SHORT-RUN UNDERPRICING AND ITS DETERMINANTS: EVIDENCE FROM AUSTRALIAN IPOS

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Abstract

To find out whether the Australian IPOs are underpriced and what the determinants are, this study investigates the short-run market performance of 254 IPOs by industry, listing year and issue year over the period 2006 to 2011.To measure the short-run performance, the first listing day returns are divided into the primary market which is calculated based on the first day beginning prices and issue prices, the secondary market which is estimated based on the first day closing and opening prices and total market which is calculated based on the first day closing prices and issue prices. Then it is extended to the post-day listing analysis which includes returns up to 10 days. To find out the determinants of underpricing, this study estimates binary and multiple regression models with the offer, firm and market characteristics. The marginal probability analysis was also carried out to estimate the associated probability of each determinant which shows a directional change in the short-run market performance. The study found that overall the Australian IPOs are underpriced by 25.47% and 23.11% based on the average abnormal return (AAR) in the primary and total market, which is statistically significant at 1% and 5% level respectively. However, the secondary market analysis indicates that the Australian IPOs are overpriced by 1.55% on the AAR and it is statistically significant at 5% level. The examination of post listing returns shows that Australian IPOs are underpriced based on the average cumulative abnormal return (CAR) and it signals that investors' wealth can be diluted due to overpricing in the long-run. The primary, total and post listing analysis shows that the industrial sector IPOs are more attractive to investors whereas the chemical and material sector IPOs are less attractive compared to other sectors. The IPO period, time to listing, listing delays, total net proceeds ratio, issue price, attached share option and the market volatility are the main determinants for the observed underpricing. The marginal probability analysis also shows that market volatility and total net proceeds ratio have a significant impact on the level of underpricing. As far as the investors' wealth is concerned, the study shows that the short-run market performance analysis should consider both the first day return including primary and secondary market and the post-day return. Study concludes that short-run market performance is sensitive to the market, industry and listing & issue year and determinants to the model.

Keywords: Australian IPOs, Underpricing, Binary Models, Marginal Probability Analysis
JEL Code: G12, G14, G32

1. INTRODUCTION

The evaluation of the short-run market performance of IPOs[13] has been paid much attention in prior studies due to the wealth of initial investors in different countries. Underpricing[14] of IPOs is widely accepted as a short-run market phenomenon which is also considered as a universal phenomenon. This phenomenon was first documented in the finance literature by Stoll and Curley(1970), Logue(1973), Reilly(1973) and Ibbotson(1975). To test the underpricing phenomenon, most of the researchers used the first listing day average return which is defined as the closing price performance which covers the period from issuing date to ending of the first trading day[15] [Ritter (1987), Finn and Higham (1988), Ibbotson, Sindelar and Ritter (1994), Lee, Taylor & Walter(1996), Chan, Wang and Wei (2004), Omran (2005), Dimovski and Brooks(2005), Loughran and Schultz (2006), Chang et al.(2008) and Moshirian, Ng & Wu (2010),].

[13] An IPO, refer as initial public offering which is the first sale of a corporation's equity shares to investors on a public stock exchange and it is known as unseasoned equity.

[14] Dimovski and Brooks (2004) stated that the issue price of a newly listed company's shares being below the price at the shares subsequently trade is known as underpricing. The underpricing is considered as transferring wealth from issuing firm to initial IPO investors.

[15] The positive (negative) average return of the first listing day is known as the underpricing (overpricing).

However, analysing the short-run market performance based on the first-day return may not provide sufficient information to investors. The reasons are that (1) the investors do not know much about the newly listed companies, (2) the motive of speculative investors in the very first day to earn higher profit, (3) the market needs to have a reasonable time period to settle down in the short run, (4) this closing price performance (first day return) does not provide clear an answer who is the beneficiary of short-run underpricing, and (5) the price variation in the beginning and closing of the first trading day.

In order to overcome the reasons (1), (2) and (3) which are associated with the first day return, some researchers suggested to extend the evaluation period from the first day return to the post-listing day return. Ritter (1991) also documented that short-run market performance can be evaluated using an initial period including both first day and post-day return. Thus, they have used both the first day return and the post-day return to measure the short-run market performance [Sohail, Raheman and Durrani(2010); Kenourgios, Papathanasious and Melas (2007); Aktas, Karan and Aydogan(2003); Finn and Higham (1988)]. The post-day return is calculated as the cumulative abnormal return (CAR) and buy-and-hold return (BHR).To overcome the reasons (4) and (5), other researchers have argued that the short-run market performance should be evaluated using opening price performance which splits the first day return into two parts such as the first day primary market return and the secondary market return. The primary market return covers the period from the issuing date to the beginning of the first trading date and the secondary market covers from the beginning to ending of the first trading date. Therefore, Edwards and Hanley (2010), Bradlet et al. (2009), Chang et al. (2008), Aggarwal and Conroy (2000), Schultz and Zaman (1994) and Barry and Jennings (1993) have used the opening price performance which includes primary (offer-to-open) and secondary (open-to-close) market returns.However, a review of past Australian IPO studies has indicated the followings: (1) the short-run market performance has not been evaluated using the opening price performance such as the first day primary market return and the secondary market return and (2) the post-day return has been given less attention to evaluate the short-run market performance. This type of IPO short-run market performance analysis could provide more valuable information for investors.

Having indentified the importance of analysing the short-run underpricing (short-run market performance) using the first day primary market, secondary market, total market and post-day returns, it is necessary to find out the resons for underpricing. Ritter (1998) and Ritter and Welch (2002) studies provided a list of asymmetric information theories such as the winner's curse, signalling, uncertainty, agency cost etc. to explain the resons (determinants) for the short-run underpricing. These theories have been tested by many IPO researchers developing multiple regression models with different determinants. However, the multiple regression model identifies only the determinants but it does do not provide the associated marginal probabilities (risks) of determinants which shows the changes in underpricing. These marginal probabilities are more important for IPO investors due to the change in economic and financial factors which cause higher uncertainity in the IPO market.Therefore, some researchers have used binary regression models to estimates the associated probability of occurrence compared to the multiple regression model, providing more information to IPO investors for their investment decisions. The marginal probability shows the directional changes in the short-run market performance, which is used to find out which is the most important determinants that causes the changes in underpricing. A review was undertaken on previous Australian IPO studies shows that the determinants of short-run underpricing have not been analysed with the aid of a combination of binary regression and marginal probabilty analysis.

Therefore, this research paper seeks to examine (1) whether Australian IPOs are underpriced in the short-run using the first day primary market return, secondary market return, total market return and the post-day return and (2) what are the reasons for short-run underpricing with the aid of logit and probit binary regression models and a marginal probability analysis. The post-day returns are calculated up to 9 trading days after the first listing day. The average market adjusted abnormal return (AAR) is used to measure the short-run performance in the first day primary market, secondary market and total market and the average cumulative abnormal return (CAR) used in the post-listing period.

The remainder of this article is organized as follows. Section 2 reviews the evidence on underpricing. Section 3 covers the data and methodology. Section 4 discusses the results and analyses and section 5 concludes.

2. EVIDENCE ON SHORT-RUN UNDERPRICING

The Australian IPO market has been widely examined by many researchers over the past years. Finn & Higham (1988) reported that Australian industrial and commercial IPOs are underpriced by 29.2%. Lee et al.(1996), How et al. (1995) and Dimovski et al. (2011) also reported that the industrial sector IPOs are underpriced in the short-run market by 11.86%, 19.74% and 29.6% respectively. However, Dimovski and Brooks (2008) and How (2000) documented that mining IPOs are underpriced by 13.3% and 107.18% and respectively. Nguyen et al. (2010) found that resource IPOs are underpriced by 16.13%. Dimovski and Brooks (2005) and Dimovski and Brooks (2004) also found that Australian mining and energy IPOs and industrial and resource IPOs are underpriced by 17.93% and 25.6% on the first day return respectively. Silva Rosa et al. (2003) reported that venture capital-backed and non-venture capital-backed IPOs are underpriced by 25.47% whereas Gong and Shekhar (2001) found privatized IPOs are underpriced by 11.96%. Bird and Yeung (2010) and Bayley et al. (2006) also found that Australian IPOs are underpriced by 37.35% and 26.72% respectively.

US IPO market has been researched extensively by many researchers over the last two decades. Johnston and Madura (2002) have studied the internet and non-internet IPOs during the period of 1996 to 2000 and the study shows that the initial returns are more favourable for internet than non-internet firm IPOs. Further, the study shows that the level of underpricing of internet firms does not become statistically significant due to the demise of the internet sector. They investigated a sample of 366 IPOs and the average initial return was 78.5 per cent. The US IPO market was also analysed by Loughran & Schultz (2006) and Ritter & Welch(2002) who reported that the average initial day returns were 18.1 per cent and 18.8 per cent respectively. Further, Ibbotson(1975), Ritter (1987), and Ibbotson, Sindelar & Ritter (1994) reported that initial day returns are between 11.4 per cent and 47.8 per cent.

Moshirian, Ng and Wu (2010) examined the price performance of emerging and developed Asian markets and found that China, Korea, Malaysia, Hong Kong, Japan and Singapore are underpriced on the first day returns by 202.93%, 70.3%, 61.81%, 21.43%, 34.04% and 33.10% respectively. The study of Sohail, Raheman and Durrani (2010) indicated that Pakistan IPOs are underpriced under the general state of economy by 42.17%, 40.99%, 37.35%, 38.17% and 39.38% on the close of 1st, 5th, 10th, 15th & 20th days respectively. Chan, Wang and Wei (2004) also analysed the Chinese IPO market and found that the average level of underpricing in A-shares and B-shares are 178% and 11.6% respectively. Further, Banerjee, Hansen and Hrnjic (2009) found that on average investors of Singaporean IPOs out-perform (underpricing) in the short-run.

The evidence from the international literature on underpricing shows that the level of underpricing and its determinants could vary according to the sample period, state of the economy, nature of the market, industry etc. Therefore, there is a need to measure the level of underpricing and find out its determinants by market in the current time period due to the different state of economic condition.

3. DATA AND METHODOLOGY

3.1. Data and Sample Selection

In order to analyse the short-run market performance of Australian IPOs, all IPO data was collected from the Connect 4 database (www.connect4.com.au) which is more specialised for IPOs. The study examines listed fixed price offering equity[16] IPOs in the Australian securities exchange (ASX) from January 2006 to January 2011. A sample is selected based on the random sampling method by industry or sector as a main criterion. To analyse IPOs by industry, all the listed IPOs during this period are sub divided into seven sectors using the industry criterion. The financial sector IPOs and the property & equity trust or close-End funds IPOs are excluded from the sample following the other researchers (Dimovski and Brooks, 2004 and Ahmad-Zaluki, Campbell and Goodacre, 2007)[17]. Mergers, takeovers and restructuring schemes are also eliminated from the sample because it undeservedly impacts on the IPO companies' performance. Due to the large number of listed IPOs in the resource sector, the selected sample from this industry represents only 33% of the total listed IPOs while other sectors represent 100%. Finally, we selected 254 IPO for this study as a sample based on the availability of data which represents 47% of the total listed IPOs in January 2006 to January 2011.

The table 2 shows the number of sample companies, offer proceeds (issue price per share * number of issued shares) and money left on the table (the first day returns in terms of AUS $) which are classified by industry, listed year and issued year. In comparison of number of IPOs with the offer proceeds by industries, the resource sector has 56% of the sample IPO companies but it gives only 12% of the total sample offer proceeds. Industrial sector represents 18% of the sample IPO companies and it contributes 65% of the total sample proceeds which is the highest offer proceeds under the industries. The industrial sector has the highest value for money left on the table compared to all other sectors which shows that on an average market price of industrial sector is higher than other sectors. The utility sector indicates a negative value for the money left on the table which shows the wealth of the investors in this sector diluted compared to all other sectors. When examining the listing years, money left on the table has the negative values in 2010 and 2011 due to higher issue price compare to the first listing day market price. Issue years 2008 and 2010 have the negative values for money left on the table due to higher issue prices.

3.2. Methodology

Having selected the sample of IPO companies by industries, listing years and issue years, then the market prices of sample companies were selected from the Morningstar database (www.morningstar.com.au).To measure the market performance of IPOs, this study selected the first day adjusted[18] opening and closing market prices, and the post-listing day adjusted prices.

In order to calculate abnormal returns, the first listing day primary, secondary market and total market raw returns are calculated using the following equations.

$$PR_i = \frac{P_{i,b} - P_{i,o}}{P_{i,o}} \quad (1)$$

Where,

$\boldsymbol{PR_i}$ = the first listing day primary market raw return for security i measures between the issue price and beginning of the first listing day price

[16] An IPO in which the price is set and quoted in the prospectus and remains unchanged until completion of the offer.

[17] These researchers mentioned that IPOs in Finance, Trust, and Closed-Ends Funds sector are not comparable with non-financial companies. These companies' annual reports are normally prepared according to the different statutory requirements.

[18] Adjusted prices are those prices adjusted for any dilution factors such as bonus issues, rights issues, options etc.

$\boldsymbol{P_{i,b}}$ = the beginning price of security *i* at the first listing date

$\boldsymbol{P_{i,o}}$ = the issue (offer) price of security *i* at the time of issue

$$SR_i = \frac{P_{i,c} - P_{i,b}}{P_{i,b}} \quad (2)$$

Where,

$\boldsymbol{SR_i}$ = the first listing day secondary market raw return for security *i* measures between the beginning price and the closing of the first listing day

$\boldsymbol{P_{i,c}}$ = the closing price of security *i* at the first listing day

$\boldsymbol{P_{i,b}}$ = the beginning price of security *i* at the first listing date.

$$TR_i = \frac{P_{i,c} - P_{i,o}}{P_{i,o}} = [(1 + PR_i) \times (1 + SR_i)] - 1 \quad (3)$$

Where,

$\boldsymbol{TR_i}$ = the first listing day total market raw return for security *i* measures between the issue price and closing of the first listing day price

$\boldsymbol{P_{i,c}}$ = the closing price of security *i* at the first listing day

$\boldsymbol{P_{i,o}}$ = the issue (offer) price of security *i* at the time of issue

$\boldsymbol{PR_i}$ = the first listing day primary market raw return for security *i*

$\boldsymbol{SR_i}$ = the first listing day secondary market raw return for security *i*

From the above raw returns (PR_i , SR_i and TR_i), the market-adjusted abnormal/ excess returns are calculated to measure the short-run market performance in the primary, secondary and total market. The abnormal/excess return is considered as a superior performance measure relative to the raw return because it adjusts market return of each IPO. The market return can be calculated by using ASX indices such as ASX 200, ASX 300 etc. However, this study used All Ordinary Index as a market benchmark to measure the abnormal/excess market returns because this price index covers 95 per cent of the listed company prices in the ASX (http://en.wikipedia.org/wiki/All_Ordinaries). All Ordinary Index were obtained from the DataStream database. The following equations are used to calculate the market-adjusted abnormal (AR) return and the market-adjusted average abnormal return (AAR).

$$AR_{it} = R_{it-} R_{mt} \quad (4)$$

Where,

$\boldsymbol{AR_{it}}$ = the market-adjusted abnormal rate of return for company (i) in period (t)

$\boldsymbol{R_{it}}$ = the rate of return for company (i) in period (t) from PR_i, SR_i, and TR_i

$\boldsymbol{R_{mt}}$ = the rate of return on the benchmark (market) during the corresponding time period (t)

$$AAR_t = \frac{1}{n}\sum_{i=1}^{n} AR_{i,t} \quad (5)$$

Where,

$\boldsymbol{AAR_t}$ = the market-adjusted average abnormal return, **n** = the number of IPO companies in period (t)

To determine whether the average raw and abnormal returns are statistically significant, this study uses the following t-statistics [Ritter(1991), Brown and Warner (1985), Omran (2005)].

$$t(AAR) = AAR_t * \frac{\sqrt{n_t}}{\sigma_t} \quad (6)$$

Where,

$\boldsymbol{AAR_t}$ = the market-adjusted average abnormal return for day t

$\boldsymbol{\sigma_t}$ = the cross-sectional standard deviation of the return for day t.

From the above market-adjusted average abnormal return, this study calculates the cumulative market-adjusted average abnormal return(CAR) following the past studies [Ritter(1991) and Aktas, Karan and Aydogan(2003)]. This measure is useful to analysis the short-run performance of IPOs after the listing. Therefore, the CAR is calculated for nine post-listing days by using the following equation[19].

$$CAR_{q,s} = \sum_{t=q}^{s} AAR_t \quad (7)$$

Where,

$\boldsymbol{CAR_{q,s}}$ = the market-adjusted post-day listing return (performance) from event day q to event day s

The t-statistic for the cumulative market-adjusted average abnormal return is computed as follows [Aktas, Karan and Aydogan (2003)].

$$t(CAR) = \frac{CAR_t}{\sigma(CAR)_t} \quad (8)$$

Where,

$\boldsymbol{\sigma(CAR)_t} = \sigma(AR)_t * (t+1)^{1/2}$

$\boldsymbol{\sigma(AR)_t}$ = the variance of market-adjusted abnormal return over t days

The short-run market performance models are estimated by using the binary and multiple regression statistical models. The binary models are estimated using logit and probit regression models and multiple regression models are estimated using the Ordinary least square (OLS) method. The dependent variable in the binary models is defined as "1" and "0".The underpricing[20] is considered as "1" and overpricing as "0". The dependent variable of the multiple regression models is taken as natural log value of market-adjusted abnormal returns in the short-run market. The explanatory variables in all these models are given the in table 2. In addition to these explanatory variables, the industry represent dummy variables are also tested with these models with a view to capture the industry effect. The binary and multiple regression models are estimated with the Eviews (version 7) statistical package. The determinants of the short-run underpricing (short-run market performance) can be identified with aid of the binary and multiple regression models.

[19] The CAR is calculated after considering the first listing day total market return (TR).

[20] The Underpricing (overpricing) is defined as positive (negative) market-adjusted abnormal returns in the short-run IPO market

Table 2: Issue, firm and market characteristics

Explanatory variables	*Variable in the model*	*Variable measure*	*Expected sign*	*Variable proxy for theory*
Issue Characteristics				
IPO period (time given to invest)	IPOP	Period from opening to closing days of the offer which is measured in calendar days	Negative	Rock hypothesis
Oversubscription ratio	OVER	Number of demand shares over the number of shares offered	Positive	Signalling hypothesis/Rock hypothesis
Issue price	*ln* (PRICE)	Offer price of the issue	Negative	Signalling hypothesis/Uncertainty hypothesis
Offer size	*ln* (OSIZE)	The number of offered shares x issue price	Negative	Uncertainty hypothesis
Listing delay	LISD	Time period between the proposed listing date and the actual listing date which is measured in business days	Positive/ negative	Uncertainty hypothesis/Rock hypothesis
Total listing period (time to listing)	TOTP	Time period between the issued date and the listed date which is measured in business days	Negative	Rock hypothesis
Issue cost ratio	ICOR	Total Issue cost relative to the total offer proceeds. The total issue cost includes ASIC fee, ASX fee, broker commission, manager fee, annual report fee, legal cost, industry report fee, printing fee, other cost	Positive	Uncertainty hypothesis
Total net proceeds ratio	TNPR	1 minus issue cost ratio	Negative	Uncertainty hypothesis
Underwriter availability	UWRA	This is a dummy variable which defines 1 for "underwritten IPOs" and 0 for 'Not underwritten IPOs "	Positive	Signalling hypothesis
Attached share option availability	ATOA	Some issued IPOs are attached with a free share option and some are not. This is a dummy variable which defines 1 for "yes" and 0 for 'No"	Negative	Agency-cost hypothesis
Oversubscription option availability	OVSO	Some IPOs are accepted oversubscription and some are not. This is a dummy variable which defines 1 for " yes" and 0 for 'No"	Positive	Signalling hypothesis/Rock hypothesis
Recover of working capital	WICP	Some issued IPOs recover their working capital needs from the initial issued capital and some are not. This is a dummy variable which defines 1 for "Yes" and 0 for 'No"	Positive	Uncertainty hypothesis
Firm Characteristics				
Book value per share	*ln* (BOOKV)	Total equity capital divided by the number of equity shares	Positive	Signalling hypothesis
Original ownership	OWSH	Percentage of shares retained by original owners	Positive/ negative	Signalling/agency-cost /ownership dispersion hypothesis
Firm Age	*ln* (1+FAGE)	Number of years between the year of creation and listing	Negative	Uncertainty hypothesis
Firm size	*ln* (FSIZE)	Total assets at the end of the year preceding the IPO of an issuing firm	Negative	Uncertainty hypothesis
Market Characteristics				
Market volatility	MV	Standard deviation of daily market returns over the two months before the closing date of the offer	Positive	Uncertainty hypothesis
Average market return	RETU	Square value of the average daily market returns over the two months before the closing date of the offer	Positive	Uncertainty hypothesis
Market sentiment	MS	Changes in the All Ordinary Index (AOX) from the date of the issue to the AOX to the day of the listing	Positive	Uncertainty/Signalling hypothesis
Hot issue market	HC	Hot issue market is identified as issue year using IPO volume and first day return where number of IPOs and average first day returns (in the sample) are greater than the sample's average. This is a dummy variable which defines 1 for "hot issue market" and 0 for "otherwise"	Positive	Hot issue market hypothesis

Table 3. Number of sample companies, offer proceeds and money left on the table by industry, listing year and issue year

Sample Classification	*Number of IPOs*	*%*	*Offer Proceeds[1] (AU$ 000')*	*%*	*Money left on the table[2] (AU$ 000')*
By Industry					
Resources (Energy, Metals & Mining)	143	56%	1279743	12%	113727
Chemicals/Materials	4	2%	953400	9%	113042
Industrials	46	18%	6717995	65%	190481
Consumer Discretionary/Staples	31	12%	588975	6%	72296
Information Technology	20	8%	645582	6%	96831
Telecommunication	4	2%	22573	0%	2749
Utilities	6	2%	79750	1%	-7020
Total	**254**		**10288018**		**582106**
By Listing Year					
2006	68	27%	2856066	28%	216233
2007	91	36%	1607983	16%	244248
2008	29	11%	361219	4%	166584
2009	17	7%	368500	4%	45445
2010	41	16%	5045650	49%	-85511
2011	8	3%	48600	0%	-4893
Total	**254**		**10288018**		**582106**
By Issue Year					
2005	9	4%	53296	1%	19299
2006	69	27%	2887770	28%	191578
2007	96	38%	1666183	16%	421421
2008	19	7%	272019	3%	-10911
2009	16	6%	332000	3%	52203
2010	45	18%	5076750	49%	-91484
Total	**254**		**10288018**		**582106**

Note:

1. Issue price per share X Number of issued shares

2. Money left on the table indicates the first day returns in terms AU $ earned by initial investors. This is calculated by: (Market price per share - Issue price per share) X Number of issued shares

Multiple regression Model

$$ln[R_i] = \alpha + \beta_1 IPOP_i + \beta_2 OVER_i + \beta_3 lnPRICE_i + \beta_4 lnOSIZE_i + \beta_5 LISD_i + \beta_6 TOTP_i + \beta_7 ICOR_i + \beta_8 TNPR_i + \beta_9 UWRA_i + \beta_{10} ATOA_i + \beta_{11} OVSO_i + \beta_{12} WICP_i + \beta_{13} lnBOOKV_i + \beta_{14} OWSH_i + \beta_{15} ln(1 + FAGE_i) + \beta_{16} lnFSIZE_i + + \beta_{17} MV_i + \beta_{18} RETU_i + \beta_{19} MS_i + \beta_{20} HM_i + \sum_{i=1}^{6} \beta_i D_i + \varepsilon_i \quad (9)$$

Logistic Model

$$ln\left[\frac{P_i}{1-P_i}\right] = \alpha + \beta_1 IPOP_i + \beta_2 OVER_i + \beta_3 lnPRICE_i + \beta_4 lnOSIZE_i + \beta_5 LISD_i + \beta_6 TOTP_i + \beta_7 ICOR_i + \beta_8 TNPR_i + \beta_9 UWRA_i + \beta_{10} ATOA_i + \beta_{11} OVSO_i + \beta_{12} WICP_i + \beta_{13} lnBOOKV_i + \beta_{14} OWSH_i + \beta_{15} ln(1 + FAGE_i) + \beta_{16} lnFSIZE_i + + \beta_{17} MV_i + \beta_{18} RETU_i + \beta_{19} MS_i + \beta_{20} HM_i + \sum_{i=1}^{6} \beta_i D_i + \varepsilon_i \quad (10)$$

Probit Model

$$P_i = \alpha + \beta_1 IPOP_i + \beta_2 OVER_i + \beta_3 lnPRICE_i + \beta_4 lnOSIZE_i + \beta_5 LISD_i + \beta_6 TOTP_i + \beta_7 ICOR_i + \beta_8 TNPR_i + \beta_9 UWRA_i + \beta_{10} ATOA_i + \beta_{11} OVSO_i + \beta_{12} WICP_i + \beta_{13} lnBOOKV_i + \beta_{14} OWSH_i + \beta_{15} ln(1 + FAGE_i) + \beta_{16} lnFSIZE_i + + \beta_{17} MV_i + \beta_{18} RETU_i + \beta_{19} MS_i + \beta_{20} HM_i + \sum_{i=1}^{6} \beta_i D_i + \varepsilon_i \quad (11)$$

Where, $\boldsymbol{R_i}$ is market-adjusted abnormal returns (AR) or cumulative abnormal returns (CAR), $\boldsymbol{ln[R_i]}$ is the natural log value of the AR or CAR, $\boldsymbol{P_i}$ is the probability of underpricing (1) occurs in the short-run market, $\boldsymbol{1 - P_i}$ is the probability of underpricing does not occur or the overpricing (0) occurs in the short-run market, $\boldsymbol{ln\left[\frac{P_i}{1-P_i}\right]}$ is the natural log value of the odds ratios (in other words the probability of occurring) for the event of underpricing (1) occurrence, $\boldsymbol{IPOP_i}$ is a period from opening to closing days of the offering firm i, $\boldsymbol{OVER_i}$ is the oversubscription ratio of firm i, $\boldsymbol{lnPRICE_i}$ is the natural log value of the offer price of firm i, $\boldsymbol{lnOSIZE_i}$ is the natural log value of the offer size of firm i, $\boldsymbol{LISD_i}$ is the period of listing delay of firm i, $\boldsymbol{TOTP_i}$ is the total time period for listing of firm i, $\boldsymbol{ICOR_i}$ is the issue cost ratio of firm i, $\boldsymbol{TNPR_i}$ is the total net proceeds ratio of firm i, $\boldsymbol{UWRA_i}$ is the underwriter availability of the offer in firm i, $\boldsymbol{ATOA_i}$ is the attached share options available with the offer of firm i, $\boldsymbol{OVSO_i}$ is

the oversubscription option of firm i, $\boldsymbol{WICP_i}$ is the working capital recovery from the offer proceeds of firm i, $\boldsymbol{lnBOOKV_i}$ is the natural log value of the book value per share of the firm i, $\boldsymbol{OWSH_i}$ is the original ownership of firm i, $\boldsymbol{ln(1+FAGE_i)}$ is the natural log value of the age of issuing firm i, $\boldsymbol{lnFSIZE_i}$ is the natural log value of the size of issuing firm i, $\boldsymbol{MV}$ is the market volatility, $\boldsymbol{RETU}$ is the average market return before the closing date of the offer, and $\boldsymbol{MS}$ is the market sentiment, $\boldsymbol{HM}$ is the hot issue market dummy, $\boldsymbol{D_i}$ = industry dummy variables such as $\mathbf{D_1}$=dummy for resource industry, $\mathbf{D_2}$= dummy for chemical/material industry , $\mathbf{D_3}$= dummy for industrial sector, $\mathbf{D_4}$= dummy for consumer discretionary/staples industry, $\mathbf{D_5}$= dummy for information technology industry, and $\mathbf{D_6}$= dummy for utilities industry. The telecommunication industry is captured in the intercept term. $\boldsymbol{\beta_i}$ is the coefficient of the explanatory variables and $\boldsymbol{\varepsilon_i}$ is the error term of the model[21]

The marginal probability analysis is based on the logistic binary regression model and it measures the likelihood of changing in probability (Δp) associated with the underpricing (short-run market performance) due to a change in the explanatory variables. The marginal probabilities are very important for IPO investors for their investment decisions. Therefore, the marginal probability (Δp) has been estimated by using the following probability equations.

$$P_i = \frac{e^{\propto + \sum_{i=1}^{n} \beta_i X_i}}{1 + e^{\propto + \sum_{i=1}^{n} \beta_i X_i}} \quad (12)$$

$$\Delta p = \beta_i P_i (1 - P_i) \quad (13)$$

Where, $\boldsymbol{P_i}$ = the probability of underpricing (1) occurs in the short-run market, $\boldsymbol{\Delta p}$ = marginal probability, $\boldsymbol{\beta_i}$ = Coefficient of each explanatory variables, $\boldsymbol{X_i}$ = the average value of each explanatory variables.

5. RESULTS AND DISCUSSION

This section provides the statistical analysis and the results which are derived from the methodology that are discussed in section 4.2. The discussion on empirical findings of the short-run market performance on the first listing day returns and the post-day listing returns are presented in sections 5.1. The estimated models based on the short-run market returns are discussed in section 5.2. The discussion on the marginal analysis is shown in section 5.3.

5.1. The short-run market performance

The short-run market performance was evaluated by using the first trading day market-adjusted abnormal returns and the post-day cumulative abnormal returns. The findings of the first trading day market-adjusted abnormal returns are discussed under the first day primary market, the secondary market and the total market. Furthermore, the discussion is continued by industries, listing years and issue years under the primary, secondary and total market. The first trading day returns and post-day returns are given in table 4 and 5 respectively.

5.2. The first trading day returns of IPOs

Table 4 shows that sample companies are underpriced in the primary market by 25.47% based on the market-adjusted abnormal return which is statistically significant at 1% level. In comparison with the primary market returns, the Australian IPOs are overpriced in the secondary market by 1.55% which is statistically significant at 5% level. The first day total return indicates that all sample Australian IPOs are underpriced at 23.14% on the market adjusted abnormal return which is statistically significant at 5% level.

If we examine IPOs by industries, in the primary market, the highest level of underpricing can be seen in industrial sector IPOs which is 68.03% based on abnormal returns. However, this underpricing level is not statistically significant. The resources sector IPOs are generally underpriced by 16.64% which is statistically significant at 1% level. The level of underpricing (23.88% on abnormal returns) in the telecommunication sector is also statistically significant at 10% level. The information technology sector IPOs are also underpriced on abnormal returns by 14.14%.In contrast with IPOs in other sectors, the chemical and material sector IPOs are overpriced by 10.91% based on abnormal returns. It is interesting to see that this sector IPOs earned negative returns in the very first day primary market. However, this negative return is not statistically significant. According to the closing price secondary market, the highest average overpricing level on abnormal returns can be seen in the utility sector (7.54%) and the lowest is in the resources industry (0.70%).The average overpricing levels in the chemical & material sector is 6.35%. The overpricing level (4.66% on abnormal returns) in the information technology industry is not statistically significant. In the secondary market, underpricing has not been found in any sectors. Total market return analysis shows that the highest level of underpricing can be seen in the industrial sector IPOs which is 65.31% based on abnormal returns. However, this underpricing level is not statistically significant. The resources sector IPOs are generally underpriced by 15.69% which is statistically significant at 1% level. The levels of underpricing (16.77% based on the abnormal return) in the telecommunication sector is also statistically significant at 10% level. The chemical and material sector IPOs are overpriced by 15.94% based on the abnormal return compared to the other sectors because it gives a negative return for their investors.

The listing year analysis shows that the highest level of underpricing takes place in the primary market in year 2008 based on abnormal returns by 106.37%. This level of returns is not statistically significant. In listing years 2006, 2007

[21] The logit and probit regression models are differ due to the error term of each of the models. The cumulative distribution of the error term can be seen in a logit model and the normal distribution can be seen in a probit model (Kulendran and Wong, 2001, p. 423). Further, they mentioned that the results of these binary models will not vary unless the sample size is large.

and 2010, listed IPOs are underpriced on abnormal returns by 17.62%, 16.38% and 14.02% respectively and these are also statistically significant at 1% level. The IPOs in listing year 2009 are underpriced by 9.1% which is not statistically significant. The Australian IPOs are overpriced in 2011 by 4.12% on abnormal returns. The statistical significance cannot be seen in this overpricing level. The listing year classification of the secondary market shows that IPOs are not underpriced based on abnormal returns in listing year 2008 which is not statistically significant. Statistically significant overpricing levels can be found in 2007 and 2010 only. Listed IPOs in 2007 and 2010 are overpriced by 1.90% and 2.99% respectively. These rates of overpricing are statistically significant at 10% and 5% levels. In the total market, the highest underpricing level in 2008 is 101.26% on abnormal return. But this underpricing level is not statistically significant. Only in listing year 2011, the overpricing is reported as 6.65% which indicates that negative returns are given to investors in this listing year. IPOs are underpriced by 16.85%, 13.83% and 10.60% in 2006, 2007 and 2010 respectively. These levels are also statistically significant at 1% and 5% levels.

When we examine IPOs in the primary market by the issue year, the highest underpricing level can be seen in 2005 based on abnormal both return which is not statistically significant, while the lowest in 2006 which is statistically significant at 5%. The issued IPOs in 2010 are underpriced by 11.15% which is also statistically significant at 1% level. In issued years 2007 and 2009, the IPOs are underpriced by 46.73% and 12.57% respectively which are significant at 10% and 5% levels. In the Australian IPO market, the overpricing has not been found in any issued years because the negative returns have not reported in these periods. Only statistically significant overpricing can be found in the secondary market in issued year 2007 and 2010. In 2007 and 2010, issued IPOs are overpriced by 2.09% and 2.58% respectively and these are significant at 5% level. The IPOs issued in all years are overpriced in the secondary market except in 2008. The first day total market returns analysis shows that the highest level of underpricing can be seen in the issue year 2005 which is 56.06%. However, this underpricing level is not statistically significant. The statistically significant underpricing levels can be found only in issue years 2006, 2007 and 2010. In 2010, the issued IPOs are underpriced by 8.34% which is statistically significant at 1% level. Issued IPOs in 2006 and 2007 are underpriced by 42.58% and 7.37% respectively. These underpricing levels are statistically significant at 10% level. In comparison with the industry and listing year analysis, the overpricing has not been found under the issue year analysis.

5.3. The post-day returns of IPOs

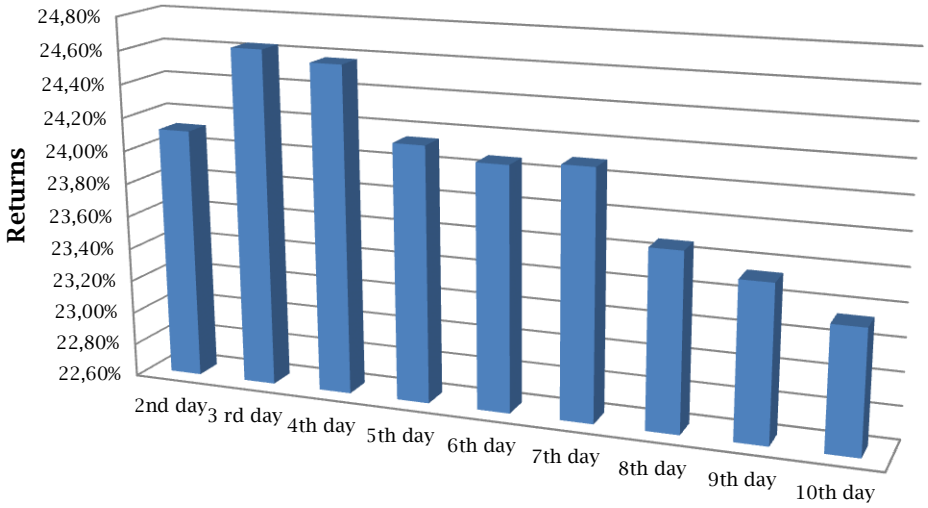
This section analyses the post-day returns by calculating the cumulative abnormal return (CAR) for nine post listing days. The calculated average cumulative abnormal returns of all sample IPOs for the nine post listing days are shown in figure 1.

Table 4. First Trading Day Returns: Primary, Secondary and total Markets

Sample Classification	N	Primary Market		Secondary Market		Total Market	
		AAR (%)	t-stat	AAR (%)	t-stat	AAR (%)	t-stat
All sample companies	254	25.47	2.58***	-1.55	-2.29**	23.14	2.40**
By Industries							
Resources	143	16.64	4.26***	-0.71	-0.76	15.69	3.93***
Chemicals/Materials	4	-10.91	-0.64	-6.35	-2.08	-15.94	-0.96
Industrials	46	68.03	1.31	-1.15	-0.84	65.31	1.28
Consumer Discretionary/Staples	31	18.29	1.40	-1.89	-0.97	13.71	1.42
Information Technology	20	14.14	1.12	-4.66	-1.69	9.80	0.73
Telecommunication	4	23.88	2.38*	-4.56	-0.64	16.77	2.83*
Utilities	6	10.09	0.71	-7.54	-2.00	1.09	0.08
By listing year							
2006	68	17.62	2.58***	-0.60	-0.45	16.85	2.47**
2007	91	16.38	3.79***	-1.90	-1.83*	13.83	3.15***
2008	29	106.37	1.27	0.09	0.04	101.26	1.25
2009	17	9.10	1.35	-2.05	-0.50	9.18	0.91
2010	41	14.02	5.26***	-2.99	-2.06**	10.60	3.58***
2011	8	-4.12	-0.48	-3.28	-1.40	-6.65	-0.75
By Issue year							
2005	9	62.45	1.43	-3.65	-0.59	56.06	1.34
2006	69	7.82	2.13**	-0.58	-0.49	7.37	1.79*
2007	96	46.73	1.84*	-2.09	-2.05**	42.58	1.72*
2008	19	9.42	0.90	0.88	0.23	10.90	0.93
2009	16	12.57	2.23**	-1.36	-0.45	12.20	1.45
2010	45	11.15	3.74***	-2.58	-1.99**	8.34	2.64***

N= Sample size, **AAR**= Average market-adjusted abnormal return
* statistically significant at 10% level,
** statistically significant at 5% level,
*** statistically significant at 1% level

Figure 1. The calculated average CARs for the nine post listing days from 2006 to 2011



The table 4 provides only the post-day listing returns for the 3rd, 6th and 10th days by all sample companies, industries, listing years and issue years. All sample IPO companies are underpriced based on CARs by 24.63%, 24.07% and 23.35% in the 3rd, 6th, and 10th days respectively. However, only day 6 is statistically significant at 10% level. The post-day listing returns of all IPOs are decreasing from the 3rd date to the 10th day.

All IPOs in industries are underpriced except the chemical and material sector. Only IPOs in the industrial sector are statistically significant at 1% level in all three post listing days and underpriced by 68.94%, 67.84% and 66.30% in the 3rd, 6th, and 10th days respectively. The chemical and material industry is overpriced in the 3rd, 6th and 10th days by 16.03%, 18.41% and 23.34% respectively. Only the return in day 6 is statistically significant at 1% level.

The highest level of underpricing is found in the listing year 2008 which is statistically significant at 1% level. In 2008, the average levels of underpricing in the 3rd, 6th and 10th days are 98.97%, 98.21% and 95.91% respectively. The listed IPOs in 2011 are overpriced only in the 3rd day and 6th day and underpriced in the 10th day. However, these overpricing levels are not statistically significant.

The issued IPOs from 2005 to 2010 are underpriced in the 3rd, 6th, and 10th day but issued IPOs only in 2005 are statistically significant in all three days. In 2007, the underpricing levels are statistically significant only in the 3rd and 6th day. The overpricing has not been found in these issue years

Table 5. Post-day Returns

Sample Classification	N	Day 3		Day 6		Day 10	
		CAR (%)	t-stat	CAR (%)	t-stat	CAR (%)	t-stat
All sample companies	254	24.63	1.50	24.07	1.75*	23.35	0.74
By Industries							
Resources	143	17.52	0.99	17.23	1.14	17.00	0.42
Chemicals/Materials	4	-16.03	-1.19	-18.41	-9.32***	-23.34	-1.18
Industrials	46	68.94	5.47***	67.84	6.54***	66.30	5.94***
Consumer Discretionary/Staples	31	11.14	0.58	9.56	0.69	7.34	0.49
Information Technology	20	9.98	1.39	9.83	0.79	10.13	0.90
Telecommunication	4	15.42	1.54	17.26	1.95	13.12	1.60
Utilities	6	6.34	0.26	6.82	0.87	10.01	0.62
By listing year							
2006	68	22.04	0.92	18.56	1.70*	19.21	1.03
2007	91	14.92	1.34	15.27	1.14	12.45	0.35
2008	29	98.97	4.68***	98.21	4.39***	95.91	3.78***
2009	17	7.57	0.74	9.41	0.72	10.40	0.89
2010	41	11.25	1.39	12.20	1.01	11.61	0.82
2011	8	-7.48	-0.95	-5.68	-0.72	6.99	0.07
By Issue year							
2005	9	63.82	2.34**	58.68	4.78***	55.00	3.07***
2006	69	11.44	0.52	8.43	0.80	8.68	0.47
2007	96	42.96	2.84***	43.27	2.66***	41.00	1.15
2008	19	10.51	1.01	10.89	0.66	7.56	0.35
2009	16	11.85	1.27	13.06	1.00	12.53	1.26
2010	45	8.44	1.03	9.65	0.89	12.36	0.27

N= Sample size, CAR= Cumulative Average Abnormal Return
* statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level

5.2. The estimated models for the short-run market performance

This section estimates binary and multiple regression statistical models with a view to identify the significant determinants of the short-run market performance. In section 5.1, the short-run IPO market performance is identified as the underpricing which measured using short-run abnormal returns. The estimated binary and multiple regression models for the primary, secondary, total and post-day listing market are presented in table 6 and 7 respectively. To eliminate multicollinearity issue, highly correlated variables are excluded from the estimated models. Only the statistically significant explanatory variables are reported in these estimated models which indicate only the issue and market characteristics as the short-run determinants. The firm characteristics are not statistically significant in these estimated models. Some of the industry represent dummies are also significant in the estimated regression models. LR and F statistics of the estimated models in table 6 and 7 are significant at 5% levels which indicate that models are valid. The calculated diagnostics test statistics such as Durbin-Watson (DW), Lagrange Multiplier (LM) and White Heteroscedasticity (WH) for the error terms in table 7 are statistically insignificant at 5% level which indicates the robustness of the multiple regression models. The significant determinants of the short-run underpricing in the estimated models are discussed under the issue and market characteristics as follows.

5.2.1. Issue characteristics

The statistically significant issue characteristics in the estimated binary and multiple regression models are listing delay (LISD), IPO period (IPOP), total period (TOTP), total net proceeds ratio (TNPR), issue price (PRICE) and attached share option availability (ATOA). In table 6, the LISD is a significant variable in the all binary estimated models except the secondary market model and also it is significant in the primary market multiple regression model. The TOTP is only significant in the estimated all total market models in table 6 and 7. The IPOP and TNPR are significant only in the all estimated binary market models except the total market. The PRICE and ATOA are only significant in the multiple regression secondary market and total market respectively. The relationship between the underpricing (short-run market performance) and these significant variables is examined using the estimated models below.

5.2.2. Underpricing (short-run market performance) and listing delay (LISD)

The estimated regression models in table 6 and 7 shows that LISD is negatively and significantly associated with the level of underpricing which is statistically significant at 1% level for the all estimated binary models except the secondary market model and 5% level for the primary multiple regression model. The result shows lower LISD IPOs are more underpriced compared to the higher LISD IPOs. It may suggest that increasing LISD will lead to decrease the demand of informed investors' because informed investors think this issue is not an attractive issue to invest and they withdrawing from the market. In other words, this may give an opportunity to uninformed investors to invest in this issue. This situation may lead to minimize the winner's curse problem and much underpricing is not necessary to attract uninformed investors. Therefore, According to the Rock's hypothesis, we cannot expect a higher level of underpricing with longer delay in listing. The finding is consistent with the Australian prior studies in IPO performance [How, (2000) and Lee et al. (1996)]. They found that listing delay is an important variable of the underpricing in Australian IPOs and can be used to test the Rock's hypothesis. According to the uncertainty hypothesis, however, Chowdhry and Sherman (1996) found that the longer time period of listing indicates more uncertainty about the offer. Mok & Hui (1998), Su & Fleischer (1999), Megginson &Tian (2006) and Zouari et al. (2011) also found a positive association between the level of underpricing and LISD.

5.2.3. Underpricing (short-run market performance) and IPO period (IPOP)

The primary market, total market and post-day market binary regression models in the table 6 show that the IPOP coefficient is negative and it is statistically significant at the level of 1% in the primary and total market and 5% in the post-day market. This shows that if the IPOP is increased it leads to decrease the level of underpricing. The finding argues that the level of underpricing can be reduced due to the uninformed investors (Rock, 1986). If the IPOP is increased it may gives chance to uninformed investors to invest in this offer. Therefore, the future demand may decline due to the less number of uninformed investors in the market and relative high level of underpricing cannot be used to attract or compensate uninformed investors who suffer from the winner's curse problem. Therefore, we can expect at a lower level of underpricing with longer IPO period according to the Rock's hypothesis.

5.2.4. Underpricing (short-run market performance) and total listing period (TOTP)

The estimated secondary market models in table 6 and 7 show that there is an inverse relationship between underpricing and TOTP. This implies that IPOs with higher TOTP tend to have lower level of underpricing. Rock (1986) found that underpricing can be used to attract uninformed investors who exist due to the winner's curse problem. This problem indicates that informed investors do not give a chance to uninformed investors to invest when the offer is attractive and they withdraw from the market when the offer is unattractive. Lee et al. (1996) also found that quickly sold issues (longer issues) are more underpriced (less underpriced) due to the higher (lower) level of informed demand. How (2000) found that there is a statistically significant negative relationship between underpricing and time to listing. The finding is statistically significant at 1% level and consistent with the Rock's hypothesis.

5.2.5. Underpricing (short-run market performance) and total net proceeds ratio (TNPR)

The table 6 shows that there is an inverse association between underpricing and TNPR of the issuing company. This finding implies that higher the TNPR of an IPO firm, lower the level of underpricing based on the estimated binary models except secondary market model is. It could be argued that there is a lower risk for the IPOs with greater TNPR, which results in lower underpricing. If TNPR increases, the future investors feel this offer as lower risk investment for them. They cannot earn higher return on this investment because this is considered as a low risk investment. Therefore, the lower prices can be expected due to the lower risk. As a result of the lower prices, the higher levels of underpricing can be seen in the short-run IPO market. Dimovski and Brooks (2004) have also reported a negative association between retained capital and the level of underpricing. The retained capital is a similar variable to the TNPR which shows what percentage of equity capital retained by an IPO company after paying issue cost. Therefore, our result is consistence with the uncertainty hypothesis ant it is statistically significant at 1% level for the estimated total and post-day market models and 5% level for the binary primary market.

5.2.6. Underpricing (short-run market performance) and issue price (PRICE)

In table 7, the multiple regression secondary market model shows that there is an inverse relation between the underpricing and the issue price (PRICE). The empirical evidence also shows an inverse relationship between the offer price and the level of underpricing. This relationship may exist due to higher uncertainty or higher demand for lower price of IPO's. Ibbotson, Sindelar & Ritter(1988) found that firms that offer with very low prices usually record a high level of underpricing. Fernando, Krishnamurthy & Spindt(1999) found a U-shaped association between these two variables and they pointed out that the offer price may also indicate the extant of underpricing but its level seems to have little economic significance. Certo *et al.*(2003) and Slama Zouari et al. (2011) suggest that higher offer prices indicate lower uncertainty regarding the future performance of the firm. Furthermore, Jain and Kini (1999) found that a low offer price is associated with lower short term performance. The past researchers argue that lower priced-offers are underpriced relative to the higher priced-offers due to the high risk and speculative trading. Therefore, the result is consistent with the uncertainty hypothesis and it is also statistically significant at 5% level.

5.2.7. Underpricing (short-run market performance) and attached share option availability (ATOA)

The multiple regression total market model in table 7 indicates that there is a negative relationship between underpricing and ATOA. The result indicates that the attached free share option for subscribers increase agency cost and hence reduces the level of underpricing. Grossman and Hart (1982) and Williams (1987) argue that high leverage reduces agency costs and increases firm value by encouraging managers to act more in the interests of equity holders. Once the attached free share option is exercised by the existing share holders, the leverage level goes down. Therefore, the agency cost goes up due to the low leverage. Finally, the firm value may decrease due to the low market price. If the market price goes down the level of underpricing also goes down. Therefore, the negative relationship can be seen between the level of underpricing and attached share option. This finding is supported by Dimovski and Brooks (2004) who found a negative relationship between underpricing and attached share option. How and Howe (2001) have investigated package initial public offerings (PIPOs)[22] in order to test the agency-cost hypothesis but their findings have not confirmed this hypothesis. However, our finding confirms the agency cost hypothesis and it is statistically significant at 5%.

5.2.8. Market characteristics

Only the market volatility (MV) and the market return (RETU) are statistically significant variables in the estimated binary and multiple regression models. The market volatility is a significant variable in the binary primary market in table 6 and the multiple regression total and post-day market models in table 7. The market return is only significant in the multiple regression models such as secondary, total and post-day markets. The relationship between the level of underpricing and each of these significant variables is explained as follows.

5.2.9. Underpricing (short-run market performance) and market volatility (MV)

According to the estimated binary primary market model in table 6, the market volatility (MV_{t-60}) appears to be positively related to underpricing, indicating that the IPO firms with higher market volatility tend to have higher degree of underpricing in the primary market. In other words, lesser the market volatility of the firm, low riskier the firm, the lower the level of underpricing will be. This relationship is also consistence with the uncertainty hypothesis, which in turn also supports the normal hypothesis of a risk-return relationship. This result is also statistically significant at 10% level. However, the unexpected sign has been found between underpricing and market volatility when models are estimated by the multiple regression. According to the estimated multiple regression models for total market and post-day market in table 7, the market volatility (MV_{t-10}) appears to be negatively related to underpricing, indicating that the IPO firms with lower market volatility tend to have higher underpricing in the total and post-day markets. In other words, lesser the market volatility of the firm the higher the level of underpricing will be. This result is statistically significant at 5% level. The past researchers [How, Izan and Monroe (1995) and Omran (2005)] have found a similar relationship between underpricing and market

[22] PIPOs are known as IPOs with common stock and warrants. In Australia, share warrants are called share options (how and Howe, 2001).

volatility under the multiple regression model. However, these researchers also mentioned the expected sign of this relationship as positive. We can argue that the positive sign of this relationship can be found when we analyse using the binary regression model because this type of model indicates the likelihood of occurrence. When we analyse using multiple regression model it may gives a negative relationship between these two variables because it indicates values of occurrence under real market behaviour. However, this result is not consistence with the uncertainty hypothesis.

5.2.10. Underpricing (short-run market performance) and market return (RETU)

In table 7, the estimated regression models for the total market and the post-day market indicate a positive relationship between underpricing and $RETU_{t-1}$. This shows that the higher (lower) $RETU_{t-1}$ tend to have the higher (lower) underpricing. The market return is a major component of a firm's return which can be used to estimate the reward for the market risk (risk premium). In other words, the first day total return of the firm varies according to the market return. This result is consistent with the uncertainty hypothesis. The positive relationship between these two variables in the total market is statistically significant at 5% level and the post-day market is at 10% level. In comparison with this finding, the estimated multiple regression secondary market model indicates a negative relationship between underpricing and $RETU_{t-3}$ and this relationship is statistically significant with 5% level. However, this finding does not confirm the uncertainty hypothesis.

5.2.11. The marginal probability analysis on the short-run market performance

This section analyses the marginal probability associated with the significant variables in the short-run IPO market in Australian based on the logistic estimated models in table 6. Marginal analysis is used to find out which is the most important explanatory variables that contribute to the change the short-run market performance. The calculated marginal probability associated with the variables in the short-run market (based on the first day returns) such as primary, secondary and total markets are presented in table 8 and the post-day market (based on the post listing returns) in table 9.

Table 8. The change in probability (Δp) due to a change in explanatory variables

Variables	Primary market	Secondary market	Total market
TOTP		$\Delta p=-0.041 \times 10^{-3}$	
IPOP	$\Delta p=-0.071 \times 10^{-3}$		$\Delta p=-0.076 \times 10^{-3}$
LISD	$\Delta p=-0.063 \times 10^{-3}$		$\Delta p=-0.080 \times 10^{-3}$
TNPR	$\Delta p=-0.169 \times 10^{-1}$		$\Delta p=-0.212 \times 10^{-1}$
MV_{t-60}	$\Delta p= 0.160 \times 10^{0}$		

Note: Negative sign indicates an inverse relationship between explanatory variables and underpricing whereas positive sign shows direct relationship between these. Where, Δp = marginal probability, TOTP = total listing period in days, IPOP = IPO period in days, LISD = listing delay in days, TNPR = total net proceeds ratio and MV_{t-60} = market volatility of 60 days period prior to closing date of the offer.

Table 8 shows the calculated marginal probabilities for the significant explanatory variables in the primary, secondary and total markets. Except MV_{t-60}, all other explanatory variables in these market models have a negative sign. The negative sign for IPOP shows that if IPOP is increased by one day then the probability of change to overprice or decrease in the level of underpricing is 0.071×10^{-3} for the primary market and -0.076×10^{-3} for the total market .The positive sign for MV_{t-60} in the primary market indicates that if the market volatility increases by one unit then the probability of change to underprice or decrease in the level of overpricing is 0.160×10^{0}. The negative sign for LISD indicates that if listing is delayed by one day then the probabilities of change to overprice or decrease in the level of underpricing are 0.063×10^{-3} and -0.080×10^{-3} for the primary market and the total market respectively. A one unit increase in TNPR will result in a decrease in the probability of occurrence of underpricing by -0.169×10^{-1} and -0.212×10^{-1} for the primary and total markets respectively. The market volatility (MV_{t-60}) and TNPR are the most important explanatory variables in the primary and total market models. Only one explanatory variable is significant under the secondary market model which is the total period (TOTP). The negative sign for TOTP indicates that a day increase in the total period will result in a decrease in the probability of the level of underpricing or an increase in the probability of overpricing by 0.041×10^{-3}.

Table 9. The change in probability (Δp) due to a change in explanatory variables

Industry dummy	IPOP	LISD	TNPR
D_1	$\Delta p=-0.065 \times 10^{-3}$	$\Delta p=-0.065 \times 10^{-3}$	$\Delta p=-0.241 \times 10^{-1}$
D_2	$\Delta p=-0.055 \times 10^{-3}$	$\Delta p=-0.055 \times 10^{-3}$	$\Delta p=-0.206 \times 10^{-1}$
D_4	$\Delta p=-0.069 \times 10^{-3}$	$\Delta p=-0.069 \times 10^{-3}$	$\Delta p=-0.259 \times 10^{-1}$
D_5	$\Delta p=-0.065 \times 10^{-3}$	$\Delta p=-0.065 \times 10^{-3}$	$\Delta p=-0.241 \times 10^{-1}$
D_7	$\Delta p=-0.065 \times 10^{-3}$	$\Delta p=-0.065 \times 10^{-3}$	$\Delta p=-0.244 \times 10^{-1}$
Average Marginal Prob.	$\Delta p=-0.064 \times 10^{-3}$	$\Delta p=-0.064 \times 10^{-3}$	$\Delta p=-0.238 \times 10^{-1}$

Note: Negative sign indicates an inverse relationship between explanatory variables and underpricing whereas positive sign shows direct relationship between these. Where, Δp = marginal probability, IPOP = IPO period in days, LISD = listing delay in days, TNPR = total net proceeds ratio, D_1= dummy for resource industry, D_2= dummy for industrial sector, D_4= dummy for consumer discretionary/staples industry, D_5= dummy for information technology industry, and D_7= dummy for utilities industry.

Table 6. Estimated binary (logit and probit) regression models for the short-run market performance

Short-run Market Performance	Estimated Logit Model from January 2006 to January 2011	N	LR statistics	Probability (LR stat.)	R^2
Primary market	$ln\left[\frac{P_i}{1-P_i}\right]$= 8.591 - 0.034 **IPOP**– 0.030 **LISD** – 8.073 **TNPR** + 76.348 $\mathbf{MV}_{t\text{-}60}$ (0.005)*** (0.001)*** (0.028)** (0.100)*	254	28.60551	0.000009	8.9%
Secondary market	$ln\left[\frac{P_i}{1-P_i}\right]$= 0.334 - 0.017 **TOTP** (0.016)**	254	6.925333	0.008498	2%
Total market	$ln\left[\frac{P_i}{1-P_i}\right]$= 10.090 - 0.033 **IPOP** - 0.038 **LISD** - 9.173 **TNPR** (0.006)*** (0.000)*** (0.012)***	254	35.42371	0.000000	10.5%
Post day market	$ln\left[\frac{P_i}{1-P_i}\right]$= 8.828 - 0.028 **IPOP** - 0.028 **LISD** - 10.481 **TNPR** + 2.216 $\mathbf{D}_1$ + 2.650 $\mathbf{D}_3$ + 1.858 $\mathbf{D}_4$ + 2.223 $\mathbf{D}_5$ + 2.173 $\mathbf{D}_7$ (0.016)** (0.001)*** (0.005)*** (0.013)** (0.005)*** (0.052)* (0.028)** (0.081)*	254	35.00782	0.000027	10.28%
	Estimated Probit Model from January 2006 to January 2011				
Primary market	P_i= 5.020 - 0.021 **IPOP**– 0.018 **LISD** – 4.665 **TNPR** + 44.276 $\mathbf{MV}_{t\text{-}60}$ (0.005)*** (0.000)*** (0.029)** (0.102)*	254	28.51855	0.000010	8.97%
Secondary market	P_i= 0.205 - 0.010 **TOTP** (0.013)***	254	7.034133	0.007997	2%
Total market	P_i= 5.874 - 0.019 **IPOP** - 0.022 **LISD** - 5.301 **TNPR** (0.006)*** (0.000)*** (0.013)***	254	35.05781	0.000000	10.41%
Post day market	P_i= 5.318 - 0.017 **IPOP** - 0.017 **LISD** - 6.324 **TNPR** + 1.359 $\mathbf{D}_1$ + 1.619 $\mathbf{D}_3$ + 1.133 $\mathbf{D}_4$ + 1.341 $\mathbf{D}_5$ + 1.319 $\mathbf{D}_7$ (0.014)*** (0.001)*** (0.012)*** (0.009)*** (0.003)*** (0.043)** (0.024)** (0.077)*	254	35.15332	0.000025	10.32%

*Note: Figures in brackets indicate the significance levels. Negative sign indicates an inverse relationship between explanatory variables and dependent variable whereas positive sign shows direct relationship between these. Where, N = sample size, TOTP = total listing period in days, IPOP = IPO period in days, LISD = listing delay in days, TNPR = total net proceeds ratio, $MV_{t\text{-}60}$ = market volatility of 60 days period prior to closing date of the offer, D_1= dummy for resource industry, D_3= dummy for industrial sector, D_4= dummy for consumer discretionary/staples industry, D_5= dummy for information technology industry, D_7= dummy for utilities industry. LR statistics test the joint hypothesis that all slope coefficients except the constant are zero. Probability is the p value of the LR test statistics. R^2 is the McFadden R-squared. * statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level*

Table 7. Estimated multiple regression models for the short-run market performance

Short-run Market Performance	Estimated Multiple Regression Model for the period from January 2006 to January 2011
Primary market	$ln[AR]$= 0.109 - 0.002 [**LISD**] + 0.111[$\mathbf{D}_3$] (0.053)* (0.076)* N =254 F=3.574 Prob.(F)= 0.029 AdjR² = 2% DW = 2.046 LM = 0.831 WH = 0.773
Secondary market	$ln[AR]$= 0.140 - 0.026 ln[**PRICE**] - 0.001 [**TOTP**] - 289.258 [$\mathbf{RETU}_{t\text{-}3}$] - 0.032 [**D2**] + 0.021 [**D3**] + 0.013 [**D4**] -0.005 [**D5**] (0.028)** (0.000)*** (0.041)** (0.53) (0.332) (0.571) (0.868) - 0.059[$\mathbf{D}_6$] - 0.049[$\mathbf{D}_7$] (0.270) (0.258) N =254 F=4.294 Prob.(F)= 0.000 AdjR² =10% DW =2.113 LM = 0.539 WH = 0.127
Total market	$ln[AR]$= 0.189 - 0.185 [**ATOA**] - 15.062 [$\mathbf{MV}_{t\text{-}10}$] + 330.027 [$\mathbf{RETU}_{t\text{-}1}$] + 0.108 [**D3**] (0.059)* (0.015)** (0.0316)** (0.094)* N =254 F=3.319 Prob.(F)= 0.011 AdjR² = 4% DW =2.007 LM = 0.989 WH = 0.966
Post day market	$ln[CAR_{10}]$ = 0.206 - 16.62 [$\mathbf{MV}_{t\text{-}10}$] + 282.196 [$\mathbf{RETU}_{t\text{-}1}$] - 0.416[$\mathbf{D}_2$] (0.017)** (0.10)* (0.064)* N =254 F= 3.176 Prob.(F)= 0.025 AdjR² = 3% DW =2.100 LM = 0.321 WH = 0.999

*Note: Figures in brackets indicate the significance levels. Negative sign indicates an inverse relationship between explanatory variables and dependent variable whereas positive sign shows direct relationship between these. Where, AR = abnormal (excess) return, CAR_{10} = cumulative abnormal return in post listing day 10, N= sample size, LISD = listing delay in days, PRICE= issue price, TOTP = total listing period in days, $RETU_{t\text{-}1}$= square value of average market return before one day of the closing date of the offer, $RETU_{t\text{-}3}$= square value of average market return before three days of the closing date of the offer, ATOA = attached share option availability and $MV_{t\text{-}10}$ = market volatility of ten days period prior to closing date of the offer, D_1= dummy for resource industry, D_2= dummy for chemical/material industry , D_3= dummy for industrial sector, D_4= dummy for consumer discretionary/staples industry, D_5= dummy for information technology industry, D_6= dummy for telecommunication industry, D_7= dummy for utilities industry, Prob.(F)= significant level of the F-statistic , $AdjR^2$ is the adjusted R-squared, F= F-statistic, DW = Durbin-Watson statistic to test serial correlation, LM = Lagrange multiplier chi-square statistics to test serial correlation, WH = White heteroscedasticity test to test the constant error variance, * statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level*

Table 9 shows the calculated marginal probabilities associated with the significant variables in the post-day market based on the industry dummies. Table 6 shows that some industry dummies were statistically significant on the return in the post-day listing market .The post day market model also show an inverse sign for the explanatory variables.

The resource industry and the information technology industry dummies show similar marginal probabilities for the significant explanatory variables whereas the other industry dummies indicate different marginal probabilities in relation to each significant variable. The highest marginal probability of the all explanatory variables shows in the consumer discretionary industry whereas the lowest probabilities in the industrial sector. However, a considerable difference cannot be seen among the probabilities of the explanatory variables in different industries. Therefore, the average marginal probability is also estimated for each of the explanatory variables. According to the average marginal probability, TNPR is the most important variable of the post-day market due to the highest marginal probability compared to others. The negative sign for TNPR indicates that If TNPR is increased by one unit then the probability of change to overpricing or decrease in the level of underpricing is 0.238×10^{-1}.

6. CONCLUSIONS

This research paper has evaluated the short-run market performance of the Australian IPOs listed from 2006 to 2011 using the first listing day returns and the post-day listing returns. The first listing day returns are analysed by considering the first listing day opening price primary market, the closing price secondary market, and the total market using the average abnormal returns. The post listing returns are analysed using the average cumulative abnormal returns. This study identifies the issue, firm and market characteristics as determinants of short-run underpricing with the aid of binary and multiple regression models. A marginal probability analysis was carried out to measure the risk associated with the determinants of short-run underpricing.

The analysis based on the first listing day primary market returns, total market returns and the post-day listing returns shows that Australian IPOs are underpriced in the short-run. This finding is lined up with the underpricing phenomenon of IPOs, which is widely accepted as a universal phenomenon. Although the Australian IPOs are underpriced, the post-day listing return indicates that the level of underpricing is slowly decreasing after the listing particularly from 7th day to 10th day period. The decreasing trend of post listing returns is in line with the findings of Aktas, Karan and Aydogan(2003), Kenourgios, Papathanasious and Melas (2007) and Kazantzis and Thomas (1996). However, Sohail, Raheman and Durrani(2010) argue that this trend can be expected only up to the 10th day under the normal economic condition. The decreasing trend of post-listing returns signal that investors' wealth can be diluted due to overpricing in the long-run.

Having identified that the IPOs are always underpriced based on the first listing day opening price primary market, the closing price secondary market return analysis indicates that the Australian IPOs are overpriced by 1.55% on abnormal returns. Study found that there is a substantial variation in the first listing day returns between the opening price primary and the closing price secondary markets. This may occur due to the speculative behaviour of investors in the market. In contrast with this finding, however, Chang et al.(2008) documented that the Chinese IPOs were underpriced by 1.55% in the first day closing price secondary market[23]. The closing price secondary market analysis may be useful to the investors because the first day primary market high returns are due to the lack of information and speculative behaviour of the investors.

The analysis of short-run IPO market performance by industries, listing years and issue years shows that there is a substantial variation in the level of short-run performance. When we examine the IPOs by the industries, IPOs issued by chemical and material industry are overpriced in the primary market, the secondary market and the total market. Industrial sector IPOs are underpriced on abnormal returns by 68.03% in the primary market and 65.31% in the total market which are the highest levels of underpricing relative to other sectors. The resource sector IPOs are underpriced in the primary and total markets, which is statistically significant at 1% level. In contrast to the resource sector, the telecommunication sector IPOs are also underpriced in both markets which is also statistically significant. The listing year analysis found that IPOs in the primary market and the total market are underpriced except in listing year 2011 and overpriced in the secondary market. In the primary and the total markets, the levels of underpricing in year 2006, 2007 and 2010 are statistically significant at 1% on abnormal returns. In 2011, the levels of overpricing in primary, secondary and total markets are not statistically significant. The level of overpricing in the secondary market is statistically significant in 2007 and 2010.The issue year analysis shows that IPOs are underpriced in the primary market and the total market and overpriced in the secondary market except 2008. Issued IPOs in all markets are underpriced in 2008 but it is not statistically significant. In the secondary market, statistically significant overpricing levels can be found only in 2007 and 2010. The statistically significant underpricing levels in the both markets primary and total can be seen in all issue years except 2008 and 2005.

The post day return analysis shows that the industrial sector IPOs are more attractive than all other sectors. The industrial sector IPOs are underpriced on CARs by 68.93%, 67.84% and 66.29% in the 3rd, 6th and 10th days respectively. These underpricing levels are statistically significant at 1% level. However, IPOs in the chemical and material industry are not attractive to investors because it is overpriced based on the CAR measure for all days. The IPOs listed in 2008 are also underpriced by 98.97%, 98.21% and 95.91 in the 3rd, 6th and 10th days and these underpricing levels are statistically significant at 1%. In listing year 2011, the negative

[23] We have not compared our findings directly with prior research findings of Australian IPOs because we are unaware of any study that has focused on the first day primary and the closing price secondary market in relation to the Australia.

average cumulative abnormal returns in day 3 and day 6 have been found which indicates that listed IPOs in this year are overpriced. The overpricing IPOs cannot be found in the issue year analysis because the negative returns have not been reported. The statistically significant underpricing levels can be seen in issue year 2005 and 2007. However, in overall, the post-day listing analysis shows that the wealth of the investors has been decreasing as the time goes on.

The determinants of underpricing in Australia IPOs are the IPO period (IPOP), time to listing (TOTP), listing delays (LISD), total net proceeds ratio (TNPR), the market volatility (MV), issue price (PRICE), time to listing (TOTP), attached share option availability (ATOA) and market return (RETU). These determinants confirm that the issue and market characteristics are more important than the firm characteristics when explaining the short-run underpricing in Australian IPOs. The IPO period, time to listing, listing delays support Rock's hypothesis while the total net proceeds ratio, market volatility, market return and issue price confirm the uncertainty hypothesis. The attached share option availability supports the agency cost hypothesis. The marginal probability found that increasing (decreasing) of market volatility (MV) and decreasing (increasing) of total net proceeds ratio (TNPR) lead to increase (decreasing) the level of uncertainty which causes to increase (decrease) the level of underpricing in short-run. Study concludes that short-run market performance is sensitive to the market, industry, listing & issues years and models.

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