.653	-0.001	0.522
Ordinary IPOs	Mean	0.707	0.605	-0.137	0.397
	Median	0.058	0.050	0.002	0.002
	<i>t</i> -statistic	3.448	3.304	-1.704	3.069
	<i>p</i> -value	0.001	0.001	0.090	0.002
	Value-weighted	0.838	0.705	-0.025	0.472
VC-backed IPOs	Mean	0.321	0.289	0.073	0.278
	Median	0.080	0.076	0.035	0.037
	<i>t</i> -statistic	1.921	1.744	2.733	1.864
	<i>p</i> -value	0.060	0.087	0.008	0.068
	Value-weighted	0.845	0.812	0.150	0.727
PE-backed IPOs	Mean	0.396	0.202	-0.225	0.285
	Median	0.075	0.039	0.034	0.035
	<i>t</i> -statistic	1.834	1.958	-0.950	1.482
	<i>p</i> -value	0.073	0.056	0.347	0.145
	Value-weighted	0.686	0.204	-0.009	0.630

Notes: UPH – headline underpricing, UPIL – underpricing issuer loss, UPLMV – underpricing loss by market value, and UPLIP – underpricing loss by issue price. VC – venture capital, PE – private equity. *t*-statistics and *p*-values are tests of null hypothesis that means are equal to zero.

Table 2. Tests for differences in variances and means of IPO underpricing by category

Category		UPH		UPIL		UPLMV		UPLIP	
Variance		<i>F</i> -statistic	<i>p</i> -value	<i>F</i> -statistic	<i>p</i> -value	<i>F</i> -statistic	<i>p</i> -value	<i>F</i> -statistic	<i>p</i> -value
	VC-backed IPOs	4.869	0.000	3.942	0.000	28.400	0.000	2.446	0.000
	PE-backed IPOs	3.351	0.000	11.653	0.000	0.431	0.000	1.677	0.023
Mean		<i>t</i> -statistic	<i>p</i> -value	<i>t</i> -statistic	<i>p</i> -value	<i>t</i> -statistic	<i>p</i> -value	<i>t</i> -statistic	<i>p</i> -value
	VC-backed IPOs	-1.448	0.075	-1.266	0.104	2.475	0.007	-0.596	0.276
	PE-backed IPOs	-1.037	0.151	-1.909	0.029	-0.354	0.362	-0.475	0.318

Notes: UPH – headline underpricing, UPIL – underpricing issuer loss, UPLMV – underpricing loss by market value, and UPLIP – underpricing loss by issue price. VC – venture capital, PE – private equity. The null hypothesis for the two-sided variance test is that the underpricing for ordinary IPOs and VC/PE-backed IPOs have equal variances. The null hypothesis of the one-sided means test is that the mean underpricing for VC/PE-backed IPOs is less than ordinary IPOs. The variance test determines whether the means test assumes equal or unequal variances.

Table 3. Two-year abnormal returns for IPOs by category

Category	Variable	CBHAR	VCBHAR
All IPOs	Index	<0.001	9.364
	Market value quintiles	0.007	-0.410
	Book-to-market quintile	0.006	2.066
Ordinary IPOs	Index	-0.003	7.682
	Market value quintiles	0.003	-0.011
	Book-to-market quintile	0.003	2.816
VC-backed IPOs	Index	0.021	12.277
	Market value quintiles	0.028	8.331
	Book-to-market quintile	0.027	6.350
PE-backed IPOs	Index	0.019	11.330
	Market value quintiles	0.024	11.143
	Book-to-market quintile	0.025	6.988

Notes: CBHAR – cumulative buy-and-hold return, VCHAR – mean CBHAR, VC – venture capital, PE – private equity.

Table 4. Tests for differences in variances and means of IPO CBHAR by category

Category		Index		Market value		Book-to-market	
Variance		<i>F</i> -statistic	<i>p</i> -value	<i>F</i> -statistic	<i>p</i> -value	<i>F</i> -statistic	<i>p</i> -value
	VC-backed IPOs	0.117	<0.001	0.158	<0.001	0.157	<0.001
	PE-backed IPOs	0.234	<0.001	0.290	<0.001	0.289	<0.001
Mean		<i>t</i> -statistic	<i>p</i> -value	<i>t</i> -statistic	<i>p</i> -value	<i>t</i> -statistic	<i>p</i> -value
	VC-backed IPOs	1.482	0.070	1.434	0.076	1.418	0.079
	PE-backed IPOs	1.621	0.053	1.450	0.074	1.493	0.069

Notes: CBHAR – cumulative buy-and-hold return, VC – venture capital, PE – private equity. The null hypothesis for the two-sided variance test is that the CBHAR for ordinary IPOs and VC/PE-backed IPOs have equal variances. The null hypothesis of the one-sided means test is that the mean CBHAR for VC/PE-backed IPOs are greater than ordinary IPOs. The variance test determines whether the means test assumes equal or unequal variances.

Table 5. Pooled Fama-French regressions

Coefficients and statistics	All IPOs	Ordinary IPOs	VC-backed IPOs	PE-Backed IPOs
Alpha	0.003	0.000	0.009	0.014
<i>t</i> -value	0.840	0.040	0.810	1.600
<i>p</i> -value	0.401	0.971	0.419	0.111
Beta	1.195	1.241	0.861	1.230
<i>t</i> -value	10.410	9.710	2.290	4.020
<i>p</i> -value	<0.001	<0.001	0.022	<0.001
Gamma	0.311	0.259	0.525	0.379
<i>t</i> -value	7.610	5.730	3.920	3.360
<i>p</i> -value	<0.001	<0.001	<0.001	<0.001
Delta	0.065	0.027	0.411	-0.166
<i>t</i> -value	1.950	0.710	3.680	-1.680
<i>p</i> -value	0.052	0.476	<0.001	0.094
R-squared	0.047	0.046	0.072	0.065
Adj. R-squared	0.046	0.045	0.067	0.059

Notes VC – venture capital, PE – private equity. Alpha is the constant, beta is the estimated coefficient for the market portfolio, gamma is the estimated coefficient for the small-minus-big portfolio, delta is the estimated coefficient for the high-minus-low portfolio.