Evaluation of Market Performance of Initial Public Offerings (IPOs) and Its Determinants: Evidence from Australian IPOs

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Abstract

To determine whether Australian initial public offerings (IPOs) underprice in the short run and underperform in the long run, and to identify their determinants, this study investigated the short-run and the long-run stock market performance of 254 IPOs listed during 2006 to 2011 by industry and year (listing and issue). To measure their short-run performance, the first listing day returns were divided into the primary market, which was calculated based on the first-day beginning prices and issue prices; the secondary market, which was estimated based on the first-day closing and opening prices; and the total market, which was calculated based on the first-day closing prices and issue prices. The investigation was then extended to a post-day listing analysis that included returns of up to nine trading days. To measure their long-run market performance, the return measures were calculated under equally weighted and value-weighted schemes up to the three post-listing years using an event-time approach. To identify the determinants of short-run and long-run market performance, this study estimated binary and multiple regression models with offer, firm and market characteristics. Marginal probability analysis was also carried out to estimate the associated probability of each determinant that indicated a directional change in market performance.

The study found that, overall, the Australian IPOs underpriced by 25.47% and 23.11% based on the market-adjusted abnormal return (MAR) in the primary and total market. However, the secondary market analysis indicated that the Australian IPOs overpriced by 1.55% based on the MAR. The examination of post-listing returns showed that the Australian IPOs underpriced based on the average cumulative abnormal return (CAR), and this signals that investors' wealth can be diluted in the long run. The overall results varied by industry and year. The IPO period, time to listing, LISDs, total net proceeds ratio, issue price, attached share option and market volatility were the main determinants for the observed short-run performance. Marginal probability analysis also indicated that the market volatility and total net proceeds ratio had a significant effect on the directional changes of the short-run performance. The findings support Rock's hypothesis and the uncertainty hypothesis.

The appearance of long-run market performance was sensitive to the performance measures applied. When full sample CARs were used, the IPOs overperformed in three years, but when buy-and-hold return measures such as raw buy-and-hold returns (BHRs), buy-and-hold abnormal returns (BHARs) and wealth relative (WR) index were used, the IPOs underperformed. Industry- and issue-year-level analyses confirmed the full sample results except in the case of CARs for the consumer discretionary and staples, and information technology sectors. Market volatility, the dummy variable for consumer discretionary and staples industry, post-day market return, first-day primary market return, market sentiment and issue cost ratio were the main determinants of long-run performance. Marginal probability analysis also showed that market volatility and post-day market return had a significant effect on the directional changes of the long-run performance. The findings on determinants confirm that market characteristics are the most important in the long run and support the investor overoptimism, window of opportunity and uncertainty hypotheses.

Declaration

I, Kotalawala Liyanage Wasantha Perera, declare that the PhD thesis entitled **'Evaluation of Market Performance of Initial Public Offerings (IPOs) and Its Determinants: Evidence from Australian IPOs'** is no more than 100,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Wasantha Perera ___________________________ Date _____________________________

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List of Publications and Awards

Conference Publications

1. Perera KLW, and Kulendran N, (2012), 'New Evidence of Short-Run Underpricing in Australian IPOs', 3rd Conference on Financial Markets and Corporate Governance in Melbourne, organised by the Faulty of Business, Economics and Law, Latrobe University, Australia.
2. Perera KLW, and Kulendran N, (2012), 'Short-Run Underpricing and Its Determinants: Evidence from Australian IPOs', AIB-ANZ Annual Symposium, Melbourne Business School, University of Melbourne, Australia.
3. Perera KLW, and Kulendran N, (2011), 'A Review of IPO Market Performance', 8th International Conference on Business Management (ICBM), Colombo, Sri Lanka.

Awards

1. The research paper 'New Evidence of Short-Run Underpricing in Australian IPOs' was short-listed for an award by the review committee of the 3rd Conference on Financial Markets and Corporate Governance, Melbourne, organised by the Faulty of Business, Economics and Law, Latrobe University, Australia.
2. Later this paper was listed on the Social Science Research Network's (SSRN) Top 10 Downloads list for: CGN: Equity issue at the IPO & in Mid-Stream (Topic).

Abstract-Based Presentations at School Research Day

1. Perera KLW, and Kulendran N, (2012), 'Short-Run Underpricing and Its Determinants: Using Binary Models with Australian Evidence', Research day program, School of Accounting and Finance, Victoria University
2. Perera KLW, and Kulendran N, (2010), 'New Approach to Measure IPO Market Performance', Research day program, School of Accounting and Finance, Victoria University, Australia.

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List of Abbreviations

AAR	Market-adjusted average abnormal return
AMEX-NYSE	American Stock Exchange-New York Stock Exchange
AOX	All Ordinary Index
AR	Abnormal return
ARR	Average raw return
ASIC	Australian Securities and Investments Commission
ASX	Australian Securities Exchange
ATOA	Attached share option availability
BHAR	Buy-and-hold abnormal return
BHR	Buy-and-hold return
B/M	Book-to-market ratio
CAP	Capitalization
CAPM	Capital assets pricing model
CAR	Cumulative abnormal return
DCF	Discounted cash flow
DW	Durbin-Watson
EMH	Efficient market hypothesis
EW	Equally weighted
FAGE	Firm age
HC	Hot issue market dummy
HM	Hot issue market
ICBM	International Conference on Business Management
ICOR	Issue cost ratio
IPO	Initial public offering
IPOP	IPO period
IPRS	International Postgraduate Research Scholarship
LISD	Listing delay
LM	Lagrange multiplier
LR	Likelihood ratio
MAR	Market-adjusted abnormal return

MLE	Maximum likelihood estimation
MR	Market return
MS	Market sentiment
MV	Market volatility
OLS	Ordinary least square
OVSO	Oversubscription option availability
P/E	Price-earnings ratio
PIPO	Package initial public offering
PRICE	Issue price
PRIM	Primary market return
RATS	Returns across time and securities
RETU	Average market returns
RR	Raw return
SD	Standard deviation
SEC	Securities and exchange commission
SIP	Share issue privatisation
SECON	Secondary market return
SSRN	Social Science Research Network
TNPR	Total net proceeds ratio
TOTP	Total listing period
TR	Total Market Return
UWRA	Underwriter availability
VW	Value weighted
WH	White heteroscedasticity
WICP	Working capital recovery
WR	Wealth relative

Chapter 1: Introduction

1.1 Background of the Research

Most of the publicly traded firms in the world today are organised as relatively small, privately owned start-up firms, or ventures, that are masterminded by a single individual or a group of individuals (Ogden, Jen & O'Connor 2003). These entrepreneurs simultaneously serve as the firms' major shareholders, governance bodies and management teams. They obtain financing for expansion of the business from various sources and eventually sell equity shares to the general public via an initial public offering (IPO) of equity. An IPO is the first sale of a corporation's equity shares to investors on a public stock exchange, and it is known as unseasoned equity. Bancel and Mittoo (2009) identified the most important benefit of transforming into an IPO is acquiring funds for growth of the business. In addition to raising equity capital for the business, IPOs create a public market in which founders and other shareholders can convert some of their wealth into cash at a future date (Ritter & Welch 2002). In addition, Ritter and Welch suggested that a non-financial reason for going public is to increase publicity, but this plays only a minor role for most firms. The IPO converts the ownership of a company from private to public, which can create agency problems, such as conflict between owners and managers, which normally arise due to the separation of ownership and control in IPOs. Even though IPOs are used to obtain funds, Ritter and Welch (2002) have noted that this still leaves the question of why IPOs are the best way for entrepreneurs to raise capital. Currently, there are stiff regulatory and financial reporting requirements relating to IPOs imposed by the securities and exchange commissions (SECs) in different countries. Ogden, Jen and O'Connor (2003, p. 389) and Welch (2000) have summarised the advantages and disadvantages of going public by making IPOs.[1] The advantages of going public

1 Advantages include (1) financial advantages, such as availability of greater funds at lower costs, and having a fair value of the firm by the stock exchange; (2) public image advantages, such as increased publicity and attention from the investment community, and the ability to attract and retain employees through use of equity incentives; (3) liquidity advantages, whereby an IPO may include selling of shares in the secondary market. Disadvantages include (1) dilution of the current shareholders' ownership and control of the company might shift and be subject to unfriendly takeover; (2) disclosure disadvantages, such as the company becoming subject to periodic reporting and other disclosure requirements of the Securities Exchange that would not otherwise be available, giving competitors potential advantages; (3)

outweigh the disadvantages (Bancel and Mittoo 2009, p. 876). Therefore, currently, many of the world's privately owned companies have transformed into publically owned companies via IPOs.

Having identified the importance of investigating the IPO market, the next step is to evaluate the market performance of IPOs with respect to the investors, market analysis, issuing companies, IPO researchers and regulatory bodies. The market performance of IPOs has received much attention in prior studies because of the wealth of initial investors in various countries that is involved. Market performance has been evaluated in the literature mainly under two time periods: short-run market performance and long-run market performance. Underpricing of IPOs is widely accepted as the norm in short-run market performance and is considered a universal phenomenon. Dimovski and Brooks (2004) stated that the issue price (PRICE) of a newly listed company's shares being below the price at which the shares are subsequently traded is known as underpricing. Underpricing is considered the transfer of wealth from the issuing firm to initial IPO investors. This phenomenon was first documented in the finance literature by Stoll and Curley (1970), Logue (1973) and Ibbotson (1975). To analyse short-run market performance, most researchers have used the first-day average return (Chan, Wang & Wei 2004; Chang et al. 2008; Dimovski & Brooks 2005; Finn & Higham 1988; Ibbotson, Sindelar & Ritter 1994; Lee, Taylor & Walter 1996; Loughran & Schultz 2006; Moshirian, Ng & Wu 2010; Omran 2005; Ritter 1987). The first-day return is denoted as the closing price performance, which covers the period from issuing date to the end of the first trading day. A positive (negative) average return of the first trading day is identified as 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 very much about the newly listed companies; (2) the motive of speculative investors on the very first day is to earn higher profit; (3) the market needs to have a reasonable time period to settle down in the short run; (4) the closing price performance (first-day return) does not provide a clear answer about who is the beneficiary of the short-run underpricing; and (5) there is price variation between the beginning and closing of the first trading day.

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expenses disadvantages, such as underwriters' discounts and commission and offering expenses; and (4) market pressure disadvantages, whereby the market places too much pressure on short-term results to maintain stock prices, forging risk necessary for future success.

To overcome reasons (1), (2) and (3) associated with the first-day return, some researchers have suggested extending 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 that includes both first-day and post-day returns. Thus, both the first-day return and the post-day listing return have been used to measure short-run market performance (Aktas, Karan & Aydogan 2003; Finn & Higham 1988; Kenourgios, Papathanasiou & Melas 2007; Sohail, Raheman & Durrani 2010). Other researchers have argued that short-run market performance should be evaluated using the opening price performance, which splits the first-day return into two parts, the first-day primary market return (PRIM) and the secondary market return (SECON), and thus overcomes reasons (4) and (5). The PRIM covers the period from the issuing date to the beginning of the listing date, and the SECON covers from the beginning to the end of the listing date. Accordingly, Aggarwal and Conroy (2000), Barry and Jennings (1993), Bradley et al. (2009), Chang et al. (2008), Edwards and Hanley (2010) and Schultz and Zaman (1994) used the opening price performance, which includes primary (offer-to-open) and secondary (open-to-close) market returns (MRs). However, a review of past Australian IPO studies has indicated that short-run market performance has not yet been evaluated by the first-day PRIM, the SECON, the total MR and the post-day listing return. This type of IPO short-run market performance analysis could provide information that is more valuable for investors.

Underperformance of IPOs is generally accepted as typical of long-run market performance, but it is not as widespread as short-run underpricing of IPOs. Long-run underperformance indicates that the subsequent share prices are often lower than the first trading day prices, which provides negative abnormal returns for investors in the long run. Long-run market performance is a debatable issue among financial researchers as shown by the conflicting results and controversial findings they have obtained. Some researchers have found that IPOs underperform marginally or have no abnormal performance in the long run, which implies that the market is efficient because the results do not reject the market efficiency hypothesis in the long run (Gompers & Lerner 2003; Ibbotson 1975; Jenkinson & Ljungqvist 2001). Others have reported that IPOs overperform or do not underperform in the long-run market (Bird & Yeung 2010; Da Silva Rosa, Velayuthen & Walter 2003; Thomadakis, Nounis & Gounopoulos 2012). Some have argued that underperformance disappears when different measures of performance or methodology are used (Abukari & Vijay 2011; Ahmad-Zaluki, Campbell & Goodacre 2007; Gompers & Lerner 2003; Kooli & Suret 2004). The remaining researchers have found that IPOs underperform considerably in the long-run IPO market (How 2000; Lee, Taylor & Walter 1996; Ritter 1991). These contradicting outcomes regarding long-run market performance were the motivations for the current study.

To identify IPO market performance and its determinants, this research evaluated (1) the short-run market performance of 254 Australian IPOs by industry, issue year and listing year using the first-day PRIM, SECON, total MR and post-day listing return with the aid of binary (logit and probit) and multiple regression models and a marginal probability analysis (in Chapter 4) and (2) the long-run market performance of 249 Australian IPOs by industry and issue year with the aid of binary (logit and probit) and multiple regression models and marginal probability analysis (in Chapter 5).

This section presents the background information related to the research. The remainder of the discussions in this chapter are given in Figure 1.1.

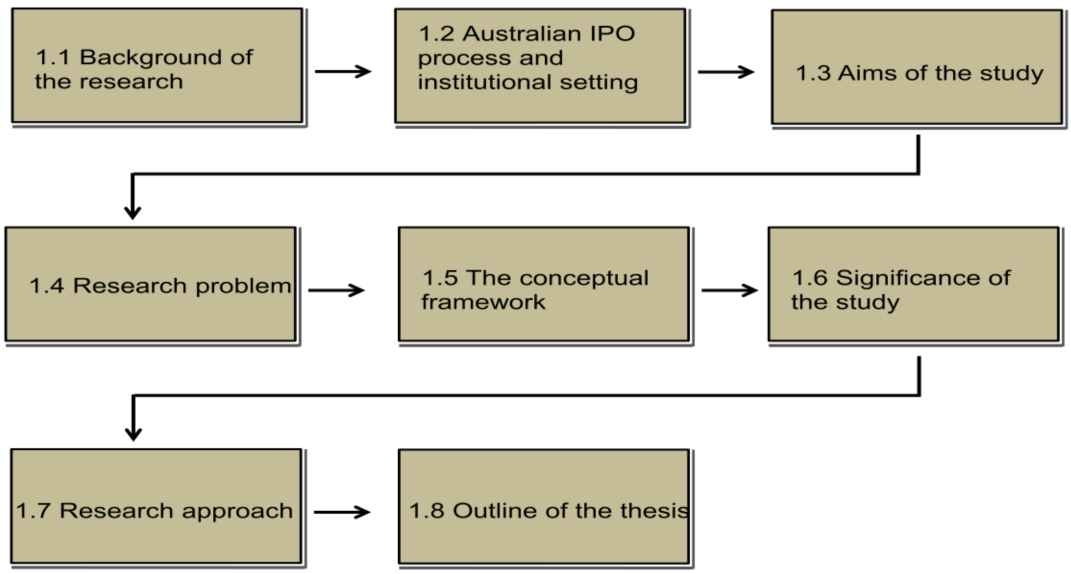


Figure 1.1: Organisation Flow of Chapter

1.2 Australian IPO Process and Institutional Setting

The Australian Securities Exchange (ASX) was established in July 2006 after the Australian Stock Exchange and the Sydney Futures Exchange were merged. The ASX is known as the major financial market in Australia for equities and derivatives, and is one of the world's top-10 listed exchange groups based on its market capitalisation of floating capital. The ASX is also considered one of the leading global share markets because over 42% of ASX's market capitalisation is currently owned by international investors. Around 40% of the current compulsory superannuation levy (9% of every working Australian's annual gross income) and 41% of Australia's population have invested in the Australian share market. More than one-third of all ASX listed companies are in the resources industry (energy, metals and mining), and this industry is considered the heart of the Australian economy. Other important industries are financials, consumer discretionary, consumer staples, industrials, health care, information technology, materials (excluding metals and mining), telecommunication services and utilities.

Many privately owned companies in Australia have transformed into publically owned companies by listing their shares on the ASX with a view to acquiring more funds. This is known as a float or an IPO. The IPO process in Australia and its institutional setting are briefly discussed below.

1.2.1 IPO Process

The IPO process in Australia (Australian Securities Exchange 2009, p. 16) is shown in Figure 1.2.

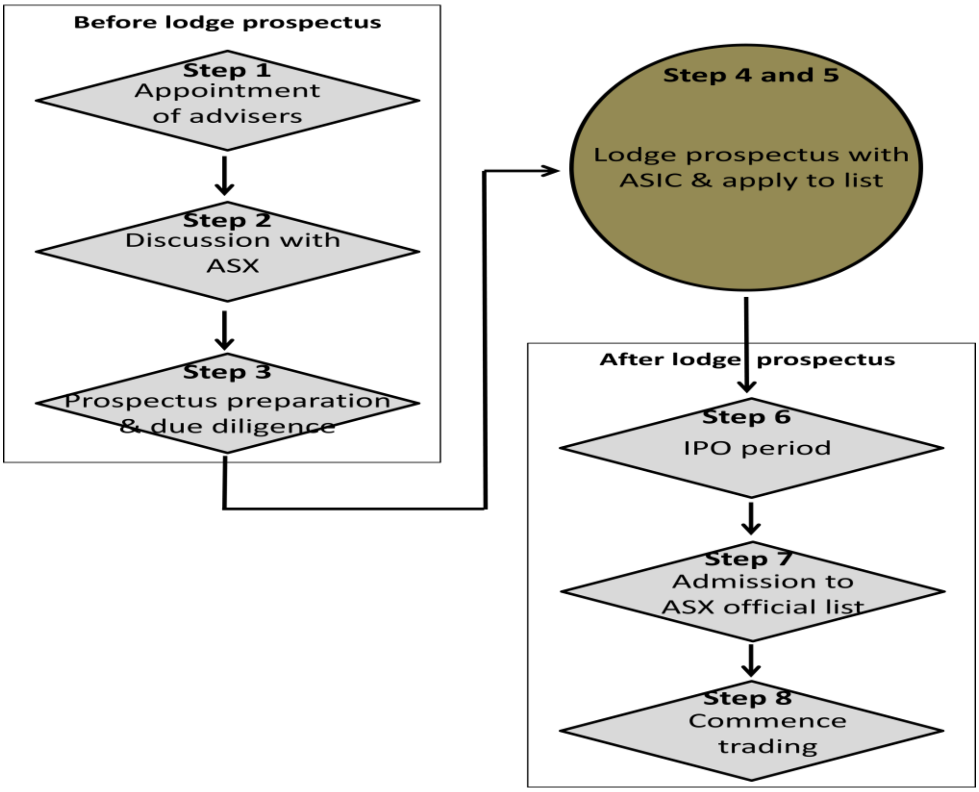


Figure 1.2: IPO Process in Australia

1.2.1.1 Step 1: Appointment of advisors

The company needs to have advisors and consultants who provide professional advice in relation to such issues as corporate structure, prospectus, legal matters, financial and marketing matters, and public relations. The key advisors are corporate advisors, stockbrokers and investment banks, underwriters, lawyers, accountants, share registries, communication and investor relation consultants, and other experts such as geologists and valuation experts. Corporate advisors, stockbrokers or investment bankers, and underwriters are important players in any type of IPO because they ensure that the IPO company's business and management are suitable for a listing. Corporate advisors provide advice on the corporate and strategic implications of an IPO company and, in some cases, corporate advice is provided by an underwriter. Stockbrokers and investment banks provide advice related to the management of the listing process, including company and industry analyses, offer price and number of shares, company valuation, identification of investors and marketing of the IPO. Underwriters agree to purchase any number of shares not taken by investors under the IPO issue. An underwriter is necessary because all minimum shares must be sold by the issuing company before starting trading on the ASX. However, there is no specific requirement to appoint underwriters other than for receiving a shortfall minimum subscription. However, many IPOs on the ASX are underwritten. Stockbrokers, investment banks and other financial institutions normally provide underwriting services. Finally, the issuing company must choose quality professional advisors with a wide range of experience in IPOs.

1.2.1.2 Step 2: Discussion with Australian Stock Exchange (ASX)

There are numerous regulatory, structural and organisation constitutional issues that companies need to be aware of before listing, including those relating to constituent documents, listing timetables, escrow of securities, management contracts and related party transactions. In conjunction with their advisors, companies should try to discuss these matters with the ASX at the earliest opportunity.

1.2.1.3 Step 3: Preparation of prospectus and due diligence

A prospectus must be issued before a company lists on the ASX. A prospectus must contain all of the information that its investors and advisors require and expect with a view to making an informed decision on whether to participate in the IPO. To enable investors to make an informed investment decision, it should contain information such as the company's background and prospects, management structure, details of the offer, financial status, material contracts, proposed application of the funds and expert reports. The prospectus information is subject to the listing rules of the ASX and the Corporations Act 2001.

The due diligence process is integral to the preparation of the prospectus and normally informs all parties concerned of their legal responsibilities, the structure of the transaction and the content of the prospectus. This process enables an examination of the company and detailed verification of the information disclosed in the prospectus. The process is carried out by key participants in the IPO process, including directors and senior management of the company, underwriters, lawyers and accountants. A properly conducted due diligence process may also provide a statutory defence against potential liability arising under the Corporations Act.

1.2.1.4 Steps 4 and 5: Lodging of prospectus and list application

After the prospectus is prepared, it must be lodged with the Australian Securities and Investments Commission (ASIC), which is the government body responsible for regulating and enforcing company and financial services law. After lodgement, the prospectus is subject to an ‘exposure period’, which lasts a minimum of seven days. During the exposure period, a company cannot accept public subscriptions, but the prospectus is available to potential investors. However, formalised pre-selling of the issue is prohibited until the prospectus is registered. Having lodged the prospectus with ASIC, the company is now able to submit the listing application to ASX.

1.2.1.5 Step 6: IPO period

After lodgement of the prospectus with ASIC, the company declares the start of the offer. The offer is generally open to investors for three to four weeks, which is considered the IPO period (IPOP). The IPOP begins when the exposure period ends, and this period can be extended by the directors of the company. During the IPOP, the company normally conducts a marketing campaign to attract potential investors, particularly institutional investors, and this is known as a roadshow.

1.2.1.6 Step 7: Admission to ASX Official List

Once the listing application has been lodged with the ASX, additional information may be required to ensure that investors have sufficient information to make an informed decision about whether to invest. Usually the ASX will grant admission to the official list subject to the satisfaction of certain conditions, including completion of the IPO capital raising.

1.2.1.7 Step 8 Commencement of trading

Once all conditions have been satisfied, the company can commence its share trading on the ASX.

1.2.2 Institutional Setting

According to the IPO process in Australia, when a company has lodged its prospectus with ASIC, it officially announces the opening of its offer. Companies in Australia use a variety of offering methods in issuing new shares. Two of the methods used are ‘open’ price offers and ‘fixed’ price offers. The open price offer is called a book building offer and is normally used for larger listings. This price is determined for the institutional offer, which is either open or set within a range of prices (e.g. $0.20 to $1.50). However, the final price for the institution offer is determined using the book building process. Compared with the open price offer, the fixed-price offering is a more widely used method in Australia. Under this offering, the price is set as a fixed issue or subscription price, which is quoted in the prospectus and remains unchanged until completion of the offer. This pricing method is normally underwritten with the PRICE for the shares fixed in the company’s prospectus. However, the final PRICE is determined by the underwriter/corporate advisor using market research. The final PRICE is calculated by comparing it with the industry benchmark, which is normally discounted by 10% to 15% (PricewaterhouseCoopers 2011, p. 21). According to the listing requirement of the ASX, the minimum PRICE of an offer is A$0.20.

The underwriter, stockbrokers and investment bankers, and corporate advisors will, in some cases, be the same party and, in other cases, separate parties. Though there is no specific requirement to appoint an underwriter, many Australian IPOs on the ASX are underwritten. Australian underwriters are involved through a ‘standby’ agreement. According to this agreement, underwriters purchase at the PRICE the shortfall shares that are not taken by IPO investors. This agreement is similar to the firm efforts underwriting method used in the United States. However, US IPOs can also use different forms of agreement involving underwriters such as best-efforts underwriting and firm efforts underwriting. Ritter (1987) found that risky IPOs involve best-efforts underwriting to reduce the winner’s curse faced by uninformed investors. The winner’s curse is a problem whereby informed investors do not give uninformed investors a chance to invest when the offer is attractive and they withdraw from the market when the offer is unattractive. Suchard and Singh (2007) argue that, in comparison with best-efforts underwriting, risk related to the offer (due to the shortfall subscription) is created by the underwriter under the standby agreement or firm efforts underwriting. Otherwise, the offer is withdrawn by an issuer if there is any shortfall in the minimum subscription. Therefore, the standby agreement leads to an increase in the chance that a winner's curse will be faced by uninformed investors (Lee, Taylor & Walter 1996).

The timing and cost of the new issue listing are very important aspects in Australian IPOs. Appendix 1 shows that Steps 3 to 8 in the IPO process normally involve a 100-day (20-week) listing period and, after lodging the prospectus with ASIC (from Steps 4 to 8), there is a 45-day (nine-week) listing period. The elapsed time between lodging the prospectus and listing is considered an important determinant of IPO market performance because (1) it measures the uncertainty and risk of both issuers and subscribers (Chen, Firth & Kim 2004; Ekkayokkaya & Pengniti 2012; How, Lam & Yeo 2007; Lee, Taylor & Walter 1996; Mudambi et al. 2012; Suchard & Singh 2007), (2) it is related to the level of informed demand (Brooks et al. 2009; How 2000; Lee, Taylor & Walter 1996) and (3) it shows the time it takes for the issue to sell (Lee, Taylor & Walter 1996). According to past studies in Australia, the average listing time period varies from 50 to 60 days (Brooks et al. 2009; How 2000; Lee, Taylor & Walter 1996; Suchard & Singh 2007). However, the average listing period differs across countries, and China has the longest listing period compared with others (Guo & Brooks 2009). The cost of listing on the ASX is substantial and includes two main parts: monetary costs and non-monetary costs (PricewaterhouseCoopers 2011, p. 16). The monetary costs includes fees for the appointment of advisors and experts such as lawyers, corporate advisors, underwriters and accountants, and other costs such as ASX, legal, experts, registry and printing fees. Normally, the underwriting and broking fees for listing vary from 2% to 8% of the amount raised, and other costs vary from $300,000 to $800,000, depending on the size of the company and its business. Dimovski and Brooks (2007) have documented that the average costs of underwriting, legal, accounting and valuation are 3.3%, 0.39%, 0.23% and 0.12% respectively. How and Yeo (2000) also reported an average underwriting fee of 3.7% for industrial IPOs. Ritter (1998) reported that the average direct issue cost of going public is 11% in the United States. Non-monetary costs are incurred in presenting investor roadshows, assisting with the disclosure document and dedication of senior management to the process. In addition to the above two costs, the ASX charges fees for general admission, such as the in-principle decision fee, initial listing fee, other administrative and related fees.

The ASX restricts insider selling or transfer of founders' shares for up to two years (PricewaterhouseCoopers 2011, p. 25). This is known as 'escrow'. Escrow is a mandatory restriction on insider selling or transferring shares of original owners that was created to protect the integrity of the market and applied to speculative or businesses without an established track record. The escrow restriction in the ASX unduly supports the explanatory power of the signalling hypothesis based on insider ownership that signals about company value. Leland and Pyle (1977) suggest that greater percentage ownership by insiders is a positive signal about the company, since insiders are assumed to have superior information about expected future cash flows. However, this mandatory restriction does not work in the following situations: (1) if a company gained admission to the ASX under the 'profit test' and (2) if founding shareholders voluntarily submit their shares to escrow in agreement with the underwriter (the terms of voluntarily escrow differ from mandatory escrow). Therefore, some past studies have argued that original ownership does not show any consistent indication because founders sell in the secondary market (Gale & Stiglitz 1989).

Most of the IPOs are set at a fixed price and quoted in the prospectus prior to listing because underwriting agreements are normally signed five to six weeks before the listing on the ASX. In contrast, US IPOs normally set the subscription price one week prior to listing because they wait until offers have been received from potential subscribers. Ritter (1987) found that, as a result, US IPOs face relatively low price uncertainty in setting the subscription price, and the expected level of underpricing is generally lower. Lee, Taylor and Walter (1996) argued that the Australian price setting increases heterogeneity in information availability between classes of investors. The pre-selling restriction also enhances heterogeneity in information between informed and uninformed investors. Allen (1987) observed that most of the IPO shares go to preferred clients of the underwriting stockbrokers in Australia. Further, Aggarwal, Krigman and Womack (2002) argued that institutional investors are able to earn profit from the favourable allocation of underwriters and informational advantage, particularly from private information such as the final offer price. Because of information heterogeneity, the expected level of underpricing in Australia is normally higher.

1.3 Aims of the Study

The main aim of this research is to evaluate the short-run and long-run market performance and identify the determinants of Australian IPOs.

The specific aims of the study are as follows:

1. to investigate whether Australian IPOs are underpriced in the short run
2. to identify the major determinants of short-run market performance
3. to analyse whether Australian IPOs underperform in the long run
4. to identify the key determinants of long-run market performance
5. to examine whether IPO market performance varies by applying different methodologies such as performance measures, approach, weighting scheme, period, industry, issue year and listing year
6. to discover whether determinants of the IPO market performance are sensitive to the developed econometric models and the dependent variables.

1.4 Research Problem

To achieve the above-mentioned aims, this study seeks to answer the following research questions:

Research Question 1 (RQ_1)

Are IPOs in Australia underpriced in the short run?

Research Question 2 (RQ_2):

What are the main determinants of short-run market performance of Australian IPOs?

Research Question 3 (RQ_3)

Do IPOs in Australia underperform in the long run?

Research Question 4 (RQ_4)

What are the major determinants that affect the long-run market performance of Australian IPOs?

Research Question 5 (RQ_5)

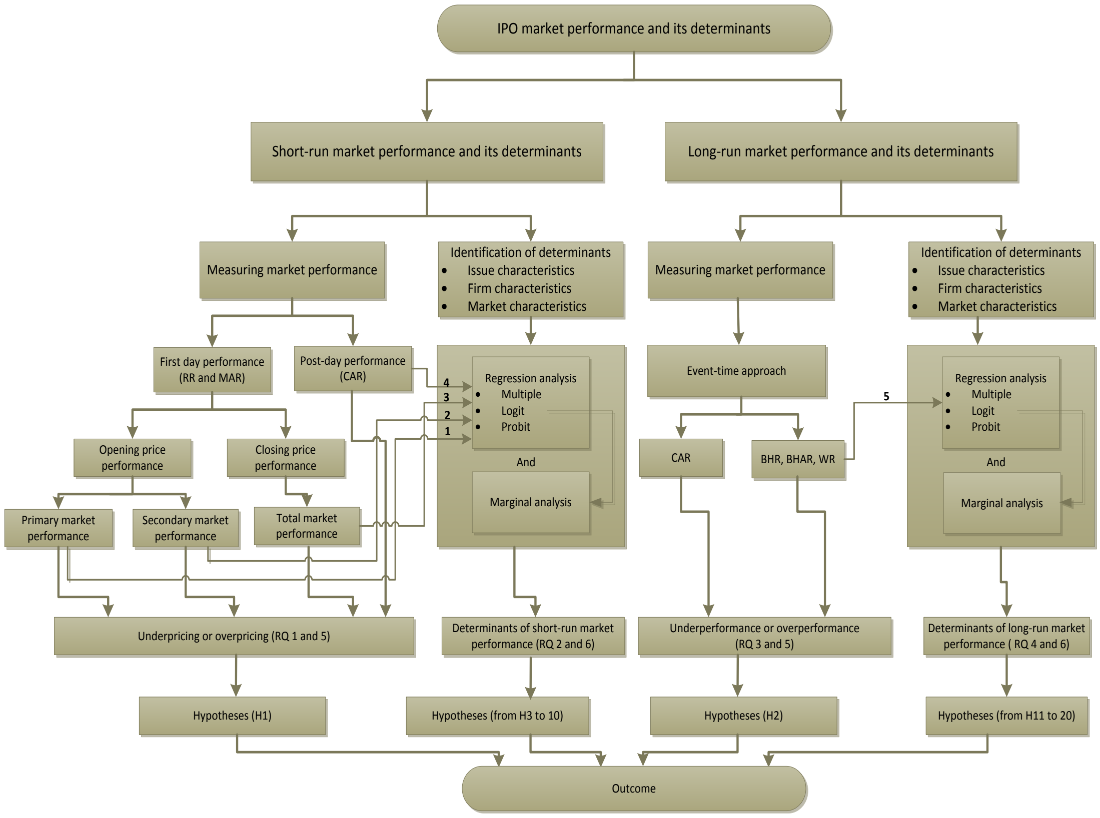
Do the results for RQ_1 and RQ_3 vary by applied methodology, industry, issue year and listing year?

Research Question 6 (RQ_6)

Do the determinants of short-run and long-run market performance for RQ_2 and RQ_4 vary by the developed econometric models and the dependent variables?

1.5 The Conceptual Framework

Figure 1.3 explains the conceptual framework of the research. It shows how the IPO market performance is evaluated and its determinants are identified under two time periods: short run and long run. The short-run market performance is measured using both the first-day and post-day performance measures. The first-day performance measures are the raw return (RR) and the market-adjusted abnormal return (MAR). The post-day performance measure is the cumulative abnormal return (CAR). Further, the study identifies the first-day performance based on two prices: the opening price performance and closing price performance. The opening price performance is again identified under the first-day primary market performance and the secondary market performance. The closing price performance is known as first-day total market performance. Finally, the study provides answers for RQ_1 and RQ_5 by evaluating the performance of the following short-run markets: primary, secondary, total market and post-day. The answer for RQ_1 will decide whether the developed hypothesis 1 (H1) (see page 124) is consistent with the literature.



Note: **RR** = Raw return, **MAR** = Market-adjusted abnormal return, **CAR** = Cumulative abnormal return, **BHR** = Buy-and-hold return, **BHAR** = Buy-and-hold abnormal return, **WR** = Wealth relative, **1** = Short-run primary market model, **2** = Short-run secondary market model, **3** = Short-run total market model, **4** = Short-run post-day market model and **5** = Long-run regression models for years 1, 2 and 3 considering BHR and BHAR as dependent variables.

Figure 1.3: The Conceptual Framework

The long-run market performance is measured using the event-time approach. Under this approach, the study measures the long-run performance using CAR and buy-and-hold assumption-based return measures, raw buy-and-hold return (BHR), buy-and-hold abnormal return (BHAR) and wealth relative (WR). These long-run performance measures are normally calculated under equally weighted (EW) and value-weighted (VW) schemes considering the market capitalisation. Evaluating long-run market performance using these measures provides answers for RQ_3 and RQ_5. The answer for RQ_3 determines whether the developed hypothesis 2 (H2) (see page 125) can be accepted.

The identification of determinants in relation to the IPO market performance is also shown in Figure 1.3. Determinants of the short-run and long-run market performance are identified based on the issue, firm and market characteristics using regression analysis and marginal analysis. The study uses multiple regression and binary regression models probit and logit. Marginal analysis is based on logit regression analysis, which estimates the marginal probabilities associated with determinants. This study estimates the short-run regression models primary market model (shown as 1), secondary market model (shown as 2), total market model (shown as 3) and post-day market model (shown as 4), considering each MR (MAR and CAR) as a dependent variable. Marginal probability is also estimated for the determinants of the estimated short-run logit regression models. The study provides answers for RQ_2 and RQ_6 after identifying the determinants of the short-run market performance. The answer for RQ_2 will decide whether the developed hypotheses 3 to 10 (H3 to H10) (see pages 129 to 131) are consistent with the literature. The developed hypotheses are the Rock hypothesis, signalling hypothesis, uncertainty hypothesis and agency cost hypothesis.

Long-run regression models are estimated for years 1, 2 and 3, considering BHR and BHAR as dependent variables (shown as 5). Marginal probability is also estimated for the determinants of the estimated long-run logit regression models. The study provides answers for RQ_4 and RQ_6 after identifying the determinants of the long-run market performance. The answer for RQ_4 will decide whether the developed hypotheses 11 to 20 (H11 to H20) (see pages 131 to 132) are accepted. The developed hypotheses are the signalling hypothesis, uncertainty hypothesis, overoptimistic hypothesis and window of opportunity hypothesis.

The evaluation of the market performance of IPOs in Australia will have important implications for the decisions of investors, market analysts, academic researchers and the ASX. This study also contributes to the developed-market literature on IPO performance and to the Australian IPO literature.

1.6 Significance of the Study

The study mainly contributes to knowledge and practice by examining the short-run and long-run market performance of Australian IPOs, in particular, by analysing different approaches, which can provide valuable information to investors, security analysts, companies, IPO researchers and the ASX.

First, discovering the determinants of IPO market performance with marginal probability is a new contribution to the IPO literature because no published studies have been found that have applied this theoretical concept to IPOs. Marginal probability shows the probability that measures directional changes in short-run and long-run market performance, which provides the associated risk of the determinants. This is more important for IPO investors and market analysts because it answers the following question: what is the probability that changes in determinants are instrumental in causing price increases (underpricing or overperformance) or price decreases (overpricing or underperformance)? In addition, it is important because changes in economic and financial factors cause higher uncertainty in the IPO market.

Second, although short-run markets have been analysed using opening price performance in non-Australian studies, a review of past Australian IPO studies has indicated that no Australian studies have evaluated short-run market performance using opening price performance measures. Therefore, the significance of this study lies in its evaluation of short-run market performance based on both the first-day PRIM and the first-day SECON. This type of analysis is more important for the IPO literature in Australia for the following reasons: (1) there is variation in the opening and closing price levels of the very first trading day, which indicates that there is more uncertainty about the short-run market performance of IPOs, and (2) it will identify who gains the benefits of IPO underpricing.

Third, little attention has been paid to analysing short-run market performance using both the first trading day return (closing price performance) and the post-day listing return, particularly in Australia. Analysing the short-run market performance based only on the first-day return may not provide sufficient information to investors for the following reasons: (1) the investors will know little about the newly listed companies (because of information heterogeneity due to the IPO institutional setup in Australia), (2) the motives of speculative investors on the very first day to earn higher profit and (3) the market needs to have a reasonable time period to settle down in the short run. To overcome problems associated with the closing price performance (first-day return), both the first-day return and the post-day listing return should be used to measure short-run market performance.

Fourth, determinants such as the IPOP and working capital recovery (WICP) have not been considered as explanatory variables of IPO market performance in previous Australian studies. Inclusion of these determinants will make another contribution to the Australian IPO literature.

1.7 Research Approach

To achieve the aims of this research, the study uses a quantitative approach, as suggested by the IPO literature, with secondary data, which normally focus on hypothesis and theory testing. A quantitative approach is considered a concept of positive philosophy and a deductive approach.

The study analyses the short-run performance of 254 Australian IPOs that listed during 2006 to 2011 by industry, issue year and listing year, using both first-day returns and post-day listing returns. The first-day returns are divided into the primary market, which is calculated based on the first-day beginning prices and 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 PRICEs. The PRIM and SECON are based on the first-day beginning price, and they are called the opening price performance based measures. The total MRs are known as the closing price performance based measure because they are considered the closing price for the return estimation. The post-day listing returns are calculated for up to nine trading days after the first trading day.

The long-run performance of 249 Australian IPOs is analysed over a three-year period by industry and issue year using the event-time approach. The event-time is a widely accepted approach in the IPO literature to examine long-run market performance. Under this approach, the long-run market performance measures CAR, and BHRs are calculated using monthly EW and VW schemes up to the three-year post-listing period.

To identify the determinants of the short-run and long-run market performance of the IPOs, this study estimates binary and multiple regression models with offer, firm and market characteristics. Marginal probability analysis is also carried out to estimate the probability associated with each determinant. The study tests 20 hypotheses in relation to the market performance.

1.8 Outline of the Thesis

The purpose of this section is to provide a brief outline of the organisation of the thesis, as shown in Figure 1.4.

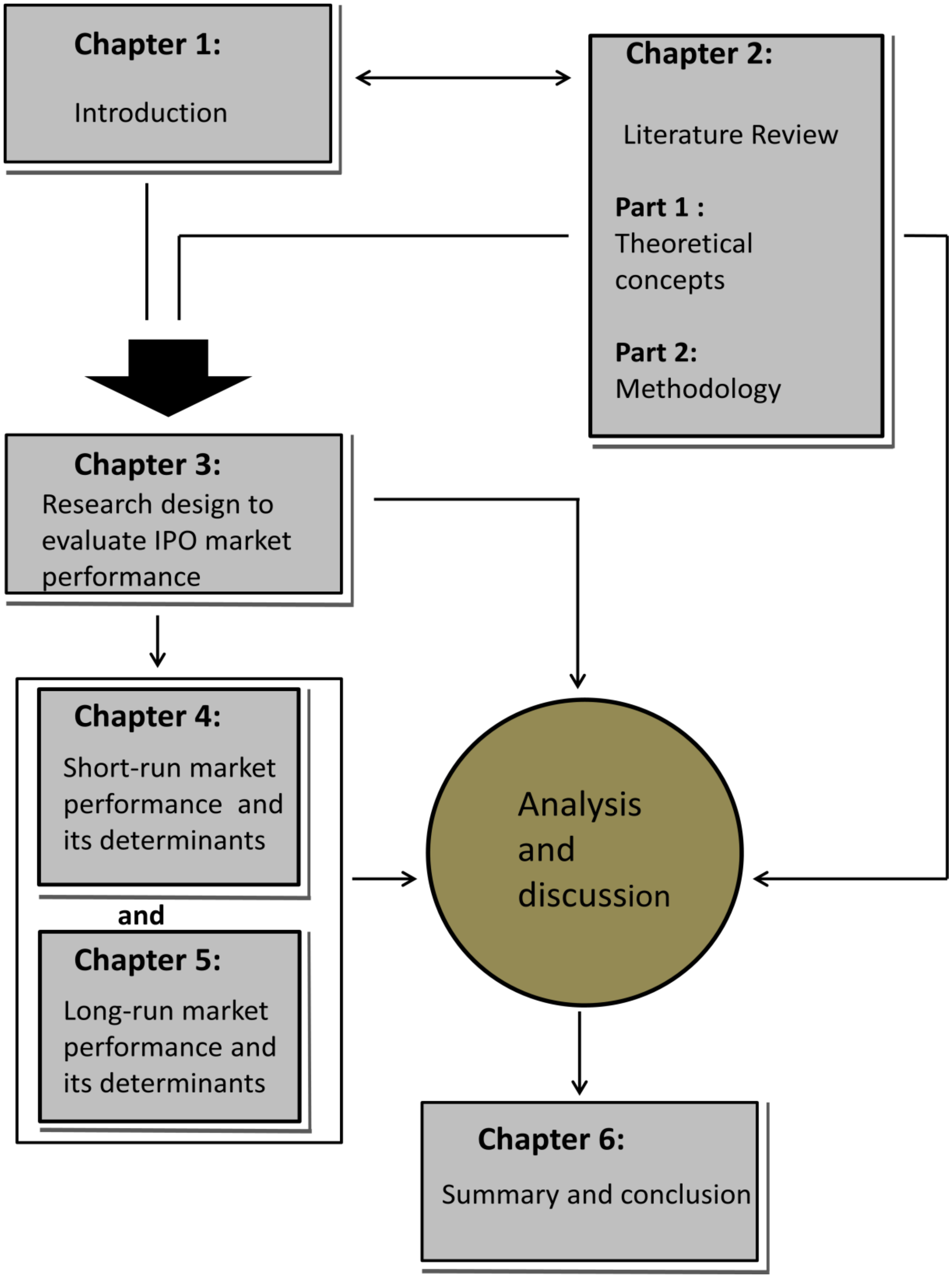


Figure 1.4: Outline of the Thesis

Chapter 1: Introduction

The first chapter provides an introduction to the research, explaining the background, the Australian IPO process and institutional setup, the research aims, the research problems, the conceptual framework, the study's significance, the research approach and the organisation of the thesis.

Chapter 2: Literature Review

The second chapter presents a review of the literature related to the short-run and long-run market performance of IPOs. The review comprises two parts. The first part explains the literature related to the theoretical concepts and findings that provided the knowledge for the development of the research questions, hypotheses and aims of the study. The second part explains the methodologies used in previous studies in IPO market performance, which were useful for developing the research methodology presented in Chapter 3. Finally, the chapter summarises and identifies gaps in the literature.

Chapter 3: Research Design to Evaluate IPO Market Performance

The third chapter presents the methodology used to evaluate the short-run and long-run market performance of IPOs and to identify its determinants.

Chapter 4: Analysis and Discussion: Short-Run Market Performance and Its Determinants

Chapter 4 presents the analysis and discussion of the short-run market performance and its determinants. The short-run market performance is analysed by full sample, industry, issue year and listing year using the first-day primary market, secondary market, total market and post-day listing returns. Determinants of the short-run market performance are identified using binary and multiple regression models. Marginal analysis is also used to identify the probability associated with determinants for the directional changes in the short-run market performance.

Chapter 5: Analysis and Discussion: Long-Run Market Performance and Its Determinants

Chapter 5 presents the analysis and discussion of the long-run market performance and its determinants. The long-run market performance is analysed by full sample, industry and issue year using performance metrics over periods varying from one to three years. The determinants of the long-run market performance are identified with the aid of binary and multiple regression models. Marginal analysis is used to identify the probability associated with determinants for the directional changes between long-run underperformance and overperformance.

Chapter 6: Summary and Conclusion

Chapter 6 presents an overall summary of the study, its conclusions based on the findings in Chapters 4 and 5, and the implications of the study. Also discussed are the limitations of the study and some suggestions for further research.

Chapter 2: Review of Literature on IPO Market Performance

2.1 Introduction

This chapter reviews the existing literature related to the market performance of IPOs. The review is divided into two parts. The first part explains the literature related to the theoretical concepts and findings that provided the knowledge for the development of the research questions, hypotheses and aims of the study. The first part comprises six sections. The first section (Section 2.2) provides an overview of the market performance of IPOs. The second section (Section 2.3) examines the empirical evidence on the initial or short-run market performance of IPOs. The third section (Section 2.4) explains why IPOs are underpriced in the short run, using theory and empirical research. The fourth section (Section 2.5) examines the empirical evidence on the post or long-run market performance of IPOs. The fifth section (Section 2.6) discusses why IPOs underperform in the long run using theory and empirical research. Finally, the sixth section (Section 2.7) briefly explains the ‘hot issue’ market phenomenon.

The second part of this chapter explains the methodologies used in previous studies in IPO market performance that were useful in developing the research methodology for this study. The second part has two sections. The first section (Section 2.8) examines the empirical evidence related to the methodology on the initial or short-run market performance of IPOs. The second section (Section 2.9) explains the empirical evidence related to the methodology on the post or long-run market performance of IPOs.

The final sections summarise the literature review (Section 2.10) and identify gaps in the research on IPO market performance (Section 2.11). The identification of research gaps provided the direction for the development of the research questions, aims and methodology of this study.

Part 1: Theoretical Concepts and Findings

2.2 Overview of IPO Market Performance

Ritter and Welch (2002) reviewed previous IPO studies and classified them into the three categories of IPO activity, pricing and allocation. They discussed all available research evidence under the following areas: IPO activity, including why firms go public; IPO pricing and allocation of shares, including why they reward first-day investors with considerable underpricing; and how IPOs perform in the long run. The pricing and price performance of IPOs was examined using stock price returns, which were calculated using stock market prices. On the first day, IPO investors earn high returns, and this is defined as short-run underpricing. In the subsequent periods, investors do not earn positive returns, and this is defined as long-run underperformance or overpricing. The price performance of IPOs is considered the market performance of IPOs, which includes both short-run underpricing and long-run underperformance.

Much attention has been paid to the evaluation of market performance of IPOs by major players in the IPO process such as issuers, underwriters or investment bankers, and investors; their objectives are to maximise their investments, proceeds or shares. For example, investors who are involved in this process try to maximise their wealth (maximise share price performance) and issuing companies engage with a view to maximising their proceeds. The evaluation of IPO market performance helps them to achieve their personal financial goals.

The IPO literature has identified three major phenomena in relation to the market performance of IPOs. Ritter (1991) documented these three phenomena in his study as follows:

- the short-run underpricing phenomenon
- the long-run underperformance phenomenon
- the ‘hot issue’ market phenomenon.

The phenomenon of positive stock returns earned by initial investors on the very first day of listing is known as short-run underpricing by which first-day listing prices are higher than the issuing prices. The underpricing phenomenon was first documented by Stoll and Curley (1970), Logue (1973) and Ibbotson (1975). These studies used the first-day return to measure the short-run underpricing.[2] Sections 2.3 and 2.4 discuss the literature evidence and reasons for the short-run underpricing phenomenon.

Earning negative stock returns in the long run by investors is known as long-run underperformance; in this case, subsequent stock prices are lower than the initial-day prices. Ritter (1991) initially examined the underperformance (overpricing) phenomenon in the finance literature, and it was later explored by other researchers (Abukari & Vijay 2011; Ahmad-Zaluki, Campbell & Goodacre 2007; Ajlouni & Abu-Ein 2009; Bird & Yeung 2010; Gompers & Lerner 2003; Kooli & Suret 2004; Moshirian, Ng & Wu 2010; Omran 2005; Thomadakis, Nounis & Gounopoulos 2012). Section 2.5 and 2.6 explain the literature evidence and reasons for the long-run underperformance phenomenon.

The cyclical behaviour of short-run underpricing is known as the ‘hot issue’ market phenomenon and is considered a further extension of short-run underpricing. The hot issue market (HM) phenomenon was introduced to the finance literature by Ibbotson and Jaffe (1975), and their hypothesis has been tested by many researchers in different parts of the world (Brailsford et al. 2004; Guo, Brooks & Shami 2010; Ibbotson, Sindelar & Ritter 1988; Loughran & Ritter 2002a; Lowry 2003; Lowry, Officer & Schwert 2010; Lowry & Schwert 2002; Ritter 1984). Section 2.7 briefly discusses the literature related to the HM phenomenon.

2.3 Evidence on the Short-Run Underpricing Phenomenon

Dimovski and Brooks (2004) stated that the PRICE of a newly listed company’s shares being below the price at which the shares subsequently trade is known as underpricing. The terms first-day returns and underpricing are used interchangeably by academics (Ritter & Welch 2002). The high returns achieved by investors on the very first day of a company’s shares being listed on a stock exchange have been reported historically (McDonald & Fisher 1972; Reilly & Hatfield 1969). The underpricing of IPOs has been

[2] First-day initial return is used instead of underpricing. The positive return (negative) average return of the first listing day is known as underpricing (overpricing).

widely documented in the finance literature and it appears to be a short-run phenomenon.

Extensive research on this phenomenon indicates that, on average, investors outperform (underprice) in the market, and therefore, underpricing has been a persistent empirical phenomenon for many decades (see Table 2.1). Moshirian, Ng and Wu (2010) examined the price performance of a selected sample of 4,439 IPOs from advanced and emerging Asian markets from 1991 to 2004. Their study provides a comparative assessment on the short- and long-term stock performance of Asian and developed countries. The findings show that initial underpricing in the emerging Asian markets of China (202.63%), Korea (70.3%) and Malaysia (61.81%) exceeded that of the developed markets of Hong Kong (21.43%), Japan (34.04%) and Singapore (33.10%).

Table 2.1: Evidence on the Short-Run Underpricing Phenomenon

Country	Average initial return (%)*	Sample size	Sample period	Author(s)
Australian				
Australia	29.2	93	1966–1978	Finn & Higham
Australia	11.86	266	1976–1989	Lee, Taylor & Walter
Australia	16.36	523	1979–1989	How & Low
Australia	107.18	130	1979–1990	How
Australia	19.74	340	1980–1990	How, Izan & Monroe
Australia	15.48	313	1976–1993	Balatbat, Taylor & Walter
Australia	25.6	358	1994–1999	Dimovski & Brooks
Australia	25.47	333	1991–1999	Da Silva Rosa, Velayuthen & Walter
Australia	11.96	11	1989–1999	Gong & Shekhar
Australia	33	275	1993–2000	How, Lam & Yeo
Australia	26.72	419	1995–2000	Bayley, Lee & Walter
Australia	48.04	156	1999–2000	Ho et al.
Australia	16.13	260	1994–2004	Nguyen, Dimovski & Brooks
Australia	37.35	68	1995–2004	Bird & Yeung
Australia	28.8**	743	1992–2004	How, Ngo & Verhoeven
Australia	19.8	1103	1976–2006	Lee, Taylor & Walter; Woo; Pham; Ritter
Non-Australian				
Austria	6.5	96	1971–2006	Aussenegg
Belgium	13.5	114	1984–2006	Rogiers, Manigart & Ooghe; ManigartDuMortier; Ritter
Brazil	48.7	180	1979–2006	Aggarwal, Leal & Hernandez; Saito
Canada	7.1	635	1971–2006	Jog & Riding; Jog & Srivastava;Kryzanowski, Lazrak & Rakita; Ritter
Chile	8.4	65	1982–2006	Aggarwal, Leal & Hernandez;Celis & Maturana; Ritter
China	164.5	1394	1990–2005	Chen, Choi, and Jiang
Cyprus	23.7	51	1999–2002	Gounopoulos, Nounis & Stylianides
Egypt	8.4	53	1990–2000	Omran

Finland	17.2	162	1971–2006	Keloharju
France	10.7	686	1983–2006	Husson & Jacquillat; Leleux & Muzyka;Paliard & Belletante; Derrien & Womack; Chahine; Ritter
Germany	25.3	700	1978–2008	Ljungqvist; Rocholl: Ritter; Vismara
Hong Kong	15.9	1008	1980–2006	McGuinness; Zhao & Wu; Ljungqvist &Yu; Fung, Gul & Radhakrishnan; Ritter
India	92.7	2811	1990–2007	Marisetty & Subrahmanyam
Indonesia	21.5	339	1989–2008	Hanafi; Danny; Suherman
Iran	22.4	279	1991–2004	Bagherzadeh
Ireland	23.7	31	1999–2006	Ritter
Japan	40.1	2628	1970–2008	Fukuda; Dawson & Hiraki; Hebner &Hiraki; Pettway & Kaneko; Hamao, Packer & Ritter; Kaneko & Pettway; Ritter; TokyoIPO.com
Jordan	149	53	1999–2008	Marmar
Korea	55.2	1490	1980–2006	Dhatt, Kim & Lim; Ihm; Choi & Heo; Mosharian & Ng; Cho; Ritter
Malaysia	69.6	350	1980–2006	Isa; Isa & Yong; Yong
Mexico	15.9	88	1987–1994	Aggarwal, Leal & Hernandez; Eijgenhuijsen & van der Valk
Netherlands	10.2	181	1982–2006	Wessels; Eijgenhuijsen & Buijs; Jenkinson, Ljungqvist & Wilhelm; Ritter
New Zealand	20.3	214	1979–2006	Vos & Cheung; Camp & Munro; Ritter
Norway	9.6	153	1984–2006	Emilsen, Pedersen & Saettem; Liden; Ritter
Poland	22.9	224	1991–2006	Jelic & Briston; Ritter
Portugal	11.6	28	1992–2006	Almeida & Duque; Ritter
Russia	4.2	40	1999–2006	Ritter
Sri Lanka	34	105	1987–2008	Samarakoon
Singapore	27.4	519	1973–2008	Lee, Taylor & Walter; Dawson; Ritter
South Africa	18	285	1928–2007	Page & Reyneke; Ali, Subrahmanyam & Gleason; Ritter
Spain	10.9	128	1986–2006	Ansotegui & Fabregat; Alvarez Otera
Sweden	27.3	406	1980–2006	Rydqvist; Schuster; Simonov; Ritter
Switzerland	28	159	1983–2008	Kunz,Drobetz, Kammermann & Walchli; Ritter
Taiwan	32.7	1312	1980–2006	Chen
Thailand	36.6	459	1987–2007	Wethyavivorn & Koo–smith; Lonkani & Tirapat; Ekkayokkaya and Pengniti
Turkey	10.6	315	1990–2008	Kiymaz; Durukan; Ince; Kucukkocaoglu
United Kingdom	16.3	4198	1959–2008	Dimson; Levis
United States	16.9	12028	1960–2008	Ibbotson, Sindelar & Ritter; Ritter

Source: The figures were taken from 'Initial Public Offerings: International Insights' by Loughran, Ritter and Rydqvist (1994, updated 2010) and rest of the figures were based on the papers published by the authors.
Note: * The average initial returns are equally weighted average returns, which are calculated using issue prices and first-day listing prices. Some of the returns are raw returns and some are market-adjusted returns.
** The authors have calculated the first-day returns for dividend payers (332) and non-payers (441) as 22% and 32% respectively. Considering these returns, the study recalculated the average first-day return for all sample companies (743) as 28.8% ([22% *332 + 32% * 441]/743).

A study on the listed securities at the Karachi Stock Exchange (KSE) by Sohail, Raheman and Durrani (2010) investigated a sample of 73 IPOs using data for 10 years (2000–2009). The performance of the IPOs was analysed according to different states of the economy: normal, boom and recession. The results showed that the Pakistan IPO market provided positive abnormal returns to investors on a short-run basis, as was observed in other countries. Under normal economic conditions, the average raw return (ARR) of the first day was 43% and the market-adjusted first-day return was 36.75%. Generally, the average market-adjusted return was 42.17%, 40.99%, 37.35%, 38.17%, and 39.38% on the close of the first, fifth, tenth, fifteenth and twentieth day respectively. Further, the findings indicate that, under the boom conditions in 2008, investors could earn a 95.60% market-adjusted return on the very first day.

Chan, Wang and Wei (2004) analysed 570 A class shares and 39 B class shares in Chinese IPOs over the period 1993–1998. A-shares are tradable only by domestic investors and B-shares are tradable only by foreign investors. The findings were consistent with the results from previous studies; they found that there was a huge underpricing of A class shares of IPOs. The average return of an A-share IPO on the first trading day was 178%. In contrast, underpricing for B-share IPOs was much smaller, with an average return of 11.6% on the first day of trading. Further, Banerjee, Hansen and Hrnjic (2009) empirically analysed the cross-country differences in IPO underpricing among 18 countries between 2000 and 2006. They found that, on average, investors overperformed (earning high stock returns) in the short-run IPO market.

Underpricing of IPOs in Egypt was analysed by Omran (2005) using a sample of 53 privatisation IPOs between 1994 and 1998. The study identified that the sample companies' yielded economically and statistically significant initial excess returns in line with the underpricing phenomenon of IPOs, which is widely documented as a universal phenomenon in the finance literature.

The US IPO market has been studied extensively by many researchers over the last two decades. Johnston and Madura (2002) showed that initial returns were more favourable for internet IPOs than non-internet-firm IPOs during the period of 1996 to 2000. In addition, the degree of underpricing (initial return) of internet firms was not significantly different after the demise of the internet sector. They investigated a sample of 366 internet-related IPOs and the average initial return was 78.5%. In addition, Loughran and Schultz (2006) and Ritter and Welch (2002) reported average initial-day returns in the United States of 18.1% and 18.8% respectively. The studies of Ibbotson (1975), Ritter (1987) and Ibbotson, Sindelar and Ritter (1994) reported initial-day returns of between 11.4% and 47.8%.

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

Table 2.1 presents selected empirical evidence on short-run underpricing in Australian and non-Australian studies. According to the table, the level of underpricing in Australia varied from 11.96% to 107.18% in the period 1966 to 2004. Loughran, Ritter and Rydqvist (1994 [updated 2010]) reported that Australian IPOs were underpriced on average by 20% during the period 1976–2006. The level of underpricing in Australia varied according to the sample size and sample period. Most of the higher underpricing levels were reported for a low sample size, except for the study by Gong and Shekhar (2001). Compared with the underpricing levels in developed countries, including European countries, the United Kingdom and the United States, except for Germany, Ireland, Poland and Switzerland, Australian IPOs were underpriced at a higher rate. However, the sample sizes used to calculate average initial returns in Germany, Ireland, Poland and Switzerland were lower than those in Australia. In comparison with the emerging markets of Chile, Egypt, Hong Kong, Mexico and Turkey, the average level of underpricing in Australia was higher. Generally, developed-market underpricing levels were more consistent than those of the emerging markets because they had less variation in average initial returns in the first listing day.

In general, this review of the literature suggests that underpricing (outperforming) of IPO securities in the short run is a universally persistent phenomenon. Ritter and Welch's (2002) study found that approximately 70% of the IPOs ended the first day of trading at a closing price greater than the offer price, whereas 16% had a first-day return of exactly zero. However, very few IPO studies have reported that IPOs were overpriced (underperforming) in the short run (Shaw 1971; Stigler, 1964).

2.4 Reasons for the Underpricing Phenomenon

This section explains the theoretical and empirical background related to short-run underpricing. There are a number of reasons why IPOs are underpriced. The theoretical explanation links with the uncertainty and the information asymmetry among the issuer, the underwriter and the investor. The issuer, underwriter (investment banker) and investor are major players in the IPO process. Section 2.4.1 discusses the theoretical explanation for short-run underpricing and 2.4.2 explains the determinants of underpricing using empirical evidence. The underpricing determinants are used as proxies to explain the theoretical concepts related to underpricing.

2.4.1 Theoretical Explanation for Short-Run Underpricing

Ibbotson (1975) examined the initial market performance on newly issued common stocks that were offered to the general public during the period of 1960–1969. The results indicated that the average initial performance was positive and the sample companies were underpriced by 11.4%. The aim of this study was to determine whether the positive initial performance took place because a low offering price was set or because investors overvalued the new issues. The final results indicated that if there was any departure from efficiency in the market, positive initial performance could only be attributed to the low offering price. The study documented a number of possible explanations for this short-term underpricing under the subtitle of ‘Economic Interpretation of the Results’.

There are three main interested parties in IPOs: issuers, underwriters and investors. Underwriters are the intermediaries between the issuers (funds needers) and the investors (fund suppliers). A primary legal requirement according to the Rules of Fair Practice is that new issues must be offered at a fixed price. Once underwriters are limited to offering new issues at a fixed price according to the law, there is potential for one-sided risks to occur. Therefore, underwriters may break the syndicate once the offering is made and sell the offering at lower than the fixed price that was set for the offering. However, it is not possible to sell any part of the issue above the fixed offering price under strong demand conditions.

Underwriting takes place on either a ‘firm commitment’ or ‘best efforts’ basis. Under the firm commitment basis, the underwriter buys all of the issues from the issuer and subsequently bears all of the risks in selling the issue. Then, the underwriter determines the investors’ purchasing price (fixed offering price), which is equal to the underwriter’s purchasing price from the issuer plus the underwriting spread. In the best-efforts method, the issuer takes the risk of selling the issue at the fixed price, but the underwriter receives the underwriting spread to cover costs.

Ibbotson’s (1975) study suggested the following new scenarios, which were used to explain the underpricing of new issue offerings.

- Regulations require underwriters to set the offering price below the expected value.
- Underpriced new issues ‘leave a good taste in investors’ mouths’ so that future underwritings from the same issuer can be sold at attractive prices.
- Underwriters collude or individually exploit inexperienced issuers to favour investors.
- Firm commitment underwriting spreads do not include all of the risk assumption costs.

- Through tradition or some other arrangement, the underwriting process consists of underpricing offerings with full (or partial) compensation via side payments from investors to underwriters to issuers.
- The issuing company and underwriter perceive that underpricing constitutes a form of insurance against legal suits.

Many of the above reasons that Ibbotson (1975) presented in his study were formally explored by other researchers in later work. Among them, Ritter (1998) explained a number of possible reasons for new issue underpricing based on a number of different theories on various aspects of the relations between investors, issuers and investment bankers (underwriters) who take IPO firms into the public. Further, this study explained that these theories are not mutually exclusive. These short-run underpricing theories are illustrated in Figure 2.1. All of the theories (hypotheses) to explain short-run underpricing are discussed below.

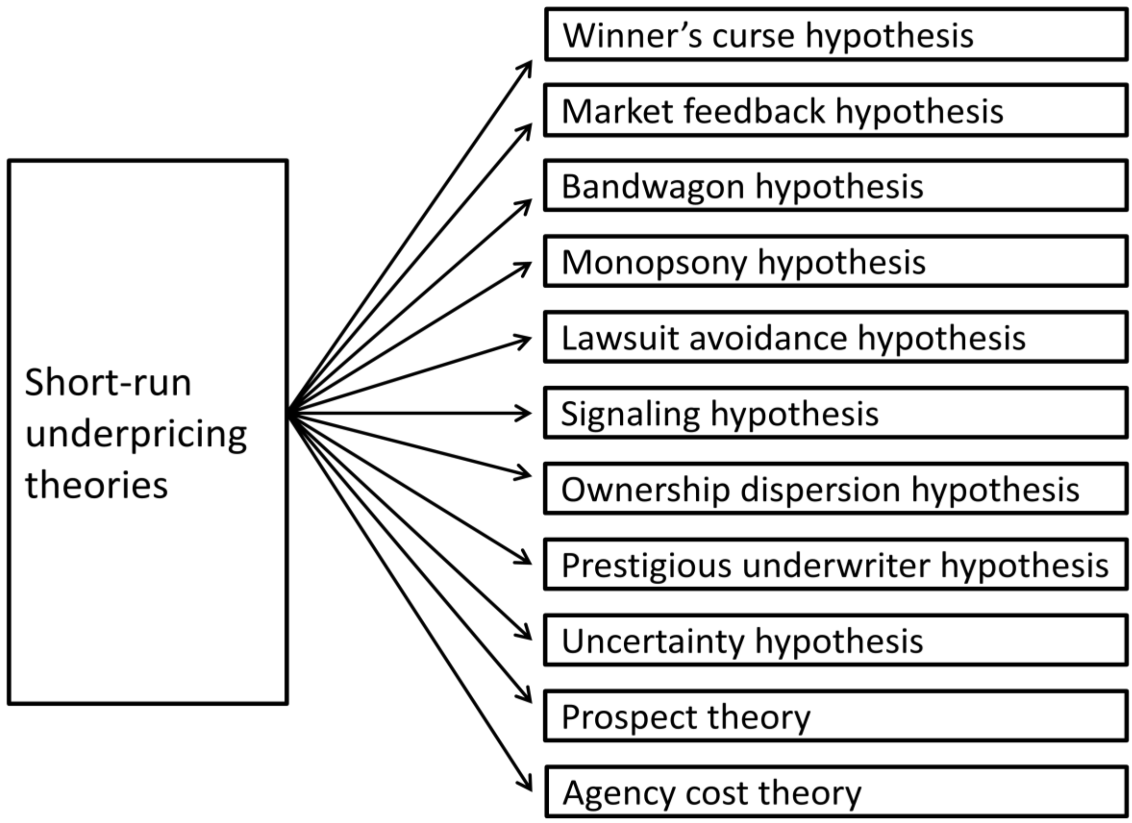


Figure 2.1: Short-Run Underpricing Theories

2.4.1.1 The winner's curse hypothesis

The winner's curse hypothesis assumes that underpricing can be used to attract uninformed investors who would otherwise suffer the 'winner's curse' when trading with informed investors. The winner's curse problem implies that informed investors do not give uninformed investors a chance to invest when an offer is attractive and they withdraw from the market when an offer is unattractive. To encourage participation by uninformed investors, all IPOs must be underpriced or discounted. The following discussion shows how this hypothesis has been tested by researchers in the IPO area.

Numerous studies have tested the winner's curse hypothesis in different countries. The first attempt was made by Rock (1986), who documented that high positive returns in IPOs cannot be realised in practice due to the winner's curse or adverse selection problem. Uninformed investors are allocated a greater number of shares in overpriced IPOs and a smaller number of shares in underpriced IPOs because informed investors will subscribe only for underpriced IPOs. Rock proposed that underpricing was needed to attract uninformed investors. In equilibrium, the first-day returns after adjusting for the allocation rate should equal the risk-free rate. Koh and Walter (1989) studied 66 IPOs on the Singapore Stock Exchange during 1973–1987. During this period, if the IPOs were oversubscribed, all subscribers of similar size had an equal chance of obtaining the shares. Their tests confirmed the major predictions of the winner's curse hypothesis, or Rock's hypothesis. They showed that there was a significant positive correlation between the oversubscription ratio and first-day return. They concluded that the returns of uninformed investors were similar to the risk-free rate. This indicates that to break even, investors need to be underpriced. Keloharju (1993) also confirmed the presence of the winner's curse model using 80 IPOs in the Finnish market from 1984 to 1989. This study documented a significant negative relationship between the shares allocation rate and first-day return. Amihud, Hauser and Kirsh (2003) studied 284 IPOs in the Tel Aviv Stock Exchange (TASE) from 1989 to 1993. They found that allocations were negatively related to underpricing and these findings support the existence of a winner's curse model. They concluded that underpricing occurred to a greater extent than was necessary to attract sufficient demand. Derrien (2005) studied 62 IPOs in the French Stock Exchange from 1999 to 2001. This study documented a positive correlation between the individual-investor demand and first-day return. Derrien's findings show that IPO demand can be explained by market conditions prevailing at the time of the offering. IPOs in bullish market conditions attract more individual-investor demand. Chen and Chen (2010) examined the underpricing of A-share IPOs in the Chinese tourism industry. Their study tested the winner's curse as an information asymmetry-based theory and their findings confirmed the hypothesis. Further, they documented that investors, in spite of the high level of underpricing, should expect to earn more than a market-adjusted return in the risk-free rate. Yu and Tse (2006) also tested the winner's curse hypothesis to explain IPO underpricing in China and they found the winner's curse was a main reason for underpricing in China.

Appendix 2 summarises several other testable hypotheses and empirical evidence related to the winner's curse model, which can be used to explain short-run underpricing.

2.4.1.2 The market feedback hypothesis

Book building is used by investment bankers (underwriters) to undertake widespread marketing campaigns (roadshows) to canvass regular investors' opinions prior to pricing shares. Based on the investors' opinions acquired during the pre-selling period, investment bankers may underprice IPOs to attract regular investors. To encourage regular investors to reveal their valuations truthfully, the investment banker compensates investors via underpricing. In addition, with a view to encouraging honest publicity for a given IPO, the investment banker must underprice issues for which favourable information is discovered by more than those for which unfavourable information is discovered. Finally, the offer is adjusted upwards or downwards in the final prospectus based on the market feedback. In other words, IPOs with an upwards-adjusted offer price would be more underpriced than IPOs with a downwards-revised offer price.

Several notable studies have been carried out by many researchers in different markets of the world to test the market feedback hypothesis. Benveniste and Spindt (1989) reported that underpricing arises naturally as a cost of compensating investors with positive information about the value of the stock for truthful disclosure of their private information. In addition, the theory presented in this study helps to explain the marketing of the types of securities, such as high-yield bonds, for which informational frictions may be important. Benveniste and Wilhelm (1990) studied the effect on IPO proceeds of uniform-price restrictions and restrictions on the allocation of oversubscribed issues. They indicated that uniform-price restrictions increase the cost of soliciting information from regular investors and, when combined with even-handed distribution restrictions, make information gathering impossible. Finally, they concluded that either adverse selection or the cost of soliciting information may be the central force behind IPO underpricing. Spatt and Srivastava (1991) reported that a posted-price mechanism leads to an allocation of the security that maximises the seller's expected revenue, given the informational constraints imposed by the potential buyers. Benveniste and Spindt (1989), Benveniste and Wilhelm (1990) and Spatt and Srivastava (1991) argued that the common practice of book building allows underwriters to obtain information from informed investors.

Hanley (1993) first documented that the most commonly discussed factor behind book building theories is the effect of revisions in the offer price during the filing period. This study found that issues' final offer prices that exceed the limits of the offer range have greater underpricing than all other IPOs. This concludes that underwriters do not fully adjust their pricing upward to keep underpricing constant when demand is strong. These results are consistent with those of Benveniste and Spindt (1989), who found that shares in an offering are rationed and prices only partially adjust to new information.

The information revelation theory of book building was examined by Lee, Taylor and Walter (1999). They found that a large number of better informed investors (institutional investors) tended to preferentially request participation in IPOs with higher initial returns. In related work, Cornelli and Goldreich (2003) examined institutional bids submitted under the book building procedure for a sample of international equity issues. They concluded that information in bids that included a limit price, especially those of large and frequent bidders, affected the PRICE. In addition, public information affected the PRICE to the extent that it was reflected in the bids.

2.4.1.3 The bandwagon hypothesis

Ritter (1998) documented that the IPO market may be subject to a bandwagon effect or informational cascade. The bandwagon effect can be observed when potential investors are concerned, not only about the information they have regarding a new issue, but also whether other investors are purchasing. In other words, investors do not want to buy shares even when there is favourable information if other investors do not want to buy the shares. Therefore, issuers want to underprice their shares to encourage the first few potential investors to buy so that all subsequent investors will want to buy shares without considering their own information. The bandwagon effect was tested by Welch (1992).

2.4.1.4 The investment banker's monopsony power hypothesis

Another valid explanation for the short-run underpricing phenomenon is the investment banker's (underwriter's) monopsony power. Under this hypothesis, investment bankers take advantage of their superior knowledge of market conditions to underprice offerings. This helps underwriters to spend less on marketing efforts and ingratiate themselves with buy-side clients. In addition, investment bankers are successful at convincing clients and regulatory agencies. Thus, underpricing is normal for IPOs. Underwriters' monopsony power has been examined by many researchers. Ritter (1984) argued that, under the assumption of perfect or symmetric information, investment bankers take advantage of their superior knowledge of market conditions to underprice the offerings to maximise their incomes.

2.4.1.5 The lawsuit avoidance hypothesis

According to the securities acts in different countries, all participants who have signed an IPO prospectus are liable for any material omissions. Therefore, the frequency and severity of future lawsuits can be minimised by using underpricing of shares. Ritter (1998) has argued that underpricing of IPOs is a very costly way of reducing the probability of future lawsuits. Further, other countries in which securities class actions are unknown, such as Finland, have just as much underpricing as in the United States.

The lawsuit avoidance hypothesis is also related to the risk of litigation. Underwriters are intermediaries between the issuer and the capital market and make pricing decisions that maximise their own welfare. Underwriters set the PRICE knowing that they will be sued in the future if there is evidence that the courts will judge as indicative of overpricing. A perfect sequential equilibrium exists because some issues are overpriced, some are underpriced, there is underpricing on average, and there is a positive probability of successful litigation against the underwriter (Ogden, Jen & O'Connor 2003, p. 411).

2.4.1.6 The signalling hypothesis

Underpricing of new issues signals that future share offerings can be sold at a higher price by issuers and insiders. This argument has been considered by many researchers in several signalling models. The hypothesis assumes that intrinsically higher-valued firms strategically underprice their shares to discourage lower-valued firms. In addition, high-valued firms underprice more than low-valued firms with a view to encouraging information production by investors that will then be revealed in the price of the secondary market. These models involve firms that deal directly with investors rather than investment bankers (Ogden, Jen & O'Connor 2003, p. 411). Various empirical studies have lined up with this hypothesis and a very few studies have rejected the signalling hypothesis.

Welch (1989), among others, proposed a signalling model in which issuers convey their private information about the value of their firms by underpricing their IPOs. Allen and Faulhaber (1989) examined the signalling hypothesis in relation to underpricing in the IPO market. They found that underpricing can signal favourable prospects for a firm. In certain circumstances, firms with the most favourable prospects find it optimal to signal their type by underpricing their initial issue of shares, and investors know that only the best can recover the cost of this signal from subsequent issues. Jegadeesh, Weinstein and Welch (1993) also tested the signalling theory in relation to the IPO market. They found a positive relationship between IPO underpricing and the size of subsequent season offerings. Their findings are more consistent with the implications of the signalling hypothesis. In contrast to the findings of the above three empirical studies, Michaely and Shaw (1994) did not find empirical evidence to support the signalling model as an explanation for why firms underprice. They found that (1) firms that underprice more return to the reissue market less frequently, and for a lesser amount, than firms that underprice less, and (2) firms that underprice less experience higher earnings and pay higher dividends, contrary to the model's predictions. In their model, they found no evidence of either a higher propensity to return to the market for a seasoned offering or a higher propensity to pay dividends for IPOs that were more underpriced. Ritter and Welch (2002) have argued that, theoretically, it is unclear why underpricing is a more efficient signal than committing to spending money on charitable donations or advertising. Ritter (2003b) also mentioned that underpricing generates publicity. This publicity creates additional investor interest (Aggarwal, Krigman & Womack 2002; Chemmanur 1993) and additional product market revenue from greater brand awareness (Demers & Lewellen 2003). However, Habib and Ljungqvist (2001) have argued that this type of promotion is more expensive than traditional advertising campaigns such as television and newspaper advertising.

The current findings of Chen and Chen (2010) are also in line with the findings of Michaely and Shaw (1994). They also documented empirical evidence to support the rejection of the signalling hypothesis. Further, they mentioned that investors in the Chinese tourism IPO market should not view underpricing as a signal of quality firms. Zou and Xia (2009) retested the signalling hypothesis in explaining the underpricing phenomenon in IPOs for both non-book building IPOs and book building IPOs. However, they reported mixed empirical evidence in Chinese IPOs for the signalling hypothesis. The signalling hypothesis was retested by Francis et al. (2010). They clearly stated that signalling does matter in determining IPO underpricing. Further, they argued that the evidence clearly supports the notion that some firms are willing to leave money on the table voluntarily to obtain a more favourable price at seasoned offerings when they are substantially wealth constrained.

2.4.1.7 The ownership dispersion or control hypothesis

This hypothesis assumes that issuing IPO firms may purposely underprice their shares with a view to increasing excess demand and attracting a large number of small shareholders. The dispersion of ownership will increase the liquidity of the market for the shares and establish a strong management team, which can create a challenging environment for competitors.

Brennan and Franks (1997) examined how separation of ownership and control evolves as a result of an IPO and how underpricing of the issue can be used by insiders to retain control. They found that the pre-IPO shareholders in a firm, the directors, sell only a modest fraction of their shares at the time of the offering and in subsequent years. In contrast, the holdings of non-directors are virtually eliminated during the same period. Finally, they concluded that a large majority of shares owned by pre-IPO shareholders are sold at the IPO or in subsequent years. Booth and Chua (1996) also explained that the issuer’s demand for ownership dispersion creates an incentive to underprice. Promoting of oversubscription allows broad initial ownership, which in turn increases secondary market liquidity. Increased liquidity reduces the return required by the investors. However, broad initial ownership requires an increase in investor-borne information costs, and these information costs are offset via underpricing. Finally, the empirical findings of this study confirmed that initial underpricing is reflected in the level of ownership dispersion.

2.4.1.8 Prestigious underwriter hypothesis

Underwriter reputation is an important variable to explain why IPOs are underpriced. Beatty and Ritter (1986) have argued that, under the situation of asymmetric information, underwriters are more concerned about their reputation and, therefore, they do not underprice IPOs too much. Carter and Manaster (1990) have also argued that underwriters have an informational advantage and they undertake only high-quality offerings with a view to enhancing their reputation and retaining their high-prestige status. Carter, Dark and Singh (1998) and Kenourgios, Papathanasiou and Melas (2007) examined the effect of underwriter reputation, and their findings are in line with Beatty and Ritter’s hypothesis. Dimovski, Philavanh and Brooks (2011) also tested the link between underwriter reputation and underpricing using Australian evidence, and their results confirm that more prestigious underwriters are associated with a high level of underpricing.

2.4.1.9 The uncertainty hypothesis

If uncertainty about the value of the new issue is high, underpricing of that new issue is also high. The changing risk composition hypothesis, which was introduced by Ritter (1984), assumes that riskier IPOs will be more underpriced than less risky IPOs. Loughran and Ritter (2004) have argued that a small part of the increase in underpricing can be attributed to the changing risk composition of the universe of firms going public. Beatty and Ritter (1986) have also argued that the greater the uncertainty about the value of a new issue, the greater the underpricing needed to attract uninformed investors. Further, they found that, while underpricing is common, the 'need' for and extent of underpricing is reduced if uncertainty about IPOs' future cash flows is reduced.

2.4.2 Additional Theories to Explain Short-Run Underpricing

Ritter and Welch (2002) also presented a list of theories for short-term underpricing. Before explaining these theories, they emphasised that it is important to understand that simple fundamental market misevaluation or asset-pricing risk premia are likely to explain average first-day returns. They argued that, if a diversified IPO first-day investor requires a premium for bearing a systematic risk or liquidity risk, why does a second-day investor (purchasing from the first-day investor) not appear to require this compensation? Further, they suggested that the solution to the underpricing puzzle has to lie in the setting of the offer price, whereby the normal interplay of supply and demand is suppressed by the underwriter.

They reported that former theories of underpricing can be classified according to whether:

- the IPO issuer is more informed than investors (about the internal project)
- IPO investors are more informed than the issuer (about demand).

According to Ritter and Welch, all the theories of underpricing have been categorised based on whether asymmetric information or symmetric information is assumed. Therefore, they discussed all the theories of underpricing under the following headings:

- theories based on asymmetric information

- theories based on symmetric information.

Theories based on asymmetric information include signalling, winner's curse, market feedback (book building), agency, investment banker's monopsony power, bandwagon and ownership dispersion. Symmetric information theories include the lawsuit avoidance hypothesis, internet bubble and trading volume. They concluded that future explanations need to focus on agency conflicts and behaviour.

Ritter (2003b) provided a number of explanations for the underpricing of IPOs. He explained that the reasons for short-run underpricing of IPOs give different weight to the objectives of the three players who are involved in the IPO game. The reasons for underpricing include dynamic information, prospect theory, corruption, the winner's curse, informational cascades, lawsuit avoidance, signalling and IPO as a marketing event. All these reasons are discussed in Section 2.4.1, except for prospect theory and agency theory.

2.4.2.1 Prospect theory

Ritter (2003b) suggested that it is easy to understand why underwriters would like to leave money on the table. He argued that the situation is similar to a professor being more inclined to give an A grade to a student who offered a $10,000 gift in return. He cannot understand, however, why issuers do not get upset about leaving money on the table. Loughran and Ritter (2002b) applied prospect theory to address this issue. This theory was originally developed by Kahneman and Tversky (1979). Prospect theory is not a normative theory about how people should behave; it is a descriptive theory on how people do behave. It assumes that people focus on change in wealth, rather than level of wealth.

One of the puzzles presented by IPOs is that issuers rarely become upset about leaving substantial amounts of money on the table. Loughran and Ritter (2002b) advanced the prospect theory model, which focuses on the covariance of money left on the table and wealth changes. They considered the second puzzling pattern (the HM) in the finance literature and found that more money is left on the table following recent market rises than after market falls. They explained that most of the IPOs leave relatively little money on the table and some IPOs leave a great deal of money on the table. By integrating loss and gain, issuers are happy to leave money on the table. Further, they argue that leaving money on the table is an indirect compensation to the underwriter and underpricing is an indirect cost to the issuer. They concluded that the results of prospect theory can be used to explain the HM phenomenon.

2.4.2.2 Agency theory

Ritter and Welch (2002) have argued that agency conflicts should be addressed in relation to the underpricing of IPOs in future explanations. The agency conflict of underpricing was first addressed by Baron (1982). Therefore, this hypothesis is known as Baron's hypothesis. According to his theory, the issuer is less informed than its underwriter. Therefore, the issuer is unable to monitor the underwriter's activity without incurring costs. In contrast to these findings, Muscarella and Vetsuypens (1989) found that, when underwriters themselves go public, their shares are also underpriced, even though there is no monitoring problem. This finding is not in line with the Baron hypothesis. Loughran and Ritter (2004) have argued that an agency problem between the decision makers at issuing firms and other pre-issue shareholders also contributes to a willingness to hire underwriters with a history of leaving large amounts of money on the table.

Ritter has summarised that all of the above explanations for short-term underpricing can be considered rational strategies of investors. In addition to these explanations, several other explanations have been proposed involving irrational strategies by investors. These irrational strategies can be used to explain the long-run performance of IPOs. However, behavioural and agency conflicts have become more important as explanations for the short-run underpricing phenomenon.

2.4.3 Determinants of Underpricing

In the finance literature, determinants of underpricing are used to support the above-discussed theories in relation to underpricing. Different researchers have used different determinants as proxies to explain the theoretical background related to underpricing. IPO characteristics (variables) have been used by many researchers as determinants of underpricing. Dimovski and Brooks (2004) proposed 13 financial and non-financial characteristics to explain the underpricing and long-term performance of Australian IPOs. Bhabra and Pettway (2003) also used firms' financial and operating characteristics and offer characteristics as their underpricing determinates. Issue-related characteristics and market-related characteristics were explained by Johnston and Madura (2002). However, Ogden, Jen and O'Connor (2003, p. 404) clearly documented that all characteristics of IPOs can be classified into the two areas of firm-specific characteristics (age statistics, firm size, leverage, profitability, dividend policy) and offer-related characteristics (offer price, valuation statistics, primary shares, secondary shares, underwriter spread, ownership statistics, lockup statistics and overallotment option statistics).

This study examines three major characteristics to explain short-run underpricing: issue-specific, firm-specific and market-specific characteristics. These characteristics are shown in Figure 2.2.

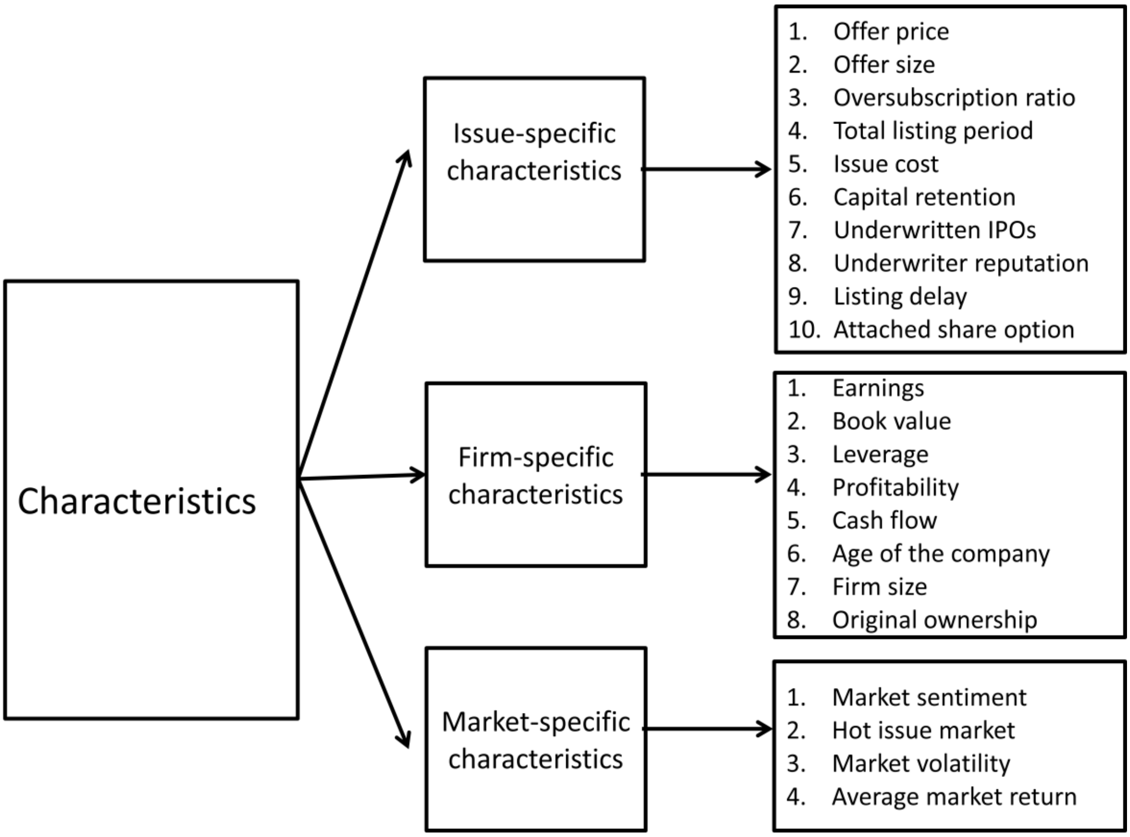


Figure 2.2: Issue-, Firm- and Market-Specific Characteristics

The following discussion concerns how issue-specific characteristics, firm-specific characteristics and market-specific characteristics have been used by other researchers to explain the underpricing phenomenon.

2.4.3.1 Issue- (offer-) specific characteristics

2.4.3.1.1 Offer price

Empirical evidence shows moderate results regarding the relationship between the offer price and the level of underpricing. Ibbotson, Sindelar and Ritter (1988), Guo and Brooks (2008) and Dimovski, Philavanh and Brooks (2011) found that firms that offer with very low prices usually record a high level of underpricing. Certo et al. (2003) suggested that higher offer prices indicate lower uncertainty regarding the future performance of the firm. In contrast with these findings, Kutsuna, Dimovski and Brooks (2008) found a statistically significant positive relationship between short-run underpricing and the offer price. Further, Jain and Kini (1999b) found that a low offer price is associated with lower short-term performance. Fernando, Krishnamurthy and Spindt (1999) found a U-shaped association between these two variables, and they pointed out that the offer price may also indicate the extent of underpricing but its level seems to have little economic significance.

2.4.3.1.2 Offer size

The ex-ante risk is measured by the size of the IPO offer. The size of the IPO offer is negatively related to the level of underpricing. The size of the offering indicates the uncertainty about IPO firms (Clarkson & Simunic 1994; Miller & Reilly 1987). The larger IPOs are usually offered by well-known firms with several operating years and better records. Empirically, several research studies have reported a negative relationship between the offer size (amount of funds raised) and the level of underpricing (Belghitar & Dixon 2012; Chalk & Peavy 1990; Chi & Padgett 2005; Clarkson & Merkley 1994; Guo & Brooks 2008; Marisetty & Subrahmanyam 2010). However, Alli, Subrahmanyam and Gleason (2010) and Suchard and Singh (2007) reported a positive relationship between the first underpricing and gross offer proceeds.

2.4.3.1.3 Oversubscription ratio

Theoretically, the level of underpricing depends on the demand for the IPO. The demand for the IPO is measured by the oversubscription ratio. Rock (1986) and Michaely and Shaw (1994) argued that the level of underpricing depends on information heterogeneity among investors. Further, they assumed that the level of heterogeneity increases with the demand for the firm's shares. Empirically, several researchers have used the oversubscription ratio as an independent variable to explain the first-day returns of IPOs. Among them, Agarwal, Liu and Rhee (2008), Boudriga, Slama and Boulila (2009), Kandel, Sarig and Wohl (1999) and Chowdhry and Sherman (1996) found a positive relationship between the subscription ratio and the short-run market performance of IPOs.

2.4.3.1.4 Total listing period

The variable of total listing period indicates the total time taken for listing and it is used to test Rock's hypothesis and the uncertainty hypothesis in the IPO literature. Lee, Taylor and Walter (1996), How (2000), How, Lam and Yeo (2007) and Ekkayokkaya and Pengniti (2012) found a statistically significant negative relationship between short-run underpricing and the time period to listing. They argued that quickly sold issues (longer issues) are more underpriced (less underpriced) due to the higher (lower) level of informed demand. This finding confirms Rock's hypothesis. However, Chan, Wang and Wei (2004), Chen, Firth and Kim (2004), Suchard and Singh (2007) and Mudambi et al. (2012) found a significant positive relationship between short-run underpricing and time to listing. They argued that the longer delay between the issuing of IPOs and subsequent listing may increase the risk of the investors. Therefore, investors need more returns to compensate for this risk, and heavy underpricing can be expected at the listing date. This finding is consistent with the uncertainty hypothesis.

2.4.3.1.5 Issue cost and capital retention

There are a number of costs associated with IPOs including direct and indirect costs. The main direct cost of going public is the issue cost, which includes the management fee, broker commission, registration fee, annual report fee, legal cost, industry report fee, printing fee and auditing cost. The direct issue cost of going public varies according to the size of the issue capital and the average direct cost is 11% in the United States (Ritter 1998). If the issue costs of an IPO increase, retention capital (after paying the issue costs) decreases. This is considered a risky offer and investors expect higher returns on the very first day for their investment. Therefore, a positive relationship can be expected between short-run underpricing and issue costs, whereas a negative relationship can be expected for short-run underpricing and retained capital. To measure the ex-ante uncertainty surrounding the price, Dimovski and Brooks (2004) examined capital retention (after deducting issue costs) as an explanatory variable of IPO market performance. They found a negative relationship between short-run underpricing and retained capital.

2.4.3.1.6 Underwritten IPOs and underwriter reputation

Underwriters (or investment bankers) are important players in the IPO process. They have superior knowledge about market conditions and their reputations are important for short-run market performance. Ritter (1984) has argued that investment bankers underprice offerings with a view to maximising their revenues using their superior knowledge about the market conditions. Dimovski and Brooks (2004), Kenourgios, Papathanasiou and Melas (2007) and Dimovski and Brooks (2008) found a positive relationship between short-run underpricing and underwritten IPOs. This finding shows that underwritten IPOs are more underpriced in the short run than non-underwritten IPOs. However, Beatty and Ritter (1986) found that underwriters care about their reputations and do not underprice offers too much. Carter and Manaster (1990) also argued that underwriters undertake only high-quality offerings with a view to enhancing their reputation and retaining their high-prestige status. Kenourgios, Papathanasiou and Melas (2007) and Mudambi et al. (2012) examined the effect of underwriter reputation and found a statistically significant negative relationship with short-run underpricing. This finding implies that more prestigious underwriters are associated with a low level of underpricing. Their findings are in line with Beatty and Ritter’s hypothesis. However, Dimovski, Philavanh and Brooks (2011) tested underwriter reputation and underpricing using Australian evidence, and their results confirm that more prestigious underwriters are associated with a high level of underpricing.

2.4.3.1.7 Listing delay

The variable of listing delay (LISD) measures the period from the proposed listing date to the actual listing date. International research studies found a positive relationship between underpricing and LISD. Chowdhry and Sherman (1996) found that the longer the period of listing the more uncertainty about the offer. Mok and Hui (1998), Su and Fleisher (1999), Tian and Megginson (2006) and Slama Zouari, Boudriga and Boulila (2011) also found a positive association between the level of underpricing and LISD. This indicates that IPOs with a higher LISD are underpriced in the short run relative to IPOs with a lower LISD.

2.4.3.1.8 Attached share option availability

In Australia, some IPOs issue shares with a share option or warrant. This is known as package initial public offerings (PIOPs). PIOP is a sequential financing method that does not allow managers to invest company funds in unprofitable projects (Schultz 1993). Using the agency cost hypothesis, Schultz (1993) and Jain (1994) explained the importance of sequential financing for relatively young firms because this type of financing reduces their agency costs associated with free cash flows. Schultz (1993) predicted and found that IPOs with attached options (PIOPs) are less underpriced than normal IPOs. Dimovski and Brooks (2004, 2006), Dimovski, Philavanh and Brooks (2011), How, Lam and Yeo (2007) and How (2000) tested the attached share option as a dummy variable with their models, and they found a negative relationship with short-run market performance. They confirmed the agency cost hypothesis because the attached option reduces the level of underpricing. However, How and Howe (2001) investigated Australian PIPOs and they found that PIPOs are more underpriced than other normal IPOs because PIPOs are normally issued by young and risky companies.

2.4.3.2 Firm-specific characteristics

2.4.3.2.1 Earnings and book value

Beatty, Riffe and Thompson (2000) have stated that firm-specific accounting information is important for first-day return and IPO pricing. They found that the first-day stock return has a significantly positive correlation with earnings and book value.

Further, they provided some insight into how and when accounting information is impounded by examining share prices. Klein (1996) investigated the explanatory power of accounting variables and items contained in a prospectus. The study concluded that accounting information is important in the pricing of IPOs. In addition, Pukthuanthong-Le and Varaiya (2007) concluded that IPOs with strong financial health indicate high offer values, that is, high positive book value, high positive earnings, high sales, high positive cash flow, high growth in profit margin and high growth in sales.

2.4.3.2.2 Leverage

Traditional (optimal) capital structure theory signals that the value of a firm can be increased using more debt capital, but Modigliani and Miller's (1958) theory indicates that capital structure has no effect on the value of a firm. However, recognising the effects of tax, bankruptcy, agency costs and asymmetric information, capital structure theory has evolved to acknowledge that the use of debt capital does affect the value of a firm. Therefore, theory shows that there is a strong relationship between share price and leverage. Debt-equity ratio is used by financial analysts to measure the leverage position and financial risk of a company. Su (2004) showed that underpricing is positively correlated with pre-IPO leverage, which is a proxy for ex-ante information asymmetry. This finding is not in accordance with the conventional theory of capital structure. Deb and Marisetty (2010) analysed debt-equity ratio as a pre-issue accounting variable and concluded that firm debt-equity ratio (financial risk) is highly significant in explaining institutional demand. Bhabra and Pettway (2003) investigated how characteristics are related to the level of performance of IPO using prospectus data. They concluded that leverage as a firm characteristic is more significant than offering characteristics.

2.4.3.2.3 Profitability

Profitability is another variable examined in this study. In theory and practice, profitability is widely used to evaluate the financial health of a firm. Deb and Marisetty (2010) used profitability as an accounting variable to explain institutional demand. Bhabra and Pettway (2003) used profitability as a variable in their study and showed that financial and operating characteristics have a limited relation to stock returns. Further, Su (2004) analysed profitability as a variable and showed that profitability is not a statistically significant variable in relation to IPO underpricing. However, Pukthuanthong-Le and Varaiya 2007 found that IPOs with strong profitability (profit margin) indicate high offer values.

2.4.3.2.4 Cash flow

Discounted cash flow (DCF) analysis is a very precise and widely recommended valuation technique in both academic and practitioner publications (Kim & Ritter 1999). Further, Kim and Ritter state that the DCF approach is based on a firmer theoretical footing than ony other valuation approach because shareholders' wealth is defined as the present value of future cash flows of the firm. Pukthuanthong-Le and Varaiya (2007) considered operating cash flow as an independent variable and concluded that a high positive cash flow indicates high offer values. Bhabra and Pettway (2003) clearly noted that free cash flow is a more significant variable than other firm characteristics in the level of IPO performance.

2.4.3.2.5 Age of the issuing firm

The age of the firm shows the operating history of the firm prior to going public, which measures the ex-ante risk of the offer. Newly formed firms exhibit higher ex-ante uncertainty than older firms. Ritter (1984) and Hensler, Rutherford and Springer (1997) found that the availability of information on firms operating for several years contributes to the reduction of IPO information asymmetry. Bilson et al. (2003) concluded that this ex-ante uncertainty will be reflected in higher underpricing of the IPO firms. Therefore, IPOs with a low age are expected to be more underpriced than high-age IPOs. This shows that the age of the issuing firm has a negative effect on the level of underpricing (Belghitar & Dixon 2012). However, How, Lam and Yeo (2007) and Suchard and Singh (2007) found a positive relationship between underpricing and the age of the issuing firm. The positive relationship reported by Suchard and Singh (2007) is statistically significant.

2.4.3.2.6 Firm size

The size of the issuing firm is also used to measure the ex-ante risk of IPOs. The size of a firm is usually negatively associated with its risk (Boudriga, Slama and Boulila 2009). Finkle (1998) has shown that larger firms have better access to investment capital and resources, which are crucial for the firm's profitability and survival. Empirically, several studies have reported a negative relationship between the level of underpricing and firm size (Alli, Subrahmanyam & Gleason 2010; Carter, Dark & Singh 1998; Ibbotson, Sindelar & Ritter 1994; Jewartowski & Lizinska 2012; Suchard & Singh 2007). However, some studies have reported a positive relationship between these two variables (Marisetty & Subrahmanyam 2010).

2.4.3.2.7 Original ownership

Going public leads to a significant change in a firm's ownership structure and results in separation of managerial control and ownership (Wang 2005). The separation of ownership and control creates agency problems between owners and managers. The agency problems can be minimised by increasing the ownership of original owners (owner managers). From an agency cost theory viewpoint, a high level of original ownership will lead to higher value of the firm (Jensen & Meckling 1976). According to signalling theory, insider ownership sends a signal about the company value. Leland and Pyle (1977) suggest that a greater percentage of ownership by insiders is a positive signal about the company, since insiders are assumed to have superior information about expected future cash flows. This indicates that there is a positive relationship between short-run market performance and the portion of shares retained by the original owners. However, Mroczkowski and Tanewski (2004) have argued that retained capital of the existing owners makes a signal about the true value of the company to their potential investors. Thus, this leads to a low level of underpricing due to the higher PRICE. According to the uncertainty hypothesis, a high level of original ownership may be connected with high risks of cash flows of minority shareholders (Bozzolan & Ipino 2007). In this situation, the potential investors only buy shares when they are underpriced.

2.4.3.3 Market-specific characteristics

2.4.3.3.1 Market sentiment

Market sentiment (MS) is the general prevailing attitude of investors regarding the price development in a market. It shows the overall trend of the stock market before listing and also tests the institutional lag in the share offering (Kiymaz 2000; Ritter 1984) because it measures the overall stock MRs from issuing date to the first trading date. The MS indicates investors' expectation about the overall stock MRs and their expectation shows their demand for IPO stocks. If the MS goes up, it shows that the investors' expectation about the overall market also goes up, which indicates high demand for IPO stock. As a result of high demand, price appreciation or underpricing can be expected on the first listing day. Similarly, a decrease in MS indicates a low demand for IPO stock, and this leads to a decrease in the price or reduction of the level of underpricing on the first trading day. Therefore, a positive relationship can be expected between short-run market performance and MS. Ho et al. (2001), Dimovski and Brooks (2004, 2006, 2008), Dimovski, Philavanh and Brooks (2011) and Jewartowski and Lizinska (2012) reported a highly statistically significant positive relationship between the first-day returns and MS. In addition, Jelic, Saadouni and Briston (2001) and Kiymaz (2000) found a statistically significant positive relationship between initial returns and pre-listing stock MRs. However, Gong and Shekhar (2001) found a statistically significant negative relationship between these two variables, and this shows that if the MR prior to the listing is higher, the first-day underpricing will be lower. Kutsuna, Dimovski and Brooks (2008) also found a negative relationship between short-run underpricing and MS. MS is similar to investor sentiment because it also indicates the investors' attitudes and their expectations regarding overall stock MRs or price development in the market. Investor sentiment has been tested using stock MRs in prior studies (Samarakoon 2010).

2.4.3.3.2 Hot issue market (HM)

The HM phenomenon is considered the second anomaly in IPO pricing and a further extension of the short-run underpricing phenomenon (Ritter 1991). A period that has high initial returns and high volume (number of IPOs) is known as a 'hot issue' market (Ritter, 1998). This concept was first reported by Ibbotson and Jaffe (1975), who defined the HM as the period when the monthly average first-day return is greater than the median first-day return. Later, Ritter (1984) reported that HMs usually have high volume, severe underpricing and frequent oversubscription. Ibbotson, Sindelar and Ritter (1994) again confirmed their previous findings. Lowry and Schwert (2002) found a relationship between months, high average first-day return and rising frequency of new issue, and Loughran and Ritter (2002a) documented that volume and first-day returns are highly correlated. Guo, Brooks and Shami (2010) characterised hot issue IPO markets as having a large volume of new offerings, high underpricing, strong market conditions, and quick subscribing and listing speed. However, Lowry, Officer and Schwert (2010) found that the volatility of initial returns is higher for firms during 'hot' IPO markets, which are more difficult to value because of higher information volatility asymmetry. Samarakoon (2010), Alli, Subrahmanyam and Gleason (2010) and Thorsell and Isaksson (2012) also reported a significant positive relationship between underpricing and the HM variable.

2.4.3.3.3 Market volatility and average market return

Market volatility (MV) and MR have an effect on IPO market performance. Omran (2005) and Paudyal, Saadouni and Briston (1998) used the standard deviation of daily MRs before the closing date of the offer to analyse short- and long-run market performance. They expected a positive relationship between IPO performance and MV. However, Omran (2005) found a negative relationship between these two variables. Ekkayokkaya and Pengniti (2012) and Belghitar and Dixon (2012) also found a negative relationship between first-day returns and pre-offer MV. Ekkayokkaya and Pengniti (2012) found a statistically significant positive relationship between underpricing and pre-offer MRs. Belghitar and Dixon (2012) reported a negative relationship between short-run underpricing and market index performance (MR) prior to issue. However, in accordance with the conventional risk-return relationship, my study expects a positive relationship with short-run market performance.

2.5 Evidence on the Long-Run Underperformance Phenomenon

The evidence on long-run underperformance of IPOs is not as widespread as that of short-run underpricing of IPOs. However, underperformance of IPOs is a debatable issue among financial researchers because of their studies' conflicting results and controversial findings. Some researchers have found that IPOs underperform marginally or have no abnormal performance in the long run; thus, they do not reject the market efficiency hypothesis in the long run (Gompers & Lerner 2003; Ibbotson 1975; Jenkinson & Ljungqvist 2001). Others have reported that IPOs overperform or do not underperform in the long-run market (Bird & Yeung 2010; Da Silva Rosa, Velayuthen & Walter 2003; Thomadakis, Nounis & Gounopoulos 2012). Still others have argued that underperformance disappears when different performance measures or methodologies are used (Abukari & Vijay 2011; Ahmad-Zaluki, Campbell & Goodacre 2007; Gompers & Lerner 2003; Kooli & Suret 2004). The rest have found that IPOs underperform considerably in the long-run IPO market (How 2000; Lee, Taylor & Walter 1996; Ritter 1991).

Ritter (1991) documented the long-run performance of US IPOs appearing to be overpriced (underperformed) as the third anomaly in the pricing of IPOs of common stock. He summarised the average holding period return for a sample of 1,526 IPOs of common stock in 1975–1984 as 34.47% in the three years after going public. Further, Omran (2005) found mixed results in the long-run performance of Egyptian IPOs between 1994 and 1998. He clearly noted that investors can earn positive aftermarket abnormal returns (average return 41%) over a one-year period and negative aftermarket abnormal returns over a three- and five-year horizon. The aftermarket performance of internet firms is initially favourable but weakens over time, according to Johnston and Madura (2002). Further, they documented that the long-term performance of internet firms in the United States declined over time, and the market was underperformed by the end of one year.

Boabang (2005) analysed the opening, short-term, medium-term and long-term performance of Canadian unit trust IPOs using a sample of 83 IPOs listed on the Toronto Stock Exchange over the period 1990–2000. The study concluded that, in the long run, Canadian IPOs were fairly priced but underperformed the Canadian market. Further, he indicated that the Canadian unit trust IPO market appeared to be inefficient in the short and long term, but over the medium term, the market appeared to be efficient.

Cai, Liu and Mase (2008) examined the three-year post-IPO performance of firms listedon the Shanghai A-share stock market between 1997 and 2001. According to this study, the IPO market underperformed by 30% over the long run. Ajlouni and Abu-Ein (2009) reported that Jordanian IPOs significantly underperformed in the long run similarly to advanced economies. In addition, they concluded that IPOs of service companies performed better than industrial companies. However, both companies underperformed in the market. In the long run, Chinese A-share IPOs slightly underperformed the matched portfolios and B-shares outperformed the benchmark portfolios (Chan, Wang & Wei 2004). Álvarez and González (2005) revealed negative long-run abnormal stock returns in relation to Spanish IPOs. Kooli and Suret (2004) examined the aftermarket performance of Canadian IPOs with a sample of 445 IPOs from 1991 to 1998. Their sample indicated that Canadian IPOs were also underperforming in the long run. These performance results depend on the methodology used and on the weighting schemes. Moshirian, Ng and Wu (2010) provided further evidence to support this argument, revealing that the existence of long-run underperformance for Asian IPOs depends resoundingly on the methodology used for assessment. In contrast to the underperformance argument, Ahmad-Zaluki, Campbell and Goodacre (2007) documented significant overperformance in the long run in EW event-time CARs and BHARs. They investigated the long-run share price performance of 454 Malaysian IPOs during the period 1999–2000. Further, they explained that the long-run performance of the Malaysian IPOs was in line with the underperformance phenomenon when return was calculated on VW or a matched company benchmark. However, this study is consistent with the argument that long-run performance depends on the methodology and benchmarks used for assessment.

In the Australian literature, Finn and Higham (1988) and Lee, Taylor and Walter (1996) found that industrial IPOs underperformed by 6.52% and 51.58% based on long-run returns. How (2000) found that mining IPOs underperformed by 7.6%, whereas Dimovski and Brooks (2004) reported that industrial and resource IPOs underperformed by 4.6%. However, Da Silva Rosa, Velayuthen and Walter (2003) found that Australian IPOs did not underperform in the post-market. Bird and Yeung (2010) found that Australian IPOs overperformed by 12%.

The review of the above studies attempts to shed some light on the IPO market performance in the long run. Table 2.2 also presents some Australian and international evidence on long-run IPO performance. The table clearly indicates that long-run market performance has been reported as underperformance or overperformance in Australia as well as in other countries. In particular, long-run overperformance can be observed in Korea (+2%), Malaysia (+17.9%), Sweden (+1.2%) and the United States (+11.7%) based on average long-run returns. However, long-run underperformance has been reported in more parts of the world when compared with overperformance. The following section discusses the main reasons for the long-run underperformance phenomenon.

Table 2.2: Evidence on long-run market performance phenomenon

Country	Average long-run return (%)	Sample size	Sample period	Author(s)
Australian				
Australia	–6.52	93	1966–1978	Finn & Higham
Australia	–25.38	120	1974–1984	Allen & Patrick
Australia	–51.58	266	1976–1989	Lee, Taylor & Walter
Australia	–7.6	130	1979–1990	How
Australia	+13.12	333	1991–1999	Da Silva Rosa, Velayuthen & Walter
Australia	–4.6	251	1994–1999	Dimovski & rooks
Australia	–25.27	419	1995–2000	Bayley , Lee & Walter
Australia	+12	68	1995–2004	Bird & Yeung
Non-Australian				
Austria	–27.3	57	1965–1993	Aussenegg
Brazil	–47.0	62	1980–1990	Aggarwal, Leal & Hernandez
Canada	–17.9	216	1972–1993	Jog & Srivistava
Chile	–23.7	28	1982–1990	Aggarwal, Leal & Hernandez
China	–30	335	1997–2001	Cai,Liu & Mase
China	+16.6	897	1996–2002	Chi, Wang & Young
Egypt	–27.0	53	1994–1998	Omran
Finland	–21.1	79	1984–1989	Keloharju
Germany	–12.1	145	1970–1990	Ljungqvist
Greece	–31.43	254	1994–2002	Thomadakis, Nounis & Gounopoulos
Japan	–27.0	172	1971–1990	Cai & Wei
Jordan	–1.5	24	1990–2006	Ajlouni
Korea	+2.0	99	1985–1988	Kim, Krinsky & Lee
Malaysia	+17.9	454	1990–2000	Ahmad-Zaluki, Campbell & Goodacre
Singapore	–9.2	45	1976–1984	Hin & Mahmood
Spanish	–28.0	52	1987–1997	Álvarez & González
Sweden	+1.2	162	1980–1990	Loughran, Ritter & Rydqvist
UK	–8.1	712	1980–1988	Levis
US	–20.0	4753	1970–1990	Loughran & Ritter
US	+11.7	2829	1988–2005	Abukari & Vijay

Source: The figures were taken from the article 'Initial Public Offerings' (Ritter 1998) and the rest of the figures were based on papers published by the authors listed in the table.
Note: A negative (–) sign indicates underperformance and a positive (+) sign indicates overperformance in the long run.

2.6 Reasons for the Long-Run Underperformance Phenomenon

This section explains the theoretical and empirical background pertaining to long-run underperformance and provides a number of reasons why IPOs underperform in the long run.

2.6.1 Theoretical Explanation for Long-Run Underperformance

Theoretical explanations for the long-run underperformance of IPOs are less abundant than those for the underpricing phenomenon (Kooli & Suret 2004). Jakobsen and Sorensen (2001) also noted that no convincing theory exists that explains IPO long-run market performance. Studies on long-run performance have reported controversial and conflicting findings (Thomadakis, Nounis & Gounopoulos 2012). Therefore, much attention has been paid to theoretical explanations for long-run performance of IPOs in the recent IPO literature. The following behavioural theories have been proposed to explain the phenomenon of long-run underperformance of IPOs (Ritter 1998):

- the divergence of opinion hypothesis
- the impresario hypothesis (fads hypothesis)
- the window of opportunity hypothesis.

In addition to these behavioural theories of long-run market performance, some theories on short-run underpricing (e.g. signalling theory, agency cost theory, prospect theory and uncertainty theory) and methodological issues including measurement problems can be used to explain long-run underperformance. Accordingly, the theories on long-run underperformance are categorised as (1) behavioural theories of long-run underperformance, (2) methodological problems and (3) theories of short-run underpricing. Figure 2.3 shows the long-run underperformance theories that are discussed in the following section.

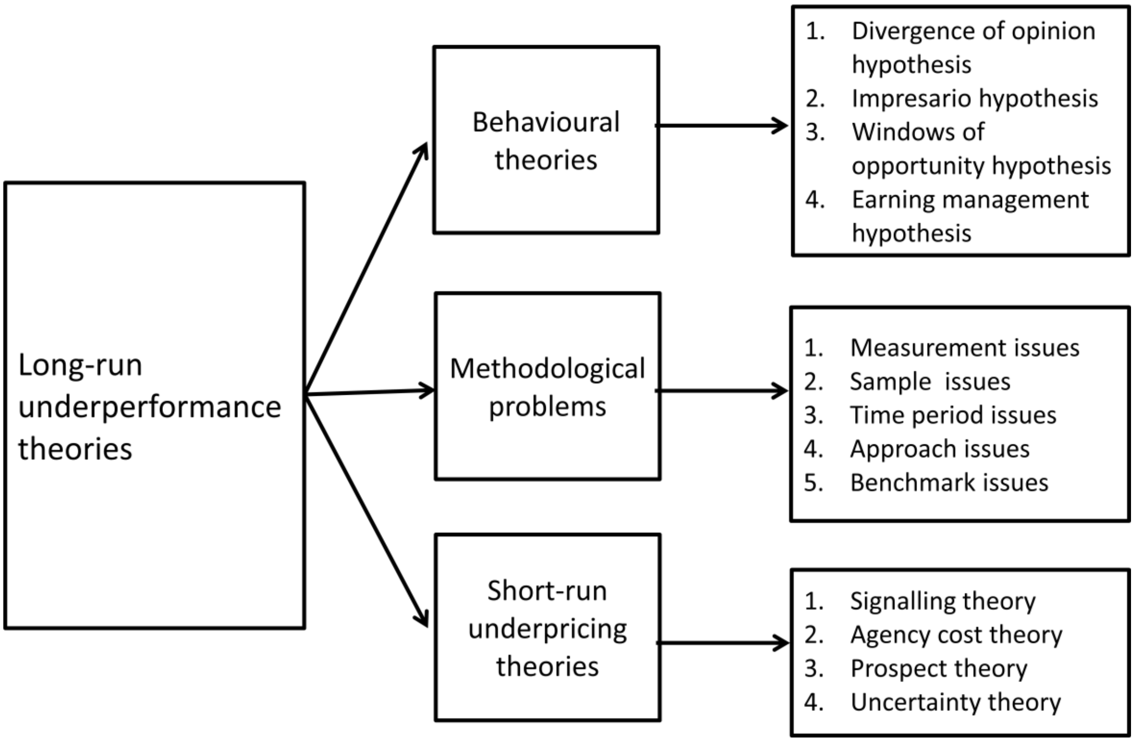


Figure 2.3: Long-Run Underperformance Theories

2.6.1.1 Behavioural theories on long-run underperformance

2.6.1.1.1 The divergence of opinions hypothesis

The divergence of opinions hypothesis on long-run stock market performance was presented by Miller (1977). This hypothesis explains that investors who are most optimistic regarding the future cash flows and growth potential of IPOs will be the buyers. Their valuation determines the initial trading day's price. The valuations of an optimistic investor will be higher than those of the pessimistic investor when there is uncertainty about the value of an IPO. As time goes on, more information becomes available in the market. The divergence of opinion between optimistic and pessimistic investors will narrow because of the availability of information. Therefore, this will lead to a reduction of the market price, resulting in long-run underperformance.

2.6.1.1.2 The impresario hypothesis (fads hypothesis)

The impresario hypothesis was introduced by Aggarwal and Rivoli (1990) following Miller's (1977) divergence of opinions explanation. This hypothesis indicates that companies with high initial returns should have low aftermarket returns. The theory argues that the market for IPOs is subject to fads and that IPOs are underpriced by investment bankers to create the appearance of excess demand (Ritter 1998). Conversely, many firms go public near industry-specific ‘fad’ or ‘hot’ periods (Álvarez & González 2005). Consequently, a negative relationship between long-run performance and initial returns can be expected. This hypothesis is also similar to the investor overoptimism or overreaction hypothesis (De Bondt 1985; Thaler 1987) because investors become overly optimistic about a firm’s value during fad or hot periods.

2.6.1.1.3 The window of opportunity hypothesis

The window of opportunity hypothesis was introduced by Ritter (1991) and considered a further extension of the fads hypothesis introduced by Aggarwal and Rivoli (1990). This hypothesis suggests that, once investors become overoptimistic about a firm’s value, the firm’s share price rises higher than a fair price. Issuers can take this as an opportunity to sell shares at a higher price, thus seizing the ‘window of opportunity’. The window of opportunity hypothesis forecasts that firms going public in high-volume periods (‘hot’ periods) are more likely to be overvalued than other IPOs.

2.6.1.1.4 Earnings management hypothesis

The earnings management hypothesis is also considered a behavioural theory of long-run performance. Normally, companies manage earnings for the following purpose: to window-dress financial statements prior to IPO, to increase managers’ compensation and job security, to avoid violating lending contracts, to reduce regulatory costs or to increase regulatory benefits. Beneish (2001) has argued that much of the evidence of earnings management depends on the company’s performance, which suggests that earnings management is likely to be present when a company’s performance is either unusually good or unusually bad. However, some IPO companies manipulate their financial statements with a view to attracting investors and this ‘window-dressing’ technique is not useful in the long run because, once investors know the true value of the firm, prices fall (Teoh, Welch & Wong 1998).

2.6.1.1.5 Empirical evidence on behavioural theories for long-run underperformance

The above theories have been examined in the IPO literature by many academic researchers. Among them, Ritter has made a significant contribution to the debate about long-run performance of IPOs. The long-run underperformance phenomenon was first documented by Ritter (1991). He used a large sample of 1,526 US IPOs from 1975 to 1984 and documented that the IPOs appeared to be overpriced in the long run. This is considered a third anomaly in the IPO literature. This study found that, in the three years after going public, the sample firms significantly underperformed in comparison with a set of comparable firms matched by size and industry. Further, this study explained that there was substantial variation in the underperformance from year to year and across industries, and younger companies going public in heavy volume years performed even worse than average.

Ritter's (1991) study made an attempt to shed some light on the reasons for this underperformance phenomenon. The possible reasons included (1) risk mismeasurement, (2) bad luck and (3) fads or overoptimism. In particular, this study investigated whether the sample companies underperformed merely due to bad luck or whether the market systematically overestimated the growth opportunities of the IPOs. The evidence is consistent with the notion that many firms go public near the peak of industry-specific fads. The investors in this sample were overoptimistic about the firms' prospects and issuers took advantage of the 'window of opportunity'. These patterns are consistent with an IPO market in which (1) investors are periodically overoptimistic about the earnings potential of young companies, and (2) firms take advantage of these windows of opportunity. This indicates that the study's findings are in line with the impresario or fads hypothesis and window of opportunity hypothesis. In addition, the study analysed cross-sectional and time-series patterns in the post-market performance of IPOs with a view to identifying possible explanations for the long-run underperformance of IPOs. Aftermarket performance was categorised using initial returns, issue size, industry, age of the issuing firm and year of issuance.

Finally, Ritter (1991) argued that there were three unresolved issues in relation to long-run underperformance: (1) the generality of the findings, (2) the relationship of the long-run underperformance to the short-run underpricing phenomenon and (3) the tendency for underperformance in the long run.

Kooli and Suret (2004) examined the aftermarket performance of IPOs in Canada for up to five years using a sample of 445 IPOs during the period 1991–1998. The cross-sectional patterns were also analysed to identify plausible reasons for the underperformance of IPOs in Canada. They found that overpriced stocks performed better than underpriced stocks. This study confirms the international evidence on long-term performance and it indicates that underpriced stocks show a more negative long-term performance. The study's findings mildly support the overreaction or fads hypothesis. In addition, the study segmented the sample period into two sections: the hot period and the cold period. At 36 months, the aftermarket return was –18.06% for the hot period and –10.41% for the cold period. At 60 months, the aftermarket returns for hot and cold issues were –39.08% and –4.6% respectively. The difference in these returns is statistically significant at the 1% level. This study's findings are also consistent with the evidence that firms choose to go public when investors are willing to pay a high price-earnings ratio (P/E) or market-to-book, reflecting the optimistic assessments of the net present value of growth opportunities. They mentioned that, according to Ritter's interpretation, this may be consistent with the window of opportunity hypothesis. They concluded that their findings on the long-run performance of large Canadian IPOs explain the investors' overreaction hypothesis, not the divergence of opinions hypothesis.

Dimovski and Brooks (2004) analysed the financial and non-financial characteristics of Australian IPOs to explain their long-term underperformance. The overall results of their study support the long-run underperformance hypothesis on IPOs. During the period of 1994–1998, Australian IPOs were overpriced in the long run by 4% and the median market-adjusted return for the long run was –25%. Excess MR was the main explanatory variable of the long-run market performance in Australia. This study indicated a negative coefficient (–0.051) for the one-year excess return variable. This supports the overoptimism hypothesis, which explains the long-run underperformance. However, the authors argued that their study supports the overoptimism hypothesis based on the positive coefficient (1.069) on one-month excess returns. Further, similar interpretations can be made about the coefficient with the partitioned data. However, the

MS variable indicates an unexpected positive coefficient. This finding is not in line with the overoptimism hypothesis and window of opportunity hypothesis explanations for long-run underperformance.

In addition, Omran (2005) documented mixed findings on the long-run performance of 53 share issue privatisations (SIPs) in the Egyptian stock market between 1994 and 1998. Positive abnormal returns were reported for a one-year period and negative abnormal returns were reported for three- and five-year horizons. However, over three- and five-year periods, abnormal returns were significantly affected by initial excess returns and the P/E. Their empirical findings are consistent with the overoptimism hypothesis.

Cai, Liu and Mase (2008) reported a comparable level of underperformance on the long-run performance of IPOs in China. They found that initial overoptimism and the size of the offer were important explanatory variables for this underperformance. This indicates that the findings are in line with the overoptimism hypothesis and divergence of opinions hypothesis. In addition, Chinese economic reforms affected government shareholding, and this supports a signal argument in relation to continuing government support. Therefore, this study provides an interesting outcome on how the regulatory environment and economic transition have influenced the long-run performance of IPOs in China.

Álvarez and González (2005) analysed the long-run performance of Spanish IPOs during the period 1987–1997, examining the influence of underpricing as a signalling mechanism in the aftermarket performance of Spanish IPOs. Their findings are consistent with the international evidence on long-run underperformance of IPOs. They confirmed that there was a positive relation between the level of underpricing of IPOs and the long-run performance of IPOs. This result confirms the signalling hypothesis for explaining the initial underpricing and long-run underperformance of IPOs in the Spanish capital market.

Kooli and Suret (2004) have argued that investor sentiment towards an IPO is an important factor in the long-run underperformance of IPOs. Gao (2010) studied the IPO price and long-term performance in China after the adaptation of the book building pricing mechanism. The study found that positive pre-market returns did not affect higher underpricing and it reduced underpricing. This indicates that the issuer and underwriter seize the window of opportunity opened by IPO issuance to maximise the offer price when investor sentiment is high. However, positive MS strongly increases overpricing in the long run. Other variables related to investor sentiment, individual-investor demand and trading volume, also have a positive effect on IPO overpricing. In addition, IPO initial returns can be used to predict IPO long-term performance. Finally, the study argues that rational theories have little power in explaining the IPO return in the Chinese market.

IPO investors are very concerned about obtaining prospectus information before buying shares, and managers have a strong motivation to report their managed earnings to increase the offer proceeds (Bhabra & Pettway 2003; Chaney & Lewis 1995; Rangan 1998; Teoh, Welch & Wong 1998). Loughran and Ritter (1997) have argued that, if an IPO company boosts its current earnings before issuing shares, this may lead to a decline in stock returns in the post issues because investors may overvalue new issues due to misinterpretation of the reported high earnings. However, investors may be disappointed because of the decline in post-operating performance (earnings) and this may negatively affect the long-run IPO performance.

2.6.1.2 Methodological problems of long-run performance

The issue of methodology is another important factor that researchers have emphasised in the current literature as far as the long-run underperformance phenomenon is concerned. Ahmad-Zaluki, Campbell and Goodacre (2007) documented mixed findings on the long-run price performance of Malaysian IPOs. A significant overperformance was reported in EW event CARs and BHARs using market benchmarks. However, this finding disappeared when the VW method was used to measure both returns and matched companies were employed as a benchmark. In addition, the significant overperformance disappeared when the Fama–French three-factor model was used to measure the long-run performance. This indicates that the even-time approach provides a more positive return in the long run relative to the calendar-time approach. Therefore, the findings vary according to the methodology used for analysis. Gompers and Lerner (2003) and Abukari and Vijay (2011) also found that whether IPOs underperform or overperform in the long run is determined by the method of performance measurement. Moreover, Ajlouni and Abu-Ein (2009) have argued that, overall, the suggested methodologies may create a positive return in the short run, but in the long run, they are dangerous to the investors' wealth. Therefore, they recommend the use of different methodologies and benchmarks in future analysis. Kooli and Suret (2004) documented that the long-run underperformance of Canadian IPOs depended on the methodology used and on the weighting schemes. Finally, Moshirian, Ng and Wu (2010) used alternative methodologies to examine the robustness of IPO performance in the Asian region. Their results clearly revealed that conflicting findings were obtained when different benchmarks were adopted. Further, the amount of abnormal returns depended on the methodology used and on the benchmark used for the return adjustment on IPOs. They concluded that the long-run performance of IPOs is a methodological issue and depends on the approach used in estimating the long-run abnormal returns.

2.6.1.3 Theories of short-run underpricing to explain long-run performance

The main theories of short-run underpricing that may explain the long-run performance are signalling theory, agency cost theory, prospect theory and uncertainty theory.

2.6.1.3.1 Signalling theory

As discussed in Section 2.4.1.6, short-run underpricing can be used as tool to signal the quality of issuers to the market. Allen and Faulhaber (1989), Welch (1989) and Grinblatt and Hwang (1989) explained short-run underpricing as a signal of high-quality issuers.

Normally, to recover any opportunity losses at the time of the IPO, high-quality issuers conduct secondary equity offerings when the market price is established after quality is discovered by investors. Grinblatt and Hwang (1989) found that high-quality issuers initially issue a low proportion of their equity capital at the time of the IPO at a low PRICE and then sell their remaining equity capital at a high price in the secondary market. This signals that companies earning high short-run returns with a low fraction of their equity capital tend to have better long-run performance.

Álvarez and González (2005) analysed the long-run performance of Spanish IPOs during the period 1987–1997 and examined the influence of underpricing as a signalling mechanism in the aftermarket performance of Spanish IPOs. They found a positive relation between the level of underpricing of IPOs and the long-run performance of IPOs. This result confirms the signalling hypothesis as an explanation for the long-run underperformance of IPOs in the Spanish capital market.

Using Australian and UK IPOs, Lee, Taylor and Walter (1996) and Belghitar and Dixon (2012) found a positive relationship between long-run market performance and the first-day return. They confirmed the signalling theory as an explanation of long-run market performance.

2.6.1.3.2 Agency cost theory

When a company is converted to an IPO, the ownership and control are conducted by two different parties. This is known as separation of ownership and control. This leads to an increase in agency costs, particularly because there is a reduction in owner managers or management owners. This principle was discussed in Section 2.4.2.2.

The agency cost theory may explain declines in long-run market performance due to the low ownership retained by owner managers at the time of the IPO. In other words, if the owner managers have high ownership after the IPO, the company may perform better in the long run. However, Jenkinson and Ljungqvist (2001) found that long-run market performance cannot be explained by agency cost in a semi-strong efficient market.

2.6.1.3.3 Prospect theory

Ma and Shen (2003) explained long-run IPO performance using prospect theory as an alternative to the existing theories. They argued that IPO underperformance is not a puzzle because of investor rationality. According to this theory, it is assumed that investors have utility functions that overweigh low probability events and underweigh medium and high probability events. IPOs have more extreme returns under the prospect theory than the expected utility theory. Therefore, if the average returns in the long run are lower, the investors will still invest in IPOs because of these extreme returns under the prospect theory.

2.6.1.3.4 Uncertainty theory

Thomadakis, Nounis and Gounopoulos (2012) used the ownership retention ratio as a proxy to measure the uncertainty of the quality of the firm and argued that a high retention ratio will indicate low uncertainty about the quality of the firm and expectations of better long-run performance. Goergen and Renneboog (2007) supported this argument. Some researchers have used variables to test the uncertainty theory to explain long-run market performance. These variables are the age of the issuing firm, size of the issue, size of the firm, offer price, LISD and MV. How (2000) used the delay variable to explain long-run performance. Offer size was used to explain long-run performance by Cai, Liu and Mase (2008) and Thomadakis, Nounis and Gounopoulos (2012). Omran (2005) used MV as an explanatory variable of long-run performance.

2.6.2 Determinates of Underperformance

Determinants of underperformance are employed to explain the above-discussed theories. The underperformance phenomenon has been explained using various determinants and proxies by different finance researchers. The following discussion shows how different researchers have used various determinants and proxies to explain the long-run IPO performance.

2.6.2.1 Initial return

Under market overreaction conditions, there is a negative relationship between past and subsequent abnormal returns on individual securities using a holding period of one year or more (De Bondt & Thaler 1987). When investors are overoptimistic as a result of a degree of underpricing, the positive initial return is expected to diminish over time (Omran 2005). Therefore, we can observe a negative relationship between initial excess returns and long-run abnormal returns. Ritter (1991) also found a negative relationship between excess initial return and aftermarket return. This relationship has been reported by many researchers (Abukari & Vijay 2011; Ahmad-Zaluki, Campbell & Goodacre

2007; Cai, Liu & Mase 2008; Chi, Wang & Young 2010; Dimovski & Brooks 2004; Johnston & Madura 2002; Kutsuna, Smith & Smith 2009; Mudambi et al. 2012; Omran 2005). However, a positive relationship between short-run underpricing and long-run performance has been reported in other IPO studies (Álvarez & González 2005; Belghitar & Dixon 2012; Lee, Taylor & Walter 1996). These studies suggested that underpricing signals the quality of the firms and these firms can issue shares in subsequent offerings at a market value price.

2.6.2.2 Operating performance

The operating performance of any firm has a direct influence on its market performance. Chan, Wang and Wei (2004) have argued that stock price performance in the long run in China reflects operating performance and is not purely driven by speculation. They reported that post-issuance stock returns for IPOs of A-shares were positively related to changes in operating cash flows on total assets, changes in sales growth rate and changes in operating return on assets. Chen and Ritter (2000) and Cai, Liu and Mase (2008) also reported that operating performance measures were positively related to long-run performance.

2.6.2.3 Industry

The long-run performance measures of IPOs can be categorised by industry, thus indicating how the long-run performance of IPOs varies in different industries. Ritter (1991) documented that financial institutions outperformed in the market because of the large drop in interest rates in 1985–1986, and oil and gas firms substantially underperformed in the market due to the decline of oil prices during 1981–1983. However, long-run underperformance of IPOs has been reported in all except three industries, and his study concluded that underperformance is more consistent with a ‘fads’ explanation than that of bad luck. Kooli and Suret (2004) also reported that the long-run performance of IPOs varies widely between industries. Their findings indicate that financial IPOs outperform in the long-run market, but mining IPOs underperform for any period in the long-run market. Further, they examined how high initial returns affect the long-run performance of industries. They found that oil and gas IPOs in Canada had high initial returns but very poor aftermarket performance. Moreover, they documented that, although technology IPOs underperformed over the long run, technology IPOs had among the highest aftermarket performances. In addition, communication and media and merchandising IPOs were also overpriced, indicating less dramatic underperformance than other industries. However, Ahmad-Zaluki, Campbell and Goodacre (2007) documented contradictory findings relative to those of the previous researchers on the long-run performance of Malaysian IPOs. They found that the construction sector outperformed in the long-run IPO market because it had a mean three-year BHAR of +36.28% and a high WR of 1.25, but consumer products, industrial products and properties sectors showed underperformance in the long run.

2.6.2.4 Age of the issuing firm

The age of the firm shows the operating history of the firm. Although firm age (FAGE) has shown a negative relationship with short-run underpricing, Ritter (1991) found a statistically significant positive relationship between long-run performance and FAGE. Further, he explained that poor long-run performance of younger IPOs (higher market-to-book ratio than older firms) can be expected because of the overoptimism and fads hypotheses. Balatbat, Taylor and Walter (2004) also reported a statistically significant positive relationship between the operating history of a company and the company's long-run performance. This relationship has been reported in many studies in the IPO literature (Belghitar & Dixon 2012). However, an insignificant negative relationship was reported by Brau, Couch and Sutton (2012) and Liu, Uchida and Gao (2012).

2.6.2.5 Years

The year is an important variable to explain long-run performance of IPOs. Ritter (1991) reported a negative relationship between long-run performance and annual volume. He argued that IPO companies decide to go public when investors can pay a high price (high price-earning or market-to-book) and poor long-run performance can be expected because of an unexpected realisation of subsequent net cash flows. Long-run poor performance is consistent with (1) bad lack or (2) irrational overoptimistic forecasts or fads. Chi, Wang and Young (2010) also found a negative relationship between listing year and three-year BHARs. However, Cai, Liu and Mase (2008) reported a positive relationship for all years with CARs and a negative relationship with BHARs.

2.6.2.6 Original ownership

An IPO forms a significant change in the firm's ownership structure and results in separation of managerial control and ownership (Wang 2005). The separation of ownership and control creates agency problems between owners and managers. From an agency cost theory viewpoint, a high level of original ownership will lead to a higher value of the firm (Jensen & Meckling 1976). According to the signalling theory, insider ownership sends a signal about the company's value. Leland and Pyle (1977) suggested that a greater percentage of ownership by insiders is a positive signal about a company, since insiders are assumed to have superior information about expected future cash flows. According to the uncertainty hypothesis, high retention indicates low uncertainty about the quality of the firm and this leads to better performance in the long run (Goergen & Renneboog 2007). Thomadakis, Nounis and Gounopoulos (2012) and Álvarez and González (2005) also found a positive relationship between long-run market performance and ownership retained by original shareholders. This relationship indicates that the original owners retaining more equity capital results in better long-run performance.

2.6.2.7 Issue size

Issue size is normally measured by the total issue capital in terms of dollars. According to past studies, investigations into the relationship between long-run performance and issue size have given contradicting results. Keloharju (1993), How (2000), Goergen and Renneboog (2007), Bird and Yeung (2010), Belghitar and Dixon (2012) and Minardi, Ferrari and Araujo Tavares (2013) found a positive relationship between issue size and long-run performance. This indicates that higher issues perform better in the long run than lower issues. However, Lee, Taylor and Walter (1996), Cai, Liu and Mase (2008), Chorruk and Worthington (2010), Chi, Wang and Young (2010), Liu, Uchida and Gao (2012) and Thomadakis, Nounis and Gounopoulos (2012) have reported a negative relationship with long-run performance. This shows that higher offers perform poorly in the long run compared with lower offers.

2.6.2.8 Hot issue market (HM) and market sentiment (MS)

HM and MS variables are used as proxies to test the window of opportunity hypothesis, expecting a negative relationship with long-run market performance. Thomadakis, Nounis and Gounopoulos (2012) tested the window of opportunity hypothesis using a dummy variable for 'hot' issue periods. They found a statistically significant negative relationship between long-run performance and hot issue periods. This relationship has been examined by several researchers (Abukari & Vijay 2011; Bancel & Mittoo 2009; Derrien & Kecskes 2007; Gajewski & Gresse 2006; Lowry 2003). The MS variable was used by Dimovski and Brooks (2004) to test the window of opportunity hypothesis. However, they were unable to find a negative relationship between long-run performance and MS.

2.6.2.9 Market return

MR is another important variable in investigations of the long-run performance of IPOs. Ritter (1991) used this variable to explain long-run performance in the United States and found a highly statistically significant positive relationship with the long-run performance of IPOs. However, he expected that the coefficient of the MR would be greater than 1. The coefficient of the MR indicates the average beta, which is used to measure the market risk. In contrast with Ritter's finding, Chorruk and Worthington (2010) reported a statistically significant negative relationship between long-run market performance and MR when they used three-year benchmark-adjusted BHARs as the dependent variable and a statistically insignificant negative relationship when they used three-year BHRs as the dependent variable.

2.7 The 'Hot Issue' Market Phenomenon

The second anomaly in the pricing of IPO is the 'hot' issue market phenomenon, which is a further extension of the underpricing phenomenon. The extent of underpricing is highly cyclical in some periods (Ritter 1991). Further, the periods of high average initial returns and rising volume are known as hot issue IPO markets. The hot issue IPO market is defined as when the monthly average first-day return is higher than the median (Ibbotson & Jaffe 1975). Hot issue IPO markets have been documented in different markets of the world, including the United Kingdom in October 1986 and South Korea in 1988 (Ritter 1998).

The hot issue IPO market phenomenon was first reported in the IPO literature in 1975 by Ibbotson and Jaffe, and other researchers have examined this issue subsequently. They have identified a significant relationship between the monthly number of IPOs (the frequency of new offerings) and the monthly average first-day return (aftermarket performance). Ibbotson and Jaffe (1975) tested this hypothesis using a sample of unseasoned common stock issues offered during the period 1960–1970. For each issue in the sample, they calculated the average new issue return during a particular calendar month using the original offer price and the first two months' ending prices. They documented a high degree of autocorrelation in monthly underpricing, which generally lasted for 11 months. Further, they suggested that their findings were more useful for investors, issuers and researchers. Investors may be able to earn a profit from the predictability of new issue first month premia in several ways. If issuers desire to offer their shares at the highest possible price, it is important to examine whether they can expect to obtain a higher price in a hot or cold issue market. Later, Ritter (1984) documented HMs as those having an unusually high volume of new offerings, severe underpricing and frequent oversubscription of offerings. He argued that the hot market in 1980 may have been attributable to small, natural resources issues since only these issues appeared excessively underpriced during the period. Ibbotson, Sindelar and Ritter (1994) confirmed the previous findings related to the HM. Further, they described the level of underpricing and IPO volume in terms of a persistent process in which current period values are a good predictor of the next period value. In addition, they observed that the first-order autocorrelation coefficient of monthly average initial returns and IPO volume were 0.66 and 0.89, respectively. Ibbotson and Ritter (1995) observed that the magnitude of swings in underpricing could not be fully accounted for by changes in risk. The changing risk hypothesis also did not explain the related phenomenon of cycles in the volume of new issues. Lowry and Schwert (2002) also found a relationship between months, high average first-day return and rising frequency of new issues. Loughran and Ritter (2002) documented that the autocorrelation of both volume and average first-day returns was high. Further, they reported that the first-day return could be predicted by using lagged MRs. This indicates that there is a lead-lag relation between the initial returns and the volume of IPOs. However, rational explanations for the HMs are difficult to come by (Ritter 1998). Nevertheless, Loughran and Ritter's (2002) prospect theory argument can be used as an explanation of HMs. Lowry (2003) examined why IPO offering frequency fluctuates so much and concluded that changes in aggregate capital demands and investor optimism are the primary determinants of changes in IPO volume over time. Brailsford et al. (2004) found that a high level of initial returns tends to coincide with a large volume of IPOs for up to a six-month period. Further, they suggested that this relationship supports the contention that the decision to issue is a function of current underpricing. Guo, Brooks and Shami (2010) characterised hot issue IPO markets as having a large volume of new offerings, high underpricing, strong market conditions and quick subscribing and listing speeds. The monthly volatility of IPO initial returns is substantial, fluctuates dramatically over time and is considerably larger during a hot IPO market (Lowry, Officer & Schwert 2010). Further, they suggested that the volatility of initial returns is higher for firms that are more difficult to value because of a higher information volatility asymmetry.

Part 2: Methodology on IPO Market Performance

Part two of this chapter discusses the methodology that has been used in the literature to analyse the short-run and long-run market performance of IPOs. The discussion includes the methods of performance measures, models and different approaches. The current study developed its methodology based on this section. The methodology is discussed, first, in relation to short-run market performance and, second, in relation to long-run market performance.

2.8 Methodology on Short-Run Market Performance

Short-run or initial market performance is measured using the level of underpricing of IPOs. The level of underpricing is normally measured using first-day returns. However, a few researchers have used post-day returns with first-day returns to measure short-run market performance. The following steps provide a basic idea on the methodology used for short-run market performance. These preliminary steps have been followed by many researchers.

- Step 1: Identify the first trading day.
- Step 2: Calculate the first-day return using different forms of return.
- Step 3: Estimate the average rate of return and identify whether IPOs are underpriced or overpriced in the short run.
- Step 4: Calculate test statistics to check whether short-run underpricing or overpricing is statistically significant.
- Step 5: Identify the determinants of short-run market performance using different econometric or statistical models (binary or non-binary models).

The first selling date of company shares to investors on a public stock exchange is considered the first trading date. Different types of companies are quoted on the securities exchange on different trading dates. Therefore, the first trading date of each company varies according to the selling date of the stock exchange.

The first-day returns are normally calculated using the following return measures:

1. RR

2. AR (excess return)

The RR for a share on the first trading day is calculated using the following equation:

$$RR_i = \frac{P_t - P_{t-1}}{P_{t-1}} \qquad (2.1)$$

where P_t = the closing price of a share on the first trading day, P_{t-1} = the offer price (subscription or issue) price and RR_i = the raw first-day return on a share.

The abnormal returns are estimated relative to a benchmark. A matching company and market index are the key benchmarks used in past studies. The following formula has been used to calculate the excess returns:

$$AR_i = RR_i - BR_m \qquad (2.2)$$

where RR_i = the raw first-day return on a share, BR_m = the benchmark return for the first day and AR_i = abnormal or excess return on a share.

To identify whether the IPOs are underpriced or overpriced, the average measures can be calculated using the above return measures. Underpricing (+) and overpricing (–) can be identified using a sign (+ or –) of the average return measure. Then, the t-statistic is used to test whether the underpricing or overpricing are statistically significant.

Finally, studies identify the major determinants of short-run market performance using different statistical models such as binary and non-binary. These determinants can be used to explain the short-run performance of IPOs. However, some past studies have not identified the reasons for short-run market performance. In Part 1 of this chapter, the determinants of short-run market performance are explained in detail.

The next section discusses the methodology for short-run market performance in detail using empirical evidence.

2.8.1 Empirical Evidence on Methodology for Short-Run Market Performance

The following discussion shows how different methodologies and models have been adopted by many finance researchers to measure short-run market performance.

Ibbotson (1975) examined the initial price performance of unseasoned stocks in the United States. The study examined the risk and performance of newly issued common stocks during the period 1960–1969. The offering was selected at random each month from the universe of unseasoned SEC registered offerings. The initial performance was measured from bid to bid adjusted for capital changes. The study estimated the initial raw returns on a monthly basis due to the unavailability of data. This method is an impure measure of initial performance because it includes up to one month's aftermarket performance. In addition to the monthly RR, Ibbotson used the two-parameter model and the RATS (returns across time and securities) model to estimate excess returns.

2.8.1.1 The two-parameter model

The Sharpe-Lintner model and the Fama model are used as a two-parameter model to estimate excess returns of risky assets. The following equation has been applied to forecast the excess returns under the two-parameter model:

$$\left(\bar{R}_{j,t}-\bar{\gamma}_{0,t}\right) = \propto_j + \beta_j\left(\bar{R}_{m,t}-\bar{\gamma}_{0,t}\right)+\bar{e}_{j,t} \qquad (2.3)$$

where $\bar{R}_j$ = the expected or average return on asset j, $\bar{\gamma}_0$ = the minimum variance portfolio that is uncorrelated with $\bar{R}_{m,}$, $\bar{R}_m$ = the expected or average return on the market portfolio, β_j = the systematic or market risk of any assets j and$t$ = the time period in months.

2.8.2.2 The RATS (return across time and securities) regression model

The measurement of systematic risk for individual securities is not possible because there is no price series available prior to an offering and since the stability of the systematic risk is itself being examined as the issue becomes seasoned. Therefore, the RATS are combined and this model is designated as RATS. The following RATS regression model has been used to estimate the returns of each month for a one-stock portfolio that consists of a different stock each month:

$$\left(\bar{R}_{j,n}-\bar{\gamma}_0\right) = \propto_n + \beta_{n,o}(\bar{R}_m-\bar{\gamma}_0)+\beta_{n,-1}\left(\bar{R}_{m,-1}-\bar{\gamma}_{0,-1}\right)+\bar{E}_{j,n} \qquad (2.4)$$

where n = the month of seasoning, which is held constant in each regression, $\bar{R}_{j,n}$ = the return of security j during the nth month of seasoning, $\propto_n$ = the regression constant, which is the average return in excess of the returns implied by the equilibrium relationship, $\beta_{n,o}$ = the regression coefficient for the unlagged independent variable, $\beta_{n,-1}$ = the regression coefficient for the independent variable lagged one month, $\bar{R}_m, \bar{\gamma}_0$ = the measure during the same calendar month as $\bar{R}_{j,n}$ for the unlagged independent variable $(\bar{R}_m - \bar{\gamma}_0)$, and measured in the previous calendar month for the lagged independent variable $\left(\bar{R}_{m,-1} - \bar{\gamma}_{0,-}\right)$ and $\bar{E}_{j,n}$ = the stochastic disturbance term for asset j during the nth month of seasoning.

2.8.2.3 The first-day and post-day return based models

The initial performance of Greek IPOs was documented by Kenourgios, Papathanasiou and Melas (2007) using 169 listed IPOs on the Athens Stock Exchange over the period 1997–2002. This sample was considered the population of IPOs in this period and included common stock listings only. Preference shares and transfers were excluded from the sample.

The initial performance was measured using the RRs and the excess or adjusted returns widely used in the literature:

$$Raw\ Return\ for\ shares = \frac{(Closing\ price\ of\ the\ P_x\ day) - \left(the\ IPO\ price_{\lambda,i}\right)}{The\ IPO\ price_{\lambda,i}} X100 \quad (2.5)$$

where x = 1, 5, 21 and λ, i = the last day of the public offering of firm i.

In addition to the first day, the study estimated the RRs for the fifth and twenty-first days. The following formula was used to estimate the RR of the General Index (GI) of the Athens Stock Exchange:

$$Raw\ return\ for\ the\ market\ index = \frac{GI_x - GI_{\lambda,i}}{GI_{\lambda,i}}\ X\ 100 \quad (2.6)$$

The excess returns for shares were estimated using the following equation considering the RR for shares and the market:

$$Excess\ returns_x = \left[\frac{(P_x - P_{\lambda,i})}{P_{\lambda,i}} - \frac{(GI_x - GI_{\lambda,i})}{GI_{\lambda,i}}\right] 100 \quad (2.7)$$

Cross-sectional and regression analysis (non-binary) was employed to investigate how the underwriter's reputation and oversubscription affected the initial performance of the Greek IPOs. Heteroscedasticity problems of the residuals in the regressions were also adjusted using White's heteroscedasticity-consistent estimation.

A study on the listed securities of the Tunis Stock Exchange by Slama Zouari, Boudriga and Boulila (2011) investigated short-run IPO performance using a sample of 34 Tunisian IPOs for the period 1992–2008. Following previous studies, this study estimated the return of a stock at the end of the first trading day using the following equation:

$$R_{i1} = \frac{P_{i1}}{S_{i0}} - 1 \qquad (2.8)$$

where P_{i1} = the closing price of the stock i on the first trading day, S_{i0} = the subscription price and R_{i1} = the raw first-day return on the stock i.

The market-adjusted abnormal return (MAR) was used to measure the underpricing due to the LISD. The MAR was computed as follows:

$$MAR_{m1} = R_{i1} - \left[\frac{P_{m1}}{P_{m0}} - 1\right] \qquad (2.9)$$

where P_{m1} = the closing market index on the first trading day and P_{m0} = the closing market index value on the last day of the subscription period.

The market capitalization weighted index for the Tunis Stock Exchange (TUNIDEX) was employed as a proxy for the market index. This study estimated the MAR for three windows (t = 1, 2, 3) for the following reasons:

1. The literature indicated that the average beta of newly listed firms is higher than the systematic risk of the market portfolio (value of beta is greater than 1).
2. Previous studies indicated that underpricing should be measured over a longer window in less developed markets because aftermarket prices may take more time to reach equilibrium.

However, this study did not explain the reasons for the short-run market performance by developing regression models.

Sohail, Raheman and Durrani (2010) evaluated the short-run IPO performance of 73 IPOs listed on the KSE during 2000–2009. This study analysed the short-run IPO performance under three economic conditions (normal, boom and recession) and four window periods (first day, fifth day, tenth day and twentieth day).

The calculation of RR and market-adjusted return was consistent with the empirical literature. The market-adjusted short-run performance (MASRP) for each IPO was measured using the following equation:

$$MASRP_{i,d} = 100\, X \left\{\left[\left(1 + R_{i,d}\right)/\left(1 + R_{m,d}\right)\right] - 1\right\} \quad (2.10)$$

where $R_{i,d}$ = the RR for stock i at the end of the d^{th} trading day and $R_{m,d}$ = the d^{th} day's equivalent MR.

The following t-statistic was also used to test the hypothesis, which is the cross-sectional short-run performance (returns) at the d^{th} day is equal to zero:

$$t = [\overline{MASRP}_d]/\left[\frac{s}{\sqrt{n}}\right] \quad (2.11)$$

where $\overline{MASRP}_d$ = the sample mean value of MASRP and s = the cross-sectional standard deviation of $\overline{MASRP}_d$ for the sample of n firms.

In addition to the market-adjusted returns, the following WR model was used to measure the short-run performance:

$$WR_d = \left[1 + \frac{1}{n}\sum_{i=1}^{n} R_{i,d}\right]/\left[1 + \frac{1}{n}\sum_{i=1}^{n} R_{m,d}\right] \quad (2.12)$$

where WR_d = the wealth relative for the dth trading day and n = the total number of IPOs in the sample.

This study did not identify the reasons for the short-run underpricing.

2.8.2.4 The first-day primary and secondary market return based model

Chinese A-Share IPO initial returns were analysed by Chang et al. (2008) using a sample of 891 from the period 1996 to 2004. In this paper, the IPO initial return was divided into two components: the initial return in the primary market and the initial return in the secondary market. The main reasons behind this classification were the opening and closing price variation on the first listing day and the political control of the primary equity market in China.

The initial return in the primary and secondary market was estimated using the following formulas:

$$Primary\ market\ return(R_P) = \frac{1st\ day\ opening\ price - offering\ price}{Offering\ price} \tag{2.13}$$

$$Secondary\ market\ return\ (R_S) = \frac{1st\ day\ closing\ price - 1st\ day\ opening\ price}{1st\ day\ opening\ price} \tag{2.14}$$

The total initial return was estimated using the following equation:

$$Total\ Return\ (R) = [(1 + R_P)(1 + R_S)] - 1$$

The excess returns were calculated only for the secondary market, taking into consideration the MR. The time interval was taken as the log of the number of days between IPO issuing and listing. The main reason for using this log value was that the average number of days between issuing and listing is longer than in developed countries. Finally, a regression analysis (non-binary) was conducted to find the reasons for the PRIMs and SECONs.

2.8.2.5 Forecasting models of short-run market performance

Forecasting of short-run market performance is an important aspect in the IPO literature because less attention has been given to this area in previous research. Aktas, Karan and Aydogan (2003) examined this area using 190 IPOs listed on the Istanbul Stock Exchange (ISE) during 1992–2000. They estimated the short-run market performance of 95 IPOs that were listed in 1992–1996 and tested these developed models using the remaining IPOs that were listed in 1997–2000. They analysed the short-run market performance by calculating CARs for first listing day and another 14 trading days. The statistical significance of CARs was tested using the following t-statistics:

$$t(CAR) = \frac{CAR_t}{\sigma(CAR)_t} \tag{2.15}$$

where $\sigma(CAR)_t = \sigma(AR)_t * (t + 1)^{1/2}$ and $\sigma(AR)_t$ = the variance of MAR over t days.

They identified the determinants of short-run market performance by estimating models using multiple regression, multiple discriminant analysis and logit regression. The three models that they used are given below.

Multiple regression model:

$$CAR_i = \beta_0 + \sum_{k=1}^{k} \beta_k X_{k_i} + \varepsilon_i \qquad (2.16)$$

where CAR_i = either 1-day, 7-day or 15-day CAR for IPO i, β_k = the coefficient of the explanatory variables and X_{k_i} = explanatory variables and ε_i = the error term of the model.

This model was estimated three times, for CAR 1, CAR 7 and CAR 15.

Multiple discriminant model:

$$Z_i = \beta_0 + \sum_{k=1}^{k} \beta_k X_{k_i} \qquad (2.17)$$

where Z_i = the discriminant value for IPO i, β_k and β_0= the discriminant coefficients and X_{k_i} = explanatory variables.

These models were specially developed for binary dependent variables and, therefore, CAR 1, CAR 7 and CAR 15 were converted into the values 1 and 0. Positive CARs were identified as 1 and negative CARs as 0.

Logit model:

$$ln\left[\frac{P_i}{1-P_i}\right] = \beta_0 + \sum_{j=1}^{m} \beta_j X_{i_j} \qquad (2.18)$$

where P_i = the probability of dependent variable, which is 1 (probability of having a positive CAR), $1 - P_i$ = the probability of dependent variable, which is 0 (probability of having a negative CAR), β_j and β_0 = parameters and X_{i_j} = independent variables.

These models were also specially developed for binary dependent variables, and positive CARs were identified as 1 and negative CARs as 0. Further, the study explained that the logit models are more realistic than multiple regression models because they do not depend on the normal distribution assumption.

2.8.2.6 Australian short-run market performance models

Short-run market performance in Australia has been examined by many researchers. Similarly to studies in other countries, most studies in Australia have used first-day returns to evaluate short-run market performance (Balatbat, Taylor & Walter 2004; Bird & Yeung 2010; Dimovski & Brooks 2004; Dimovski, Philavanh & Brooks 2011; Gong & Shekhar 2001; How 2000; How, Izan & Monroe 1995; How & Low 1993; Lee, Taylor & Walter 1996). However, Finn and Higham (1988) examined the short-run market performance using market-adjusted daily returns, which included the first-day returns and post-day listing return up to the tenth trading day. In addition to the market-adjusted performance measures, they calculated risk-adjusted monthly returns for the first 12 months following Ibbotson's (1975) RATS model. How, Lam and Yeo (2007) and Da Silva Rosa, Velayuthen and Walter (2003) used different adjusted first-day return measures to evaluate short-run underpricing. How and Howe (2001) calculated first-day raw (RR) and abnormal return (AR) using a continuously compounded method to measure short-run underpricing. The short-run market performance methodologies of the selected Australian studies are discussed below.

The short-run performance of industrial and commercial IPOs listed in July 1966 to June 1978 on the Sydney Stock Exchange was examined by Finn and Higham (1988). Their study evaluated the short-run market performance using average market-adjusted daily returns (MARs) and cumulative abnormal returns (CARs). First, they calculated the excess return of securities from the first trading day to the tenth trading day using the following equation:

$$U_{it} = R_{it} - R_{mt} \quad (2.19)$$

Where U_{it}= the excess return on security i in period t, R_{mt}= the benchmark return in period t and R_{it}= the RR on security i in period t.

Using excess return of securities, the AERs and CAERs were calculated as follows:

$$AER_t = \frac{1}{n}\sum_{i=1}^{N} U_{i,t} \quad (2.20)$$

$$CAER_{q,s} = \sum_{t=1}^{s} AER_t \quad (2.21)$$

The statistical significance was tested using a standard cross-sectional t-statistic for the AERs only. The statistical significance of the CAERs were not tested.

How, Lam and Yeo (2007) and Da Silva Rosa, Velayuthen and Walter (2003) measured short-run market performance using adjusted initial-day returns. Following Habib and Ljungqvist (1998), they calculated the following underpricing measures based on the first-day RRs:

Underpricing issuer loss (UPIL):

$$UPLI = [(P_c – P_i)/P_i] * (1 – RO) \quad (2.22)$$

where $(P_c – P_i)/P_i$ = the first-day RR relative to the PRICE, RO = the retained original ownership, P_c = the first trading day closing price and P_i = the PRICE.

Underpricing loss by market value (UPLMV):

$$UPLRMV = (P_c – P_i) * [(SS + RO * PS)/(P_c * TS)] \quad (2.23)$$

where SS = the number of shares held by pre-IPO shareholders that are sold, in the IPO, which are known as secondary shares, PS = the number of new shares offered in the IPO, which are known as primary shares and TS = the total shares on issue for that firm after the IPO.

Underpricing loss by issue price (UPLIP):

$$UPLRIP = (P_c – P_i) * [(SS + RO * PS)/(P_i * TS)] \quad (2.24)$$

The above underpricing measures are known as non-traditional underpricing measures. However, these underpricing measures are calculated after adjusting the first-day RR (P_c – P_i). Therefore, these measures are also considered first-day-return-based measures.

The review of the Australian IPO literature shows that most studies have used non-binary regression models to identify the reasons for short-run market performance or short-run underpricing (Balatbat, Taylor & Walter 2004; Bird & Yeung 2010; Da Silva Rosa, Velayuthen & Walter 2003; Dimovski & Brooks 2004, 2006; Dimovski, Philavanh & Brooks 2011; Finn & Higham 1988; Gong & Shekhar 2001; How 2000; How, Izan & Monroe 1995; How, Lam & Yeo 2007; How & Low 1993; Lee, Taylor & Walter 1996; Nguyen, Dimovski & Brooks 2010; Suchard & Singh 2007).

2.9 Methodology on Long-Run Market Performance

Long-run or post-market performance has been widely measured using cumulative-based returns and buy-and-hold-based returns. These return measures are normally calculated as abnormal return measures. The various methods of measuring abnormal performance have been explained by Strong (1992), Barber and Lyon (1997), Kothari and Warner (1997) and Lyon, Barber and Tsai (1999). Their papers did not recommend a single measure to evaluate the long-run market performance because these measures suffer a number of biases. However, the method of performance measurement varies according to the approach. In prior studies, long-run performance has always been analysed under the following three main approaches:

1. event-time approach
2. calendar-time approach
3. mixed-time approach.

The following discussion briefly explains how long-run performance is analysed under each of the above-mentioned approaches.

2.9.1 Event-Time Approach

In the event-time approach, return measures are estimated according to the event-time methodology. The following steps have been applied under the event-time approach to measure the long-run performance of IPOs.

- Step 1: Denote the first trading day or initial period as t = 0.
- Step 2: Determine the event period for assessment.
- Step 3: Identify and calculate different measures for the long-run performance.
- Step 4: Interpret results to identify whether IPOs underperform or outperform in the long run.
- Step 5: Test the statistical significance of this underperformance or overperformance.
- Step 6: Identify the determinants of long-run market performance using different econometric or statistical models. The determinants are used to explain the long-run performance of IPOs, which have been explained in detail in section 2.6.2 of this chapter. However, some studies have not explained the reasons for long-run performance (underperformance) using developed econometric models.

The determination of the event period is an important factor as far as IPO long-run performance is concerned. Previous studies have measured this period in terms of days, months and years. Studies have calculated the long-run return for the period of one year, three years and five years. The previous studies indicate that the average long-run period is three years.

Another important step under this approach is the evaluation of long-run IPO performance using different performance measures. In the event-time approach, the CARs, ARRs, BHRs and WRs are used to measure the long-run performance of IPOs.

The abnormal returns are normally calculated using the following benchmarks:

1. control or matching company
2. a reference portfolio—based on indexes
3. alpha and beta values of Fama and French (1993)

4. beta value of the capital assets pricing model (CAPM; 1964).

The next step is to identify whether IPOs underperform (–) or outperform (+) in the long-run IPO market. The sign (+ or –) of the calculated average performance measures can be used for this identification.

The final step is to determine whether the long-run underperformance or overperformance is statistically significant. The statistical significance is mainly tested using two t-statistics: conventional t-statistic and the bootstrapped skewness-adjusted t-statistic. The skewness-adjusted t-statistic is related to the BHRs. Previous studies suggest the skewness-adjusted t-statistic for BHRs when a reference portfolio or market index is used as a benchmark to calculate the abnormal returns.

2.9.2 Calendar-Time Approach

Some studies have used the calendar-time approach instead of the event-time approach to evaluate the long-run performance of IPOs. They have argued that the event-time returns overstate the statistical significance of mean excess (abnormal) returns because of the cross-sectional dependence of observations. Time-series regressions analysis is mainly used under the calendar-time approach. In this approach, performance measures are calculated based on the calendar period. The long-run period is measured in terms of calendar months. The average period is three to five years.

In the calendar approach, all measures are calculated using different models. Previous studies have frequently employed the CAPM (1964) and the Fama and French (1993) three-factor model to measure long-run performance. Some studies have argued that Fama and French’s three-factor model is superior to other models. However, this argument is not accepted by some IPO researchers. The statistical significance of all measures is tested using conventional t-statistics.

2.9.3 Mixed-Time Approach

Under the mixed-time approach, long-run performance measures are computed by following the two above-mentioned approaches.

2.9.4 Empirical Evidence on Methodology for Long-Run Market Performance

The following discussion indicates how different researchers have adopted different methodologies to evaluate IPOs' long-run performance.

Ritter (1991) examined the long-run performance of IPOs using 1,526 US companies during 1975–1984. The study used the following five criteria for sample selection:

1. an offer price of $1.00 per share or more
2. gross proceeds, measured in terms of 1984 purchasing power, of 1,000,000 or more
3. the offering involved common stock only (unit offers are excluded)
4. the company was listed on the Center for Research in Security Prices (CRSP) daily American Stock Exchange-New York Stock Exchange (AMEX-NYSE) or NASDAQ tapes within six months of the offer date
5. an investment banker took the company public

Ritter applied the following two measures to evaluate the long-run performance of the IPOs of his sample companies:

1. CARs with monthly portfolio rebalancing, in which the adjusted returns are computed using several different benchmarks
2. three-year BHRs for both the IPOs and a set of matching firms.

All returns were computed for two intervals: the initial return period (first day) and the aftermarket period. The initial return was defined as the offering date to the first closing price listed on the CRSP daily return tapes (both NASDAQ and AMEX-NYSE) and the aftermarket was defined as the three years after the IPO exclusive of the initial return period. The initial return period was denoted as month 0, and the aftermarket period included the following 36 months, where months were defined as successive 21-trading-day periods relative to the IPO date.

Monthly benchmarked-adjusted returns were calculated as the monthly RR on a stock minus the monthly benchmark return for the corresponding 21-trading-day period. The following benchmarks were used to estimate the adjusted return:

1. the CRSP VW NASDAQ index

2. the CRSP VW AMEX-NYSE index
3. listed firm matched by industry and size
4. an index of the smallest size decile on the NYSE.

The benchmarked-adjusted return (ar) for stock i in event month t was calculated using the following equation:

$$ar_{i,t} = r_{i,t} - r_{m,t} \tag{2.25}$$

where $r_{i,t}$ = the RR for stock i event month t and $r_{m,t}$ = the benchmark return for event month t.

The EW arithmetic average benchmark-adjusted returns (ARs) on a portfolio of n stocks for event t were calculated using the following equation:

$$AR_t = \frac{1}{n}\sum_{i=1}^{n} ar_{i,t} \tag{2.26}$$

The CAR from event month q to event month s was the summation of the average benchmark-adjusted returns. This was computed as follows:

$$CAR_{q,s} = \sum_{t=q}^{s} AR_t \tag{2.27}$$

If any firm was delisted in portfolio p from the CRSP data, the portfolio return for the next month was an EW average of the remaining firms in the portfolio.

In addition to the CARs, three-year BHRs were calculated to evaluate aftermarket returns assuming monthly portfolio rebalancing.

$$R_i = \prod_{t=1}^{36}\left(1 + r_{i,t}\right) \tag{2.28}$$

where $r_{i,t}$ = the RR on the firm in event month t.

The RR measured the total return from a buy and holds strategy where a stock was purchased at the first closing market price after going public and held until the earlier of (a) its three-year anniversary, or (b) its delisting.

Ritter calculated WRs as a long-run performance to interpret the three-year buy-and-hold total returns:

$$WR = \frac{(1 + average\ 3{-}year\ total\ return\ on\ IPOs)}{(1 + average 3{-}year\ total\ return\ on\ matching\ firms)} \tag{2.29}$$

A WR of greater than 1 indicated that the IPOs were outperformed; a WR of less than 1 was interpreted as IPOs underperforming.

Ritter investigated possible reasons for the long-run underperformance of IPOs by analysing cross-sectional and time-series patterns.

The Canadian evidence on long-run performance was documented by Kooli and Suret (2004) using 445 IPOs from 1991 to 1998. Their sample provides clear evidence of clustering. They revealed that 321 of the 445 sample offers (72.16%) occurred in 1993, 1994, 1996 and 1997. In addition, 62.84% of the aggregate gross proceeds in the sample were in these four years. Therefore, these periods are considered the HM periods. The years 1991, 1992, 1995 and 1998 are considered cold issue market periods because they had low sample offers and less gross proceeds.

The aftermarket period was 60 months (five years), where months are defined as successive 21-trading-day periods relative to the IPO date. Mainly, they measured the aftermarket performance on the PRICE and the first closing market price. The PRICE base allowed them to identify the performance of IPOs taken by institutional investors since institutional investors are able to buy IPOs at the PRICE. However, the first closing market price base helped them to examine the long-run performance of IPOs acquired by individual investors, because they normally buy shares at the market price. The control firm approach was used as benchmark to calculate excess returns. However, they rejected the use of a control of similar size and book-to-market ratio (B/M) due to the reduction of the sample size. CARs were EW and value weighted (VW).

They used the following long-run performance measures to evaluate Canadian IPOs:

1. cumulative average adjusted returns (CARs)
2. BHARs
3. calendar-time abnormal returns (CTARs)

The CARs were calculated relative to the benchmark using the convention equation that was used by Ritter (1991). The following equation was used to test the statistical significant (t-statistic) for the CARs:

$$tCAR_{1,t} = \sqrt{\frac{n_t}{t \times var + 2 \times (t-1) \times cov}} \qquad (2.30)$$

where var = the average of the cross-sectional variations over 60 months of the excess returns ($ar_{i,t}$) and cov = the first-order autocovariance of the monthly average excess return series (AR_t). This is based on EW and VW.

The second measure of aftermarket performance was the BHARs. This was also computed based on the PRICE and the first closing market price. BHARs were EW and VW. The BHAR was defined as:

$$BHAR_{i,T} = \left[\prod_{t=1}^{T}(1 + r_{i,t}) - 1\right] - \left[\prod_{t=1}^{T}(1 + r_{m,t}) - 1\right] \qquad (2.31)$$

where T = 60 months or the delisted date of the stock, $r_{i,t}$ = return of the firm i during the month and $r_{m,t}$ = return on the benchmark during the corresponding time period.

They used skewness-adjusted t-statistics to test the null hypothesis of zero mean BHR. The skewness-adjusted t-statistic was calculated as follows:

$$t = \sqrt{n} * \left(s + \frac{1}{3}\hat{y}s^2 + \frac{1}{6n}\hat{y}\right) \qquad (2.32)$$

where $S = \frac{\overline{BHAR_t}}{\sigma(BHAR_t)}$ $t = 12,\ 24,\ 36,\ 48\ and\ 60\ months$ and $\hat{y} =$ the estimation of the coefficient of skewness.

Kooli and Suret also analysed cross-sectional and time-series patterns with a view to identifying the explanation for the long-run performance.

Ahmad-Zaluki, Campbell and Goodacre (2007) examined the long-run share price performance of 454 Malaysian IPOs during the period 1990–2000. They gathered the relevant data from the Kuala Lumpur Stock Exchange (KLSE) during this period and some data were collected for the study. The final sample was selected using the following criteria:

1. an offer price of at least RM1.00 per share
2. an offering involving common stock only
3. a fixed-price offering only (exclude tender offer)
4. the company to be listed on the main board or the second board of the KLSE

5. an investment bank is responsible for taking the company public
6. the availability of returns data on the Datastream database for up to three years after listing
7. the listing did not result from a takeover or merger, or from an introduction or a major restructuring scheme
8. the exclusion of companies classified as infrastructure project companies, and companies from the finance, trust, or closed-end funds sector.

The study employed the following benchmarks in calculating long-run abnormal or excess returns:

1. a matching or control company benchmark
2. a reference portfolio of the Malaysian main market index (Kuala Lumpur composite index [KLCI])
3. a reference portfolio consisting of the alternative market indices in Malaysia (EMAS/second board index)
4. alpha values derived from the Fama and French (1993) three-factor model.

The market-adjusted returns were aggregated into overall reference portfolio returns on an EW and VW basis. The study used two different approaches to analyse the long-run abnormal performance: the event-time approach and the calendar-time approach.

Under the event-time approach, the abnormal returns were computed for up to three years after the first day of listing (exclude the initial return). The event month was defined as the month period following the listing date. The monthly RRs for the event months were calculated as follows:

$$r_{it}=\frac{(P_{it}-P_{it-1})}{P_{it-1}} \qquad (2.33)$$

where r_{it} = RR for company i in the event month t following listing, P_{it} = last traded total return index of the company in event month t and P_{it-1}= last traded total return index in event month $t-1$.

The study employed three abnormal return measures under the event-time approach:

1. CAR
2. BHR
3. WR.

The CAR was calculated using EW and VW cumulative mean benchmark-adjusted returns over various intervals during the 36-month post-market period, q to s, as follows:

$$CAR_{q,s} = \sum_{t=q}^{s} AR_t \tag{2.34}$$

The initial return was excluded by treating the return index on the first day of listing as a purchase price. Following Ritter (1991), the study calculated the cumulative mean benchmark-adjusted return for months 1 to 36, $CAR_{1,36}$, considering monthly rebalancing. The t-statistic was also calculated according to Ritter as follows:

$$t(CAR) = CAR_{1,t} * \sqrt{n_t}/csd_t \tag{2.35}$$

where, n_t is the number of companies trading in each month, and csd_t is calculated as follows:

$$csd_t = [t * var + 2 * (t-1) * cov]^{1/2} \tag{2.36}$$

where, t = the event month, var = the mean cross-sectional variance over 36 months and cov = the first-order autocovariance of the AR_t.

BHR was employed to reduce the downward statistical bias in long-term CARs. The study calculated two types of BHRs for the three-year holding period as follows:

1. raw BHR
2. benchmark-adjusted (excess or abnormal) BHR.

Raw BHR and benchmark-adjusted BHR were computed using the following equations:

$$Raw\ BHR_{i,t} = \left[\prod_{t=start}^{min(T,delist)} (1 + r_{i,t}) - 1\right] \tag{2.37}$$

$$\text{Benchmark} - \text{adjusted } BHR_{i,T} = \left[\prod_{t=start}^{min(T,delist)} (1 + r_{i,t}) - 1\right] - \left[\prod_{t=start}^{min(T,delist)} (1 + r_{m,t}) - 1\right] \tag{2.38}$$

where $min(T, delist)$ = the earlier of the last month of KLSE-listed trading or the end of the three-year window, $t = start$ = the first event listing month, $r_{i,t}$ = company's monthly RR and $r_{m,t}$ = relevant monthly benchmark return.

A negative (positive) value of benchmark-adjusted BHR indicated that IPOs underperformed (outperformed) a portfolio of benchmarks. The mean returns were also calculated for both the BHR returns on EW and VW bases. The statistical significance of the mean BHARs was tested using two different methods: conventional t-statistic and bootstrapped skewness-adjusted t-statistic. The conventional method was used when the matching company benchmark was employed. The bootstrapped skewness-adjusted method was employed when a reference portfolio or market index was used as a benchmark. The bootstrapped skewness-adjusted t-statistic was computed as follows:

$$t_{sa} = \sqrt{n}\left(s + \frac{1}{3}\hat{y}s^2 + \frac{1}{6n}\hat{y}\right) \tag{2.39}$$

Following Ritter (1991), the WRs were also calculated using the three-year total BHRs to measure the long-run relative performance, as follows:

$$WR = \frac{1 + average\ 3-\ year\ total\ return\ on\ IPO}{1 + average\ 3-year\ total\ return\ on\ benchmars} \tag{2.40}$$

Under the calendar-time approach, the study analysed the long-run performance using the calendar-time approach because the event approach may have overstated the statistical significance of the mean abnormal return. Under the calendar-time approach, they employed the alpha coefficient from a Fama-French three-factor model to measure the long-run abnormal return. The three-factor model is illustrated by the following regression:

$$R_{pt} - R_{ft} = \propto + \beta(R_{mt} - R_{ft}) + \gamma SMB_{t+}\delta HML_t + \varepsilon_t \tag{2.41}$$

where R_{pt} = the IPO portfolio return in month t, R_{ft} = the one-month Malaysian base lending rate, R_{mt} = the monthly MR of the KLCI, SMB_t = the monthly return on the zero investment portfolio for the size factor in the stock returns and HML_t = the monthly return on the zero investment portfolio for the book-to-market equity factor in stock returns.

Finally, Ahmad-Zaluki, Campbell and Goodacre (2007) analysed the cross-sectional pattern of the long-run performance of Malaysian IPOs using year of listing, company characteristics and issue characteristics. The company characteristics were sector classification, board of listing, type of company and company size. The issue characteristics were IPO gross proceeds and initial returns.

Ajlouni and Abu-Ein (2009) examined the long-run price performance in Jordan IPOs during the period 1990–2006. The final sample represented 51.06% of new issues during the sample period. This sample was selected using the following criteria:

1. The IPO company was listed and traded on the Amman Stock Exchange during the period 1993–2006.
2. The listing was not a result of a takeover or merger.
3. Monthly closing prices were available from the listing day (listing month) until October 2006.

The post-market performance was analysed using the returns of investors. The market index of the Amman Stock Exchange was used as a benchmark and it measured the overall performance of the market. The event-study was the main approach employed to measure the performance of the IPOs. The following three measures were applied under this approach:

1. CARs
2. BHRs
3. wealth relatives (WR).

The returns were calculated for 12-month, 24-month and 36-month windows after eliminating the initial return period. Event month definition and calculation of monthly returns were more or less similar to the previous researchers' methods. However, they calculated the monthly market-adjusted return for every IPO based on the following market model:

$$R_{at} = \alpha_i + \beta_i R_{Mt} + \Omega_{it} \tag{2.42}$$

where R_{at} = the adjusted rate of return for company i in the t following listing, β_i = the systematic risk of security, α_i = the intercept term and Ω_{it} = the error term, with $\sum \Omega_{it}$ = 0.

The above formula helped to calculate the market- and risk-adjusted rate of return for each IPO company. This rate of return took into account the company's systematic risk.

The benchmark-adjusted return, EW average benchmark-adjusted return and CAR were estimated by following Ritter (1991). The statistical significance of CAR was tested using a parametric test. This test is not suitable because the abnormal returns distributions show as fat tails and left skewed. Standardisation of the average abnormal returns (SARs) was calculated for the cross-sectional t-test for market-adjusted CARs. The SAR was calculated as follows:

$$SAR_{it} = \frac{AR_{it}}{SD_{AR,t}} \tag{2.43}$$

where SAR = standardisation of the average abnormal returns, AR_{it} = abnormal returns and $SD_{AR,t}$ = standard deviation.

The cross-sectional t-test for any point of time during the event window was calculated using the following equation:

$$t - value = \frac{1}{\sqrt{N}} * \sum_{i=1}^{N} SAR_{it} \tag{2.44}$$

where N = the number of IPOs in the time window.

The BHR and benchmark-adjusted BHR were calculated using the conventional equations used by the other researchers. The average benchmark-adjusted BHR was calculated using the EW method and the statistical significance was tested using skewness-adjusted t-statistics.

The WR was also calculated according to Ritter (1991) and the individual WR and average WR were estimated using the following equations.

$$Individual\, WR_T = \sum_{t=1}^{N} WR_{i,T} \tag{2.45}$$

$$Average\, WR_T = \frac{1}{N}\left(\sum_{t=1}^{N} WR_{i,t}\right) \tag{2.46}$$

The average WR was calculated as the EW average across a portfolio of N stock. A WR greater than 1 indicated that a portfolio of (n) stocks (IPOs) overperformed the benchmark of matching companies or market indices.

Omran (2005) examined the long-run performance of 53 SIPs on the Egyptian stock market during the period between 1994 and 1998. This study excluded privatisation due to liquidation, asset sales, lease or inactive trading on the stock market. The market-adjusted return was used to measure the initial performance instead of the conventional measure because of the following two issues:

1. Investors in most cases could not have the amount of SIPs in their bid; they had to bear extra costs for the capital tied up in the subscription but were not given any allocations.
2. The transaction costs applied to SIPs but not to market portfolios.

The above-mentioned costs were adjusted using the following market-adjusted equation:

$$r_i = \frac{P_{i,t}-P_{i,0}}{P_{i,0}} - \left[\frac{ARF_{0,t}(SD-TD)}{365} X\ (1-\psi)\ +\ \frac{TC_i}{P_{i,0}}\right] \qquad (2.47)$$

where $ARF_{0,t}$ = the average risk-free rate from the date of subscription to the date of trading, $SD - TD$ = the difference in number of days between the first day of trading and the last day of subscription, ψ = the percentage of shares allocated, TC_i = the transaction costs for each security of firm i, $P_{i,0}$ = the offer price of security i at the time of subscription and $P_{i,t}$ = the closing price of security i on the first trading day.

The market-adjusted return was calculated as the RR for security i minus the benchmark return on a corresponding reference portfolio. This study considered the following two indexes as a benchmark:

1. the general Egyptian capital market index (CMI)
2. the industry sector indexes (INDs).

The following models were used to measure the long-run performance of Egyptian privatisation IPOs:

1. CARs (for 12, 36 and 60 months)
2. BHARs (for 253, 756 and 1,260 trading days)
3. Sharpe-Lintner CAPM
4. WR.

CARs and BHARs were computed using the market-adjusted model over one-, three-, and five-year intervals, excluding the initial returns. CAPM was used to calculate risk-adjusted excess because CARs and BHARs are not adjusted for risk as are market-adjusted models. The following equation was used to estimate risk-adjusted abnormal returns:

$$CAPMAR_{i,t} = r_{i,t} - r_{f,t} - \beta_i[r_{crp,t} r_{f,t}] \quad (2.48)$$

where $CAPMAR_{i,t}$ = the abnormal return using CAPM for firm i in month t, $r_{f,t}$ = the risk-free rate proxy as a short-term one-month rate for bank deposits and β_i = the risk of security i (market risk of security i or slope of the regression).

Following Ritter (1991), the WR measure was also used to compare the aggregate BHR on a portfolio of SIPs relative to the aggregate BHR on a corresponding reference portfolio to interpret the performance of the SIPs.

Finally, this study examined several cross-sectional regressions to explain the determinants of the aftermarket performance. The initial excess return, ex-ante uncertainty, oversubscription of shares, proportion of shares offered, timing, MV and P/E were the main explanatory variables of the regression model.

Álvarez and González (2005) examined the long-run performance of Spanish IPOs using 52 final sample companies. This sample represented approximately 17% of the population of the quoted companies and the sample companies were smaller than the quoted companies.

The long-run performance was measured mainly using BHARs. BHARs were estimated by monthly compounding for different windows: 12, 36 and 60 months. The following equation was applied to estimate the BHARs:

$$BHAR = \frac{1}{N}\sum_{i=1}^{N}\left[\prod_{t=t_i}^{Ti}(1 + R_{it}) - 1\right] - \left[\prod_{t=t_i}^{Ti}(1 + ER_{it}) - 1\right] \quad (2.49)$$

where

R_{it} = the return on security i in month t adjusted for dividends

N = the number of securities

T = the number of months (12, 36 or 60 months)

t_i = the date of the closing price on the first day of trading

ER_{it} = the expected return.

This study used the following benchmarks to study the IPO performance:

1. a VW market index (the Madrid Stock Exchange General Index [IGBM]) and an EW market index
2. size and/or book-to-market portfolio
3. a control firm approach.

Firm size was measured in terms of the market value of common equity (the number of shares outstanding times the closing price). Book-to-market value was estimated as the total book value of the common equity in the balance sheet divided by the market value of common equity. The study followed Fama-French’s (1993) model to match the size and book-to-market portfolios. The sample firms were also matched to a control firm on the basis of size and B/M.

WR ratios were also used with the BHARs to analyse the long-run performance. Statistical significance of the excess stock returns was tested using a conventional t-statistic. Binary logit regression analysis was carried out to find the reasons for the long-run performance with offer characteristics and firm characteristics as independent variables. The dependent variable was identified as a dummy variable, which is defined as 1 for winner and 0 for loser in the long run. The study identified a winner as one that earned a positive abnormal return (+BHAR) and a loser as zero that earned negative abnormal return (–BHAR) in the long run. The long-run logit models were developed for year one, year three and year five. Similarly to Álvarez and González (2005), Abukari and Vijay (2011) explained the reasons for long-run market performance by developing binary logit models based on year three BHARs.

Moshirian, Ng and Wu (2010) examined the post-PRICE performance of six Asian countries (China, Hong Kong, Japan, Korea, Malaysia and Singapore) during 1991–2004. The sample in this study consisted of 4,439 IPO companies in these countries. The following criteria were considered when selecting the final sample:

1. Only common stock is involved in the offering and is being offered.
2. The stock is only traded in domestic currency.
3. The stock is listed on the main board only.

This study calculated BHARs under the following benchmarks to measure the long-run IPO performance:

1. market indices

2. control firm approach (size and B/M matched control firms)
3. reference portfolio approach (size and B/M matched reference portfolios).

The long-run excess returns were estimated for three years and five years. The short-term market performance was also measured using BHAR based on the market indices and control firm approach for one month, three months, six months and one year. The following formula was used to calculate the BHARs.

$$BHAR_{Kt} = \prod_{t=1}^{t}(1 + ER_{it}) - \prod_{t=1}^{t}(1 + CR_{it}) \tag{2.50}$$

where

ER_{it} = the buy-and-hold investment return for the event firm i at day (month) t and CR_{it} = the buy-and-hold investment return for the control firm i at day (month) t.

The conventional t-statistic was also used to test the significance of the compounding BHARs.

In addition to BHAR, the Fama and French three-factor model was employed to explain the time-series variations of IPO returns over time. The following time-series regression was used to estimate the calendar-time return on a portfolio for the five years of the calendar month:

$$R_{pt} - R_{ft} = \propto_0 + \propto_1 \left(R_{mt} - R_{ft}\right) + \propto_2 SMB_t + \propto_3 HML_t + \varepsilon_{it} \tag{2.51}$$

where

R_{pt} = the simple monthly return on the calendar-time portfolio, R_{ft} = the monthly short-term (three-month deposit) interest rate, R_{mt} = the return on an EW market index, SMB_t = the returns of portfolios of small stocks and big stocks and HML_t = the difference in the returns of high book-to-market stocks and low book-to-market stocks.

This study did not explain the reasons for the long-run performance by developing the econometric models.

The long-run performance of Chinese IPOs were examined by Cai, Liu and Mase (2008) using 335 A-share and B-share sample companies on the Shanghai Stock Exchange. The study eliminated 26 companies from the initial sample due to unavailability of data, subsequent seasoned equity offerings and a longer time period between issuing and listing. The matched-firm approach was not applied due to the small number of companies included in the sample. Therefore, the three-year post-IPO excess returns were estimated based on the following Chinese stock market indexes:

1. the Shanghai Stock Exchange A-share index
2. a capitalisation weighted index.

The BHAR and CAR were used as alternative measures to evaluate the long-run performance. Statistical significance was also tested using the conventional t-statistic and skewness-adjusted t-statistic, as was the case with previous researchers. This study examined several factors in relation to the Chinese IPOs and these factors explained the investor overoptimism and riskiness of the firms. The examined factors were the initial return, the size of the IPO, the holding retained by the government, the probabilty of success in the allocation, the firm's earnings prior to issue, the firm's operating performance after IPO and the decision by the firm to use a separate underwriter and referee. Finally, the study tested the significance of all factors using cross-sectional and regression analysis.

The long-term performance of IPOs in China was also analysed by Chan, Wang and Wei (2004) using a sample of 570 A-shares and 39 B-shares. Following Ritter (1991), this study also estimated excess returns using a control firm approach benchmark. According to this approach, three benchmarks were used to measure the long-term performance: size matching, B/M matching and size and B/M matching. The primary performance measures were BHAR and WR. The P/E and the B/M of the new issues were also employed as secondary measures for analysing the long-term performance of China's IPOs. Finally, this study investigated how their post-operating performance affected the post-issue stock returns using cross-sectional regressions. The post-market operating performance was measured using several proxies such as operating return on assets, operating cash flows on total assets, sales growth rate, assets turnover and capital expenditure growth rate. Statistical significance was tested using the conventional t-statistic. Gao (2010) also analysed long-run performance in the Chinese market using the event-time methodology. This study calculated BHAR for three months, six months and one year using the market index and industry index as benchmarks.

The long-run methodology (e.g. performance measures, approaches, time windows, econometric models) used in Australian IPO studies is similar to the non-Australian studies' methodology, except for the studies of Lee, Taylor and Walter (1996) and How (2000). These studies reported that the long-run cumulative average returns (CARs) were calculated under the buy-and-hold investment strategy considering dividends under the two weighting schemes of EW and VW. The studies avoided the monthly rebalancing assumption in calculating CARs due to the downward bias in the long-run returns reported by Ritter in 1991. They argued that the monthly rebalancing assumption does not produce a better investment strategy in the long run because the cross-sectional average combines the returns of firms in different calendar time intervals. According to their methodology, initial market-adjusted returns (R) were calculated using the following equation:

$$R_{i,t} = \left[\frac{P_{i,t}+d_{i,t}}{P_{i,t-1}} - \frac{I_t}{I_{t-1}}\right] \quad (2.52)$$

where $P_{i,t}$ = the price of security i in period t, $d_{i,t}$ = the value of any dividend for security i in period t and I_t = the marker index value in period t.

After calculating market-adjusted returns for each security, the MAR and CAR were calculated as follows:

$$AR_t = \sum_{i=1}^{n} \frac{R_{i,t} * x_i * P_{i,t-1}}{\sum_{i=1}^{n} x_i * P_{i,t-1}} \quad (2.53)$$

$$CAR_i = \prod_{t=1}^{36}(1 + AR_t) - 1 \quad (2.54)$$

where $x_i = \frac{1}{S_i}$, or $\frac{Z_i}{100}$, depending on the weighting scheme used, S_i = the subscription price per share and Z_i = the total number of shares on issue.

Table 2.3 shows the different performance measures, approaches, time and models used to analyse the short-run and long-run market performance of IPOs in Australia and non-Australian studies. The table shows that first-day return is a widely used approach for measuring short-run market performance whereas the event-time approach is commonly used to measure long-run performance. Most of the studies evaluated long-run performance using non-binary regression models for up to three years. However, less attention has been given to measuring short-run market performance using both first-day and post-days returns (returns of initial period) in Australia and other countries. In evaluating IPO market performance, binary regression models have also received less attention in the IPO literature, particularly in Australia.

Table 2.3: A Summary of Selected Australian and Non-Australian Published Empirical Evidence on Short-Run and Long-Run Performance Measures, Approaches, Time and Econometric Models

Author (s)	Period	Country	Performance measure[1] Short-run	Long-run	Approach for short-run/long-run[2]	Time window for long-run[3]	Econometric model[4]
Australian							
Finn & Higham (1988)	1966–1978	Australia	AR & CAR	CAR & RATS	First-day/Mixed	1 year	Non-binary
How & Low (1993)	1979–1989	Australia	RR & AR		First-day		Non-binary
How, Izan & Monroe (1995)	1980–1990	Australia	RR & AR		First-day		Non-binary
Lee, Taylor & Walter (1996)	1976–1989	Australia	AR	BHR	First-day/Event-time	3 years	Non-binary
How (2000)	1979–1990	Australia	AR	BHR	First-day/Event-time	3 years	Non-binary
How & Howe (2001)	1979–1990	Australia	AR & AR		First-day		Non-binary[5]
Gong & Shekhar (2001)	1989–1999	Australia	RR & AR		First-day		Non-binary
Da Silva Rosa, Velayuthen & Walter (2003)	1991–1999	Australia	RR & Adj. RR	BHR, WR & FF	First-day/Mixed	2 years	Non-binary
Dimovski & Brooks (2004)	1994–1999	Australia	RR	BHR	First-day/Event-time	1 year	Non-binary
Balatbat, Taylor & Walter (2004)	1976–1993	Australia	RR		First–day		Non-binary
Dimovski & Brooks (2008)	1994–2004	Australia	RR		First-day		Non-binary
Nguyen, Dimovski & Brooks (2010)	1994–2004	Australia	RR		First-day		Non-binary
How, Lam & Yeo (2007)	1993–2000	Australia	RR & Adj. RR		First-day		Non-binary
Suchard & Singh (2007)	1991–1996	Australia	RR & AR	BHR	First-day/Event-time	5 years	Non-binary
Bird & Yeung (2010)	1995–2004	Australia	AR	CAR	First-day/Event-time	2 years	Non-binary
How, Ngo & Verhoeven (2011)	1992–2004	Australia		BHR, CAR & FF	Mixed	5 years	Non-binary
Dimovski, Philavanh & Brooks (2011)	1994–1999	Australia	RR		First-day		Non-binary
Non-Australian							
Minardi, Ferrari & Araujo Tavares (2013)	2004–2008	Brazil		CAR	Event-time	1 year	Non-binary
Aggarwal, Leal & Hernandez (1993)	1980–1990	Brazil		BHR & WR	Event-time	3 years	Non-binary
Kooli & Suret (2004)	1991–1998	Canada		CAR & BHR	Event-time	5 years	Non-binary

Boabang (2005)	1990–2000	Canada	RR, CRR & CAR	CRR, CAR & FF	First-day and post-days/Mixed	3 years	Non-binary
Celis & Maturana (1998)	1991–1997	Chile	CAR	CAR	First-day and post-days/Event-time	4 years	Non-binary
Chen, Firth & Kim (2004)	1992–1997	China	AR		First-day		Non-binary
Chan, Wang & Wei (2004)	1993–1998	China	RR, AR, P/E & B/M	BHR, WR, P/E & B/M	First-day/Event-time	3 years	Non-binary
Chi & Padgett (2005)	1996–2000	China	AR & WR		First-day and post-days		Non-binary
Yu & Tse (2006)	1995–1998	China	AR		First-day		Non-binary
Guo & Brooks (2008)	2001–2005	China	AR, CAR		First-day and post-days		Non-binary
Cai, Liu & Mase (2008)	1997–2001	China		BHR & CAR	Event-time	3 years	Non-binary
Chang et al. (2008)	1996–2004	China	RR & AR		First-day (Primary and secondary)		Non-binary
Chi, Wang & Young (2010)	1996–2002	China		CAR, BHR & FF	Mixed	3 years	Non-binary
Gao (2010)	2006–2008	China	RR	BHR	First-day/Event-time	1 year	Non-binary
Liu, Uchida & Gao (2012)	2000–2007	China		BHR, WR & FF	Mixed	3 years	Non-binary
Moshirian, Ng & Wu (2010)	1991–2004	China, HK, Japan, Korea, Malaysia & Singapore	RR	BHR & FF	First-day/Event-time	5 years	#
Omran (2005)	1994–1998	Egypt	RR & AR	CAR, BHR, WR & CAPM	First-day/Mixed	5 years	Non-binary
Keloharju (1993)	1984–1989	Finland		CAR, BHR & WR	Event-time	3 years	Non-binary
Ljungqvist (1997)	1970–1990	Germany		BHR	Event-time	3 years	Non-binary
Stehle, Ehrhardt & Przyborowsky (2000)	1960–1992	Germany		BHR & WR	Event-time	3 years	Non-binary
Kasimati & Dawson (2005)	1999–2004	Greece	AR	CAR	First-day/Event-time	3 years	
Kenourgios, Papathanasiou &Melas (2007)	1997–2002	Greece	RR & AR		First-day and post-days		Non-binary
Thomadakis, Nounis & Gounopoulos (2012)	1994–2002	Greece		BHR, CAR, CAPM & SC	Mixed	3 years	Non-binary

Lyn & Zychowics (2003)	1991–1998	Hungary & Poland		AR	Event-time	3 years	Non-binary
Marisetty & Subrahmanyam (2010)	1990–2004	India	RR	CAR, BHR	First-day/Event-time	3 years	Non-binary[5]
Ajlouni & Abu-Ein (2009)	1990–2006	Jordan		CAR, BHR & WR	Event-time	3 years	#
Jelic, Saadouni & Briston (2001)	1980–1995	Malaysia	RR & AR	CAR, BHR & WR	Event-time	3 years	Non-binary
Ahmad-Zaluki, Campbell & Goodacre (2007)	1990–2000	Malaysia		CAR, BHR & FF	Mixed	3 years	Non-binary
Aggarwal, Leal & Hernandez (1993)	1987–1990	Mexico		BHR & WR	Event-time	1 year	Non-binary
Firth (1997)	1979–1987	New Zealand		CAR, BHR & WR	Event-time	5 years	Non-binary
Sohail, Raheman & Durrani (2010)	2000–2009	Pakistan	RR, AR & WR		First-day and post-days		#
Jewartowski & Lizinska (2012)	1998–2008	Poland	AR	CAR & BHR	First-day/Mixed	3 years	Non-binary
Alli, Subrahmanyam & Gleason (2010)	1995–2004	South Africa	AR	BHR	First-day/Event-time	3 years	Non-binary
Álvarez & González (2005)	1987–1997	Spain	RR & AR	BHR & WR	First-day/Event-time	5 years	Binary (logit)
Peter (2007)	1990–2002	Sri Lanka	RR & AR	BHR	First-day/Event-time	3 years	Non-binary
Samarakoon (2010)	1987–2008	Sri Lanka	RR		First-day		Non-binary
Thorsell & Isaksson (2012)	1996–2006	Sweden	AR	BHR	First-day/Event-time	2 years	Non-binary
Drobetz, Kammermann & Walchli (2005)	1983–2000	Switzerland		SW	Calendar-time		
Chorruk & Worthington (2010)	1997–2008	Thailand	RR & Adj. RR	CAR, BHR & WR	First-day/Event-time	3 years	Non-binary
Ekkayokkaya & Pengniti (2012)	1990–2007	Thailand	RR		First-day		Non-binary
Slama Zouari, Boudriga & Boulila (2011)	1992–2008	Tunisia	AR		First-day		Non-binary
Kiymaz (2000)	1990–1996	Turkey	AR	CAR	First-day and post-days /Event-time	0.25 year	Non-binary
Aktas, Karan & Aydogan (2003)	1992–2000	Turkey	CAR		First-day and post-days		Binary (discriminant and logit) and non-binary
Ngatuni, Capstaff & Marshall (2007)	1986–1999	UK		BHR	Event-time	5 years	Non-binary
Espenlaub, Gregory & Tonks (2000)	1985–1995	UK		CAPM & FF	Calendar-time	5 years	Non-binary
Mudambi et al. (2012)	1991–1995	UK	AR	BHR	First-day/Event-time	3 years	Non-binary
Belghitar & Dixon (2012)	1992–1996	UK	AR	BHR & CTAR	Mixed	3 years	Non-binary

Ritter (1991)	1975–1984	US		CAR, BHR & WR	Event-time	3 years	Non-binary
Johnston & Madura (2002)	1996–2000	US	RR, AR	BHR & WR	First-day/Event-time	1 year	Non-binary
Gompers & Lerner (2003)	1935–1972	US		BHR, CAR, FF & CAPM	Mixed	5 years	Non-binary
Ejara & Ghosh (2004)	1990–2001	US	RR	BHR & S&P500	First-day/Mixed	3 years	Non-binary
Fernando, Krishnamurthy & Spindt (2004)	1981–1998	US	RR		First-day		Non-binary[5]
Eckbo & Norli (2005)	1972–1998	US		BHR	Event-time	5 years	Non-binary
Pukthuanthong-Le & Varaiya (2007)	1993–2002	US		BHR & FF	Mixed	3 years	Non-binary
Bradley et al. (2009)	1993–2003	US	RR	BHR	First-day (Secondary market)/Event-time	3 years	Non-binary
Abukari & Vijay (2011)	1988–2005	US		BHR & CAR	Event-time	3 years	Binary (logit)
Brau, Couch & Sutton (2012)	1985–2003	US		BHR & FF	Mixed	3 years	Non-binary

Note: RR = Raw return, **Adj. RR =** Adjusted first-day raw return, **AR** = Abnormal return, **CAR** = Cumulative abnormal return, **BHR** = Buy-and-hold return, **WR** = Wealth relative, **FF** = Fama-French model (1993), **CAPM** = Capital assets pricing model, **P/E** = Price-earnings ratio, **B/M** = Book-to-market ratio, **SW** = Swiss index, **S&P** = Standard & Poor, **SC** = Multi-index model, **RATS** = Return across time and securities.

1 Market performance measures include short-run measures and long-run measures. The main short-run measures are RR and AR. Some studies have used CAR (Aktas, Karan & Aydogan 2003; Boabang 2005; Finn & Higham 1988) and Adj. RR (Chorruk & Worthington 2010; Da Silva Rosa, Velayuthen & Walter 2003; How, Lam & Yeo 2007). Adj. RR is calculated as underpricing issuer loss (UPIL), underpricing loss by market value (UPLMV) and underpricing loss by issue price (UPLIP) following Habib and Ljungqvist (1998). The main long-run performance measures are CAR, BHR, WR, FF and CAPM.

2 The short-run approach is identified under the two approaches: first-day return based approach and post-day return based approach. The long-run approaches are known as event-time and calendar-time. Mixed approach is considered both the event-time and the calendar-time approach.

3 'Time window for long run' is the number of years over which long-run or aftermarket returns are calculated. This period does not include the initial-day or initial period.

4 'Econometric model' is a developed econometric model in stock market performance to identify the determinants of short-run (underpricing) and long-run (underperformance) performance. Using past studies, all developed econometric models are identified under two categories: binary models, including logit, probit and discriminant, and non-binary models, including multiple regression.

5 These studies have used binary regression models for warrants in IPOs (PIPO or package IPOs) (How & Howe 2001), long-term survival (Marisetty & Subrahmanyam 2010) and financial distress (Fernando, Krishnamurthy & Spindt 2004). Lee et al. (2003) have also used a binary logit model to measure the audit quality of IPOs in Australia and this study is not quoted in the above table because it has not focused on IPO market performance.

These studies have not developed any econometric models to identify the determinants of market performance.

2.10 Summary of the Literature

This section summarises the above-discussed literature pertaining to the market performance of IPOs. Figure 2.4 indicates the different performance measures, approaches and models employed in the literature to evaluate the stock market performance of IPOs.

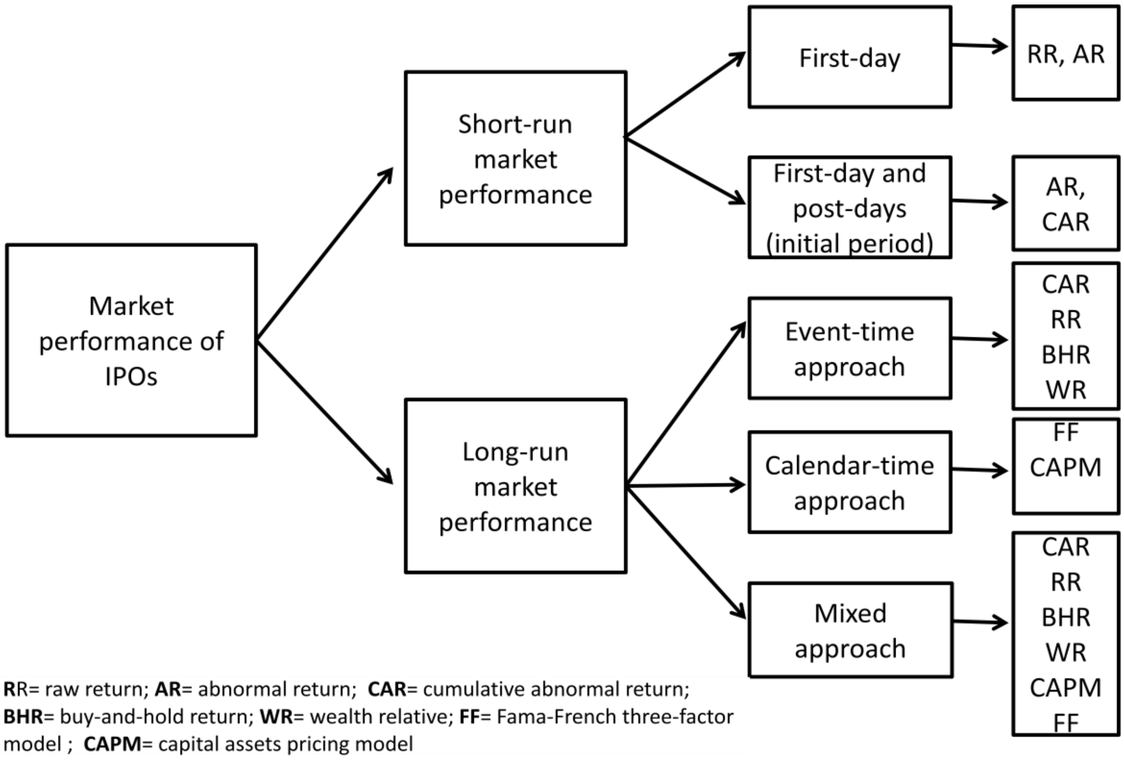


Figure 2.4: IPO Market Performance Evaluation Measures, Approaches and Models Used in the Literature

In prior studies, the IPO market performance has been evaluated using stock returns under two time periods: short-run and long-run. In the short run, initial investors always earn high positive returns because the first-day listing prices are greater than the PRICEs. This is known as short-run underpricing, which is a universally accepted persistent phenomenon. In the long run, subsequent investors normally earn negative returns because the subsequent share prices are lower than the initial-day listing prices. This is considered the long-run underperformance phenomenon, which is not persistent like short-run underpricing. To identify the determinants of short-run underpricing and long-run underperformance, most of the past studies analysed cross-sectional time-series data using ordinary least square (OLS), univariate and multivariate regression methods. A few studies have focused on analysing the short-run and long-run stock market performance using binary regression models (Abukari & Vijay 2011; Aktas, Karan & Aydogan 2003; Álvarez & González 2005). It is difficult to find any Australian published studies that used binary models to analyse short- and long-run stock market performance. However, a few Australian IPO studies have applied binary logit models to measure the audit quality (Lee et al. 2003) and package IPOs (How & Howe 2001).

Even if short-run underpricing is documented as a persistent phenomenon in the IPO literature, the degree of underpricing and reasons for underpricing are not persistent because of such factors as the sample size, market, sample period, measures and models. Therefore, there is no single dominant theoretical reason for underpricing, and only a few studies explain the relative importance of different explanations of underpricing (Ritter & Welch 2002). However, in explaining short-run underpricing, academic researchers have paid more attention to asymmetric information theories. They have found that short-run underpricing violates the efficient market hypothesis (EMH). Most past studies have measured short-run underpricing using first-day (initial-day) stock returns. Hence, some researchers have used the term 'first-day returns' instead of underpricing.

The long-run underperformance of IPOs is a debatable phenomenon because long-run performance is the most controversial area in IPO research. Jakobsen and Sorensen (2001) supported this argument, reporting that there is no convincing theory that explains IPO long-run market performance. In addition, Thomadakis, Nounis and Gounopoulos (2012) mentioned that long-run performance studies have reported controversial and conflicting findings. However, previous researchers have explained long-run performance using behavioural theories, methodological issues and short-run underpricing theories. Some IPO researchers are in line with an efficient market point of view and others are in line with a behavioural point of view. The period considered for the long-run evaluation varies from one year to five years and the mean period is three years. Long-run performance is normally evaluated using three main approaches: event-time approach, calendar-time approach and mixed approach. Compared with other approaches, the event-time approach has been more widely used in the IPO literature to examine long-run or post-listing share price behaviour. The performance measures vary according to the used approach. Under the event-time approach, CAR, BHR and WR are the main performance measures, whereas CAPM and FF models are used to calculate calendar-time return measures. The mixed approach applies all performance measures used in the event- and calendar-time approaches. However, long-run performance is normally sensitive to the applied methodology, such as the method of performance measurement (Abukari & Vijay 2011; Ahmad-Zaluki, Campbell & Goodacre 2007; Gompers & Lerner 2003), sample period (Ritter & Welch 2002), sample and size of the sample company (Bird & Yeung 2010), benchmark (Abukari & Vijay 2011; Moshirian, Ng & Wu 2010;), weighting method (Kooli & Suret 2004) and approach (Gompers & Lerner 2003).

2.11 Identification of Gaps in the Literature

The review of past Australian and non-Australian IPO studies has shown that analysing short-run market performance using both the first listing day return and the post-day listing return has been given little attention. However, analysing short-run market performance based on the first listing day return alone may not provide sufficient information to investors. The reasons are that (1) investors do not know much about the newly listed companies and (2) the motive of speculative investors on the very first day is to earn higher profit. Therefore, the market needs to have a reasonable period to settle down in the short run. To overcome the problems associated with the first-day return, both the first-day return and the post-day listing return should be used to measure short-run market performance.

Even though short-run market performance has been analysed using both first-day primary and SECONs in non-Australian studies, the review of past Australian IPO studies has indicated that short-run market performance has not been evaluated by combining the first listing day PRIM and the first listing day SECON. This type of analysis is more important for the IPO literature in Australia for two reasons. First, there is variation in the opening and closing price levels on the very first listing day. The variation in the price levels of the first listing day indicates more uncertainty about the short-run market performance of IPOs. Second, it is necessary to discover who gains the benefits of IPO underpricing. The first-day total return analysis (closing-price-return-based performance analysis) does not directly address this question. Therefore, analysing short-run market performance using first-day primary and SECONs may provide significant information about the IPO market performance for interested parties such as investors, market analysis, market researchers and IPO companies.

The review of the Australian IPO literature has shown that binary regression models are given less priority compared with multiple regression models when identifying the determinants of short-run underpricing and long-run underperformance. However, the multiple regression model identifies only the determinants and it does do not provide the associated probabilities (risks) of determinants that indicate the directional changes in market performance. These probabilities are more important for IPO investors because of the changes in economic and financial factors that cause higher uncertainity in the IPO market. Therefore, binary regression models are more important to estimate the marginal probability associated with the determinants compared with the multiple regression model, since they provide more information to IPO investors for their investment decisions. Marginal probability shows the directional changes in the short-run and long-run market performance.

The long-run performance of IPOs is a debatable issue in the IPO literature because of the controversial results and conflicting findings indicating underperformance, overperformance or zero performance. For example, in Australia, some studies have reported long-run underperformance while some have found overperformance or no underperformance. Another important fact is that long-run performance normally varies according to the applied methodology, such as the methods of performance measurement, sample period, sample and size of the sample company, benchmark, weighting method and approach. This is a motivation to examine the long-run market performance using performance metrics, including different performance measures and weights, different sample periods and sample sizes, and different models.

Even though underpricing is documented as a universal phenomenon in the IPO literature, a substantial variation can be identified in the level of underpricing in Australia. Further, a variation can be seen in the level of long-run market performance. Table 2.1 clearly indicates that the level of underpricing in Australia varies from 12% to

107% and Table 2.2 shows that long-run performance has varied from –52% to +13% during last four decades. This also suggests that further investigation is needed.

After considering the above facts, it is suggested that further investigation on market performance (short-run and long-run) of Australia IPOs can provide valuable results and findings for investors, financial analysts, academic researchers, IPO companies, the ASX and other information users. The analysis of IPO market performance has received profound attention among financial academics in recent years. The current study aims to broaden the knowledge on short-run and long-run performance, in Australia, particularly, and the world, generally. This study attempts to fill the gap in the Australian IPO market literature.

The next chapter develops the methodology of the study based on this chapter.

Chapter 3: Research Design to Evaluate IPO Market Performance

3.1 Introduction

Following the literature review chapter, this chapter discusses the methodology employed in this study to evaluate the short-run and long-run market performance of IPOs and to identify their determinants. The first section of this chapter explains the data, sample and time period. The second section presents the measurements of IPO market performance and their test statistics. The third section explains the evaluation of short-run and long-run market performance and develops their hypotheses based on the first part of the literature review. The fourth section identifies and measures the selected explanatory variables for regression. The fifth section develops the hypotheses for the explanatory variables based on the first part of the literature review. The sixth section estimates the multiple regression models. The seventh section estimates probit and logit binary regression models. The eighth section discusses the marginal probability analysis. The final section provides the statistical tests applied for the developed multiple and binary regression models.

3.2 Data, Sample and Time Period

In this study, all IPO data were collected from the Morningstar database (www.morningstar.com.au) and the collected data were crosschecked with the Connect 4 database (www.connect4.com.au) to confirm the accuracy.

The study examines listed fixed-price offering equity[3] IPOs in the ASX from January 2006 to January 2011. Within the Australian IPO context, prior published studies on short-run and long-run market performance have not examined this sample period (Dimovski & Brooks 2004; Finn & Higham 1988; How 2000; How, Izan & Monroe 1995; Lee, Taylor & Walter 1996; Silva Rosa, Velayuthen & Walter 2003).

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

To identify the sample, all the listed IPOs during this period were subdivided into seven sectors using the industry criterion. Financial-sector IPOs and property and equity trust or closed-end fund IPOs were excluded from the sample in line with other researchers (Ahmad-Zaluki, Campbell & Goodacre 2007; Dimovski & Brooks 2004)[4]. Mergers, takeovers and restructuring schemes were also eliminated from the sample because these undeservedly affect the IPO companies' performance. Due to the large number of listed IPOs in the resource sector, randomly selected sample from this industry represents only 33% of the total listed IPOs while other sectors represent 80% or more. The Australian Securities Exchange (2009, p. 10) has also reported that the resource sector represents a one-third of its total listed companies. Finally, we selected 254 IPOs for this study as a sample based on the availability of share price data, which represents 47% of the total listed IPOs in January 2006 to January 2011. Table 3.1 shows the distribution of the sample and the total listed IPOs by industry, in terms of the number of offers.

Table 3.1: Distribution of Sample and Total Listed IPOs by Industry 2006–2011

Industry	**Total number of IPOs**	**Sample number of IPOs**	**Sample IPOs as % of total**
Resources (energy, metals & mining)	428	143	33
Chemicals/materials	5	4	80
Industrials	49	46	94
Consumer discretionary/staples	31	31	100
Information technology	20	20	100
Telecommunication	5	4	80
Utilities	7	6	86
Total	**545**	**254**	**47**

Table 3.2 shows the number of sample companies, offer proceeds (PRICE per share times number of issued shares) and money left on the table (the first-day returns in terms of Australian dollars), which are classified by industry, listed year and issue year. In a comparison of the 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. The industrial sector represents 18% of the sample IPO companies and it contributes 65% of the total sample proceeds, which is the highest of offer proceeds under the industries. The industrial sector has the highest value for

[4] These researchers mentioned that IPOs in finance, trust, and closed-end funds sectors are not comparable with non-financial companies. These companies' annual reports are normally prepared according to different statutory requirements.

money left on the table compared with all other sectors, which shows that on average, the market price of the industrial sector is higher than that of 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 is diluted compared with all other sectors. When examining the listing years, the money left on the table had negative values in 2010 and 2011 due to higher PRICEs compared with the first listing day market price. Issue years 2008 and 2010 had negative values for money left on the table due to higher PRICEs. A list of the sample companies is attached in Appendix 3.

Table 3.2: 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] (A$ 000s)	%	Money left on the table[2] (A$ 000s)
By industry					
Resources (energy, metals & mining)	143	56	1,279,743	12	1,137,267
Chemicals/materials	4	2	953,400	9	113,042
Industrials	46	18	6,717,995	65	190,481
Consumer discretionary/staples	31	12	588,975	6	72,296
Information technology	20	8	645,582	6	96,831
Telecommunication	4	2	22,573	0	2,749
Utilities	6	2	79,750	1	–7,020
Total	**254**		**10,288,018**		**582,106**
By listing year					
2006	68	27	2,856,066	28	216,233
2007	91	36	1,607,983	16	244,248
2008	29	11	361,219	4	166,584
2009	17	7	368,500	4	45,445
2010	41	16	5,045,650	49	–85,511
2011	8	3	48,600	0	–4,893
Total	**254**		**10,288,018**		**582,106**
By issue year					
2005	9	4	53,296	1	19,299
2006	69	27	2,887,770	28	191,578
2007	96	38	1,666,183	16	421,421
2008	19	7	272,019	3	–10,911
2009	16	6	332,000	3	52,203
2010	45	18	5,076,750	49	–91,484
Total	**254**		**10,288,018**		**582,106**

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

3.3 Measurement of Market Performance and Test Statistics

Market performance has generally been measured in terms of stock returns by most researchers. Therefore, in line with past researchers, the IPO market performance was measured by calculating short-run and long-run performance measures based on stock returns. Short-run market performance can be evaluated in three ways: the RR, MAR and CAR. Long-run market performance can be measured using the following four measures: CAR, BHR, BHAR and WR. The long-run market performance measures were calculated under monthly EW and VW schemes up to the three post-listing periods using an event-time approach, which is widely accepted in the IPO literature for examining long-run market performance. The weighting scheme identified whether the performance of the IPOs varied by market capitalisation.

To measure the market performance of the IPOs, this study selected the first-day adjusted[5] opening and closing market prices, and the post-listing day adjusted prices up to three years from the Morningstar database. The calculation of both short-run and long-run performance measures and their test statistics are discussed below.

3.3.1 Short-Run Performance

This study evaluated the short-run market performance mainly considering both the first listing day return and the post-day-listing return. In line with other researchers (Aggarwal & Conroy 2000; Barry & Jennings 1993; Bradley et al. 2009; Chang et al. 2008; Schultz & Zaman 1994), the first listing day return, which is considered the total MR, was divided into the first listing day PRIM and SECON for the following reasons: (1) there is a significant price variation at the beginning and closing of the first trading day and (2) most previous studies have evaluated the short-run market performance using the first listing day total return, which is known as the closing price performance (using the return from the offer price to the closing price of the first trading day). This closing price performance (offer-to-close return) does not provide a clear answer about who is the beneficiary of short-run underpricing. To answer this question, Barry and Jennings (1993) initially proposed the opening price performance, which includes

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

primary (offer-to-open or opening price return) and secondary (open-to-close or intraday return) MRs.

Figure 3.1 shows the relationship between first-day total MRs, PRIMs and SECONs.

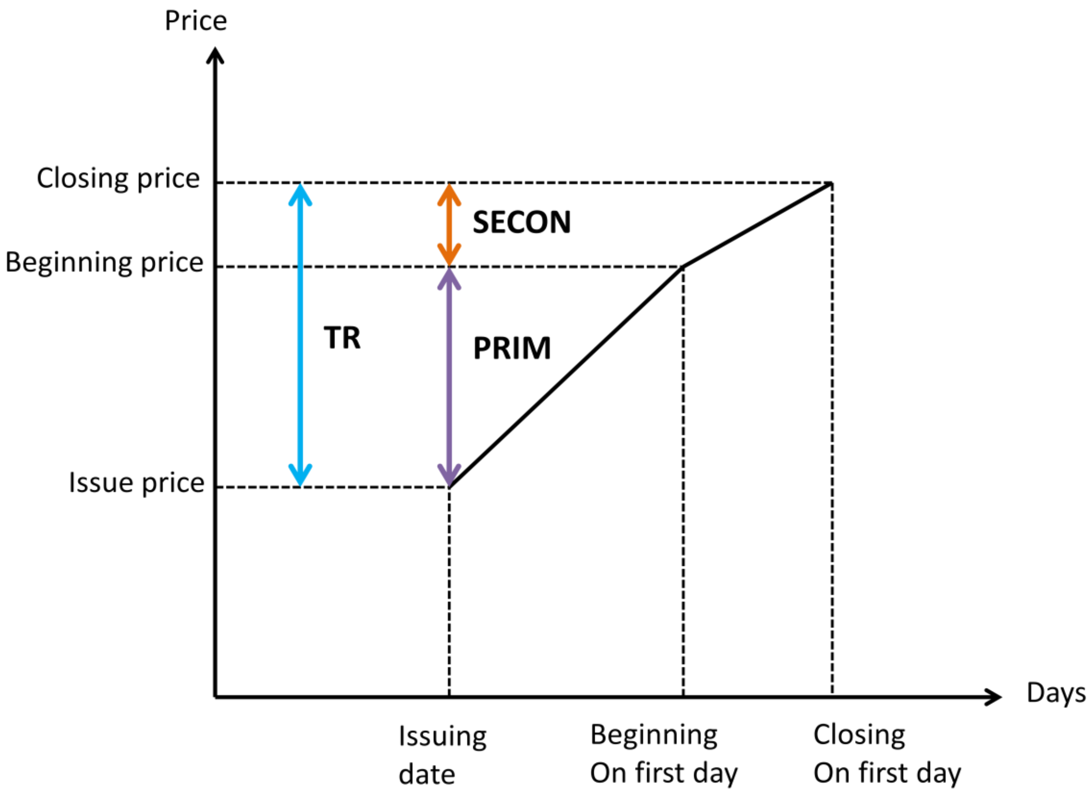

Figure 3.1: The Relationship between First-Day Total Market Return (TR), Primary Market Return (PRIM) and Secondary Market Return (SECON)

The post-day listing returns are calculated up to nine trading days after the first listing day because this post-day period is indicated as a short period. Analysing IPO short-run market performance using first-day PRIMs, SECONs and post-listing returns has been given little attention in the IPO literature. A review of past Australian IPO studies has also shown that short-run market performance has not been analysed using first-day primary and SECONs. Therefore, first-day primary and secondary market analysis is a new contribution to the Australian IPO literature.

Figure 3.3 shows how to measure the short-run market performance using first-day PRIMs, SECONs, total MRs and post-day returns. The first-day primary and SECONs are identified as opening price performance, and total MR is identified as closing price performance. The primary, secondary and total MRs are considered the first-day returns.

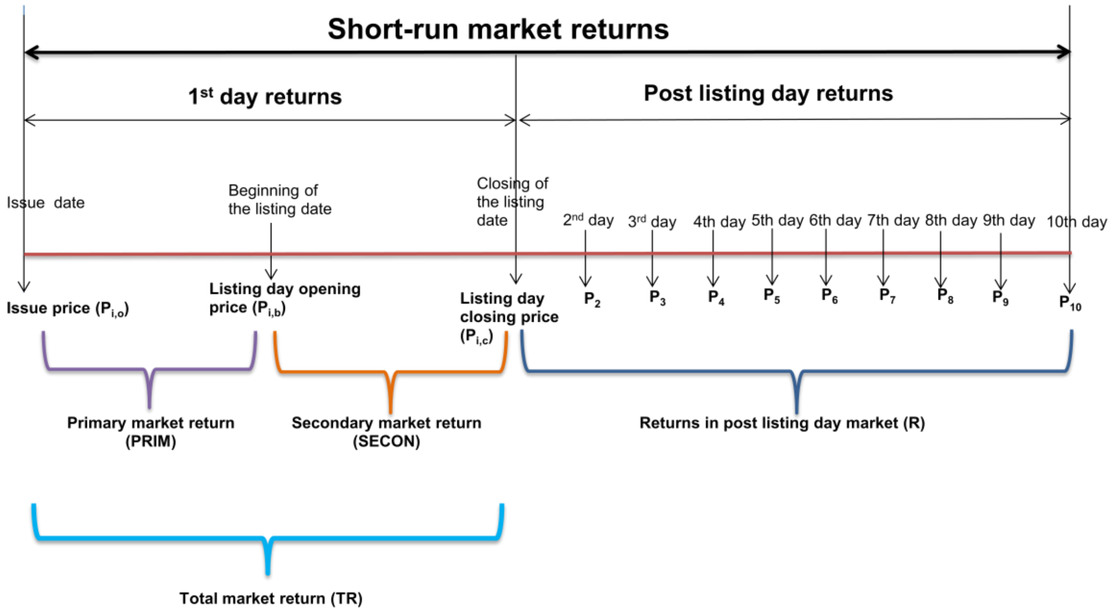

Figure 3.2: Measurement of Short-Run Market Performance

The RR and MAR are used to measure the short-run performance in the first listing day (primary, secondary, total markets) and the CAR used in the post-listing period. The first listing day primary, secondary market and total market RRs are calculated using the following equations.

$$PRIM_i = \frac{P_{i,b} - P_{i,o}}{P_{i,o}} \tag{3.1}$$

where $PRIM_i$ = the first listing day primary market RR for security i measures between the PRICE and beginning of the first listing day price, $P_{i,b}$ = the beginning price of security i at the first listing date and $P_{i,o}$ = the issue (offer) price of security i at the time of issue.

$$SECON_i = \frac{P_{i,c} - P_{i,b}}{P_{i,b}} \tag{3.2}$$

where $SECON_i$ = the first listing day secondary market RR for security i measures between the beginning, price and the closing of the first listing day, $P_{i,c}$ = the closing price of security i at the first listing day and $P_{i,b}$ = the beginning price of security i at the first listing date.

$$TR_i = \frac{P_{i,c} - P_{i,o}}{P_{i,o}} = [(1 + PR_i) \times (1 + SR_i)] - 1 \quad (3.3)$$

where TR_i = the first listing day total market RR for security i measures between the PRICE and closing of the first listing day price, $P_{i,c}$ = the closing price of security i at the first listing day, $P_{i,o}$ = the issue (offer) price of security i at the time of issue, $PRIM_i$ = the first listing day primary market RR for security i and $SECON_i$ = the first listing day secondary market RR for security i.

From the above RRs ($PRIM_i$, $SECON_i$ and TR_i), the market-adjusted abnormal/excess returns (MARs) and ARRs for each market are also calculated to measure the short-run market performance of IPO. The abnormal/excess return is considered a superior performance measure relative to the RR because it is adjusted by the MR. The MR can be calculated by available ASX indices such as ASX 200 and ASX 300. However, this study used the All Ordinary Index (ASX 500) as a market benchmark to measure the abnormal/excess MRs because this price index covers 95% of the value of all shares listed in the ASX (http://en.wikipedia.org/wiki/All_Ordinaries). The All Ordinary Index was obtained from the DataStream database. The following equations are used to calculate the MAR and the market-adjusted average abnormal return (AAR):

$$MAR_{it} = R_{it-} R_{mt} \quad (3.4)$$

where MAR_{it} = the market-adjusted abnormal rate of return for company (i) in period (t), R_{it} = the rate of return for company (i) in period (t) from PR_i, SR_i, and TR_i and R_{mt} = the rate of return on the benchmark (market) during the corresponding time period (t).

$$AAR_t = \frac{1}{n}\sum_{i=1}^{n} MAR_{i,t} \quad (3.5)$$

where AAR_t = the market-adjusted average abnormal return and n = the number of IPO companies in period (t).

In this study, the RRs were calculated using Equations 3.1, 3.2 and 3.3 and abnormal returns were calculated using Equations 3.4 and 3.5. To determine whether the average raw and abnormal returns were statistically significant, this study used the following t-statistics (Brown & Warner 1985; Omran 2005; Ritter 1991).

$$t(AAR) = AAR_t * \frac{\sqrt{n_t}}{\sigma_t} \quad (3.6)$$

where AAR_t = the market-adjusted average abnormal return for day t and σ_t = the cross-sectional standard deviation of the return for day t.

From the above AAR, this study calculated the market-adjusted CAR, following previous studies (Aktas, Karan & Aydogan 2003; Ritter 1991). This measure is useful to analyse the short-run performance of IPOs after the listing. Therefore, the CAR was calculated for nine post-listing days, which showed a short time period, using the following equation:[6]

$$CAR_{q,s} = \sum_{t=q}^{s} AAR_t \tag{3.7}$$

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

The t-statistic for the CAR was computed as follows (Aktas, Karan & Aydogan 2003):

$$t(CAR) = \frac{CAR_t}{\sigma(CAR)_t} \tag{3.8}$$

where $\sigma(CAR)_t = \sigma(MAR)_t * (t+1)^{1/2}$ and $\sigma(MAR)_t$ = the variance of MAR over t days.

3.3.2 Long-Run Performance

In contrast to short-run market performance, long-run market performance seems to be more complicated. There is no consensus on the method of calculating long-run abnormal returns (Barber & Lyon 1997; Omran 2005). There are two ways of measuring long-run market performance: (1) the event-time approach and (2) the calendar-time approach. The most common approach used to measure the long-run performance of IPOs is the event-time approach because it measures the post-listing share price behaviour. The event-time returns are more important than the calendar-time returns for the following reasons: calendar-time returns do not measure investor experience (Barber & Lyon 1997), calendar-time returns are generally misspecified in random samples (Lyon, Barber & Tsai 1999) and calendar-time returns have low power (Loughran & Ritter 2000). In the event-time approach, there are four different

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

performance measures: CARs, BHRs, BHARs and WRs. These long-run performance measures are normally calculated after eliminating initial period or short-run returns; otherwise, they bias with the short-run returns and for different time windows.

The long-run market performance measures were calculated for the three post-listing time periods: year one (12 months or 252 trading days), year two (24 months or 504 trading days) and year three (36 months or 756 trading days). These periods are considered time windows. In these time windows, the performance measures were calculated on a monthly basis using daily prices based on the event-time approach. In the event-time approach, the initial period was identified as 10 days including the first day and this period was denoted as t_0. Having identified the initial period, the first month was identified as consisting of event days of 10–22 (12 trading days) and the eleventh trading day was identified as the starting day of the long-run analysis and denoted as t_1. Year one, year two and year three are denoted as t_{252}, t_{504} and t_{756} respectively.

The long-run performance measures were calculated under EW and VW schemes to identify whether the performance of the IPOs varied by market capitalisation. Following Ritter (1991), the CARs were calculated considering the 'independent' monthly rebalancing assumption, which indicates that periodical buying or selling assets in the portfolio maintains the original desired level of asset allocation. Other performance measures such as BHR, BHAR and WR were calculated under the buy-and-hold assumption, which indicates that investors hold their investment for a long period of time without considering the MV. Both CARs and buy-and-hold assumption-based performance measures have advantages and disadvantages. Therefore, the study used both measures to test the robustness of the results. These long-run stock market performance measures are discussed further.

3.3.2.1 Cumulative abnormal returns (CAR)

Barber and Lyon (1997), Lyon, Barber and Tsai (1999) and Kothari and Warner (1997) have examined several long-run stock market performance measures and their common finding is that no single performance measure is dominant. However, some researchers (Fama 1998; Gompers & Lerner 2003; Mitchell & Stafford 2000) have argued that the

CAR is a better and less biased performance measure for evaluating long-run performance.

Following Ritter (1991), the MARs for an IPO company (i) in event month (t) were calculated as the difference between the monthly IPO company's RR and the monthly benchmark's return in period (t):

$$MAR_{it} = r_{it-} r_{mt} \tag{3.9}$$

where MAR_{it} is the market-adjusted abnormal return for company (i) in event month (t), r_{it} is the return on IPO company (i) in event month (t) and r_{mt} is the return on the market index in event month (t).

The MAR was employed to identify the stock return movement. The study used VW market indices, as suggested by Ritter (1991) and Ahmad-Zaluki, Campbell and Goodacre (2007).

The EW and VW means of the MARs were calculated as follows:

$$AAR_{EW\ t} = \frac{1}{n}\sum_{i=1}^{n} MAR_{i,t} \tag{3.10}$$

$$AAR_{VW\ t} = \sum_{i=1}^{n} MAR_{i,t}\, w_{i,t} \tag{3.11}$$

where $AAR_{EW\ t}$ is the EW market-adjusted average abnormal return in period (t) and $AAR_{VW\ t}$ is the VW market-adjusted average abnormal return in period (t), n is the number of IPO companies in period (t), $w_{i,t}$ is the value weight for IPO company (i) in period (t) [$w_{i,t}$ = $MV_i / \sum MV_i$] and MV_i is the IPO company's market capitalisation value at the beginning of eleventh trading day.

Some researchers argue that the selection of weighting method depends on the hypothesis of interest to the researcher (Fama 1998). Brav, Geczy and Gompers (2000) reported that the VW method measures the changes in the average wealth of investors. However, this study employed both EW and VW schemes to identify whether the long-run performance of IPOs varied by market capitalisation.

The CAR was calculated as a summation of AARs on a monthly basis up to a 36-month aftermarket period as follows:

$$CAR_{q,s} = \sum_{t=q}^{s} AAR_t \tag{3.12}$$

where $CAR_{q,s}$ is the cumulative ARR from event month 'q' to event month 's'.

According to the usual way of interpreting the CAR value, when the CAR takes a positive (negative) value, this indicates that the IPOs outperform (underperform) relative to the market portfolio.

If a company in portfolio p is eliminated due to delisting, the portfolio return for the next month is an EW average of the remaining companies in the portfolio. This implies that the investors liquidate their portfolio at the end of each event month. As a result, the cumulative average market-adjusted return for event month one to 36 ($CAR_{1,\ 36}$) is considered the monthly rebalancing to achieve equal weight each month (Ritter 1991, p. 8).

The statistical significance of the AAR was calculated using the conventional t-statistic, whereas the statistical significance of the CAR was determined by using the t-statistic (Brown and Warner 1985; Ritter 1991). The t-statistic for the AAR in event month t,AAR_t, was computed as follows:

$$t(AAR) = AAR_t * \frac{\sqrt{n_t}}{sd_t} \tag{3.13}$$

where AAR_t is the market-adjusted average abnormal return for event month (t), n_t is the number of observations in event month (t) and sd_t is the cross-sectional standard deviation of the MARs for event month (t).

Following Ritter (1991), the t-statistic for the CAR in event month t,$CAR_{1,t}$, was calculated as follows:

$$t(CAR) = CAR_{1,t} * \frac{\sqrt{n_t}}{csd_t} \tag{3.14}$$

where n_t is the number of companies trading in each event month, and csd_t is computed as follows:

$$csd_t = \sqrt{[t * var + 2 * (t - 1) * cov]} \quad (3.15)$$

where t is the event month, var is the mean cross-sectional variance over 36 months and cov is the first-order autocovariance of the AAR_t series.

3.3.2.2 Buy-and-hold returns (BHR)

BHR is a better long-run performance measure compared with CAR for the following reasons: (1) the monthly portfolio rebalancing assumption may establish a downward bias in long-term CAR and (2) this may lead to cross-sectional correlation problems. Lee, Taylor and Walter (1996) also reported that the rebalancing assumption does not produce a feasible investment strategy due to the cross-sectional combined returns. Barber and Lyon (1997) and Lyon, Barber and Tsai (1999) have reported that using the BHARs is a good long-run market performance measure due to the downward bias of the CAR. BHR was used to reduce the statistical bias in the measurement of cumulative performance (Conrad & Kaul 1993). Fama (1998) has also argued that BHRs accurately measure long-run returns. BHR is defined as the geometrically compounded return. Geometric mean return is considered better than arithmetic mean return because it avoids negative return problems in long-run abnormal returns (Ljungqvist 1997). Following Loughran and Ritter (1995), the BHR was calculated as follows:

$$BHR_{i,t} = \left[\prod_{t=start}^{min(T,delist)} \left(1 + r_{i,t}\right) - 1 \right] \quad (3.16)$$

where $r_{i,t}$ is the monthly RR on company i in event month t, start is the first month in which the event takes place and $min(T, delist)$ is the earlier of the last month of trading (delisting) and the end of the three-year window.

In the usual way of interpreting the BHR value, when the BHR takes a positive (negative) value, this indicates that IPOs outperform (underperform) in the long-run market.

BHR measures the total return from a buy-and-hold strategy, where a stock is purchased at the first closing market price after going public and held until the earlier of (i) its one-, two- or three-year anniversary, or (ii) its delisting (Ritter 1991). Using BHR, the average BHR returns $\left(\overline{BHR_t}\right)$ could be calculated for the IPO companies based on EW and VW returns as follows:

$$\overline{BHR}_{EW\ t} = \frac{1}{n}\sum_{i=1}^{n} BHR_{i,t} \tag{3.17}$$

$$\overline{BHR}_{VW\ t} = \sum_{i=1}^{n} W_{i,t} BHR_{i,t} \tag{3.18}$$

where $\overline{BHR}_{EW\ t}$ is the EW average BHR in period (t) and $\overline{BHR}_{VW\ t}$ is the VW average BHR in period (t), n is the number of IPO companies in period (t), $w_{i,t}$ is the value weight for IPO company (i) in period (t) [$w_{i,t}$ = $MV_i/\sum MV_i$] and MV_i is the IPO company's market capitalisation value at the beginning of the eleventh trading day.

3.3.2.3 Buy-and-hold abnormal returns (BHAR)

The market-adjusted BHAR measure was used in this study as the third performance measure for evaluating long-run market performance. The market-adjusted BHAR is the difference between the BHR on a stock and the calculated BHR based on the market index, and it was calculated following Loughran and Ritter (1995) as follows:

$$BHAR_{i,t} = \left[\prod_{t=start}^{min(T,delist)} \left(1 + r_{i,t}\right) - 1\right] - \left[\prod_{t=start}^{min(T,delist)} \left(1 + r_{m,t}\right) - 1\right] \tag{3.19}$$

where $BHAR_{i,t}$ is the market-adjusted BHR of company i in event month t, $r_{i,t}$ is the monthly RR on company i in event month t and $r_{m,t}$ is the relevant monthly MR based on market index.

In the usual way of interpreting the BHAR value, when the BHAR takes a positive (negative) value, this shows that IPOs outperform (underperform) relative to the market portfolio.

The mean market-adjusted BHAR $\left(\overline{BHAR}_t\right)$ for a period t was also calculated on EW and VW bases as follows:

$$\overline{BHAR}_{EW\,t} = \frac{1}{n}\sum_{i=1}^{n} BHAR_{i,t} \tag{3.20}$$

$$\overline{BHAR}_{VW\,t} = \sum_{i=1}^{n} W_{i,t} BHAR_{i,t} \tag{3.21}$$

where $\overline{BHAR}_{EW\,t}$ is the EW average BHAR in period (t) and $\overline{BHAR}_{VW\,t}$ is the VW average BHAR in period (t), n is the number of IPO companies in period (t), $w_{i,t}$ is the value weight for IPO company (i) in period (t) [$w_{i,t}$ = $MV_i/\sum MV_i$] and MV_i is the IPO company's market capitalisation value at the beginning of the eleventh trading day.

The statistical significance of the mean BHR and mean BHAR were calculated according to the bootstrapped skewness-adjusted t-statistic due to the high skewness and negatively biased t-statistics of the long-run BHR measures. This method was suggested by Lyon, Barber and Tsai (1999), particularly when a market index or reference portfolio is used to calculate abnormal returns. High skewness of abnormal returns can be expected when the long-run return of an individual security is compared with the market portfolio. The long-run return of an individual security is highly skewed due to price fluctuation, whereas the long-run return of a market portfolio is not skewed due to portfolio diversification. In addition to the bootstrapped skewness-adjusted t-statistic, the study calculated the conventional t-statistics for comparison.

The bootstrapped skewness-adjusted t-statistic ($t_{s,a}$) was calculated as follows:

$$t_{s,a=}\sqrt{n}\left(s + \frac{1}{3}\hat{\gamma}S^2 + \frac{1}{6n}\hat{\gamma}\right) \tag{3.22}$$

$$S = \frac{\overline{BHR}_t}{\sigma(BHR_t)}, \quad and \;\; \hat{\gamma} = \frac{\sum_{i=1}^{n}(BHR_{it} - \overline{BHR})^{\,3}}{n\sigma(BHR_t)^{\,3}} \tag{3.23}$$

$$S = \frac{\overline{BHAR}_t}{\sigma(BHAR_t)}, \quad and \;\; \hat{\gamma} = \frac{\sum_{i=1}^{n}(BHAR_{it} - \overline{BHAR})^{\,3}}{n\sigma(BHAR_t)^{\,3}} \tag{3.24}$$

Where $\hat{\gamma}$ is the estimate of the coefficient of skewness and $\sqrt{n}S$ is the conventional t-statistic.

The critical values used for the conventional t-statistic were not suitable for the bootstrapped skewness-adjusted t-statistic. The procedure for obtaining appropriate critical values for bootstrapped skewness-adjusted t-statistic and testing BHRs of IPOs was comparable with that of Lyon, Barber and Tsai (1999, pp. 174–175).

3.3.2.4 Wealth relative (WR)

The final long-run performance measure used in this study was the WR. The WR is defined as the ratio or index of a stock's BHR over a market benchmark's BHR during the period. Similar to Ritter (1991), the WR was calculated as follows:

$$WR = \frac{1 + average\ 3 - year\ total\ return\ on\ IPO}{1 + average\ 3 - year\ total\ return\ on\ benchmarks} \tag{3.25}$$

A WR greater than 1 indicates that IPOs outperform over the market benchmark and less than 1 indicates that IPOs underperform over the market benchmark.

3.4 Evaluation of Market Performance

The market performance of Australian IPOs was evaluated mainly using two time periods: short-run market performance and long-run market performance.

To investigate whether the Australian IPOs were underpriced, the short-run market performance was evaluated using first-day PRIMs, SECONs, total returns and post-day returns by industry, listing year and issue year. The evaluation of short-run market performance using first-day PRIMs and SECONs is known as opening price performance, whereas using first-day total returns is known as closing price performance. To continue this investigation, the following short-run market performance hypothesis was developed:

$H1_0$: Australian IPOs are fairly priced in the short run.

$H1_1$: Australian IPOs are underpriced in the short run.

To extend this investigation into long-run market performance, this study investigated whether Australian IPOs underperformed in the long run by evaluating their performance by industry and issue year using a performance matrix. The performance matrix included different long-run performance measures, including CARs, BHRs, BHARs and WRs, which were calculated on a monthly basis under EW and VW schemes. To investigate the long-run market performance, the following hypothesis was developed:

$H2_0$: Australian IPOs do not perform (zero perform) in the long run.

$H2_1$: Australian IPOs underperform in the long run.

The hypotheses of the short-run and long-run market performance were developed based on the first part of the literature chapter (see Chapter 2).

3.5 Identification and Measurement of Variables for Regression

To ascertain the major determinants of the short-run and long-run market performance, this study developed binary and multiple regression models. The explanatory variables of these regression models were identified under the three categories of issue-specific characteristics, firm-specific characteristics and market-specific characteristics. Issue-specific characteristics were defined as offer-related characteristics, such as offer size, offer price and total listing period (TOTP). Firm-specific characteristics are such factors as firm size, book value and ownership structure. Market-specific characteristics are those specific to the stock market, such as MV, MR, MS and HMs. Most of the issue and firm characteristics were identified using the IPO companies' prospectuses and market characteristics were identified using market information. These characteristics provided information on the issues, firms and markets, which might help to explain the short-run and long-run market performance of Australian IPOs. All the variables except the IPOP and WICP in this study were identified and measured using the literature. IPOP and WICP, which have not been tested in previous Australian studies, were used as new explanatory variables in this study. The IPOP is defined as the period that is given to initial investors to invest. This period is measured in calendar days, and covers the period from opening to closing days of the offer. This variable was used as proxy to measure the informed or uninformed demand. The WICP variable indicates whether the IPO companies used issued equity capital to finance working capital requirements. This indicates the company's financing/investment policy, which shows that long-term funds are used for short-term investment. This variable measures future uncertainty about the company.

Following other researchers, the first-day PRIM, SECON and post-day MR were specially tested in the long-run models as explanatory variables. The PRIM measures the returns from the issuing date to the beginning of the listing date and it was tested for the investor overoptimism or market overreaction hypotheses. The SECON measures the returns from the beginning of the first listing date to the closing, which tests the signalling hypothesis. The MR measures the post-day MR using the market index for the same return interval as the dependent variable. The regression coefficient of the MR variable shows the average beta of the sample companies, which measures the market risk. All the explanatory variables (issue-, firm- and market-specific characteristics) with their measurements, expected signs and relevant theories are given in Table 3.3.

Table 3.3: Selected Explanatory Variables with Measurement, Expected Sign and Relevant Theories

Explanatory variables	Variable in the model	Variable measure	Expected sign		Variable proxy for theory
Issue-specific characteristics			Short-run	Long-run	
IPO period (time given to invest)	IPOP	Period from opening to closing days of the offer measured in calendar days	–		Rock hypothesis
Issue price	ln (PRICE)	Offer price of the issue	–		Signalling hypothesis/uncertainty hypothesis
Offer size	ln (OSIZE)	The number of offered shares times the issue price	–	+	Uncertainty hypothesis
Listing delay	LISD	Time period between the proposed listing date and the actual listing date measured in business days	+/–		Uncertainty hypothesis/Rock hypothesis
Total listing period (time to listing)	TOTP	Time period between the issued date and the listed date measured in business days	–		Rock hypothesis
Issue cost ratio	ICOR	Total issue cost including ASIC fee, ASX fee, broker commission, manager fee, annual report fee, legal cost, industry report fee, printing fee, other costs relative to the total offer proceeds	+	–	Uncertainty hypothesis
Total net proceeds ratio	TNPR	1 minus issue cost ratio	–	+	Uncertainty hypothesis
Underwriter availability	UWRA	Dummy variable, which denotes 1 for ‘underwritten IPOs’ and 0 for ‘otherwise’	+	+	Signalling hypothesis
Attached share option availability	ATOA	Dummy variable, which denotes 1 for ‘attached share option with the offer’ and 0 for ‘otherwise’	–		Agency cost hypothesis
Oversubscription option availability	OVSO	Dummy variable, which denotes 1 for oversubscription accepted by issuing company and 0 for otherwise	+	+	Signalling hypothesis/Rock hypothesis
Recovery of working capital	WICP	Dummy variable, which denotes 1 for ‘issuing company recovers the short-term working capital requirement from the initial issue capital’ and 0 for ‘otherwise’	+	–	Uncertainty hypothesis
Firm-specific characteristics					
Book value per share	ln (BOOKV)	Total equity capital divided by the number of equity shares	+		Signalling hypothesis
Original ownership	OWSH	Percentage of shares retained by original owners	+/-	+	Signalling/agency-cost/ownership dispersion hypothesis

Firm age	ln (1+FAGE)	Number of years between the year of creation and listing	–	+	Uncertainty/overoptimistic hypothesis
Firm size	ln (FSIZE)	Total assets at the end of the year preceding the IPO of an issuing firm	–	+	Uncertainty hypothesis
Primary market return*	ln (PRIM)	The first-day primary market measures the returns from the issuing date to the beginning of the listing date**		–	Overoptimistic hypothesis
Secondary market return*	ln (SECON)	The first-day secondary market measures the returns from the beginning of the first listing date to the closing**		+	Signalling hypothesis
Market-specific characteristics					
Market volatility	MV	Standard deviation of daily market returns over the periods before the closing date of the offer	+	+	Uncertainty hypothesis
Average market return	RETU	Square value of the average daily market returns over the periods before the closing date of the offer	+		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	+	–	Uncertainty/signalling/window of opportunity hypothesis
Hot issue market	HC	Hot issue market was 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. Dummy variable, which denotes 1 for 'hot issue market' and 0 for 'otherwise'	+	–	Hot issue market/window of opportunity hypothesis
Post-day market returns*	ln (MR)	Post-day market return was calculated based on the All Ordinary Index for the same return interval as the dependent variable		+	Risk-return theory

Note:* These variables were only tested with long-run market performance; ** these returns are normally calculated under short-run market performance.

In addition to the explanatory variables, the industry and listing year based dummy variables were tested with the developed models with a view to capturing the industry and year effect. Year-based dummy variables were used only for long-run models because the year is an important determinant of the long-run performance (Cai, Liu & Mase 2008; Chi, Wang & Young 2010; Ritter 1991).

3.6 Development of Hypotheses for Explanatory Variables

To identify the association between the IPO market performance and its explanatory variables, the study developed hypotheses based on the first part of the literature chapter (see Chapter 2). The developed hypotheses are categorised as follows: explanatory variables of the short-run market performance and explanatory variables of the long-run market performance.

3.6.1 Explanatory Variables of the Short-Run Performance

In Section 3.5, the study identified more than 20 explanatory variables categorised under issue-specific characteristics, firm-specific characteristics or market-specific characteristics. However, the short-run market performance analysis (see Chapter 4) found that only a few variables explained the short-run market performance of the IPOs in Australia because of the statistical insignificance of the other variables. Therefore, this section shows the hypotheses only for the variables that were statistically significant in explaining the short-run market performance. These variables are total listing period (TOTP), which indicates the time to listing; IPOP, which indicates the time given to invest; LISD; total net proceeds ratio (TNPR); MV; PRICE; average market returns (RETU); and attached share option availability (ATOA). After considering the first part of the literature presented in Chapter 3, the study developed the following hypotheses for the variables that could be used to explain the short-run market performance in Australia:

The TOTP:

> $H3_0$: There is no association between the level of underpricing and the TOTP of the issuing firm.

$H3_1$: There is a negative association between the level of underpricing and the TOTP of the issuing firm.

The IPOP:

$H4_0$: There is no association between the level of underpricing and IPOP of the issuing firm.

$H4_1$: There is a negative association between the level of underpricing and the IPOP of the issuing firm.

LISD:

$H5_0$: There is no association between the level of underpricing and the LISD of the issuing firm.

$H5_1$: There is a positive association between the level of underpricing and the LISD of the issuing firm.

TNPR:

$H6_0$: There is no association between the level of underpricing and the TNPR of the issuing firm.

$H6_1$: There is a negative association between the level of underpricing and the TNPR of the issuing firm.

MV:

$H7_0$: There is no association between the level of underpricing and the MV.

$H7_1$: There is a positive association between the level of underpricing and the MV.

PRICE:

$H8_0$: There is no association between the level of underpricing and the PRICE of the issuing firm.

$H8_1$: There is a negative association between the level of underpricing and the PRICE of the issuing firm.

RETU:

$H9_0$: There is no association between the level of underpricing and the RETU.

$H9_1$: There is a positive association between the level of underpricing and the RETU.

ATOA:

$H10_0$: There is no association between the level of underpricing and the ATOA of the issuing firm.

$H10_1$: There is a negative association between the level of underpricing and the ATOA of the issuing firm.

3.6.2 Explanatory Variables of the Long-Run Performance

All explanatory variables of the long-run market performance are discussed in Section 3.5. However, as shown in Chapter 5, the variables that are statistically significant to explain the long-run market performance in Australian IPOs are first-day PRIM, post-day MR, MS, MV, FAGE, HM dummy (HC), issue cost ratio (ICOR), dummy for WICP from the issue capital, dummy for underwriter availability (UWRA) and dummy for oversubscription option availability (OVSO). The developed hypotheses for these long-run variables are as follows:

First-day PRIM:

$H11_0$: There is no association between the long-run performance and the PRIM.

$H11_1$: There is a negative association between the long-run performance and the PRIM.

Post-day MR:

$H12_0$: There is no association between the long-run performance and the MR.

$H12_1$: There is a positive association between the long-run performance and the MR.

MS:

$H13_0$: There is no association between the long-run performance and the MS.

$H13_1$: There is a negative association between the long-run performance and the MS.

MV:

$H14_0$: There is no association between the long-run performance and the MV.

$H14_1$: There is a positive association between the long-run performance and the MV.

FAGE:

$H15_0$: There is no association between the long-run performance and the FAGE.

$H15_1$: There is a positive association between long-run performance and the FAGE.

HC:

$H16_0$: There is no association between the long-run performance and the HC.

$H16_1$: There is a negative association between the long-run performance and the HC.

ICOR:

$H17_0$: There is no association between the long-run performance and the ICOR.

$H17_1$: There is a negative association between the long-run performance and the ICOR.

WICP from the issue capital:

$H18_0$: There is no association between long-run performance and WICP.

$H18_1$: There is a negative association between long-run performance and WICP.

UWRA:

$H19_0$: There is no association between the long-run performance and the UWRA.

$H19_1$: There is a positive association between the long-run performance and the UWRA.

OVSO:

$H20_0$: There is no association between the long-run performance and the OVSO.

$H20_1$: There is a positive association between the long-run performance and the OVSO.

3.7 Multiple Regression Models

To identify the determinants of short-run and long-run market performance, multiple regression analysis has been used by many researchers. To identify the key determinants of the IPO market performance, this study estimated the short-run and long-run multiple regression models using the OLS method. The multiple regression models identified the linear relationship between the long-run market performance and the independent variables (explanatory variables) including issue characteristics, firm characteristics, market characteristics, industry dummies and year dummies.

The following regression equation was used for the analysis:

$$R_i = \alpha + \sum_{j=1}^{m} \beta_j D_{i_j} + \varepsilon_i \qquad (3.26)$$

where R_i = short-run or long-run returns, β_i = coefficient of the explanatory variables, D_{i_j} = explanatory variables and ε_i = the error term of the model.

The above regression equation was developed for the short-run and long-run markets as follows:

Short-run market

$$\begin{aligned} ln[R_i] = \alpha &+ \beta_1 IPOP_i + \beta_2 lnPRICE_i + \beta_3 lnOSIZE_i + \beta_4 LISD_i + \beta_5 TOTP_i \\ &+ \beta_6 ICOR_i + \beta_7 TNPR_i + \beta_8 UWRA_i + \beta_9 ATOA_i + \beta_{10} OVSO_i \\ &+ \beta_{11} WICP_i + \beta_{12} lnBOOKV_i + \beta_{13} OWSH_i + \beta_{14} ln(1 + FAGE_i) \\ &+ \beta_{15} lnFSIZE_i + + \beta_{16} MV_i + \beta_{17} RETU_i + \beta_{18} MS_i + \beta_{19} HC_i \\ &+ \sum_{i=1}^{6} \beta_i D_i + \varepsilon_i \end{aligned} \qquad (3.27)$$

Long-run market

$$\begin{aligned} & ln[BR_i] \\ & = \alpha + \beta_1 IPOP_i + \beta_2 lnPRICE_i + \beta_3 lnOSIZE_i + \beta_4 LISD_i + \beta_5 TOTP_i + \beta_6 ICOR_i \\ & + \beta_7 TNPR_i + \beta_8 UWRA_i + \beta_9 ATOA_i + \beta_{10} OVSO_i + \beta_{11} WICP_i + \beta_{12} lnBOOKV_i \\ & + \beta_{13} OWSH_i + \beta_{14} ln(1 + FAGE_i) + \beta_{15} lnFSIZE_i + \beta_{16} MV_i + \beta_{17} RETU_i + \beta_{18} MS_i \\ & + \beta_{19} HC_i + \beta_{20} lnMR_i + \beta_{21} lnPRIM_i + \beta_{22} lnSECON_i + \sum_{i=1}^{6} \beta_i D_i + \sum_{i=1}^{6} \beta_i DY_i \\ & + \varepsilon_i \end{aligned} \qquad (3.28)$$

where R_i is MARs or CARs, BR_i is buy-and-hold raw returns (BHR) or buy-and-hold market-adjusted abnormal returns (BHAR), $IPOP_i$ is a period from opening to closing days of the offering firm i, $lnPRICE_i$ is the natural log value of the offer price of firm i, $lnOSIZE_i$ is the natural log value of the offer size of firm i, $LISD_i$ is the period of listing delay of firm i, $TOTP_i$ is the total time period for listing of firm i, $ICOR_i$ is the issue cost ratio of firm i, $TNPR_i$ is the total net proceeds ratio of firm i, $UWRA_i$ is the underwriter availability of the offer in firm i, $ATOA_i$ is the attached share options available with the offer of firm i, $OVSO_i$ is the oversubscription option of firm i, $WICP_i$ is the working capital recovery from the offer proceeds of firm i, $lnBOOKV_i$ is the natural log value of the book value per share of the firm i, $OWSH_i$ is the original ownership of firm i, $ln(1 + FAGE_i)$ is the natural log value of the age of issuing firm i, $lnFSIZE_i$ is the natural log value of the size of issuing firm i, MV is the market volatility, $RETU$ is the average market return before the closing date of the offer, MS is the MS, HC is the hot issue market dummy, $lnMR$ is the natural log value of post-day market for the same return interval as the dependent variable, $lnPRIM$ is the natural log value of the first-day PRIM, $lnSECON$ is the natural log value of the first-day secondary market return, D_1 = dummy for resource industry, D_2 = dummy for chemicals/materials industry, D_3 = dummy for industrial sector, D_4 = dummy for consumer discretionary/staples industry, D_5 = dummy for information technology industry, and D_6 = dummy for utilities industry. The telecommunication industry is captured in the intercept term. DY_1 = dummy for listing year 2006, DY_2 = dummy for listing year 2007, DY_3 = dummy for listing year 2008, DY_4 = dummy for listing year 2009, DY_5 = dummy for listing year 2010. The listing year 2011 is captured in the intercept term.

Using the above multiple regression equations, this study estimated four short-run market performance models: first-day primary market model, secondary market model, total market model and post-day market model. In addition, the study estimated six long-run regression models for BHR and BHAR for year one, year two and year three. When estimating the short-run and long-run models, some of the explanatory variables in the above regression equations were eliminated because of a multicollinearity problem. The dummy variables for the telecommunication industry and the listing year 2011 were not considered in these models due to multicollinearity.

3.8 Binary Regression Models (Logit and Probit)

The binary regression model is more realistic and important for IPO investors than the multiple regression model for the following reasons: (1) it does not assume normal distribution and linearity; (2) it estimates the associated probabilities (risks) of determinants, which is more important due to the change in economic and financial factors in the market; (3) the associated probability (risk) of a determinant is known as marginal probabilty, which is important to identify the directional change in the IPO market performance; (4) the marginal probabilty could provide information related to the market timing, which is more important for investment decisions. However, binary regression models have been given less attention in the IPO literature generally and particularly in Australia. Therefore, to identify the determinants of short-run and long-run IPO market performance, this study estimated the available binary regression models logit and probit regressions.

To estimate the logit and probit regression models, the study first determined the positive and negative returns (MAR, CAR, BHR and BHAR) of the IPO companies in the short run and long run as 1 and 0 variables, where 1 represents the positive returns and 0 represents the negative returns. Positive returns in the short-run IPO market were considered underpricing and in the long run they were considered overperformance. Negative returns in the short-run market were interpreted as overpricing and, in the long run, they were interpreted as underperformance. The logit and probit regression equations are as follows:

Logit regression equation

$$ln\left[\frac{P_i}{1-P_i}\right] = \alpha + \sum_{j=1}^{m} \beta_j D_{i_j} + \varepsilon_i \tag{3.29}$$

Probit regression equation

$$P_i = \alpha + \sum_{j=1}^{m} \beta_j D_{i_j} + \varepsilon_i \tag{3.30}$$

where P_i = the probability of underpricing (overperformance) (1) occurs in the short-run (long-run) market, $1 - P_i$ = the probability of underpricing (overperformance) does not occur or the overpricing (underperformance) (0) occurs in the short-run (long-run) market, $ln\left[\frac{P_i}{1-P_i}\right]$ = the natural log value of the odds ratios (in other words, the probability of occurring) for the event of underpricing(overperformance) (1) occurrence, β_i = coefficient of the explanatory variables, D_{i_j} = explanatory variables and ε_i = the error term of the model.

Kulendran and Wong (2001, p. 423) have reported that the logit and probit regression models differ because of the error term of each of the models. If the cumulative distribution of the error term is logit, the model is known as a logit model, and if the cumulative distribution is normal, it is called a probit model. Maddala (2001) revealed that the results of these binary models will not vary unless the sample size is large. The application of the logit model regression model is more important than probit regression because of the simplicity of the distribution function and ease of interpreting the results (Amemiya 1981). Due to the large sample size of the study, these two models were used to analyse the IPO market performance to identify the significant results.

The estimated logit and probit regression models used for the short-run market performance were:

Logit regression model

$$\begin{aligned} ln\left[\frac{P_i}{1-P_i}\right] = \alpha &+ \beta_1 IPOP_i + \beta_2 lnPRICE_i + \beta_3 lnOSIZE_i + \beta_4 LISD_i + \beta_5 TOTP_i \\ &+ \beta_6 ICOR_i + \beta_7 TNPR_i + \beta_8 UWRA_i + \beta_9 ATOA_i + \beta_{10} OVSO_i \\ &+ \beta_{11} WICP_i + \beta_{12} lnBOOKV_i + \beta_{13} OWSH_i + \beta_{14} ln(1 + FAGE_i) \\ &+ \beta_{15} lnFSIZE_i + + \beta_{16} MV_i + \beta_{17} RETU_i + \beta_{18} MS_i + \beta_{19} HC_i \\ &+ \sum_{i=1}^{6} \beta_i D_i + \varepsilon_i \end{aligned} \tag{3.31}$$

Probit regression model

$$\begin{aligned} P_i = \alpha &+ \beta_1 IPOP_i + \beta_2 lnPRICE_i + \beta_3 lnOSIZE_i + \beta_4 LISD_i + \beta_5 TOTP_i + \beta_6 ICOR_i \\ &+ \beta_7 TNPR_i + \beta_8 UWRA_i + \beta_9 ATOA_i + \beta_{10} OVSO_i + \beta_{11} WICP_i \\ &+ \beta_{12} lnBOOKV_i + \beta_{13} OWSH_i + \beta_{14} ln(1 + FAGE_i) \\ &+ \beta_{15} lnFSIZE_i + + \beta_{16} MV_i + \beta_{17} RETU_i + \beta_{18} MS_i + \beta_{19} HC_i \\ &+ \sum_{i=1}^{6} \beta_i D_i + \varepsilon_i \end{aligned} \tag{3.32}$$

The estimated logit and probit regression models used for the long-run market performance were:

Logit regression model

$$ln\left[\frac{P_i}{1-P_i}\right] = \alpha + \beta_1 IPOP_i + \beta_2 lnPRICE_i + \beta_3 lnOSIZE_i + \beta_4 LISD_i + \beta_5 TOTP_i$$
$$+ \beta_6 ICOR_i + \beta_7 TNPR_i + \beta_8 UWRA_i + \beta_9 ATOA_i + \beta_{10} OVSO_i$$
$$+ \beta_{11} WICP_i + \beta_{12} lnBOOKV_i + \beta_{13} OWSH_i + \beta_{14} ln(1 + FAGE_i)$$
$$+ \beta_{15} lnFSIZE_i + \beta_{16} MV_i + \beta_{17} RETU_i + \beta_{18} MS_i + \beta_{19} HC_i + \beta_{20} lnMR_i$$
$$+ \beta_{21} lnPRIM_i + \beta_{22} lnSECON_i + \sum_{i=1}^{6} \beta_i D_i + \sum_{i=1}^{6} \beta_i DY_i + \varepsilon_i \qquad (3.33)$$

Probit regression model

$$P_i = \alpha + \beta_1 IPOP_i + \beta_2 lnPRICE_i + \beta_3 lnOSIZE_i + \beta_4 LISD_i + \beta_5 TOTP_i + \beta_6 ICOR_i$$
$$+ \beta_7 TNPR_i + \beta_8 UWRA_i + \beta_9 ATOA_i + \beta_{10} OVSO_i + \beta_{11} WICP_i$$
$$+ \beta_{12} lnBOOKV_i + \beta_{13} OWSH_i + \beta_{14} ln(1 + FAGE_i)$$
$$+ \beta_{15} lnFSIZE_i + \beta_{16} MV_i + \beta_{17} RETU_i + \beta_{18} MS_i + \beta_{19} HC_i + \beta_{20} lnMR_i$$
$$+ \beta_{21} lnPRIM_i + \beta_{22} lnSECON_i + \sum_{i=1}^{6} \beta_i D_i + \sum_{i=1}^{6} \beta_i DY_i + \varepsilon_i \qquad (3.34)$$

where P_i = the probability of overperformance (1) occurs in the long-run market, $1 - P_i$ = the probability of overperformance does not occur or the underperformance (0) occurs in the long-run market, $ln\left[\frac{P_i}{1-P_i}\right]$ = the natural log value of the odds ratios (in other words, the probability of occurring) for the event of overperformance (1) occurrence, $IPOP_i$ is the period from opening to closing days of the offering firm i, $lnPRICE_i$ is the natural log value of the offer price of firm i, $lnOSIZE_i$ is the natural log value of the offer size of firm i, $LISD_i$ is the period of listing delay of firm i, $TOTP_i$ is the total time period for listing of firm i, $ICOR_i$ is the issue cost ratio of firm i, $TNPR_i$ is the total net proceeds ratio of firm i, $UWRA_i$ is the underwriter availability of the offer in firm i, $ATOA_i$ is the attached share options available with the offer of firm i, $OVSO_i$ is the oversubscription option of firm i, $WICP_i$ is the working capital recovery from the offer proceeds of firm i, $lnBOOKV_i$ is the natural log value of the book value per share of the firm i, $OWSH_i$ is the original ownership of firm i, $ln(1 + FAGE_i)$ is the natural log value of the age of issuing firm i, $lnFSIZE_i$ is the natural log value of the size of issuing firm i, MV is the market volatility, $RETU$ is the average market return before the closing date of the offer, and MS is the market sentiment, HC is the hot issue market dummy, $lnMR$ is the natural log value of post-day market for the same return interval as the dependent variable, $lnPRIM$ is the natural log value of the first-day PRIM, $lnSECON$ is the natural log value of the first-day secondary market return, D1 = dummy for resource industry, D2 = dummy for chemicals/materials industry, D3 = dummy for industrial sector, D4 = dummy for consumer discretionary/staples industry, D5 = dummy for information technology industry, and D6 = dummy for utilities industry. The telecommunication industry is captured in the intercept term. DY1 = dummy for listing year 2006, DY2 =dummy for listing year 2007, DY3 = dummy for listing year 2008, DY4 = dummy for listing year 2009, DY5 = dummy for listing year 2010. The listing year 2011 is captured in the intercept term.

Probit and logit binary regression models also estimated short-run models for the first-day primary market, secondary market, total market and post-day market and long-run models for year one, year two and year three for BHR and BHAR. When estimating the binary models, some of the explanatory and dummy variables were excluded from the above probit and logit equations because of multicollinearity.

3.9 Marginal Probability Analysis

Although marginal probability analysis is applied in other areas of finance research, the IPO literature indicates that it has not been applied to analyse the market performance of IPOs. Therefore, analysing short-run and long-run market performance using marginal probability analysis is a new contribution of this study.

Marginal probability analysis was used to identify the directional changes between short-run underpricing and overpricing or the long-run underperformance and overperformance due to change in probability (Δp) associated with the determinants. Marginal probabilities can be estimated only with the logit model because the logit model transforms the estimated function into a logistic probability using logistic distribution function. Following Kulendran and Wong (2001), Maddala (2001), Gujarati (2003) and Hill et al. (2011), this study estimated the marginal probability (Δp) of each variable in the logit models as follows:

$$P_i = \frac{e^{\propto + \sum_{i=1}^{n} \beta_i X_i}}{1 + e^{\propto + \sum_{i=1}^{n} \beta_i X_i}} \quad (3.35)$$

$$\Delta p = \beta_i P_i (1 - P_i) \quad (3.36)$$

where P_i = the probability of underpricing (overperformance) (1) occurs in the short-run (long-run) market, Δp = marginal probability, β_i = coefficient of each explanatory variable and X_i = the average value of each explanatory variable.

3.10 Diagnostic Tests for the Available Regression Models

This section discusses the statistical tests that were applied to test the overall validity of the developed models and their statistical significance. These tests were applied to both binary and multiple regression models and are discussed below.

3.10.1 Diagnostic Tests for Binary Regression Models

LR statistics, probability of LR statistic and McFadden R-squared were used as diagnostic tests for the probit and logit binary models. These tests are discussed below.

3.10.1.1 LR statistics

The LR statistic is defined as two times the log of the ratio of the likelihood functions of two models evaluated at their maximum likelihood estimation (MLE). LR statistics test the joint hypothesis that all slope coefficients except the constant are zero. The formula used to obtain LR is $-2[ln(L_1) - ln(L_2)]$ where L_1 is the maximum of the log likelihood function under the assumption that all slope coefficients are equal to zero and L_2 is the maximum of the log likelihood function in the unconstrained version of the model in which the coefficients are significant. The likelihood ratio (LR stat.) approximates a chi-square distribution, and evaluation procedures normally apply to chi-square tests of significance. This statistic helps to determine the overall significance of the binary models.

3.10.1.2 Probability (LR statistics)

This indicates the probability level of the LR statistics. If the probability value of a model is significant at the 0.05 significance level, the model is considered a well-fitted, valid model.

3.10.1.3 The McFadden R-squared (R^2_{McF})

The McFadden R-squared can be used to measure the strength of the association of the logit and probit binary models. However, unlike the R-squared of OLS regression, binary models R-squared is not an accurate measure of the overall fit of the models because of the dummy dependent variables (Studenmund 2001). A satisfactory level of McFadden R-squared cannot be interpreted as an OLS R-squared can be interpreted because the different pseudo R-squareds can arrive at very different values. The McFadden R-squared satisfactory value is smaller than that of the OLS R-squared, and the McFadden R-squared values of 0.20 to 0.40 are considered highly satisfactory (Ainsworth n.d.).

3.10.2 Diagnostic Tests for Multiple Regression Models

F-statistics, probability of F-statistic, adjusted R-squared, autocorrelation test, heteroscedasticity test and multicollinearity test were used as diagnostic tests for the multiple regression models. These test statistics are discussed below.

3.10.2.1 F-statistics

F-statistics were used to test the overall significance of the developed OLS regression models. The idea is very similar to the LR statistics in the binary regression models. These statistics test the joint hypothesis, which indicates that all the model parameters (slopes) are zero except the intercept (constant). This null hypothesis was rejected if the critical value of the F-statistics was less than or equal to F-test statistics. The rejection of null hypothesis indicates that the estimated relationship is significant. In other words, it shows that the developed model is valid.

3.10.2.2 Probability (F- statistics)

Probability (F-statistics) indicated the p-value of the F-test statistics. If the p-value of the F-test statistics was less than or equal at a 5% significance level, the null hypothesis that all the model parameters (slopes) are equal to zero except the intercept (constant) was rejected. This indicates that at least one of the explanatory variables in the model has an influence on short-run and long-run performance.

3.10.2.3 Adjusted R-squared ($AdjR^2$)

Adjusted R-squared was used to check the goodness of fit of the developed OLS regression models. This measures how well the regression lines of the developed models approximate the real data points. Adjusted R-squared can be negative and its value normally less than the unadjusted R-squared. Unlike unadjusted R-squared, adjusted R square allows for the degrees of freedom associated with the sums of the squares. Therefore, even though the residual sum of squares decreases or remains the same as new explanatory variables are added, the residual variance does not. For this reason, adjusted R-squared is generally considered a more accurate goodness-of-fit measure than unadjusted R-squared.

3.10.2.4 Test for autocorrelation

Durbin-Watson (DW) (1951) and Lagrange multiplier (LM) chi-square statistical tests can be used to test the serial correlation or autocorrelation problem. In regression models, error terms are independent white noise sequence with zero mean, which has constant variance, independence and normality assumptions.

3.10.2.5 Test for heteroscedasticity

White's (1980) heteroscedasticity test was used to test the constant error variance, which indicates that the error terms (residuals) do maintain constant variance throughout the time series. If the variance is not constant, this issue is considered a heteroscedasticity problem.

3.10.2.6 Test for multicollinearity

The multicollinearity issue can occur when two or more explanatory variables in the developed models are highly correlated. A simple cross-correlation test is used to recognise the multicollinearity problem.

The next chapter analyses the data and discusses the results of the investigation into short-run market performance and its determinants using the methodology developed in this chapter.

Chapter 4: Analysis of Data and Discussion of Results: The Short-Run Market Performance and Its Determinants

4.1 Introduction

This chapter discusses the summary statistics of the distribution of short-run return used to measure the short-run market performance of the IPOs, the evaluation of the short-run market performance, the determinants of the short-run market performance, and the conclusions and findings.

The first section of the chapter briefly discusses the summary statistics of the short-run returns based on the first listing day and the post-day listing period. In the first listing day, returns were calculated based on the raw and abnormal returns under the three market scenarios—primary, secondary and total—and these market scenarios were identified using different time periods. In the post-day listing, returns were calculated based on the CARs for the three post-listing days, third day, sixth day and tenth day.

The second section presents the evaluation of the short-run market performance based on the RR, MAR and CAR. These return measures were used as the main performance measures to determine whether the Australian IPOs were underpriced or overpriced in the short-run market. In addition, the short-run market performance was evaluated by industry, listing year and issue year under the first listing day and post-day listing period with a view to identifying any substantial variation in the short-run market performance across industries and year to year.

The third section identifies the significant determinants of the short-run market performance with the aid of logistics, probit and multiple regression models with a marginal analysis. The final section provides the conclusions and findings.

4.2 Summary Statistics

Table 4.1 presents the summary statistics, which were calculated based on raw, market-adjusted abnormal (excess) and cumulative abnormal return measures for the first listing day and the post-day listing period, as an overview of the nature of the data analysed. The raw, market-adjusted abnormal and cumulative abnormal returns were the three main return measures used as performance measures to evaluate the short-run IPO market performance. Further, the market-adjusted abnormal and cumulative abnormal returns were used as dependent variables of the regression models employed to identify the significant determinants of the short-run market performance.

Table 4.1 Summary Statistics of Short-Run Return Measures

Dependent variable		N	Mean	Median	SD	Kurtosis	Skewness	Minimum	Maximum
First listing day returns									
Primary market *(the period from the issuing date to the beginning of the first listing date)*	**RR**	254	0.2643	0.1000	1.5697	208.7654	13.8691	–0.8250	24.000
	MAR	254	0.2547	0.0809	1.5736	209.3005	13.8928	–0.7013	24.066
Secondary market *(the period from the first listing day time of beginning to the time of closing)*	**RR**	254	–0.0154	–0.0098	0.1058	1.8233	0.2465	–0.4437	0.4008
	MAR	254	–0.0155	–0.0160	0.1080	1.9669	0.2129	–0.4735	0.3999
Total market *(the period from the issuing date to the closing time of the first listing date)*	**RR**	254	0.2411	0.0750	1.5346	210.6155	13.9303	–0.8150	23.500
	MAR	254	0.2314	0.0648	1.5387	211.1912	13.9532	–0.8987	23.568
									Post-day listing returns
*__Post-day market__ (*the after-listing period from day 2 to day 10)*	**CAR_3**	254	0.2463	0.0862	1.5418	204.2008	13.6212	–1.0291	23.437
	CAR_6	254	0.2406	0.0789	1.5443	202.9261	13.5590	–0.9416	23.432
	CAR_{10}	254	0.2334	0.0709	1.5468	198.7942	13.3537	–0.9577	23.345

Note: **N** = Sample size, **RR** = Raw return, **MAR** = Market-adjusted abnormal (excess) return, **CAR** = Cumulative Abnormal Return for post-days 3, 6 and 10, **SD** = Standard deviation. The first listing day returns except for the secondary market returns and post-listing day returns are calculated with outlier, which affects the overall results. Therefore, the study also calculated the short-run return measures after excluding outlier. The summary statistics after excluding outlier are given in Appendix 4.

*The CAR was calculated after considering the first listing day total market return.

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Table 4.1 shows that the short-run returns were calculated based on the first listing day returns and the post-listing day returns. The first listing day returns were classified under the three market scenarios of primary market, secondary market and total market. The primary market is the period from the issuing date to the beginning of the first listing date. The secondary market covers the period from the first listing day from the time of beginning to the time of closing. The total market is the period from the issuing date to the closing time of the first listing date. In other words, the total market is a combination of primary and secondary markets. The RR and the MAR were calculated to evaluate the short-run performance of the IPOs in the primary, secondary and total markets.

In addition to the first listing day returns, the post-listing day returns were used to evaluate the short-run market performance. The post-listing day covers the after-listing period from day 2 to day 10. To evaluate the short-run market performance in the post-listing period, the CAR was calculated for the third day, sixth day and tenth day.

The summary statistics for the short-run return measures in Table 4.1 were calculated for the full sample companies based on the first listing day return and the post-day listing return. The summary statistics calculated for the first listing day return are discussed first.

The mean and median return values for the primary and total markets are positive signs, but the SECON values are negative signs for both statistical measures. The mean values for the primary market on raw and market-adjusted abnormal returns are higher than the total market mean values. The mean return values between the primary and total market vary from 0.2411 to 0.2643 on RRs and 0.2314 to 0.2547 on MARs. The median values for the primary on both return measures are also higher than the total market median values. The median values between the primary and total market vary from 0.075 to 0.10 on RRs and 0.0648 to 0.0809 on MARs. The mean return values on raw and market-adjusted abnormal returns for the secondary market are similar, but the median returns for the secondary market on both return measures vary from –0.0160 to –0.0098. The standard deviation statistics for the primary and the total market on both return measures are much higher than the secondary market, which shows a higher variation between these markets. However, the standard deviation statistics for the secondary market on both return measures do not differ. The standard deviation statistics between the primary and total market vary from 1.5346 to 1.5697 on RRs and 1.5387 to 1.5736 on MARs.

The kurtosis statistics values for the primary and total market indicate the high peakedness of both return measures compared with the secondary market. This high peakedness shows that the return distributions are more peaked than the normal distribution. This type of distribution can be expected for stock MRs. However, the kurtosis statistics for the secondary market are relatively low. The positive skewness can be seen for all the markets on the first listing day. This indicates that return distribution skews to the right or has a long tail to the right. However, the skewness statistics for the primary and total market are higher than the secondary market. The secondary market skewness values on both return measures are less than 1. The minimum and maximum statistics for all return measures for the primary and total markets indicate that the range of returns is higher than the secondary market.

In the post-day listing period, the calculated mean return values for all three days are positive and vary between 0.2334 and 0.2463. The median statistics also indicate a positive sign varying from 0.0709 to 0.0862. The standard deviation for all three post-day listing periods is 1.54. The kurtosis statistics values indicate that the return distributions are more peaked than the normal distribution. The positive skewness can be seen for all three days, showing that the distribution of post-day listing return skews to the right. A similar skewness value can be seen for each of the post-listing days. The minimum and maximum values show a higher range of returns in the post-day listing period.

4.3 Analysis of Short-Run Market Performance

The main objective of the analysis in this section was to evaluate the short-run market performance and identify whether the Australian IPOs were underpriced (overperformance) or overpriced (underperformance) in the short run. The positive and negative returns of the short-run IPO market were used to measure the underpricing and overpricing respectively. To identify the underpricing and overpricing, the short-run market performance was analysed using the first listing day returns and the post-day listing returns. The first listing day returns were calculated under the three markets: primary, secondary and total. The post-day listing returns were also calculated under the three post-listing days: third day, sixth day and tenth day. This section provides the statistical analysis and the results derived from the methodology discussed in the previous chapter. The empirical findings of the short-run market performance on the first listing day returns and the post-day listing returns are presented in Sections 4.3.1 and 4.3.2 respectively.

4.3.1 The First Listing Day Returns of IPOs

The findings on the first listing day raw and MARs are discussed separately for the primary market, the secondary market and the total market. The results of both the primary and SECONs are given in Table 4.2 and the total MRs are given in Table 4.3. The primary and total MRs after excluding outlier are also given in Appendix 5.

4.3.1.1 Primary market

Table 4.2 shows that all sample companies were underpriced on the first listing day primary market by 26.43% (excluding outlier 17.05%) based on the RR and 25.47% (excluding outlier 16.06%) based on the MAR because these MRs are positive. These returns are statistically significant at the 1% level. This finding supports that of Chang et al. (2008) that Chinese A-share IPOs were underpriced in the first-day primary market by 121.78% during 1996 to 2004. However, the Chinese A-share underpricing level was much higher than the Australian underpricing level because it is an emerging market. The study’s finding is also comparable with US findings (Aggarwal & Conroy 2000; Barry & Jennings 1993; Bradley et al. 2009; Edwards & Hanley 2010; Schultz & Zaman 1994). The first-day PRIM (offer-to-open return) reported by Edwards and Hanley (2010), Bradley et al. (2009), Aggarwal and Conroy (2000) and Barry and Jennings (1993) are 9.07%, 27.5%, 17.66% and 6.16% respectively. The level of underpricing reported by Bradley et al. (2009) is closer to the underpricing level found in this study.

Table 4.2: First Listing Day Returns: Primary and Secondary Market

Sample classification		Primary market				Secondary market			
	N	**ARR**	**t-stat**	**AAR**	**t-stat**	**ARR**	**t-stat**	**AAR**	**t-stat**
All sample companies	254	0.2643	2.68***	0.2547	2.58***	–0.0154	–2.32**	–0.0155	–2.29**
By industry									
Resources	143	0.1751	4.33***	0.1664	4.26***	–0.0062	–0.68	–0.0070	–0.75
Chemicals/materials	4	–0.0568	–0.30	–0.1091	–0.64	–0.0649	–2.24	–0.0635	–2.08
Industrials	46	0.6701	1.28	0.6803	1.30	–0.0136	–1.02	–0.0114	–0.84
Consumer discretionary/staples	31	0.1874	1.49	0.1829	1.40	–0.0191	–0.98	–0.0189	–0.97
Information technology	20	0.2014	1.66	0.1414	1.11	–0.0451	–1.73*	–0.0465	–1.72*
Telecommunication	4	0.2345	2.70*	0.2388	2.38*	–0.0493	–0.74	–0.0456	–0.64
Utilities	6	0.1190	0.82	0.1009	0.70	–0.0736	–1.89	–0.0753	–2.00
By listing year									
2006	68	0.2097	2.99***	0.1762	2.58**	–0.0050	–0.38	–0.0059	–0.44
2007	91	0.1841	4.28***	0.1638	3.79***	–0.0200	–1.98**	–0.0189	–1.83*
2008	29	0.9809	1.17	1.0637	1.27	–0.0008	–0.03	0.0009	0.04
2009	17	0.1294	2.48**	0.0910	1.35	–0.0177	–0.45	–0.0204	–0.50
2010	41	0.1352	4.85***	0.1402	5.25***	–0.0286	–1.96*	–0.0299	–2.06**
2011	8	–0.0094	–0.10	–0.0412	–0.48	–0.0314	–1.29	–0.0327	–1.40
By issue year									
2005	9	0.7254	1.64	0.6245	1.43	–0.0366	–0.58	–0.0365	–0.58
2006	69	0.1066	2.95***	0.0782	2.13**	–0.0047	–0.41	–0.0057	–0.49
2007	96	0.4609	1.81*	0.4673	1.83*	–0.0221	–2.23**	–0.0208	–2.05**
2008	19	0.0692	0.65	0.0942	0.89	0.0069	0.19	0.0087	0.22
2009	16	0.1572	3.51***	0.1257	2.23**	–0.0103	–0.34	–0.0136	–0.45
2010	45	0.1148	3.81***	0.1115	3.74***	–0.0245	–1.88*	–0.0258	–2.00**

Note: Positive return indicates underpricing whereas negative return shows overpricing. **N** = Sample size, **ARR** = Average raw return, **AAR** = Market-adjusted average abnormal return. * statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level.

4.3.1.1.1 Industry analysis

If we examine IPOs by industry, in the primary market, the highest level of underpricing can be seen in industrial sector IPOs: 67.01% (excluding outlier 15.16%) based on RRs and 68.03% (excluding outlier 16.07%) based on MARs. However, these underpricing levels are not statistically significant. The resources sector IPOs are generally underpriced by 17.51% on RRs and 16.64% on MARs. These underpricing levels are statistically significant at the 1% level. The levels of underpricing (23.45% on RRs and 23.88% on MARs) in the telecommunication sector are also statistically significant at the 10% level. The information technology sector IPOs were also underpriced on RRs by 20.14%, which is not statistically significant. In contrast with IPOs in other sectors, the chemicals and materials sector IPOs were overpriced by 5.68% based on RRs and 10.91% based on MARs. It is interesting to see that IPOs of this sector earned negative returns in the very first-day primary market in relation to both measures. However, these negative returns are not statistically significant.

4.3.1.1.2 Listing year analysis

The listing year analysis shows that the highest level of underpricing occurred in the primary market in 2008 based on raw and market-adjusted abnormal returns by 98.09% (excluding outlier 15.88%) and 106.37% (excluding outlier 24.23%) respectively. These levels of return are not statistically significant. In listing years 2006, 2007 and 2010, the listed IPOs were underpriced on RRs by 20.97%, 18.41% and 13.52% respectively. These underpricing levels are statistically significant at the 1% level. According to the MARs, IPOs listed in 2006, 2007 and 2010 were underpriced by 17.62%, 16.38% and 14.02% respectively and these are statistically significant at the 5% level. The IPOs in listing year 2009 were underpriced by 12.94% on RRs, which is statistically significant at the 5% level. The Australian IPOs were overpriced in 2011 by 1% based on RRs and 4.12% on MARs because these average returns are negative signs. The statistical significance cannot be seen in these overpricing levels.

4.3.1.1.3 Issue-year analysis

When we examine the IPOs in the primary market by the issue year, we find that issued IPOs in 2006, 2009 and 2010 were underpriced by 10.66%, 15.72% and 11.48% based on RRs respectively. These levels of underpricing are statistically significant at the 1% level. In issue year 2007, the IPOs were underpriced by 46.09% (excluding outlier 21.31%) and 46.73% (excluding outlier 21.9%) on RRs and MARs respectively, which are statistically significant at the 10% level. The highest underpricing level can be seen in 2005 based on both returns, which are not statistically significant, while the lowest is in 2006. Based on MARs, the issued IPOs in 2010 were underpriced by 11.15%, which is statistically significant at the 1% level. In issue years 2006 and 2009, the IPOs were also underpriced by 7.82% and 12.57% respectively, which are significant at the 5% level. In the Australian IPO market, overpricing was not found in any issue years because the negative returns were not reported in these periods.

4.3.1.2 Secondary market

Table 4.2 indicates that the Australian IPOs were overpriced in the closing price secondary market by 1.54% and 1.55% based on RRs and MARs respectively. It is interesting to observe that IPO investors in this market earned average negative returns in relation to both return measures. These levels of overpricing are statistically significant at the 5% level. This is another interesting finding compared with the primary and total market of the Australian IPOs. This finding may be consistent with IPO flipping or stagging (as it is known in Australia), in which initial IPO investors sell their acquired shares in the secondary market due to underpricing in the primary market. Bayley, Lee and Walter (2006) have reported that, unlike the role of US underwriters, Australian underwriters' role does not extend to the aftermarket. As a result, they found that the average flipping of underpriced IPOs is much higher than the average of overpriced IPOs. Aggarwal (2003) also found that the average flipped shares in very hot IPOs (higher underpricing) are higher than in the very cold IPOs.

This study's finding slightly confirms the finding of Barry and Jennings (1993) that intraday returns (SECONs) are lower than normal transaction costs. This implies that the net return (after deducting transaction costs) is negative in the secondary market.

However, the study's finding is inconsistent with some international findings reported by Bradley et al. (2009), Chang et al. (2008), Aggarwal and Conroy (2000), Schultz and Zaman (1994) and Barry and Jennings (1993). Bradley et al. (2009) Aggarwal and Conroy (2000)[7] and Schultz and Zaman (1994) found that US IPOs were further underpriced based on SECONs (open-to-close returns) by 2.35%, 1.54% and 3% respectively. Chang et al. (2008) also found that Chinese A-share IPOs were underpriced in the first-day secondary market by 1.55%.

4.3.1.2.1 Industry analysis

According to the industry analysis, the highest average overpricing level on RRs can be observed in the utility industry IPOs (7.36%), which is not statistically significant, and the lowest is in the resources sector IPOs (0.62%). According to the MARs, the highest overpricing level can be observed in the utility sector (7.53%), which is not statistically significant, and the lowest is in the resources industry (0.70%). The average overpricing levels in the chemicals and materials sector based on the raw and market-adjusted abnormal returns are 6.49% and 6.35% respectively. These overpricing levels are also not statistically significant. The overpricing levels (4.51% on RRs and 4.65% on MARs) in the information technology industry are statistically significant at the 10% level. In the secondary market, underpricing was not found in any sector.

4.3.1.2.2 Listing-year analysis

The listing year classification of the secondary market shows that the IPOs were not underpriced based on RRs even though the underpricing can be observed in MARs in listing year 2008, which is not statistically significant. Statistically significant overpricing levels can be found on both return measures in 2007 and 2010 only. Listed IPOs in 2007 and 2010 were overpriced on RRs by 2% and 2.86% respectively. These rates of overpricing are statistically significant at the 10% level. The overpricing levels of listed IPOs on MARs (1.89% and 2.99%) in 2007 and 2010 are statistically significant at 10% and 5% levels respectively.

[7] They reported that the average offer-to-open (primary) and offer-to-close (secondary) returns were 0.1766 and 0.1947. This shows that the average open-to-close return was approximately 0.0154. The open-to-close return can be calculated using the following equation: open-to-close return (r) = (1 + offer-to-close return)/(1 + offer-to-open return)] – 1.

4.3.1.2.3 Issue-year analysis

The issue-year analysis shows that statistically significant overpricing can be found in the secondary market on both return measures in issue years 2007 and 2010. In 2007, issued IPOs were overpriced on raw and market-adjusted abnormal returns by 2.21% and 2.08% respectively and these are statistically significant at 5% level. The issued IPOs were overpriced on raw and market-adjusted abnormal returns in issue year 2010 by 2.45% and 2.58% respectively. These overpricing levels are statistically significant at 10% and 5% levels. The IPOs issued in all years were overpriced except in 2008.

4.3.1.3 Total market

The total MR indicates the return earned by an IPO investor on the very first day of the listing. The total MR includes both the first-day PRIM and the SECON. The calculated total MRs are given in Table 4.3.

Table 4.3: First Listing Day Returns: Total Market

Sample classification	Total market				
	N	**ARR**	**t-stat**	**AAR**	**t-stat**
All sample companies	254	0.2411	2.50**	0.2314	2.39**
By industry					
Resources	143	0.1664	4.04***	0.1568	3.93***
Chemicals/materials	4	–0.1084	–0.59	–0.1594	–0.95
Industrials	46	0.6407	1.25	0.6530	1.27
Consumer discretionary/staples	31	0.1413	1.51	0.1371	1.42
Information technology	20	0.1598	1.26	0.0980	0.73
Telecommunication	4	0.1595	3.51**	0.1677	2.83*
Utilities	6	0.0305	0.22	0.0109	0.07
By listing year					
2006	68	0.2030	2.92***	0.1685	2.47**
2007	91	0.1574	3.59***	0.1383	3.15***
2008	29	0.9282	1.14	1.0126	1.24
2009	17	0.1333	1.57	0.0917	0.91
2010	41	0.1021	3.24***	0.1059	3.58***
2011	8	–0.0331	–0.36	–0.0665	–0.74
By issue year					
2005	9	0.6614	1.56	0.5605	1.34
2006	69	0.1031	2.54**	0.0737	1.78*
2007	96	0.4180	1.69*	0.4258	1.71*
2008	19	0.0825	0.71	0.1089	0.92
2009	16	0.1569	2.13**	0.1220	1.44
2010	45	0.0880	2.70***	0.0834	2.64**

Note: Positive return indicates underpricing whereas negative return shows overpricing. **N** = Sample size, **ARR** = Average raw return, **AAR** = Market-adjusted average abnormal return. * statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level.

According to the first-day total MRs presented in Table 4.3, all sample companies were underpriced on the first day of listing by 24.11% (excluding outlier 14.92%) based on RRs and 23.14% (excluding outlier 13.92%) based on MARs because these returns are positive signs. These underpricing levels are statistically significant at 5%. This finding is consistent with international findings (see Table 2.1) and the Australian findings given in Table 4.4 based on the first-day average return. Although the finding of short-run underpricing is consistent with all Australian studies, the level of underpricing is not consistent with some of the studies shown in Table 4.4 (Bird & Yeung 2010; Ho et al. 2001; How 2000).

Table 4.4: Australian Evidence on Short-Run Underpricing

Author(s)	**Average initial return* (%)**	**Sample size**	**Sample period**
Finn & Higham (1988)	29.2	93	1966–1978
How & Low (1993)	16.36	523	1979–1989
Lee, Taylor & Walter (1996)	11.86	266	1976–1989
How, Izan & Monroe (1995)	19.74	340	1980–1990
How (2000)	107.18	130	1979–1990
Ho et al. (2001)	48.04	156	1999–2000
Gong & Shekhar (2001)	11.96	11	1989–1999
Da Silva Rosa, Velayuthen & Walter (2003)	25.47	333	1991–1999
Balatbat, Taylor & Walter (2004)	15.48	313	1976–1993
Dimovski & Brooks (2004)	25.6	358	1994–1999
Dimovski & Brooks (2005)	17.93	127	1994–2001
Dimovski & Brooks (2006)	27	262	1994–1999
Bayley, Lee & Walter (2006)	26.72	419	1995–2000
How, Lam & Yeo (2007)	33	275	1993–2000
Dimovski & Brooks (2008)	13.3	114	1994–2004
Bird & Yeung (2010)	37.35	68	1995–2004
Nguyen, Dimovski & Brooks (2010)	16.13	260	1994–2004
Dimovski, Philavanh & Brooks (2011)	29.6	380	1994–2004
How, Ngo & Verhoeven (2011)**	28.8	743	1992–2004
Lee, Taylor & Walter; Woo; Pham; Ritter***	19.8	1103	1976–2006

Note: * The average initial returns are equally weighted average returns, which were calculated using issue prices and first-day listing prices. Some of the returns are raw returns and some are market-adjusted abnormal returns.
** The authors have calculated the first-day returns for dividend payers (332) and non-payers (441) as 22% and 32% respectively. Considering these returns, the average first-day return for all sample companies (743) in this study was recalculated as 28.8% [(22% *332 + 32% * 441)/743].
***This figure was taken from ‘Initial Public Offerings: International Insights’ by Loughran, Ritter and Rydqvist (1994, updated 2010)

4.3.1.3.1 Industry analysis

In the examination by industry, the highest level of underpricing can be observed in the industrial sector IPOs: 64.07% (excluding outlier 13.27%) based on RRs and 65.30% (excluding outlier 14.39%) based on MARs. These underpricing levels are slightly higher than those of some of the previous Australian studies. Finn and Higham (1988), How, Izan and Monroe (1995), Lee, Taylor and Walter (1996), Balatbat, Taylor and Walter (2004), How, Lam and Yeo (2007) and Dimovski, Philavanh and Brooks (2011) found that Australian industrial IPOs were underpriced by 29.2%, 19.74%, 11.86%, 15.48%, 33% and 29.6% respectively. The reason for this slight increase in underpricing may be the outlier. However, the study underpricing levels are not statistically significant. The resources sector IPOs were generally underpriced by 16.64% based on RRs and 15.68% based on MARs. These underpricing levels are statistically significant at the 1% level. The levels are consistent with the finding of Nguyen, Dimovski and Brooks (2010) that resource IPOs were underpriced by 16.13% during 1994–2004. Dimovski and Brooks (2004) also found that resource IPOs were underpriced by 21.6% during 1994–1999. How (2000) and Dimovski and Brooks (2005) also documented that mining and energy (resources sector) IPOs were underpriced by 107.18% and 17.93% respectively. However, the underpricing level related to the mining IPOs (How 2000) is much higher than the finding of the current study. The levels of underpricing (15.95% based on the RR and 16.77% based on the MAR) in the telecommunication sector are also statistically significant at 5% and 10% levels. The chemicals and materials sector IPOs were overpriced by 10.84% based on the RR and 15.94% based on the MAR compared with the other sectors because this gives a negative return for their investors on both returns. These underpricing levels are not statistically significant. Although not significant, this finding is an interesting outcome because it indicates that other sectors were underpriced on both performance measures compared with the chemicals and materials sector. The consumer discretionary/staples and information technology sectors were also underpriced based on first-day raw (14.13% and 15.98% respectively) and market-adjusted abnormal (13.71% and 9.8% respectively) returns. However, these underpricing levels are not statistically significant. The underpricing of the information technology sector supports the finding of Ho et al. (2001) that technology IPO firms in Australia were underpriced by 49.73% based on RRs and 48.04% based on MARs. The difference in sample size and period may explain the difference in the level of underpricing in both studies. The utility sector IPOs were also underpriced by 3.05% based on the RR and 1.09% based on the MAR, which is the lowest underpricing level compared with other sectors and these underpricing levels are also not statistically significant. This finding indicates that

IPO investors of the utility sector earned a relatively low return in the first-day total market compared with that of the other sectors.

4.3.1.3.2 Listing-year analysis

The examination of the IPOs by the listing year shows that the highest underpricing level on both measures is reported in 2008 (92.82% [excluding outlier 12.21%] on RR and 101.26% [excluding outlier 20.71%] on MAR). These underpricing levels are not statistically significant. In the listing year 2011, overpricing is reported on both return measures: 3.31% based on RRs and 6.65% based on MARs. These overpricing levels are also not statistically significant. The overpricing indicates that negative returns were given to investors in that listing year. In listing years 2006, 2007 and 2010, the listed IPOs were underpriced on RRs by 20.30%, 15.74% and 10.21% respectively. These underpricing levels are statistically significant at the 1% level. According to the market-adjusted abnormal returns, IPOs were underpriced by 13.83% and 10.59% in 2007 and 2010 respectively. These levels are also statistically significant at 1%. In 2006, the underpricing level based on MARs (16.85%) is statistically significant at the 5% level. The underpricing levels based on both return measures in 2008 and 2009 are not statistically significant. The listing year analysis shows that the level of underpricing based on both return measures decreased from 2006 to 2011, except in 2008. This indicates that the wealth of the IPO investors also decreased during this period.

4.3.1.3.3 Issue-year analysis

The highest level of underpricing can be observed in issue year 2005 based on both measures (66.14% on RRs and 56.05% on MARs). Statistically significant underpricing levels cannot be seen in issue year 2005 and 2008. In issue year 2010, the levels of underpricing based on raw and market-adjusted abnormal returns are 8.8% and 8.34% respectively. These levels are significant at the 5% level. Statistically significant (5%) underpricing can be observed in 2009 only for RRs at 15.69%. The underpricing levels in 2007 based on both return measures (41.80% [excluding outlier 17.51%] based on RRs and 42.58% [excluding outlier 18.22%] based on MARs) are statistically significant at the 10% level. In the year 2006, the issued IPOs were underpriced by 10.31% based on RRs and 7.37% based on MARs, and these are statistically significant at 5% and 10% respectively. It is interesting to observe that the issue-year analysis did not indicate any overpricing because the negative return was not reported in any issue year. This finding indicates that the investors' wealth did not decrease in the issue-year analysis.

4.3.2 The Post-Day Listing Returns of IPOs

This section presents the analysis of the post-day listing returns, which calculated the CARs for nine post-listing days. The calculated average CARs of all sample IPOs for the nine post-listing days are shown in Figure 4.1. The post-day listing returns by industry, listing year and issue year are shown in Appendix 6.

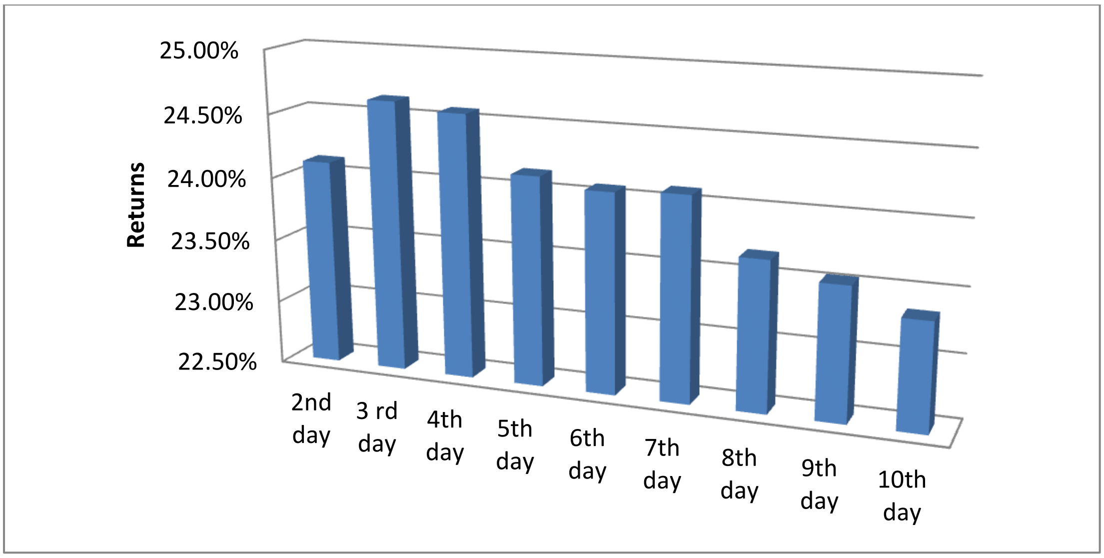


Figure 4.1: The Calculated Average CARs for the Nine Post-Listing Days from 2006 to 2011

The chart in Figure 4.1 indicates the short-run return behaviour of the post-day market from day 2 to day 10. This chart clearly indicates that the level of underpricing based on the CAR slowly decreased after the listing, particularly from the seventh day to the tenth day. It indicates that IPO investors' wealth also decrease with this behaviour. This finding may be a result of the institutional setup in Australia, particularly the underwriter's role in the post or aftermarket period. Bayley, Lee and Walter (2006) reported that Australian underwriters are not involved in the aftermarket period like US underwriters. US underwriters control the aftermarket by providing the initial source of liquidity. In particular, they use net buying in the aftermarket to control the declining price pressure arising from flipping and act against IPO flippers. However, this aftermarket control by underwriters cannot be expected in the Australian IPO market due to the institutional setup. As a result, prices may decrease within a short period after listing due to the flipping or stagging in Australia. The study finding confirms the findings of Sohail, Raheman and Durrani (2010), Kenourgios, Papathanasiou and Melas (2007), Chi and Padgett (2005), Aktas, Karan and Aydogan (2003) and Kazantzis and Thomas (1996). However, Finn and Higham (1988) found that the level of underpricing based on CARs was steady after the sixth day. This finding contradicts the current study's finding, particularly the period from day 7 to 10.

Table 4.5 provides the post-day listing returns for the third, sixth and tenth days of all the sample companies by industry, listing year and issue year. The post-day listing returns from days 2 to 10 after excluding outlier are given in Appendix 7. All sample IPO companies were underpriced based on the CARs by 24.63% (excluding outlier 15.47%), 24.07% (excluding outlier 14.9%) and 23.34% (excluding outlier 14.21%) on the third, sixth and tenth days respectively. However, only day 6 is statistically significant at the 10% level. The post-day listing returns of all IPOs decreased from the third day to the tenth day.

Table 4.5: Post-day Listing Returns

Sample classification	N	Day 3 CAR	Day 3 t-stat	Day 6 CAR	Day 6 t-stat	Day 10 CAR	Day 10 t-stat
All sample companies	254	0.2463	1.50	0.2407	1.75*	0.2334	0.73
By industry							
Resources	143	0.1751	0.99	0.1722	1.14	0.1699	0.41
Chemicals/materials	4	–0.1602	–1.19	–0.1841	–9.31***	–0.2333	–1.18
Industrials	46	0.6893	5.47***	0.6784	6.54***	0.6629	5.94***
Consumer discretionary/staples	31	0.1113	0.57	0.0956	0.69	0.0734	0.48
Information technology	20	0.0998	1.38	0.0983	0.79	0.1013	0.89
Telecommunication	4	0.1541	1.53	0.1725	1.95	0.1312	1.60
Utilities	6	0.0633	0.25	0.0681	0.86	0.1000	0.61
By listing year							
2006	68	0.2203	0.91	0.1855	1.70*	0.1921	1.02
2007	91	0.1492	1.33	0.1526	1.14	0.1245	0.35
2008	29	0.9897	4.68***	0.9820	4.38***	0.9590	3.78***
2009	17	0.0756	0.73	0.0941	0.72	0.1040	0.89
2010	41	0.1125	1.38	0.1219	1.01	0.1160	0.82
2011	8	–0.0748	–0.95	–0.0567	–0.72	0.0699	0.06
By Issue year							
2005	9	0.6382	2.33**	0.5867	4.76***	0.5500	3.07**
2006	69	0.1144	0.51	0.0843	0.80	0.0867	0.46
2007	96	0.4295	2.83***	0.4326	2.66***	0.4099	1.15
2008	19	0.1051	1.01	0.1089	0.66	0.0755	0.35
2009	16	0.1184	1.26	0.1306	0.99	0.1253	1.26
2010	45	0.0844	1.02	0.0964	0.89	0.1235	0.27

Note: Positive return indicates underpricing whereas negative return shows overpricing. **N** = Sample size, **CAR**= Cumulative average abnormal return. * statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level.

4.3.2.1 Industry analysis

The industry analysis shows that all IPOs in the industrial sector were underpriced except for the chemicals and materials sector. Only IPOs in the industrial sector are statistically significant at the 1% level on all three post-listing days; they were underpriced by 68.93% (excluding outlier 18.39%), 67.84% (excluding outlier 17.28%) and 66.29% (excluding outlier 15.90%) on the third, sixth and tenth days respectively. The chemicals and materials industry was overpriced on the third, sixth and tenth days by 16.02%, 18.41% and 23.33% respectively. Only the return on day 6 is statistically significant at the 1% level.

4.3.2.2 Listing-year analysis

The highest level of underpricing is found in the listing year 2008 and it is statistically significant at the 1% level. In 2008, the average levels of underpricing on the third, sixth and tenth days are 98.97% (excluding outlier 18.8%), 98.20% (excluding outlier 18.03%) and 95.90% (excluding outlier 15.96%) respectively. In listing year 2006, only the underpricing on day 6 is statistically significant at the 10% level. The listed IPOs in 2011 were overpriced only on the third and sixth days and were underpriced on the tenth day. However, these overpricing levels are not statistically significant.

4.3.2.3 Issue-year analysis

The issued IPOs from 2005 to 2010 were underpriced on the third, sixth and tenth days but only the IPOs issued in 2005 are statistically significant on all three days. The IPOs issued in 2005 were underpriced by 63.82%, 58.67% and 55% on the third, sixth and tenth days respectively. In 2007, the underpricing levels are statistically significant only on the third and sixth days. Overpricing was not found in these issue years.

4.4 Determinants of the Short-Run Market Performance

The main aim of this section is to identify the reasons for the short-run market performance of IPOs in Australia. The section identifies the issue- (offer-) specific characteristics, firm-specific characteristics and market-specific characteristics that affect the short-run market performance in the IPO market.[8] Issue characteristics include offer-related characteristics such as offer size, offer price and TOTP. Firm characteristics include firm size, book value and ownership structure. MV, MR and MS are considered market-related characteristics. In addition to these characteristics, the dummy variables representing industries[9] were also tested with these characteristics with a view to identifying the industry effect. The determinants of the short-run market performance were identified with the aid of logistics, probit and multiple regression statistical models. These models were estimated using the Eviews (version 7) statistical package. The short-run market is classified as the primary, secondary, total and post-day markets based on the first-day beginning price, first-day closing price and post-listing day prices. The short-run market performance in these markets was measured using market-adjusted abnormal (excess) returns.

4.4.1 Logistic Models

The logit model is a multivariate statistical model that is used to measure the probability of underpricing occurring in the short-run market performance of IPOs. The dependent variable in this model is denoted as ‘1’ and ‘0’. Underpricing is considered 1 and overpricing 0. All determinants of the short-run market performance discussed in the methodology chapter were treated as independent or explanatory variables. In contrast to the multiple regression model, the logit model measures the probability associated with the important explanatory variables in the short-run market performance. The marginal analysis (risk analysis) in the logit model also finds the most important determinant of the short-run market performance based on the relative probability. The

[8] Ritter and Welch (2002) provided a list of theories on asymmetric and symmetric information that can be used to explain the reasons why IPOs are underpriced in the short run. The characteristics of an issue, a firm and the market indicate the information in relation to issue, firm and the market. These characteristics (information) may help to explain the short-run market behaviour of the Australian IPOs. The issue and firm characteristics were identified using IPO company prospectuses.

[9] The industry dummy variables were used in the regression models due to the variation in the mean return of industries.

estimated logit short-run market models are presented in Table 4.6. This table shows the estimated models for the PRIMs, SECONs, total MRs and post-day MRs. The only significant explanatory variables in the logit regression model are the TOTP, which indicates time to listing; the IPOP, which shows the time given to invest; the LISD); the TNPR; and the MV (MV_{t-60}). None of the dummy variables representing industries were significant in the logit models except for the post-day market model. The LR statistics of the logistics models were used to test the joint hypothesis that all slope coefficients except the constant are zero. These statistics are significant at the 1% level at any estimated logistics model in Table 4.6, but the R-squared values of these models are little low.[10] The logistic models are discussed further.

[10] There are several measures used to mimic R-squared analysis, but the interpretation of these R-squared values differs (Ainsworth n.d.). The McFadden R-squared was used to measure the strength of the association of the logit and probit models, which cannot be compared with the multiple regression R-squared because the McFadden R-squared satisfactory value is smaller than the R-squared in multiple regression. The McFadden R-squared values of 0.20 to 0.40 are considered highly satisfactory. Gujarati (2003, p. 606) also documented that R-squared is not much importance in binary regression models.

Table 4.6: Estimated Logit 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_{McF}	Prediction power
Primary market	$ln\left[\frac{P_i}{1-P_i}\right] = 8.591 - 0.034\ \mathbf{IPOP} - 0.030\ \mathbf{LISD} - 0.081\ \mathbf{TNPR}$ (0.005)*** (0.001)*** (0.028)** $+ 0.764\ \mathbf{MV_{t-60}}$ (0.100)*	254	28.60551	0.000009	8.9%	73.2%
Secondary market	$ln\left[\frac{P_i}{1-P_i}\right] = 0.334 - 0.017\ \mathbf{TOTP}$ (0.016)**	254	6.925333	0.008498	2%	60.2%
Total market	$ln\left[\frac{P_i}{1-P_i}\right] = 10.090 - 0.033\ \mathbf{IPOP} - 0.038\ \mathbf{LISD} - 0.092\ \mathbf{TNPR}$ (0.006)*** (0.000)*** (0.012)***	254	35.42371	0.000000	10.5%	70.5%
Post-day market	$ln\left[\frac{P_i}{1-P_i}\right] = 8.828 - 0.028\ \mathbf{IPOP} - 0.028\ \mathbf{LISD} - 0.105\ \mathbf{TNPR}$ (0.016)** (0.001)*** (0.005)*** $+ 2.216\ \mathbf{D_1} + 2.650\ \mathbf{D_3} + 1.858\ \mathbf{D_4} + 2.223\ \mathbf{D_5} + 2.173\ \mathbf{D_6}$ (0.013)** (0.005)*** (0.052)* (0.028)** (0.081)*	254	35.00782	0.000027	10.28%	68.9%

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. **N** = Sample size, **TOTP** = Total listing period in days, **IPOP** = IPO period in days, **LISD** = Listing delay in days, **TNPR** = Total net proceeds ratio, and $\mathbf{MV_{t-60}}$ = Market volatility of 60 days period prior to closing date of the offer, $\mathbf{D_1}$ **=** Dummy for resource 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, $\mathbf{D_6}$ **=** Dummy for utilities industry, **Prediction power** indicates overall prediction power of the model. **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. $\mathbf{R_{McF}^2}$ is the McFadden R-squared. * statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level.

4.4.1.1 Logit primary market model

The primary market logit regression model is a statistical model that is estimated using the PRIM. This regression model covers the period from the issuing date to the beginning of the listing date. The market-adjusted PRIM is considered the dependent variable, denoted as ‘1’ for underpricing and ‘0’ for overpricing. Underpricing and overpricing have been used to measure short-run market performance in the IPO literature. Table 4.6 shows that only four explanatory variables have a significant effect on the level of underpricing in the primary market. These variables are the IPOP, LISD, TNPR, and the MV (MV_{t-60}). The relationship between underpricing and these explanatory variables is discussed below.

The primary market logit regression model in Table 4.6 shows that the IPOP coefficient was negative and it is statistically significant at the level of 1%. This indicates that if the IPOP is increased, this leads to a decrease in the level of underpricing. This result confirms hypothesis 4 (H4). The finding argues that the level of underpricing can be reduced due to uninformed investors (Rock 1986). If the IPOP is increased, this may give uninformed investors the chance to invest in the offer. Therefore, future demand may decline due to a lower number of uninformed investors in the market.

The estimated primary market logit model shows that LISD was negatively and significantly associated with the level of underpricing, which is statistically significant at the 1% level. The result shows that lower LISD IPOs were more underpriced compared with higher LISD IPOs. This suggests that increasing LISD will lead to an increase in the awareness of the investors regarding the offer. This awareness may negatively affect the offer price due to the short-run behaviour of the investors. Therefore, a high level of underpricing can be expected at a low level of LISD. This finding is consistent with previous Australian studies in IPO performance. How (2000) found that LISD was an important variable of the underpricing in mining IPOs in Australia, which showed a significant negative relationship with underpricing. However, international studies found a positive relationship between underpricing and LISD. Chowdhry and Sherman (1996) found that a longer time period of listing indicated more uncertainty about the offer. Mok and Hui (1998), Su and Fleisher (1999), Tian and Megginson (2006) and Slama Zouari, Boudriga and Boulila (2011) also found a positive association between the level of underpricing and LISD. This indicates that the higher LISD IPOs were underpriced relative to the lower LISD IPOs. The result is inconsistent with hypothesis 5 (H5).

Table 4.6 shows that there was an inverse association between underpricing and the TNPR of the issuing company. This finding implies that the higher the TNPR of an IPO firm, the lower the level of underpricing based on the PRIM. 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 perceived this offer as a lower-risk investment. They cannot earn a higher return on this investment on the very first day because it is considered a low-risk investment. Therefore, lower prices can be expected due to the lower risk. As a result of the lower prices, the lower levels of underpricing can be seen in the first-day primary market. Dimovski and Brooks (2004) have also reported a negative association between retained capital and the level of underpricing. Retained capital is a similar variable to the TNPR, which shows the percentage of equity capital retained by an IPO company after paying issue costs. Therefore, our result is consistent with hypothesis 6 (H6) between underpricing and TNPR. This finding is statistically significant at the 5% level.

According to the estimated model, the MV (MV_{t-60}) appears to be positively related to underpricing, indicating that the IPO firms with higher MV tend to have a higher degree of underpricing in the primary market. In other words, the lower the MV of the firm and the lower the riskiness of the firm, the lower the level of underpricing. This finding confirms the finding of Paudyal, Saadouni and Briston (1998) and contrasts with the findings of Omran (2005) and How (2000). This relationship is also consistent with hypothesis 7 (H7), which in turn also supports the normal hypothesis of a risk-return relationship. This result is also statistically significant at the 10% level.

4.4.1.2 Logit secondary market model

The logit secondary market model was developed to analyse the MARs in the secondary market and was calculated using the first listing day beginning price and the closing price. This statistical model covers the period on the first listing day from the beginning to the end. Table 4.6 shows that only one explanatory variable is significant in the secondary market: the TOTP.

Table 4.6 shows that there is an inverse relationship between underpricing and TOTP in the secondary market model. This implies that IPOs with higher TOTP tend to have a lower level of underpricing. The finding suggests that the level of underpricing can be reduced due to a low level of informed investors' demand. The low level of informed investors' demand implies low information asymmetry. This finding confirms the finding of Bradley et al. (2009) that higher first-day SECONs exist with more information asymmetries due to price and aggregate demand uncertainty.

Rock (1986) also found that underpricing can be used to attract uninformed investors, who exist due to the winner's curse problem. This problem occurs because informed investors do not give uninformed investors a chance to invest when the offer is attractive and they withdraw from the market when the offer is unattractive. Lee, Taylor and Walter (1996) also found that quickly sold issues (longer issues) are more underpriced (less underpriced) due to the higher (lower) level of informed demand. How, Lam and Yeo (2007) and Ekkayokkaya and Pengniti (2012) found a statistically significant negative relationship between underpricing and time to listing. Therefore, this finding is consistent with hypothesis 3 (H3) and is statistically significant at the 5% level. However, the study's finding does not support the finding of Chen, Firth and Kim (2004) and Suchard and Singh (2007) that there is a highly significant positive relationship between short-run underpricing and time to listing due to the high risk of investors.

4.4.1.3 Logit total market model

The logit total market model was estimated to explain the behaviour of the total market MARs, calculated using both primary market and SECONs. The total MR covers the period from the issue date to closing of the listing date. Table 4.6 shows only the statistically significant variables in the estimated logit total market model: the IPOP, LISD and TNPR.

The IPOP indicates an inverse association with underpricing. It shows that the IPOs with higher (lower) IPOP tend to have lower (higher) underpricing. This suggests that it occurs because of the smaller number of uninformed investors in the market. If the IPOP is increased, this may give uninformed investors a chance to invest in the offer. Therefore, future demand may decline due to the smaller number of uninformed investors in the market. The declining demand may negatively affect the first-day returns. This relationship is statistically significant at the 1% level. The finding is consistent with hypothesis 4 (H4).

LISD was negatively related to the level of underpricing and is statistically significant at the 1% level. This suggests that the IPOs with lower LISD were underpriced at a higher level relative to the higher LISD IPOs. This suggests that increasing LISD will lead to increasing the awareness of the investors regarding the offer. This awareness may negatively affect the offer price due to the short-run behaviour of investors. Therefore, a low level of underpricing can be expected at a high level of LISD. This finding is consistent with previous Australian studies in IPO performance. How (2000) found that LISD was an important variable of the underpricing in mining IPOs in Australia, which showed a significant negative relationship with underpricing. However, international studies found a positive relationship between underpricing and LISD. Chowdhry and Sherman (1996) found that the longer time period of listing indicates more uncertainty about the offer. Mok and Hui (1998), Su and Fleisher (1999), Tian and Megginson (2006) and Slama Zouari, Boudriga and Boulila (2011) also found a positive association between the level of underpricing and LISD. This indicates that the higher LISD IPOs were underpriced relative to the lower LISD IPOs. The result does not confirm hypothesis 5 (H5).

The estimated logit total market model shows that there was a negative relationship between underpricing and the TNPR of the issuing company. This finding indicates that higher the TNPR of an IPO firm, the lower the level of underpricing based on total MR. It could be argued that there was a lower risk for the IPOs with greater TNPR, which resulted in lower underpricing. If TNPR increases, future investors perceive this offer as a lower-risk investment for them. They cannot earn a higher return on this investment on the very first day because it is considered a low-risk investment. Therefore, lower prices can be expected due to the lower degree of risk. As a result of the lower prices, the lower levels of underpricing can be seen in the first-day primary market. Dimovski and Brooks (2004) also found a negative relationship between retained initial equity capital (after reducing issue cost) and the degree of underpricing. Our result is consistent with hypothesis 6 (H6) and this finding is statistically significant at the 1% level.

4.4.1.4 Logit post-day market model

The logit post-day market was estimated using the CARs on the tenth post-listing day, which is the boundary period between short run and long run. This return also differs from the return of the short-run market models discussed above because it indicates compound returns from the first listing date to the tenth post-listing date. Table 4.6 shows only three explanatory variables and five industry dummies have a significant effect on the level of underpricing. The significant explanatory variables are the IPOP, LISD and net proceeds ratio (TNPR). All industry dummy variables are significant except the dummies for chemicals and materials and telecommunication industries.

The IPOP appeared to be negatively related to underpricing, which shows that IPOs with higher IPOP tend to have lower underpricing. This relationship is consistent with hypothesis 4 (H4) and the results are statistically significant at the 5% level.

LISD was negatively and significantly associated with the level of underpricing, which is statistically significant at the 1% level. This means that lower LISD IPOs are more underpriced than higher LISD IPOs. It can be argued that even if LISD had a positive relationship with underpricing on the very first day, it is difficult to see this relationship in the post-listing days. This finding is consistent with previous Australian studies on IPO performance. How (2000) found that LISD was an important variable of the underpricing in mining IPOs in Australia, which showed a significant negative relationship with underpricing. However, international studies have found a positive relationship between underpricing and LISD. Nevertheless, prior studies (Chowdhry & Sherman 1996) found that a longer period of listing indicates more uncertainty about the offer. Mok and Hui (1998), Su and Fleisher (1999), Tian and Megginson (2006) and Slama Zouari, Boudriga and Boulila (2011) also found a positive association between the level of underpricing and LISD. This indicates that the higher LISD IPOs were underpriced relative to the lower LISD IPOs. However, the result is inconsistent with hypothesis 5 (H5).

Table 4.6 implies that there was an inverse relationship between underpricing and TNPR of the issuing company. This is statistically significant at the 1% level. This result confirms hypothesis 6 (H6), which indicated a negative relationship between these variables. The results shows that when TNPR increases, future investors perceive this offer as a lower-risk investment. Therefore, they cannot expect higher returns on this offer because it is considered a low-risk investment. As a result of the lower price, the lower level of underpricing can be expected in the first-day primary market. Therefore, the higher TNPR results in lower underpricing. A similar relation was found by Dimovski and Brooks (2004) between retained equity capital and the level of underpricing.

Statistically significant industry dummy variables for the resource sector, industrial sector, consumer discretionary/staples industry, information technology industry and utilities industry showed a positive effect on the level of underpricing.

4.4.2 Marginal Analysis (Risk Analysis)

Marginal analysis was used to identify the most important explanatory variables that contributed to the change in the short-run market performance of the Australian IPOs. Marginal analysis measures the likelihood of change in probability (Δp) associated with short-run market performance due to a change in the explanatory variables. The analysis was conducted for different markets: the primary market, the secondary market, the total market and the post-day market. Table 4.7 shows the calculated changes in probability associated with the short-run market performance in the primary, secondary and total markets.

Table 4.7: 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	$\Delta p = -0.017 \times 10^{-2}$		$\Delta p = -0.021 \times 10^{-2}$
MV_{t-60}	$\Delta p = 0.016 \times 10^{-1}$		

Note: Negative sign indicates an inverse relationship between explanatory variables and underpricing whereas positive sign shows direct relationship between these. **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 $\mathbf{MV_{t-60}}$ = Market volatility of 60 days period prior to closing date of the offer.

Table 4.7shows the TOTP, IPOP, LISD, TNPR and MV_{t-60} with the short-run market performance in the primary, secondary, total and post-day markets.

4.4.2.1 Primary market

The significant primary market explanatory variables are IPOP, LISD, TNPR and MV. Except for MV, all the explanatory variables in the primary market model have a negative sign, which indicates an inverse relationship between the short-run market performance and explanatory variables. This relationship can be explained as follows:

1. The negative sign for IPOP shows that, if IPOP is increased by one day, the probability of change to overprice or decrease in the level of underpricing is 0.000071.
2. The negative sign for LISD indicates that, if listing is delayed by one day, the probability of change to overprice or decrease in the level of underpricing is 0.000063.
3. The negative sign for TNPR implies that, if TNPR is increased by 1%, the probability of change to overprice or decrease in the level of underpricing is 0.00017.
4. The positive sign for MVt-60 indicates that, if the MV increases by %, the probability of change to underprice or decrease in the level of overpricing is 0.0016.

According to the primary market model, the above marginal analysis indicates that MV (MV_{t-60}) is the most important explanatory variable in the Australian IPO primary market compared with the others due to the highest probability associated with underpricing used to measure the short-run market performance. An increase (decrease) of this explanatory variable supports underpricing (overpricing) and an increase (decrease) of the other explanatory variables supports overpricing (underpricing). In the Australian IPO primary market, the marginal effect on probability of other variables is very low compared with MV.

4.4.2.2 Secondary market

Table 4.7 shows that only one explanatory variable is significant under the secondary market model, which is the TOTP. The negative sign for TOTP indicates that a day increase in the TOTP will result in a decrease in the probability of the level of underpricing or an increase in the probability of overpricing by 0.000041.

4.4.2.3 Total market

The change in probability associated with the total MR is given in Table 4.7, which shows that IPOP, LISD and TNPR are the main significant explanatory variables in the total market model. It is interesting to observe that all explanatory variables show an inverse sign, which also indicates an inverse relationship between the dependent variable and the explanatory variables. The explanation of these relationships is given below:

1. The negative sign for IPOP indicates that, if IPOP is increased by one day, the probability of change to overprice or decrease in the level of underpricing is 0.000076.
2. The negative sign for LISD indicates that, if the listing is delayed by one day, the probability of change to overprice or decrease in the level of underpricing is 0.000080.
3. The negative sign for TNPR indicates that a 1% increase in the TNPR will result in a decrease in the probability of the level of underpricing or increase in the probability of overpricing by 0.00021.

In the total market model, an increase (decrease) of all variables supports overpricing (underpricing). The most important determinant of the total market model is TNPR, which gives the highest marginal probability associated with the short-run market performance.

4.4.2.4 Post-day market

Table 4.8 shows the calculated marginal probabilities associated with the short-run market performance in the post-day market based on the industry dummies that are statistically significant in the model. The significant explanatory variables in the post-day market are IPOP, LISD and TNPR.

Table 4.8: The Change in Probability (Δp) Due to a Change in Explanatory Variables

Industry dummy	**IPOP**	**LISD**	**TNPR**
D_1	$\Delta p = -0.065 \text{ x}10^{-3}$	$\Delta p = -0.065 \text{ x}10^{-3}$	$\Delta p = -0.024 \text{ x}10^{-2}$
D_3	$\Delta p = -0.055 \text{ x}10^{-3}$	$\Delta p = -0.055 \text{ x}10^{-3}$	$\Delta p = -0.021 \text{ x}10^{-2}$
D_4	$\Delta p = -0.069 \text{ x}10^{-3}$	$\Delta p = -0.069 \text{ x}10^{-3}$	$\Delta p = -0.026 \text{ x}10^{-2}$
D_5	$\Delta p = -0.065 \text{ x}10^{-3}$	$\Delta p = -0.065 \text{ x}10^{-3}$	$\Delta p = -0.024 \text{ x}10^{-2}$
D_6	$\Delta p = -0.065 \text{ x}10^{-3}$	$\Delta p = -0.065 \text{ x}10^{-3}$	$\Delta p = -0.024 \text{ x}10^{-2}$
Average Marginal Prob.	$\Delta p = -0.064 \text{ x}10^{-3}$	$\Delta p = -0.064 \text{ x}10^{-3}$	$\Delta p = -0.024 \text{ x}10^{-2}$

Note: Negative sign indicates an inverse relationship between explanatory variables and underpricing whereas positive sign shows direct relationship between these. **Δp** = Marginal probability, **IPOP** = IPO period in days, **LISD** = Listing delay in days, **TNPR** = Total net proceeds ratio, $\mathbf{D_1}$ **=** Dummy for resource 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 post-day market model also shows 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 all the explanatory variables is in the consumer discretionary industry, whereas the lowest probabilities are 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 was also estimated for each of the explanatory variables. A brief explanation of the average marginal probabilities on these variables is given below:

1. The negative sign for IPOP indicates that, if IPOP is increased by one day, the probability of change to overpricing or decrease in the level of underpricing is 0.000064.
2. The negative sign for LISD indicates that, if listing is delayed by one day, the probability of change to overpricing or decrease in the level of underpricing is 0.000064.
3. The negative sign for TNPR indicates that, if TNPR is increased by 1%, the probability of change to overpricing or decrease in the level of underpricing is 0.00024.

According to the average marginal probability of the model, TNPR is the most important variable of the post-day market due to the highest marginal probability compared with others and an increase (decrease) of this variable supports a decrease (increase) in the level of underpricing.

As far as the all models are concerned, TNPR and MV_{t-60} are the most important explanatory variables (determinants) of the short-run market performance based on the marginal analysis. However, the effect of these variables on the level of underpricing differs.

4.4.3 Probit Models

A probit model, also called a probit regression model, is a statistical technique that is used when the dependent variable is dichotomous or binary (1 or 0). In this model, underpricing was denoted as ‘1’ and overpricing is denoted as ‘0’. In contrast to the multiple regression model, this model was used to estimate the determinants using a nonlinear approach such as maximum likelihood. Like the logistic regression model, the probit model predicts the probability of the underpricing occurring, which falls between 0 and 1. In particular, this statistical model is designed around individual cross-sectional data rather than time-series data. Table 4.9 shows the estimated probit short-run market models for the PRIMs, SECONs, total MRs and post-day MRs. The significant explanatory variables in the probit model are similar to the logit model, but the constant values of the models and coefficients of each explanatory variable differ. In the post-day market, all other dummy variables representing industries are significant except for the dummies for the materials and chemicals and telecommunication industries. The estimated probit market models are discussed further.

Table 4.9: Estimated Probit Regression Models for the Short-Run Performance

Short-run market performance	**Estimated probit model from January 2006 to January 2011**	**N**	**LR statistics**	**Probability (LR stat.)**	R^2_{McF}
Primary market	P_i = 5.020 – 0.021 **IPOP**– 0.018 **LISD** – 0.047 **TNPR** + 0.443 $\mathbf{MV_{t\text{-}60}}$ (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** – 0.053 **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 –** 0.063**TNPR** + 1.359 $\mathbf{D_1}$ + 1.619 $\mathbf{D_3}$ (0.014)*** (0.001)*** (0.012)*** (0.009)*** (0.003)*** + 1.133 $\mathbf{D_4}$ + 1.341 $\mathbf{D_5}$ + 1.319 $\mathbf{D_6}$ (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. **N** = Sample size, **TOTP** = Total listing period in days, **IPOP** = IPO period in days, **LISD** = Listing delay in days, **TNPR** = Total net proceeds ratio, and $\mathbf{MV_{t\text{-}60}}$ = Market volatility of 60 days period prior to closing date of the offer, $\mathbf{D_1}$ **=** Dummy for resource 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, $\mathbf{D_6}$ **=** 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, $\mathbf{R_{McF}}^2$ is the McFadden R-squared. * statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level.

4.4.3.1 Probit primary market model

In the probit primary market model, the dependent variable was denoted as '1' and '0'. This dependent variable was identified using the primary market MARs, which was calculated for the period from the issuing date to the beginning of the listing date after considering the first-day beginning price and the offer price. The significant explanatory variables of this model are the IPOP, LISD, TNPR and MV (MV_{t-60}), which is shown in Table 4.9. The relationship between underpricing and the explanatory variables is discussed below.

The probit primary market model in Table 4.9 indicates that the IPOP coefficient is negative and it is statistically significant at the level of 1%. This negative coefficient shows that there is an inverse relationship between underpricing and IPOP. The findings argue that, if the IPOP is increased, it may give uninformed investors, who suffer from the informational disadvantage, a chance to invest. According to the winner's curse hypothesis (Rock 1986), the level of underpricing can be reduced due to the uninformed investors who already know about the market. If the IPOP is increased by a day, this leads to an increase in the awareness of uninformed investors. Therefore, it is difficult to attract uninformed investors using the first-day underpricing. The result confirms hypothesis 4 (H4).

The result shows that LISD is negatively associated with the level of underpricing. This means that lower LISD IPOs were overpriced compared with the higher LISD IPOs. How (2000) found a significant negative relationship between underpricing and LISD in relation to mining IPOs in Australia. However, prior international studies (Chowdhry & Sherman 1996) found that a longer period of listing indicated more uncertainty about the offer. Mok and Hui (1998), Su and Fleisher (1999), Tian and Megginson (2006) and Slama Zouari, Boudriga and Boulila (2011) also found a positive association between the level of underpricing and LISD. This indicates that the higher LISD IPOs were underpriced relative to the lower LISD IPOs. Therefore, the result does not confirm hypothesis 5 (H5). However, the result is significant at the 1% level.

There is an inverse relationship between underpricing and TNPR. This relationship implies that IPOs with higher TNPR have a lower level of underpricing or they change towards overpricing. Theoretically, this can occur because IPOs with higher TNPR are considered lower-risk IPO firms. The lower-risk IPOs always expect a low return. Therefore, a lower level of underpricing can be expected due to the higher TNPR. Dimovski and Brooks (2004) found a similar association between retained capital and the level of underpricing. The result is consistent with hypothesis 6 (H6) and it is statistically significant at 5% level.

MV (MV_{t-60}) appears to be positively related to underpricing, suggesting that IPO firms with higher MV tend to have higher underpricing in the primary market. In other words, the lower the MV of the firm, the lower the level of underpricing will be. This relationship confirms hypothesis 7 (H7) and it is statistically significant at the 10% level.

4.4.3.2 Probit secondary market

The probit secondary market model was estimated using the secondary market MARs, which cover the period on the first day from the beginning to the end. The abnormal returns in the secondary market were calculated using the first-day beginning price and the closing price. Table 4.9 shows that only one explanatory variable is significant in the secondary market: the TOTP.

The TOTP appears to be negatively related to underpricing. This shows that IPOs with higher (lower) TOTP tend to have a lower (higher) level of underpricing. Lee, Taylor and Walter (1996) confirmed this relationship: they found that quickly sold issues (longer issues) are more underpriced (less underpriced) due to the higher (lower) level of informed demand. How, Lam and Yeo (2007) also found a statistically significant negative relationship between underpricing and time to listing. Therefore, this finding is consistent with hypothesis 3 (H3) and it is statistically significant at the 1% level. However, Chen, Firth and Kim (2004) found a highly significant positive relationship between short-run underpricing and time to listing due to the high risk of investors.

4.4.3.3 Probit total market

The probit total market model was estimated using the total market MARs, which was calculated using primary market and SECONs. The total MR covers the period from the issuing date to the listing date. Table 4.9 indicates that the statistically significant variables of the probit total market model are the IPOP, the LISD and the TNPR.

The IPOP indicates an inverse association with underpricing. It shows that IPOs with higher (lower) IPOP tend to have lower (higher) underpricing. This relationship is statistically significant at the 1% level and the finding confirms the testable hypothesis 4 (H4).

LISD was negatively related to the level of underpricing. This suggests that the IPOs with lower LISD were overpriced relative to the higher LISD IPOs. This finding is consistent with previous Australian studies in IPO performance. How (2000) found that LISD was an important variable of the underpricing in mining IPOs in Australia, which showed a significant negative relationship with underpricing. However, other previous studies (Mok & Hui 1998; Su & Fleisher 1999; Tian & Megginson 2006; Slama Zouari, Boudriga & Boulila 2011) found a positive association between the level of underpricing and LISD. This suggests that the higher LISD IPOs were underpriced relative to the lower LISD IPOs due to the uncertainty. The result is not consistent with hypothesis 5 (H5). However, the result is significant at the 1% level.

The finding shows that there was an inverse association between underpricing and TNPR of the issuing company. This finding implies that the higher the TNPR of an IPO firm, the lower the level of underpricing based on total MR. It could be argued that there is a lower risk for IPOs with greater TNPR, which results in lower underpricing. Dimovski and Brooks (2004) also found a negative association between retained equity capital after deducting issue cost and the level of underpricing. This finding confirms hypothesis 6 (H6) between underpricing and TNPR, and it is statistically significant at the 1% level.

4.4.3.4 Probit post-day market

The probit post-day market model was estimated using the CARs on the tenth post-listing day, which is the boundary period between short run and long run. This return differs from the returns of the other market models discussed above because it indicates compound returns from the first listing date to the tenth post-listing date. Table 4.9 shows that three explanatory variables had a significant effect on the level of underpricing: the IPOP, the LISD and the TNPR.

The IPOP appears to be negatively related to underpricing, which shows that IPOs with higher IPOP tend to have lower underpricing. This relationship is consistent with hypothesis 4 (H4) and the results are statistically significant at the 1% level.

The result shows that LISD is negatively and significantly associated with the level of underpricing, which is significant at 1% level. This means that the lower LISD IPOs were overpriced compared with the higher LISD IPOs. Prior studies (Chowdhry & Sherman 1996) found that the longer time period of listing indicated more uncertainty about the offer. Mok and Hui (1998), Su and Fleisher (1999), Tian and Megginson (2006) and Slama Zouari, Boudriga and Boulila (2011) also found a positive association between the level of underpricing and LISD. This indicates that the higher LISD IPOs were underpriced relative to the lower LISD IPOs. The result does not confirm hypothesis 5 (H5). However, How (2000) found a significant negative relationship between underpricing and LISD in relation to mining IPOs in Australia.

The result implies that there is an inverse relationship between underpricing and the TNPR of the issuing company. This is statistically significant at the 1% level. This result confirms hypothesis 6 (H6), which indicates a negative relationship between these variables. This relationship is confirmed by the finding of Dimovski and Brooks (2004) using retained equity capital and first-day return. It can be argued that there is a lower risk for IPOs with greater TNPR, which results in lower underpricing.

Statistically significant industry dummy variables for resource, industrial, consumer discretionary/staples, information technology and utilities show a positive effect on the level of underpricing measured by CARs.

4.4.4 Multiple Regression Models

The multiple regression model is a statistical model that can be used to estimate the relationship between short-run market performance and its determinants. This model explains the changes in a dependent variable, such as market-adjusted abnormal returns in different markets, associated with changes in one or more independent variables, such as LISD, TOTP, PRICE RETU, ATOA and MV. In this model, the dependent variable was denoted as the natural log value of MARs in the short-run market. The independent variables (explanatory variables) were denoted as natural log values, days, ratios, square and square roots of the offer, firm and market characteristics. In contrast to the logit and probit binary models, the multiple regression models measured the numbers or absolute values associated with the important explanatory variables in the short-run market performance. Therefore, these numbers or values may deviate from the expectation. The estimated multiple regression models for the short-run market are given in Table 4.10. The table shows the estimated models for the primary market, secondary market, total market and post-day market. The only significant variables are presented in this table. The significant explanatory variables in the multiple regression market models are the LISD, PRICE, TOTP, RETU ($RETU_{t-1}$ and $RETU_{t-3}$), MV (MV_{t-10}), and ATOA. The chemicals and materials industry (D_2) and industrial sector (D_3) dummies are the only statistically significant industry dummies in the multiple regression model. Further, the estimated multiple regression models are explained based on the different markets: primary market, secondary market, total market and post-day market.

Table 4.10: 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	$ln[MAR] = 0.109 - 0.002\ [\mathbf{LISD}] + 0.111[\mathbf{D_3}]$ (0.053)* (0.076)* N = 254 F = 3.574 Prob.(F) = 0.029 $AdjR^2$ = 2% DW = 2.046 LM = 0.831 WH = 0.773
Secondary market	$ln[MAR] = 0.139 - 0.027\ ln[\mathbf{PRICE}] - 0.001\ [\mathbf{TOTP}] - 0.000283\ [\mathbf{RETU_{t-3}}] - 0.030\ [\mathbf{D_2}] + 0.022\ [\mathbf{D_3}] + 0.014\ [\mathbf{D_4}] - 0.002\ [\mathbf{D_5}] - 0.048[\mathbf{D_6}]$ (0.026)** (0.000)*** (0.045)** (0.576) (0.286) (0.519) (0.919) (0.273) N = 254 F = 4.674 Prob.(F) = 0.000 $AdjR^2$ = 10% DW = 2.094 LM = 0.292 WH = 0.091
Total market	$ln[MAR] = 0.189 - 0.185\ [\mathbf{ATOA}] - 0.151\ [\mathbf{MV_{t-10}}] + 0.000330\ [\mathbf{RETU_{t-1}}] + 0.108\ [\mathbf{D3}]$ (0.059)* (0.015)** (0.0316)** (0.094)* N = 254 F = 3.319 Prob.(F) = 0.011 $AdjR^2$ = 4% DW = 1.99 LM = 0.996 WH = 0.966
Post-day market	$ln[CAR_{10}] = 0.206 - 0.166\ [\mathbf{MV_{t-10}}] + 0.000282\ [\mathbf{RETU_{t-1}}] - 0.416[\mathbf{D_2}]$ (0.017)** (0.10)* (0.064)* N = 254 F = 3.176 Prob.(F) = 0.025 $AdjR^2$ = 3% DW = 1.96 LM = 0.987 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. **MAR** = Market-adjusted abnormal (excess) return, $\mathbf{CAR_{10}}$ = 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, $\mathbf{RETU_{t-1}}$ = Square value of average market return before one day of the closing date of the offer, $\mathbf{RETU_{t-3}}$ = square value of average market return before three days of the closing date of the offer, **ATOA** = Attached share option availability and $\mathbf{MV_{t-10}}$ = Market volatility of 10 days period prior to closing date of the offer, $\mathbf{D_1}$ **=** Dummy for resource industry, $\mathbf{D_2}$ = Dummy for chemicals/materials 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, $\mathbf{D_6}$ **=** Dummy for utilities industry, **Prob.(F)** = Significance level of the F-statistic, $\mathbf{AdjR^2}$ 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.

4.4.4.1 Multiple regression primary market model

In the multiple regression primary market model, the dependent variable was denoted as the natural log value of MARs of the primary market. This primary market abnormal return was calculated for the period from the issuing date to the beginning of the listing date after considering the first-day beginning price and the offer price. Table 4.10 shows that only one explanatory variable is significant in the primary market: the LISD. In addition, the industrial sector (D_3) dummy is also statistically significant. The primary model is statistically significant at the 5% level, which indicates that there is a significant linear relationship between the PRIMs (response variable) and the explanatory variables (predictor variables), but it shows a relatively low adjusted R-squared value.[11] However, the diagnostics tests for error terms indicate that this model is generally satisfactory at 5%. The DW statistics and LM chi-statistics show that there is no serial correlation in this model. The White heteroscedasticity (WH) test statistics also show that there is no constant error variance in this model. The relationship between the dependent variable and explanatory variables of this model is discussed further.

The estimated primary market multiple regression model in Table 4.10 shows that LISD is negatively and significantly associated with the primary market excess returns, which is statistically significant at the 10% level. The result shows that lower LISD IPOs were underpriced (higher primary market excess returns) compared with the higher LISD IPOs. This suggests that increasing LISD will lead to an increase in the awareness of the investors regarding the offer. Investors are then more informed about the offer. This may negatively affect the offer price due to the short-run behaviour of the investors. Therefore, it suggests that lower LISD IPOs can be underpriced compared with the higher LISD IPOs. However, previous studies (Chowdhry & Sherman 1996) found that

[11] That the R-squared from a regression of squared returns on the forecasts of the variance is low does not mean that the model is misspecified (Alexander 2001, p. 124). The relatively high R-squared value can be found in studies that used economic time-series data, but the fairly low R-squared values have been reported in company-level cross-sectional time series (panel data) financial data. This study is also based on company-level cross-sectional time series data. Previous Australian studies on IPOs (Dimovski & Brooks 2004; Dimovski, Philavanh & Brooks 2011; How 2000; Lee, Taylor & Walter 1996) have indicated relatively low R-squared values for their estimated models based on multiple regressions. If these models are only used to test a theory or estimate a causal relationship, rather than forecasting, the low R-square is not a constraint. However, the low R-square values are associated with low economic significance.

a longer period of listing indicates more uncertainty about an offer. Mok and Hui (1998), Su and Fleisher (1999), Tian and Megginson (2006) and Slama Zouari, Boudriga and Boulila (2011) also found a positive association between the level of underpricing and LISD due to this uncertainty. The uncertainty hypothesis indicates that the higher LISD IPOs were underpriced relative to the lower LISD IPOs. If the LISD is used as a proxy to measure Rock's hypothesis, it can be viewed as a negative relationship between underpricing and LISD. The Australian literature (How 2000) shows that there is a negative significant relationship between underpricing and LISD. However, the result is inconsistent with hypothesis 5 (H5).

The industrial sector dummy is also significant at the 10% level, showing a positive relationship with the primary market abnormal returns. According to the PRIM analysis, the industrial sector IPOs gave the highest return (67.01% on RRs and 68.03% on abnormal returns) for their initial investors compared with the other sectors.

4.4.4.2 Multiple regression secondary market model

The multiple regression secondary market model was estimated using the secondary market MARs, which covered the period on the first day from the beginning to the end. The abnormal returns in the secondary market were calculated using the first-day beginning and the closing prices. Table 4.9 shows that only three explanatory variables are significant in the secondary market: the PRICE, TOTP and average MR ($RETU_{t-3}$). The industry dummies are not statistically significant at any level in this model. However, industry dummies are used to get fairer statistics for the WH test, which was used to test the constant error variance of the model. This model is also significant at the 1% level, showing a significant linear relationship between the PRIMs and the explanatory variables. The secondary market model indicates a good adjusted R-squared value relative to the primary market model. However, the model's R-squared is a little low. The diagnostics test statistics on DW and LM indicate that this model does not suffer from serial correlation issues. The WH value is also statistically insignificant at the 5% probability level, which shows that the model does not suffer from constant error variance. The association between the dependent variable and statistically significant explanatory variables of this model are discussed further.

The secondary market model in Table 4.10 shows that there is an inverse relation between underpricing (the secondary market abnormal return) and the PRICE. The empirical evidence also shows an inverse relationship between the offer price and the level of underpricing. Ibbotson et al. (1988) found that firms that offer with very low prices usually record a high level of underpricing. Fernando et al. (1999) found a U-shaped association between these two variables, and they pointed out that the offer price may also indicate the extent of underpricing, but its level seems to have little economic significance. Certo et al. (2003) suggested that higher offer prices indicate lower uncertainty regarding the future performance of the firm. Further, Jain and Kini (1999b) found that a low offer price is associated with lower short-term performance. Dimovski and Brooks (2004) also found an indirect relationship between underpricing and PRICE. Previous researchers have argued that lower-priced offers are underpriced relative to higher-priced offers due to the high risk and speculative trading. Therefore, the result is consistent with hypothesis 8 (H8), and it is statistically significant at the 5% level.

The estimated secondary market model shows that there is an inverse relationship between underpricing and TOTP in the secondary market model. This implies that IPOs with higher TOTP tend to have a 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. In this problem, informed investors do not give uninformed investors a chance to invest when the offer is attractive and they withdraw from the market when the offer is unattractive. Lee, Taylor and Walter (1996) also found that quickly sold issues (longer issues) are more underpriced (less underpriced) due to the higher (lower) level of informed demand. How, Lam and Yeo (2007) found a statistically significant negative relationship between underpricing and time to listing. The finding is statistically significant at the 1% level and consistent with hypothesis 3 (H3). However, the study finding does not confirm the finding of Chen, Firth and Kim (2004) that a highly significant positive relationship exists between short-run underpricing and time to listing due to the high risk for investors.

The final significant variable under the secondary market model is the average MR ($RETU_{t-3}$). The result indicates an inverse relationship between underpricing and RETU, which shows that a higher (lower) RETU tends to have lower (higher) underpricing. This relationship is statistically significant at 5%. The MR is a major component of a firm's return and it can be used to estimate the reward for the market risk (risk premium). In other words, the first-day total return of a firm varies according to the MR. The study expected a direct relationship between these two variables. However, the finding does not confirm hypothesis 9 (H9).

4.4.4.3 Multiple regression total market model

The multiple regression total market model was estimated using the total market MARs, which was calculated using both primary market and SECONs. The total MR covers the period from the issuing date to the listing date. Table 4.10 indicates that the statistically significant variables of the multiple regression total market model are ATOA, MV (MV_{t-10}), and the average MR ($RETU_{t-1}$). The dummy variable for the industrial sector (D_3) is also statistically significant in this model. The linear relationship between the PRIMs and the explanatory variables of this model is statistically significant at the 1% level, but it indicates a low adjusted R-squared value. However, the diagnostics tests for the serial correlation (DW and LM) and the constant error variance (WH) show that this model is generally satisfactory at the 5% level. The statistically significant explanatory variables of the model are discussed further.

The multiple regression total market model indicates that there is an inverse relationship between underpricing and ATOA. The result indicates that the attached free share option (sequential financing) for subscribers reduces agency cost and hence reduces the level of underpricing. This finding is supported by Dimovski and Brooks (2004), How, Lam and Yeo (2007), How (2000), Jain (1994) and Shultz (1993). This result is consistent with hypothesis 10 (H10) and is statistically significant at 5%. However, How and Howe (2001) found a direct relationship between these two variables due to the risk of the issuing company, but this relationship is not statistically significant.

According to the estimated total market model, MV (MV_{t-10}) appears to be negatively related to underpricing, indicating that IPO firms with lower MV tend to have higher underpricing in the total market. In other words, the lower the MV of the firm, the higher the level of underpricing. This result is statistically significant at the 1% level. Previous researchers (How, Izan & Monroe 1995; Omran 2005) found a similar relationship between these two variables under the multiple regression model. However, these researchers evaluated the expected sign of the relationship of these two variables as positive. The current study argues that the positive sign of this relationship can be found when an analysis uses a binary regression model because this type of model indicates the likelihood of occurrence. When an analysis uses a multiple regression model, it may give a negative relationship between these two because it indicates values of occurrence under real market behaviour. However, the result is not consistent with hypothesis 7 (H7).

The estimated total market model indicates a direct relationship between underpricing and $RETU_{t-1}$, which shows that higher (lower) RETUs tend to have higher (lower) underpricing. The MR is a major component of a firm's return and 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 MR. This result is consistent with hypothesis 9 (H9) and is statistically significant at 5%.

The industrial sector dummy shows a positive relationship with the primary market excess returns, and this relationship is statistically significant at 10% level. The PRIM analysis indicates that industrial sector IPOs earned the highest return compared with the other sectors.

4.4.4.4 Multiple regression post-day market model

The multiple regression post-day market model was developed using the CARs on the tenth post-listing day, which is the boundary period between short run and long run. This return differs from the returns of the other market models discussed above because it indicates compound returns from the first listing date to the tenth post-listing date. Table 4.10 shows that only two explanatory variables have a significant effect on the level of underpricing: MV (MV_{t-10}) and the average MR ($RETU_{t-1}$). According to the table, the MV shows a negative effect and the RETU shows a positive effect on underpricing. The dummy variable for the chemicals and materials industry is also significant in this model, showing a negative effect on the level of underpricing. The linear relationship between the post-day MRs and the explanatory variables has statistical significance at the 5% level of probability and the model produces a relatively low adjusted R-squared value. The diagnostics tests for the error terms are normally satisfactory at the 5% probability level.

The MV (MV_{t-10}) appears to be negatively related to underpricing, suggesting that IPO firms with higher MV tend to have lower underpricing in the post-day market. In other words, the lower the MV of a firm, the higher the level of underpricing. This result is statistically significant at the 5% level. The relationship is confirmed by previous studies (How, Izan & Monroe 1995; Omran 2005). Although the previous studies found a negative relationship between underpricing and MV, their developed hypotheses indicated a positive sign between these variables. Therefore, the hypothesis shows that the higher (the lower) the MV, the higher (the lower) the listing-day price and hence the higher (the lower) the level of underpricing in the post-day market. The result is inconsistent with hypothesis 7 (H7).

The next significant variable under this model is the average MR ($RETU_{t-1}$). The result indicates a direct relationship between underpricing and RETU, which shows that the higher (lower) RETUs tend to have higher (lower) underpricing. The hypothesis of the average MR variable shows that the higher (the lower) the RETU, the higher (the lower) the level of underpricing in the post-day market due to the higher (the lower) price at the listing date. The MR is a major component of a firm's return and it can be used to estimate the reward for the market risk (risk premium). This result is consistent with hypothesis 9 (H9) and it is statistically significant at 10%.

The dummy variable for the chemicals and materials industry shows a negative coefficient, which indicates that there is a negative association between underpricing and the chemicals and materials industry. This relationship is statistically significant at the 10% level. The chemicals and materials industry IPOs gave the lowest return (negative return) compared with the other sectors for their investors in the post-day market.

The multicollinearity issue can occur when two or more explanatory variables in the model are related. The binary and multiple regression models discussed above do not suffer from the multicollinearity problem because all the models are estimated after eliminating highly correlated explanatory variables. The correlation matrix for the significant explanatory variables is given in Table 4.11.

Table 4.11: Correlation Matrix

	IPOP	**TOTP**	**LISD**	**TNPR**	**MV_{t-10}**	**MV_{t-60}**	**PRICE**	**$RETU_{t-1}$**	**$RETU_{t-3}$**	**ATOA**
IPOP	1.000	0.445	0.111	0.033	0.026	0.049	–0.238	0.068	0.097	0.004
TOTP	0.445	1.000	0.903	–0.132	0.187	0.217	–0.276	0.037	0.252	0.104
LISD	0.111	0.903	1.000	–0.172	0.218	0.228	–0.189	0.011	0.230	0.058
TNPR	0.033	–0.132	–0.172	1.000	–0.026	–0.015	0.168	0.056	–0.049	–0.006
MV_{t-10}	0.026	0.187	0.218	–0.026	1.000	0.656	0.064	0.399	0.567	–0.165
MV_{t-60}	0.049	0.217	0.228	–0.015	0.656	1.000	0.030	0.224	0.468	–0.085
PRICE	–0.238	–0.276	–0.189	0.168	0.064	0.030	1.000	0.070	0.062	–0.156
$RETU_{t-1}$	0.068	0.037	0.011	0.056	0.399	0.224	0.070	1.000	0.345	–0.062
$RETU_{t-3}$	0.097	0.252	0.230	–0.049	0.567	0.468	0.062	0.345	1.000	–0.104
ATOA	0.004	0.104	0.058	–0.006	–0.165	–0.085	–0.156	–0.062	–0.104	1.000

Note: IPOP = IPO period in days, **TOTP** = Total listing period in days, **LISD** = Listing delay in days, **TNPR** = Total net proceeds ratio, **MV_{t-10}** = Market volatility of 10-day period prior to closing date of the offer, **MV_{t-60}** = Market volatility of 60-day period prior to closing date of the offer, **PRICE**= Issue price, **$RETU_{t-1}$** = Square value of average market return one day before the closing date of the offer, **$RETU_{t-3}$** = Square value of average market return three days before the closing date of the offer, **ATOA** = Attached share option availability.

Table 4.10 shows the correlation coefficients of all statistically significant explanatory variables that were included and discussed under the each regression model.

4.5 Summary

This chapter has presented the analysis of the short-run market performance and identified its significant determinants based on the offer, firm and market characteristics of Australian IPOs listed from 2006 January to 2011 January. The short-run market performance was analysed using the first listing day PRIMs, SECONs, total MRs and post-day MRs. The determinants of the short-run market performance were identified using logistics, probit and multiple regression models with a marginal probability analysis.

The short-run performance analysis based on the first listing day PRIMs, total MRs and post-day MRs shows that the Australian IPOs were underpriced in the short run. This finding is aligned with the underpricing phenomenon of IPOs, which is widely accepted as a universal phenomenon. Although the Australian IPOs were underpriced, the post-day MR indicates that the level of underpricing slowly decreased after the listing. The decreasing trend of post-listing returns is in line with the findings of Kazantzis and Thomas (1996), Aktas, Karan and Aydogan (2003), Chi and Padgett (2005), and

Kenourgios, Papathanasiou and Melas (2007). However, Sohail, Raheman and Durrani (2010) have argued that this trend can be expected only up to the tenth day under normal economic conditions. The decreased in post-listing returns indicates that IPOs may underperform (overprice) in the long run. However, this finding is in contrast with the finding of Finn and Higham (1988) that the level of underpricing is steady after day 6. In comparison with this finding, the current study found a sharp decrease in the level of underpricing after day 7 due to the decrease in post-listing prices.

The SECON analysis indicated that the Australian IPOs were overpriced by 1.55% on MARs and 1.54% on RRs. In contrast with this finding, Chang et al.(2008), Bradley et al. (2009), Aggarwal and Conroy (2000), and Schultz and Zaman (1994) documented that IPOs were underpriced in the first-day secondary market. However, the secondary market finding confirms that IPO subscribers who are allocated IPO shares at the offer price are the only beneficiaries of short-run underpricing. This result is consistent with studies by Barry and Jennings (1993) and Benveniste and Spindt (1989). Barry and Jennings (1993) found that 90% of the initial day's returns comes though the opening transaction, suggesting that initial IPO subscribers who take shares at the offer price are the sole beneficiaries of underpricing. The Benveniste and Spindt (1989) model also suggests that the suppliers of information earn all the benefits of underpricing. The secondary market analysis may be useful to investors because the first-day primary market high returns are due to the lack of information and speculative behaviour of the investors. This finding may signal future market performance of the newly listed companies.

A substantial variation can be seen in the level of short-run performance in the analysis of the first-day returns and the post-day listing returns by industry, listing year and issue year. The examination of the IPOs by industry found that IPOs issued by the chemicals and materials industry were overpriced in the primary market, the secondary market and the total market. Industrial sector IPOs were underpriced on MARs by 68.03% in the primary market and 65.31% in the total market, and these are the highest levels of underpricing relative to other sectors. The resource sector IPOs were underpriced in the primary and total markets on both return measures, which is statistically significant at the 1% level. In contrast to the resource sector, the telecommunication sector IPOs were also underpriced in both markets on both return measures, and this is also statistically significant. The listing year analysis found that IPOs in the primary market and the total market were 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 both measures. In 2011, the levels of overpricing in the 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 were underpriced in the primary market and the total market, and overpriced in the secondary market, except in 2008. Issued IPOs in all markets were underpriced in 2008 but this is not statistically significant. In the secondary market, statistically significant overpricing levels can be found only in 2007 and 2010. Statistically significant underpricing levels in both the primary and total markets can be observed in all issue years except for 2008 and 2005.

According to the post-day market analysis, the industrial sector IPOs were more attractive than all other sectors. The industrial sector IPOs were underpriced on CARs by 68.93%, 67.84% and 66.29% on the third, sixth and tenth days respectively. These underpricing levels are statistically significant at the 1% level. However, the IPOs in the chemicals and materials industry were not attractive to investors because they were overpriced based on the CAR measure for all days. The IPOs listed in 2008 were also underpriced by 98.97%, 98.21% and 95.91 on the third, sixth and tenth days, and these underpricing levels are statistically significant at 1%. In listing year 2011, negative average CARs on day 3 and day 6 were found, which indicates that listed IPOs in this year were overpriced. Overpricing of the IPOs was not found in the issue-year analysis because the negative returns had not been reported. Statistically significant underpricing levels can be observed in issue years 2005 and 2007. However, overall, the post-day listing analysis showed that the wealth of the investors decreased with time.

The binary regression models showed that the main determinants of short-run market performance in Australia are the IPOP, time to listing (TOTP), LISD, TNPR and MV whereas the multiple regression models showed that LISD, PRICE, TOTP, RETU, MV and ATOA were the main determinants. These determinants confirm that issue and market characteristics are more important than firm characteristics when explaining short-run underpricing in Australian IPOs. The IPOP, time to listing (TOTP) and LISDs were used as proxies to test Rock's hypothesis, and the TNPR, MV, RETU and PRICE tested the uncertainty hypothesis. The attached free share option availability supported the agency cost hypothesis. Rock's hypothesis could be expected due to the institutional setup and share allocation practice of IPOs in Australia. Lee, Taylor and Walter (1996) suggested that the probability that uninformed investors face a winner's curse will increase because of the standby underwriting agreement in Australia. Allen (1987) also reported that most Australian IPO shares are allocated to institutional investors or highly favoured clients of the underwriting brokers. Lee, Taylor and Walter (1996) reported that institutional investors and highly favoured clients are considered 'informed' investors. These factors imply that the winner's curse faced by 'uninformed' investors is more common in the Australian IPO market.

The marginal probability analysis supported the uncertainty hypothesis, which found that an increase (decrease) in MV and decrease (increase) in TNPR leads to an increase (decrease) in the level of uncertainty, which causes an increase (decrease) in the level of underpricing in the short run. All industry dummies except for the telecommunication sector are also important to short-run market performance.

The overall analysis concluded that (1) the Australian IPOs were underpriced in the short run except for the analysis based on the secondary market, which accepted the short-run underpricing phenomenon of IPOs, (2) short-run underpricing disappeared when the first-day SECONs were applied, which confirmed that initial IPO subscribers were the sole beneficiaries of underpricing, (3) the short-run performance also varied according to the industry, issue year and listing year, and (4) the determinants of the short-run market performance varied according to the developed models, binary regression and multiple regression.

The next chapter presents the analysis of the data on the long-run market performance and its determinants of the Australian IPOs, based on the methodology developed in Chapter 3, and a discussion of the results.

Chapter 5: Analysis of Data and Discussion of Results: The Long-Run Market Performance and Its Determinants

5.1 Introduction

This chapter discusses the following: summary statistics of the distribution of long-run returns; evaluation of long-run market performance; determinants of the long-run market performance; and conclusions and findings.

The first section of the chapter briefly discusses the summary statistics of the long-run returns for three years after the listing. The second section evaluates the long-run market performance based on the following performance measures: CAR, BHR, BHAR and WR. To identify whether the performance of the IPOs varied by market capitalisation, the performance measures were calculated based on the VW and the EW schemes. The third section of this chapter identifies the determinants of the long-run market performance with the aid of binary and multiple regression models. To measure the probability associated with determinants that affect the directional changes between long-run underperformance and overperformance, marginal probability analysis was used. The final section provides the conclusions and findings.

5.2 Summary Statistics

Table 5.1 presents the summary statistics of the raw and abnormal returns, which were calculated for the following periods: one year, two years and three years. The raw and abnormal returns calculation assumes that investors buy shares and hold them for a long period, regardless of volatility in the market. This is considered the buy-and-hold strategy in long-run investment.

Table 5.1 Summary Statistics of Long-Run Return Measures

Dependent variable		N	Mean (%)	Median (%)	SD (%)	Kurtosis	Skewness	Minimum (%)	Maximum (%)
Year 1 (12 months)									
	RR (BHR)	242	–2.35	–29.03	102.56	15.8928	3.3805	–97.33	737.21
	AR (BHAR)	242	4.32	–19.49	93.67	19.2009	3.7327	–95.73	716.91
Year 2 (24 months)									
	RR (BHR)	202	–32.15	–51.65	91.54	35.1549	5.0634	–99.52	775.76
	AR (BHAR)	202	–14.44	–32.82	86.73	36.5085	5.1793	–117.45	755.24
Year 3 (36 months)									
	RR (BHR)	185	–36.40	–55.56	67.32	8.9349	2.5023	–99.45	371.79
	AR (BHAR)	185	–15.12	–33.47	66.83	8.7780	2.4626	–90.14	387.71

Note: RR and AR calculated based on buy-and-hold strategy, **N**= Sample size, **RR (BHR)** = Raw return, **AR (BHAR)** =Abnormal return, **SD** = Standard deviation. The returns (BHR and BHAR) calculated with a few outliers and their effect on overall reported result is likely to be very small.

In Table 5.1, the mean values of raw and abnormal returns for three years have a negative sign except the abnormal return in year one. The positive abnormal return is due to the negative average MR, which causes a positive abnormal return (MR > RR) in year one. The mean return of both raw and abnormal decreases as time increases. RRs mean values from year one to year three vary from –2.35% to –36.40% and abnormal returns mean values vary from 4.32% to –15.12%. The median values for all post-listing years indicate negative signs and gradually decrease with the time period. The median values vary from –29.03% to –55.56% on RRs and –19.49% to –33.47% on abnormal returns. The first-year standard deviations for both return measures are much higher than the other years, which show high volatility in the price levels in the first year. The highest standard deviation on the RR is 102.56% in the first year and 67.32% in the third year. Within three years, the standard deviation varies from 93.67% to 66.83% on abnormal returns. Standard deviation values gradually decrease over the three-year period, and this indicates that volatility in the market gradually decreases. This is confirmed by the decrease in mean return from year one to year three. The kurtosis statistics for the second year are much higher than for the other years. This indicates that the high peakedness of the distribution of both return measures in the second year may be due to higher negative returns in the second year compared with the first year. The lowest kurtosis statistics can be seen in the third year, showing that the lowest peakedness may be due to the marginal increase in returns compared with the second year. The increase in the third year is marginal, which shows that prices are less volatile and this indicates that the long-run IPO market is moving into a stable state. The positive skewness can be seen for all three years on both return measures, indicating return distribution skews to the right. The skewness based on RR can be observed and it is mainly due to the price fluctuation in the market, whereas the skewness based on abnormal returns can be expected due to the market benchmark12 that was used to calculate abnormal returns in the study. The reason for this skewness bias is that the long-run return of an individual security was compared with the market portfolio to calculate abnormal returns. The long-run return of an individual security is highly skewed due to price

[12] Barber and Lyon (1997) identified three main biases associated with the buy-and-hold abnormal returns (BHAR) when calculating using a market index such as new listing bias, rebalancing bias and skewness bias. However, Gur-Gershgoren, Zender and Hughson (2008) and Lyon, Barber and Tsai (1999) documented that the new listing and rebalancing biases can be addressed by using a carefully constructed reference portfolio (market index).

fluctuation whereas the long-run return of the market portfolio is not skewed due to the portfolio diversification.

The skewness statistics values in Table 5.1 report that in the second year both return measures are higher than the other years due to the price fluctuation and the market benchmark. However, as a result of this positive skewness, long-run BHARs and related t-statistics may have negatively biased values. To address this skewness bias, t-statistics for long-run BHRs were calculated using a bootstrapped skewness-adjusted method (Lyon, Barber & Tsai 1999).

The minimum value varies from –99.52% to –97.33% and maximum value varies from 371.79% to 775.76% on RRs, whereas the minimum value varies from –90.14% to –117.45% and the maximum value from 387.71% to 755.24% based on abnormal returns. The second-year minimum and maximum statistics for all return measures are higher than the other years, maybe due to high volatility in both returns compared with the other years.

5.3 Evaluation of Long-Run Market Performance

This section evaluates the long-run market performance to identify whether the Australian IPOs underperformed or overperformed in the long run. In this study, the long-run market performance analysis considered three post-listing periods: year one (12 months or 252 days), year two (24 months or 504 days) and year three (36 months or 756 days). These years were considered time windows, and in these time windows, the performance measures were calculated on a monthly basis using daily prices according to the event-time approach, which is widely used in the IPO literature to examine long-run or post-listing share price behaviour. According to the event-time approach, the eleventh day of the post-listing period was identified as the starting day of the long-run analysis and is denoted as t_1; year one, year two and year three are denoted as t_{252}, t_{504}, and t_{756} respectively.

To analyse the long-run market performance of IPOs, the following four measures were considered: (1) the average CAR, (2) the average BHR, (3) the average BHAR and (4) the average WR. These measures were calculated based on EW and VW schemes to identify whether performance of IPOs varies by market capitalisation. These performance measures are widely used in the event-time approach to measure the long-run performance of IPOs. Following Ritter (1991), the CARs were calculated considering the monthly rebalancing assumption, which indicates that periodical buying or selling of assets in the portfolio maintains the original desired level of asset allocation. Other performance measures such as BHR, BHAR and WR were calculated based on the buy-and-hold assumption, which indicates that investors assume that the stock market is efficient.

To determine whether the performance measures are statistically significant, the bootstrapped skewness-adjusted t-statistics, conventional t-statistic (student t-statistics) and t-statistics were calculated. The reason for using the bootstrapped skewness-adjusted t-statistics is to eliminate the negatively biased t-statistics associated with the distribution of long-horizon BHRs, as discussed by Lyon, Barber and Tsai (1999).[13] The bootstrapped skewness-adjusted t-statistics were calculated for the average BHRs and BHARs. In addition to the bootstrapped skewness-adjusted t-statistics, conventional t-statistics were calculated for BHRs and BHARs for comparison. The conventional t-statistics were also calculated for the AAR and t-statistics were calculated for the CARs, as discussed in Ritter (1991).

In contrast to the short-run analysis, the long-run analysis required certain minor changes for the following reasons:

1. The issue year and listing year are important in a long-run analysis. Some researchers (Dimovski & Brooks 2004; Ritter 1991) have documented that long-run performance varies according to the issue year and they used the issue year to analyse long-run performance. Chi, Wang and Young (2010) used the listing year as a dummy variable to explain the effect of the year. Following these researchers, the study used issue year to analyse the long-run performance and listing year to explain the year effect.

[13] The bootstrapping method was suggested by Lyon, Barber and Tsai (1999) to eliminate high skewness of the distribution of the long-run buy-and-hold abnormal returns. Normally, the buy-and-hold returns are highly skewed to the right (positive skewness). This positive skewness leads to negatively biased t-statistics. Prior researchers have also argued that skewness has a higher effect on the t-statistics than kurtosis.

2. The selected sample has fewer IPOs for chemicals and materials, telecommunication and utilities industries. Therefore, these industries were excluded from the industry analysis, and issue year 2005 was also excluded in the issue-year analysis due to the lower number of IPOs.
3. Long-run analysis requires a three-year window, but the selected sample IPOs in issue year 2009 and 2010 had not completed their three-year period due to their listing date and the sample period. Therefore, IPOs in issue year 2009 and 2010 were also excluded in the issue year analysis.

The evaluation of the long-run market performance is presented according to the performance measures by full sample, industry, and issue year as follows.

5.3.1 Cumulative Average Abnormal Returns (CARs)

The CARs[14] were calculated for the sample companies using the All Ordinary Index as a market benchmark under the monthly rebalancing assumption. To test the hypothesis that the average CAR is equal to zero, the t-statistics for the cumulative average abnormal return ($CAR_{1,t}$) given in Ritter (1991) were calculated on a monthly basis. To test whether the average AR is equal to zero, the student t-statistics were also calculated for monthly market-adjusted average abnormal returns (AAR_t). All average CARs were calculated using EW and VW methods for three years (36 months of seasoning) to identify the difference in the performance of smaller and larger firms in the sample. The evaluation of long-run market performance based on CARs is presented by full sample, industry and issue year.

5.3.1.1 Long-run performance by full sample

Table 5.2 shows the full sample (249 IPOs) selected for year one, year two and year three to estimate the average market-adjusted CAR and the average monthly AR from January 2006 to January 2011. In this analysis, five companies were excluded from the original sample (254 IPOs) due to incompleteness of the data. Six

[14] Previous studies have reported that CARs are subject to measurement bias, new listing bias and skewness bias. However, Barber and Lyon (1997) documented that the skewness bias related to CARs is smaller than for BHARs and particularly the new listing bias may lead to positively biased t-statistics when benchmark returns are calculated based on a market index.

companies in the final sample were delisted before the three-year anniversary. The number of companies that completed the three-year anniversary is lower than the total number of companies in the sample due to the share price data collection period. Table 5.2 indicates that only 180 sample companies completed their three-year anniversary.

Table 5.2: Equally Weighted (EW) and Value-Weighted (VW) Market-Adjusted Average Abnormal Returns (AARs) and Cumulative Average Abnormal Returns (CARs) for the Full Sample

Months of seasoning		Number of firms trading	Equally weighted (EW)				Value-weighted (VW)			
			AAR_t	t-stat	$CAR_{1,t}$	t-stat	AAR_t	t-stat	$CAR_{1,t}$	t-stat
	1	249	0.0004	0.04	0.0004	0.02	0.0154	2.44[b]	0.0154	1.20
	2	249	–0.0046	–0.35	–0.0042	–0.17	–0.0098	–1.46	0.0057	0.31
	3	249	–0.0352	–3.03[a]	–0.0393	–1.28	0.0353	4.43[a]	0.0409	1.83[c]
	4	249	0.0106	0.84	–0.0288	–0.81	0.0515	6.56[a]	0.0924	3.58[a]
	5	249	0.0173	1.16	–0.0114	–0.29	–0.0133	–1.49	0.0791	2.74[a]
	6	249	–0.0040	–0.29	–0.0154	–0.35	0.0093	1.19	0.0884	2.79[a]
	7	249	0.0289	1.08	0.0135	0.29	0.0051	0.53	0.0935	2.73[a]
	8	249	0.0201	1.07	0.0336	0.67	0.0178	1.19	0.1113	3.04[a]
	9	249	–0.0220	–1.82[c]	0.0116	0.22	0.0175	1.99[b]	0.1288	3.32[a]
	10	249	0.0030	0.16	0.0146	0.26	–0.0134	–1.32	0.1153	2.82[a]
	11	249	–0.0043	–0.28	0.0103	0.18	–0.0461	–6.48[a]	0.0693	1.61
(Year 1)	12	242	0.0057	0.33	0.0161	0.26	0.0148	1.62	0.0841	1.85[c]
	13	228	0.0132	0.63	0.0293	0.44	0.0026	0.23	0.0867	1.78[c]
	14	224	–0.0177	–1.17	0.0116	0.17	–0.0568	–5.09[a]	0.0299	0.59
	15	218	–0.0281	–1.90[c]	–0.0165	–0.23	–0.0528	–4.42[a]	–0.0229	–0.43
	16	215	0.0061	0.35	–0.0104	–0.14	–0.0289	–1.92[c]	–0.0518	–0.93
	17	214	–0.0062	–0.37	–0.0166	–0.21	0.0245	1.75[c]	–0.0273	–0.47
	18	213	–0.0336	–2.10[b]	–0.0502	–0.62	–0.0411	–3.14[a]	–0.0684	–1.15
	19	211	0.0223	1.11	–0.0280	–0.33	0.0760	2.64[a]	0.0076	0.12
	20	206	0.0130	0.70	–0.0149	–0.17	0.0366	2.45[b]	0.0442	0.70
	21	203	–0.0294	–1.50	–0.0443	–0.49	–0.0224	–2.06[b]	0.0218	0.33
	22	202	0.0427	1.65[c]	–0.0016	–0.02	0.0511	3.25[a]	0.0729	1.08
	23	201	0.0291	1.56	0.0274	0.29	0.0774	4.78[a]	0.1503	2.18[b]
(Year 2)	24	199	–0.0008	–0.05	0.0266	0.27	0.0283	2.02[b]	0.1786	2.52[b]
	25	192	0.0412	1.99[b]	0.0677	0.67	0.0629	5.13[a]	0.2414	3.28[a]
	26	190	0.0016	0.07	0.0694	0.67	–0.0637	–4.93[a]	0.1777	2.35[b]
	27	186	0.0304	1.31	0.0998	0.94	0.0031	0.18	0.1808	2.32[b]
	28	185	0.0675	3.03[a]	0.1673	1.54	0.0092	0.54	0.1900	2.39[b]
	29	184	0.0270	1.16	0.1943	1.75[c]	–0.0502	–2.70[a]	0.1398	1.72[c]

	30	183	0.0211	1.02	0.2153	1.90[c]	–0.0292	–2.01[b]	0.1106	1.34
	31	182	0.0147	0.68	0.2301	1.99[c]	0.0354	2.27[b]	0.1459	1.73[c]
	32	182	0.0636	2.98[a]	0.2936	2.51[b]	0.1113	4.68[a]	0.2572	3.00[a]
	33	182	0.0180	1.12	0.3117	2.62[a]	0.0186	1.16	0.2758	3.17[a]
	34	181	0.0426	1.17	0.3543	2.92[a]	0.0337	1.44	0.3095	3.50[a]
	35	180	0.0446	2.16[b]	0.3989	3.24[a]	0.0495	3.21[a]	0.3590	3.99[a]
(Year 3)	36	180	0.0111	0.56	0.4100	3.28[a]	–0.0163	–1.26	0.3427	3.75[a]

Note: AAR= Market-adjusted average abnormal return, **CAR**= Cumulative average abnormal return. The student t-statistic (t-stat) was calculated for the AAR of each month using $(AAR_t/SD_t) \times \sqrt{n_t}$ where SD $_t$ is the cross-sectional standard deviation of abnormal returns for month t, and n $_t$ is the number of firms trading in month t. The t-statistic (t-stat) for the each month CAR was calculated following Ritter (1991) as $CAR_{1,t}$ x (n $_t$)$^{0.5}$/CSD $_t$ where CSD $_t$ is the cross-sectional standard deviation of cumulative abnormal returns in month t and calculated as CSD $_t$ = [t x VAR + 2 x COV x (t – 1)]$^{0.5}$ where VAR is the mean cross-sectional variance of abnormal returns over 36 months, and COV is the first-order autocovariance of the average abnormal return (AAR $_t$) series. The calculated equally and weighted VAR values are 0.077861 (27.90% squared) and 0.041190 (20.30% squared) respectively, and equally and weighted COV values are 0.000134 (autocorrelation coefficient 0.2107) and 0.000254 (autocorrelation coefficient 0.1496) respectively, **[a]** statistically significant at 1% level, [b] statistically significant at 5% level, [c] statistically significant at 10% level.

Table 5.2 shows the EW and VW CARs with the associated t-statistics and number of firms under the months of seasoning. EW CARs ($CARs_{EW}$) show a steady growth from months 24 to 36 compared with months 1 to 23. Most of the calculated $CARs_{EW}$ from months 25 to 36 are also statistically significant. The highest CAR_{EW}, of 41%, can be seen in the thirty-sixth month of seasoning and this is statistically significant at the 1% level. The lowest CAR_{EW}, of –5.02%, occurred in the eighteenth month of seasoning. The EW CARs rose from 0.04% to 1.61% at 12 months of seasoning and then increased to 2.66% by month 24. Finally, the $CARs_{EW}$ rose again to 41% by the end of 36 months, which is statistically significant at the 1% level. The average CAR over 12, 24 and 36 months of seasoning is not equal to zero, which rejects the null hypothesis. The results based on EW CARs indicate an overperformance of the Australian IPOs in the long run. This finding is consistent with the results reported by Bird and Yeung (2010), Chi, Wang and Young (2010) and Ahmad-Zaluki, Campbell and Goodacre (2007) concerning long-run IPO performance in Australia, China and Malaysia respectively, using the market index as a benchmark with the EW return scheme. However, the study finding contrasts with the Australian finding by Lee, Taylor and Walter (1996) and US finding by Ritter (1991). The severe underperformance reported by Lee, Taylor and Walter (1996) is most probably sample specific and the US results reported by Ritter (1991) are sample-period specific.

The calculated VW CARs ($CARs_{VW}$) indicate that the CARs increased from 1.54% to 8.41% in 12 months and increased again to 17.86% and 34.27% in months 24 to 36 respectively. This increasing trend in $CARs_{VW}$ is much higher than the EW CARs up to 24 months. The average CARs under the VW scheme are greater than the EW CARs up to 24 months. This indicates that the larger IPO companies performed well compared with the smaller IPOs. However, the average VW CARs from months 29 to 36 were lower compared with the EW. These lower VW average CARs may indicate that the larger IPO companies performed less well compared with the smaller IPO companies of the sample in the long run. This finding is supported by the finding of Ahmad-Zaluki, Campbell and Goodacre (2007). Most of the VW average CARs are statistically significant over 36 months and the VW average CARs in months 12, 24 and 36 are statistically significant at 10%, 5% and 1% level respectively. The calculated VW CARs for the long run show that the Australian IPOs overperformed compared with the market benchmark. This finding is also supported by the findings of Ahmad-Zaluki, Campbell and Goodacre (2007).

The behaviour of the calculated CAR_{EW} and CAR_{VW} for the full sample over the 36 months of seasoning is shown in Figure 5.1. This figure clearly indicates that all sample companies overperformed on both EW and VW CARs because most of the CARs in both schemes were above zero at the months of seasoning 12, 24 and 36. The VW CARs in months 1 to 6 and 15 to 22 were below the zero line, which indicates that all sample companies underperformed on the VW method in these periods. Both EW and VW CARs indicate that the sample IPOs underperformed from months 15 to 19. The EW underperformance levels are much higher than those of the VW. Figure 5.1 shows that the EW overperformance levels were much lower than the VW levels up to 28 months of seasoning after the VW levels up to 36 months of seasoning are overridden.

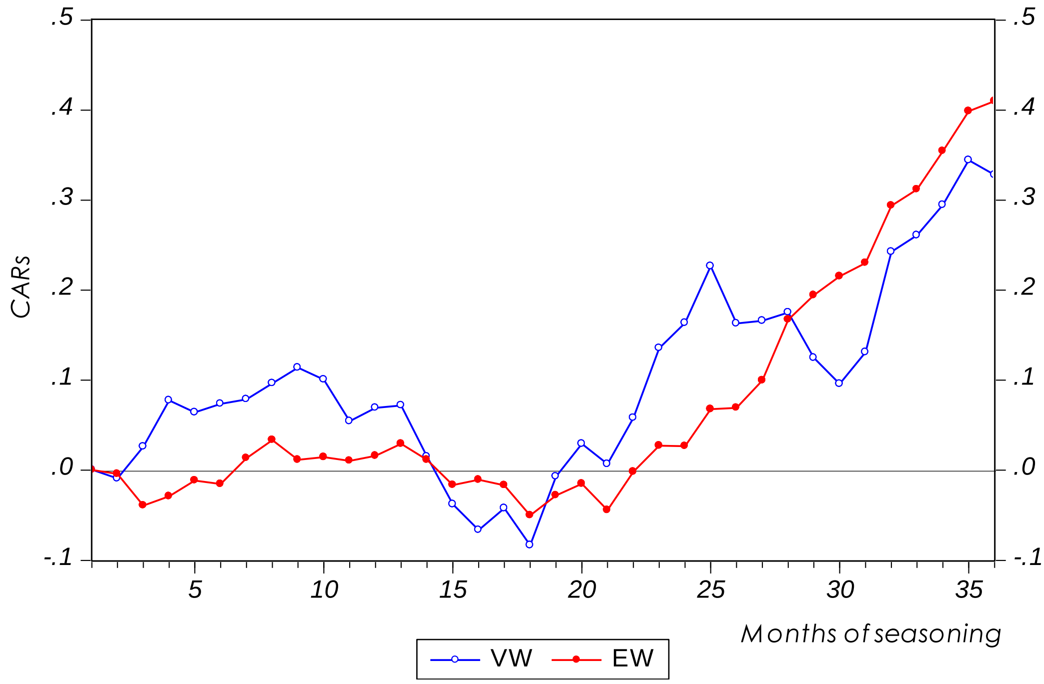


Figure 5.1: Equally and Value-Weighted (EW & VW) CARs for the Full Sample

5.3.1.2 Long-run performance by industry

To identify whether the long-run performance varied by industry, the CARs were calculated for the industries of resources, industrials, consumer discretionary and staples, and information technology. To analyse the performance of the industries, the calculated EW and VW AARs and CARs for these industries are provided in Tables 5.3, 5.4, 5.5 and 5.6. The following long-run performance discussion is presented separately by industry.

5.3.1.2.1 Resources industry performance analysis

Table 5.3 shows both the EW and VW long-run performance measures based on the abnormal return for the resources industry. In the resources industry, 139 companies were considered for the long-run analysis after eliminating four companies from the original industry sample (143 IPOs) due to incompleteness of data. None of the companies in the resources sector was delisted before the three-year anniversary. Table 5.3 indicates that, due to the listing year and sample period, only 100 resources industry sample companies completed the three-year anniversary (36 months), whereas 39 companies that were considered for the long-run analysis did not complete the three-year anniversary.

Table 5.3: Equally Weighted (EW) and Value-Weighted (VW) Market-Adjusted Average Abnormal Returns (AARs) and Cumulative Average Abnormal Returns (CARs) for the Resources Industry

Months of seasoning		Number of firms trading	Equally weighted (EW) AAR $_t$	t-stat	CAR$_{1,t}$	t-stat	Value-weighted (VW) AAR $_t$	t-stat	CAR$_{1,t}$	t-stat
	1	139	0.0145	0.90	0.0145	0.54	–0.0055	–0.30	–0.0055	–0.23
	2	139	0.0012	0.06	0.0158	0.41	–0.0335	–2.20[b]	–0.0390	–1.12
	3	139	–0.0382	–2.28[b]	–0.0224	–0.48	–0.0479	–3.56[a]	–0.0869	–2.04[b]
	4	139	0.0102	0.57	–0.0122	–0.22	0.0750	4.29[a]	–0.0119	–0.24
	5	139	0.0580	2.55[b]	0.0458	0.76	–0.0084	–0.34	–0.0203	–0.37
	6	139	0.0065	0.32	0.0523	0.79	0.0043	0.27	–0.0160	–0.27
	7	139	0.0584	1.26	0.1107	1.54	0.0020	0.08	–0.0139	–0.21
	8	139	0.0448	1.47	0.1555	2.03[b]	0.1260	2.78[a]	0.1120	1.61
	9	139	–0.0313	–1.93[c]	0.1242	1.53	0.0194	1.38	0.1314	1.78[c]
	10	139	–0.0093	–0.39	0.1150	1.34	–0.0856	–3.19[a]	0.0458	0.59
	11	139	–0.0076	0.72	0.1073	1.19	–0.0090	–0.69	0.0368	0.45
(Year 1)	12	135	0.0088	0.35	0.1161	1.22	0.0048	0.24	0.0416	0.48
	13	126	0.0197	0.59	0.1358	1.32	0.0566	1.67[c]	0.0982	1.05
	14	123	–0.0338	–1.79[c]	0.1020	0.95	–0.0461	–2.54[b]	0.0521	0.53
	15	120	–0.0320	–1.48	0.0700	0.62	–0.0266	–1.48	0.0255	0.25
	16	119	–0.0037	–0.15	0.0663	0.57	–0.0240	–1.19	0.0015	0.01
	17	118	0.0157	0.63	0.0819	0.68	–0.0277	–1.14	–0.0261	–0.24
	18	117	–0.0172	–0.75	0.0647	0.52	–0.0990	–5.24[a]	–0.1251	–1.10
	19	115	0.0038	0.14	0.0685	0.53	0.0054	0.18	–0.1197	–1.02
	20	112	0.0223	0.87	0.0908	0.67	0.0382	1.84[c]	–0.0815	–0.67
	21	111	–0.0377	–1.16	0.0531	0.38	–0.0512	–2.44[b]	–0.1327	–1.05
	22	111	0.0495	1.15	0.1027	0.72	0.0186	0.52	–0.1141	–0.88
	23	111	0.0429	1.61	0.1455	1.00	0.1445	4.25[a]	0.0305	0.23
(Year 2)	24	111	0.0307	1.22	0.1762	1.19	0.0439	1.69[c]	0.0744	0.55
	25	105	0.0758	2.25[b]	0.2520	1.62	0.0203	0.68	0.0947	0.67
	26	103	0.0448	1.18	0.2968	1.85[c]	0.0336	1.07	0.1283	0.88
	27	101	0.0537	1.40	0.3505	2.12[b]	0.0214	0.60	0.1497	1.00
	28	101	0.0940	2.85[a]	0.4445	2.64[a]	0.0832	3.24[a]	0.2329	1.53
	29	101	0.0477	1.31	0.4923	2.87[a]	0.0155	0.54	0.2484	1.60
	30	101	0.0250	0.76	0.5173	2.97[a]	0.0170	0.64	0.2654	1.68[c]

	31	101	0.0180	0.55	0.5353	3.02^{a}	0.0116	0.34	0.2770	1.72^{c}
	32	101	0.0878	2.69^{a}	0.6231	3.46^{a}	0.0415	1.65^{c}	0.3185	1.95^{c}
	33	101	0.0220	0.93	0.6451	3.53^{a}	0.0310	1.59	0.3495	2.11^{b}
	34	101	0.0491	0.80	0.6941	3.74^{a}	0.0285	0.49	0.3780	2.25^{b}
	35	100	0.0619	2.22^{b}	0.7560	4.00^{a}	0.0325	1.24	0.4105	2.39^{b}
(Year 3)	36	100	0.0055	0.21	0.7615	3.97^{a}	0.0399	1.89^{c}	0.4504	2.59^{b}

Note: AAR = Market-adjusted average abnormal return, **CAR** = Cumulative average abnormal return. The student t-statistic (t-stat) was calculated for the AAR of each month using $(AAR_t/SD_t) \times \sqrt{n_t}$ where SD_t is the cross-sectional standard deviation of abnormal returns for month t, and n_t is the number of firms trading in month t. The t-statistic (t-stat) for each month's CAR was calculated following Ritter (1991) as $CAR_{1,t}$ x $(n_t)^{0.5}/CSD_t$ where CSD_t is the cross-sectional standard deviation of cumulative abnormal returns in month t and calculated as $CSD_t = [t \text{ x } VAR + 2 \text{ x } COV \text{ x } (t - 1)]^{0.5}$ where VAR is the mean cross-sectional variance of abnormal returns over 36 months, and COV is the first-order autocovariance of the average abnormal return (AAR_t) series. The calculated equally and weighted VAR values are 0.101309 (31.83% squared) and 0.083354 (28.87% squared) respectively, and equally and weighted COV values are 0.000420 (autocorrelation coefficient 0.3424) and 0.000382 (autocorrelation coefficient 0.1540) respectively, ^{a} statistically significant at 1% level, ^{b} statistically significant at 5% level, ^{c} statistically significant at 10% level.

Table 5.3 shows both the EW and VW average CARs ($CARs_{EW}$ and $CARs_{VW}$) and AARs ($AARs_{EW}$ and $AARs_{VW}$) and their relevant t-statistics. The calculated EW average CARs for months 12, 24 and 36 are 11.61%, 17.62% and 76.15% respectively. These indicate that the resources industry IPOs overperformed in the long run based on the EW scheme. The overperformance level of the resources industry at 36 months is much higher than at 12 and 24 months. All EW average CARs after 24 months are statistically significant. The EW average CAR for the three years (36 months) is also statistically significant at the 1% level. However, the overperformance level in year one and two are not statistically significant. The negative average $CARs_{EW}$ are found only in months three and four and these negative $CARs_{EW}$ indicate that resource IPOs underperformed in these periods. In contrast with the overperformance in the long run, How (2000) found that mining sector IPOs underperformed in EW CARs from month 11 to month 36. However, it is important to note that she calculated the market-adjusted cumulative returns on a buy-and-hold strategy.

The calculated VW average CARs in Table 5.3 (column 9) show that the sample resources IPOs overperformed in months 12, 24 and 36 by 4.16%, 7.44% and 45.04% respectively. The overperformance level at 36 months is statistically significant at the 5% level. In comparison, the reported negative CARs are much higher under the VW schemes than under the EW schemes. The VW CARs have negative values in months one to seven and months 17 to 22, which shows that in these periods IPOs in the resources sector underperformed. The overperformance levels for year one, two and three are much lower compared with those under the EW scheme. In the long run, the lower performance under the VW schemes may indicate that the larger IPO companies in the sample performed less well compared with the smaller IPO companies.

5.3.1.2.2 Industrial sector performance analysis

Table 5.4 shows both the EW and the VW AARs and CARs for the industrial sector. Only one company was excluded from the original industrial sector sample (46 IPOs) due to incompleteness of data and 45 companies were considered for the final sample. Only one IPO company in the final sample in the industrial sector was delisted before the three-year anniversary. There were seven IPOs in the final sample of the industrial sector whose available share prices were for less than 36 months. Table 5.4 indicates that only 37 sample companies completed their three-year anniversary.

Table 5.4: Equally Weighted (EW) and Value-Weighted (VW) Market-Adjusted Average Abnormal Returns (AARs) and Cumulative Average Abnormal Returns (CARs) for the Industrial Sector

Months of seasoning		Number of firms trading	Equally weighted (EW) AAR $_t$	t-stat	CAR$_{1,t}$	t-stat	Value-weighted (VW) AAR $_t$	t-stat	CAR$_{1,t}$	t-stat
	1	45	–0.0082	–0.68	–0.0082	–0.27	0.0217	3.54[a]	0.0217	0.74
	2	45	–0.0028	–0.16	–0.0110	–0.26	–0.0190	–1.69[c]	0.0028	0.07
	3	45	–0.0258	–1.13	–0.0368	–0.71	0.0659	4.29[a]	0.0687	1.33
	4	45	0.0536	2.37[b]	0.0168	0.28	0.0702	5.22[a]	0.1389	2.32[b]
	5	45	–0.0369	–1.38	–0.0200	–0.30	–0.0140	–0.99	0.1250	1.86[c]
	6	45	0.0080	0.36	–0.0121	–0.16	0.0113	0.86	0.1363	1.85[c]
	7	45	0.0020	0.08	–0.0101	–0.13	0.0180	1.37	0.1542	1.94[c]
	8	45	0.0129	0.51	0.0028	0.03	0.0143	0.99	0.1685	1.98[c]
	9	45	0.0143	0.41	0.0171	0.19	0.0217	0.97	0.1902	2.11[b]
	10	45	0.0031	0.13	0.0202	0.21	–0.0061	–0.43	0.1841	1.94[c]
	11	45	–0.0129	–0.56	0.0073	0.07	–0.0413	–3.68[a]	0.1429	1.43
(Year 1)	12	45	–0.0004	–0.02	0.0069	0.07	0.0226	1.19	0.1655	1.59
	13	44	0.0373	1.03	0.0442	0.40	0.0094	0.52	0.1749	1.59
	14	43	–0.0420	–1.63	0.0022	0.02	–0.1007	–3.75[a]	0.0742	0.64
	15	41	–0.0654	–2.00[b]	–0.0633	–0.52	–0.0921	–2.63[b]	–0.0179	–0.15
	16	40	0.0061	0.15	–0.0571	–0.45	0.0118	0.26	–0.0061	–0.05
	17	40	–0.0289	–1.07	–0.0860	–0.65	–0.0612	–2.26[b]	–0.0673	–0.51
	18	40	–0.0478	–1.45	–0.1338	–0.99	–0.0222	–0.63	–0.0895	–0.66
	19	40	0.0647	1.31	–0.0691	–0.50	0.2222	2.60[b]	0.1327	0.95
	20	39	0.0225	0.67	–0.0466	–0.32	0.1015	2.84[a]	0.2343	1.62
	21	38	0.0010	0.04	–0.0456	–0.30	0.0043	0.16	0.2386	1.59
	22	38	0.0452	1.32	–0.0004	0.00	0.0933	2.64[b]	0.3319	2.16[b]
	23	38	0.0424	1.04	0.0419	0.27	0.1088	3.19[a]	0.4407	2.81[a]
(Year 2)	24	38	–0.0274	–0.73	0.0146	0.09	–0.0169	–0.57	0.4238	2.64[b]
	25	38	–0.0104	–0.51	0.0042	0.03	0.0472	2.56[b]	0.4710	2.88[a]
	26	38	–0.0744	–2.39[b]	–0.0702	–0.42	–0.1315	–5.85[a]	0.3395	2.03[b]
	27	37	0.0134	0.32	–0.0568	–0.33	0.0165	0.46	0.3560	2.06[b]
	28	37	0.0262	0.69	–0.0306	–0.17	0.0041	0.12	0.3601	2.05[b]
	29	37	0.0090	0.27	–0.0216	–0.12	–0.1049	–2.97[a]	0.2553	1.43
	30	37	–0.0214	–0.71	–0.0431	–0.24	–0.0699	–2.46[b]	0.1854	1.02

	31	37	–0.0089	–0.32	–0.0520	–0.28	0.0336	1.37	0.2190	1.18
	32	37	0.0172	0.51	–0.0347	–0.19	0.1630	2.67[a]	0.3820	2.03[b]
	33	37	0.0503	1.45	0.0155	0.08	0.0061	0.15	0.3881	2.03[b]
	34	37	0.0380	0.90	0.0535	0.28	0.0507	1.33	0.4388	2.27[b]
	35	37	0.0623	1.21	0.1158	0.59	0.0737	2.31[b]	0.5124	2.61[b]
(Year 3)	36	37	–0.0567	–1.91[c]	0.0591	0.30	–0.0235	–0.97	0.4889	2.45[b]

Note: AAR = Market-adjusted average abnormal return, **CAR** = Cumulative average abnormal return. The student t-statistic (t-stat) was calculated for the AAR of each month using $(AAR_t/SD_t) \times \sqrt{n_t}$ where SD $_t$ is the cross-sectional standard deviation of abnormal returns for month t, and n $_t$ is the number of firms trading in month t. The t-statistic (t-stat) for the each month CAR was calculated following Ritter (1991) as $CAR_{1,t}$ x $(n_t)^{0.5}$/CSD $_t$ where CSD $_t$ is the cross-sectional standard deviation of cumulative abnormal returns in month t and calculated as CSD $_t$ = $[t \text{ x } VAR + 2 \text{ x } COV \text{ x } (t - 1)]^{0.5}$ where VAR is the mean cross-sectional variance of abnormal returns over 36 months, and COV is the first-order autocovariance of the average abnormal return (AAR $_t$) series. The calculated equally and weighted VAR values are 0.040778 (20.19% squared) and 0.038909 (19.73% squared) respectively, and equally and weighted COV values are –0.000008 (autocorrelation coefficient –0.0069) and 0.000972 (autocorrelation coefficient 0.1870) respectively, [a] statistically significant at 1% level, [b] statistically significant at 5% level, [c] statistically significant at 10% level.

In Table 5.4, the calculated EW CARs for the industrial sector in months 12, 24 and 36 are 0.69%, 1.46% and 5.91% respectively. This shows that, in these periods, the industrial sector IPOs overperformed in the long run, but the levels are not statistically significant. Apart from a few positive values, most of the CARs show negative signs, which indicates that the industrial sector IPOs underperformed by months of seasoning and they are also not statistically significant at any level. This finding is supported by the findings of Lee, Taylor and Walter (1996) that Australian industrial sector IPOs underperformed in EW CARs over a 36-month period. However, it is important to note that they calculated the market-adjusted cumulative returns based on the buy-and-hold strategy.

According to the VW CARs in Table 5.4, the sample IPOs in the industrial sector overperformed in the long run by 16.55%, 42.38% and 48.89% at 12, 24 and 36 months respectively. The overperformance levels at 24 and 36 months are statistically significant at the 5% level. Unlike the results of the EW method, most of the VW CARs have positive signs and they are statistically significant at 5% and 10% levels. In comparison, the levels of overperformance based on the VW method are much higher than those of the EW method. These higher overperformance levels show that the larger IPO companies in the industrial sector performed well compared with the smaller IPOs.

5.3.1.2.3 Consumer discretionary and staples industry performance analysis

The EW and VW abnormal return performance measures and relevant t-statistics for the consumer discretionary and staples industry are given in Table 5.5. Thirty-one IPO companies were considered in the sample and two IPO companies were delisted before the three-year anniversary. However, Table 5.5 indicates that, due to the listing date and sample period, only 20 sample companies completed their three-year anniversary and nine companies were unable to complete their three-year anniversary.

Table 5.5: Equally Weighted (EW) and Value-Weighted (VW) Market-Adjusted Average Abnormal Returns (AARs) and Cumulative Average Abnormal Returns (CARs) for the Consumer Discretionary and Staples Industry

Months of seasoning		Number of firms trading	Equally weighted (EW) AAR $_t$	t-stat	$CAR_{1,t}$	t-stat	Value-weighted (VW) AAR $_t$	t-stat	$CAR_{1,t}$	t-stat
	1	31	–0.0450	–2.10[b]	–0.0450	–1.09	–0.0330	–1.90[c]	–0.0330	–1.04
	2	31	–0.0313	–1.61	–0.0763	–1.30	0.0069	0.50	–0.0262	–0.59
	3	31	–0.0495	–1.78[c]	–0.1258	–1.75[c]	–0.0286	–1.09	–0.0548	–1.01
	4	31	–0.0507	–2.25[b]	–0.1765	–2.12[b]	–0.0259	–1.25	–0.0807	–1.29
	5	31	–0.0715	–2.31[b]	–0.2480	–2.67[b]	–0.0178	–1.14	–0.0985	–1.41
	6	31	–0.0116	–0.37	–0.2596	–2.55[b]	–0.0004	–0.01	–0.0990	–1.29
	7	31	0.0102	0.31	–0.2493	–2.27[b]	0.0084	0.40	–0.0906	–1.10
	8	31	–0.0598	–2.37[b]	–0.3092	–2.63[b]	–0.0208	–1.07	–0.1113	–1.26
	9	31	–0.0291	–1.25	–0.3383	–2.71[b]	0.0127	0.67	–0.0987	–1.05
	10	31	–0.0072	–0.23	–0.3454	–2.63[b]	–0.0041	–0.19	–0.1027	–1.04
	11	31	–0.0029	–0.06	–0.3484	–2.53[b]	–0.0195	–0.78	–0.1222	–1.18
(Year 1)	12	31	0.0092	0.17	–0.3391	–2.35[b]	–0.0479	–1.65	–0.1702	–1.57
	13	30	–0.0316	–0.69	–0.3707	–2.43[b]	0.0116	0.25	–0.1585	–1.39
	14	30	0.0002	0.01	–0.3705	–2.34[b]	–0.0226	–1.45	–0.1811	–1.53
	15	29	0.0107	0.28	–0.3597	–2.16[b]	–0.0085	–0.31	–0.1897	–1.52
	16	28	0.0152	0.41	–0.3446	–1.97[c]	–0.0288	–1.24	–0.2185	–1.66
	17	28	–0.0429	–1.09	–0.3875	–2.15[b]	0.0039	0.19	–0.2145	–1.58
	18	28	–0.0625	–1.25	–0.4500	–2.42[b]	–0.0923	–1.93[c]	–0.3069	–2.20[b]
	19	28	0.1103	1.68[c]	–0.3397	–1.78[c]	0.1090	1.46	–0.1979	–1.38
	20	27	0.0237	0.40	–0.3160	–1.59	–0.0136	–0.29	–0.2114	–1.41
	21	27	–0.0401	–1.00	–0.3561	–1.74[c]	–0.0041	–0.16	–0.2155	–1.41
	22	26	–0.0215	–0.61	–0.3776	–1.77[c]	0.0198	0.54	–0.1957	–1.22
	23	25	0.0098	0.19	–0.3678	–1.66	–0.0701	–1.98[c]	–0.2657	–1.60
(Year 2)	24	24	–0.0860	–1.54	–0.4539	–1.96[c]	–0.0086	–0.18	–0.2743	–1.58
	25	23	–0.0527	–1.24	–0.5065	–2.10[b]	–0.0126	–0.34	–0.2869	–1.58
	26	23	0.0011	0.02	–0.5054	–2.05[b]	–0.0037	–0.11	–0.2906	–1.57
	27	23	–0.0122	–0.48	–0.5177	–2.06[b]	–0.0019	–0.11	–0.2925	–1.55
	28	23	0.0443	0.63	–0.4734	–1.85[c]	–0.0841	–1.92[c]	–0.3766	–1.97[c]
	29	23	0.0546	0.87	–0.4188	–1.61	0.1434	2.32[b]	–0.2332	–1.20
	30	22	0.0789	1.55	–0.3399	–1.26	0.0439	1.03	–0.1894	–0.93

	31	21	0.0710	0.98	–0.2688	–0.95	–0.0317	–0.77	–0.2211	–1.05
	32	21	0.0057	0.10	–0.2631	–0.92	0.0467	1.27	–0.1744	–0.81
	33	21	–0.0012	–0.03	–0.2644	–0.91	0.0777	2.07[b]	–0.0966	–0.44
	34	20	–0.0153	–0.31	–0.2797	–0.93	–0.0141	–0.48	–0.1107	–0.49
	35	20	–0.0563	–0.98	–0.3359	–1.10	–0.0389	–1.30	–0.1496	–0.65
(Year 3)	36	20	0.1211	1.61	–0.2149	–0.69	–0.0535	–1.33	–0.2030	–0.87

Note: AAR = Market-adjusted average abnormal return, **CAR** = Cumulative average abnormal return. The student t-statistic (t-stat) was calculated for the AAR of each month using $(AAR_t/SD_t) \times \sqrt{n_t}$ where SD $_t$ is the cross-sectional standard deviation of abnormal returns for month t, and n $_t$ is the number of firms trading in month t. The t-statistic (t-stat) for the each month CAR was calculated following Ritter (1991) as $CAR_{1,t}$ x (n $_t$)$^{0.5}$/CSD $_t$ where CSD $_t$ is the cross-sectional standard deviation of cumulative abnormal returns in month t and calculated as CSD $_t$ = [t x VAR + 2 x COV x (t – 1)]$^{0.5}$ where, VAR is the mean cross-sectional variance of abnormal returns over 36 months, and COV is the first-order autocovariance of the average abnormal return (AAR $_t$) series. The calculated equally and weighted VAR values are 0.052768 (22.97% squared) and 0.031031 (17.62% squared) respectively, and equally and weighted COV values are 0.000477 (autocorrelation coefficient 0.2261) and –0.000451 (autocorrelation coefficient –0.2115) respectively, [a] statistically significant at 1% level, [b] statistically significant at 5% level, [c] statistically significant at 10% level.

Table 5.5 shows the EW and VW CARs and their t-statistics. Unlike the results of the resources and industrial sectors, the consumer discretionary and staples industry have negative values for EW average CARs for all the months of seasoning. This shows that the sample IPOs in this sector underperformed based on the EW method for the entire post-listing period considered in this analysis. The highest underperformance level, 51.77%, can be observed at 27 months, whereas the lowest, 4.5%, is in month one. This sector's IPOs underperformed by 33.91% at 12 months, 45.39% at 24 months and 21.49% at 36 months, and these values are statistically significant at 5% and 10% levels. In addition, most of the EW average CARs from months three to 28 are statistically significant.

According to the VW CARs, IPOs in the consumer discretionary and staples industry underperformed in the long run because the VW CARs have negative values for all months of seasoning. The calculated VW average CARs for months 12, 24 and 36 are –17.02%, –27.43% and –20.30% respectively and they are not statistically significant. Statistically significant VW CARs were only found in months 18 and 28. The underperformance levels based on the VW method in months 12 and 24 are much smaller than under the EW method because, during this period, the larger companies in this sector did not perform well compared with the smaller companies. However, the underperformance levels under the VW and EW methods are more similar at 36 months of seasoning.

5.3.1.2.4 Information technology industry performance analysis

Table 5.6 shows both EW and VW AARs and CARs and their t-statistics for the information technology industry. Only 20 sample companies were considered for the long-run return analysis. Two companies were delisted before the three-year anniversary in the final sample of the information technology industry. Table 5.6 indicates that only 13 companies completed the three-year anniversary. Therefore, only 13 companies were considered for the three-year period. However, five companies in the final sample were unable to complete their three-year anniversary due to the listing years.

Table 5.6: Equally Weighted (EW) and Value-Weighted (VW) Market-Adjusted Average Abnormal Returns (AARs) and Cumulative Average Abnormal Returns (CARs) for the Information Technology Industry

Months of seasoning		Number of firms trading	Equally weighted (EW)				Value-weighted (VW)			
			AAR_t	t-stat	$CAR_{1,t}$	t-stat	AAR_t	t-stat	$CAR_{1,t}$	t-stat
	1	20	–0.0190	–0.83	–0.0190	–0.35	0.0321	2.41[b]	0.0321	0.99
	2	20	–0.0206	–0.59	–0.0396	–0.52	0.0771	3.12[a]	0.1093	2.36[b]
	3	20	–0.0241	–0.53	–0.0637	–0.68	0.0986	3.60[a]	0.2078	3.66[a]
	4	20	0.0053	0.10	–0.0584	–0.54	0.0252	0.93	0.2330	3.55[a]
	5	20	–0.0076	–0.25	–0.0660	–0.55	0.0066	0.37	0.2397	3.27[a]
	6	20	–0.0508	–0.88	–0.1168	–0.88	0.0560	1.60	0.2957	3.68[a]
	7	20	–0.0259	–0.92	–0.1427	–1.00	0.0164	1.26	0.3121	3.59[a]
	8	20	–0.0500	–1.13	–0.1927	–1.26	–0.0670	–2.52[b]	0.2451	2.64[b]
	9	20	–0.0388	–1.50	–0.2315	–1.43	0.0063	0.46	0.2514	2.55[b]
	10	20	0.0604	0.40	–0.1711	–1.00	–0.0053	–0.15	0.2461	2.37[b]
	11	20	0.0321	0.39	–0.1390	–0.77	–0.0682	–1.86[c]	0.1779	1.63
(Year 1)	12	18	–0.0663	–1.78[c]	–0.2053	–1.04	0.0010	0.04	0.1790	1.49
	13	16	–0.0464	–1.41	–0.2517	–1.15	–0.0329	–1.39	0.1460	1.10
	14	16	0.0414	0.44	–0.2104	–0.93	–0.0435	–0.94	0.1025	0.75
	15	16	0.0033	0.09	–0.2071	–0.88	–0.0034	–0.20	0.0991	0.70
	16	16	0.0820	1.11	–0.1251	–0.52	–0.0181	–0.49	0.0810	0.55
	17	16	–0.0145	–0.28	–0.1396	–0.56	0.0543	1.92[c]	0.1353	0.89
	18	16	–0.0784	–1.74	–0.2180	–0.85	–0.0386	–1.62	0.0967	0.62
	19	16	–0.0063	–0.12	–0.2243	–0.85	–0.0039	–0.08	0.0928	0.58
	20	16	–0.0091	–0.10	–0.2334	–0.86	–0.0802	–1.45	0.0126	0.08
	21	16	–0.0755	–2.19[b]	–0.3090	–1.12	–0.0159	–0.63	–0.0033	–0.02
	22	16	0.0589	0.93	–0.2501	–0.88	0.0080	0.22	0.0047	0.03
	23	16	–0.0783	–1.50	–0.3284	–1.13	–0.0954	–3.62[a]	–0.0908	–0.51
(Year 2)	24	16	0.0092	0.19	–0.3192	–1.08	0.0511	1.14	–0.0397	–0.22
	25	15	0.0827	1.57	–0.2365	–0.76	0.0654	1.76[c]	0.0257	0.14
	26	15	–0.0565	–1.20	–0.2930	–0.92	–0.0175	–0.51	0.0081	0.04
	27	15	0.0209	0.35	–0.2721	–0.84	–0.0437	–0.82	–0.0355	–0.18
	28	14	0.0582	1.02	–0.2139	–0.63	0.0317	0.51	–0.0038	–0.02
	29	13	–0.1234	–2.51[b]	–0.3373	–0.93	–0.1175	–3.08[a]	–0.1213	–0.55

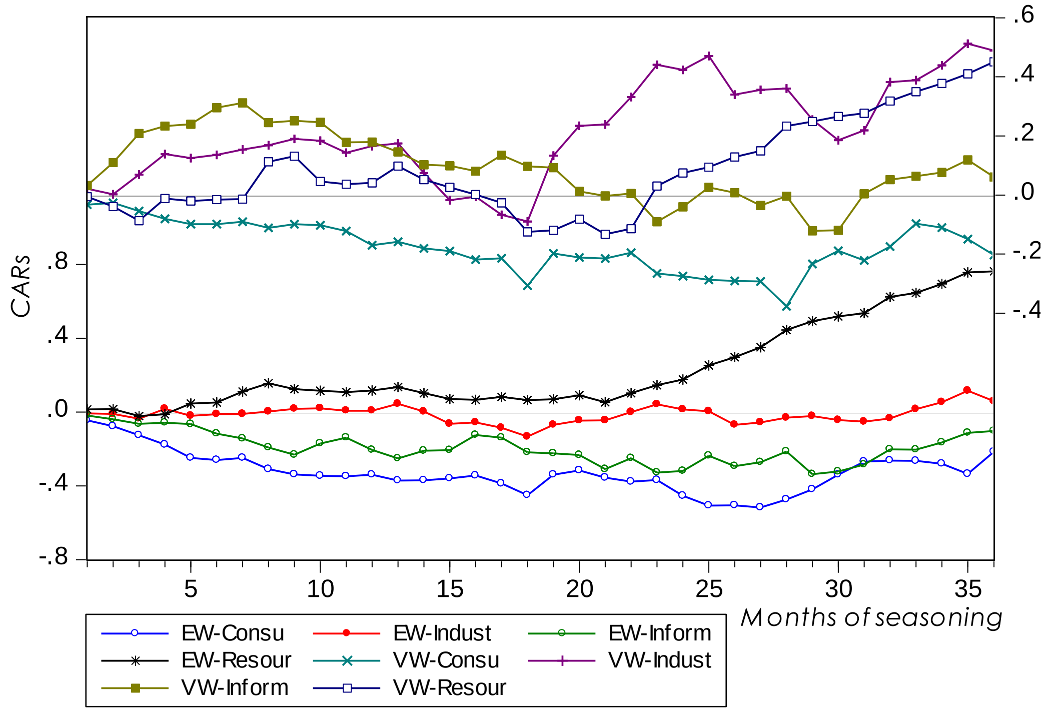
	30	13	0.0149	0.23	–0.3224	–0.88	0.0020	0.07	–0.1192	–0.53
	31	13	0.0377	0.54	–0.2847	–0.76	0.1232	2.43[b]	0.0039	0.02
	32	13	0.0829	1.30	–0.2018	–0.53	0.0484	0.80	0.0524	0.23
	33	13	–0.0014	–0.04	–0.2032	–0.53	0.0111	0.34	0.0634	0.27
	34	13	0.0376	0.67	–0.1656	–0.42	0.0125	0.28	0.0759	0.32
	35	13	0.0525	0.76	–0.1131	–0.29	0.0431	0.73	0.1190	0.49
(Year 3)	36	13	0.0108	0.17	–0.1023	–0.25	–0.0581	–1.67	0.0610	0.25

Note: AAR = Market-adjusted average abnormal return, **CAR** = Cumulative average abnormal return. The student t-statistic (t-stat) was calculated for the AAR of each month using $(AAR_t/SD_t) \times \sqrt{n_t}$ where SD_t is the cross-sectional standard deviation of abnormal returns for month t, and n_t is the number of firms trading in month t. The t-statistic (t-stat) for each month's CAR was calculated following Ritter (1991) as $CAR_{1,t}$ x $(n_t)^{0.5}/CSD_t$ where CSD_t is the cross-sectional standard deviation of cumulative abnormal returns in month t and calculated as $CSD_t = [t \text{ x } VAR + 2 \text{ x } COV \text{ x } (t-1)]^{0.5}$ where VAR is the mean cross-sectional variance of abnormal returns over 36 months, and COV is the first-order autocovariance of the average abnormal return (AAR_t) series. The calculated equally and weighted VAR values are 0.059077 (24.31% squared) and 0.021078 (14.52% squared) respectively, and equally and weighted COV values are –0.000315 (autocorrelation coefficient –0.1202) and 0.000278 (autocorrelation coefficient 0.0990) respectively, [a] statistically significant at 1% level, [b] statistically significant at 5% level, [c] statistically significant at 10% level.

The EW and VW CARs and their associated t-statistics are reported in Table 5.6. The EW average CARs for all months of seasoning have negative signs. These negative signs indicate that the information technology industry IPOs underperformed in the long run. The average CARs for months 12, 24 and 36 are –20.53%, –31.92% and –10.23% respectively and are not statistically significant. The underperformance level based on the EW scheme at 36 months is lower than at months 12 and 24. All calculated EW average CARs are statistically insignificant.

The VW CARs in Table 5.6 show that the information technology sector overperformed by 17.9% at month 12, underperformed by 3.9% at month 24 and overperformed by 6.1% at month 36. These results indicate mixed performance in the long run compared with the EW scheme and CAR values (positive and negative) are not statistically significant. This mix performance may indicate that larger IPOs in the information technology industry performed well in the long run.

Figure 5.2 provides an overview of both EW and VW CARs over the 36 months of seasoning. The left bottom vertical axis is related to the EW CARs and the right top axis is linked with the VW CARs. The plot clearly shows that IPOs in the consumer discretionary and staples and information technology sectors underperformed in the long run on the EW method because the value of CARs in these industries is below the zero line over 36 months of seasoning. However, the resource sector IPOs outperformed on the EW CARs compared with these sectors. The industrial sector IPOs show a mixed performance because their CARs movement is along the zero line. Under the VW method, only the consumer discretionary and staples sector IPOs underperformed over the 36-month period compared with all the other sectors. At the end of three years, the industrial sector overperformance level on the value weight scheme is much higher than that of the information technology and resource sectors.



Note: the left bottom vertical axis is related to the equally weighted CARs and the right top axis is related to the value-weighted CARs.

Figure 5.2: Equally and Value-Weighted (EW & VW) CARs for the Industries

5.3.1.3 Long-run performance by issue year

This section examines whether the long-run performance varies between issue years. Previous researchers have identified that the issue year is an important factor when analysing the long-run market performance of IPOs. Therefore, this section presents an analysis of the long-run market performance of IPOs based on issue year. The analysis of the long-run market performance of the IPOs is presented separately for issue years 2006, 2007 and 2008.

5.3.1.3.1 Performance of issue year 2006

Table 5.7 reports the estimated average value of both EW and VW AARs and CARs for issue year 2006. In this analysis, two companies were excluded from the original issue-year sample (69 IPOs) due to incompleteness of data. Therefore, initially only 67 IPO companies were considered for the long-run analysis under issue year 2006. However, due to the delisting of sample IPOs, Table 5.7 reports that the number of companies who completed the three-year anniversary is lower than the total number of companies considered for the analysis. From the final sample, two companies were delisted before the three-year anniversary. Finally, Table 5.7 shows that only 65 sample companies completed 36 months.

Table 5.7: Equally Weighted (EW) and Value-Weighted (VW) Market-Adjusted Average Abnormal Returns (AARs) and Cumulative Average Abnormal Returns (CARs) for Issue Year 2006

Months of seasoning	Number of firms trading	Equally weighted (EW)				Value-weighted (VW)			
		AAR_t	t-stat	$CAR_{1,t}$	t-stat	AAR_t	t-stat	$CAR_{1,t}$	t-stat
1	67	0.0180	0.95	0.0180	0.53	0.0213	2.75[a]	0.0213	0.94
2	67	0.0369	1.33	0.0549	1.14	0.0145	1.26	0.0358	1.10
3	67	–0.0174	–0.77	0.0375	0.63	0.0068	0.46	0.0426	1.06
4	67	0.0404	1.60	0.0779	1.14	0.0177	1.29	0.0603	1.30
5	67	0.0769	2.48[b]	0.1547	2.02[b]	0.0018	0.13	0.0621	1.20
6	67	0.0207	0.60	0.1754	2.09[b]	0.0220	1.27	0.0841	1.48
7	67	0.1307	1.54	0.3061	3.37[a]	0.0044	0.17	0.0885	1.44
8	67	0.0550	1.80[c]	0.3611	3.72[a]	–0.0217	–1.53	0.0668	1.02
9	67	–0.0205	–0.83	0.3407	3.31[a]	0.0153	1.30	0.0821	1.18
10	67	0.0123	0.43	0.3530	3.25	–0.0152	–1.09	0.0669	0.91
11	67	0.0255	0.83	0.3785	3.32[a]	–0.0557	–3.72[a]	0.0112	0.15
(Year 1) 12	67	0.0010	0.04	0.3795	3.19[a]	–0.0115	–0.96	–0.0003	0.00
13	67	–0.0268	–1.23	0.3526	2.85[a]	0.0001	0.01	–0.0001	0.00
14	67	–0.0654	–3.42[a]	0.2872	2.23[b]	–0.0351	–3.52[a]	–0.0353	–0.41
15	67	–0.0481	–2.07[b]	0.2391	1.80[c]	–0.0401	–3.11[a]	–0.0754	–0.84
16	67	–0.0024	–0.11	0.2367	1.72[c]	–0.0804	–4.80[a]	–0.1558	–1.67[c]
17	67	–0.0063	–0.21	0.2304	1.63	0.0963	4.37[a]	–0.0595	–0.62
18	67	–0.0679	–3.43[a]	0.1626	1.12	–0.0414	–2.92[a]	–0.1010	–1.02
19	67	–0.0108	–0.33	0.1518	1.01	–0.0587	–2.10[b]	–0.1597	–1.57
20	67	–0.0007	–0.02	0.1510	0.98	0.0073	0.38	–0.1524	–1.46
21	67	–0.0917	–4.23[a]	0.0593	0.38	–0.0602	–4.66[a]	–0.2126	–1.99[c]
22	67	–0.0376	–1.26	0.0218	0.14	0.0777	3.18[a]	–0.1348	–1.23
23	67	–0.0276	–0.84	–0.0058	–0.04	0.0546	2.36[b]	–0.0802	–0.72
(Year 2) 24	67	–0.0478	–1.56	–0.0536	–0.32	0.0091	0.39	–0.0712	–0.62
25	67	0.0152	0.47	–0.0385	–0.22	0.0664	3.28[a]	–0.0047	–0.04
26	67	–0.0469	–1.60	–0.0854	–0.49	–0.0921	–4.61[a]	–0.0968	–0.81
27	66	0.0092	0.25	–0.0762	–0.42	–0.0400	–1.40	–0.1367	–1.12
28	66	0.0843	1.89[c]	0.0082	0.04	–0.0516	–1.49	–0.1884	–1.52
29	66	0.0374	0.89	0.0455	0.24	–0.0779	–2.02[b]	–0.2662	–2.11[b]
30	66	0.0497	1.28	0.0952	0.50	–0.0449	–1.61	–0.3111	–2.42[b]
31	65	0.0665	1.37	0.1617	0.83	0.0175	0.56	–0.2936	–2.23[b]
32	65	0.1048	2.28[b]	0.2665	1.35	0.2170	4.20[a]	–0.0766	–0.57
33	65	0.0204	0.73	0.2869	1.43	0.1179	5.56[a]	0.0412	0.30
34	65	0.0454	1.26	0.3323	1.63	0.0372	1.25	0.0784	0.57

	35	65	0.0836	2.35[b]	0.4159	2.01[b]	0.0564	1.92[c]	0.1348	0.96
(Year 3)	36	65	0.0023	0.06	0.4181	2.00[b]	–0.0501	–2.12[b]	0.0847	0.60

Note: AAR = Market-adjusted average abnormal return, **CAR** = Cumulative average abnormal return. The student t-statistic (t-stat) was calculated for the AAR of each month using $(AAR_t/SD_t) \times \sqrt{n_t}$ where SD $_t$ is the cross-sectional standard deviation of abnormal returns for month t, and n $_t$ is the number of firms trading in month t. The t-statistic (t-stat) for each month's CAR was calculated following Ritter (1991) as $CAR_{1,t}$ x (n $_t$)$^{0.5}$/CSD $_t$ where CSD $_t$ is the cross-sectional standard deviation of cumulative abnormal returns in month t and calculated as CSD $_t$ = [t x VAR + 2 x COV x (t – 1)]$^{0.5}$ where VAR is the mean cross-sectional variance of abnormal returns over 36 months, and COV is the first-order autocovariance of the average abnormal return (AAR $_t$) series. The calculated equally and weighted VAR values are 0.076885 (27.73% squared) and 0.034405 (18.55% squared) respectively, and equally and weighted COV values are 0.001182 (autocorrelation coefficient 0.4614) and 0.001023 (autocorrelation coefficient 0.2671) respectively, [**a**] statistically significant at 1% level, [b] statistically significant at 5% level, [c] statistically significant at 10% level.

The EW CARs in Table 5.7 show that the issued IPOs in 2006 overperformed by 37.95% at 12 months of seasoning, which is statistically significant at the 1% level. However, at 24 months of seasoning, IPOs underperformed by 5.36% and this is not statistically significant at any level. At 36 months of seasoning, IPOs overperformed by 41.81%, which is statistically significant at the 5% level. The analysis shows a mixed long-run performance of issued IPOs in 2006. The calculated CARs from five to 16 months of seasoning are statistically significant.

The VW CARs also show that the issued sample IPOs in 2006 underperformed by 0.03% and 7.12% at 12 and 24 months of seasoning respectively and are not statistically significant. Although they underperformed at 12 and 24 months of seasoning, the issued IPOs overperformed by 8.47% at 36 months of seasoning, which is also not statistically significant. However, both weighting schemes show that the issued IPOs underperformed at the end of the second post-listing year and overperformed at the end of the third post-listing year.

5.3.1.3.2 Performance of issue year 2007

Issue year 2007 is identified as the hot issue period based on the highest average first-day return and volume compared with the other issue years, discussed in Section 4.3.1. Table 5.8 shows the EW and VW AARs and CARs and related t-statistics for issue year 2007. In the final sample, two companies from the original sample (96 IPOs) were excluded due to incompleteness of data. Therefore, only 94 sample companies were considered for the long-run market analysis, and then another three sample companies were delisted before the three-year anniversary. Table 5.8 shows that the long-run performance measures for the three-year period were calculated for only 91 sample companies.

Table 5.8: Equally Weighted (EW) and Value-Weighted (VW) Market-Adjusted Average Abnormal Returns (AARs) and Cumulative Average Abnormal Returns (CARs) for Issue Year 2007

Months of seasoning	Number of firms trading	Equally weighted (EW)				Value-weighted (VW)			
		AAR_t	t-stat	$CAR_{1,t}$	t-stat	AAR_t	t-stat	$CAR_{1,t}$	t-stat
1	94	0.0017	0.10	0.0017	0.06	0.0001	0.01	0.0001	0.00
2	94	–0.0134	–0.73	–0.0117	–0.27	0.0162	1.27	0.0163	0.47
3	94	–0.0592	–3.51[a]	–0.0708	–1.35	–0.0302	–2.40[b]	–0.0139	–0.33
4	94	0.0030	0.15	–0.0678	–1.12	0.0445	2.34[b]	0.0306	0.62
5	94	0.0004	0.02	–0.0674	–0.99	–0.0095	–0.43	0.0211	0.38
6	94	–0.0091	–0.42	–0.0765	–1.03	–0.0455	–2.64[a]	–0.0244	–0.40
7	94	0.0191	0.76	–0.0574	–0.71	0.0538	3.67[a]	0.0294	0.45
8	94	–0.0566	–3.15[a]	–0.1140	–1.32	–0.0578	–4.15[a]	–0.0284	–0.41
9	94	–0.0325	–1.64	–0.1464	–1.60	–0.0127	–0.50	–0.0411	–0.56
10	94	–0.0729	–3.15[a]	–0.2193	–2.28[b]	–0.0273	–1.70[c]	–0.0685	–0.88
11	94	–0.0124	–0.42	–0.2317	–2.29[b]	–0.0507	–2.80[a]	–0.1192	–1.46
(Year 1) 12	94	–0.0024	–0.07	–0.2341	–2.22[b]	–0.0412	–1.64[c]	–0.1603	–1.87[c]
13	93	0.0682	1.48	–0.1659	–1.50	0.0146	0.49	–0.1457	–1.63
14	93	–0.0139	–0.54	–0.1798	–1.57	–0.1226	–4.90[a]	–0.2682	–2.89[a]
15	92	–0.0394	–1.52	–0.2192	–1.84[c]	–0.1032	–3.80[a]	–0.3715	–3.84[a]
16	92	0.0010	0.03	–0.2182	–1.77[c]	0.0469	1.42	–0.3246	–3.25[a]
17	92	–0.0065	–0.25	–0.2247	–1.77[c]	–0.0724	–3.02[a]	–0.3970	–3.86[a]
18	92	0.0296	0.97	–0.1951	–1.49	–0.0217	–0.74	–0.4188	–3.95[a]
19	92	0.0441	1.28	–0.1510	–1.13	0.2985	4.73[a]	–0.1203	–1.10
20	92	0.0381	1.26	–0.1129	–0.82	0.1309	4.67[a]	0.0106	0.10
21	92	–0.0050	–0.13	–0.1179	–0.84	0.0211	0.94	0.0317	0.28
22	92	0.1273	2.53[b]	0.0094	0.07	0.0202	0.68	0.0519	0.44
23	92	0.1073	3.59[a]	0.1167	0.79	0.1661	5.55[a]	0.2180	1.82[a]
(Year 2) 24	92	0.0423	1.45	0.1590	1.05	0.0435	1.84[c]	0.2615	2.14[b]
25	92	0.0451	1.45	0.2041	1.33	0.0735	4.03[a]	0.3351	2.68[a]
26	92	0.0274	0.73	0.2315	1.48	–0.0691	–4.03[a]	0.2660	2.09[b]
27	91	0.0171	0.57	0.2486	1.55	0.0567	2.43[b]	0.3227	2.47[b]
28	91	0.0788	2.75[a]	0.3273	2.00[b]	0.0659	3.90[a]	0.3886	2.92[a]
29	91	0.0083	0.25	0.3357	2.01[b]	–0.0343	–1.75[c]	0.3543	2.62[b]
30	91	0.0056	0.20	0.3413	2.01[b]	–0.0269	–1.62	0.3274	2.38[b]
31	91	–0.0199	–0.90	0.3214	1.86[c]	0.0501	2.91[a]	0.3775	2.70[a]
32	91	0.0515	2.04[b]	0.3729	2.13[b]	0.0251	1.42	0.4026	2.83[a]
33	91	0.0126	0.55	0.3856	2.17[b]	–0.0738	–3.18[a]	0.3288	2.28[b]
34	91	0.0530	0.81	0.4385	2.43[b]	0.0374	0.94	0.3662	2.50[b]

	35	91	0.0510	1.82[c]	0.4895	2.67[a]	0.0614	3.49[a]	0.4276	2.88[a]
(Year 3)	36	91	0.0052	0.21	0.4947	2.66[a]	0.0071	0.50	0.4347	2.88[a]

Note: AAR = Market-adjusted average abnormal return, **CAR** = Cumulative average abnormal return. The student t-statistic (t-stat) was calculated for the AAR of each month using $(AAR_t/SD_t) \times \sqrt{n_t}$ where SD $_t$ is the cross-sectional standard deviation of abnormal returns for month t, and n $_t$ is the number of firms trading in month t. The t-statistic (t-stat) for the each month CAR was calculated following Ritter (1991) as $CAR_{1,t}$ x (n $_t$)$^{0.5}$/CSD $_t$ where CSD $_t$ is the cross-sectional standard deviation of cumulative abnormal returns in month t and calculated as CSD $_t$ = [t x VAR + 2 x COV x (t – 1)]$^{0.5}$ where VAR is the mean cross-sectional variance of abnormal returns over 36 months, and COV is the first-order autocovariance of the average abnormal return (AAR $_t$) series. The calculated equally and weighted VAR values are 0.085737 (29.28% squared) and 0.055399 (23.54% squared) respectively, and equally and weighted COV values are 0.000741 (autocorrelation coefficient 0.3974) and 0.001041 (autocorrelation coefficient 0.1693) respectively, [a] statistically significant at 1% level, [b] statistically significant at 5% level, [c] statistically significant at 10% level.

The EW CARs in Table 5.8 indicate that issued IPOs in 2007 underperformed by 23.41% at 12 months of seasoning. This underperformance is statistically significant at the 5% level. At 24 months of seasoning, the IPOs overperformed by 15.9%, which is not statistically significant. The statistically significant overperformance can be found at 36 months of seasoning. In this period, IPOs overperformed by 49.37%, which is statistically significant at the 1% level. Although the year 2007 is identified as a hot issue period, statistically significant poor long-run performance (underperformance) was found after 12 months of listing.

The VW CARs in Table 5.8 show that issued IPOs in 2007 underperformed by 16.03% at 12 months of seasoning and overperformed by 26.15% and 43.47% at 24 and 36 months of seasoning respectively. The underperformance level in the 12-month period is statistically significant at 10%, whereas the overperformance levels in months 24 and 36 are statistically significant at 5% and 1%. Compared with the EW scheme, the level of overperformance is much higher at 24 months of seasoning and lower at 36 months of seasoning. This shows that the larger companies in issue year 2007 performed well at 24 months and less well at 36 months of seasoning. The underperformance level at 12 months of seasoning is also lower compared with the level for the EW method.

5.3.1.3.3 Performance of issue year 2008

Table 5.9 shows the calculated EW and VW long-run market performance measures based on the abnormal returns for issue year 2008. Nineteen IPOs were considered for the long-run analysis. None of the sample companies were delisted before the three-year anniversary. Table 5.9 indicates that only 16 out of 19 IPOs completed their three-year anniversary (36 months of seasoning). This shows that three companies did not complete their three- year anniversary (36 months).

Table 5.9: Equally Weighted (EW) and Value-Weighted (VW) Market-Adjusted Average Abnormal Returns (AARs) and Cumulative Average Abnormal Returns (CARs) for Issue Year 2008

Months of seasoning		Number of firms trading	Equally weighted (EW) AAR $_t$	t-stat	$CAR_{1,t}$	t-stat	Value-weighted (VW) AAR $_t$	t-stat	$CAR_{1,t}$	t-stat
	1	19	–0.0692	–2.69[b]	–0.0692	–1.04	–0.1252	–4.88[a]	–0.1252	–1.99[c]
	2	19	–0.0815	–1.10	–0.1506	–1.59	–0.1730	–3.26[a]	–0.2982	–3.32[a]
	3	19	–0.0671	–1.25	–0.2177	–1.88[c]	–0.1423	–2.86[a]	–0.4405	–4.00[a]
	4	19	–0.0550	–1.50	–0.2727	–2.04[c]	–0.0970	–3.89[a]	–0.5374	–4.22[a]
	5	19	–0.0663	–1.01	–0.3390	–2.27[b]	–0.0380	–0.55	–0.5754	–4.04[a]
	6	19	0.0118	0.25	–0.3272	–2.00[c]	0.0644	1.44	–0.5110	–3.27[a]
	7	19	–0.0933	–0.95	–0.4204	–2.38[b]	–0.1021	–1.62	–0.6131	–3.63[a]
	8	19	0.2698	1.74[c]	–0.1506	–0.80	0.8516	3.42[a]	0.2384	1.32
	9	19	0.0338	0.57	–0.1168	–0.58	0.0734	1.21	0.3118	1.63
	10	19	0.0901	1.15	–0.0267	–0.13	0.1895	1.93[c]	0.5013	2.48[b]
	11	19	–0.0060	–0.13	–0.0328	–0.15	–0.0343	–1.11	0.4670	2.21[b]
(Year 1)	12	19	0.1146	1.23	0.0819	0.35	0.1048	1.57	0.5719	2.59[b]
	13	19	0.0173	0.43	0.0992	0.41	0.0954	2.10[b]	0.6673	2.90[a]
	14	19	0.1164	1.26	0.2156	0.86	0.1052	1.84[c]	0.7725	3.23[a]
	15	19	–0.0163	–0.38	0.1993	0.77	–0.0075	–0.36	0.7650	3.09[a]
	16	19	0.1158	1.32	0.3151	1.18	0.0616	1.26	0.8266	3.23[a]
	17	19	0.0768	1.34	0.3919	1.42	–0.0236	–0.57	0.8030	3.05[a]
	18	19	–0.1140	–2.20[b]	0.2779	0.98	–0.1483	–3.12[a]	0.6547	2.42[b]
	19	19	0.0528	0.72	0.3307	1.13	0.0313	0.72	0.6859	2.46[b]
	20	19	–0.0792	–1.56	0.2515	0.84	–0.0689	–2.23[b]	0.6170	2.16[b]
	21	19	–0.0019	–0.05	0.2496	0.81	–0.0367	–1.75[c]	0.5803	1.98[c]
	22	19	–0.0132	–0.36	0.2364	0.75	0.0319	1.25	0.6122	2.04[c]
	23	19	–0.0525	–1.92[c]	0.1839	0.57	–0.0519	–2.89[a]	0.5603	1.83[c]
(Year 2)	24	19	–0.0161	–0.42	0.1678	0.51	0.0103	0.36	0.5706	1.82[c]
	25	19	0.1320	1.72[c]	0.2998	0.90	–0.0103	–0.19	0.5603	1.75[c]
	26	19	0.0867	1.13	0.3865	1.13	0.1662	2.15[b]	0.7265	2.23[b]
	27	19	0.1828	1.56	0.5693	1.64	0.0995	1.17	0.8260	2.49[b]
	28	19	0.0095	0.15	0.5788	1.63	0.0442	0.94	0.8703	2.57[b]
	29	18	0.0419	0.95	0.6207	1.68	0.0127	0.45	0.8830	2.50[b]
	30	18	0.0234	0.45	0.6441	1.71	0.0764	1.79[c]	0.9593	2.67[b]

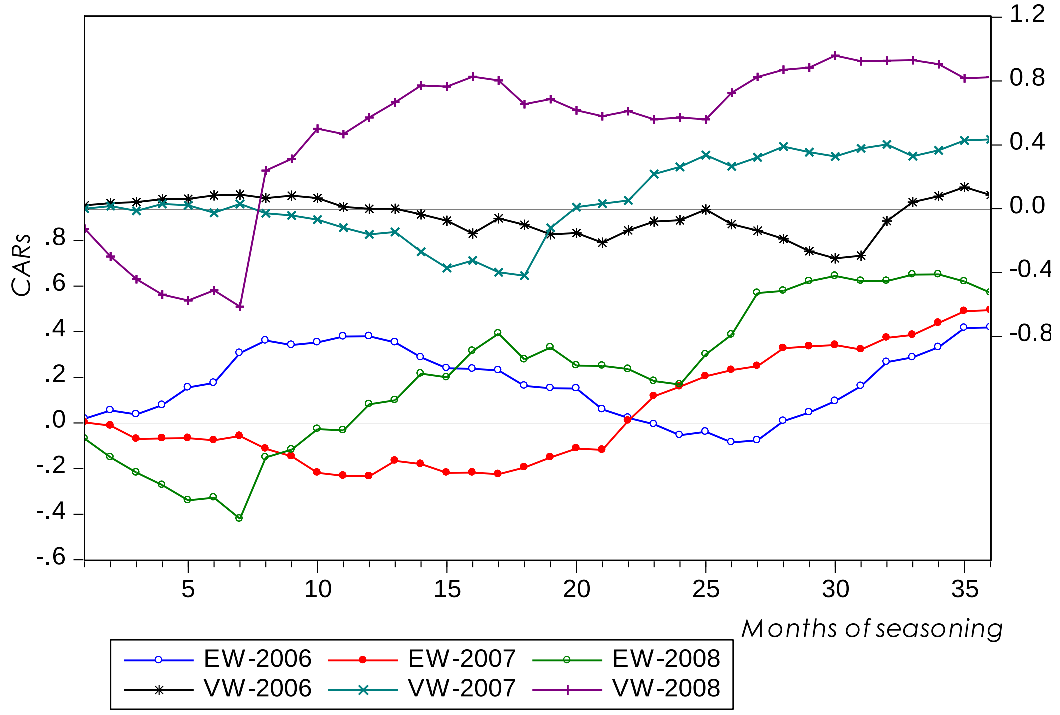
	31	18	–0.0217	–0.37	0.6224	1.63	–0.0354	–1.21	0.9239	2.53[b]
	32	18	–0.0010	–0.03	0.6214	1.60	0.0031	0.13	0.9270	2.50[b]
	33	18	0.0284	0.60	0.6498	1.65	0.0039	0.12	0.9309	2.47[b]
	34	17	0.0015	0.02	0.6513	1.58	–0.0256	–0.62	0.9053	2.30[b]
	35	16	–0.0323	–0.49	0.6190	1.43	–0.0876	–2.01[c]	0.8177	1.98[c]
(Year 3)	36	16	–0.0486	–1.44	0.5704	1.30	0.0064	0.29	0.8241	1.97[c]

Note: **AAR** = Market-adjusted average abnormal return, **CAR** = Cumulative average abnormal return. The student t-statistic (t-stat) was calculated for the AAR of each month using $(AAR_t/SD_t) \times \sqrt{n_t}$ where SD $_t$ is the cross-sectional standard deviation of abnormal returns for month t, and n $_t$ is the number of firms trading in month t. The t-statistic (t-stat) for the each month CAR was calculated following Ritter (1991) as $CAR_{1,t}$ x $(n_t)^{0.5}$/CSD $_t$ where CSD $_t$ is the cross-sectional standard deviation of cumulative abnormal returns in month t and calculated as CSD $_t$ = $[t$ x VAR + 2 x COV x $(t – 1)]^{0.5}$ where, VAR is the mean cross-sectional variance of abnormal returns over 36 months, and COV is the first-order autocovariance of the average abnormal return (AAR $_t$) series. The calculated equally and weighted VAR values are 0.084431 (29.06% squared) and 0.075143 (27.41% squared) respectively, and equally and weighted COV values are 0.000348 (autocorrelation coefficient 0.0515) and 0.001274 (autocorrelation coefficient 0.0468) respectively, [a] statistically significant at 1% level, [b] statistically significant at 5% level, [c] statistically significant at 10% level.

Table 5.9 shows both EW and VW CARs and their associated t-statistics. The EW average CARs for months 12, 24 and 36 are 8.19%, 16.78% and 57.04% respectively, which indicates that the issued IPOs in 2008 overperformed in the long run. The overperformance level drastically increased from 12 to 36 months of seasoning and none of these levels was statistically significant at any level. Negative mean CARs were found only from month one to 11, which indicates that sample IPOs slightly underperformed in these periods.

The VW average CARs show that issued IPOs in 2008 overperformed at 12, 24 and 36 months of seasoning by 57.19%, 57.06% and 82.41% respectively. This finding indicates that issued IPOs in 2008 overperformed in the long run. The overperformance level at 12 months is statistically significant at the 5% level and the other periods are significant at 10%. In comparison with the EW method, the calculated CARs (overperformance levels) are much higher and most of the values are statistically significant. This indicates that the larger IPOs issued in 2008 perform well compared with the smaller IPOs. Statistically significant negative VW CARs can be found only in months 1 to 7, which shows that issued IPOs have underperformed during this period.

Figure 5.3 shows the overall behaviour of the issue-year-based CARs calculated on EW and VW bases over 36 months of seasoning. The left bottom vertical axis shows the EW CARs and the right top vertical axis indicates the VW CARs. The chart clearly shows that issued IPOs in 2006, 2007 and 2008 overperformed up to the three-year period in both weighting schemes. In EW CARs, the issued IPOs in 2007 and 2008 underperformed in the early months of seasoning and overperformed in the later months. In comparison with the issued IPOs in 2007 and 2008, IPOs in 2006 overperformed in the early months of seasoning. Although issued IPOs in 2008 underperformed in the early periods, this shows that the highest overperformance levels in both weighting methods are in the late months of seasoning. In the latter part of the period, the issued IPOs in 2006 did not perform well.



Note: The left bottom vertical axis relates to the equally weighted CARs and the right top axis relates to the value-weighted CARs.

Figure 5.3: Equally and Value-Weighted (EW & VW) CARs for the Issue Years

5.3.2 Buy-and-Hold Average Returns (BHRs)

This section examines the second measure of the long-run market performance: BHRs. The buy-and-hold method assumes that investors hold their investment for three years. These returns were calculated as raw BHRs. The BHRs were not adjusted for market benchmark returns. The BHRs of the companies were estimated at the earlier of the delisting date or the end of the three-year anniversary. This indicates that the BHR includes both the delisting company returns and the existing company returns. The BHRs were calculated using the EW and VW methods. Due to the high positive skewness[15] of the distribution of BHRs, the t-statistics were calculated using the bootstrapped skewness-adjusted method of Lyon, Barber and Tsai (1999). The conventional t-statistics (student t-statistics) are also given with the bootstrapped skewness-adjusted t-statistics for comparison. The EW and VW BHRs for the one-, two- and three-year holding periods with t-statistics by full sample, industry and issue

[15] All BHRs for one-, two- and three-year holding periods are positively skewed with a value of 3.38, 5.06 and 2.50 respectively. These skewness values are indicated in the summary statistics table (Table 5.1) for the long-run measures.

year are given in Panel A, Panel B and Panel C in Table 5.10. The calculated monthly BHRs (from months one to 36) for the full sample, industries and issue years are also reported in Appendices 8 to 15. The evaluation of long-run market performance based on BHRs is presented by full sample, industry and issue year.

Table 5.10: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Returns (BHRs) for the Full Sample, Industry and Issue Year

Sample classification	**Equal-weighted BHRs**			**Value-weighted BHRs**		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Panel A: by full sample						
All sample companies	–0.0235	–0.3215	–0.3640	0.1530	–0.1163	–0.2512
Bootstrapped skew-adjusted t-statistics	–0.31	–2.02[b]	–4.06[a]	6.12[a]	–1.37	–3.43[a]
Conventional t-statistics	–0.36	–4.99[a]	–7.35[a]	3.5[a]	–1.57	–5.73[a]
Number of companies	242	202	185	242	202	185
Panel B: by industry						
Resources	0.0416	–0.3325	–0.3261	0.2873	–0.2192	–0.2729
Bootstrapped skew-adjusted t-statistics	0.48	–2.27[b]	–2.63[a]	3.09[a]	–1.65[c]	–0.71
Conventional t-statistics	0.42	–4.42[a]	–4.49[a]	2.66[a]	–3.37[a]	–4.81[a]
Number of companies	135	111	100	135	111	100
Industrials	0.0826	–0.0987	–0.3648	0.1975	–0.0541	–0.3875
Bootstrapped skew-adjusted t-statistics	0.59	–0.26	–2.08[b]	5.21[a]	–0.11	–1.95[c]
Conventional t-statistics	0.50	–0.40	–3.33[a]	2.14[b]	–0.22	–3.63[a]
Number of companies	45	38	38	45	38	38
Consumer discretionary/staples	–0.3041	–0.5055	–0.4752	–0.1065	–0.3773	–0.3851
Bootstrapped skew-adjusted t-statistics	–3.52[a]	–3.89[a]	–2.64[b]	–2.12[b]	–4.83[a]	–2.80[b]
Conventional t-statistics	–4.09[a]	–6.43[a]	–4.33[a]	–1.75[c]	–4.73[a]	–3.85[a]
Number of companies	31	25	22	31	25	22
Information technology	–0.2209	–0.5021	–0.4010	0.2010	–0.1106	–0.3201
Bootstrapped skew-adjusted t-statistics	–1.38	–3.28[a]	–1.63	0.68	–1.16	–1.49
Conventional t-statistics	–1.61	–4.53[a]	–2.09[c]	2.00[c]	–0.94	–1.95[c]
Number of companies	18	17	14	18	17	14
Panel C: by issue year						
2006	0.6973	–0.1180	–0.3512	0.2842	0.0851	–0.1753
Bootstrapped skew-adjusted t-statistics	5.16[a]	–0.56	–3.12[a]	6.6[a]	0.61	–2.04[b]
Conventional t-statistics	3.81[a]	–0.71	–4.5[a]	2.58[b]	0.51	–2.2[b]
Number of companies	67	67	67	67	67	67
2007	–0.4559	–0.4627	–0.3908	–0.2405	–0.4830	–0.3772
Bootstrapped skew-adjusted t-statistics	–1.04	–1.59	–2.18[b]	–3.06[a]	–6.34[a]	–4.03[a]
Conventional t-statistics	–9.62[a]	–7.55[a]	–5.38[a]	–3.17[a]	–11.86[a]	–7.52[a]
Number of companies	94	94	94	94	94	94
2008	–0.3784	–0.3422	–0.0719	–0.2561	–0.1630	–0.0425
Bootstrapped skew-adjusted t-statistics	–3.55[a]	–2.90[a]	–0.38	–3.36[a]	–1.32	–0.27
Conventional t-statistics	–4.83[a]	–3.16[a]	–0.41	–3.12[a]	–1.25	–0.31
Number of companies	19	19	16	19	19	16

Note: BHR = Buy-and-hold average return, [a] statistically significant at 1% level, [b] statistically significant at 5% level, [c] statistically significant at 10% level.

5.3.2.1 Long-run performance by full sample

Appendix 8 shows that 249 sample IPO companies were initially considered for the analysis. However, Panel A in Table 5.10 shows that the number of companies used to analyse the performance in year three is 185, which includes 180 existing companies and five delisted companies. This shows that the number of companies who completed the three-year anniversary is less than the total number of companies initially considered for the analysis. The performance of 242 and 202 IPO companies were analysed in the year-one and year- two holding periods respectively.

Table 5.10 reveals that all sample IPO companies underperformed over the three-year period when the BHRs were calculated using the EW scheme. The underperformance levels of the full sample at one, two and three years for BHRs are –2.35%, –32.15% and –36.4% respectively. All underperformance levels are statistically significant at the 5% level except for year one. This finding supports the finding of Liu, Uchida and Gao (2012) that Chinese IPOs significantly underperformed on mean BHRs by –15.4%, –36%, –19.2% over years one, two and three respectively. When the VW scheme was used the one-year average BHRs were significantly positive, which indicates that IPOs overperformed in year one. However, two- and three-year BHR values are negative values: –11.63% and –25.12% respectively. Only the year-three value is statistically significant at the 1% level. The VW BHRs show that the larger IPOs that higher market capitalization (CAP) in the sample performed slightly well, particularly in year one.

Figure 5.4 shows that the VW BHRs in the long-run performance evaluation are much higher than the EW BHRs. When the VW BHRs were adopted for the long-run evaluation, the IPOs overperformed for the months of holding one to 14. Figure 5.4 clearly shows that the calculated BHRs are greater than 0 in holding periods one to 14, and after that, the IPOs underperformed because the BHR values are less than the zero. This clearly shows that the IPO investors earned less negative average returns compared with the EW levels in the long run. The figure shows that, when EW was used for the analysis, the IPOs underperformed in all periods except for in months of holding five to 11. The BHRs for both weighting methods show that IPOs in the full sample underperformed in months 15 to 36 of holding.

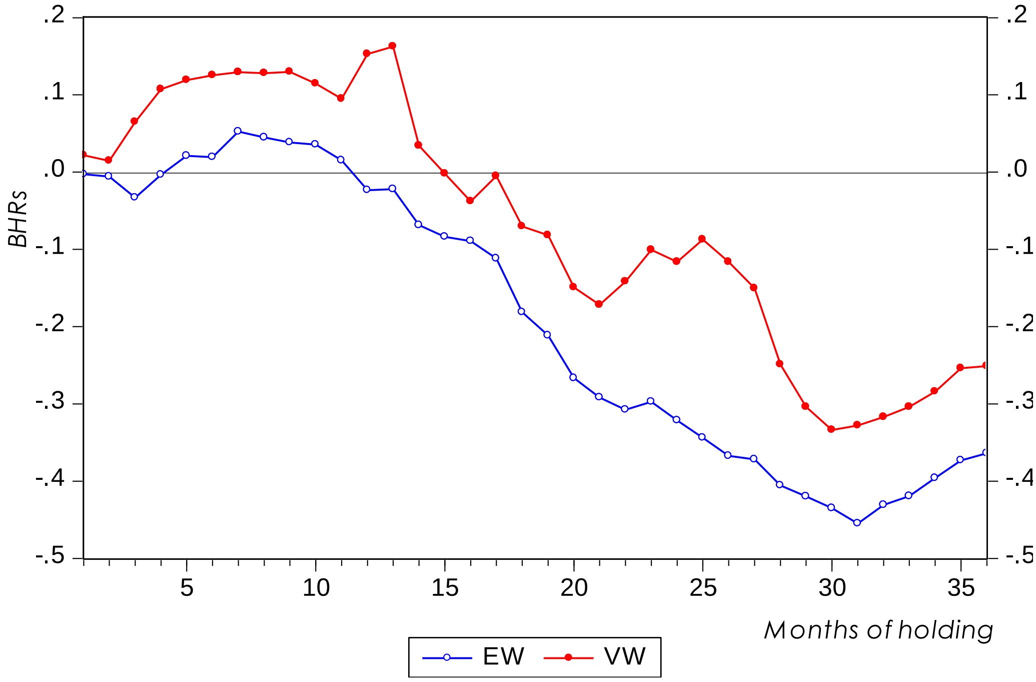


Figure 5.4: Equally and Value-Weighted (EW & VW) BHRs for the Full Sample

5.3.2.2 Long-run performance by industry

This section presents the analysis of the industry performance carried out with a view to identifying the long-run performance of each industry. The long-run performance of each industry may vary compared with the performance of the full sample. The calculated EW and VW BHRs for each industry with the t-statistics and number of IPOs are reported in Panel B of Table 5.10. In addition, Appendices 9 to 12 show industry-related monthly EW and VW BHRs with t-statistics over three years. The analysis of long-run market performance in different industries is discussed below.

5.3.2.2.1 Resources industry performance analysis

Panel B in Table 5.10 shows the calculated EW and VW BHRs with associated t-statistics for the resources industry. As shown in Appendix 9, 139 sample companies were initially considered for the analysis. However, as shown in Panel B, the number of companies used for the analysis in year one, year two and year three was 135, 111, and 100 respectively. In this sample period, 39 sample companies were unable to complete their three-year anniversary (36 months).

Panel B shows that the sampled resource sector companies overperformed in year one and underperformed in year two and three on both the EW and the VW schemes. The overperformance levels at one year on the EW and VW schemes are 4.16% and 28.73% respectively. Only the VW overperformance level is statistically significant at the 1% level. The EW overperformance level is much lower than that of the VW scheme. This confirms that larger IPOs that have a higher market CAP in the resource sector performed well compared with the smaller IPOs. In the second and third years, the underperformance levels using the EW method are –33.25% and –32.61% respectively, which are all statistically significant at the 5% level. The VW underperformance levels for years two and three are –21.92% and –27.29% respectively and only the two-year underperformance level is statistically significant at the 10% level. The EW underperformance levels at two years and three years are much higher than those of the VW schemes. EW mean BHRs marginally decreased and VW BHRs increased from the second year to the third year.

5.3.2.2.2 Industrial sector performance analysis

With respect to the industrial sector, 45 sample companies were initially considered for the analysis, which is shown in Appendix 10. All sample companies considered for the analysis in this sector had completed their first-year anniversary. However, as shown in Panel B in Table 5.10, only 38 sampled companies completed their second- and third-year anniversaries and were thus used for the analysis of the long-run market performance in year two and year three.

The calculated EW and VW BHRs in Table 5.10 explain that industrial IPOs overperformed in the first year and underperformed in the second and third years. The EW mean BHRs at one, two and three years are reported as 8.26%, –9.87% and –36.48% respectively. The three-year average BHR is statistically significant at the 5% level. The VW average one-, two- and three-year BHRs were found to be 19.75%, –5.41% and –38.75% respectively. The average BHRs at year one and three are statistically significant at the 1% and 10% levels respectively. Both EW and VW average BHRs indicate that the levels of underperformance (negative average BHRs) increased from year two to year three.

5.3.2.2.3 Consumer discretionary and staples industry performance analysis

For the consumer discretionary and staples industry, 31 IPO companies were initially considered for the long-run analysis (see Appendix 11). However, as shown in panel B in Table 5.10, the number of companies analysed in year one, year two and year three are 31, 25 and 22 respectively. This implies that only six and nine sample companies in this sector were unable to complete their second and third anniversaries respectively.

The EW average BHRs for the one-, two- and three-year holding periods are –30.41%, –50.55% and –47.52% respectively, and the VW mean BHRs for the one-, two- and three-year holding periods are –10.65%, –37.73% and –38.51% respectively. These negative BHRs indicate that the consumer discretionary and staples industry IPOs underperformed over the three-year period in both weighting schemes. The EW and VW average BHRs for the one-, two- and three-year holding periods are statistically significant at the 5% level. In comparison with the other sectors, the consumer discretionary and staples industry is the only sector that underperformed on both the EW and the VW schemes for the one-, two-, and three-year holding periods.

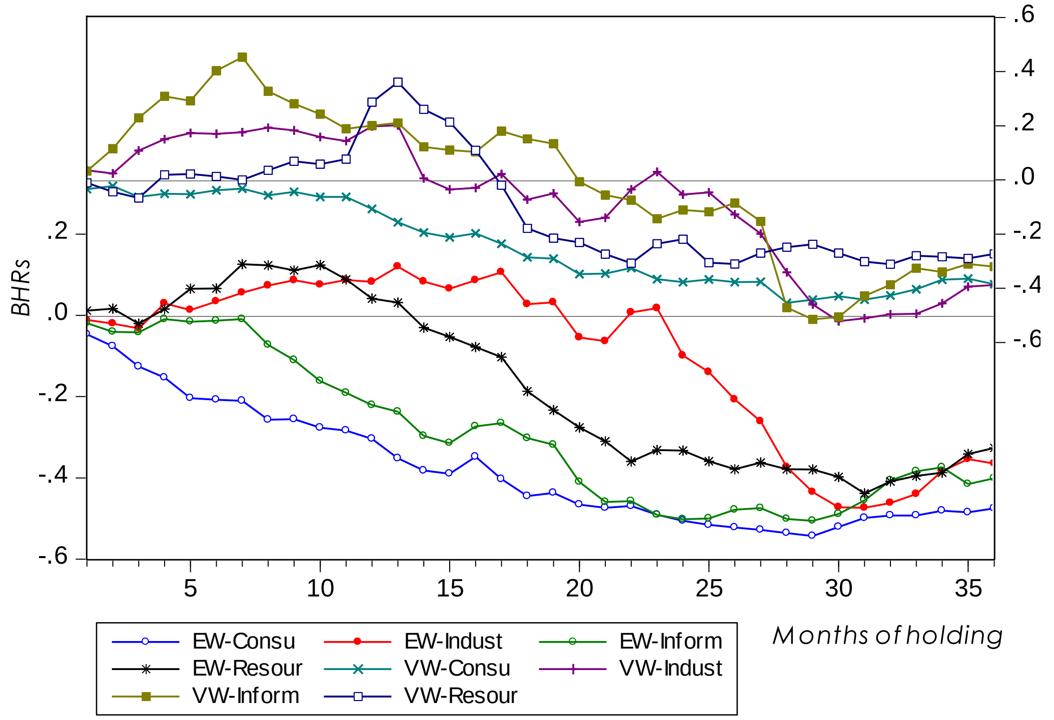
5.3.2.2.4 Information technology industry performance analysis

As shown in Appendix 12, 18 IPO companies were considered for the long-run analysis of the information technology industry. However, as reported in Panel B in Table 5.10, only 14 companies completed their three-year anniversary. This indicates that four sample companies did not complete their three-year anniversary. However, only 17 companies completed the second-year anniversary and all the sample companies that were considered for the long-run analysis completed their first-year anniversary.

Panel B shows that the EW mean BHRs for the one-, two- and three-year holding periods are –22.09%, –50.21% and –40.10% respectively. These negative BHRs indicate that sample IPO companies in the information technology sector underperformed over the three-year period. This is the second sector in which underperformance was reported over the three-year period on the EW scheme. However, only a two-year period average BHR is statistically significant at the 1% level. The VW average BHRs for the one-, two- and three-year holding periods are

20.1%, –11.06% and –32.01% respectively, which are not statistically significant. The mean BHRs reports that sample IPOs overperformed for a one-year period and underperformed for two-year and three-year periods.

Figure 5.5 shows the behaviour of the EW and VW BHRs in all industries. The left bottom vertical axis shows EW BHRs and the right top vertical axis indicates VW BHRs. The diagram clearly shows that all industries underperformed in both weighting schemes for two-year and three-year periods because in these periods BHR values are below the zero line. The consumer discretionary and staples industry IPOs underperformed under EW and VW schemes from months of holding one to 36 and the information technology sector IPOs underperformed only on the EW scheme over 36 months of holding.



Note: The left bottom vertical axis relates to the equally weighted BHRs and the right top axis relates to the value-weighted BHRs.

Figure 5.5: Equally and Value-Weighted (EW & VW) BHRs for the Industry

5.3.2.3 Long-run performance by issue year

The issue-year analysis was used to identify any significant differences that could be observed in the long-run performance by issue year. Panel C in Table 5.10 shows the EW and VW monthly BHRs, associated t-statistics and number of sample companies considered for the long-run analysis. Appendices 13 to 15 also indicate the calculated monthly BHRs (EW and VW) for the three-year period by issue year. The analysis of the long-run IPO performance by issue year is presented below.

5.3.2.3.1 Performance of issue year 2006

Appendix 13 reports that 67 sample companies were considered for the long-run analysis of 2006. In addition, Panel C in Table 5.10 shows that all considered companies for the analysis were used for BHR calculation of the one-, two- and three-year holding periods.

Panel C in Table 5.10 shows that the EW average BHRs for the one-, two- and three-year holding periods are 69.73%, –11.8% and –35.12% respectively. One-year and three-year BHRs are statistically significant at the 1% level on both t-statistics. The mean values of BHRs confirm that issued IPOs in 2006 overperformed in the first year and underperformed in the second and third years. Meanwhile, the VW BHRs indicate that issued IPOs in 2006 overperformed in the first two years and underperformed in the last year. The VW BHRs for the one-, two- and three-year holding periods are 28.42%, 8.51% and –17.53% respectively. One- and three-year BHRs are statistically significant at the 5% level on both conventional and bootstrapped skew-adjusted t-statistics.

5.3.2.3.2 Performance of issue year 2007

Table 5.10 and Appendix 14 show that 94 IPO companies were considered for the long-run analysis in issue year 2007 and all sampled companies completed the three-year period.

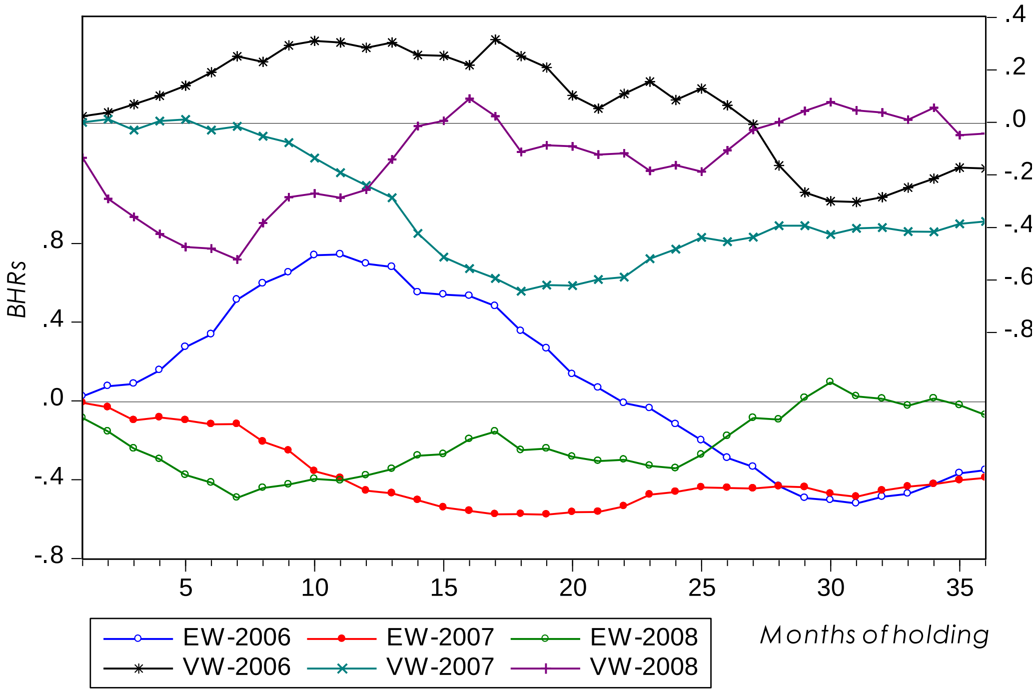
Issue year 2007 was identified as the HM because this period had high average first-day returns and high IPO volume. Even though issue year 2007 is considered a HM, it shows average negative BHRs on the EW and VW schemes for the one-, two- and three-year holding periods. This confirms that issued IPOs in 2007 underperformed in both weighting schemes. The EW mean BHRs for the one-, two- and three-year holding periods are –45.59%, –46.27% and –39.08% respectively, and only the three-year holding period BHR is statistically significant at the 5% level. However, according to the conventional statistics, all BHRs are statistically significant at the 1% level. The VW average BHRs for the one-, two- and three-year holding periods are –24.05%, –48.3% and –37.72% respectively, which are statistically significant at the 1% level on both conventional and bootstrapped skew-adjusted t-statistics.

5.3.2.3.3 Performance of issue year 2008

Table 5.10 shows that 16 sampled IPO companies were used for the three-year analysis. However, as indicated in Appendix 15, 19 sample companies were considered for the long-run analysis of issue year 2008. Therefore, only three sampled IPO companies did not complete the three-year period in 2008.

Panel C in Table 5.10 has negative values for EW and VW BHRs in the one-, two- and three-year holding periods, which indicates that issued IPOs in 2008 underperformed in both weighting schemes. The EW average BHRs for the one-, two- and three-year holding periods are –37.84%, –37.22% and –7.19% respectively. Only one- and two-year BHRs are statistically significant at the 1% level on both t-statistics. The VW average BHRs for the one-, two- and three-year holding periods are –25.61%, –16.3%, and –4.25% respectively and the BHRs in year one is only statistically significant at 1%.

Figure 5.6 shows the behaviour of the EW and VW monthly BHRs in 2006, 2007 and 2008. The left bottom vertical axis shows EW BHRs and the right top vertical axis indicates VW BHRs. Most of the monthly BHRs in both weighting schemes in issue year 2007 and 2008 are below the zero line, which confirms that issued IPOs in these periods underperformed over 36 months of holding. However, slight overperformance can also be observed in issue year 2008. Considerable overperformance was identified in issue year 2006, particularly from one to 21 months of holding under the EW scheme and one to 26 months on the VW scheme. This indicates that issued IPOs in 2006 performed well compared with other issue years.



Note: The left bottom vertical axis relates to the equally weighted BHRs and the right top axis relates to the value-weighted BHRs.

Figure 5.6: Equally and Value-Weighted (EW & VW) BHRs for the Issue Years

5.3.3 Buy-and-Hold Average Abnormal Returns (BHARs)

The previous section presented the calculations of the raw BHRs. This section presents the analysis of the long-run market performance using BHARs,[16] which were calculated using the market benchmark return (MR based on the All Ordinary Index). Previous studies (Barber and Lyon 1997) have argued that long-run stock returns should be estimated as the BHARs for the following reasons: the CARs are bias predictors of BHARs and the magnitude of the CARs does not relate to the average or median sample firm relative to the appropriate benchmark over the period. Therefore, this study calculated the average BHARs after eliminating the average market benchmark returns from the BHRs. This performance measure is considered the MAR, which is superior to

[16] Previous researchers have documented that BHARs are also subject to rebalancing bias, new listing bias and skewness bias. Barber and Lyon (1997) documented that, as a result of the rebalancing and skewness biases, the t-statistics are normally negatively biased when the reference portfolio (market index) is used as a benchmark.

the BHR. This return also assumes a buy-and-hold strategy and calculates using a reference portfolio. To eliminate the skewness[17] bias of BHARs, the t-statistics were calculated using the bootstrapping method suggested by Lyon, Barber and Tsai (1999). The conventional t-statistics were estimated in addition to the bootstrapped skew-adjusted t-statistics for comparison. The BHAR was estimated using EW and VW schemes. The calculated BHARs for the three post-listing years with both t-statistics on the full sample, industries and issue years are reported in Panel A, Panel B and Panel C in Table 5.11. The calculated monthly EW and VW BHARs with the bootstrapped skew-adjusted t-statistics are given in Appendices 16 to 23. The evaluation of long-run market performance based on BHARs is presented by full sample, industry and issue year.

[17] The skewness statistics of the BHARs for one-, two- and three-year holding periods are all greater than zero with a value of 3.73, 5.17 and 2.46 respectively. The skewness statistics of the BHARs are given in the summary statistics in Table 5.1.

Table 5.11: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Abnormal Returns (BHARs) for the Full Sample, Industry and Issue Year

Sample classification	**Equal-weighted BHARs**			**Value-weighted BHARs**		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Panel A: by full sample						
All sample companies	0.0432	–0.1444	–0.1512	0.1753	0.0116	–0.0875
Bootstrapped skew-adjusted t-statistics	0.80	–1.65[c]	–2.48[b]	8.26[a]	0.20	–1.68[c]
Conventional t-statistics	0.72	–2.37[b]	–3.08[a]	4.25[a]	0.17	–2.11[b]
Number of companies	242	202	185	242	202	185
Panel B: by industry						
Resources	0.1077	–0.1478	–0.1157	0.3855	–0.0081	–0.0636
Bootstrapped skew-adjusted t-statistics	1.36	–1.53	–1.33	4.49[a]	–0.06	–0.83
Conventional t-statistics	1.17	–2.06[b]	–1.6	3.72[a]	–0.13	–1.10
Number of companies	135	111	100	135	111	100
Industrials	0.1793	0.0601	–0.1555	0.2462	0.0955	–0.1582
Bootstrapped skew-adjusted t-statistics	1.55	0.38	–1.15	11.47[a]	0.54	–1.17
Conventional t-statistics	1.25	0.26	–1.41	3.00[a]	0.41	–1.48
Number of companies	45	38	38	45	38	38
Consumer discretionary/staples	–0.2674	–0.3473	–0.2672	–0.1488	–0.2494	–0.2149
Bootstrapped skew-adjusted t-statistics	–2.87[a]	–4.51[a]	–1.82[c]	–2.64[b]	–3.70[a]	–1.60
Conventional t-statistics	–3.53[a]	–4.55[a]	–2.55[b]	–2.65[b]	–3.20[a]	–2.33[b]
Number of companies	31	25	22	31	25	22
Information technology	–0.1812	–0.3017	–0.1677	0.1852	0.0319	–0.1111
Bootstrapped skew-adjusted t-statistics	–1.37	–2.84[b]	–0.79	0.65	0.16	–0.58
Conventional t-statistics	–1.56	–2.89[b]	–0.90	2.07	0.34	–0.67
Number of companies	18	17	14	18	17	14
Panel C: by issue year						
2006	0.5068	–0.0179	–0.1513	0.0769	0.0978	–0.0648
Bootstrapped skew-adjusted t-statistics	3.6[a]	–0.03	–1.65	1.31	0.73	–0.79
Conventional t-statistics	2.82[a]	–0.12	–1.93[c]	0.71	0.61	–0.87
Number of companies	67	67	67	67	67	67
2007	–0.1749	–0.1565	–0.1496	0.0083	–0.1497	–0.1204
Bootstrapped skew-adjusted t-statistics	–2.53[b]	–1.44	–1.57	0.12	–2.50[b]	–0.52
Conventional t-statistics	–3.77[a]	–2.57[b]	–2.07[b]	0.12	–3.52[a]	–2.40[b]
Number of companies	94	94	94	94	94	94
2008	–0.2887	–0.3263	–0.0142	–0.2240	–0.2009	–0.0474
Bootstrapped skew-adjusted t-statistics	–6.01[a]	–2.77[b]	–0.06	–4.50[a]	–1.56	–0.27
Conventional t-statistics	–5.55[a]	–3.00[a]	–0.08	–3.75[a]	–1.51	–0.34
Number of companies	19	19	16	19	19	16

Note: BHAR = Buy-and-hold average abnormal return, **[a]** statistically significant at 1% level, [b] statistically significant at 5% level, [c] statistically significant at 10% level.

5.3.3.1 Long-run performance by full sample

In the full sample analysis, 242, 202 and 185 sample companies' returns were used for the long-run performance in year one, year two and year three respectively. These included the returns of existing (surviving) companies and delisted companies. However, the total number of sample companies used for the analysis was lower than the sample companies initially considered (249 IPOs), as shown in Appendix 16, because the price data was last collected from the Morningstar database in the first week of 2012 when some of the sample companies had not yet completed their one-year, two-year and three-year anniversaries.

Panel A in Table 5.11 shows that the EW BHARs for the one-, two- and three-year holding periods are 4.32%, –14.44% and –15.12% respectively. The average positive BHARs in year one indicates that sample companies overperformed up to the one-year holding period and negative signs show underperformance up to the two- and three-year holding periods. The average one-year and two-year EW BHARs overperformance is not statistically significant. However, the average three-year holding period EW BHARs underperformance is statically significant at the 5% level. The calculated EW BHARs for the full sample show a decreasing trend in BHAR values over the three-year post-listing period. This implies that there was a decrease in investors' wealth in the long run based on BHARs. These findings support the findings of How (2000), Silva Rosa, Velayuthen and Walter (2003), Omran (2005) and Chorruk and Worthington (2010). Silva Rosa, Velayuthen and Walter's (2003) study found that Australian IPOs insignificantly overperformed in EW average BHARs in the first 12 months after listing and then underperformed in the 24-month holding period. How (2000), Omran (2005) and Chorruk and Worthington (2010) also found that IPOs significantly overperformed in the one-year holding period and underperformed in the two- and three-year holding periods. The current study's finding is also consistent with the finding of Thomadakis, Nounis and Gounopoulos (2012) that Greek IPOs overperformed in the market for a substantial period and transformed into underperformance for a lengthy period. The study finding partially contrasts with the studies of Suchard and Singh (2007). They found that privatised IPOs in Australia severely overperformed based on EW BHARs over one-, two- and five-year periods. This severe overperformance is most probably sample specific. The long-run underperformance reported in years two and three are comparable with findings in some of the past studies (Belghitar & Dixon 2012; Brau, Couch & Sutton 2012; Jewartowski & Lizinska 2012; Marisetty & Subrahmanyam 2010).

The calculated VW average BHARs for the one-, two- and three-year holding periods are 17.53%, 1.16% and –8.75% respectively. At 1% and 10% levels respectively, only the BHARs for year one and year three are statistically significant. The VW average BHARs indicate that the Australian IPOs overperformed in the first two years after listing and underperformed in the third year. This finding supports the finding of Ahmad-Zaluki, Campbell and Goodacre (2007) that IPOs overperformed on VW BHARs in the 12- and 24-month periods and underperformed in 36 months.

Figure 5.7 shows the calculated EW and VW BHARs over 36 months of holding for the full sample. The average values of VW BHARs are much higher than the EW values. This confirms that, in the long-run performance (underperformance or overperformance), the VW BHARs are much higher than the EW BHARs. Most of the calculated BHAR values in both weighting methods up to 15 months are greater than zero, which indicates that the IPOs overperformed in the market during this period whereas, after 15 months, most of the time, IPOs underperformed in both weighting schemes. Underperformance based on EW BHARs is identified after 17 months of holding.

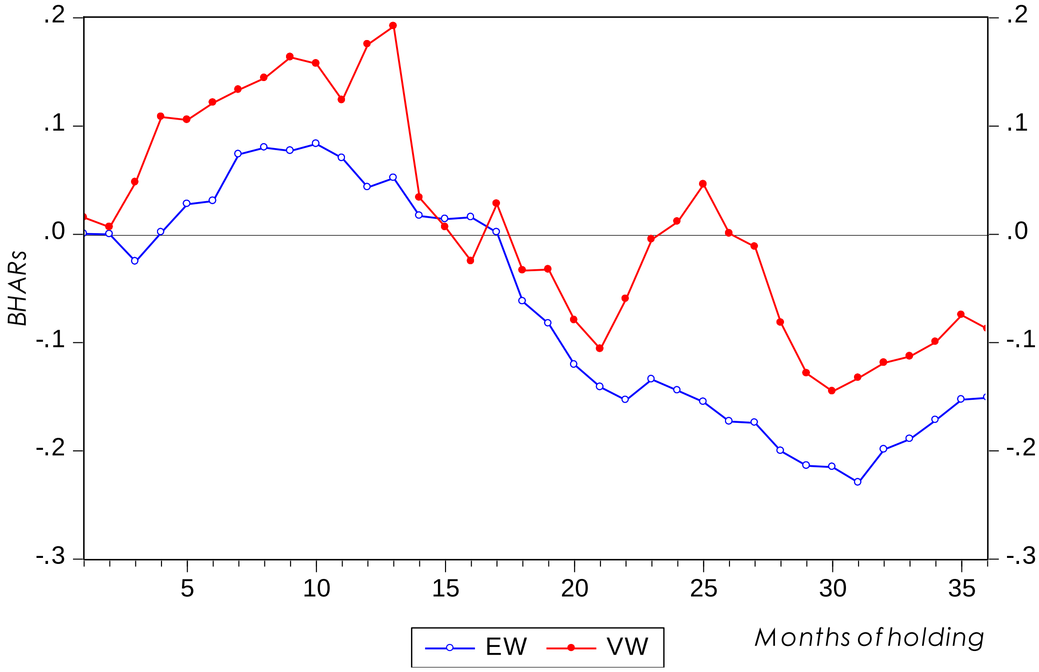


Figure 5.7: Equally and Value-Weighted (EW & VW) BHARs for the Full Sample

5.3.3.2 Long-run performance by industry

To analyse the long-run market performance by industries, the EW and VW BHARs for industries were calculated as shown in Panel B of Table 5.11. The different industries related monthly EW and VW BHARs for three years are also given in Appendices 17 to 20. The industry-related analysis is presented below.

5.3.3.2.1 Resources industry performance analysis

The EW and VW BHARs with t-statistics for the resource industries are shown in Panel B of Table 5.11. In this analysis, 135, 111 and 100 sample companies were considered for year one, year two and year three respectively. As shown in Appendix 17, 139 IPO companies were initially considered to analyse the long-run performance in this sector, but the total number of companies considered for the three-year analysis is lower than the total number of companies considered initially.

Table 5.11 shows that the EW BHARs for the one-, two- and three-year holding periods are 10.77%, –14.78%, –11.57% respectively, which are not statistically significant. However, this finding supports the finding of How (2000). She found that the EW market-adjusted BHRs for one-, two- and three-year holding periods were 20.32%, –23.16% and –7.6% respectively. The VW BHARs for the one-, two- and three-year holding periods are 38.55%, –0.81% and –6.36% respectively and only year one is statistically significant at the 1% level. Both weighting methods confirmed that the resource sector IPOs overperformed in the one-year period and underperformed in the two- and three-year periods. Dimovski and Brooks (2004) also found that Australian resources IPOs underperformed by –29.2% in the long run. The VW BHARs show that the larger IPOs that have higher market CAP in the resources sector did not perform well in the long run, particularly for the two- and three-year periods.

5.3.3.2.2 Industrial sector performance analysis

Table 5.11 shows that 38 IPO companies were considered in the analysis of the long run-returns in the two-year and three-year periods. Appendix 18 shows that a total of 45 companies were initially considered for the analysis, but seven IPO companies in the sample did not complete the two- and three-year periods.

The calculated EW BHARs for the one-, two- and three-year holding periods are 17.93%, 6.01% and –15.55% respectively. These BHAR values show that the industrial sector IPOs overperformed in the first two years and underperformed in the last year. The calculated VW BHARs show that the IPOs overperformed by 24.62% and 9.55% in years one and two respectively and underperformed in year three by –15.82%. Statistically significant VW BHARs can be observed only in year one, and this is significant at the 1% level. The performances of the larger IPOs that have higher market CAP in this sector performed well in the first two years, but did not perform well in the third year. The underperformance of industrial IPOs in the long run supports the findings of other Australian studies (Finn & Higham 1988; Lee, Taylor & Walter 1996; Suchard & Singh 2007). However, Dimovski and Brooks (2004) reported that industrial IPOs overperformed by 10.8% during 1994 to 1999.

5.3.3.2.3 Consumer discretionary and staples industry performance analysis

In the consumer discretionary and staples industry analysis, 31 IPOs were considered for year one, 25 IPOs for year two and 22 IPOs for year three. Appendix 19 indicates that 31 IPOs were initially considered for the long-run analysis. This shows that nine out of 31comapnies in this sector were unable to complete their three-year period.

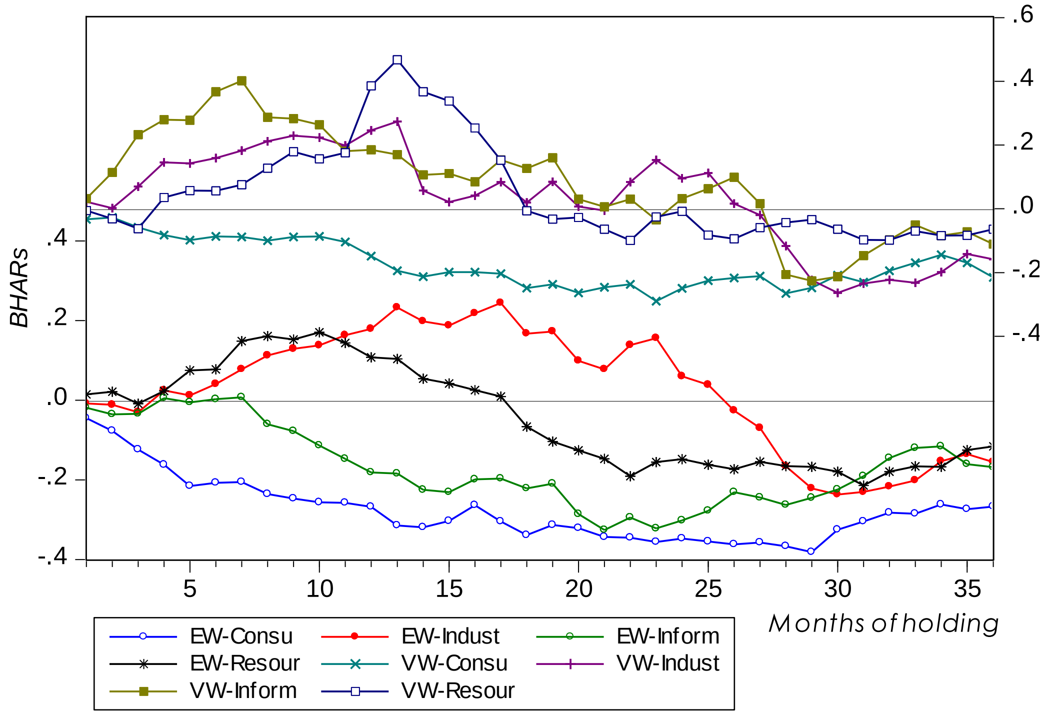
The EW average BHARs for the one-, two- and three-year holding periods are –26.74%, –34.73% and –26.72% respectively, and the VW mean BHARs for the one-, two- and three-year holding periods are –14.88%, –29.94% and –21.49% respectively. The negative mean BHAR values in the consumer discretionary and staples industry show that IPOs underperformed over the three-year period in both weighting schemes. The EW and VW average BHARs for the one-year and two-year holding periods are statistically significant at the 5% level and the EW BHARs at one year are statistically significant at the 10% level. The consumer discretionary and staples industry is the only sector that underperformed in both weighting schemes for the one-, two- and three-year holding periods.

5.3.3.2.4 Information technology industry performance analysis

For the information technology industry analysis, 18 IPO companies were initially considered for the long-run analysis (see Appendix 20). Only 14 IPO companies completed their three-year period and 17 IPO companies completed the second-year period.

The EW average BHARs for the one-, two- and three-year holding periods are –18.12%, –30.17% and –16.77% respectively. Only the two-year holding period BHAR is statistically significant at the 5% level. The negative BHARs indicate that sample IPO companies in the information technology sector underperformed over the three-year period. The VW average BHARs for the one- and two-year holding periods are 18.52% and 3.19% respectively, which indicates that IPOs overperformed in these periods. In the third year, IPOs underperformed by –11.11%, which is not statistically significant.

Figure 5.8 shows the behaviour of the EW and VW industry BHARs over 36 months of holding. The left bottom vertical axis shows the EW BHARs and the right top vertical axis indicates the VW BHARs. The sample IPOs in all industries underperformed in both weighting schemes in the three-year period because in this period all BHAR values are below the zero line. The consumer discretionary and staples industry IPOs underperformed under the EW and VW schemes over the 36 months of holding. The IPOs in the information technology sector also underperformed over the 36-month period only under the EW scheme.



Note: The left bottom vertical axis relates to the equally weighted BHARs and the right top axis relates to the value-weighted BHARs.

Figure 5.8: Equally and Value-Weighted (EW & VW) BHARs for the Industry

5.3.3.3 Long-run performance by issue year

The issue-year analysis was carried out to examine whether any significant differences in the market performance in different issue years could be observed in the long run. Panel C in Table 5.11 shows the EW and VW BHARs with associated t-statistics and the number of sample companies considered for this analysis. Appendices 21 to 23 report the EW and VW monthly BHARs by issue year for the three-year period. The analysis of the long-run market performance based on BHARs by issue year is given below.

5.3.3.3.1 Performance of issue year 2006

Appendix 21 shows that 67 sample companies were considered for the analysis of year 2006. Panel C in Table 5.11 confirms that all companies considered for the analysis completed their three-year period. This indicates that none of the sample companies in 2006 was delisted before the three-year anniversary.

The EW average BHARs for years one, two and three are 50.86%, –1.79%, and –15.13% respectively. The year-one average BHAR is statistically significant at the 1% level using bootstrapped skew-adjusted statistics and conventional statistics. The average BHARs in year three are statistically significant using conventional statistics at the 10% level. The average positive BHARs in year one show that the issued IPOs overperformed in 2006 and the negative signs in years two and three indicate underperformance in the long run. The level of underperformance from year two to year three increased by 13.34%, which indicates that the investors' wealth intensively declined over this period.

The VW average BHARs for holding years one, two and three are 7.69%, 9.78% and –6.48% respectively, which are not statistically significant under both t-statistics. The positive average BHARs in year one and two show that IPOs overperformed in these periods. The negative average BHAR in year three indicates that the IPOs underperformed under the VW scheme.

5.3.3.3.2 Performance of issue year 2007

In issue year 2007, all sample companies completed their three-year period. This shows that 94 companies were considered for the long-run analysis (see Table 5.11 and Appendix 22).

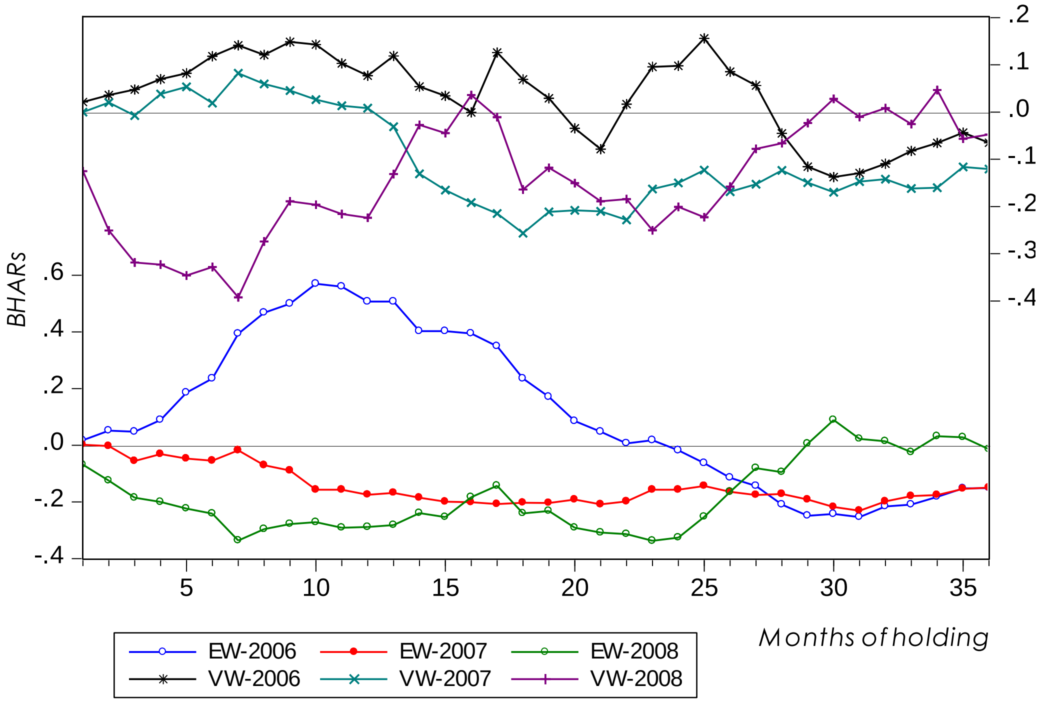
Although the study identified that issue year 2007 was a HM based on the high average first-day return and high IPO volume, Table 5.11 shows average negative BHARs under the EW scheme for holding years one, two and three and negative VW BHARs for years two and three. This indicates that the issued IPOs in 2007 underperformed under both weighting schemes. The EW average BHARs for the one-, two- and three-year holding periods are –17.49%, –15.65% and –14.96% respectively. The year-one average EW BHAR is statistically significant at 1% under bootstrapped skew-adjusted t-statistics. All EW BHARs are statistically significant at the 5% level under conventional t-statistics. The VW BHARs for holding years one, two and three are 0.83%, –14.97%, and –12.04% respectively; only the year-two average BHAR is statistically significant at the 5% level under bootstrapped skew-adjusted t-statistics. According to the conventional t-statistics, the average BHARs in holding years two and three are statistically significant at the 5% level.

5.3.3.3.3 Performance of issue year 2008

As shown in Table 5.11, 16 IPO sample companies were used for the year-three long-run analysis. Appendix 23 indicates that 19 sample companies were considered for the long-run analysis under issue year 2008, but three sample IPO companies did not complete their three-year anniversary.

Table 5.11 shows negative values for EW and VW BHARs for the one-, two- and three-year holding periods, which indicates that the issued IPOs in 2008 underperformed. The EW average BHARs for the one-, two- and three-year holding periods are –28.87%, –32.63% and –1.42% respectively, and the year one and two average BHARs are statistically significant at the 5% level under both t-statistics. The VW average BHARs for the one-, two- and three-year holding periods are –22.40%, –20.09% and –4.74% respectively, and the average BHAR in year one is statistically significant at 1% under both t-statistics.

Figure 5.9 shows the behaviour of the EW and VW monthly BHARs over the three-year period. The left bottom vertical axis shows the EW BHARs and the right top vertical axis indicates the VW BHARs. Most of the monthly BHARs under both weighting schemes in issue year 2007 and 2008 are below the zero line, which confirms that the issued IPOs in these periods underperformed. However, in issue year 2008, they slightly overperformed between months of holding 29 to 35 under both weighting schemes. In issue year 2007, overperformance can be found only under the VW scheme up to 12 months of holding. Considerable overperformance can be seen in issue year 2006, particularly in the one- to 23-month period of holding under the EW scheme and the one- to 28-month period (except months 16, 20 and 21) under the VW scheme.



Note: The left bottom vertical axis relates to the equally weighted BHARs and the right top axis relates to the value-weighted BHARs.

Figure 5.9: Equally and Value-Weighted (EW & VW) BHARs for the Issue Year

5.3.4 Average Wealth Relatives (WRs)

The WR is the other performance measure that can be used to measure the long-run performance of Australian IPOs. This performance measure is calculated using both the raw buy-and-hold average return (BHR) and the average MR. The calculation of BHR was discussed in Section 5.3.2. The MR was calculated using the All Ordinary Index as a market benchmark. The BHR and MR were also estimated under the assumption of the buy-and-hold investment strategy. The WR is considered a ratio or index: when it is greater than 1, it can be interpreted as the IPOs' overperformance compared with the market benchmark and less than 1 as underperformance. The average WRs were estimated based on EW and VW schemes. The calculated WRs in both weighting schemes and the number of companies considered for the analysis in each year are shown in Table 5.12. Appendices 24 to 31 also indicate the EW and VW monthly WRs and number of companies for the three-year period. The long-run market performance based on the WRs was analysed by full sample, industry and issue year and these are given in Panels A, B and C respectively in Table 5.12.

Table 5.12: Equally Weighted (EW) and Value-Weighted (VW) Average Wealth Relatives (WRs) for the Full Sample, Industry and Issue Year

Sample classification	**Equal-weighted WRs**			**Value-weighted WRs**		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Panel A: by full sample						
All sample companies	1.0462	0.8245	0.8080	1.1793	1.0133	0.8954
Number of companies	242	202	185	242	202	185
Panel B: by industry						
Resources	1.1154	0.8187	0.8535	1.4274	0.9897	0.9195
Number of companies	135	111	100	135	111	100
Industrials	1.1985	1.0714	0.8033	1.2588	1.1123	0.7948
Number of companies	45	38	38	45	38	38
Consumer discretionary/staples	0.7224	0.5874	0.6626	0.8572	0.7141	0.7410
Number of companies	31	25	22	31	25	22
Information technology	0.8113	0.6227	0.7813	1.1823	1.0372	0.8595
Number of companies	18	17	14	18	17	14
Panel C: by issue year						
2006	1.4256	0.9801	0.8109	1.0637	1.0991	0.9272
Number of companies	67	67	67	67	67	67
2007	0.7568	0.7745	0.8028	1.0111	0.7754	0.8380
Number of companies	94	94	94	94	94	94
2008	0.6828	0.6684	0.9849	0.7686	0.8065	0.9528
Number of companies	19	19	16	19	19	16

5.3.4.1 Long-run performance by full sample

The average WRs under the EW and VW schemes for the full sample are given in Panel A in Table 5.12. Only 185 out of 249 (see Appendix 24) sample companies were considered for the three-year period.

The EW WRs for the one, two and three years of holding are 1.0462, 0.8245 and 0.8080 respectively. These values indicate that the Australian IPOs overperformed (WR values are greater than 1) in year one and underperformed in years two and three (WR values are less than 1). This finding is comparable with the finding of Chorruk and Worthington (2010) that Thai IPOs overperformed in year one and then transformed to underperformance in years two and three based on WRs.

In contrast with the EW WRs, overperformance can be observed in years one and two under VW WRs because the average values for WR (1.1793 for year one and 1.0133 for year two) in these years are greater than 1. However, both weighting methods show that the Australian IPOs underperformed in the three-year window (average WRs are less than 1), indicating that, on average, investors buying IPO shares at the end of the tenth day after listing and holding them for a three-year period could not earn significant returns compared with the market benchmark. The VW finding supports those of Ahmad-Zaluki, Campbell and Goodacre (2007) that IPOs overperformed on VW WRs in year one and year two and underperformed in year three.

Figure 5.10 shows the monthly behaviour of the calculated WRs over the three-year period under the EW and VW schemes. Most of the IPOs overperformed on both equal and value weight for up to 15 months of holding because their calculated average WRs are greater than 1 (WR > 1). Figure 5.10 shows that, most of the time, the VW underperformance (overperformance) levels were higher than the EW levels. The plot clearly indicates that all IPOs underperformed under both weighting schemes after 36 months of holding.

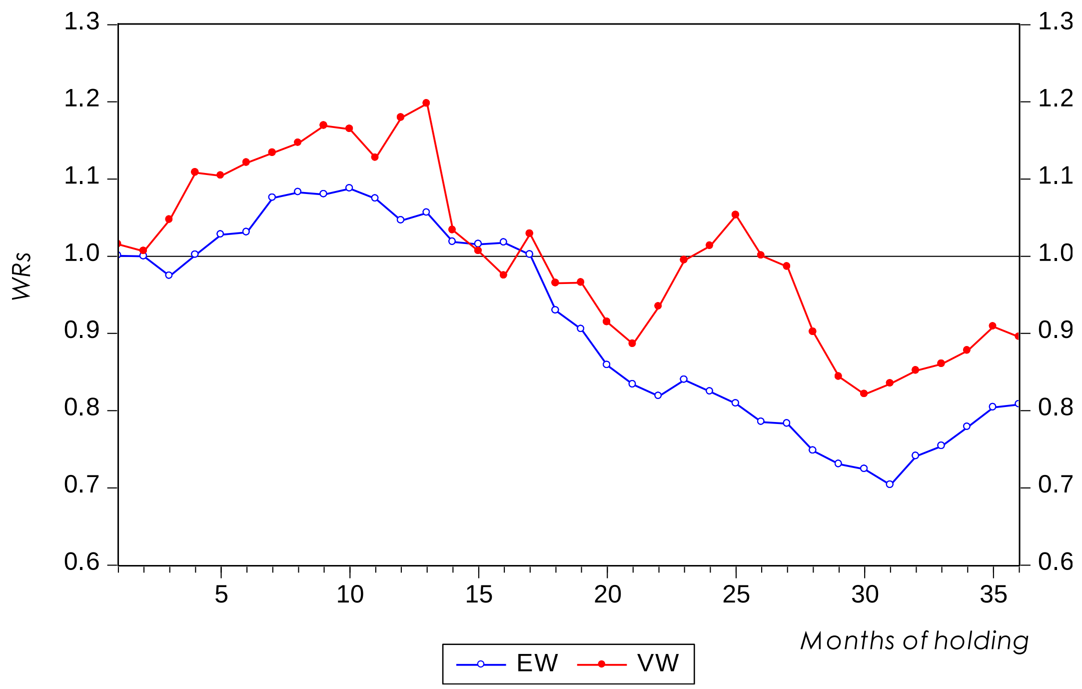


Figure 5.10: Equally and Value-Weighted (EW & VW) WRs for the Full Sample

5.3.4.2 Long-run performance by industry

The EW and VW average WRs and number of companies considered for the long-run analysis are shown in Panel B in Table 5.12. Appendices 25 to 28 show the EW and VW monthly WRs for industries with the number of firms trading. The analysis of the long-run market performance by industry is presented below.

5.3.4.2.1 Resource industry performance analysis

Panel B in Table 5.12 shows the EW and VW average WRs for the resource industry. The number of companies considered for the years one, two and three analyses are 135, 111 and 100 respectively. Appendix 25 shows that 139 IPOs were initially considered for the analysis in the resources sector.

Table 5.12 shows that the resources sector sample companies overperformed in year one (WR values are greater than 1) and underperformed in years two and three (WR values are less than 1) based on both the EW and VW schemes. The EW WRs for holding years one, two and three are 1.1154, 0.8187 and 0.8535 respectively and the VW WRs for year one, two and three are 1.4274, 0.9897 and 0.9195 respectively. This finding shows that the larger IPOs that had higher market CAP in this sector performed well compared with the smaller IPO companies over the three-year period, particularly in year one.

5.3.4.2.2 Industrial sector performance analysis

Appendix 26 shows that 45 IPO companies w1ere initially considered for the industrial sector. However, as indicated in Table 5.12, only 38 companies completed their second- and third-year anniversaries. Therefore, only seven IPO companies in this sector did not complete the third and second anniversaries.

The EW average WRs for one-, two- and three-year holding periods are 1.1985, 1.0714 and 0.8033 respectively. The VW average WRs for holding years one, two and three are 1.2588, 1.1123, and 0.7948 respectively. The average WRs for one year and two years under both weighting methods are greater than 1 and the three-year WR values are less than 1. This confirms that the industrial sector IPOs overperformed in yeas one and two and underperformed in year three under both weighting schemes. The finding shows that the larger IPOs in this sector performed slightly better than the smaller IPO companies over the three-year period, except for in year three.

5.3.4.2.3 Consumer discretionary and staples industry performance analysis

As shown in Appendix 27, 31 IPO companies were initially considered for the long run analysis. Panel B in Table 5.12 shows that only 22 IPO companies in this sector completed their three-year anniversary. Therefore, only nine IPO companies in this sector did not complete their three-year anniversary. The IPO companies that fulfilled the one- and two-year periods are only 31 and 25 respectively.

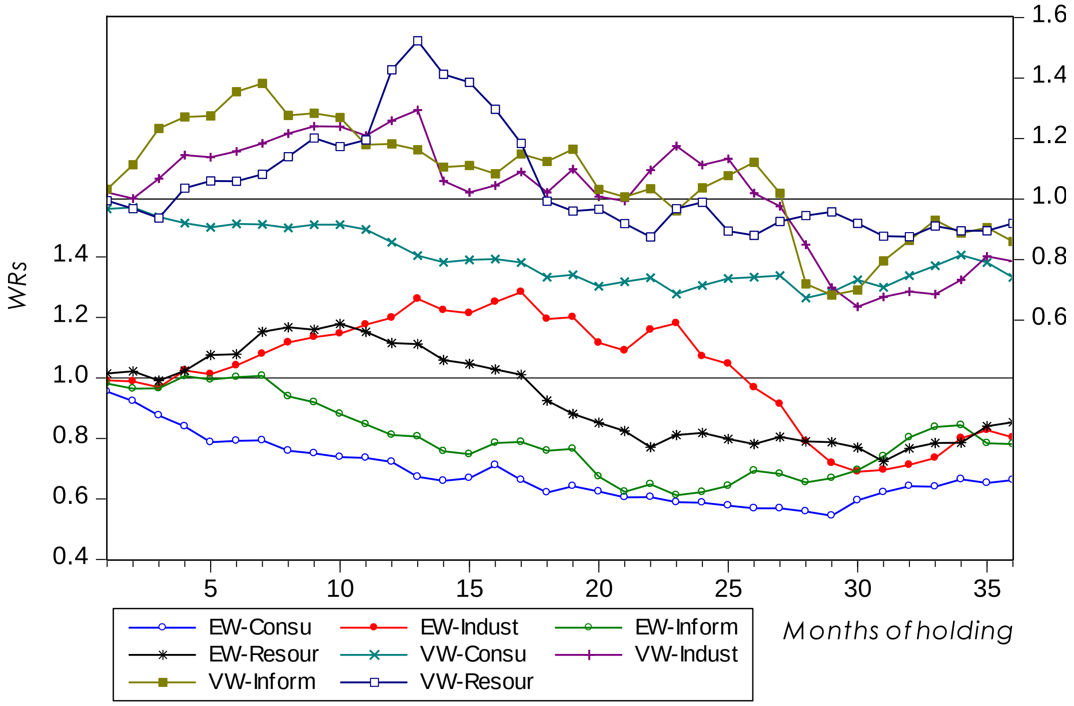
Panel B shows that consumer discretionary and staples sector sample companies underperformed (WR values are less than 1) based on both the EW and VW schemes for the one-, two- and three-year holding periods. The EW and VW WRs indicate that the larger IPOs in this sector performed slightly better than the smaller IPOs in the long run.

5.3.4.2.4 Information technology industry performance analysis

Table 5.12 shows that only 14 companies completed their three-year anniversary. As shown in Appendix 28, 18 IPO companies were considered for the long-run analysis in the information technology industry. Four sample companies did not complete their three-year anniversary. However, only 18 and 17 companies completed their first and second anniversaries respectively.

The EW average WRs for the one-, two- and three-year holding periods are 0.8113, 0.6227 and 0.7813 respectively. This indicates that the information technology sector IPOs underperformed over the three-year holding period because all WR values are less than 1. The VW average WRs for the one-, two- and three-year holding periods are 1.1823, 1.0372, and 0.8595 respectively. The VW average WRs for holding periods one and two are greater than 1, which indicates that the information technology sector IPOs overperformed for these periods. However, the IPOs in this sector underperformed under the VW method for the three-year period. The finding shows that the larger IPOs in this sector performed well, particularly in the first two years, compared with the smaller IPOs.

Figure 5.11 shows the EW and VW WRs for all industries. The left bottom vertical axis shows the EW WRs and the right top vertical axis indicates the VW WRs. The diagram clearly indicates that all industries underperformed compared with the market under both weighting schemes at the end of the three-year period because all WR values are below one. The consumer discretionary and staples industry IPOs underperformed over the 36 months of holding under both weighting schemes. The information technology sector IPOs also underperformed under the EW schemes and showed mixed performance under the VW scheme over the three-year period. The resources and industrial sectors also show mixed performance over the 36 months of holding under both weighting schemes. However, as indicated in Figure 5.11, the IPOs in all industries underperformed under both weighting schemes compared with the market benchmark after three years of listing.



Note: The left bottom vertical axis relates to the equally weighted WRs and the right top axis relates to the value-weighted WRs.

Figure 5.11: Equally and Value-Weighted (EW & VW) WRs for the Industries

5.3.4.3 Long-run performance by issue year

Panel C in Table 5.12 shows the EW and VW monthly WRs and number of sample companies considered for the long-run analysis by issue year. In addition, appendices 29 to 31 indicate the EW and VW WRs by issue year. The analysis of the long-run IPO performance by issue years 2006, 2007 and 2008 is presented below.

5.3.4.3.1 Performance of issue year 2006

Panel C in Table 5.12 shows that all the companies considered for the analysis were used for the WR calculation in the one-, two- and three-year holding periods. In addition, appendix 29 reports that 67 sample companies were initially considered for the long-run analysis for 2006. This shows that all sample companies completed their three-year anniversary.

In issue year 2006, the EW average WRs for the one-, two-, and three-year holding periods are 1.4256, 0.9801 and 0.8109 respectively. These values show that the issued IPOs overperformed in year one and underperformed in years two and year three. However, according to the VW WR, the IPOs underperformed in the first two years and overperformed in the last year. The EW average WRs for the one-, two- and three-year holding periods are 1.0637, 1.0991 and 0.9272 respectively. The result of this analysis shows that the larger IPOs issued in 2006 performed slightly better than the smaller IPOs, particularly in the last two years.

5.3.4.3.2 Performance of issue year 2007

Table 5.12 and Appendix 30 show that 94 IPO companies were considered for the long-run analysis of issue year 2007. All sample companies completed the three-year anniversary.

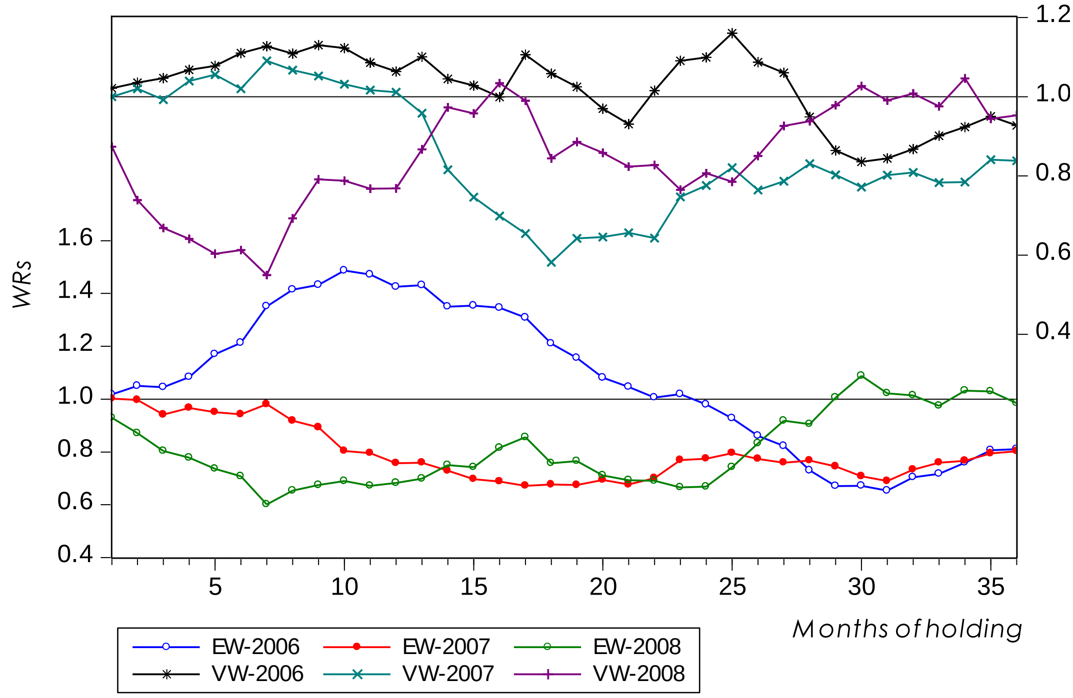
Panel C in Table 5.12 shows that the issued companies in 2007 underperformed in all three years (WR values are less than 1) based on the EW scheme. The EW WRs for holding years one, two and three are 0.7568, 0.7745 and 0.8028 respectively. The VW WR indicates that IPOs overperformed in year one (WR values are greater than 1) and underperformed in year two and three (WR values are less than 1). The VW WRs for years one, two and three are 1.0111, 0.7754 and 0.8380 respectively. This finding shows that the larger IPOs in this sector performed well compared with the smaller IPO companies over the three-year period, particularly in year one.

5.3.4.3.3 Performance of issue year 2008

Appendix 31 indicates that 19 sample companies were initially considered for the long-run analysis under this year. However, Table 5.12 shows that 16 IPO sample companies were only used for the three-year analysis. Only three sample IPO companies did not complete their three-year anniversary.

Table 5.12 shows that the EW WRs for the one, two and three years of holding are 0.6828, 0.6684 and 0.9849 respectively, whereas the VW WRs for the one, two and three years of holding are 0.7686, 0.8065and 0.9528 respectively. The EW and VW WRs indicate that the Australian IPOs underperformed over the three-year windows (WR values are less than 1). This indicates issued IPO companies in 2008 did not perform well compared with the market benchmark. However, the result shows that the larger IPOs in this sector performed well compared with the smaller IPO companies over the three-year period except for in year three.

Figure 5.12 shows the EW and VW monthly WRs over the three-year period. The left bottom vertical axis shows the EW WRs and the right top vertical axis indicates the VW WRs. Most of the monthly WRs under both weighting schemes in issue years 2007 and 2008 are below 1, which shows that the IPOs in these periods underperformed compared with the market benchmark. However, in issue year 2008, slight overperformance can be observed under both weighting schemes between months of holding 30 to 34. In issue year 2007, overperformance can be found only under the VW scheme for up to 12 months of holding. Considerable overperformance can be observed in issue year 2006, particularly from one to 23 months of holding under the EW WRs and one to 28 months (except for months 16, 20 and 21) on the VW WRs. The plot clearly shows that issued IPOs in all years underperformed under both weighting schemes compared with the market benchmark after 36 months of holding.



Note: The left bottom vertical axis relates to the equally weighted WRs and the right top axis relates to the value-weighted WRs.

Figure 5.12: Equally and Value-Weighted (EW & VW) WRs for the Issue Years

5.4 Determinants of the Long-Run Market Performance

This section identifies the reasons for the long-run market performance of the Australian IPOs. Characteristics specific to issue, firm and market, year dummies and industry dummies were used as the determinants of the long-run market performance in the IPO market. Issue characteristics are defined as offer-related characteristics such as offer size, offer price and TOTP. Firm characteristics are such factors as firm size, book value and ownership structure. In addition to these firm characteristics, the first-day PRIM and SECON were considered independent variables in the long-run model estimation. Market characteristics include MV, MR, MS, HC and post-day MR. Post-day MRs were used to identify the market risk. To capture the effects of industry and listing year on the long-run market performance, dummy variables representing the industry and year were also included in these models. The determinants of the long-run market performance were identified with the aid of logistics, probit and multiple regression models. These models were estimated using the Eviews (version 7) statistical package. Marginal probability analysis was used to measure the probability associated with the determinants that affected the directional changes in the long-run performance. Long-run regression models were estimated based on raw and market-adjusted abnormal BHRs and BHARs of the full sample IPOs for three year windows: year one, year two and year three. The estimated multiple and binary regression models for year one, year two and year three are presented below.

5.4.1 Multiple Regression Models

This section presents the estimates of the multiple regression models, carried out to identify the linear relationships between the dependent variables, such as buy-and-hold raw (BHR) and market-adjusted abnormal (BHAR) returns in different years, and the independent variables (explanatory variables), such as issue characteristics, firm characteristics, market characteristics, industry dummies and year dummies. In this model estimation, the dependent variable was measured as the natural log value of BHR and BHAR ($ln\, BHR$ and $ln\, BHAR$), whereas the independent variables were measured as natural log values, days, ratios, square and square roots.

The estimated multiple regression models for the long-run market performance are given in Table 5.13. The table shows the estimated regression models based on BHRs and BHARs for year one, year two and year three. Only the statistically significant variables or determinants are presented in Table 5.13. To overcome the multicollinearity issue, highly correlated variables were excluded from the model estimation. F-statistics of the estimated models in Table 5.13 are significant at the 1% level, which indicates that the models are valid.

Table 5.13: Estimated Multiple Regression Models for the Long-Run Market Performance

Long-run market performance	Estimated multiple regression model for the period from January 2006 to January 2012
BHRs	
Year 1	$ln[BHR] = -0.447 + 1.454\, ln[\mathbf{MR}] + 0.167\, [\mathbf{MV_{t\text{-}10}}] - 0.330\, [\mathbf{D_4}] - 0.331\, [\mathbf{D_5}] + 0.404\, [\mathbf{DY_1}]$ (0.000)*** (0.089)* (0.014)*** (0.053)* (0.002)*** **N** = 242 **F** = 28.3208 **Prob.(F)** = 0.0000 **AdjR^2** = 36% **DW** = 1.6792 **LM** = 0.0576 **WH** = 0.1782
Year 2	$ln[BHR] = -0.614 + 2.216\, ln[\mathbf{MR}] + 0.277\, [\mathbf{MV_{t\text{-}10}}] - 0.434\, [\mathbf{D_4}] - 0.483\, ln[\mathbf{PRIM}] - 1.01E\text{-}06\, [\mathbf{MS}] + 0.443\, [\mathbf{HC}]$ (0.000)*** (0.065)* (0.032)** (0.002)*** (0.000)*** (0.011)*** **N** = 202 **F**= 12.2265 **Prob.(F)** = 0.0000 **AdjR^2** = 25% **DW** = 1.8142 **LM** = 0.5798 **WH** = 0.1995
Year 3	$ln[BHR] = -1.237 + 0.642\, [\mathbf{MV_{t\text{-}10}}] - 0.567\, [\mathbf{D_4}] - 0.367\, ln[\mathbf{PRIM}] - 1.12E\text{-}06\, [\mathbf{MS}] - 0.198\, ln[\mathbf{1 + FAGE}]$ (0.000)*** (0.021)** (0.043)** (0.000)*** (0.074)* **N** = 185 **F** = 6.0241 **Prob.(F)** = 0.0000 **AdjR^2** = 12% **DW** = 2.0866 **LM** = 0.6302 **WH** = 0.0920
BHARs	
Year 1	$ln[BHAR] = -0.447 + 0.454\, ln[\mathbf{MR}] - 0.167\, [\mathbf{MV_{t\text{-}10}}] - 0.330\, [\mathbf{D_4}] - 0.331\, [\mathbf{D_5}] + 0.404\, [\mathbf{DY_1}]$ (0.035)** (0.089)* (0.014)*** (0.053)** (0.002)*** **N** = 242 **F** = 8.6792 **Prob.(F)** = 0.0000 **AdjR^2** = 14% **DW** = 1.6792 **LM** = 0.0576 **WH** = 0.1782
Year 2	$ln[BHAR] = -0.614 + 1.216\, ln[\mathbf{MR}] + 0.277\, [\mathbf{MV_{t\text{-}10}}] - 0.434\, [\mathbf{D_4}] - 0.483\, ln[\mathbf{PRIM}] - 1.01E\text{-}06\, [\mathbf{MS}] + 0.443\, [\mathbf{HC}]$ (0.000)*** (0.065)* (0.032)** (0.002)*** (0.000)*** (0.011)*** **N** = 202 **F** = 6.5144 **Prob.(F)** = 0.0000 **AdjR^2** = 14% **DW** = 1.8142 **LM** = 0.5798 **WH** = 0.1995
Year 3	$ln[BHAR] = -0.918 + 0.583\, [\mathbf{MV_{t\text{-}10}}] - 0.556\, [\mathbf{D_4}] - 0.376\, ln[\mathbf{PRIM}] - 1.19E\text{-}06\, [\mathbf{MS}] - 0.209\, ln[\mathbf{1 + FAGE}]$ (0.000)*** (0.024)** (0.038)** (0.000)*** (0.058)* **N** = 185 **F** = 6.0170 **Prob.(F)** = 0.0000 **AdjR^2** = 12% **DW** = 2.0709 **LM** = 0.7190 **WH** = 0.0796

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. **BHR** = Raw buy-and-hold return, **BHAR** = Buy-and-hold abnormal return , **N**= Sample size, **MR** = Post-day market return, which was calculated based on the All Ordinary Index for the same return interval as the dependent variable, **PRIM** = First-day primary market return, **MS =** Market sentiment before listing, which measured square value of change in market index from issuing date to listing date, **$MV_{t\text{-}10}$** = Market volatility of 10-day period prior to closing date of the offer, **HC =** Hot issue market dummy, **D_4** = Dummy for consumer discretionary/staples industry, **D_5** = Dummy for information technology industry, **FAGE =** Firm age in years, which was calculated by the year of issue minus the year of founding, **DY_1 =** Dummy for listing year 2006, **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.

The calculated diagnostics test statistics for error terms such as DW, LM and White heteroscedasticity WH in Table 5.13 indicate that the estimated models are generally satisfactory at the 5% level. The estimated multiple regression models have relatively low adjusted R-squared values.[18] However, the adjusted R-squared values for BHR models are greater than they are for BHAR models. The significant variables in the estimated multiple regression models for years one, two and three are first-day PRIM, dummy for consumer discretionary/staples industry (D_4), post-day MR (MR), MS, MV (MV_{t-10}), FAGE, HC, dummy for listing year 2006 (DY_1) and industry dummy for information technology (D_5). The relationships between these variables and the dependent variables such as BHRs and BHARs are discussed further.

The multiple regression models for years two and three in Table 5.13 show that the first-day PRIM is negatively associated with the long-run market performance (BHRs and BHARs), which is statistically significant at the 5% level. This indicates that if the PRIM is increased, this leads to a decrease in the level of overperformance or an increase in underperformance in the long run. This result supports hypothesis 11 (H11). The finding suggests that the level of overperformance (underperformance) can be reduced (increased) by the investors' irrational behaviour. Due to their irrational behaviour, IPO investors become overly optimistic about a firm's value during 'fad' or 'hot' periods, which indicate high return periods. This is known as the investor overoptimism or market overreaction hypothesis. This finding is consistent with previous studies in Australia and other countries (Abukari & Vijay 2011; Ahmad-Zaluki, Campbell & Goodacre 2007; Cai, Liu & Mase 2008; Chi, Wang & Young 2010; De Bondt & Thaler 1987; Dimovski & Brooks 2004; How 2000; Johnston & Madura 2002; Kutsuna, Smith & Smith 2009; Mudambi et al. 2012; Omran 2005; Ritter 1991). This result is not consistent with the findings of Lee, Taylor and Walter (1996), Álvarez and González (2005) and Belghitar and Dixon (2012), who found a positive relationship between long-run returns and first-day returns when considering Australian, Spanish

[18] That the R-squared from a regression of squared returns on the forecasts of the variance is low does not mean that the model is misspecified (Alexander 2001, p.124). The relatively high R-squared value can be found in studies that used economic time-series data but fairly low R-squared values have been reported in company-level cross-sectional time series (panel data) financial data. This study is also based on company-level cross-sectional time-series data. Previous Australian studies on IPOs (How 2000; Lee, Taylor & Walter 1996) have indicated relatively low R-squared values for their estimated models based on multiple regressions. If these models are only used to test a theory or to estimate a causal relationship rather than forecasting, the low R-square is not a constraint. However, the low R-square values are associated with low economic significance.

and UK IPOs. Further, Lee, Taylor and Walter (1996) found a negative and curvilinear relationship[19] between long-run market performance and first-day returns (short-run underpricing) when they used first-day return squared values as an explanatory variable.

This study found a direct relationship between long-run market performance and post-day MR. This positive association is statistically significant at the 5% level only for year one and year two. This finding implies that the higher the MR, the higher the long-run market performance in BHRs and BHARs. It shows that the long-run performance of IPOs is sensitive to the MR, which could lead to overperformance in the long run. The coefficient of the MR measures the market risk of the sample companies because it indicates the average beta of all companies. Most of the estimated MR coefficients are greater than 1, which shows a high market risk of the sample companies. Ritter (1991) also found a statistically significant positive association between the long-run returns and the MRs, and Chorruk and Worthington (2010) reported a statistically significant negative relationship between these two variables. However, this study's finding supports the finding of Ritter (1991) and confirms hypothesis 12 (H12) on the relationship between long-run market performance and MR.

The MS variable has an inverse relationship with the long-run market performance and it is statistically significant at the 1% level only for year two and year three. This shows that the IPOs with higher (lower) MS tended to have lower (higher) long-run performance, which is considered underperformance (overperformance). Normally, investors are optimistic about growth potential or market fads and firms take this as an opportunity to 'time' their IPOs in the market. This is known as the 'window of opportunity' hypothesis, which indicates that companies with higher MS (growth or overoptimistic investor sentiment) have lower long-run returns. Therefore, this negative relationship confirms the window of opportunity hypothesis. Dimovski and Brooks (2004) tested this hypothesis in relation to the Australian IPOs using a MS variable, but they found an unexpected sign on this relationship. Thomadakis, Nounis and

[19] The study tested both the value's first-day returns and its squared values as explanatory variables of the long-run regression models. It found a statistically significant negative relationship between the long-run market performance and first-day returns and a positive relationship between the long-run market performance and first-day returns squared values for year two and year three. However, it was found that the regression models suffered from the multicollinearity problem when both first-day returns and its squared values were used as explanatory variables. The finding also confirms the curvilinear relationship between long-run market performance and first-day returns (short-run underpricing) as reported in Lee, Taylor and Walter (1996), regardless of the multicollinearity problem.

Gounopoulos (2012) tested hot issue period as a MS and found a statistically significant negative relationship with the long-run market performance. The study finding is consistent with hypothesis 13 (H13).

According to the estimated models, the MV (MV_{t-10}) appears to be positively related to the long-run market performance, indicating that the IPO firms with higher MV tended to have overperformance in a long-run market. This relationship is also statistically significant at the 10% level for all three years. This positive relationship exists due to pre-issue market uncertainty. This finding is consistent with hypothesis 14 (H14).

The age of the firm (FAGE) is negatively related to the level of long-run market performance (measured under BHRs and BHARs), and is statistically significant at the 10% level only for year three. This suggests that the IPOs with a lower age (younger companies) overperformed relative to the higher-age IPOs (older companies). It can be argued that most high-age (established firms) go public near the peak of their business cycle. Therefore, they may give negative returns in the long run due to the decline of their business cycle. In other words, young firms (lower-age firms) go to the IPO market when they are in a growing stage in their business cycle. Therefore, they perform well in the long run compared with the old firms in the IPO market and may give positive returns in the long run. However, the finding does not confirm hypothesis 15 (H15) because it does not support the findings of previous studies (Balatbat, Taylor & Walter 2004; Belghitar & Dixon, 2012; Ritter 1991).

The hot issue (HC) market dummy has a positive sign in years two and three, and it is statistically significant at the 1% level only in year two. However, the expected sign between hot issue period and long-run returns is negative, which, is explained by the window of opportunity hypothesis (Abukari & Vijay 2011; Bancel & Mittoo 2009; Derrien & Kecskes 2007; Gajewski & Gresse 2006; Lowry 2003; Thomadakis, Nounis & Gounopoulos 2012). This finding is not consistent with hypothesis 16 (H16).

The industry dummy variable for the consumer discretionary and staples sector (D_4) has a negative sign, which indicates that consumer discretionary/staples firms underperformed in the long-run market. It is statistically significant at the 5% level for year one, year two and year three. The long-run industry analysis in Section 5.3 also shows that the consumer discretionary/staples sector was the worst-performing industry of the Australian IPOs because the firms in this sector gave negative returns (decreasing of wealth) for their investors over the three-year period. Ritter (1991) also found underperformance by retailing and oil and gas industries in the long-run market and a negative relationship with long-run performance. The industry dummy variable for the information technology industry (D_5) has a negative sign and it is statistically significant (at the 5% level) only in year one. This negative relationship indicates that IPO firms in the information technology industry underperformed in the long run. The dummy for listing year 2006 (DY_1) has a positive sign and is statistically significant at the 1% level only for year one. This relationship shows that the listed IPOs in 2006 earned positive long-run returns.

5.4.2 Binary Regression Models

In the previous section on the multiple regression models, the study identified the determinants that did not provide change in the associated probabilities (risks) of the determinants. The binary regression models provide the probabilities associated with the directional change in the long-run performance for a unit change in explanatory variables. These probabilities are more important for IPO investors due to change in economic and financial factors because it causes higher uncertainty in the IPO market.

The logit and probit regression models were used to analyse the long-run market performance under the binary models. Binary models were estimated with the determinants using the nonlinear approach of maximum likelihood. The logit and probit statistical models are associated with the occurrence of underperforming and overperforming the market, which is defined as 0 and 1 respectively. The dependent variable of these models is dichotomous or binary (1 or 0). The overperformance (positive BHR or BHAR) is considered '1' and underperformance (negative BHR or BHAR) is '0'. The estimated logit and probit binary regression models for the long-run market performance based on BHRs and BHARs are shown in Tables 5.14 and 5.15 respectively. The statistically significant explanatory variables in both the logit and probit regression models are similar under each performance measure. However, the constant values of the models and coefficients of each explanatory variable differ. The statistically significant variables in the binary regression models (logit and probit) for years one, two and three are post-day MR, MS, MV (MV_{t-10}), first-day PRIM, ICOR, dummy for listing year 2006 (DY_1), dummy for WICP from the issue capital, dummy for UWRA and dummy for OVSO.

Table 5.14: Estimated Binary Regression Models for the Long-Run Market Performance Based on BHRs

Short-run market performance	Estimated logit model from January 2006 to January 2012	N	LR statistics	Probability (LR stat.)	R^2_{McF}
1 year BHRs	$ln\left[\frac{P_i}{1-P_i}\right]$ = 0.804 + 5.186 ln[**MR**] – 0.085 [**ICOR**] – 0.768 [**WICP**] (0.000)*** (0.040)** (0.031)**	242	73.51637	0.000000	24.05%
2 year BHRs	$ln\left[\frac{P_i}{1-P_i}\right]$ = –0.483 + 3.979 ln[**MR**] – 1.195 ln[**PRIM**] – 2.32E-06 [**MS**] (0.000)*** (0.046)** (0.066)*	202	34.19766	0.000000	17.78%
3 year BHRs	$ln\left[\frac{P_i}{1-P_i}\right]$ = 0.357 + 4.288 ln[**MR**] – 0.132 [**ICOR**] – 3.81E-06 [**MS**] + 0.754 [$\mathbf{MV_{t-10}}$] (0.040)** (0.037)** (0.020)** (0.074)*	185	21.57603	0.000243	12.02%
	Estimated Probit Model from January 2006 to January 2012				
1 year BHRs	P_i = 0.470 + 2.841 ln[**MR**] – 0.049 [**ICOR**] – 0.449 [**WICP**] (0.000)*** (0.042)** (0.029)**	242	71.48035	0.000000	23.38%
2 year BHRs	P_i = –0.301 + 2.253 ln[**MR**] – 0.696 ln[**PRIM**] –1.25E-06[**MS**] (0.000)*** (0.047)** (0.060)*	202	34.26488	0.000000	17.81%
3 year BHRs	P_i = 0.136 + 2.472 ln[**MR**] – 0.073 [**ICOR**] – 1.94E-06 [**MS**] + 0.432 [$\mathbf{MV_{t-10}}$] (0.034)** (0.039)** (0.010)*** (0.073)*	185	21.39671	0.000264	11.92%

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. **N** = Sample size, **MR** = Post-day market return, which was calculated based on the All Ordinary Index for the same return interval as the dependent variable, **ICOR =** Issue cost ratio, **WICP =** dummy for working capital recovery from the issue capital, $\mathbf{MV_{t-10}}$ = Market volatility of 10-day period prior to closing date of the offer, **PRIM** = First-day primary market return, **MS =** Market sentiment before the listing, which measured square value of change in market index from issuing date to listing date, **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. $\mathbf{R_{McF}^2}$ is the McFadden R-squared. * statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level.

Table 5.15: Estimated Binary Regression Models for the Long-Run Market Performance on BHARs

Short-run market performance	Estimated logit model from January 2006 to January 2012	N	LR statistics	Probability (LR stat.)	R^2_{McF}
1 year BHARs	$ln\left[\frac{P_i}{1-P_i}\right]$ = –0.965 – 0.734 [**WICP**] + 0.892 **[UWRA]** + 0.824 **[OVSO]** + 1.085 [$\mathbf{DY_1}$] (0.020)** (0.007)*** (0.014)*** (0.000)***	242	25.41031	0.000042	8.19%
2 year BHARs	$ln\left[\frac{P_i}{1-P_i}\right]$ = –2.022 + 0.659 [$\mathbf{MV_{t\text{-}10}}$] (0.037)**	202	4.218341	0.039989	2.04%
3 year BHARs	$ln\left[\frac{P_i}{1-P_i}\right]$ = –0.935 + 1.000 [$\mathbf{MV_{t\text{-}10}}$] – 2.14E-06 [**MS**] – 0.101 [**ICOR**] (0.006)*** (0.046)** (0.048)**	185	14.57796	0.002215	7.03%
	Estimated probit model from January 2006 to January 2012				
1 year BHARs	P_i = –0.580 – 0.444 [**WICP**] + 0.534 **[UWRA]** + 0.489 **[OVSO]** + 0.658 [$\mathbf{DY_1}$] (0.020)** (0.007)*** (0.015)** (0.000)***	242	25.28655	0.000044	8.16%
2 year BHARs	P_i = –1.233 + 0.528 [$\mathbf{MV_{t\text{-}10}}$] – 8.80E-07 [**MS**] (0.010)*** (0.098)*	202	7.661667	0.021692	3.71%
3 year BHARs	P_i = –0.573 **+** 0.602 [$\mathbf{MV_{t\text{-}10}}$] – 1.22E-06 [**MS**] – 0.062 [**ICOR**] (0.005)*** (0.035)** (0.038)**	185	14.90908	0.001896	7.18%

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. **N** = Sample size, **WICP =** Dummy for working capital recovery from the issue capital, $\mathbf{MV_{t\text{-}10}}$ = Market volatility of 10-day period prior to closing date of the offer, **ICOR =** Issue cost ratio, **UWRA =** Dummy for underwriter availability, **OVSO =** Dummy for oversubscription option availability, **MS =** Market sentiment before the listing, which measured square value of change in market index from issuing date to listing date, $\mathbf{DY_1}$ **=** Dummy for listing year 2006, **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. $\mathbf{R_{McF}^2}$ is the McFadden R-squared. * statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level.

The estimated logit and probit binary regression models in Table 5.14 show that there is a positive relationship between the long-run performance and the post-day MRs. This relationship is statistically significant only for all the three-year BHRs at the 5% level. This relationship has been reported by Ritter (1991) and the finding is consistent with hypothesis 12 (H12).

The first-day PRIM variable indicates an inverse association with the long-run market performance under BHRs. This indicates that if the PRIM is increased (decreased), this leads to a decrease (increase) in the level of overperformance (underperformance) in the long run. This relationship is statistically significant only for two-year BHRs at the 5% level. However, this relationship is not statistically significant for any estimated logit and probit binary models based on BHARs. This finding of the study supports the investor overoptimism hypothesis, as discussed by prior researchers (Abukari & Vijay 2011; Ahmad-Zaluki, Campbell & Goodacre 2007; Cai, Liu & Mase 2008; De Bondt & Thaler 1987; Dimovski & Brooks 2004; How 2000; Johnston & Madura 2002; Omran 2005; Ritter 1991) and confirms hypothesis 11 (H11).

According to the estimated logit and probit models, the MS variable is negatively associated with the long-run market performance. This relationship is also statistically significant only for two- and three-year BHRs, at 10% and 5% levels respectively, whereas it is significant at the 5% level for the estimated logit model based on three-year BHARs. However, the probit regression models for two- and three-year BHARs show that this relationship is statistically significant at 10% and 5% levels respectively. The negative relationship between the long-run market performance and MS supports the window of opportunity hypothesis and the finding is consistent with hypothesis 13 (H13).

The estimated logit and probit binary regression models indicate that MV (MV_{t-10}) is positively related to the long-run market performance, showing that the IPO firms with higher MV tended to have overperformance in the long-run market. This association is statistically significant at the 5% level only for three-year BHRs and for two- and three-year BHARs at 1%. The positive relationship between these two variables supports the uncertainty hypothesis, which shows that investors need reasonable compensation (high return) for accepting high volatility or risk. This finding confirms hypothesis 14 (H14).

The ICOR has a negative sign in both the estimated logit and the estimated probit binary regression models under BHRs. This relationship is statistically significant only for one-year BHRs at the 5% level and it is not significant for BHARs. This negative relationship can be explained by the future funding cost. If the ICOR is increased, this causes an increase in the cost of the future funds. This finding shows that a negative relationship can be expected between long-run performance and issue cost, which is consistent with hypothesis 17 (H17).

The dummy variable for WICP from the issue capital appears to be negatively associated with the long-run market performance, showing that the IPO firms with WICP tended to have poor performance (underperformance) in the long run. This association is statistically significant only for one-year BHRs and BHARs at the 5% level. The negative relationship can be explained based on future funding costs. IF an IPO company uses long-term funds (equity capital) to finance its day-to-day working capital requirements, the company may take future funding requirements at higher finding costs, which could adversely affect the company's performance. Therefore, we can expect a negative relationship between long-run performance and WICP, and this is consistent with hypothesis 18 (H18).

The dummy variable for listing year 2006 is statistically significant at the 1% level only for year-one BHARs, which shows that the listed IPOs in 2006 positively affected the long-run market performance.

The dummy variable for UWRA has a positive relationship with the long-run performance, and this relationship is statistically significant at the 1% level, only for year-one BHARs. This finding support the argument of prior research that underwritten issues should have superior performance compared with non-underwritten issues due to the underwriters' buying support, reputation and superior knowledge about the market conditions (Dimovski & Brooks 2004; Ritter 1984; Welch 1992). This finding is consistent with the hypothesis 19 (H19).

The dummy variable for OVSO appears to be positively associated with the long-run market performance. This relationship is statistically significant at the 1% level under both the binary regression models for year-one BHARs only. Theoretically, the level of price performance depends on the demand for the IPO, which is measured by oversubscription. Rock (1986) and Michaely and Shaw (1994) argued that the level of IPO performance depends on the information heterogeneity among investors and they assumed that the level of heterogeneity increases with the demand for the firm's shares. Empirically, several researchers have used oversubscription as an independent variable to explain IPO performance. Among them, Agarwal, Liu and Rhee (2008), Boudriga, Slama and Boulila (2009), Kandel, Sarig and Wohl (1999) and Chowdhry and Sherman (1996) found a positive relationship between subscription and IPO performance. Therefore, this finding supports hypothesis 20 (H20).

5.5 Marginal Analysis (Risk Analysis)

The marginal analysis measured the probability associated with the explanatory variables in the long-run performance, which affect directional changes between long-run underperformance and overperformance. This analysis was useful to identify the most important explanatory variables that contribute to change in the long-run market performance of the Australian IPOs. Table 5.16 shows the calculated marginal probabilities associated with the explanatory variables in the long-run market performance (based on BHRs and BHARs) for years one, two and three.

Table 5.16: The Change in Probability (Δp) Due to a Unit Change in Explanatory Variables

Explanatory variables	Dependent variable measures in BHRs		
	Year 1(BHRs)	Year 2 (BHRs)	Year 3 (BHRs)
MR	$\Delta p = 0.860 \times 10^{0}$	$\Delta p = 0.451 \times 10^{0}$	$\Delta p = 0.516 \times 10^{0}$
ICOR	$\Delta p = -0.142 \times 10^{-1}$		$\Delta p = -0.159 \times 10^{-1}$
WICP	$\Delta p = -0.128 \times 10^{0}$		
PRIM		$\Delta p = -0.135 \times 10^{0}$	
MS		$\Delta p = -0.263 \times 10^{-6}$	$\Delta p = -0.459 \times 10^{-6}$
MV_{t-10}			$\Delta p = 0.908 \times 10^{-1}$
	Dependent variable measures in BHARs		
	Year 1(BHARs)	**Year 2 (BHARs)**	**Year 3 (BHARs)**
ICOR			$\Delta p = -0.179 \times 10^{-1}$
WICP	$\Delta p = -0.137 \times 10^{0}$		
MS			$\Delta p = -0.379 \times 10^{-6}$
MV_{t-10}		$\Delta p = 0.107 \times 10^{0}$	$\Delta p = 0.177 \times 10^{0}$
UWRA	$\Delta p = 0.167 \times 10^{0}$		
OVSO	$\Delta p = 0.154 \times 10^{0}$		

Note: Negative sign indicates an inverse relationship between explanatory variables and long-run performance (based on BHRs and BHARs) whereas positive sign shows direct relationship between these. **BHRs** = Raw buy-and-hold returns, **BHARs** = Buy-and-hold abnormal returns, Δ**p** = Marginal probability, **MR** = Post-day market return, which was calculated based on the All Ordinary Index for the same return interval as the dependent variable, **ICOR =** Issue cost ratio, **WICP =** Working capital recovery from the issue capital, **PRIM** = First-day primary market return, **MS =** Market sentiment before the listing, which measured square value of change in market index from issuing date to listing date, $\mathbf{MV_{t-10}}$ = Market volatility of 10-day period prior to closing date of the offer, **UWRA =** Dummy for underwriter availability, **OVSO =** Dummy for oversubscription option availability.

5.5.1 Marginal Effect Analysis for Year One (BHRs and BHARs)

The change in probability associated with the determinants in the long-run market performance for year one is given in Table 5.16. MR, ICOR, WICP, UWRA and OVSO are the main significant explanatory variables in year one. In the case of BHRs, MR and ICOR are statistically significant variables. In the case of BHARs, UWRA and OVSO are significant variables. In both cases, WICP is the only variable statistically significant for year one. ICOR and WICP indicate an indirect relationship and MR, UWRA and OVSO show a direct relationship with the long-run returns. The explanation of these relationships is as follows:

1. The positive sign for MR shows that, if MR is increased by 1%, the probability of change to overperformance or a decrease in the level of underperformance based on BHRs is 0.860.
2. The negative sign for ICOR shows that, if ICOR is increased by 1%, the probability of change to underperformance or a decrease in the level of overperformance based on BHRs is 0.0142.

3. The negative sign for WICP shows that, if a company recovers working capital requirements from its initial issued equity capital, the probability of change to underperformance or a decrease in the level of overperformance based on BHRs and BHARs is 0.128 and 0.137 respectively.
4. The positive sign for UWRA shows that, if the IPO issue is underwritten, the probability of change to overperformance or a decrease in the level of underperformance based on BHRs is 0.167.
5. The positive sign for OVSO shows that, if a company accepts oversubscription, the probability of change to overperformance or a decrease in the level of underperformance based on BHRs is 0.154.

In year one, the most important determinant that contributes to the directional change in BHRs is MR, and in BHARs, it is UWRA, because these variables have the highest marginal probabilities.

5.5.2 Marginal Effect Analysis for Year Two (BHRs and BHARs)

The significant explanatory variables for year two are MR, PRIM, MS and MV_{t-10}. In the case of BHRs, MR, PRIM, MS are significant variables. In the case of BHARs, the MV_{t-10} is the only significant variable. None of the variables is statistically significant in both cases. MR and MVt_{-10} have positive signs with the long-run performance and PRIM and MS have negative signs. These relationships can be explained as follows:

1. The positive sign for MR shows that, if MR is increased by 1%, the probability of change to overperformance or a decrease in the level of underperformance based on BHRs is 0.451.
2. The negative sign for PRIM shows that, if PRIM is increased by 1%, the probability of change to underperformance or a decrease in the level of overperformance based on BHRs is 0.135.
3. The negative sign for MS shows that, if MS is increased by one unit, the probability of change to underperformance or a decrease in the level of overperformance based on BHRs is 0.000000263.
4. The positive sign for MV_{t-10} shows that, if MV_{t-10} is increased by 1%, the probability of change to overperformance or a decrease in the level of underperformance based on BHARs is 0.107.

In year 2, the most important determinants that contribute to the directional change in BHRs and BHARs are MR and MV_{t-10} respectively. These variables have the highest marginal probabilities.

5.5.3 Marginal Effect Analysis for Year Three (BHRs and BHARs)

Table 5.16 shows the calculated marginal probabilities for significant variables for year three: MR, ICOR, MV_{t-10} and MS. All these variables are significant in the case of BHRs and, except for MR, in BHARs. In both cases, the variables ICOR, MV_{t-10} and MS are statistically significant. ICOR and MS have negative relationships and MR and MV_{t-10} have positive relationships with the long-run performance. The explanation of these relationships is as follows:

1. The positive sign for MR shows that, if MR is increased by 1%, the probability of change to overperformance or a decrease in the level of underperformance based on BHRs is 0.516.
2. The negative sign for ICOR shows that, if ICOR is increased by 1%, the probability of change to underperformance or a decrease in the level of overperformance based on BHRs and BHARs is 0.0159 and 0.0177.
3. The negative sign for MS shows that, if MS is increased by one unit, the probability of change to underperformance or a decrease in the level of overperformance based on BHRs and BHARs is 0.000000459 and 0.000000379 respectively.
4. The positive sign for MV_{t-10} shows that, if MV_{t-10} is increased by 1%, the probability of change to overperformance or a decrease in the level of underperformance based on BHRs and BHARs is 0.0908 and 0.177.

In year 3, the most important determinants that contribute to the directional change in BHRs and BHARs are MR and MV_{t-10} respectively because these variables have the highest marginal probabilities.

The study found from the marginal probability analysis that MR and MV_{t-10} are the most important explanatory variables (determinants) of the long-run market performance. These variables are considered market-related characters. MR is an important determinant in BHRs for all three years and MVt_{-10} for years two and three in

BHARs. These market variables were used to measure the risk of the market. However, the effect of these variables on long-run performance differs.

The estimated long-run econometric models do not suffer from the multicollinearity problem because all the models were estimated after eliminating highly correlated explanatory variables. The correlation matrix for the significant explanatory variables is given in Table 5.17.

Table 5.17: Correlation Matrix

	IPOP	MR	ICOR	OWSH	FAGE	MV_{t-10}	MS	PRIM	SECON	FSIZE
IPOP	1.000	–0.093	–0.044	–0.019	0.093	0.044	0.197	0.023	–0.192	–0.267
MR	–0.093	1.000	–0.045	0.018	0.053	–0.214	–0.231	–0.059	0.024	0.025
ICOR	–0.044	–0.045	1.000	0.310	–0.009	0.064	0.016	0.064	–0.034	–0.078
OWSH	–0.019	0.018	0.310	1.000	0.045	0.047	–0.001	0.072	–0.088	0.226
FAGE	0.093	0.053	–0.009	0.045	1.000	0.012	–0.075	–0.015	–0.067	0.109
MV_{t-10}	0.044	–0.214	0.064	0.047	0.012	1.000	0.287	–0.049	–0.154	0.024
MS	0.197	–0.231	0.016	–0.001	–0.075	0.287	1.000	–0.030	–0.119	–0.104
PRIM	0.023	–0.059	0.064	0.072	–0.015	–0.049	–0.030	1.000	–0.040	0.014
SECON	–0.192	0.024	–0.034	–0.088	–0.067	–0.154	–0.119	–0.040	1.000	–0.030
FSIZE	–0.267	0.025	–0.078	0.226	0.109	0.024	–0.104	0.014	–0.030	1.000

Note: IPOP = IPO period in days, which shows time given to invest, **MR** = Post-day market return, which was calculated based on the All Ordinary Index for the same return interval as the dependent variable, **ICOR** = Issue cost ratio, **OWSH** = Original ownership, **FAGE** = Firm age in years, **MV_{t-10}** = Market volatility of 10-day period prior to closing date of the offer, **MS** = Market sentiment before listing, which measured square value of change in market index from issuing date to listing date, **PRIM** = First-day primary market return, **SECON** = First-day secondary market return, **FSIZE** = firm size.

5.6 Summary

This chapter first presented the analysis of the long-run market performance based on the event-time approach by full sample, industry and issue year. Then, the study identified the significant determinants of the long-run market performance based on the offer, firm and market characteristics of 249 Australian IPOs over the three-year period after listing. The long-run market performance was analysed using performance measures such as the CAR and the buy-and-hold investment strategy based performance measures, which include BHR, BHAR and WR. To identify whether the performance of the IPOs varied by market capitalisation, the performance measures were calculated based on the VW and the EW schemes. To determine whether the calculated performance measures are statistically significant, the bootstrapped skewness-adjusted t-statistics, conventional t-statistic (student t-statistics), and t-statistics were calculated. The determinants of the long-run market performance were identified using logistic regression, probit regression and multiple regression models with a marginal probability analysis. A summary of the long-run market performance is presented in Appendix 32.

When this study analysed the full sample based on CARs, it was found that, in the three years after going public, overall, the Australian IPOs overperformed by 41% and 34.27% based on EW and VW CARs respectively. These overperformance levels are statistically significant at the 1% level. This overperformance can be seen year in year one and year two under both weighting schemes. However, the overperformance levels based on the EW scheme in year one and year two are not statistically significant. The weighting scheme also indicated that the larger IPO companies that have higher market CAP in the full sample performed well compared with the smaller IPOs. However, this was not the case when the study analysed the resources sector and issue year 2006 because the IPOs with higher market CAP in the resources sector and issue year 2006 performed less well than the lower market CAP IPOs. Although the full sample of IPOs overperformed on CARs, the industry analysis shows that the consumer discretionary and staples sector IPOs underperformed based on EW and VW CARs in three years by –21.49% and –20.3% respectively. The information technology sector IPOs also underperformed over the three-year period in EW CARs. The highest overperformance levels can be found in the resources sector on EW and VW CARs, by 76.15% and 45.04% respectively, which are statistically significant at the 5% level. A substantial variation in the long-run performance by issue year can be identified in the first two years. However, the highest overperformance levels can be observed in 2008 in EW and VW CARs by 57.04% and 82.41% respectively. The overperformance levels in 2007 under EW and VW schemes (49.47% on VW CARs and 43.47% on VW CARs) are statistically significant at the 1% level. The EW CARs in 2006 (41.81%) and VW CARs in 2008 (82.41%) are also statistically significant at the 5% and 10% level.

When the study examined the full sample based on the buy-and-hold investment strategy based performance measures, the EW and VW BHRs (–36.40% under the EW scheme and –25.12% under the VW scheme), BHARs (–15.12% under the EW scheme and –8.75% under the VW scheme) and WRs (0.80 under the EW scheme and 0.89 under the VW scheme) indicated that the Australian IPOs underperformed in the three years after listing. The underperformance levels based on BHRs and BHARs are statistically significant at the 1% level and 5% level respectively. The EW BHRs indicated that the sample IPOs underperformed over three years. However, the VW BHRs showed that the full sample of IPOs overperformed in year one, which is statistically significant at the 1% level under both t-statistics. This overperformance can be observed under the EW BHARs and WRs in year one and VW BHARs and WRs in years one and two. The overperformance level in year one based on VW BHARs is only statistically significant under both t-statistics. The IPOs in the consumer discretionary and staples sector and issued IPOs in 2007 and 2008 underperformed in EW and VW BHRs over the three-year period. The information technology sector IPOs also underperformed over the three-year period in EW BHRs. A substantial variation in the long-run performance by full sample, industry and issue year can be identified in the first two years compared with the last year. The VW BHARs and WRs indicate that investors could earn positive abnormal returns investing in the larger IPOs for up to two years because most of the larger IPOs performed well in the first two years. The information technology sector also overperformed only on VW BHARs and WRs up to two years, which shows that the larger IPOs in this sector earned positive abnormal returns compared with the smaller IPOs. However, the industrial sector IPOs overperformed on value and EW BHARs and WRs in the first two years, which indicates that, on average, investors of this sector earned positive abnormal returns for up to two years after going public.

When this study estimated multiple regression models, the main determinants of the long-run market performance were found to be MV (MV_{t-10}) and the dummy variable for the consumer discretionary and staples industry (D_4), which significantly affected all three years. The other significant determinants are post-day MR, first-day PRIM and MS. When the study estimated the binary regression models to identify the determinants of the long-run market performance, the main determinant was found to be the post-day MR, which significantly affected all three years. Other significant determinants are ICOR, MS and MV (MV_{t-10}). The marginal analysis showed that the most important determinants of the directional change in the long-run performance were post-day MR and MV (MV_{t-10}), which can be used to measure the market uncertainty. All the significant determinants of the long-run market performance in the Australian IPOs show that the market characteristics are more important than the other characteristics. However, the negative significant relationship between the long-run performance and the first-day PRIM confirms the investor overoptimism hypothesis, as reported in the

IPO literature. The negative coefficient on the MS variable is consistent with the window of opportunity hypothesis, and the positive sign on MV (MV_{t-10}) and post-day MR support the uncertainty hypothesis.

The overall analysis concludes that:

1. The long-run performance of the IPOs was sensitive to the performance measures. When CARs were applied, the IPOs overperformed in the long run, which shows a three-year investment with changing of a portfolio is a good investment for long-term investors. However, it disappeared when BHRs were used, which shows, on average, a three-year buy-and-hold strategy appears to be a bad investment for long-run investors.
2. The long-run performance also varied according to the industry and weighting scheme.
3. The determinants of the long-run market performance varied according to the developed models, such as binary regression and multiple regression, and return measures, such as BHRs and BHARs.

The next chapter summaries and concludes the major findings of this chapter and the previous chapter.

Chapter 6: Summary and Conclusions

6.1 Introduction

The final chapter provides an overall summary of the study and its conclusions. This chapter is organised as follows: the first section provides an overview of the study, the second section presents a summary of the findings of Chapters 4 and 5, the third section explains the implications of the study, the fourth section identifies the limitations of the study, and the final section offers some suggestions for further research.

6.2 Overview of the Study

The main objective of this study was to determine whether Australian IPOs underprice in the short run and underperform in the long run and to identify their determinants. The study investigated the short-run stock market performance and the long-run stock market performance of Australian IPOs that were listed during 2006–2011 by industry, listing year and issue year. To measure the short-run performance, the first listing day returns were divided into the primary market, the secondary market and the total market. The PRIMs and SECONs were used to measure the opening price performance and the total MRs were used to measure the closing price performance. Then, the first-day return was extended to the post-day listing analysis, which measured the post-listing performance for up to nine trading days. The short-run market performance was evaluated using the RRs, ARs and CARs. To measure the long-run market performance, the return measures were calculated based on two different weighted methods—monthly EW and VW schemes—for up to the three post-listing years using an event-time approach. The long-run market performance was evaluated based on the following performance measures: CARs, BHRs, BHARs and WRs.

To identify the determinants of the short-run market performance (underpricing) and long-run market performance (underperformance), this study estimated both binary and multiple regression models with the offer characteristics, firm characteristics and market characteristics. In addition to these characteristics, industry and year dummies were tested with a view to determining the effects of industry and year. Marginal analysis was also carried out to estimate the probability associated with each determinant, under the logit binary model, of significantly affecting the directional changes between underpricing and overpricing in the short run and underperformance and overperformance in the long run. The probability associated with determinants indicates the risk, which is more important to IPO investors because of changes in economic and financial factors, which cause higher uncertainity in the IPO market. Although, in recent times, IPO performance has been increasingly examined by other researchers, there is a dearth of literature on the risk issue. The findings of this study will contribute to the literature on IPOs, particularly on the risks related to the determinants of IPO market performance. In evaluating the IPO short-run market performance, this study provided an in-depth analysis using both the first-day returns (include first-day PRIMs, SECONs and total MRs) and post-day returns. In evaluating the long-run market performance, this study used different performance measures (include weighting methods). Finally, the study identified the determinants of IPO market performance (short-run and long-run) using both binary and multiple regression models with estimating of the marginal probability.

6.3 Summary of Findings

This section provides a summary of the main results presented in Chapters 4 and 5. The findings from the analyses based on the short-run and long-run market performance and their determinants are presented separately.

6.3.1 Analysis Based on Short-Run Market Performance and Its Determinants

The findings on the short-run market performance are:

- The short-run market performance analysis showed that the Australian IPOs were underpriced in the short run (except for the analysis based on the secondary market). This finding confirmed the underpricing phenomenon of IPOs, which is widely accepted as a universal phenomenon.
- The post-day MR analysis showed that the level of underpricing slowly decreased after the listing.

- The SECON analysis indicated that the Australian IPOs were overpriced under both return measures: MARs and RRs.
- The industry analysis showed that the resource sector IPOs were underpriced in the primary and total markets on both return measures: MARs and RRs.
- The year analysis indicated that listed and issued IPOs in year 2006, 2007 and 2010 were underpriced in both the primary and total markets on MARs and RRs.
- The SECON analysis also showed that listed and issued IPOs in year 2007 and 2010 were overpriced under both return measures: MARs and RRs.
- A variation could be observed in the level of short-run performance in the analysis of the first-day PRIMs, SECONs, total MRs and the post-day listing returns by industry, listing year and issue year.

The findings on the determinants of the short-run market performance are:

- The multiple regression models showed that the main determinants of the short-run market performance in Australia were LISD, PRICE, time to listing (TOTP), market return (RETU), MV (MV_{t-10}) and attached free share option availability (ATOA).
- The binary regression models showed that IPOP, TOTP, LISD, TNPR and MV (MV_{t-60}) were the significant determinants of the short-run market performance in the Australian IPOs.
- The marginal probability analysis showed that the most important determinants of the directional changes in the short-run performance were MV (MV_{t-60}) and TNPR.
- All significant determinants confirmed that issue characteristics and market characteristics are more important than firm characteristics when explaining short-run underpricing in Australian IPOs.
- The findings results on IPOP, TOTP and LISD support Rock's hypothesis, and MV (MV_{t-60}) and TNPR support the uncertainty hypothesis.
- The determinants of the short-run market performance varied according to the developed econometric model—binary regression or multiple regression—and by market—primary, secondary, total or post-day.

6.3.2 Analysis Based on Long-Run Market Performance and Its Determinants

The findings on the long-run market performance are:

- The analysis showed that the outcome of long-run performance in the three years after listing varied by performance measure. When the study analysed the full sample using CARs, the IPOs overperformed, whereas when BHR measures, such as BHRs, BHARs and WR index, were used, the IPOs underperformed.
- The outcome of the industry- and issue-year-level analysis was similar to the full sample outcome (except for the performance of the consumer discretionary and staples and information technology sectors based on CARs).
- The industry analysis showed that the consumer discretionary and staples sector IPOs underperformed based on all performance measures and the information technology sector IPOs also underperformed only in EW CARs over the three-year period.
- In the first two years, the long-run performance was not similar to the third year, which showed a variation in the long-run performance by full sample, industry, and issue year.
- In the first two years, EW and VW schemes did not provide results consistent with those of the third year.

The findings on the determinants of the long-run market performance are:

- In the multiple regression models, the significant determinants of the long-run market performance were MV (MV_{t-10}), the dummy variable for the consumer discretionary and staples industry (D_4), post-day MRs, first-day PRIMs and MS.
- In the binary regression models, the significant determinants were post-day MRs, ICOR, MS and MV (MV_{t-10}).
- From the marginal probability analysis, the most important determinants of the directional changes in the long-run performance were found to be post-day MR and MV (MV_{t-10}).
- Out of the significant determinants of the long-run market performance, market characteristics were more important than the other characteristics.
- The negative relationship between the long-run performance and the first-day PRIMs confirmed the investor overoptimism hypothesis, as reported in the IPO

literature. The negative coefficient on MS variable was consistent with the window of opportunity hypothesis and the positive sign on MV (MV_{t-10}) supported the uncertainty hypothesis.

- The identified determinants for the long-run market performance varied according to the developed econometrics model used—binary regression or multiple regression—and the return measures—BHRs or BHARs. This finding supports the methodological argument in long-run performance analysis, which shows that long-run performance is sensitive to the applied models or methodology.

6.4 Implications of the Study

The findings of this thesis may be useful for the following parties: investors, security analysts, academic researchers and the ASX.

Findings that can benefit investors are as follows:

- In the short run, initial investors can earn higher returns on the first-day primary market. Further, they can take full benefit of the first-day underpricing due to the overpricing in the first-day secondary market. However, investors should be cautious about overpricing in the first-day secondary market and decreasing of underpricing in the post-day market. The study has confirmed that investors' wealth decreases in the first-day secondary market and the post-day market.
- Econometric models and marginal probability analysis can help investors to identify the significant determinants in short-run market performance, which are more useful for formulating their short-run investment strategies.
- In the long run, frequent change in an investment portfolio rather than holding for a long period (a three-year period) is a better investment strategy for IPO investors in Australia for the following reasons: (1) the changes that occur in market characteristics, such as MV and post-day MR, which indicate uncertainty in the market and (2) the irrational behaviour of investors.
- The results derived from the industry and year (issue and listing) analysis can be more informative for investors when formulating their short-run and long-run

investment strategies because, in some cases, industry and issue results vary in comparison with the full sample.

Findings that can benefit security analysts are:

- A decrease in investors' wealth in the secondary market and the post-day market may signal companies' future performance. These findings may be useful for security analysts in forecasting the future stock market performance of IPO companies.
- The contradicting results based on long-run performance measures may create more opportunities for security analysts to expand their consultation services and expertise to investors by recommending stocks that may overperform in the long run due to higher investor demand on stocks.
- The significant determinants of short- and long-run market performance help to identify the reasons for market performance and to forecast the future market performance of IPOs.
- Marginal probability analysis based on binary models is more important for market analysis when forecasting future directional changes in IPO market performance.
- The findings based on the industry and year (issue and listing) analysis is more informative for market analysis when recommending stocks for investors and forecasting future market performance because the market performance varies according to the industry and year.

The findings of the study, and the different approaches used to measure the performance and to identify significant determinants using different econometric models and validated hypotheses are useful for academic researchers as follows:

- The finding based on short-run and long-run market performance and their determinants could be important for academics who are involved in researching IPO market performance.
- The study used different approaches to evaluate the short-run market performance, including first-day opening price performance (primary and secondary market), closing price performance and post-day performance. Some of the approaches used in this study led to outcomes that differ from those in the

existing literature. These approaches might be useful for further investigation of IPO market performance.

- The long-run performance was evaluated using a performance metric that includes different performance measures and weighting systems. The contradicting results based on performance measures may motivate researchers to examine this area further.
- Analysis of IPO market performance using marginal probability is a new direction for IPO researchers. Researchers can identify the most important determinants of the changes in market performance as well as the associated risk (probability) of these determinants using marginal probability.
- The study used different econometric models to identify the determinants of the market performance and found that the determinants of the short- and long-run market performance varied according to the developed model used—binary regression or multiple regression. This finding may encourage researchers to analyse performance using different models to test the methodological arguments in the IPO research.
- The study's findings supported the following theories used to explain IPO market performance: Rock's hypothesis and the uncertainty hypothesis in the short run and the investor overoptimism hypothesis, the window of opportunity hypothesis and the uncertainty hypothesis in the long run.

The ASX can benefit from the findings of the study for the following reason. The study has examined an explanatory variable called the IPO period (IPOP), which has not been considered in prior Australian IPO research. It had a statistically significant negative effect on the short-run market performance (underpricing). The marginal probability analysis also showed that, if IPOP increased in the first-day primary market by one day, the probability of change to overpricing or decrease in the level of underpricing was 0.0071%. This implies that, if the IPOP is increased, it leads to a decrease in the level of underpricing (increase in the level of overpricing) due to a decrease in investors' demand, particularly by uninformed investors. This finding may be useful for the ASX because they could manage the level of underpricing through uninformed investors' demand by decreasing or increasing the IPO period.

6.5 Limitations of the Study

This study has the following limitations:

- This study examined the long-run market performance for up to three post-IPO years. This period may not be an adequate period for revealing the gains and losses of the IPO companies. In addition, the study found inconsistency in the long-run performance in the first two years compared with the third year. However, extending the post-IPO period beyond the three-year period was not feasible due to data availability and sample size problems. Further, the three-year period is the average period considered for long-run analysis and is consistent with previous studies on long-run market performance (Ahmad-Zaluki, Campbell & Goodacre 2007; Cai, Liu & Mase 2008; How 2000; Lee, Taylor & Walter 1996; Ritter 1991).
- This study calculated returns based on share prices, and some past studies (How, 2000; Lee, Taylor & Walter 1996; Liu, Uchida & Gao 2012) have calculated returns considering both share prices and dividends. However, this study evaluated the market performance using share price performance because one of the main objectives of the study was to identify whether the IPOs underpriced in the short run and underperformed (overpriced) in the long run. Further, the evaluation of market performance by using share price based returns is widely accepted and consistent with prior research on stock market performance.
- This study did not consider the option price adjustment (Dimovski & Brooks 2004; Dimovski, Philavanh & Brooks 2011; How 2000; How, Lam & Yeo 2007) to the return calculation because the sample included only 15 companies (a small proportion [6%] of the sample of 254) that had issued free options to IPO investors. Thus, the option price adjustment effect on overall reported results was likely to be very small.
- This study measured the returns in the first-day secondary market using the opening and closing prices of the first day. However, some studies have calculated this return based on the transaction occurring at different time intervals of the first trading day (Aggarwal & Conroy 2000; Barry & Jennings 1993; Bradley et al. 2009; Edwards & Hanley 2010; Schultz & Zaman 1994). Although this type of analysis is more useful for investigating performance in

the secondary market, it was not feasible due to time constraints and the sample size of the study.

- This study analysed the long-run market performance based on the event-time approach. Some prior studies have analysed long-run performance using both the calendar time approach and the event-time approach. These studies have used different methodologies under each approach and reported different results. However, as explained in Chapters 3 and 5, the event-time approach has been widely used for evaluating long-run market performance in the IPO literature because calendar-time returns do not measure investor experience (Barber & Lyon 1997).
- Finally, this study used only one market benchmark, the All Ordinary Index, to identify the market performance of the IPO companies. Particularly in the evaluation of long-run performance, some past studies (Abukari & Vijay 2011; Ahmad-Zaluki, Campbell & Goodacre 2007; Moshirian, Ng & Wu 2010) have used different benchmarks rather than using a single benchmark. According to these past studies, these benchmarks have produced different outcomes in the long run. The most serious problem associated with the use of a market benchmark (a reference portfolio) to evaluate the performance is the skewness bias (Lyon, Barber & Tsai 1999). To eliminate the skewness bias, this study calculated the bootstrapped skewness-adjusted t-statistic for the long-run BHR measures as suggested by Lyon, Barber and Tsai (1999). However, use of a market benchmark to evaluate IPO market performance is consistent with prior research (Ajlouni & Abu-Ein 2009; Bird & Yeung 2010; Cai, Liu & Mase 2008; Dimovski & Brooks 2004; How 2000; Kiymaz 2000; Lee, Taylor & Walter 1996; Suchard & Singh 2007; Thorsell & Isaksson 2012).

6.6 Suggestions for Further Research

Suggestions for further research include:

- The study suggests using risk-adjusted performance measures such as the Treynor measure and the Sharpe measure to evaluate the market performance of IPOs with the market-adjusted performance measures because evaluation of performance based on market-adjusted average returns alone is not very useful

(Kulendran 2011, p. 291). Further, risk-adjusted performance measures are particularly important for investors because their money invested in the stock market is normally subject to risk. Therefore, these risk-adjusted measures are considered effective performance measures, particularly for investors.

- Forecasting of IPO market performance has been given little attention in the IPO literature. However, forecasting of IPO performance is important for investors and market analysts because it helps with their investment analysis and decisions. IPO performance can be forecast using a logit regression model, a probit regression model, discriminant analysis and a multiple regression model. Therefore, the study suggests forecasting of IPO market performance using these models.
- The study suggests evaluating first-day secondary market performance using transaction-based returns at different time intervals such as every five minutes or every 10 minutes. This type of movement analysis is useful for identifying whether initial investors (IPO investors) can take underpricing benefits in the first-day primary market.
- In order to identify the possible reasons for industry and year based performance, the study suggests estimating the econometric models by industries, issue years and listing years.
- The study found that the IPO market performance is sensitive to the applied methodology particularly the long-run market performance. Therefore, the study suggests identifying the possible reasons for this may be useful to investors and security analysis.
- After considering some of the limitations mentioned in the previous section, the study suggests evaluating long-run market performance using both approaches (the event- and calendar-time approaches) with different benchmarks, such as control or matching firms, reference portfolios (with different indices), alpha and beta values of Fama and French (1993), and the beta value of the capital assets pricing model (1964) for more than a three-year period. This kind of analysis would provide more information for investors, security analysts, academic researchers and the ASX.

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Appendices

Appendix 1: Listing Timetable of the ASX

Task	Activity	Due rate	Responsibility
1	1st due diligence meeting	Week 1	Due diligence committee
2	Circulate draft documents including:		
	• due diligence planning memo/checklist	Week 1	Lawyers
	• materiality guidelines	Week 1	Accountants
	• outline draft prospectus	Week 1	Lawyers
3	1st draft prospectus	Week 2	Company/corporate advisors/lawyers
4	2nd due diligence meeting	Week 2	Due diligence committee
5	Draft accountants reports including:		
	• independent accountant's report	Week 3	Accountant/company/corporate advisors
	• forecasts/projections	Week 3	Accountant/company/corporate advisors
6	Draft material contracts	Week 3	Lawyers
7	3rd due diligence meeting	Week 4	Due diligence committee
8	3rd draft prospectus	Week 4	Company/corporate advisors/lawyers
9	4th due diligence meeting	Week 5	Due diligence committee
10	Final drafts:		
	• Accountants' reports	Week 5	Accountants
	• Material contracts	Week 5	Lawyers
11	4th draft prospectus	Week 5	Company/corporate advisors/lawyers
12	Pre-marketing	Week 5	Company/corporate advisors
13	ASX/ASIC waivers declarations escrow	Week 5	Company/corporate advisors/lawyers
14	5th due diligence meeting	Week 6	Due diligence committee
15	6th due diligence meeting	Week 7	Due diligence committee
16	Appointment of share registrar	Week 9	Company/corporate advisors
17	7th due diligence meeting	Week 9	Due diligence committee
18	Prospectus verification and final draft accounts report	Week 11	Lawyers/company/corporate advisors/accountants
19	8th due diligence meeting	Week 11	Due diligence committee
20	Execute all contracts/plans/schemes	Week 11	All parties
21	Consents	Week 11	All parties
22	Prospectus sign-off	Week 11	All parties
23	Lodge prospectus with ASIC/ASX	Week 11	Lawyers
24	End of period for non-issue	Week 12	
25	Printing and dispatch of prospectus	Week 13	Company/corporate advisors
26	Prospectus to be put on web	Week 14	Company
27	Printing and dispatch of reports	Week 14	Company/corporate advisors
28	Issue opens	Week 14	
29	Media release	Week 14	Company/corporate advisors
30	Retail investor roadshows	Wee 14–16	Company/corporate advisors
31	9th due diligence meeting	Week 18	Due diligence committee
32	Issue close	Week 18	
33	Allotment of shares	Week 19	Share registrar
34	Approval for admission to official list and quotation of shares	Week 20	ASX
35	Announcement and press release	Week 20	Company/corporate advisors
36	Start trading in shares	Week 20	

Source: *Listing a Company on the Australian Securities Exchang*e (PricewaterhouseCoopers 2011).

Appendix 2: Testable Hypotheses and Empirical Evidence of the Winner's Curse Model to Explain Underpricing

Testable hypothesis	**Empirical evidence** Supportive	Contrast
The abnormal initial returns for uninformed investors are zero when adjusted for rationing.	Rock (1986), Koh and Walter (1989), levis (1990), Keloharju (1993), Lee, Taylor and Walter (1996), Huang (1999), How (2000), Amihud, Hauser and Kirsh (2003), Derrien (2005), Yu and Tse (2006), Chen and Chen (2010)	Khurshed et al. (1999)
Underpricing is lower if information is distributed homogeneously across investor groups.	Michaely and Shaw (1994)	
The greater the ex-ante uncertainty about the value of the IPO company, the higher is the expected underpricing.	Ritter (1984), Beatty and Ritter (1986), Ritter (1991), Keasey and Short (1992), Kiymaz (2000)	McGuinness (1992)
Underwriters that underprice too much will lose business from issuers.	Beatty and Ritter (1986), Nada and Yun (1997), Dunbar (2000)	
Underpricing can be reduced by minimising the information asymmetry by choosing a prestigious underwriter and a reputable auditor.	Both and Smith (1986), Carter and Manaster (1990), Timan and Trueman (1986), Michaely and Shaw (1994), Habib and Ljungqvist (2001)	McGuinness (1992), Betty and Welch (1996)

Source: Ljungqvist (2007) and the papers published by the authors listed in the table.

Appendix 3: Sample Companies by Industry, IPO Year, Issue Year, Delisted Date, Issue Price and Issue Shares

ASX code	Company name	Industry*	IPO year	Issue year	Delisted date	Issue price	Issue shares
AAX	Ausenco Limited	3	2006	2006		1.00	25,921,000
AAY	AACL Holdings Limited	4	2010	2010		0.25	44,000,000
ACB	A-Cap Resources Limited	1	2006	2006		0.20	25,000,000
AEE	Aura Energy Limited	1	2006	2006		0.20	20,000,000
AGR	Aguia Resources Limited	1	2008	2007		0.20	30000000
AHN	Athena Resources Limited	1	2006	2006		0.20	12,000,000
AIR	Astivita Renewables Limited	4	2009	2009		0.50	3,600,000
AKM	Aspire Mining Limited	1	2007	2006		0.20	12,000,000
AMA	Ama Group Limited	3	2006	2006		0.40	59,000,000
ANQ	AnaeCo Limited	3	2008	2007		0.25	32,000,000
AOK	Austex Oil Limited	1	2008	2007		0.40	50,000,000
AON	Apollo Minerals Limited	1	2007	2007		0.25	32,000,000
APB	Arafura Pearl's Holdings Limited	4	2006	2006		0.25	16,000,000
ARR	Arasor International Ltd	5	2006	2006		1.5	23,333,333
ASW	Advanced Share Registry Ltd	5	2008	2008		0.40	12,500,000
AVB	Avanco Resources Limited	1	2007	2007		0.20	20,000,000
AVD	Advance Energy Limited	1	2006	2006		0.25	24,000,000
AVY	Avenue Resources Limited	1	2010	2010		0.20	30,000,000
AYR	Alloy Resources Limited	1	2006	2006		0.20	25,000,000
AZM	Azumah Resources Limited	1	2006	2005		0.20	30,000,000
AZU	Azurn International Limited	5	2009	2009		0.20	15,000,000
BAU	Bauxite Resources Limited	1	2007	2007		0.20	37,500,000
BCC	Buccaneer Energy Limited	1	2007	2007		0.25	80,000,000
BDR	Beadell Resources Limited	1	2007	2007		0.25	60,000,000
BLG	Bluglass Limited	3	2006	2006		0.20	45,000,000
BLK	Blackham Resources Limited	1	2006	2006		0.20	20,000,000
BLU	BlueFreeway Limited	4	2006	2006	7/8/2009	1.00	36,300,000
BMY	Brumby Resources Limited	1	2006	2006		0.20	20,000,000
BOM	Bondi Mining Limited	1	2006	2006		0.20	30,000,000
BTN	Brighton Mining Group Limited	1	2010	2010		0.20	11,000,000
BTU	Bathurst Resources Limited	1	2007	2007		0.20	15,000,000
BVA	Bravura Solutions Limited	5	2006	2006		1.12	35,714,286
BYL	Brierty Limited	3	2007	2007		1.00	60,000,000

BYR	Burey Gold Limited	1	2006	2006		0.20	25,000,000
CAP	Carpentaria Exploration Limited	1	2007	2007		0.25	30,000,000
CAV	Carnavale Resources Limited	1	2007	2007		0.20	20,000,000
CAY	Canyon Resources Ltd	1	2010	2010		0.20	17,500,000
CBX	Cape Alumina Limited	1	2009	2008		0.50	50,000,000
CCD	Caledon Resources PLC	1	2008	2008		1.10	13,653,636
CCF	Carbon Conscious Limited	2	2008	2008		0.40	25,000,000
CEL	Challenger Energy Limited	1	2007	2007		0.20	15,000,000
CES	Coal Fe Resources Limited	1	2007	2007		0.20	35,000,000
CGR	Careers Multilist Limited	4	2010	2009		0.20	10,000,000
CIL	Centrebet International Limited	4	2006	2006		2.00	35,000,000
CKK	Coretrack Limited	1	2006	2006		0.20	11,250,000
CLQ	Clean TeQ Holdings Limited	3	2007	2007		0.50	12,500,000
CMN	Cumminscorp Limited**	3	2006	2005	9/1/2009	0.20	75,000,000
CNK	Condor Metals Limited	1	2008	2008		0.20	40,000,000
CNL	Celamin Holdings NL (VIC)	1	2009	2009		0.20	15,000,000
CPZ	Car Parking Technologies Limited	5	2007	2006		0.35	28,571,429
CRZ	Carsales.com Limited	5	2009	2009		3.50	71,057,143
CSV	CSG Limited	5	2007	2007		1.00	60,532,336
CTD	Corporate Travel Management Limited	4	2010	2010		1.00	21,700,000
CVE	Cove Resources Limited	1	2011	2010		0.20	22,500,000
CYL	Catalyst Metals Limited	1	2006	2006		0.20	16,000,000
CYS	Chrysalis Resources Limited	1	2008	2008		0.20	20,000,000
DAU	Dampier Gold Limited	1	2010	2010		0.50	40,000,000
DDD	3D Resources Limited	1	2007	2006		0.20	20,000,000
DDR	Dicker Data Limited	5	2011	2010		0.20	5,000,000
DGI	Digislide Holdings Limited	5	2009	2008		1.25	3,600,000
DGO	Drummond Gold Limited	1	2007	2007		0.25	28,000,000
DGX	Diploma Group Limited	3	2007	2007		0.50	18,000,000
DLE	Dragon Energy Limited	1	2009	2008		0.20	7,500,000
DMG	Dragon Mountain Gold Limited	1	2007	2007		0.40	37,500,000
DSB	Delta SBD Limited	3	2010	2010		0.80	3,750,000
DSQ	Datasquirt Limited	5	2007	2007		0.90	13,333,333
DTG	Daton Group Australia Limited	2	2011	2010		0.25	36,000,000
DWS	DWS Advanced Business Solutions Limited	5	2006	2006		1.00	71,350,000
DXL	Dyno Nobel Limited	2	2006	2006	6/17/2008	2.37	380,759,494

EDS	Every Day Mine Services Limited	3	2007	2007	0.40	20,000,000
EGN	Engenco Limited	3	2006	2006	1.00	25,000,000
EHL	Emeco Holdings Limited	3	2006	2006	1.90	496,842,105
EMU	Emu Nickel Limited	1	2008	2007	0.50	40,000,000
EMX	Energia Minerals Limited	1	2009	2009	0.20	37,500,000
ENB	Eneabba Gas Limited	7	2006	2005	0.25	50,000,000
ENL	Eagle Nickel Limited	1	2008	2007	0.30	30,000,000
ENR	Encounter Resources Limited	1	2006	2006	0.20	20,000,000
ENT	Enterprise Metals Limited	1	2007	2007	0.20	20,000,000
EOC	Endocoal Limited	1	2010	2010	0.60	28,333,333
EOL	Energy One Limited	5	2007	2006	1.00	10,000,000
EPD	Empired Ltd	5	2007	2007	0.30	10,000,000
EPW	ERM Power Limited	1	2010	2010	1.75	57,142,857
ERL	Empire Resources Limited	1	2007	2006	0.20	30,000,000
ESW	Emerson Stewart Group Limited	3	2008	2008	0.20	40,000,000
EXG	Excelsior Gold Limited	1	2007	2007	0.30	33,333,333
EYE	Eagle Eye Metals Limited	1	2006	2006	0.20	25,000,000
FAS	Fairstar Resources Limited	1	2006	2006	0.25	30,000,000
FGI	Flat Glass Industries Limited	3	2006	2006	1.00	6,000,000
FIS	Fission Energy Limited	1	2007	2007	0.20	30,000,000
FRY	Fitzroy Resources Limited	1	2010	2010	0.20	25,000,000
GBM	Greater Bendigo Gold Mines Limited	1	2007	2006	0.20	20,000,000
GBZ	GBM Resources Limited	1	2007	2007	0.20	25,000,000
GCS	Global Construction Services Limited	3	2007	2007	1.00	20,000,000
GER	Greenearth Energy Limited	7	2008	2007	0.30	66,666,667
GGG	Greenland Minerals and Energy Limited	1	2006	2006	0.20	17,500,000
GHT	Geothermal Resources Limited	7	2006	2006	0.25	19,000,000
GLG	Gerard Lighting Group Limited	4	2010	2010	1.00	85,000,000
GMX	Goldminex Resources Limited	1	2007	2007	0.75	29,400,000
GNM	Gujarat Nre Coking Coal Limited	1	2007	2007	0.50	30,000,000
GNV	Green Invest Limited	3	2008	2007	1.00	5,000,000
GOR	Gold Road Resources Limited	1	2006	2006	0.20	30,000,000
GOT	Northern Manganese Limited	1	2006	2006	0.20	12,500,000
GPR	Geopacific Resources NL	1	2006	2005	0.20	22,500,000
GRB	Gage Roads Brewing Co Limited	4	2006	2006	0.40	10,000,000
GRG	GRG International LTD	3	2010	2010	0.20	22,500,000

GTE	Great Western Exploration Limited	1	2007	2007		0.20	15,000,000
GTR	GTI Resources Limited	1	2007	2007		0.20	20,000,000
GUF	Guildford Coal Limited	1	2010	2010		0.20	10,000,000
HEM	Hemisphere Resources Limited	1	2007	2007		0.20	20,000,000
HOG	Hawkley Oil and Gas Limited	1	2006	2006		0.20	15,000,000
HUM	Humanis Group Limited	3	2008	2007		0.25	28,000,000
IAW	Integrated Legal Holdings Limited	4	2007	2007		0.50	28,000,000
IBG	Ironbark Zinc Ltd	1	2006	2006		0.20	15,000,000
IDM	Industrial Minerals Corporation Limited	1	2006	2006		0.20	60,000,000
IGG	Ingena Group Limited	5	2007	2007	1/14/2009	0.50	19,000,000
III	Icon Resources Ltd	1	2006	2006		0.20	20,000,000
IOG	Incremental Oil and Gas Limited	1	2011	2010		0.30	17,000,000
IPP	IPGA Limited	4	2007	2007		0.25	30,000,000
IPX	Intrapower Limited	6	2007	2007		1.00	12,073,000
IRL	India Resources Limited	1	2007	2007		0.20	55,000,000
ISH	Ishine International Resources Limited	1	2009	2009		0.20	15,000,000
ISK	Island Sky Australia Limited	4	2007	2007		0.20	60,000,000
ITX	itX Group Limited	5	2007	2007	1/5/2011	0.50	10,000,000
IVA	Ivanhoe Australia Limited	1	2008	2008		2.00	62,500,000
JAL	Jameson Resources Limited	1	2007	2007		0.20	12,000,000
JKA	Jacka Resources Limited	1	2010	2010		0.20	20,000,000
KDR	Kidman Resources Limited	1	2011	2010		0.20	20,000,000
KEN	KUTh Energy Limited	7	2007	2007		0.25	30,000,000
KOG	Kilgore Oil & Gas Limited	1	2008	2008		0.20	50,000,000
KRA	Killara Resources Limited	1	2009	2009		0.20	15,000,000
KRB	Krucible Metals Limited	1	2007	2007		0.20	30,000,000
LBL	Laserbond Limited	3	2007	2007		0.20	15,000,000
LCM	Logicamms Limited	3	2007	2007		1.00	10,000,000
LCR	Laconia Resources Limited	1	2009	2009		0.20	30,000,000
LHD	Lochard Energy Group plc	1	2007	2007		0.35	100,000,000
LME	L&M Energy Limited	1	2007	2006		0.20	100,000,000
LNC	Linc Energy Ltd**	1	2006	2006		0.25	88,000,000
MBD	Marbletrend Group Limited	3	2007	2007		0.25	48,000,000
MBO	Mobilarm Limited	3	2010	2010		0.20	30,000,000
MEG	MCM Entertainment Group Limited	4	2007	2007		0.20	15,000,000
MES	Mesbon China Nylon Limited	4	2007	2007		0.50	40,000,000

MET	Mt Isa Metals Limited	1	2008	2008		0.20	35,000,000
MEU	Marmota Energy Limited	1	2007	2007		0.25	60,000,000
MGY	Malagasy Minerals Limited	1	2008	2008		0.20	50,000,000
MIN	Mineral Resources Limited	3	2006	2006		0.90	15,000,000
MKB	MOKO.mobi Limited	4	2007	2007		0.20	20,000,000
MLD	Maca Limited	3	2010	2010		1.00	60000000
MNF	My Net Fone Limited	6	2006	2006		0.20	12,500,000
MNW	Mint Wireless Limited	4	2007	2007		0.20	50,000,000
MNZ	Mnet Group Limited	6	2007	2007		0.20	15,000,000
MSL	The MAC Services Group Limited	3	2007	2007	12/31/2010	1.50	49,000,000
MSR	Manas Resources Limited	1	2008	2008		0.20	30,000,000
MUM	Mount Magnet South NL	1	2007	2007		0.25	24,000,000
MUX	Mungana Goldmines Ltd	1	2010	2010		0.95	80,000,000
MYA	MyATM Holdings Limited	5	2011	2010		0.20	50,000,000
MYE	Mastermyne Group Limited	3	2010	2010		1.00	40,000,000
MZM	Montezuma Mining Company Limited	1	2006	2006		0.20	22,500,000
NCO	Namibian Copper Nl	1	2007	2007		0.20	15,000,000
NFK	Norfolk Group Limited	3	2007	2007		1.95	100,974,359
NME	Nex Metals Exploration Limited	1	2007	2007		0.25	24,000,000
NOD	Nomad Building Solutions Limited	3	2006	2006		1.00	23,868,124
NOE	Novarise Renewable Resources International Limited	2	2010	2010		0.25	128,000,000
NRU	Newera Uranium Limited	1	2006	2006		0.20	15,000,000
NSE	New Standard Energy Limited	1	2008	2008		0.20	17,500,000
NTR	NT Resources Limited	1	2010	2009		0.20	15,000,000
NTU	Northern Minerals Limited	1	2006	2006		0.20	20,000,000
NWH	NRW Holdings Limited	3	2007	2007		2.00	151,544,920
NXT	NEXTDC	5	2010	2010		1.00	40,000,000
OKJ	Oakajee Corporation Limited	3	2008	2008		0.20	25,000,000
OKL	Oakland Resources Limited	1	2010	2010		0.20	15,000,000
ORE	Orocobre Limited**	1	2007	2007		0.25	25,000,000
ORS	Octagonal Resources Limited	1	2011	2010		0.25	48,000,000
OXX	Octanex N.L.	1	2009	2009		0.30	1,000,000
OZB	Oz Brewing Limited	4	2006	2006		0.20	15,000,000
PEH	Pacific Environment Limited	3	2008	2007		0.50	32,000,000
PFL	Patties Foods Limited	4	2006	2006		1.75	58,700,228
PLS	Pilbara Minerals Limited**	1	2007	2007		0.20	12,500,000

PTB	PTB Group Limited	3	2006	2006		2.00	2,500,000
PTO	Photo-Me Australia Limited	4	2007	2007		0.20	22,500,000
PWW	Power Resources Limited	1	2008	2007		0.20	11,000,000
QRN	QR National Limited	3	2010	2010		2.75	1,573,800,000
RAD	Radar Iron Limited	1	2010	2010		0.20	40,000,000
RAI	Raisama Limited	1	2009	2009		0.35	35,000,000
RDH	RedHill Education Limited	4	2010	2010		1.00	16,000,000
REW	The Rewards Factory Limited	4	2008	2007	9/1/2009	0.20	20,000,000
RFG	Retail Food Group Limited	4	2006	2006		1.00	36,500,000
RGP	Refresh Group Limited	4	2006	2005		0.20	15,000,000
RIS	Richfield International Limited	3	2006	2005		0.20	7,480,000
RNU	Renaissance Uranium Limited	1	2010	2010		0.20	40,000,000
ROG	Red Sky Energy Limited	1	2007	2007		0.20	40000,000
ROY	Royal Resources Limited	1	2006	2006		0.20	5,650,000
RPX	RP Data Ltd	5	2006	2006	5/13/2011	1.10	59272,727
RUB	Rubicor Group Limited	3	2007	2007		1.00	75,838,196
RUM	Rum Jungle Resources Ltd	1	2007	2007		0.25	48,000,000
SAV	Savcor Group Limited	3	2007	2007		2.00	55,750,000
SDM	Sedgman Limited	3	2006	2006		1.00	40,000,000
SEO	Sentosa Mining Limited	1	2010	2010		0.20	20,000,000
SFZ	South American Ferro Metals Limited	1	2008	2008		0.20	12,500,000
SGH	Slater & Gordon Limited	4	2007	2007		1.00	35,000,000
SGQ	St George Mining Limited	1	2010	2010		0.20	20,000,000
SGU	Success Resources Global Ltd	4	2006	2005		0.20	15,000,000
SGZ	Scotgold Resources Limited	1	2008	2007		0.25	24,000,000
SHH	Shree Minerals Limited	1	2010	2009		0.20	20,000,000
SHU	Shenhua International Limited	4	2009	2009		0.50	41,900,000
SMR	Stanmore Coal Limited	1	2009	2009		0.20	30,000,000
SND	Saunders International Limited	3	2007	2007		0.50	24,000,000
SOC	Sovereign Gold Company Limited	1	2010	2010		0.20	20,000,000
SOI	Soil Sub Technologies Limited	4	2008	2007		1.00	10,000,000
SPI	Spitfire Resources Limited	1	2007	2007		0.20	30,000,000
SRR	Shaw River Resources Limited	1	2006	2006		0.20	30,000,000
STZ	Strzelecki Metals Limited	1	2006	2005		0.20	25,000,000
SVL	Silver Mines Limited	1	2007	2006		0.20	35,000,000
SWK	Swick Mining Services Ltd	3	2006	2006		0.20	20,000,000

SWL	Seymour Whyte Limited	3	2010	2010		1.10	18,000,000
SWR	Southern Crown Resources Limited	1	2010	2010		0.20	20,000,000
SXE	Southern Cross Electrical Engineering Ltd	3	2007	2007		1.00	20,000,000
SXG	Southern Cross Goldfields Limited	1	2008	2007		0.20	50,000,000
SXP	SAPEX Limited**	1	2007	2006	10/24/2008	0.20	60,000,000
SYR	Syrah Resources Limited	1	2007	2007		0.20	21,000,000
TEY	Torrens Energy Limited	7	2007	2007		0.20	30,000,000
TPC	Tel. Pacific Limited	6	2007	2007		0.20	25,000,000
TRF	Trafford Resources Limited	1	2006	2006		0.20	20,000,000
TRH	Transit Holdings	1	2006	2006		0.20	15,000,000
TRM	Truscott Mining Corporation Limited	1	2007	2007		0.20	16,000,000
TTA	TTA Holdings Limited	5	2006	2005		0.20	14,000,000
TUC	Territory Uranium Company Limited	1	2007	2007		0.20	20,000,000
TWT	TWT Group Limited	4	2007	2007		0.50	12,000,000
TYO	Treyo Leisure And Entertainment Limited	4	2009	2008		0.25	100,000,000
UMS	UCMS Group Limited	3	2007	2007	8/18/2009	1.00	5,000,000
UNV	Universal Coal Plc	1	2010	2010		0.26	76,923,077
UOG	United Orogen Limited	1	2006	2006		0.20	40,000,000
UUL	United Uranium Limited	1	2007	2007		0.20	25,000,000
VEC	Vector Resources Limited	1	2007	2007		0.20	60,000,000
VKA	Viking Ashanti Limited	1	2010	2010		0.30	26,666,667
VMC	Venus Metals Corporation Limited	1	2007	2007		0.20	11,000,000
VMG	VDM Group Limited	3	2006	2006		1.00	8,200,000
VXR	Venturex Resources Limited	1	2007	2007		0.20	20,000000
WAF	West African Resources Limited	1	2010	2010		0.20	32,500,000
WCL	Westside Corporation Limited	1	2007	2006		0.50	19,200,000
WDS	WDS Limited	3	2006	2006		1.50	43,100,000
WHE	WildHorse Energy Limited	1	2006	2006		0.40	25,000,000
WHN	WHL Energy Limited	1	2007	2007		0.20	75,000,000
WNI	Wah Nam International Holdings Limited	1	2011	2010		0.20	15,000,000
WPI	West Peak Iron Limited	1	2010	2010		0.20	20000000
WRG	Water Resources Group Limited	7	2010	2010		0.25	120,000,000
WRM	White Rock Minerals Limited	1	2010	2010		0.30	16,666,667
XAM	Xanadu Mines Limited	1	2010	2010		0.60	35,000,000
XRF	XRF Scientific Limited	3	2006	2006		0.20	25,000,000
XXL	XiaoXiao Education Limited	4	2010	2009		0.25	40,000,000

YBR	Yellow Brick Road Holdings Limited	3	2008	2007	1.00	5,000,000
YHL	Yanghao International Limited	4	2009	2008	0.50	16,000,000
YTC	YTC Resources Limited	1	2007	2007	0.25	14,000,000
ZMG	Zingmobile Group Limited	5	2007	2007	0.50	18,000,000
ZNC	Zenith Minerals Limited	1	2007	2007	0.20	25,000,000

Note:

* **1** = Resources (energy, metals & mining) sector, **2** = Chemicals/materials industry, **3** = Industrial sector, **4** = Consumer discretionary/staples industry, **5** = Information technology industry, **6** = Telecommunication industry, **7** = Utilities industry

** These IPO companies were entirely eliminated from the long-run analysis due to the unavailability of data. Therefore, 254 IPO companies were initially considered for the short-run analysis and 249 companies considered for the long-run analysis.

Appendix 4: Summary Statistics of Short-Run Return Measures after Excluding Outlier

Dependent variable		N	Mean	Median	SD	Kurtosis	Skewness	Minimum	Maximum
First listing day returns									
Primary market	**RR**	253	0.1705	0.1000	0.4789	24.5992	3.9789	–0.8250	3.7500
(the period from the issuing date to the beginning of the first listing date)	**MAR**	253	0.1606	0.0798	0.4771	24.8018	3.9545	–0.7013	3.8908
Secondary market	**RR**	254	–0.0154	–0.0098	0.1058	1.8233	0.2465	–0.4437	0.4008
(the period from the first listing day time of beginning to the time of closing)	**MAR**	254	–0.0155	–0.0160	0.1080	1.9669	0.2129	–0.4735	0.3999
Total market	**RR**	253	0.1492	0.0750	0.4576	14.3366	2.9629	–0.8150	3.2950
(the period from the issuing date to the closing time of the first listing date)	**MAR**	253	0.1392	0.0620	0.4555	13.1461	2.7994	–0.8987	3.0994
									Post-day listing returns
***Post-day market** *(the after-listing period from day 2 to day 10)*	**CAR_3**	253	0.1547	0.0846	0.4943	11.4409	2.6167	–1.0291	3.1729
	CAR_6	253	0.1490	0.0753	0.5018	10.8447	2.5400	–0.9416	3.2016
	CAR_{10}	253	0.1421	0.0702	0.5237	8.8426	2.2452	–0.9578	3.1346

Note: N= Sample size, **RR**= Raw return, **MAR**= Market-adjusted abnormal return, **CAR**= Cumulative abnormal return for post-days 3, 6 and 10, **SD** = Standard deviation.
* The CAR is calculated after considering the first listing day total market return.

Appendix 5: First Listing Day Primary and Total Market Returns after Excluding Outlier

Sample Classification		Primary market				Total market			
	N	**ARR**	**t-stat**	**AAR**	**t-stat**	**ARR**	**t-stat**	**AAR**	**t-stat**
All sample companies	253	0.1705	5.66***	0.1606	5.35***	0.1492	5.18***	0.1392	4.86***
By industry									
Resources	143	0.1751	4.33***	0.1664	4.26***	0.1664	4.04***	0.1568	3.93***
Chemicals/materials	4	–0.0568	–0.30	–0.1091	–0.64	–0.1084	–0.59	–0.1594	–0.95
Industrials	45	0.1516	3.95***	0.1607	4.08***	0.1327	3.53***	0.1439	3.72***
Consumer discretionary/staples	31	0.1874	1.49	0.1829	1.40	0.1413	1.51	0.1371	1.42
Information technology	20	0.2014	1.66	0.1414	1.11	0.1598	1.26	0.0980	0.73
Telecommunication	4	0.2345	2.70*	0.2388	2.38*	0.1595	3.51**	0.1677	2.83*
Utilities	6	0.1190	0.82	0.1009	0.70	0.0305	0.22	0.0109	0.07
By listing year									
2006	68	0.2097	2.99***	0.1762	2.58**	0.2030	2.92***	0.1685	2.47**
2007	91	0.1841	4.28***	0.1638	3.79***	0.1574	3.59***	0.1383	3.15***
2008	28	0.1588	1.04	0.2423	1.59	0.1221	1.04	0.2071	1.79*
2009	17	0.1294	2.48**	0.0910	1.35	0.1333	1.57	0.0917	0.91
2010	41	0.1352	4.85***	0.1402	5.25***	0.1021	3.24***	0.1059	3.58***
2011	8	–0.0094	–0.10	–0.0412	–0.48	–0.0331	–0.36	–0.0665	–0.74
By issue year									
2005	9	0.7254	1.64	0.6245	1.43	0.6614	1.56	0.5605	1.34
2006	69	0.1066	2.95***	0.0782	2.13**	0.1031	2.54**	0.0737	1.78*
2007	95	0.2131	3.81***	0.2190	3.90***	0.1751	3.58***	0.1822	3.75***
2008	19	0.0692	0.65	0.0942	0.89	0.0825	0.71	0.1089	0.92
2009	16	0.1572	3.51***	0.1257	2.23**	0.1569	2.13**	0.1220	1.44
2010	45	0.1148	3.81***	0.1115	3.74***	0.0880	2.70***	0.0834	2.64**

Note: Positive return indicates underpricing whereas negative return shows overpricing. **N** = Sample size, **ARR** = Average raw return, **AAR** = Market-adjusted average abnormal return.
* statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level.

Appendix 6: Post-Day Listing Returns from Day 2 to Day 10

Sample classification		**Day 2**		**Day 3**		**Day 4**		**Day 5**		**Day 6**		**Day 7**	
	N	**CAR**	**t-stat**	**CAR**	**t-stat**	**CAR**	**t-stat**	**CAR**	**t-stat**	**CAR**	**t-stat**	**CAR**	**t-stat**
All sample companies	254	0.2412	1.57	0.2463	1.50	0.2457	1.61	0.2414	1.77*	0.2407	1.75*	0.2410	1.61
By industry													
Resources	143	0.1677	1.07	0.1751	0.99	0.1779	1.06	0.1715	1.13	0.1722	1.14	0.1728	1.00
Chemicals/materials	4	–0.1829	–1.95	–0.1602	–1.19	–0.1586	–3.31**	–0.1711	–2.65*	–0.1841	–9.31***	–0.1702	–2.36*
Industrials	46	0.6817	3.97***	0.6893	5.47***	0.6866	5.15***	0.6856	6.21***	0.6784	6.54***	0.6761	6.43***
Consumer discretionary/staples	31	0.1065	0.88	0.1113	0.57	0.0961	0.65	0.0914	0.90	0.0956	0.69	0.0897	0.70
Information technology	20	0.1041	1.25	0.0998	1.38	0.0962	0.80	0.0948	1.30	0.0983	0.79	0.1035	1.11
Telecommunication	4	0.2154	0.97	0.1541	1.53	0.1722	1.11	0.1357	0.87	0.1725	1.95	0.1557	4.48**
Utilities	6	0.0673	0.30	0.0633	0.25	0.0733	0.62	0.1133	0.48	0.0681	0.86	0.0999	0.53
By listing year													
2006	68	0.2004	0.97	0.2203	0.91	0.2081	1.57	0.1915	1.55	0.1855	1.70*	0.1926	1.36
2007	91	0.1460	1.07	0.1492	1.33	0.1644	0.84	0.1539	1.21	0.1526	1.14	0.1518	1.23
2008	29	0.9971	6.50***	0.9897	4.68***	0.9762	8.33***	0.9892	6.22***	0.9820	4.38***	0.9829	3.72***
2009	17	0.0677	0.78	0.0756	0.73	0.0844	0.68	0.0762	0.97	0.0941	0.72	0.0994	0.71
2010	41	0.1151	1.06	0.1125	1.38	0.1029	1.06	0.1187	0.73	0.1219	1.01	0.1101	0.94
2011	8	–0.0554	–0.68	–0.0748	–0.95	–0.0811	–0.68	–0.0697	–0.51	–0.0567	–0.72	–0.0512	–0.47
By Issue year													
2005	9	0.5912	3.23**	0.6382	2.33**	0.6584	2.80**	0.6083	3.05**	0.5867	4.76***	0.5637	3.37***
2006	69	0.1031	0.51	0.1144	0.51	0.0980	0.95	0.0892	0.88	0.0843	0.80	0.0935	0.72
2007	96	0.4266	3.18***	0.4295	2.83***	0.4425	2.25**	0.4352	3.27***	0.4326	2.66***	0.4347	2.61**
2008	19	0.1002	0.59	0.1051	1.01	0.0995	0.79	0.1073	0.63	0.1089	0.66	0.1008	0.53
2009	16	0.1246	1.13	0.1184	1.26	0.1173	1.17	0.1027	1.07	0.1306	0.99	0.1102	0.59
2010	45	0.0882	0.87	0.0844	1.02	0.0774	0.76	0.0939	0.59	0.0964	0.89	0.0949	1.01

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Appendix 6 continued

Sample classification	N	Day 8 CAR	Day 8 t-stat	Day 9 CAR	Day 9 t-stat	Day 10 CAR	Day 10 t-stat
All sample companies	254	0.2367	1.48	0.2354	1.52	0.2334	0.73
By Industries							
Resources	143	0.1718	0.35	0.1706	1.07	0.1699	0.41
Chemicals/materials	4	–0.1809	–0.89	–0.1909	–7.43***	–0.2333	–1.18
Industrials	46	0.6722	2.26**	0.6739	6.02***	0.6629	5.94***
Consumer discretionary/staples	31	0.0654	0.18	0.0711	0.37	0.0734	0.48
Information technology	20	0.1072	0.41	0.0913	0.60	0.1013	0.89
Telecommunication	4	0.1214	1.23	0.1283	0.67	0.1312	1.60
Utilities	6	0.1164	0.22	0.1039	0.68	0.1000	0.61
By listing year							
2006	68	0.1828	1.51	0.1829	1.20	0.1921	1.02
2007	91	0.1451	1.07	0.1432	1.14	0.1245	0.35
2008	29	0.9746	3.59***	0.9754	4.74***	0.9590	3.78***
2009	17	0.1258	0.74	0.1010	0.55	0.1040	0.89
2010	41	0.1117	0.70	0.1117	0.73	0.1160	0.82
2011	8	–0.0616	–0.50	–0.0316	–0.17	0.0699	0.06
By Issue year							
2005	9	0.5276	3.97***	0.5368	1.86*	0.5500	3.07**
2006	69	0.0841	0.74	0.0830	0.70	0.0867	0.46
2007	96	0.4291	2.29**	0.4285	2.84***	0.4099	1.15
2008	19	0.1018	0.77	0.0789	0.37	0.0755	0.35
2009	16	0.1352	0.76	0.1278	1.42	0.1253	1.26
2010	45	0.0951	0.59	0.1012	0.61	0.1236	0.27

Note: Positive return indicates underpricing whereas negative return shows overpricing. **N** = Sample size, **CAR** = Cumulative average abnormal return, **t-stat** = t-statistics. * statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level.

Appendix 7: Post-Day Listing Returns from Day 2 to Day 10 after Excluding Outlier

Sample classification	N	Day 2 CAR	Day 2 t-stat	Day 3 CAR	Day 3 t-stat	Day 4 CAR	Day 4 t-stat	Day 5 CAR	Day 5 t-stat	Day 6 CAR	Day 6 t-stat	Day 7 CAR	Day 7 t-stat
All sample companies	253	0.1491	0.97	0.1547	0.94	0.1541	1.01	0.1493	1.10	0.1490	1.09	0.1493	0.99
By industry													
Resources	143	0.1677	1.07	0.1751	0.99	0.1779	1.06	0.1715	1.13	0.1722	1.14	0.1728	1.00
Chemicals/materials	4	–0.1829	–1.95	–0.1602	–1.19	–0.1586	–3.31**	–0.1711	–2.65*	–0.1841	–9.31***	–0.1702	–2.36*
Industrials	45	0.1741	1.01	0.1839	1.47	0.1810	1.34	0.1773	1.71*	0.1728	1.82*	0.1702	1.60
Consumer discretionary/staples	31	0.1065	0.88	0.1113	0.57	0.0961	0.65	0.0914	0.90	0.0956	0.69	0.0897	0.70
Information technology	20	0.1041	1.25	0.0998	1.38	0.0962	0.80	0.0948	1.30	0.0983	0.79	0.1035	1.11
Telecommunication	4	0.2154	0.97	0.1541	1.53	0.1722	1.11	0.1357	0.87	0.1725	1.95	0.1557	4.48**
Utilities	6	0.0673	0.30	0.0633	0.25	0.0733	0.62	0.1133	0.48	0.0681	0.86	0.0999	0.53
By listing year													
2006	68	0.2004	0.97	0.2203	0.91	0.2081	1.57	0.1915	1.55	0.1855	1.70*	0.1926	1.36
2007	91	0.1460	1.07	0.1492	1.33	0.1644	0.84	0.1539	1.21	0.1526	1.14	0.1518	1.23
2008	28	0.1926	1.24	0.1880	0.88	0.1739	1.46	0.1831	1.18	0.1803	0.82	0.1808	0.67
2009	17	0.0677	0.78	0.0756	0.73	0.0844	0.68	0.0762	0.97	0.0941	0.72	0.0994	0.71
2010	41	0.1151	1.06	0.1125	1.38	0.1029	1.06	0.1187	0.73	0.1219	1.01	0.1101	0.94
2011	8	–0.0554	–0.68	–0.0748	–0.95	–0.0811	–0.68	–0.0697	–0.51	–0.0567	–0.72	–0.0512	–0.47
By issue year													
2005	9	0.5912	3.23**	0.6382	2.33**	0.6584	2.80**	0.6083	3.05**	0.5867	4.76***	0.5637	3.37***
2006	69	0.1031	0.51	0.1144	0.51	0.0980	0.95	0.0892	0.88	0.0843	0.80	0.0935	0.72
2007	95	0.1835	1.36	0.1874	1.24	0.2004	1.01	0.1918	1.47	0.1906	1.19	0.1926	1.15
2008	19	0.1002	0.59	0.1051	1.01	0.0995	0.79	0.1073	0.63	0.1089	0.66	0.1008	0.53
2009	16	0.1246	1.13	0.1184	1.26	0.1173	1.17	0.1027	1.07	0.1306	0.99	0.1102	0.59
2010	45	0.0882	0.87	0.0844	1.02	0.0774	0.76	0.0939	0.59	0.0964	0.89	0.0949	1.01

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Appendix 7 continued

Sample classification	N	Day 8 CAR	Day 8 t-stat	Day 9 CAR	Day 9 t-stat	Day 10 CAR	Day 10 t-stat
All sample companies	253	0.1449	0.91	0.1436	0.93	0.1421	0.45
By industry							
Resources	143	0.1718	0.35	0.1706	1.07	0.1699	0.41
Chemicals/materials	4	–0.1809	–0.89	–0.1909	–7.43***	–0.2333	–1.18
Industrials	45	0.1656	1.22	0.1674	1.48	0.1590	1.61
Consumer discretionary/staples	31	0.0654	0.18	0.0711	0.37	0.0734	0.48
Information technology	20	0.1072	0.41	0.0913	0.60	0.1013	0.89
Telecommunication	4	0.1214	1.23	0.1283	0.67	0.1312	1.60
Utilities	6	0.1164	0.22	0.1039	0.68	0.1000	0.61
By listing year							
2006	68	0.1828	1.51	0.1829	1.20	0.1921	1.02
2007	91	0.1451	1.07	0.1432	1.14	0.1245	0.35
2008	28	0.1712	0.62	0.1721	0.82	0.1596	0.64
2009	17	0.1258	0.74	0.1010	0.55	0.1040	0.89
2010	41	0.1117	0.70	0.1117	0.73	0.1160	0.82
2011	8	–0.0616	–0.50	–0.0316	–0.17	0.0699	0.06
By issue year							
2005	9	0.5276	3.97***	0.5368	1.86*	0.5500	3.07**
2006	69	0.0841	0.74	0.0830	0.70	0.0867	0.46
2007	95	0.1866	0.99	0.1860	1.23	0.1686	0.47
2008	19	0.1018	0.77	0.0789	0.37	0.0755	0.35
2009	16	0.1352	0.76	0.1278	1.42	0.1253	1.26
2010	45	0.0951	0.59	0.1012	0.61	0.1236	0.27

Note: Positive return indicates underpricing whereas negative return shows overpricing. **N** = Sample size, **CAR** = Cumulative average abnormal return, **t-stat** = t-statistics. * statistically significant at 10% level, ** statistically significant at 5% level, *** statistically significant at 1% level.

Appendix 8: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Returns (BHRs) for the Full Sample

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHR	t-stat	BHR	t-stat
1	249	–0.0026	–0.23	0.0217	5.07
2	249	–0.0056	–0.27	0.0146	2.40
3	249	–0.0329	–1.18	0.0649	8.53
4	249	–0.0033	–0.05	0.1074	21.54
5	249	0.0211	0.59	0.1191	10.63
6	249	0.0193	0.50	0.1253	9.08
7	249	0.0526	1.09	0.1293	10.12
8	249	0.0449	0.89	0.1282	9.83
9	249	0.0382	0.67	0.1299	11.97
10	249	0.0357	0.55	0.1146	8.36
11	249	0.0152	0.26	0.0950	4.02
(Year 1) 12	242	–0.0235	–0.31	0.1530	6.12
13	229	–0.0221	–0.27	0.1626	5.43
14	225	–0.0685	–0.82	0.0342	0.75
15	220	–0.0836	–0.83	–0.0019	–0.09
16	217	–0.0894	–0.90	–0.0378	–0.40
17	216	–0.1117	–1.17	–0.0052	–0.02
18	215	–0.1813	–1.93	–0.0703	–0.87
19	213	–0.2114	–2.06	–0.0818	–0.95
20	208	–0.2666	–2.73	–0.1492	–1.99
21	205	–0.2917	–2.27	–0.1718	–1.94
22	204	–0.3077	–2.18	–0.1416	–1.69
23	203	–0.2972	–1.89	–0.1005	–1.11
(Year 2) 24	202	–0.3215	–2.02	–0.1163	–1.37
25	194	–0.3438	–2.09	–0.0871	–1.09
26	192	–0.3673	–1.95	–0.1163	–1.49
27	190	–0.3717	–1.34	–0.1503	–1.85
28	189	–0.4057	–3.12	–0.2491	–4.06
29	188	–0.4199	–4.10	–0.3040	–4.69
30	187	–0.4350	–2.45	–0.3340	–2.63
31	187	–0.4548	–3.50	–0.3279	–5.58
32	187	–0.4308	–4.70	–0.3169	–5.15
33	187	–0.4194	–4.36	–0.3039	–4.75
34	186	–0.3959	–5.46	–0.2843	–5.20
35	185	–0.3732	–5.01	–0.2538	–4.52
(Year 3) 36	185	–0.3640	–4.06	–0.2512	–3.43

Note: BHR = Buy-and-hold average return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 9: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Returns (BHRs) for the Resources Industry

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHR	t-stat	BHR	t-stat
1	139	0.0115	0.76	–0.0106	–0.56
2	139	0.0164	0.60	–0.0443	–1.25
3	139	–0.0200	–0.46	–0.0661	–1.36
4	139	0.0155	0.36	0.0185	0.59
5	139	0.0654	1.32	0.0221	0.41
6	139	0.0660	1.21	0.0128	0.25
7	139	0.1260	1.78	0.0003	0.08
8	139	0.1228	1.70	0.0354	0.58
9	139	0.1108	1.29	0.0693	1.07
10	139	0.1235	1.22	0.0584	0.78
11	139	0.0886	0.93	0.0767	0.88
(Year 1) 12	135	0.0416	0.48	0.2873	3.09
13	126	0.0315	0.36	0.3613	4.06
14	123	–0.0304	–0.20	0.2604	3.28
15	120	–0.0534	–0.31	0.2140	3.00
16	119	–0.0779	–0.50	0.1097	1.44
17	118	–0.1028	–0.79	–0.0190	–0.11
18	117	–0.1866	–1.54	–0.1783	–1.18
19	115	–0.2331	–2.14	–0.2150	–1.81
20	112	–0.2755	–2.50	–0.2309	–2.09
21	111	–0.3097	–1.49	–0.2735	–0.28
22	111	–0.3598	–2.28	–0.3069	–2.11
23	111	–0.3314	–2.52	–0.2351	–2.07
(Year 2) 24	111	–0.3325	–2.27	–0.2192	–1.65
25	105	–0.3589	–2.69	–0.3050	–1.80
26	103	–0.3789	–3.60	–0.3105	–2.98
27	101	–0.3622	–2.75	–0.2699	–2.44
28	101	–0.3786	–3.57	–0.2478	–3.37
29	101	–0.3791	–2.95	–0.2379	–2.96
30	101	–0.3978	–1.86	–0.2697	–2.73
31	101	–0.4383	–1.41	–0.3013	–3.64
32	101	–0.4087	–2.82	–0.3114	–3.38
33	101	–0.3949	–2.70	–0.2794	–3.00
34	101	–0.3869	–3.98	–0.2840	–3.98
35	100	–0.3416	–3.30	–0.2892	–2.22
(Year 3) 36	100	–0.3261	–2.63	–0.2729	–0.71

Note: BHR = Buy-and-hold average return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 10: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Returns (BHRs) for the Industrial Sector

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHR	t-stat	BHR	t-stat
1	45	–0.0113	–0.88	0.0354	3.13
2	45	–0.0203	–0.82	0.0238	1.59
3	45	–0.0320	–0.82	0.1079	1.47
4	45	0.0292	0.64	0.1509	1.57
5	45	0.0128	0.22	0.1729	4.00
6	45	0.0341	0.47	0.1706	6.06
7	45	0.0559	0.63	0.1764	6.22
8	45	0.0736	0.74	0.1931	5.77
9	45	0.0868	0.78	0.1835	5.90
10	45	0.0756	0.65	0.1586	3.99
11	45	0.0870	0.65	0.1437	3.18
(Year 1) 12	45	0.0826	0.59	0.1975	5.21
13	44	0.1198	0.77	0.2020	3.60
14	43	0.0833	0.55	0.0066	0.12
15	41	0.0656	0.41	–0.0348	–0.09
16	40	0.0863	0.48	–0.0290	–0.05
17	40	0.1063	0.53	0.0219	0.17
18	40	0.0272	0.20	–0.0727	–0.19
19	40	0.0319	0.23	–0.0501	–0.09
20	39	–0.0542	–0.16	–0.1547	–0.55
21	38	–0.0634	–0.18	–0.1394	–0.46
22	38	0.0074	0.12	–0.0347	–0.04
23	38	0.0177	0.17	0.0297	0.21
(Year 2) 24	38	–0.0987	–0.26	–0.0541	–0.11
25	38	–0.1395	–0.43	–0.0458	–0.10
26	38	–0.2072	–0.65	–0.1273	–0.41
27	38	–0.2605	–0.72	–0.1984	–0.60
28	38	–0.3736	–0.99	–0.3405	–1.16
29	38	–0.4349	–2.42	–0.4595	–2.18
30	38	–0.4726	–4.69	–0.5219	–3.20
31	38	–0.4735	–4.22	–0.5108	–2.98
32	38	–0.4617	–3.06	–0.4958	–0.54
33	38	–0.4396	–2.38	–0.4942	–1.12
34	38	–0.3831	–2.24	–0.4560	–0.03
35	38	–0.3538	–2.23	–0.3938	–2.05
(Year 3) 36	38	–0.3648	–2.08	–0.3875	–1.95

Note: BHR = Buy-and-hold average return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 11: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Returns (BHRs) for the Consumer Discretionary and Staples Industry

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHR	t-stat	BHR	t-stat
1	31	–0.0463	–2.60	–0.0340	–2.75
2	31	–0.0762	–3.56	–0.0222	–1.42
3	31	–0.1258	–4.53	–0.0626	–4.01
4	31	–0.1533	–4.22	–0.0510	–2.10
5	31	–0.2038	–4.87	–0.0526	–2.41
6	31	–0.2075	–3.02	–0.0382	–0.81
7	31	–0.2103	–3.07	–0.0317	–0.72
8	31	–0.2567	–3.34	–0.0567	–1.20
9	31	–0.2558	–3.40	–0.0438	–0.93
10	31	–0.2764	–3.47	–0.0630	–1.26
11	31	–0.2837	–3.02	–0.0626	–1.13
(Year 1) 12	31	–0.3041	–3.52	–0.1065	–2.12
13	30	–0.3516	–3.15	–0.1563	–2.45
14	30	–0.3821	–3.50	–0.1943	–3.37
15	30	–0.3896	–2.29	–0.2119	–2.39
16	29	–0.3479	–1.97	–0.1975	–1.78
17	29	–0.4028	–2.16	–0.2356	–2.46
18	29	–0.4448	–2.31	–0.2861	–2.92
19	29	–0.4372	–2.97	–0.2902	–3.55
20	28	–0.4657	–3.37	–0.3479	–4.41
21	28	–0.4739	–3.22	–0.3455	–4.28
22	27	–0.4689	–3.82	–0.3245	–4.72
23	26	–0.4905	–3.42	–0.3663	–4.57
(Year 2) 24	25	–0.5055	–3.89	–0.3773	–4.83
25	24	–0.5157	–3.09	–0.3674	–3.84
26	24	–0.5224	–2.78	–0.3768	–3.87
27	24	–0.5281	–2.89	–0.3761	–4.09
28	24	–0.5359	–3.20	–0.4533	–4.54
29	24	–0.5434	–3.56	–0.4420	–5.19
30	23	–0.5210	–3.99	–0.4290	–4.79
31	23	–0.4987	–3.57	–0.4422	–3.91
32	23	–0.4927	–3.18	–0.4261	–3.40
33	23	–0.4925	–2.49	–0.4035	–2.42
34	22	–0.4806	–2.81	–0.3681	–3.08
35	22	–0.4849	–2.67	–0.3640	–2.88
(Year 3) 36	22	–0.4752	–2.64	–0.3851	–2.80

Note: BHR = Buy-and-hold average return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 12: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Returns (BHRs) for the Information Technology Industry

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHR	t-stat	BHR	t-stat
1	20	–0.0191	–0.93	0.0326	2.06
2	20	–0.0404	–0.88	0.1156	5.86
3	20	–0.0417	–0.48	0.2295	4.58
4	20	–0.0094	–0.05	0.3092	2.12
5	20	–0.0156	–0.12	0.2923	2.37
6	20	–0.0129	–0.08	0.4030	6.78
7	20	–0.0091	–0.05	0.4536	7.70
8	20	–0.0726	–0.52	0.3278	5.47
9	20	–0.1103	–0.80	0.2813	4.08
10	20	–0.1617	–1.15	0.2428	1.29
11	20	–0.1904	–1.34	0.1894	0.62
(Year 1) 12	18	–0.2209	–1.38	0.2010	0.68
13	17	–0.2373	–1.23	0.2109	1.04
14	17	–0.2965	–1.45	0.1225	0.83
15	17	–0.3142	–1.41	0.1102	0.76
16	17	–0.2732	–1.17	0.1032	0.76
17	17	–0.2650	–1.20	0.1801	1.15
18	17	–0.3019	–1.23	0.1512	0.95
19	17	–0.3182	–1.16	0.1336	0.79
20	17	–0.4102	–1.90	–0.0063	–0.10
21	17	–0.4592	–2.99	–0.0558	–0.68
22	17	–0.4574	–2.99	–0.0740	–0.86
23	17	–0.4911	–3.07	–0.1434	–1.62
(Year 2) 24	17	–0.5021	–3.28	–0.1106	–1.16
25	16	–0.4995	–3.49	–0.1179	–1.41
26	16	–0.4785	–2.72	–0.0856	–0.88
27	16	–0.4742	–2.21	–0.1527	–1.57
28	15	–0.5010	–1.98	–0.4710	–2.22
29	14	–0.5058	–1.87	–0.5145	–2.78
30	14	–0.4886	–1.73	–0.5058	–2.39
31	14	–0.4552	–1.73	–0.4279	–0.54
32	14	–0.4064	–1.47	–0.3869	–0.90
33	14	–0.3842	–1.35	–0.3264	–1.18
34	14	–0.3738	–1.30	–0.3397	–0.96
35	14	–0.4151	–1.77	–0.3102	–1.62
(Year 3) 36	14	–0.4010	–1.63	–0.3201	–1.49

Note: BHR = Buy-and-hold average return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 13: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Returns (BHRs) for Issue Year 2006

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHR	t-stat	BHR	t-stat
1	67	0.0231	1.33	0.0239	6.84
2	67	0.0748	2.64	0.0373	7.17
3	67	0.0864	2.06	0.0686	7.11
4	67	0.1561	3.23	0.1012	6.65
5	67	0.2734	4.54	0.1405	7.84
6	67	0.3390	4.48	0.1909	8.32
7	67	0.5144	5.32	0.2514	14.42
8	67	0.5968	5.85	0.2305	14.64
9	67	0.6526	5.11	0.2933	24.34
10	67	0.7398	4.82	0.3109	21.33
11	67	0.7445	5.09	0.3041	9.25
(Year 1) 12	67	0.6973	5.16	0.2842	6.60
13	67	0.6807	4.68	0.3047	4.53
14	67	0.5510	3.78	0.2566	5.32
15	67	0.5393	3.10	0.2540	4.52
16	67	0.5330	2.99	0.2180	2.42
17	67	0.4813	2.83	0.3154	2.49
18	67	0.3551	2.29	0.2522	2.08
19	67	0.2665	1.76	0.2092	1.41
20	67	0.1358	1.03	0.1021	0.88
21	67	0.0672	0.48	0.0529	0.50
22	67	–0.0100	–0.01	0.1084	0.77
23	67	–0.0374	–0.12	0.1557	0.99
(Year 2) 24	67	–0.1180	–0.56	0.0851	0.61
25	67	–0.2002	–0.99	0.1284	0.91
26	67	–0.2892	–1.28	0.0652	0.49
27	67	–0.3355	–1.15	–0.0085	–0.01
28	67	–0.4326	–1.07	–0.1647	–1.50
29	67	–0.4929	–3.37	–0.2666	–3.91
30	67	–0.5043	–5.30	–0.3004	–5.09
31	67	–0.5199	–5.43	–0.3027	–5.15
32	67	–0.4857	–4.57	–0.2846	–4.53
33	67	–0.4711	–3.40	–0.2487	–3.56
34	67	–0.4232	–3.59	–0.2141	–2.84
35	67	–0.3674	–3.40	–0.1726	–2.17
(Year 3) 36	67	–0.3512	–3.12	–0.1753	–2.04

Note: BHR= Buy-and-hold average return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 14: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Returns (BHRs) for Issue Year 2007

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHR	t-stat	BHR	t-stat
1	94	–0.0097	–0.48	–0.0002	–0.15
2	94	–0.0317	–0.73	0.0119	0.89
3	94	–0.0978	–1.47	–0.0292	–0.35
4	94	–0.0835	–0.82	0.0050	0.62
5	94	–0.0980	–1.25	0.0115	0.28
6	94	–0.1192	–1.41	–0.0291	–0.42
7	94	–0.1175	–1.29	–0.0148	–0.16
8	94	–0.2069	–2.84	–0.0530	–0.77
9	94	–0.2523	–3.05	–0.0766	–1.06
10	94	–0.3569	–3.13	–0.1353	–1.85
11	94	–0.3920	–2.36	–0.1918	–2.31
(Year 1) 12	94	–0.4559	–1.04	–0.2405	–3.06
13	94	–0.4692	–1.47	–0.2871	–4.03
14	94	–0.5035	–2.75	–0.4226	–6.47
15	94	–0.5410	–0.41	–0.5135	–7.03
16	94	–0.5574	–2.15	–0.5562	–5.45
17	94	–0.5754	–3.53	–0.5938	–5.24
18	94	–0.5749	–3.55	–0.6430	–9.79
19	94	–0.5772	–2.76	–0.6197	–7.82
20	94	–0.5655	–0.96	–0.6212	–5.01
21	94	–0.5639	–3.42	–0.5983	–8.51
22	94	–0.5345	0.01	–0.5893	–9.84
23	94	–0.4755	0.64	–0.5195	–7.34
(Year 2) 24	94	–0.4627	1.59	–0.4830	–6.34
25	94	–0.4387	–0.28	–0.4376	–4.69
26	94	–0.4414	–2.30	–0.4543	–6.5
27	94	–0.4444	–0.28	–0.4373	–4.88
28	94	–0.4335	–2.30	–0.3938	–9.26
29	94	–0.4374	–1.62	–0.3933	–7.41
30	94	–0.4712	–4.93	–0.4268	–4.63
31	94	–0.4862	–4.86	–0.4039	–6.11
32	94	–0.4560	–3.25	–0.4006	–0.44
33	94	–0.4348	–2.31	–0.4154	–3.47
34	94	–0.4232	–3.56	–0.4168	–1.38
35	94	–0.4020	–3.20	–0.3858	–2.02
(Year 3) 36	94	–0.3908	–2.18	–0.3772	–4.03

Note: BHR = Buy-and-hold average return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 15: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Returns (BHRs) for Issue Year 2008

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHR	t-stat	BHR	t-stat
1	19	–0.0865	–3.34	–0.1348	–3.06
2	19	–0.1557	–1.29	–0.2912	–4.46
3	19	–0.2412	–2.51	–0.3595	–1.59
4	19	–0.2961	–2.82	–0.4247	–1.51
5	19	–0.3752	–3.47	–0.4744	–2.96
6	19	–0.4145	–3.91	–0.4806	–3.52
7	19	–0.4917	–4.26	–0.5217	–4.10
8	19	–0.4420	–4.95	–0.3837	–5.41
9	19	–0.4236	–4.12	–0.2847	–3.14
10	19	–0.3955	–3.14	–0.2712	–3.05
11	19	–0.4039	–3.88	–0.2873	–3.46
(Year 1) 12	19	–0.3784	–3.55	–0.2561	–3.36
13	19	–0.3461	–3.09	–0.1410	–1.44
14	19	–0.2785	–2.25	–0.0139	–0.12
15	19	–0.2701	–2.22	0.0066	0.03
16	19	–0.1937	–1.44	0.0903	0.55
17	19	–0.1557	–1.18	0.0237	0.16
18	19	–0.2504	–1.96	–0.1126	–0.92
19	19	–0.2417	–2.01	–0.0867	–0.67
20	19	–0.2832	–2.19	–0.0910	–0.65
21	19	–0.3056	–2.58	–0.1223	–0.92
22	19	–0.2982	–2.58	–0.1172	–0.92
23	19	–0.3292	–3.04	–0.1847	–1.69
(Year 2) 24	19	–0.3422	–2.90	–0.1630	–1.32
25	19	–0.2724	–1.69	–0.1873	–1.35
26	19	–0.1775	–0.95	–0.1069	–0.67
27	19	–0.0863	–0.49	–0.0288	–0.18
28	19	–0.0940	–0.50	0.0014	0.03
29	18	0.0157	0.12	0.0437	0.32
30	18	0.0954	0.46	0.0775	0.68
31	18	0.0240	0.17	0.0458	0.40
32	18	0.0115	0.10	0.0375	0.31
33	18	–0.0234	–0.10	0.0106	0.11
34	17	0.0128	0.10	0.0562	0.42
35	16	–0.0210	–0.06	–0.0488	–0.19
(Year 3) 36	16	–0.0719	–0.38	–0.0425	–0.27

Note: BHR = Buy-and-hold average return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 16: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Abnormal Returns (BHARs) for the Full Sample

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHAR	t-stat	BHAR	t-stat
1	249	0.0004	0.06	0.0154	3.46
2	249	–0.0001	–0.02	0.0066	1.12
3	249	–0.0253	–0.96	0.0478	7.28
4	249	0.0015	0.10	0.1082	29.00
5	249	0.0277	0.81	0.1055	11.24
6	249	0.0305	0.83	0.1214	10.47
7	249	0.0738	1.65	0.1333	12.88
8	249	0.0798	1.76	0.1443	13.93
9	249	0.0770	1.47	0.1633	19.87
10	249	0.0834	1.39	0.1575	15.34
11	249	0.0702	1.21	0.1237	6.51
(Year 1) 12	242	0.0432	0.80	0.1753	8.26
13	229	0.0520	0.90	0.1920	7.53
14	225	0.0169	0.32	0.0336	0.83
15	220	0.0140	0.25	0.0065	0.25
16	217	0.0155	0.27	–0.0251	–0.26
17	216	0.0016	0.07	0.0280	0.46
18	215	–0.0622	–0.83	–0.0337	–0.45
19	213	–0.0826	–1.08	–0.0326	–0.40
20	208	–0.1206	–1.73	–0.0795	–1.20
21	205	–0.1412	–1.68	–0.1061	–1.38
22	204	–0.1532	–1.79	–0.0600	–0.79
23	203	–0.1341	–1.46	–0.0047	–0.03
(Year 2) 24	202	–0.1444	–1.65	0.0116	0.20
25	194	–0.1550	–1.79	0.0460	0.72
26	192	–0.1729	–1.98	0.0006	0.04
27	190	–0.1742	–1.82	–0.0117	–0.14
28	189	–0.2004	–3.13	–0.0819	–1.69
29	188	–0.2138	–3.75	–0.1287	–2.71
30	187	–0.2152	–3.51	–0.1453	–2.16
31	187	–0.2294	–4.26	–0.1329	–3.17
32	187	–0.1989	–3.82	–0.1189	–2.74
33	187	–0.1892	–3.42	–0.1129	–2.44
34	186	–0.1717	–3.29	–0.0997	–2.28
35	185	–0.1528	–2.84	–0.0748	–1.68
(Year 3) 36	185	–0.1512	–2.48	–0.0875	–1.68

Note: BHAR= Buy-and-hold average abnormal return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 17: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Abnormal Returns (BHARs) for the Resources Industry

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHAR	t-stat	BHAR	t-stat
1	139	0.0145	0.97	–0.0055	–0.28
2	139	0.0214	0.83	–0.0317	–1.00
3	139	–0.0088	–0.20	–0.0621	–1.28
4	139	0.0235	0.56	0.0352	1.24
5	139	0.0750	1.65	0.0575	1.13
6	139	0.0772	1.54	0.0563	1.10
7	139	0.1485	2.26	0.0756	1.43
8	139	0.1607	2.48	0.1271	2.30
9	139	0.1524	1.96	0.1793	3.39
10	139	0.1704	1.84	0.1563	2.34
11	139	0.1434	1.66	0.1762	2.25
(Year 1) 12	135	0.1077	1.36	0.3855	4.49
13	126	0.1036	1.27	0.4676	5.65
14	123	0.0541	0.66	0.3676	5.41
15	120	0.0417	0.48	0.3381	5.79
16	119	0.0252	0.31	0.2537	4.38
17	118	0.0091	0.16	0.1521	2.62
18	117	–0.0665	–0.68	–0.0062	–0.01
19	115	–0.1035	–1.22	–0.0325	–0.43
20	112	–0.1257	–1.53	–0.0271	–0.38
21	111	–0.1473	–1.25	–0.0644	–0.61
22	111	–0.1908	–2.08	–0.0989	–1.37
23	111	–0.1553	–1.70	–0.0252	–0.33
(Year 2) 24	111	–0.1478	–1.53	–0.0081	–0.06
25	105	–0.1620	–1.79	–0.0826	–1.08
26	103	–0.1734	–2.24	–0.0944	–1.45
27	101	–0.1546	–1.77	–0.0586	–0.81
28	101	–0.1651	–2.26	–0.0434	–0.70
29	101	–0.1675	–2.11	–0.0340	–0.50
30	101	–0.1797	–2.07	–0.0641	–0.95
31	101	–0.2140	–2.60	–0.0976	–1.59
32	101	–0.1792	–2.40	–0.0981	–1.57
33	101	–0.1660	–2.13	–0.0702	–1.11
34	101	–0.1671	–2.46	–0.0839	–1.43
35	100	–0.1254	–1.68	–0.0831	–1.26
(Year 3) 36	100	–0.1157	–1.33	–0.0636	–0.83

Note: BHAR = Buy-and-hold average abnormal return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 18: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Abnormal Returns (BHARs) for the Industrial Sector

Months of holding	Number of firms trading	Equally weighted (EW) BHAR	t-stat	Value-weighted (VW) BHAR	t-stat
1	45	–0.0082	–0.64	0.0217	2.30
2	45	–0.0117	–0.50	0.0017	0.26
3	45	–0.0306	–0.88	0.0700	3.28
4	45	0.0246	0.62	0.1460	10.61
5	45	0.0122	0.24	0.1421	9.52
6	45	0.0410	0.65	0.1595	12.18
7	45	0.0774	1.01	0.1824	13.38
8	45	0.1122	1.33	0.2121	11.79
9	45	0.1291	1.37	0.2291	12.68
10	45	0.1373	1.39	0.2235	8.37
11	45	0.1630	1.44	0.1982	6.82
(Year 1) 12	45	0.1793	1.55	0.2462	11.47
13	44	0.2323	1.78	0.2733	7.85
14	43	0.1979	1.53	0.0569	0.53
15	41	0.1874	1.30	0.0210	0.22
16	40	0.2179	1.38	0.0414	0.30
17	40	0.2441	1.37	0.0840	0.47
18	40	0.1669	1.00	0.0195	0.19
19	40	0.1727	0.96	0.0850	0.49
20	39	0.0985	0.65	0.0068	0.14
21	38	0.0774	0.51	–0.0054	–0.08
22	38	0.1386	0.74	0.0842	0.47
23	38	0.1556	0.78	0.1537	0.76
(Year 2) 24	38	0.0601	0.38	0.0955	0.54
25	38	0.0384	0.28	0.1121	0.63
26	38	–0.0261	–0.02	0.0166	0.17
27	38	–0.0699	–0.18	–0.0199	–0.03
28	38	–0.1659	–0.88	–0.1168	–0.68
29	38	–0.2212	–2.07	–0.2235	–2.04
30	38	–0.2372	–2.96	–0.2639	–2.91
31	38	–0.2300	–2.71	–0.2342	–2.70
32	38	–0.2167	–2.15	–0.2224	–1.99
33	38	–0.2011	–1.76	–0.2323	–1.81
34	38	–0.1534	–1.20	–0.1984	–1.30
35	38	–0.1351	–1.09	–0.1414	–1.14
(Year 3) 36	38	–0.1555	–1.15	–0.1582	–1.17

Note: BHAR = Buy-and-hold average abnormal return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 19: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Abnormal Returns (BHARs) for the Consumer Discretionary and Staples Industry

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHAR	t-stat	BHAR	t-stat
1	31	–0.0450	–2.19	–0.0330	–2.17
2	31	–0.0773	–2.98	–0.0272	–1.52
3	31	–0.1238	–3.73	–0.0585	–2.87
4	31	–0.1622	–3.94	–0.0821	–3.19
5	31	–0.2154	–4.66	–0.0982	–4.79
6	31	–0.2078	–2.79	–0.0862	–1.61
7	31	–0.2057	–2.72	–0.0886	–1.70
8	31	–0.2355	–3.12	–0.0997	–1.96
9	31	–0.2472	–3.33	–0.0883	–1.93
10	31	–0.2565	–3.31	–0.0862	–1.74
11	31	–0.2575	–2.72	–0.1045	–1.83
(Year 1) 12	31	–0.2674	–2.87	–0.1488	–2.64
13	30	–0.3147	–3.03	–0.1941	–3.19
14	30	–0.3189	–3.59	–0.2131	–4.30
15	30	–0.3029	–2.74	–0.1984	–2.62
16	29	–0.2635	–2.12	–0.1984	–1.88
17	29	–0.3044	–3.10	–0.2034	–3.00
18	29	–0.3386	–3.69	–0.2485	–3.77
19	29	–0.3133	–3.89	–0.2367	–3.87
20	28	–0.3210	–3.99	–0.2636	–3.99
21	28	–0.3435	–4.30	–0.2466	–3.98
22	27	–0.3452	–4.41	–0.2369	–3.88
23	26	–0.3557	–4.62	–0.2897	–3.97
(Year 2) 24	25	–0.3473	–4.51	–0.2494	–3.70
25	24	–0.3543	–3.64	–0.2251	–2.77
26	24	–0.3619	–3.54	–0.2168	–2.74
27	24	–0.3574	–3.63	–0.2112	–2.89
28	24	–0.3666	–4.38	–0.2654	–4.11
29	24	–0.3816	–4.39	–0.2479	–4.08
30	23	–0.3254	–3.08	–0.2083	–2.77
31	23	–0.3044	–2.72	–0.2301	–2.76
32	23	–0.2822	–2.33	–0.1943	–2.10
33	23	–0.2850	–1.90	–0.1689	–1.51
34	22	–0.2613	–1.81	–0.1440	–1.34
35	22	–0.2740	–1.80	–0.1691	–1.43
(Year 3) 36	22	–0.2672	–1.82	–0.2149	–1.60

Note: BHAR = Buy-and-hold average abnormal return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 20: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Abnormal Returns (BHARs) for the Information Technology Industry

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHAR	t-stat	BHAR	t-stat
1	20	–0.0190	–0.88	0.0321	2.88
2	20	–0.0353	–0.81	0.1139	5.02
3	20	–0.0340	–0.42	0.2324	6.95
4	20	0.0055	0.08	0.2794	1.84
5	20	–0.0053	–0.04	0.2782	4.45
6	20	0.0026	0.02	0.3672	8.54
7	20	0.0070	0.06	0.4020	8.51
8	20	–0.0605	–0.50	0.2872	9.45
9	20	–0.0775	–0.64	0.2830	9.95
10	20	–0.1138	–0.94	0.2639	8.50
11	20	–0.1472	–1.24	0.1809	0.09
(Year 1) 12	18	–0.1812	–1.37	0.1852	0.65
13	17	–0.1838	–1.17	0.1698	1.16
14	17	–0.2246	–1.37	0.1068	0.84
15	17	–0.2312	–1.34	0.1109	0.87
16	17	–0.1989	–1.09	0.0848	0.76
17	17	–0.1970	–1.17	0.1529	1.11
18	17	–0.2218	–1.17	0.1269	0.95
19	17	–0.2092	–1.00	0.1600	1.05
20	17	–0.2856	–1.85	0.0301	0.18
21	17	–0.3260	–2.90	0.0065	0.15
22	17	–0.2947	–2.52	0.0307	0.12
23	17	–0.3218	–3.00	–0.0348	–0.63
(Year 2) 24	17	–0.3017	–2.84	0.0319	0.16
25	16	–0.2778	–2.32	0.0634	0.36
26	16	–0.2308	–1.65	0.0992	0.60
27	16	–0.2443	–1.47	0.0160	0.09
28	15	–0.2631	–1.43	–0.2058	–1.07
29	14	–0.2447	–1.29	–0.2259	–0.83
30	14	–0.2242	–1.09	–0.2128	–0.60
31	14	–0.1910	–0.92	–0.1469	–0.78
32	14	–0.1456	–0.63	–0.0974	–0.47
33	14	–0.1195	–0.49	–0.0503	–0.21
34	14	–0.1157	–0.46	–0.0841	–0.35
35	14	–0.1609	–0.80	–0.0723	–0.40
(Year 3) 36	14	–0.1677	–0.79	–0.1111	–0.58

Note: BHAR = Buy-and-hold average abnormal return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 21: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Abnormal Returns (BHARs) for Issue Year 2006

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHAR	t-stat	BHAR	t-stat
1	67	0.0180	0.99	0.0213	6.05
2	67	0.0516	1.80	0.0357	6.92
3	67	0.0473	1.11	0.0476	4.11
4	67	0.0891	1.76	0.0697	4.49
5	67	0.1854	2.97	0.0820	3.88
6	67	0.2352	3.00	0.1180	4.31
7	67	0.3933	3.89	0.1411	6.13
8	67	0.4677	4.39	0.1207	5.75
9	67	0.4989	3.66	0.1488	8.16
10	67	0.5695	3.49	0.1430	6.08
11	67	0.5591	3.61	0.1029	2.11
(Year 1) 12	67	0.5068	3.60	0.0769	1.31
13	67	0.5066	3.43	0.1189	1.47
14	67	0.4021	2.73	0.0537	0.91
15	67	0.4023	2.30	0.0342	0.66
16	67	0.3940	2.22	–0.0009	–0.23
17	67	0.3491	2.09	0.1261	0.94
18	67	0.2351	1.54	0.0689	0.57
19	67	0.1703	1.16	0.0290	0.24
20	67	0.0854	0.69	–0.0343	–0.16
21	67	0.0473	0.37	–0.0784	–0.37
22	67	0.0062	0.11	0.0168	0.17
23	67	0.0180	0.20	0.0955	0.63
(Year 2) 24	67	–0.0179	–0.03	0.0978	0.73
25	67	–0.0628	–0.33	0.1561	1.17
26	67	–0.1149	–0.65	0.0853	0.66
27	67	–0.1437	–0.75	0.0563	0.49
28	67	–0.2096	–1.38	–0.0452	–0.46
29	67	–0.2488	–3.10	–0.1154	–2.00
30	67	–0.2422	–3.70	–0.1377	–2.71
31	67	–0.2540	–3.99	–0.1290	–2.61
32	67	–0.2164	–3.05	–0.1094	–1.97
33	67	–0.2093	–2.59	–0.0824	–1.31
34	67	–0.1826	–2.14	–0.0655	–0.94
35	67	–0.1520	–1.78	–0.0437	–0.58
(Year 3) 36	67	–0.1513	–1.65	–0.0648	–0.79

Note: BHAR = Buy-and-hold average abnormal return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 22: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Abnormal returns (BHARs) for Issue Year 2007

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHAR	t-stat	BHAR	t-stat
1	94	0.0017	0.15	0.0001	0.26
2	94	–0.0028	–0.01	0.0201	2.26
3	94	–0.0559	–1.03	–0.0075	0.11
4	94	–0.0314	–0.34	0.0384	2.96
5	94	–0.0469	–0.68	0.0533	1.24
6	94	–0.0543	–0.77	0.0190	0.47
7	94	–0.0178	–0.20	0.0819	1.88
8	94	–0.0706	–1.20	0.0594	0.97
9	94	–0.0897	–1.47	0.0455	0.68
10	94	–0.1572	–2.46	0.0262	0.39
11	94	–0.1567	–2.23	0.0132	0.18
(Year 1) 12	94	–0.1749	–2.53	0.0083	0.12
13	94	–0.1684	–2.67	–0.0311	–0.48
14	94	–0.1848	–3.32	–0.1307	–2.40
15	94	–0.1993	–3.23	–0.1653	–2.93
16	94	–0.2012	–3.79	–0.1915	–3.75
17	94	–0.2073	–4.25	–0.2147	–4.13
18	94	–0.2034	–4.13	–0.2563	0.63
19	94	–0.2035	–3.93	–0.2116	–1.67
20	94	–0.1918	–3.28	–0.2081	4.08
21	94	–0.2082	–3.85	–0.2104	–0.60
22	94	–0.1984	–2.72	–0.2283	5.30
23	94	–0.1570	–1.67	–0.1627	2.20
(Year 2) 24	94	–0.1565	–1.44	–0.1497	2.50
25	94	–0.1439	–1.53	–0.1228	0.57
26	94	–0.1641	–2.10	–0.1685	0.76
27	94	–0.1760	–1.74	–0.1531	1.91
28	94	–0.1719	–2.28	–0.1237	–1.39
29	94	–0.1919	–2.28	–0.1492	–1.28
30	94	–0.2181	–3.81	–0.1698	–3.41
31	94	–0.2310	–3.92	–0.1472	–3.20
32	94	–0.1984	–2.82	–0.1420	–2.13
33	94	–0.1795	–2.13	–0.1619	–1.50
34	94	–0.1758	–2.33	–0.1601	–1.85
35	94	–0.1546	–1.99	–0.1161	–1.51
(Year 3) 36	94	–0.1496	–1.57	–0.1204	–0.52

Note: BHAR = Buy-and-hold average abnormal return, **t-stat** = Bootstrapped skew-adjusted t-statistics**.**

Appendix 23: Equally Weighted (EW) and Value-Weighted (VW) Buy-and-Hold Average Abnormal Returns (BHARs) for Issue Year 2008

Months of holding	Number of firms trading	Equally weighted (EW)		Value-weighted (VW)	
		BHAR	t-stat	BHAR	t-stat
1	19	–0.0692	–2.86	–0.1252	–2.52
2	19	–0.1249	–1.19	–0.2507	–3.00
3	19	–0.1854	–2.17	–0.3181	–2.16
4	19	–0.2005	–2.27	–0.3228	–8.03
5	19	–0.2239	–2.81	–0.3460	–1.22
6	19	–0.2415	–3.15	–0.3281	–2.06
7	19	–0.3365	–2.33	–0.3924	–3.37
8	19	–0.2955	–4.24	–0.2739	–4.60
9	19	–0.2782	–3.10	–0.1891	–2.39
10	19	–0.2717	–3.92	–0.1963	–2.79
11	19	–0.2914	–4.13	–0.2160	–3.36
(Year 1) 12	19	–0.2887	–6.01	–0.2240	–4.50
13	19	–0.2816	–3.52	–0.1314	–1.47
14	19	–0.2398	–2.06	–0.0274	–0.22
15	19	–0.2539	–2.23	–0.0449	–0.37
16	19	–0.1829	–1.41	0.0358	0.23
17	19	–0.1425	–1.12	–0.0107	–0.08
18	19	–0.2403	–2.08	–0.1638	–1.39
19	19	–0.2319	–2.16	–0.1177	–0.91
20	19	–0.2913	–2.43	–0.1506	–1.08
21	19	–0.3078	–2.57	–0.1886	–1.47
22	19	–0.3136	–2.64	–0.1843	–1.39
23	19	–0.3373	–3.09	–0.2503	–2.18
(Year 2) 24	19	–0.3263	–2.77	–0.2009	–1.56
25	19	–0.2524	–1.54	–0.2227	–1.47
26	19	–0.1649	–0.85	–0.1577	–0.90
27	19	–0.0812	–0.43	–0.0778	–0.46
28	19	–0.0946	–0.48	–0.0663	–0.37
29	18	0.0059	0.06	–0.0234	–0.06
30	18	0.0892	0.42	0.0279	0.35
31	18	0.0222	0.15	–0.0102	–0.07
32	18	0.0141	0.11	0.0081	0.14
33	18	–0.0249	–0.10	–0.0253	–0.11
34	17	0.0315	0.19	0.0463	0.36
35	16	0.0278	0.18	–0.0566	–0.20
(Year 3) 36	16	–0.0142	–0.06	–0.0474	–0.27

Note: BHAR= Buy-and-hold average abnormal return, **t-stat** = Bootstrapped skew-adjusted t-statistics.

Appendix 24: Equally Weighted (EW) and Value-Weighted (VW) Average Wealth Relatives (WRs) for the Full Sample

Months of holding		Number of firms trading	Equally weighted WR	Value-weighted WR
	1	249	1.0004	1.0153
	2	249	0.9999	1.0065
	3	249	0.9745	1.0470
	4	249	1.0015	1.1083
	5	249	1.0279	1.1041
	6	249	1.0309	1.1209
	7	249	1.0754	1.1338
	8	249	1.0827	1.1466
	9	249	1.0801	1.1689
	10	249	1.0876	1.1646
	11	249	1.0743	1.1273
(Year 1)	12	242	1.0462	1.1793
	13	229	1.0561	1.1977
	14	225	1.0185	1.0336
	15	220	1.0155	1.0066
	16	217	1.0174	0.9746
	17	216	1.0018	1.0289
	18	215	0.9294	0.9650
	19	213	0.9052	0.9657
	20	208	0.8588	0.9146
	21	205	0.8338	0.8864
	22	204	0.8188	0.9347
	23	203	0.8398	0.9948
(Year 2)	24	202	0.8245	1.0133
	25	194	0.8089	1.0530
	26	192	0.7853	1.0007
	27	190	0.7830	0.9865
	28	189	0.7478	0.9017
	29	188	0.7307	0.8440
	30	187	0.7242	0.8209
	31	187	0.7038	0.8350
	32	187	0.7411	0.8518
	33	187	0.7542	0.8605
	34	186	0.7786	0.8777
	35	185	0.8040	0.9089
(Year 3)	36	185	0.8080	0.8954

Note: WR = Average wealth relative.

Appendix 25: Equally Weighted (EW) and Value-Weighted (VW) Average Wealth Relatives (WRs) for the Resources Industry

Months of holding	Number of firms trading	Equally weighted WR	Value-weighted WR
1	139	1.0146	0.9944
2	139	1.0215	0.9679
3	139	0.9911	0.9376
4	139	1.0236	1.0358
5	139	1.0758	1.0597
6	139	1.0781	1.0588
7	139	1.1519	1.0818
8	139	1.1671	1.1400
9	139	1.1590	1.2015
10	139	1.1787	1.1732
11	139	1.1517	1.1957
(Year 1) 12	135	1.1154	1.4274
13	126	1.1116	1.5232
14	123	1.0591	1.4118
15	120	1.0461	1.3859
16	119	1.0281	1.2964
17	118	1.0102	1.1835
18	117	0.9245	0.9925
19	115	0.8811	0.9603
20	112	0.8522	0.9660
21	111	0.8241	0.9186
22	111	0.7704	0.8752
23	111	0.8115	0.9680
(Year 2) 24	111	0.8187	0.9897
25	105	0.7983	0.8938
26	103	0.7817	0.8796
27	101	0.8049	0.9257
28	101	0.7901	0.9454
29	101	0.7875	0.9573
30	101	0.7702	0.9194
31	101	0.7241	0.8774
32	101	0.7674	0.8753
33	101	0.7847	0.9113
34	101	0.7858	0.8951
35	100	0.8400	0.8953
(Year 3) 36	100	0.8535	0.9195

Note: WR = Average wealth relative.

Appendix 26: Equally Weighted (EW) and Value-Weighted (VW) Average Wealth Relatives (WRs) for the Industrial Sector

Months of holding	Number of firms trading	Equally weighted WR	Value-weighted WR
1	45	0.9918	1.0214
2	45	0.9882	1.0016
3	45	0.9694	1.0674
4	45	1.0245	1.1453
5	45	1.0122	1.1378
6	45	1.0413	1.1577
7	45	1.0791	1.1835
8	45	1.1168	1.2161
9	45	1.1348	1.2401
10	45	1.1464	1.2390
11	45	1.1764	1.2096
(Year 1) 12	45	1.1985	1.2588
13	44	1.2618	1.2943
14	43	1.2235	1.0599
15	41	1.2134	1.0223
16	40	1.2509	1.0445
17	40	1.2831	1.0895
18	40	1.1940	1.0215
19	40	1.2010	1.0982
20	39	1.1163	1.0082
21	38	1.0901	0.9938
22	38	1.1595	1.0956
23	38	1.1805	1.1754
(Year 2) 24	38	1.0714	1.1123
25	38	1.0467	1.1332
26	38	0.9681	1.0194
27	38	0.9137	0.9758
28	38	0.7906	0.8495
29	38	0.7187	0.7075
30	38	0.6898	0.6443
31	38	0.6960	0.6762
32	38	0.7129	0.6939
33	38	0.7359	0.6853
34	38	0.8009	0.7328
35	38	0.8271	0.8108
(Year 3) 36	38	0.8033	0.7948

Note: WR = Average wealth relative.

Appendix 27: Equally Weighted (EW) and Value-Weighted (VW) Average Wealth Relatives (WRs) for the Consumer Discretionary and Staples Industry

Months of holding	Number of firms trading	Equally weighted WR	Value-weighted WR
1	31	0.9549	0.9669
2	31	0.9228	0.9730
3	31	0.8760	0.9412
4	31	0.8392	0.9203
5	31	0.7871	0.9061
6	31	0.7923	0.9177
7	31	0.7933	0.9161
8	31	0.7594	0.9044
9	31	0.7506	0.9155
10	31	0.7383	0.9157
11	31	0.7356	0.8997
(Year 1) 12	31	0.7224	0.8572
13	30	0.6732	0.8130
14	30	0.6596	0.7909
15	30	0.6683	0.7989
16	29	0.7122	0.8018
17	29	0.6624	0.7899
18	29	0.6212	0.7418
19	29	0.6424	0.7499
20	28	0.6247	0.7121
21	28	0.6050	0.7264
22	27	0.6061	0.7403
23	26	0.5889	0.6863
(Year 2) 24	25	0.5874	0.7141
25	24	0.5775	0.7376
26	24	0.5689	0.7419
27	24	0.5690	0.7471
28	24	0.5587	0.6732
29	24	0.5447	0.6924
30	23	0.5955	0.7327
31	23	0.6222	0.7079
32	23	0.6426	0.7470
33	23	0.6404	0.7793
34	22	0.6653	0.8145
35	22	0.6528	0.7900
(Year 3) 36	22	0.6626	0.7410

Note: WR = Average wealth relative.

Appendix 28: Equally Weighted (EW) and Value-Weighted (VW) Average Wealth Relatives (WRs) for the Information Technology Industry

Months of holding	Number of firms trading	Equally weighted WR	Value-weighted WR
1	20	0.9810	1.0321
2	20	0.9645	1.1137
3	20	0.9658	1.2331
4	20	1.0056	1.2713
5	20	0.9946	1.2743
6	20	1.0026	1.3545
7	20	1.0071	1.3823
8	20	0.9388	1.2760
9	20	0.9199	1.2834
10	20	0.8805	1.2695
11	20	0.8462	1.1794
(Year 1) 12	18	0.8113	1.1823
13	17	0.8058	1.1631
14	17	0.7580	1.1051
15	17	0.7479	1.1110
16	17	0.7851	1.0833
17	17	0.7886	1.1489
18	17	0.7589	1.1239
19	17	0.7652	1.1644
20	17	0.6738	1.0312
21	17	0.6239	1.0069
22	17	0.6481	1.0342
23	17	0.6126	0.9610
(Year 2) 24	17	0.6227	1.0372
25	16	0.6430	1.0774
26	16	0.6932	1.1217
27	16	0.6828	1.0192
28	15	0.6547	0.7199
29	14	0.6688	0.6824
30	14	0.6952	0.6990
31	14	0.7404	0.7957
32	14	0.8031	0.8629
33	14	0.8374	0.9305
34	14	0.8440	0.8871
35	14	0.7843	0.9052
(Year 3) 36	14	0.7813	0.8595

Note: WR = Average wealth relative.

Appendix 29: Equally Weighted (EW) and Value-Weighted (VW) Average Wealth Relatives (WRs) for Issue Year 2006

Months of holding	Number of firms trading	Equally weighted WR	Value-weighted WR
1	67	1.0179	1.0212
2	67	1.0504	1.0356
3	67	1.0455	1.0466
4	67	1.0835	1.0676
5	67	1.1704	1.0775
6	67	1.2130	1.1100
7	67	1.3508	1.1271
8	67	1.4142	1.1087
9	67	1.4324	1.1300
10	67	1.4866	1.1224
11	67	1.4717	1.0857
(Year 1) 12	67	1.4256	1.0637
13	67	1.4314	1.1003
14	67	1.3500	1.0447
15	67	1.3538	1.0280
16	67	1.3459	0.9993
17	67	1.3083	1.1060
18	67	1.2099	1.0582
19	67	1.1553	1.0246
20	67	1.0813	0.9698
21	67	1.0464	0.9307
22	67	1.0063	1.0154
23	67	1.0190	1.0901
(Year 2) 24	67	0.9801	1.0991
25	67	0.9272	1.1605
26	67	0.8608	1.0870
27	67	0.8222	1.0602
28	67	0.7303	0.9487
29	67	0.6709	0.8641
30	67	0.6718	0.8355
31	67	0.6540	0.8439
32	67	0.7039	0.8674
33	67	0.7165	0.9011
34	67	0.7595	0.9230
35	67	0.8063	0.9498
(Year 3) 36	67	0.8109	0.9272

Note: WR = Average wealth relative.

Appendix 30: Equally Weighted (EW) and Value-Weighted (VW) Average Wealth Relatives (WRs) for Issue Year 2007

Months of holding	Number of firms trading	Equally weighted WR	Value-weighted WR
1	94	1.0018	1.0001
2	94	0.9971	1.0202
3	94	0.9416	0.9923
4	94	0.9669	1.0397
5	94	0.9505	1.0556
6	94	0.9419	1.0200
7	94	0.9802	1.0906
8	94	0.9183	1.0669
9	94	0.8929	1.0518
10	94	0.8036	1.0312
11	94	0.7951	1.0166
(Year 1) 12	94	0.7568	1.0111
13	94	0.7592	0.9582
14	94	0.7288	0.8155
15	94	0.6973	0.7464
16	94	0.6875	0.6986
17	94	0.6720	0.6542
18	94	0.6764	0.5821
19	94	0.6750	0.6425
20	94	0.6938	0.6455
21	94	0.6768	0.6562
22	94	0.7011	0.6427
23	94	0.7696	0.7471
(Year 2) 24	94	0.7745	0.7754
25	94	0.7960	0.8208
26	94	0.7730	0.7641
27	94	0.7594	0.7861
28	94	0.7672	0.8306
29	94	0.7456	0.8026
30	94	0.7080	0.7714
31	94	0.6899	0.8020
32	94	0.7328	0.8085
33	94	0.7589	0.7831
34	94	0.7664	0.7846
35	94	0.7946	0.8410
(Year 3) 36	94	0.8028	0.8380

Note: WR = Average wealth relative.

Appendix 31: Equally Weighted (EW) and Value-Weighted (VW) Average Wealth Relatives (WRs) for Issue Year 2008

Months of holding	Number of firms trading	Equally weighted WR	Value-weighted WR
1	19	0.9296	0.8736
2	19	0.8711	0.7387
3	19	0.8036	0.6681
4	19	0.7783	0.6406
5	19	0.7362	0.6030
6	19	0.7080	0.6129
7	19	0.6017	0.5493
8	19	0.6538	0.6923
9	19	0.6745	0.7909
10	19	0.6899	0.7878
11	19	0.6717	0.7674
(Year 1) 12	19	0.6828	0.7686
13	19	0.6990	0.8673
14	19	0.7505	0.9730
15	19	0.7419	0.9573
16	19	0.8151	1.0339
17	19	0.8556	0.9896
18	19	0.7572	0.8442
19	19	0.7658	0.8858
20	19	0.7110	0.8579
21	19	0.6929	0.8232
22	19	0.6911	0.8273
23	19	0.6654	0.7651
(Year 2) 24	19	0.6684	0.8065
25	19	0.7424	0.7849
26	19	0.8330	0.8500
27	19	0.9184	0.9259
28	19	0.9055	0.9379
29	18	1.0058	0.9780
30	18	1.0886	1.0266
31	18	1.0221	0.9903
32	18	1.0141	1.0078
33	18	0.9751	0.9756
34	17	1.0321	1.0459
35	16	1.0292	0.9438
(Year 3) 36	16	0.9849	0.9528

Note: WR = Average wealth relative.

Appendix 32: Long-Run Performance for the Full Sample, Industries and Issue years by Performance Measures

Long-run performance for the full sample by performance measures						
Performance measures	**Year 1**		**Year 2**		**Year 3**	
	EW	VW	EW	VW	EW	VW
CAR	1	1[c]	1	1[b]	1[a]	1[a]
BHR	0	1[a]	0[b]	0	0[a]	0[a]
BHAR	1	1[a]	0[c]	1	0[b]	0[c]
WR	1	1	0	1	0	0

Long-run performance for the industries by performance measures						
Performance measures	**Year 1**		**Year 2**		**Year 3**	
	EW	VW	EW	VW	EW	VW
Resources						
CAR	1	1	1	1	1[a]	1[b]
BHR	1	1	0[b]	0[c]	0[a]	0[a]
BHAR	1	1[a]	0[b]	0	0	0
WR	1	1	0	0	0	0
Industrials						
CAR	1	1	1	1[b]	1	1[b]
BHR	1	1[a]	0	0	0[b]	0[c]
BHAR	1	1[a]	1	1	0	0
WR	1	1	1	1	0	0
Consumer discretionary/staples						
CAR	0[b]	0	0[c]	0	0	0
BHR	0[a]	0[b]	0[a]	0[a]	0[b]	0[b]
BHAR	0[a]	0[b]	0[a]	0[a]	0[c]	0
WR	0	0	0	0	0	0
Information technology						
CAR	0	1	0	0	0	1
BHR	0	1[c]	0[a]	0	0[c]	0[c]
BHAR	0	1	0[b]	1	0	0
WR	0	1	0	1	0	0

Long-run performance for issue years by performance measures						
Performance measures	**Year 1**		**Year 2**		**Year 3**	
	EW	VW	EW	VW	EW	VW
Issue year 2006						
CAR	1[a]	0	0	0	1[b]	1
BHR	1[a]	1[a]	0	1	0[a]	0[b]
BHAR	1[a]	1	0	1	0[c]	0
WR	1	1	0	1	0	0
Issue year 2007						
CAR	0[b]	0[c]	1	1[b]	1[a]	1[a]
BHR	0[a]	0[a]	0[a]	0[a]	0[b]	0[a]
BHAR	0[b]	1	0[b]	0[b]	0[b]	0[b]
WR	0	1	0	0	0	0
Issue year 2008						
CAR	1	1[b]	1	1[c]	1	1[c]
BHR	0[a]	0[a]	0[a]	0	0	0
BHAR	0[a]	0[a]	0[b]	0	0	0
WR	0	0	0	0	0	0

Note: **1** = Overperformance, **0** = Underperformance, **EW** = Equally weighted, **VW** = Value-weighted, **CAR** = Cumulative average abnormal return, **BHR** = Buy-and-hold average return, **BHAR** = Buy-and-hold average abnormal return, **WR** = average wealth relative. [a] statistically significant at 1% level, [b] statistically significant at 5% level, [c] statistically significant at 10% level.