IPO VALUATION AND PERFORMANCE: EVIDENCE FROM THE UK MAIN MARKET

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A thesis submitted in fulfilment of the degree of Doctor of Philosophy in the Department of Accounting and Finance, University of Glasgow

2005

My comfort in my suffering is this:
Your promise preserves my life.
(Psalm 199:50 – New International Version)

In memory of our beloved father
Jintar Hutagaol

Acknowledgement

Know therefore that the LORD your God is God; he is the faithful God, keeping his covenant of love to a thousand generations of those who love him and keep his commands (Deuteronomy 7:9)

I would like to offer my sincere gratitude and appreciation to many people who made this thesis possible. Special thanks are due to my supervisor, Professor Jo Danbolt for his patience, diligence, perseverance and faithfulness in helping me through this PhD. I am highly indebted to my advisers, Professor Bill Rees, who helped me with amazing ideas on the early stage of the thesis, and Professor Rob Watson, who guided me to put together the pieces of my 'jigsaw' thesis.

I also would like to thank Wards Trust, Department of Accounting and Finance, University of Glasgow, and Universitas Kristen Indonesia that have provided financial supports during my PhD periods

I dedicate this thesis for my late father, who could not see the end of my PhD, but had set an example of hard work and been a wonderful and blessed inspiration for me. I would like to thank my husband, Anton and my daughter, Lia, who have shared all the laughs and tears and been a truly God's bless for me throughout the years. Special thanks to my mother, for her loves, patience, and prayers, and to my sisters and brothers for their prayers, encouragements and supports.

I extend my sincere thanks to all staffs in Department of Accounting and Finance, especially Kirsty Husband, Veda Smillie, Julie Cairns for their kindly helps. I also want to thank Niklas Kreander who has been my sincere friend in Christ. Last but not least, I would like to thank all of our friends, especially Susan and John Rushton, Jean and George Chalmers, Selvy and Matthew Warrens, and many who are not mentioned here, for their prayers and their friendships.

However many blessings we expect from God, His infinite liberality will always exceed all our wishes and our thoughts (John Calvin)

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Introduction

Introduction

Selling stock to the general public is one important method by which firms are able to raise new equity capital. If the firm sells stock for the first time to the general public, it is called an initial public offering (IPO). Subsequent to the IPO, firms may seek to raise further equity capital by offering to sell new shares through a seasoned equity offering (SEO).

In the UK, most young/small firms initially raise equity capital from a small number of investors through private placements. If a firm prospers and needs additional equity capital, it may choose at some point to go public by selling stock through an IPO. By issuing publicly traded equity, the firm establishes both a market value for the firm and a market for its common stock.

There have been many IPO studies that record the so-called "Underpricing anomaly" as a primary stylised fact of IPOs. The underpricing refers to the significance increase of the IPO market price over the first few days after the initial listing. This fact suggests that the IPO pricing is not simple very few information about the issuing firm is available to the market prior to IPO. This study is to examine the IPO valuation based on the prospectus information, which is perceived as comprehensive information about the firm prior to the IPOs. Furthermore, this study is also to observe the impact of the prospectus information on the IPO after market performances.

This chapter introduces the background and the motivation behind the study, the research questions, and the organisation of the thesis.

1.1. IPO Anomalies

Many studies have documented apparent anomalies in the pricing of initial public offerings (IPOs). Several academic hypotheses have been posited to explain these anomalies. As mentioned earlier, the so-called 'Underpricing phenomenon' was the first and most researched IPO anomaly found by scholars. The underpricing phenomenon refers to the statistically and economically significant positive initial returns characteristic of IPOs over the first few days after the initial listing of the shares. Given the large degree of uncertainty regarding the true value of the newly listed shares, some significant degree of mispricing is to be expected. However, the typically large price increases of IPO shares in the immediate post-listing period suggest that IPOs are systematically underpriced. Underpricing was first documented in the late 1960s in the US market (Reilly and Hatfield, 1969). These authors found that from 53 sample firms that went public in 1963-1965, the initial (first-day) return ranged from 18.3 to 20.2%. Eventually, other researchers also discovered much the same underpricing phenomenon in other countries. Jenkinson and Ljungqvist (1996) summarise the evidence of IPO underpricing in a large number of countries. (see table 1.1). In this study, the underpricing issue is addressed later in the Initial returns analysis chapter (Chapter 5). It discusses the impact of the IPO valuation (Chapter 4) on the underpricing.

The second anomaly is the long-run underperformance of IPO shares. This phenomenon was first documented by Aggarwal and Rivoli (1990) who found evidence of substantial negative abnormal returns over longer time horizons. By examining the IPO prices after the first 250 trading days, they find that on

Table 1.1. Comparative evidence of IPO underpricing

Country	Study	Sample Period	Initial Return (%)
USA[1]	Ibbotson *et al* (1994)	1960-1992	15.3
UK[2]	Jenkinson and Mayer (1988)	1983-1986	10.7
Australia	Lee et al. (1994)	1976-1989	11.9
Canada	Manigart & Rogiers (1992)	1984-1990	13.7
Finland	Keloharju (1993)	1984-1992	14.4
Germany	Ljungqvist (1996)	1970-1993	9.2
Japan	Kaneko and Pettway (1994)	1989-1993	12.0
Sweden	Rydqvist (1993)	1970-1991	39.0
Brazil	Aggarwal et al (1993)	1979-1990	78.5
Hongkong	McGuiness (1992)	1980-1990	17.6
Malaysia	Dawson (1987)	1978-1983	166.6
Singapore	Koh and Walter (1989)	1973-1987	27.0

Source: Jenkinson and Ljungqvist (2001)

average, IPO prices underperform the market index by 13.73%. It means that investors who purchase IPOs on the first trading day and hold them for a period of 250 trading days would have underperformed the market by 13.73%. Like underpricing, the IPO long run underperformance also exists in other markets. Levis (1993) claims that in the UK, on average, IPOs underperform the market by –8% to –23% on their 3rd anniversaries, depending on the benchmark used. Unlike the persistence of the underpricing anomaly, the evidence for the long run underperformance is mixed (see table 1.2). There have been several theoretical explanations to account for this anomaly, which later are reviewed in the Literature review (Chapter 2).

[1] Ritter and Welch (2002) note that during the period 1999-2000, the underpricing level was as high as 65.0% on average, as a result of Internet stock IPOs.

[2] In 2000, on average, the level of underpricing in UK markets (Main, Techmark, and AIM) was 60.1% (Levis, 2001)

Table 1.2. Comparative evidence of IPO long run performance

Country	Study	Sample period	IPO long-run abnormal returns (%)
Australia[1/]	Lee et al (1996)	1976-1989	-51
Brazil[2/]	Aggarwal (1994)	1980-1990	-47.0
Chile[2/]	Aggarwal (1993)	1982-1990	-23.7
Finland[2/]	Keloharju (1993)	1984-1989	-26.4
Germany[2/]	Loughran & Ljunqvist (1994)	1974-1989	-12.8
Sweden[2/]	Loughran & Ljunqvist (1994)	1980-1990	+1.2
Tunisia[2/]	Ben Naceur (2000)	1992-1997	+5.7
UK[2/]	Levis (1993)	1980-1988	-8.1
US[1/]	Loughran & Ritter (1995)	1970-1990	-17.1

Note: [1/]*Source: Ibbotson & Ritter (1995)*
[2/]*Source: the corresponding studies*

Similar to the underpricing, this study also presents and discusses the IPO long-run performance of the research sample in the IPO long run performance analysis (Chapter 6). In particular, this study tries to examine the impact of the prospectus information on the IPO long-run performance. The results are expected to provide additional information and evidence, such as the impact of the earnings forecast on the IPO performances, to what is already included in the existing literature.

The third anomaly is the hot/cold market. This phenomenon was first documented in the US by Ibbotson and Jaffe (1975). According to the efficient market hypothesis, the timing of a financing decision should not matter since any offering will be fairly priced. This leads to the conclusion that IPOs occur randomly over time. However, evidence shows that there are sustained periods when the number of offerings is so immense and the volume of trading is very heavy. These periods are called 'hot issue' markets. On the other hand, evidence also records the periods when only very few firms go public and the volume of trading is small. These periods are called 'cold issue' markets. Although this phenomenon is very interesting, very few explanations have been suggested. This study does not intend to examine the hot/cold IPO market; however, a brief discussion about the states of the UK market during the research period is provided and this discussion will include consideration of the hot/cold phenomenon.

While the evidence for the second and third anomalies (the long-run underperformance and hot market) is mixed, scholars have observed the persistence of the underpricing. Ritter and Welch (2002) indeed argue that the explanations behind the IPO anomalies lie between the offering day and the first-trading day. Some studies even suggest that the IPO long-run underperformance is a mean reversion of the underpricing (e.g., Ritter, 1991). Other studies also examine the relationship between the hot market and the underpricing and find that there is a significant difference in the degree of underpricing between the 'hot' and the 'cold' period in the market (e.g., Ibbotson and Jaffe, 1975). Therefore, it is sensible to draw the focus of the research to the IPO pricing process among the market participants (issuers, sponsors, and the investors). This issue would be the main objective here.

This study focuses on the pricing of the IPOs in the UK main market, on both the issuers/sponsor level and the market level. It is argued that the IPO prospectus information, to some degree, has considerable explanatory power to the IPO pricing. This study will contribute to the knowledge of the usefulness of the prospectus information to price the IPOs. Later in the research design, it is argued that the determining factors affecting both levels of IPO prices may explain the underpricing as well as the long-run performance facts. Therefore, this study also may contribute to the knowledge of the impact of the prospectus information on the IPO after market performance.

1.2. The IPO pricing process

As mentioned above, going public is a very important stage of the life cycle of a firm. After deciding to list its shares on the stock exchange, a firm should follow a two-stage admission process applied to any firm that want to be listed in the London Stock Exchange (LSE). In the first stage, companies need to apply to the UK listing Authority (UKLA) for the security to be approved by being admitted to the UK Authority's Official List (the UKLA's list of approved companies). Then, they also need to apply to the Exchange to be admitted for trading. The UKLA has set a number of basic requirements that must be met before listing can be granted and the exchange can admit the shares to trading. The requirements include the sponsor, trading records, minimum shares in public hands, the controlling shareholders, the prospectus, and the continuing obligations.

The estimated timetable for a firm and its sponsors to the admission day is shown on the following table (Table 1.3). The table shows that the issuers and the sponsors spend some considerable time to set, review, and finalise the offer price and the prospectus. Therefore, it is important to examine the IPO pricing process and how the issuers and the sponsors use the prospectus for their benefit.

Tables 1.3 Time table for the issuers and sponsors to the admission week

Weeks to the admission week	Events	Firms	Sponsors
12-24 weeks	Appoint advisers	✓	✓
	Instruct all advisers	✓	✓
	Agree timetable	-	✓
6-12 weeks	Produce draft prospectus	✓	✓
	Produce other documents in first draft	-	✓
	Initial review of pricing issues	✓	✓
	Hold first draft meetings	✓	✓
	Submit draft documents to the UKLA	-	✓
	Hold initial meeting with the Exchange	✓	✓
	Review PR presentations	✓	✓
	Host analyst presentations	✓	✓
1-6 weeks	Continue draft meetings	✓	✓
	Carry out due diligence	✓	✓
	Hold PR meetings and roadshows	✓	✓
	Submit documents to the UKLA	-	✓
	Bulk print pathfinder prospectus	-	✓
1 week	Approval all documents by the UKLA	✓	✓
	Pricing and allocation of the offer	✓	✓
	Register prospectus	-	✓
	Sign subscription agreement	✓	✓
	Bulk print final prospectus	-	✓
Admission week	Make the formal application for listing and admission to trading	-	✓
	Pay UKLA and Exchange fees	✓	✓
	Listing and admission to trading granted	The UKLA & Exhange	
	Trading begins		

Source: A practical guide to listing (LSE, 2003)

According to the UKLA (2003), the IPOs could be offered at a fixed price or tender, depending on the flotation methods used. There are three methods of flotation; public offer, placing, and introduction[3] In a public offer, the adviser offers the company's shares to private and/or institutional investors and usually arranges for the offer to be underwritten. It is normally the most expensive route to market, often used by larger companies or those looking to raise substantial amounts of capital. A placing usually involves the offering company's shares to a selected base of institutional investors. This allows the firms to raise capital with lower costs and greater freedom and it gives the firms more discretion to choose its investors (UKLA, 2003). The result, however, is a narrower shareholder base and consequently there may be lower liquidity in the shares once a firm has been admitted to the markets. In an introduction, the least expensive and easiest of the three methods, the company joins our markets without raising any capital. In general a company can do this if over 25% of its shares are already in public hands and there is a fair spread of shareholders. An introduction involves no underwriting fees and little requirement for advertising; the opportunities for boosting the company's profile and visibility are, however, more limited. Since this study attempts to examine the IPO pricing, which lead to the IPO anomalies, this flotation method is considered not to be suitable for this study. Therefore, IPOs that flotate with this method are excluded from the research sample.

In conjunction to the IPO pricing, in public offer IPOs, the shares could be offered at fixed price and/or tender. In a fixed price offer, the sponsor (and the

[3] Under the previous listing rules, the methods of flotation for equities are offer for sale, offer for subscription, placing, and introduction. The public offer method includes the offer for sale and offer for subscription methods (FSA, 2002)

issuer) fixes the offer price about a week before the admission date and undertakes the distribution of the shares at this price. In a tender offer, the offer price is set in a certain range and investors are invited to bid[4]. Except in privatisations, most public offer IPOs in the UK market use the fixed price method. In that case, applications for the public offer are invited from the public; the issue is also sub-underwritten, at the same price, by a group of financial institutions. The IPOs brought to market by the placing method are usually offered at a fixed price. The sponsor underwrites the entire issue for a short period and distributes them to specified persons or its clients. Although it has not yet been a popular method in the UK, there is an increasing trend to use the book-building approach. This approach is used extensively for IPOs in a number of markets, such as the US markets. Basically, the IPO final offer price is set up after examining the market demand during the 'roadshow' period. This study includes the IPOs that are brought to the market by this method.

Although the IPO offer price categorisation is clearly described, the setting of the initial IPO offer price has been a challenging intersection between valuation theory and practise. While classic Finance theory suggests the use of discounted cash flow (DCF) as the conceptual foundation of valuation (see Brealey and Myers, 2002), McCarthy (1999) argues that the most common IPO pricing method used by issuers and sponsors is the comparable firm multiples methods. Additionally, Kim and Ritter (1999) find that estimating future cash flows and discount rates for IPOs are imprecise, suggesting that the DCF method appears to be used very little by the practitioners. This study particularly employs the

[4] The privatisation of British Airports Authority (BAA) in 1987 was split into two categories with regard to pricing: (1) 75% of the equity was offered at fixed price and (2) 25% of the equity was a tender offer to institutional investors.

accounting-based valuation model. This model is widely used in the non-IPO cases (e.g., Easton and Harris, 1991, Rees, 1999, Francis *et al.*, 1999) to investigate the value relevance of the accounting numbers. The evidence shows that the accounting-based valuation model works very well. To the researcher's knowledge, very few IPO studies use the accounting-based valuation model. Kim and Ritter (1999) indeed mention the Ohlson's model; yet, they do not use it as the research model. Keasey and McGuiness (1992) examine the usefulness of the forecasted earnings disclosed in the prospectus; however, they do not include other fundamental variables, such as book value of equity and dividend. This study develops the research models based on the accounting-based valuation model, which includes the important firm fundamentals, such as earnings, book value of equity, and dividend.

Since the IPO could be priced with any method, the circumstance is even more difficult for the investors to value the offer. Assuming that the issuing firms and their sponsors know better about the firm's value, the UKLA requires the firms to publish the prospectus, which complies with the Listing Rules.

1.3. The offering prospectus

The UKLA expects that the prospectus provides potential investors with the information they need to make an informed decision on the firm and its shares. Besides the information of the offer, the prospectus should also cover general information of the firms and the audited financial statements for minimum the last 3 years audit. It is expected that such information could be used to estimate the firm's value on the date of the IPO. However, the issuers and sponsors could also exploit the prospectus as a media to signal important insider information. Having assumed that the firm and its sponsor have better knowledge of the firm's value than other market participants, the IPO signalling theory argues that the good firms use some variables to signal the value and the prospectus is a very good media to send the signals.

The information of the offer includes the advisers (sponsor, brokers, auditor, and PR), the offer price, the number of shares sold at the IPO and the percentage to the enlarged total shares, the use of the proceeds, and the management forecasts. Such information is very important to the investors as well as the issuers. Since prior studies shows the effectiveness of the agent reputation to the IPO valuation (e.g., Byrne and Rees, 1996), disclosing the group of the adviser is a way chosen by the firms to signal their value. The other thing is the voluntary disclosure of the management forecasts. The rational of disclosing such information is that the firms try to persuade investors to value the IPO as a firm after the IPO (with proceeds as additional fund to the firms). Therefore, variables such as pro-forma book value of equity and the earnings forecasts have been widely used in the IPO prospectus. However, this kind of practice is prohibited in the tighter legal environment market, such as in the US.

The other information disclosed in the prospectus is the nature and organisation of the business. It is important for the investors to know the nature of the business of the issuing firms. Therefore in the US market, the Securities and Exchange Committee (SEC) requires the issuing firms to disclose the business risk statement in the prospectus. This is aimed to inform the investors thoroughly about the natural business risk faced by the firms that could affect the post-IPO firm's performance. Furthermore, in practice, the issuing firms even highlight the high business risk by using the bold type face of the statement (Klein, 1996)). Prior studies also show that the share performance varies across different industries, hence knowing the business of the firms enables investors to value the IPO better.

The third part of the prospectus is the firm's financial statement for the last 3 years. Although some studies in non-IPO shares find that the historic accounting information has little explanatory power to the shares performance, Klein (1996) finds that such information could be used to price the IPOs. Moreover, the financial statements could provide the accounting-based risk assessment. Bildersee (1970) argues that the accounting data can be considered as a summary of all company events and decisions. So, it summarises, in some form, information basic to the measurement of total risk associated with the firm and with the securities supporting firm.

The data of this study relies heavily on the information disclosed in the offering prospectus. A number of variables are chosen as proxies to the prospectus information. Furthermore, the information is categorised into fundamentals, ex-ante risk factors, and signals. The fundamentals, here, is defined as the accounting fundamentals, such as earnings and book value of equity. In most UK IPO prospectuses, the issuers/sponsors try to draw the potential investors' attention to the future accounting fundamentals. This is demonstrated by highlighting the information regarding the earnings forecasts and the pro-forma book value of equity in the offering information, which is presented on the very first page of the prospectus. Therefore, in particular, this study investigates the impact of the accounting fundamentals on the IPO pricing.

The next prospectus information category is the ex-ante risk factors. There have been a number of business risk models developed by academics and practitioners. Arthur Andersen developed the so-called 'Arthur Andersen Business Risk Model' (AABRM) in 1997. The model is usually used to assess the business risks of their clients. ICAEW (1998) used the AABRM as a framework for their research on financial reporting of risk of the newly listed firms, in which they try to assess the business risks of the firms through their IPO prospectuses. The AABRM includes 55 risk factors. However after a systematic content analysis through the IPO prospectuses of the sample for this study, only 5 risk factors that are consistently reported in the documents. Therefore, since only 5 out of 55 risk factors identified in the AABRM are employed in this study, it does not claim the AABRM framework is used, although, the terms and definitions of the risk factors used here are adopted from the AABRM. The literature review chapter presents a discussion on the risk concept and measures, on which this study tries to develop the proxies to the risk factors used, as defined in the AABRM.

The other prospectus information examined in this study is the signals. Potentially, the issuers/sponsors value the signals as importantly as the accounting fundamentals, since they place the signal information, such as the sponsor name, and the percentage of equity sold at the IPO in the first section of the prospectus.

1.4 The scope of research

Having highlighted the persistence of the underpricing fact in the IPO market, this study focuses on the IPO valuation. It could be argued that the underpricing phenomenon is a result of the decisions made by the market participants during the period between the admission day and the first trading day. Ritter and Welch (2002) also encourage other scholars to focus on the IPO early pricing, as they argue the IPO anomalies are the result of events between the day 0 and day 1. The IPO pricing process has been examined in section 1.2 above and also the role of prospectus as the investors' main source of the firm's information prior to the IPO.

Klein (1996) examines the importance of the prospectus to price the IPOs. She finds that accounting information, such as the earnings, is strongly related to both the offer price and the first-day market price. However, Kim and Ritter (1999) do not find a similar result; instead they find that the future earnings figures explain more of the variations in the IPO prices than the historical figures. Using the data from thinner markets (Singapore and Korea), Firth *et al.* (1995) and Firth (1998) find a robust relationship between the management earnings forecasts and the IPO valuation.

Keasey and McGuiness (1991) examine the relationship between the management earnings forecasts in the prospectus and the pricing of IPOs in the USM. They find that the prospectus earnings forecasts are significantly more accurate than time-series forecasts. Additionally, they find a positive association between the information content of the earnings forecasts to the IPO market price, although no significant relationship is found to the offer price.

Having examined the IPO prospectus in the UK main market, it could be argued that the issuers and their sponsors have a tendency to disclose and emphasize the fundamental accounting information, such as the management earnings forecasts, the pro-forma book value of equity, and the dividend forecasts in the prospectus. Therefore, this study attempts to analyse the role of the fundamental information disclosed in the prospectus in the IPO valuation (Chapter 4).

Prior studies also show that the IPO underpricing is positively related to uncertainty. However, the measure of uncertainty itself has been a long-standing debate in the research area. Most IPO studies examining the uncertainty employ an ex-post measure, such as the variance of the IPO market prices for the first 5 days (Beatty and Ritter, 1986). Very few studies employ ex-ante measures, such as the business risk (Klein, 1996). This study tries to propose new measures for the ex-ante uncertainty by employing accounting-based risk measures. Beaver *et al.* (1970) argue that the accounting measures are used widely by investors as proxies for company risk. Thus, accounting measures reflect both the systematic and unsystematic risk. By combining the offer information and the historical financial statement data in the prospectus, this study develops a number of risk factors, which could be used as proxies for company risk.

Other important information in the prospectus is the signals, which are defined as the firm's decision as to its advisers, the time for when to go public, and the ownership structure. The relationship between the signals and the IPO valuation and performance has been examined by other scholars, as discussed later in the Literature review chapter. The results vary across the markets, time periods, and the proxies used. This study includes those variables in the assessment of the IPO valuation.

The IPO valuation is defined as the IPO pricing at the firm and market level. First, this study investigates the valuation of the IPO offer price. Very few IPO studies have examined the offer price valuation (Klein, 1996; Beatty *et al.*, 2002). To my knowledge, none has been done using the UK market. Hence, this is one of the study's contributions to the research area. Most IPO valuation studies try to analyse the determining factors of the initial market price. This study also examines the valuation of the initial market price. By doing so, it is expected the results may highlight the different explanatory power of prospectus information, if any, on both prices (the offer and initial market prices). Then, any different behaviour of any prospectus information may explain the 'mispricing' of IPO, which is commonly known as the underpricing

Prior studies in the UK have found evidence of the long run underperformance following IPOs. This study extends the analysis by investigating the impact of the prospectus information to the IPO performance in the long run. In doing so, the analysis also attempts to examine whether the IPO 'mispricing' in the early days of trading affect the IPO long-run performance.

1.5. Research methodology and method

This study consists of three empirical studies that are categorised in the positivist methodology. The simplification process is used by developing two main empirical models; the IPO valuation model and the IPO performance model. The IPO valuation model adopts the accounting-valuation model as the basic theoretical model. This comes as another contribution of the study. To the researcher's knowledge, no prior IPO valuation study has used the accounting-based valuation model. The model has been widely used for seasoned and found to work very well. Therefore, this study is a test of the model of whether it performs well with the IPO sample. Then, the model is developed to several empirical models by including other prospectus information, such as the risk factors and signals. The IPO performance model is the OLS regression model that is modified into a number of operating models.

The sample of 161 IPOs is taken from the UK main market during period 1987-1997. The sample is the IPO that are brought to market by public offer and (or) placing methods. The information of fundamentals, risk factors, and signals are drawn from the IPO prospectus.

1.6 Research questions and hypotheses

This study examines the IPO valuation and performance in the UK main market during the 1987-1997 period. It is argued that at the admission day (T_0) the issuers/sponsors set up the IPO offer price based, partially, on the prospectus information (fundamentals, ex-ante risk factors, and signals). Then, it is also observed whether the 'initial' investors/brokers use the prospectus information to value the IPO on the first trading day (T_1). This objective leads to the first research question: ***Is the prospectus information useful to price the IPOs?***

Then this study investigates whether the 'mispricing' is identified on T_1. If there is any mispricing, a further examination is carried out to observe whether it is due to the different perception towards the prospectus information or to the unobservable factor, which is defined as the error terms of the IPO valuation at T_0. This argument leads to the second research questions: ***Does the prospectus information have a predictive power towards the IPO short run performance?***

Based on the IPO literature, which finds the persistence of the underpricing, this study also argues that if the issuers/sponsors underprice the IPOs relatively to the accounting fundamental, the greater the valuation residuals, the lower the initial returns[5]. Therefore it is hypothesised that the initial returns is negatively related to the valuation residuals.

Prior studies also provide evidence of the IPO underperformance in the long run, which is also examined in this study. It is expected that the prospectus information has limited impact on the IPO long run performance since other information is available in the market to price the IPOs. The IPO long run performance, here, is defined as the abnormal returns for the investors, who buy the IPOs at day 2 and hold them up to the 1st, 2nd, and 3rd listing anniversary. This argument leads to the third research question: ***Does the prospectus information still have any impact on the IPO long run performance?***

Many IPO studies find that the IPOs, which are less underpriced, perform better in the long run. This suggests that in the long run, the market correct any mispricing identified in the short run. This study posits the similar hypothesis, which expects a negative association between the initial returns and the long run abnormal returns.

[5] Valuation residual is defined as the difference between the actual offer price and the model predicted offer price. The initial returns is defined as the percentage of the price changes from the offer price to the initial market price on the close of the first trading day.

A number of IPO studies attempt to examine the relationship between the IPO valuation and the underpricing phenomenon (Welch, 1989; Klein, 1996; Byrne and Rees, 1996, Beatty *et al.*, 2002). Other studies try to investigate the IPO underpricing and the long run performance (Ritter, 1991; Levis, 1993). This study analyses the three different aspects of IPO valuation: the initial valuation, the underpricing, and the long run performance, which comes as a unique contribution of this study.

A summary of the research main hypotheses and the research method used is presented in a diagram in Figure 1.1 below.

1.7. Organisation of the thesis

The rest of the thesis is organised as follows. The next chapter is the literature review. The chapter critically reviews the influential papers on the IPO studies, particularly for the IPO valuation and performance. It also discusses a number of leading papers on the accounting-based risk measures.

The literature review is followed by the research design chapter, which describes how this study is carried out. First, it introduces the theoretical models and is followed by the empirical models used in this study. This is followed by a discussion of the working hypotheses development. After that, the research sample derivation is explained. Finally, the chapter is closed by a brief presentation of the UK institutional framework.

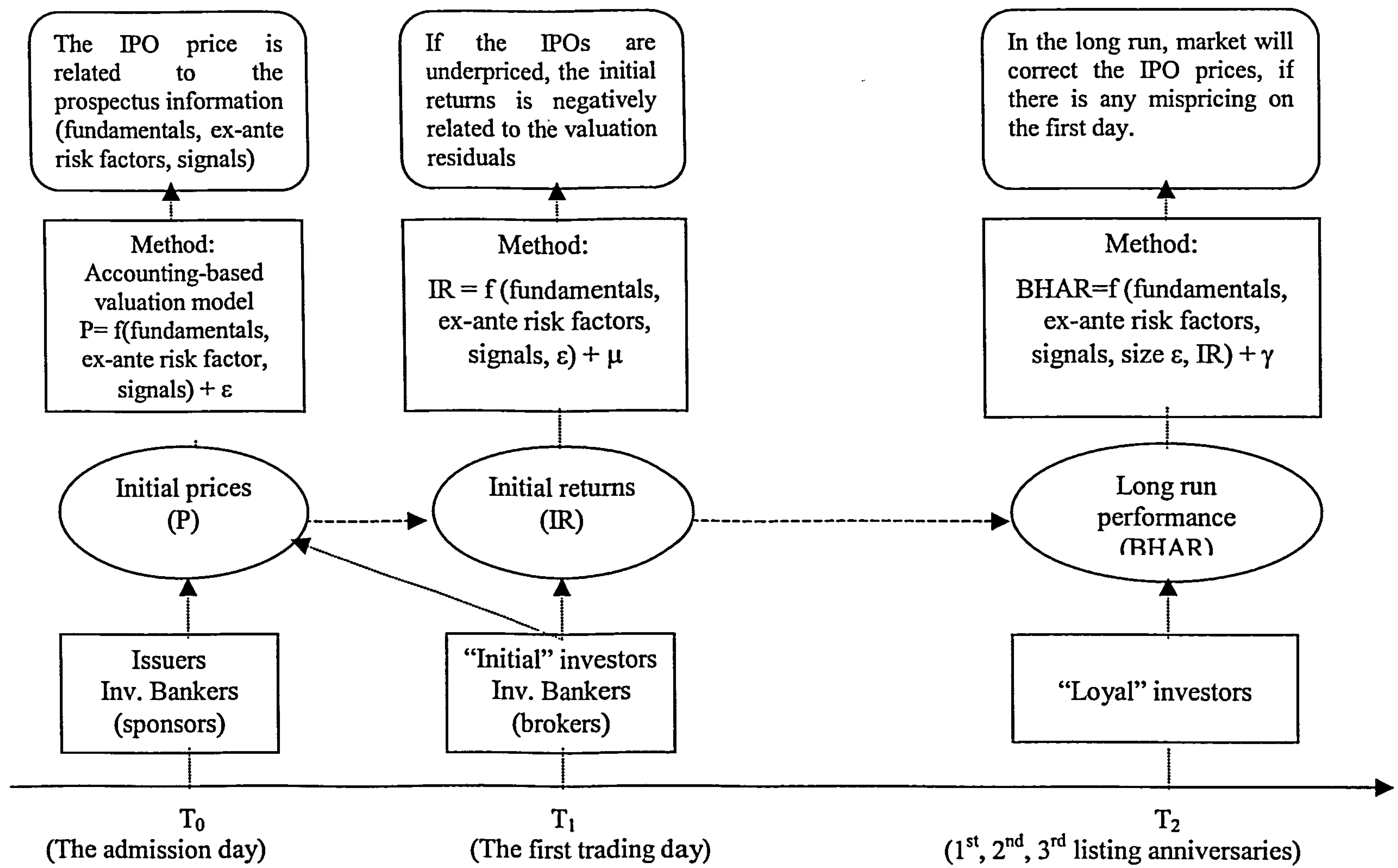

Figure 1.1 Summary of the research methods and main working hypotheses

The next three chapters provide a discussion of the empirical results. The first empirical chapter presents the analysis of the IPO valuation. Firstly, it discusses the descriptive statistics of all variables employed in the valuation model. It continues with a discussion of the empirical results of the IPO valuation models. It also includes a section of sensitivity analysis, which examines the sensitivity of the IPO valuation models to the choice of measures (proxies). This chapter aims to answer the first research question: ***Is the prospectus information useful to price the IPOs?***

The second empirical chapter includes the discussion of the result of the IPO short run performance model. It presents the evidence of the underpricing in the research sample. Furthermore, it aims to answer the second research question – ***Does the prospectus information have a predictive power towards the IPO short run performance?*** – and provides a discussion on what drives the underpricing. The final empirical chapter addresses the third research questions – ***Does the prospectus information still have any impact on the IPO long run performance?*** – and demonstrates the discussions of the result of the IPO long rung performance. Splitting the sample into the privatisation vs non-privatisation sub-samples, and survivors vs non-survivors sub-samples, provides evidence of the different IPO long run performance. Moreover, the chapter also includes a discussion of the factors that are related to the IPO long run performance.

Finally, the summary, conclusion and the possible future research are presented in the last chapter.

Chapter 2

Chapter 2

Literature Review

Introduction

The previous chapter provides a brief overview of the research area of the Initial Public Offerings (IPO), particularly of its three well-known anomalies. In the first edition of their book on "going public", Jenkinson and Ljungqvist (1996) predict that IPOs would continue to be the subject of intense academic debate. Five years later, in their second edition (2001), they show how the research on IPOs has taken a number of significant steps forward over the years.

This chapter reviews a wide range of significant IPO literatures. Firstly, it will evaluate the IPO anomaly literatures. This is followed by a discussion of IPO valuation. Finally, this chapter will review some studies of firm specific risk and its relation to IPO valuation and performance.

2.1. The underpricing anomaly

As discussed in the previous chapter, there have been many studies investigating the three well-known IPO anomalies. The first anomaly found is the underpricing phenomenon. Reilly and Hatfield (1969) are the first scholars who document the underpricing in new issues. They find that from 53 sample firms that went public in the US during 1963-1965, the initial return range from 18.3% to 20.2%. After that, there have been other studies, which find similar results using different time periods and samples (e.g., McDonald and Fischer, 1972; Logue, 1973; Neuberger and Hammond, 1974). Following those, many studies record the positive initial return of the IPOs in a large number of countries, as summarised by Jenkinson and Ljungqvist (2001) (see table 1.1 in chapter 1).

However, it is Ibbotson (1975) who, among the firsts, provides a comprehensive explanation of the underpricing evidence. He attempts to measure initial performance of new issues and to examine the aftermarket performance to test for departures from market efficiency. The result is six possible explanations for the observed underpricing in the IPO market. They are:

1. Underwriters are required by US securities regulation to price the IPOs below their expected value.
2. It may be issuers that underprice IPOs intentionally in order to 'leave a good taste in investors' mouths' to make subsequent offering at attractive price.
3. Underpricing may be the result of underwriters' colluding to favour their investor clients.
4. Underpricing is used to reduce the risk that underwriters bear, if their commissions are not enough to cover the risk.
5. There may be some undisclosed mechanism by which investors compensate issuers for the discount on offering price.
6. Underpricing may serve as a form of insurance to protect issuers and underwriters from lawsuit.

However, he concludes that all of these suggested explanations are inadequate as they involved 'unknown legal constraints, needlessly complicated indirect compensation schemes, or irrational behaviour'.

Additionally, in their recent paper, Loughran and Ritter (2002) explain that the IPOs, which leave so much money on the table, are generally those, whose the offering price and market prices are higher than had originally been anticipated. Thus, the issuers losing wealth are simultaneously discovering they are wealthier than they expected to be. Their explanation emphasises the covariance of issuers' loss and the changes in their wealth.

Since Ibbotson's paper (1975), many models have been developed to explain the underpricing anomaly. Several noble models attract scholars to undertake further investigations. The discussions of them are presented next

2.1.1. The Winner's Curse Hypothesis

The most popular model was developed by Rock (1986). This study offers a theoretical analysis of the IPO underpricing. In his model, he assumes that underpricing is the result of information asymmetry among market participants. He argues that among the market participants, investors have superior information about new issues. Investors themselves can be split into two categories regarding the information that they hold. Investors who have more information are called the informed investors (II) and investors who hold less information are called uninformed investors (UI). As a consequence of this asymmetry, IIs compete with UIs only for 'good' issues, creating an adverse selection mechanism in which UIs obtain 'bad' issues with greater probability. Thus; 'good' issues will have excess demand, and 'bad' issue will have excess supply. In the IPO, if an offering faces excess demand, the shares will be distributed to investors by rationing. Since IIs can differentiate the quality of issues from the beginning, they register a 'good' issue earlier. Thus the UIs receive disproportionate levels of 'bad' issues. This condition is well known as winner's curse. Therefore, in order to induce UIs' participation in the market, issuers underprice their IPOs deliberately. In other words, participation by UIs must require underpricing.

Nevertheless, this conclusion itself is insufficient to explain why underpricing actually occurs. First, reducing the price results in offer proceeds falling, which in turn increases IIs' demand for a larger portion of the offering.

This increases adverse selection, discouraging UIs from placing orders. Second, it can be argued whether price decreases have their expected effect of stimulating UIs' demand. This is important because one must explain why participation by UI is valuable to the issuers. (Anderson *et al.*, 1995). In spite of this, Rock's study has been a major innovation regarding the IPO underpricing explanation, and many scholars attempt to extend the work.

Beatty and Ritter (1986) are among others who develop Rock's model. They propose another explanation of IPO underpricing. In their model, they keep Rock's assumption on information asymmetry, which then leads to ex ante uncertainty faced by investors. Ex ante uncertainty is the uncertainty about issue value before the offering. They argue that there is a positive relationship between the degree of uncertainty over share value and the extent of underpricing. In particular, as share value becomes more uncertain, the differing probabilities of getting good versus bad issues become more important since bad issues become even worse. The ex ante uncertainty is not the same as systematic risk measured by the Beta coefficient in capital market. They use two proxies for ex ante uncertainty, the number of uses of the proceeds and the inverse of the gross proceed. For these proxies, Beatty and Ritter argue that many issuers appear to be reluctant to give highly detailed specification of what they will do with the proceed because it may increase exposure to legal liabilities and disclosure proprietary information to competitors. Then they conclude that there is a robust relationship between ex ante uncertainty and the degree of underpricing. The greater the ex-ante uncertainty of the issue, the greater the underpricing. This result has inspired many studies to develop alternative explanation for the IPO underpricing.

Using Finnish market data, Keloharju (1993) conducts a test for the winner's curse hypothesis. The evidence confirms the presence of the winner's curse. Michaely and Shaw (1994) also find that consistent with the hypothesis, the result shows that in markets where investors know *a priori* that they do not have to compete with informed investors, IPOs are not underpriced. They test two IPO samples, the first is a sample of relatively homogenous IPOs, and the second is a sample of 'general' IPOs. The homogenous sample reflects the lower level of asymmetric information in IPOs. They find a significantly different level of underpricing between the two samples, with the homogenous sample significantly lower than the second sample. This result is a support for the winner's curse hypothesis.

Despite evidence found to support the winner's curse hypothesis in a number of empirical studies, Keasey and Short (1992) argue that the model suffers from conflicting assumptions and untestable proposition. They suggest that the underpricing is a simple reflection of the fact that the issuers are uncertain of the demand for IPOs and they underprice to ensure sufficient demand.

2.1.2. The Underwriter reputation hypothesis

This hypothesis holds Rock's assumptions on asymmetric information. However, it assumes that the information asymmetry exists among the market participants, and it is the investment bankers, who have superior information about the market to that of the issuers or investors.

This hypothesis is firstly suggested by Baron (1982). Based on the agency theory, his model focuses on the optimal behaviour of issuers as the principals and investment banker as the agent that is hired to execute the offering. The model demonstrates a positive demand for investment bank advising and distribution services. It also provides an explanation of the underpricing of new issues. However, empirical evidence does not support the model's proposition. Muscarella and Vetsyupens (1989) find that investment bankers that underwrite their own IPO also experience underpricing.

Although Baron's model has been a major contribution to the underwriter reputation model, it does not discuss the role of underwriter reputation. Among the first studies, Logue (1973) conducts research that proposes the effect of underwriter reputation on IPO performance. Using 250 IPOs in the US market during 1965-1969, he finds that there is a negative relation between underwriter reputation and the degree of underpricing. After that, Neuberger and Hammond (1974) conduct a study to evaluate the performance of the underwriters of unseasoned offerings. The study concludes that the underwriter reputation is a significant variable in the valuation of new issues.

Following those studies, Beatty and Ritter (1986) argue that underpricing equilibrium is enforced by investment bankers. In addition, it is explained that since the issuers cannot make a credible commitment by themselves, they should hire investment bankers to take the firm public. Therefore, investment bankers are in a position to enforce the underpricing equilibrium because it will be involved in many IPOs over time. For an investment bank to find that it is in their interests to enforce the underpricing equilibrium there are three necessary conditions. The first condition is that the investment bankers are uncertain about the market price of the issue when it starts trading. Secondly, the investment bankers have non-salvage reputation capital at stake, on which investment bankers earn a return. Thirdly, the investment bankers may lose their earnings if they cheat by underpricing too much or too little. The last two conditions are the standard conditions in the recent literature on reputation and product. Beatty and Ritter (1986) also argue that to be categorised as having good reputation, the investment bankers should have willingness to not behave opportunistically. From this argument, they put forward a proposition that any investment banker that cheats will lose customers, issuers and investors.

To test the hypothesis, they use the underwriter's standardised average residual as a proxy for reputation measure. Underwriters that had greater average residual than standard are referred to as pricing 'off-line' and known as non-prestigious underwriters, whereas underwriters that have less average residual were referred as pricing 'on-line' and known as prestigious underwriters. Then, they analyse changes in underwriter's market share following the IPOs. The empirical evidence shows a robust support for the proposition.

After Beatty and Ritter's study, there have been many studies on the relationship between the underwriter reputation and the degree of underpricing. Most of them have obtained similar results that show that there is a negative relationship between the prestige of investment bankers and the underpricing. The more prestigious the underwriters, the less the degree of underpricing. (e.g., Johnson and Miller, 1988; Carter and Manaseter, 1990; Megginson and Weiss, 1991; Carter *et al.*, 1998).

Moreover, Johnson and Miller (1988) expand their investigation by proposing another hypothesis. They argue that once the ex ante uncertainty has been taken into account, the level of investment banker prestige should not offer any incremental explanation of the degree of underpricing. If more information regarding the issue value is available to investors, then a smaller number of informed investors are seeking to invest in IPOs offered by prestigious underwriters. They also argue that the prestigious investment bankers are associated with lower risk issues than non-prestigious investment bankers. The explanation behind this idea is that because of the mean-variance efficiency assumption, a high risk firm could not reduce total underwriting costs by selecting a more prestigious investment bank, since any underpricing savings realised would be offset by a higher underwriting commission. Therefore, the issuing firm hypothesis posits that total underwriter-related costs are positively related to the degree of uncertainty regarding firm's value and unrelated to underwriter prestige.

They test hypotheses that the degree of underpricing and underwriter-related costs are positively related to the degree of uncertainty regarding the issue's value, and is unrelated to underwriter prestige. They use two different proxies for underwriter reputation. The first proxy applied by Johnson and Miller (1988) is using three different cut-off points to dichotomise underwriters into prestigious and non-prestigious groups. The first cut-off is that prestigious underwriters are only members of the bulge brackets, while members of other brackets are assigned non-prestigious. Secondly, they include members of major bracket in the prestigious group. Thirdly they add members of the sub-major bracket into the prestigious group. The second method is prestige-ranking system. They assign underwriters in the bulge bracket as rank 3, those in major bracket as rank 2, those in the sub major bracket as rank 1, and the rest as rank 0.

Using a total of 962 IPOs in the US market during the 1981-1983 period, they find the negative relationship between level of investment bank prestige and the degree of underpricing. However, once initial returns are adjusted for risk, this relationship becomes insignificant. Thus, they conclude that investors have no reason to favour non-prestigious underwriters-related IPOs, except for reasons of utility. On the issuer side, they conclude that issuers have no incentive to seek out high prestige investment banks, since the choice of underwriters does not appear to influence underwriter's total cost.

Similar to Johnson and Miller's study (1988), Carter and Manaster (1990) assign underwriters' reputation into rank, by examining the tombstone advertisements. Based upon the location of each investment bank in ads, investment banks are given a rank from one to nine. By examining the relative placements of underwriters with respect of their peers, each investment bank is assigned a rank. Those underwriters appearing at the top of the ads would be the most prestigious and would receive the highest ranking. Those underwriters at the bottom of the ads would receive the lowest ranking. The result of this method is a prestige rating for each investment bank on a scale from zero (representing least prestige) through nine (most prestige). Since then, there have been many studies implement this measure of underwriter reputation.

Using 501 firm commitment US IPOs during 1979-1983, Carter and Manaster (1990) offer some empirical support for the argument that a desire to protect their reputation induces prestigious underwriters to select only less risky offerings. Hence, lower risk firms can try to signal their high quality by selecting prestigious underwriters who underprice less than non-prestigious underwriters, and underwriter reputation should be a credible guarantee of limited informed trading.

While previous studies try to measure the underwriter reputation using industry information, Megginson and Weiss (1991) and Kumar and Tsesekos (1993) propose a different approach to measure the underwriter prestige.

Megginson and Weiss (1991) use the underwriter's relative market share as a proxy for underwriter reputation. The relative market share for each underwriter is determined by dividing the underwriter's total credits by the industry's total. When a syndicate manages an offering, it is the lead manager that is given full credit for the total amount underwritten. The lead manager maintains the 'books' and its name is the very first one at the top of the tombstone advertisements. In their study, they also offer the presence of venture capital that could perform certification function as a complement to the certification provided by prestigious investment banks.

Kumar and Tsesekos (1993) argue that the use of the over allotment option gives an advantage to the underwriter to build and maintain the underwriter-investor relationship and reputation. If the issue contains the over allotment option provision, the underwriter has the option of purchasing additional shares from the issuer at a discounted price. Therefore, the over allotment option allows the underwriter to satisfy more of the original demand from clients in the event that the issue's after market price appreciates in value above the offer price. The less prestigious underwriter appear to have more interest in building client relationship, hence it is expected that the over allotment option would be more beneficial in creating a solid investor base. Therefore they posit that the relative size of the over allotment options is negatively related to the underwriter reputation.

Moreover, they also examine the relationship between the investment bank reputation and the type of underwriting contract. They argue that the role of the underwriter is to certify that the issue price is consistent with insider information regarding the future earning prospects of the firm. The issuing firm is viewed as effectively 'leasing' the brand name of an investment bank to certify that the issue price reflects available inside information. This study posits that a hierarchy of investment banking contract determines the level of certification provided by the investment bank. They define investment-banking contract as negotiated or competitive and firm commitment or best effort.

Recently, Logue *et al.* (2002) examine the interaction between underwriter reputation and market activities. They find that underwriter reputation is a significant determinant of pre-market underwriter activities, however weakly related to after-market price stabilization activities, and unrelated to issuer returns. They also find that underwriter activities prior to IPO date are significantly related to the underpricing, but unrelated to IPO long-run performance. Finally, they find underwriter activities after-market is significantly related to the IPO long-run performance. The results suggest that there is a sequence of activities in the underwriting process, which could give some impact to the IPO return both in the short and the long run.

In sum, the underwriter hypothesis posits that the investment bankers have an important role in underpricing equilibrium. The result shows the more prestigious the underwriter, the less the degree of underpricing. In many cases, 'good' firms tend to hire the prestigious underwriter in order to give signal about their value to investors. On the other hand, the prestigious investment bankers tend to select 'good' issues to be brought to market.

2.1.3 The Signalling hypothesis

Another model developed to explain the underpricing anomaly is the signalling model (Allen-Faulhaber [1989], Grinblatt and Hwang [1989], Welch [1989]). Similar to Rock's and Baron's models, the signalling model also assumes that there is information asymmetry among market participants. However, instead of investors or underwriters, this model presumes that it is issuers who know more about the firm value in the future. The model also assumes that there are two types of firms, good firms and bad firms (this assumption is excluded from the Grinblatt-Hwang model). However, investors do not know about firm quality until it is revealed in the market. Therefore, it is important to the good firms to reveal their firm value to potential investors before the flotation date. To avoid mimicking action from the bad firms, the good firms need a signal to reveal this value information. This model argues that good firms may employ underpricing as a signal to the firm value.

In the context of IPO, firms typically can signal their quality with several variables, such as the firm's choice of underwriter or auditors, quality of management, quality of bank loans, and others. However, in these particular signalling models, scholars argue that the offering price at IPO is a credible signal, since it requires no monitoring, therefore it will be beneficial to investors. For an action to succeed as an effective signal, it should satisfy two conditions. Firstly, it is not too costly, and secondly, it is unlikely to be imitated by low quality firms that aim to mislead investors. If the signal works effectively, high quality firms may separate themselves from low quality firms.

The high quality firm underprice shares in the first issue to reveal the firm's true value and to credibly separate itself from low quality firms. In Ibbotson's words, issuers underprice the IPO in order to 'leave good taste in investor's mouths', thus this will support the accomplishment of subsequent seasoned offerings in the open market. Therefore, signalling true value is beneficial to high value firms as it allows a higher price to be fetched at the second stage sale (seasoned equity offerings) if the separation is achieved. Although underpricing is costly, the high quality firm can afford it because such a firm can recover its loss in the subsequent seasoned equity offerings (SEOs) after their true quality is revealed. As a consequence, low quality firms are deterred from imitating this action because they are less likely to reap the benefits of underpricing by selling their seasoned issues at higher prices (Jegadeesh *et al.*., 1993).

The signalling models generate a rich set of empirical implications regarding the relationship between underpricing and the value of the firm, the project risk, the probability of a firm to be a high quality or low quality, the subsequent offering, and the hot issue market. The Grinblatt-Hwang (GH) model relates the project risk (here means IPO risk), to the degree of underpricing and the issuer's fractional holding. It claims that the degree of underpricing is an increasing function of project risk. In other words, it could be said that the riskier the firm, the greater the expected degree of underpricing. It also implies that, given the issuer's fractional holding, the greater the degree of underpricing, the higher the value of the firm. Allen-Faulhaber (AF) (1989) and Welch (1989) also suggest a positive relation between IPO underpricing and firm value.

The AF model provides other implications. The model is applied to earlier studies (Ibbotson & Jafe, 1975; Ritter, 1986). Regarding the hot issue in IPO, the model suggests that hot-issue markets may occur in specific industries whenever an exogenous shock substantially improves expected profitability. This is related to how the AF model explains revelation of firm value that is determined by expected dividend. Duplicating the winner's curse implication, signalling models also suggest that the greater the ex ante uncertainty, the higher must be the expected underpricing. This relationship is implied by signalling models since the noisy market is needed to achieve separating equilibrium existence that assures the extent of underpricing.

Welch's model assumes the probability of one firm categorised to one type (lower quality or high quality) relates to the underpricing phenomenon. It implies that the lower the probability that a firm is of high quality, the higher the probability that it underprices at IPO. It also implies that as the cost of imitation increases, there will be more firms underpriced at IPO. Since the Welch model assumes that IPO is always followed by the seasoned offering, it suggests that the value of the outstanding shares falls less upon news of a seasoned offering when a firm has played an underpricing equilibrium in order to adjust investors' prior belief about firm value to true value revealed.

There are a number of empirical studies regarding the signalling models in IPO. The first hypothesis tested is that if firms do underprice to condition investors favourably for subsequent offerings, it is expected that firms who reissue in open market will experience greater underpricing. However, the evidence on this is mixed. Welch himself (1989) finds that there is a significant positive relation between the degree of underpricing and the probability of firms to undergo the SEOs. Moreover, he also finds that many IPO firms that are more underpriced indeed choose to issue a substantial amount of public SEOs. Using a different time period, Michaely and Shaw (1994), find that the empirical results do not support the signalling models. In fact, they find that firms that underprice more return to the reissue market less frequently and for lesser amounts than firms that underprice less do. Further, they also find that firms that underprice less experience higher earnings and pay higher dividends, contrary to the models' predictions. Most of the GH model's predictions are not supported by Michaely and Shaw's findings. They do not find that there is a positive relationship between the degree of underpricing, firm value and risk. The evidence also does not support a positive relationship between underpricing and subsequent dividend policy that is suggested by the AF model. Regarding IPO long run performance, Michaely and Shaw's study indicates that firms that reissue in the open market outperform non-issuing firms. However, they do not find a relationship between underpricing and the degree of fractional holding with superiority of share performance in the long run.

Jegadesh *et al.*. (1993) find supporting evidence for the signalling models. Regarding the seasoned offering, they argue that there is a positive relationship between underpricing and the probability of seasoned equity offering or open market insider. Using 1,985 IPOs (1980-1986) with firm commitment offering method in the US market, they find evidence that supports the proposition suggesting that the more underpriced IPOs tend to go back to the market sooner than the less underpriced IPOs. However, they do not find a significant difference when they use the aftermarket returns (returns after 20 days of the issue). Therefore, they conclude that the evidence to support the signalling theory is weak.

Using UK data, Espenlaub and Tonks (1998) empirically test the signalling hypothesis by, in particular, examining the relationship between the post-IPO directors' sales and the SEOs. They argue that there is an incentive to the initial owners (including the directors) to deliberately undepricing the IPOs to recoup the profits in the SEOs. Therefore, they include the post-IPO director's sales in the SEOs. They hypothesise that there is a positive relationship between the undepricing and the probability (the relative volume) of the directors' sales after the IPO. They find mixed results. They do not find a significant relationship between the underpricing and the probability of the post-IPO directors' sales.

However, they find that the volume of the post-IPO directors' sales is positively related to the underpricing, as a support to the signalling hypothesis.

Although the main implication of the signalling hypothesis is a positive relationship between the firm value and the underpricing, none of the studies reviewed above empirically test this proposition. Keasey and McGuiness (1992) directly investigate the underpricing and firm value relationship. Using UK USM data, they find a positive relationship between the firm market value – proxied by the firm's market capitalisation on the fifth day of trading post-flotation – and the underpricing as predicted by the signalling hypothesis. Using Australian data, How and Low (1993) also find support for the hypothesis.

Another empirical implication of the IPO signalling model is the ownership retention at the IPO. The model argues that the issuers deliberately underprice the issues at the IPO in expectation to get profits later from their selling at the subsequent SEOs. Therefore, it is expected that the firms that are more underpriced tend to have a higher percentage of equity retained at the IPOs. In line with that, Leland and Pyle (1977) propose that retained equity is used as a signal to the firm value. They argue that the percentage of equity retained at the IPO conveys the insiders' believes in the firm's future value. A discussion of ownership retention is presented later in the IPO valuation section (section 2.6.2)

The other issue that has received much attention from scholars is whether there are other means, in addition to underpiricing, that effectively signal the value of the firm. Slovin and Young (1990) analyse the relationship between issuer and banks as a signal of firm value. They argue that bank processing of asymmetric information and external monitoring of corporate activities reduces the ex ante uncertainty of investors about firm value. They demonstrate that the existence of bank debt and/or lines of credits lowers the expected initial return associated with IPOs. The empirical result is robust regarding the inclusion of variables that reflect other mechanisms that can improve ex ante uncertainty. Concerning the conditions of effective signals, it seems that banking relation is dominated by underpricing, since it needs monitoring cost and can be easily imitated by other firms. However, it is beneficial to investors because it may reveal the type of firm before the IPO.

In sum, the signalling hypothesis posits that in order to reveal their true value, issuer deliberately underprice the issue. This signal is observable by investors but it is costly for low value firms to imitate the action. Although the model is theoretically convincing, the evidence, as discussed above, shows mixed result.

2.1.4 The insurance hypotheses

In addition to information asymmetry, underpricing is also explained by institutional aspects. Another underpricing explanation proposed by Ibbotson (1975) is that underpricing serves as an insurance against legal liabilities. Later, this hypothesis was developed by Tinic (1988) and Hughes and Thakor (1992). They argue that both issuers and underwriters underprice the IPOs deliberately in order to avoid the lawsuits from investors.

Tinic (1988) offers the insurance hypothesis, which is also well known as the lawsuit-avoidance hypothesis. She argues that the expected cost of legal liability would be particularly high for IPOs because performing the due-diligence investigations is fraught with difficulties and uncertainties. Therefore, both issuers and underwriters attempt to avoid this situation.

Moreover, the issuer typically lacks familiarity with disclosure requirements. What to them may seem to be an inconsequential piece of information to be disclosed may be judged a material omission in a civil action. On the underwriters' side, they argued that the most important part of their investigation centres on the quality of management and forecasting future earning capacity of the firm. Both are frequently based on subjective evaluation and judgement. Although the risks, uncertainties, and speculative qualities of the securities are frequently stated in the registration statements and prospectuses, they do not seem to deter investors from bringing civil suits against the issuers and investment banks.

Since issuers and investment banks both are vulnerable to legal liabilities, it may seem that an obvious means of protecting themselves would be to purchase jointly an insurance policy against potential damages. However, since there is a moral hazard problem, there will be no insurance policy available.

With insurance against legal damages, the issuer and investment bank would have incentives to shirk their responsibilities to produce information about the firm. This would increase the probability of post-offering lawsuits and the expected losses for the issuer. To protect itself against this event, the issuer would have to incur costs in verifying the quality of the investigations conducted by the investment bank and charge a predetermined penalty to the investment bank whenever it is found to be shirking. If an investment bank can establish easily verifiable standards for a diligent investigation, beforehand, then the cost of the policy can include a premium for the moral hazard.

Since there is no insurance policy to cover such lawsuits, Tinic argues that underpricing serves as an efficient form of insurance against potential legal liabilities of issuers and their agents. In sum, Tinic argues that in order to avoid legal liability for 'insufficient' information disclosure in the prospectus, both the issuer and the investment bank intentionally underprices an issue. This lawsuit-avoidance hypothesis posits three implications. Firstly, underpricing reduces the probability of litigation. Secondly, underpricing reduces the conditional probability of an adverse judgement if litigation occurs. And thirdly, underpricing reduces the amount of damages in the event of an adverse judgement.

Hughes and Thakor (1992) argue that since it is the underwriter who sets the offering price, it is his or her responsibility if investors claim that there is a mispricing in the IPO. They argue that the underwriter sets the issue price knowing that he/she will be sued in the future if there is evidence that the court will judge as indicative of overpricing. There is a perfect sequential equilibrium in which some issues are overpriced, some are underpriced. There is underpricing on average, and there exists a positive probability of successful litigation against the underwriter. Lawsuits are obviously costly to underwriters, not only direct cost, such as legal fees, but also in terms of the potential damage to their reputation capital.

They also postulate a trade-off between minimising the probability of litigation, which means minimising these costs on the one hand, and maximising flotation revenue on the other. In their model, they assume that minimising the probability of litigation increases the offering price, implying that the more overpriced an IPO, the more likely is a future lawsuit. In addition, underpricing reduces not only the probability of a lawsuit, but also the probability of an adverse ruling conditional on a lawsuit being filed and the amount of damages to other assets, such as reputation capital in the event of adverse ruling.

In order to test her hypothesis, Tinic draw 204 issues from the US market and take the year 1933 as the cut-off point in time regarding the 1933 Securities Act. She splits the sample into two groups. The first group consists of 70 flotations during 1923-1930, and the second group consists of 134 flotations during 1966-1971. Prior to the 1933 legislation, the principle of caveat emptor applied to the securities industry in an almost open way, so that issuers and investment banks faced no litigation risk. Since 1933, underpricing should have been rising in parallel to increased risk of future litigation. Evidence supports the hypothesis that in order to avoid legal liability for mis-statements in the IPO prospectus, underwriters and issuers rationally choose to underprice IPOs (Tinic [1988], Ibbotson [1975] and Hughes and Thakor [1992]). However, Drake and Vetsuypens (1993) using a longer time line do not find sufficient evidence to support the hypothesis. Moreover, using data from other markets (Finland and UK), Keloharju (1993) and Jenkinson (1990) also do not find evidence for the hypothesis.

The most thorough evidence is due to Drake and Vetsuypens (1993), who among other things find that underpricing does not reduce the probability of a lawsuit. They examine 93 IPOs by issuers who were subsequently sued under the provisions of the 1933 Securities Act in the period 1969-1990. They find that purchasers of underpriced IPOs are just as likely to sue as purchasers of overpriced ones. Moreover, issuers that are sued are no more or less underpriced than comparable firms that are not sued. Therefore, they conclude that underpricing is not a sufficient condition to avoid lawsuits. Furthermore, their analysis shows that underpricing is an expensive form of insurance against future lawsuit. However, they do not test the second and third implications of the lawsuit-avoidance hypothesis proposed by Tinic (1988), which relate the underpricing and the reduction in the conditional probability of an adverse judgement, and the amount of damages in such an event.

In sum, the lawsuit-avoidance hypothesis argues that the issuers and the investment bankers deliberately underprice the issues in order to avoid the lawsuit from investors regarding the information disclosure prior to flotation. Since this model involves the institutional aspect, in this case the securities regulation, the empirical result only supports the US cases. While different countries may set different regulation, the relationship between underpricing and legal liabilities is rarely proved in other countries.

In contrast to the insurance hypothesis, Ruud (1993) argues that underwriters do not underprice IPOs deliberately. What they do is to support offerings whose prices fall below the offering price in after-market trading. Price support is underwriters' intervention in the market by repurchasing a fraction of shares in after-market trading. Therefore, the share price could go up higher than the offering price and leave positive returns to investors. This hypothesis has some support from empirical evidence. It is recorded that about half of all US IPOs in 1982-1983 must have been supported. While price support action is illegal in some markets, it is legal in many countries, including UK, France, Germany, Greece, Hong Kong, the Netherlands, and the US. (Jenkinson, 1996).

2.2. Underpricing phenomenon in the UK

Among the first scholars examining IPO performance on the London Stock Exchange is Dimson (1979). His study finds robust evidence of underpricing in the UK market. Levis (1990) verifies that some studies find existence of underpricing in LSE (Buckland *et al.*., 1981; Bank of England, 1986). The studies indicate average first day abnormal return ranging from 8.5% to 17%. A recent working paper by Levis (2001) exhibits the persistence of underpricing in the main market, techmark market, and AIM. Levis shows that on average IPOs listed on AIM tend to be more underpriced than the ones listed on the main and techmark markets. Table 2.1 below shows the performance of first day return in each market in 2001.

Table 2.1. The IPO first day returns in LSE, 2001

The table contains a number of descriptive statistics of the first day returns of UK IPOs in 2001, which took place in the Main market, Techmark market, and AIM

	Main	Techmark	AIM	All
Average first day return (%)	5.9	39.5	72.6	60.1
Median first day return (%)	6.8	15.7	13.3	11.4
Standard deviation	6.9	102.2	245.9	214.2
Largest first day return (%)	16.7	658.8	2,775.0	2,775.0
Lowest first day return (%)	-9.3	-43.4	-32.1	-43.4
Total amount left on the table (£m)	229.6	1,335.2	644.6	2,229.4

Source: Levis (2001)

In his study, Levis (1990) aims to test Rock's model under the British institutional framework. In particular, he attempts to explain the underpricing phenomenon as a combined effect of Rock's models and the particular nature of the settlement mechanism applicable in the UK new issues market. For this purpose, he argues that new issues would be considered to be underpriced only if the 'net expected return' is significantly different from zero.[3] Similar to previous studies, Levis' study finds positive abnormal returns on the first trading day. However, it does not support the main proposition. It is apparent that the positive

[3] Net expected return is the abnormal return on the first trading day after subtracting the interest cost that occurred on the over-subscribed offers and the loss from the under-subscribed offers.

abnormal return is just sufficient to cover the losses incurred in undersubscribed and the interest costs involved in the over-subscribed offers.

Another study by Keasey and McGuiness (1992) also attempts to explain the underpricing in the UK market, in particular on the USM. They propose a signalling model, which employs multi signals. They argue that to be a credible signal, the variable should be observable by investors. They propose five observable actions as signals to the IPO value, they are: (i) the percentage of shares retained by entrepreneurs, (ii) the levels of planned post-flotation capital expenditure, (iii) the quality of the advising agents, (iv) the disclosure/non-disclosure of forecasted earnings, and (v) the level of underpricing. They derive a total of 12 proxies for these signals and test them against the dependent variable, the market capitalisation of issuers at the close of the fifth day of trading. The result confirms previous signalling models. They find that the underpricing serves as a signal to the market value of a firm. Along with that, they also find that the percentage of shares retained, net proceeds, and the auditor quality significantly signal the firm value.

Using a different set of data from the UK Main market and USM, Byrne and Rees (1994) also find a significant positive return for five days after the IPOs are first traded. Moreover, the result also shows significant relations between the underpricing and the sponsor reputation, equity retained and dividend per share. Consistent with previous studies, they find a negative relation between the underpricing and the equity retained by old shareholders on the flotation day. Contrary to previous studies, they find that IPOs brought to market by a prestigious sponsor tend to be more underpriced than other IPOs. The result of the relation between the underpricing and dividend per share comes as a unique part of this study. None has incorporate dividends in the underpricing model before this study. The result shows a robust significant negative coefficient on dividends. Based on the signalling argument, it is argued that dividends may have a role as a signal, so that investors require a lower mark-up for IPOs with high dividend payout.

Using a sample of 222 IPOs on the USM market during 1984-1988, Keasey and Short (1992) investigate the relationship between the underpricing and the *ex-ante* uncertainty surrounding IPOs. The underpricing is measured by the initial returns on the fifth day of trading. They employ a number of prospectus information as proxies to the *ex-ante* uncertainty. They find that the level of IPO undepricing on the USM is significantly related to a few factors, such as the percentage of equity retained in the firm by the original entrepreneurs, the amount of new money raised on flotation and the presence of an earnings forecast.

Dewenter and Malatesta (1997) examine public offerings of state-owned enterprise and their difference to privately owned ones. According to the government, the UK privatisation policy objectives are to promote efficiency in the business, and to spread share ownership as widely as possible among the UK population (Bishop and Kay, 1989). Moreover, it is also emphasised that the concern is with economic efficiency and not the intention of raising money for the UK Exchequer. However, Dewenter and Malatesta (1997) argue that in order to ensure the achievement of the second objective, the privatisation IPOs are deliberately underpriced. Furthermore, they also attempt to examine the undepricing deliberation with the motive to raise fund for the government.

Using a total sample of 38 UK privatisations and 2,100 private company IPOs obtained from Loughran *et al.* (1994), Dewenter and Malatesta find that privatisations are significantly more underpriced than private company IPOs are.

This confirms the evidence found by Keasey and McGuiness (1992). However, they do not find support for the hypothesis that the privatisation IPOs are deliberately underpriced.

2.3. The long-run underperformance anomaly

The second anomaly is the long-run underperformance of IPO shares. Firstly, Aggarwal and Rivoli (1990) find evidence of substantial negative abnormal returns over longer time horizons. They refer to this phenomenon as a fad. They suggest that if IPOs are systematically overvalued in early trading, investors who purchase shares at the first after market price will underperform the market index.

How IPOs perform in the long run was examined formally by Ritter (1991). He points out several reasons why the long-run performance of IPO is of interest. Firstly, from an investor's viewpoint, the existence of price patterns may present opportunities for active trading strategies to produce superior return. Secondly, a finding of non-zero after-market performance calls into question the informational efficiency of the IPO market. Thirdly, the volume of IPOs displays large variations over time. Finally, the cost of external equity capital for companies going public depends not only upon the transaction costs incurred in going public, but also upon the returns earned in the after market.

Ritter's study is motivated by several prior studies [Ibbotson (1975), Stoll and Curley (1970), Stern and Bornstein (1985)), which suggest that at some point after going public the abnormal return on IPO may be negative. After Ritter's study, there have been many studies attempting to assess the IPO long-run performance [Loughran-Ritter (1995), Levis (1993), How (2000)]. However, other studies show that IPOs outperform the market as summarised in table 1.2 in the introduction chapter. The evidence demonstrates the mixed results of the IPO long-run performance relative to the market. The hypotheses and results regarding the IPO long-run performance are discussed below.

2.3.1. Fad hypothesis

This hypothesis is proposed firstly by Aggarwal and Rivoli (1990). As mentioned above, they find evidence of IPO shares undeperforming the market over longer time horizons. They could not find any rational explanation to this phenomenon. Therefore, they refer to this situation as a fad in the IPO market.

Ritter (1991), drawing a sample of 1,526 firms that went public in the US during 1975-1984, examines their performance after three years trading, and finally compares them to the performance of matching firms by industry and market capitalisation.

He finds evidence that is consistent with the notion that many firms go public near the peak of industry-specific fads. Further, he also finds that a strategy of investing in IPOs at the end of the first day of public trading and holding them for 3 years would have left the investors with only 83 cents relative to each dollar from investing in a group of matching firms listed on the US markets. Moreover, younger firms and firm that went public in heavy volume years did even worse than average. Thus, it can be argued that while new issues are a profitable investment opportunity if bought at flotation, they should not be held long beyond the first few weeks or months of trading.

Ritter suggests three possible explanations for the long-run underperformance: risk mismeasurement, bad luck, and fads. However, the empirical evidence does not support the first two explanations. It shows that there is a robust tendency that firms go public when investors are overoptimistic about firms' prospects so that investors overpay initially. Then, share prices are corrected, as more information becomes available. Therefore, expected long-run returns decrease in initial investors' sentiment. This result is consistent with the result of Aggarwal and Rivoli's study.

Later, Loughran and Ritter (1995) extend Ritter's study. They argue that firms tend to make IPOs when they see firms in the same industry trading at high earnings and market-value to book-value multiplies. This effect is reinforced by the positively biased marketing campaign, which accompanies the share offering. Investors appear to value issuing firms as if the rapid earning growth, which they experience in the period before the offering, will continue forever. However, in fact this rapid growth often ends shortly after the offering. They also suggest that it is difficult for more rational investors to exploit other investors' overvaluation of IPO stocks. Other explanations are firstly, that when the price support provided by underwriters are withdrawn, the market will make an adjustment and this result in underperformance of IPO; and secondly, it is difficult at the best of times to control correctly for risk over long time horizons.

Replicating Ritter's study, Levis (1993) finds that the pattern of returns on UK IPOs is remarkably similar to that of US issues. This phenomenon is also found in some other countries, such as Finland, Australia, Brazil, and Canada, [Jenkinson (1993), Lee *et al.*. (1996)].

In sum, the finding that IPOs underperform implies that the costs of raising external equity capital are not inordinately high for these firms. The high transaction costs of raising external equity capital are partly offset by the low realised long-run returns, at least for those firms going public at times when investor sentiment is optimistic. Consequently, the small growth companies that predominate among firms going public do not necessarily face a higher cost of equity capital than that faced by more established firms.

2.3.2. Heterogeneous expectations hypothesis

This proposition is firstly proposed by Miller (1977). In his theoretical explanation, he relaxes the assumption of homogenous expectations of investors, hence a divergence of opinion among investors arises. He argues that in markets with restricted short selling, such as IPOs, share prices are determined by overoptimistic investors. Over time, as the restriction weakens and more information becomes available, share prices are corrected. Hence, he posits that the greater the divergence of opinion among investors will translate into greater short run overvaluation and therefore greater long run underperformance.

Using three proxies of divergence of opinions (the percentage opening bid-ask spread, the time of the first trade, and the flipping ratio), Houge *et al.*. (2001) examine the relation between the divergence of opinion and the long run return of IPOs. They argue that these variables describe the uncertainty faced by a wide spectrum of IPO market makers, which in turn lead to opinion deviation. Using a sample of 2,025 US IPOs during the 1993-1996 period, they find that IPOs with a high proportion of flipping activity, wider opening spreads, or long opening delays, significantly underperform the market for up to three years after the offering. So, they conclude that IPOs with greater uncertainty, will exhibit poor long run return.

2.3.3. Agency hypothesis

Carter *et al.* (1998) conduct a study on several proxies used to measure underwriter reputation, using data from a sample of IPOs in the US market during 1979-1991. They only take firm commitment offerings with domestic offerings of at least $2,000,000. The primary method used to examine the explanatory power of underwriter reputation measures is the OLS regression with initial return as dependent variable in model 1 and long-run performance as dependent variable in model 2. In each model, they run a number of underwriter reputation measures (from Carter and Manaster (CM), 1990; Johnson and Miller (JM), 1988; and Megginson and Weiss (MW), 1989)[4] individually as well as simultaneously. Results of model 1 show that each reputation measure is significantly related to the initial return. However, only the CM measure remains significant when evaluated simultaneously. From the analysis of model 2, they also find that on average, the long-run performances of IPOs are less negative for the IPOs that are brought to market by more prestigious underwriters. In other words, they find that the underperformance of IPO stocks relative to the market over a 3-year holding period is less severe for IPOs handled by more prestigious underwriters. In their recent paper, Logue *et al.* (2002) find that regardless its reputation, underwriter activities after-market is significantly related to IPO long-run performance.

[4] Johnson and Miller (JM) measure the underwriter reputation based on their descriptions, such as the IPO size, the number of IPOs that have been underwritten since Securities Act 1933. They categorise the investment bankers into four groups. Megginson and Weiss (MW) use the underwriter's relative market sahre as a proxy for underwriter reputation. Carter and Manaster (CM) develop ten-tier reputation measure based on the rank of the underwriters in the syndicate, which is presented in the tombstone advertisement.

The role of another agent regarding the IPO long-run performance has been examined by Brav and Gompers (1997). They investigate the long-run underperformance of US IPO firms in a sample of 934 venture-backed IPOs during 1972-1992 and 3,407 nonventure-backed IPOs from 1975-1992. It is found that venture-backed IPOs outperform nonventure-backed IPOs using equal weighted returns. Value weighting significantly reduces performance differences and substantially reduces underperformance for nonventure-backed IPOs. They conduct further tests using several comparable benchmarks and the Fama-French 3-factor asset-pricing model. They find that venture-backed companies do not significantly underperform, while the smallest nonventure-backed firms do. However, the long-run underperformance is not an IPO effect as they find that the matching firms with similar size and book-to-market that have not issued equity perform as poorly as the IPO firms.

In sum, the agents seemingly have an important role in affecting the IPO valuing process by investors. Previous studies show that prestigious investment bankers and venture capital backing of IPOs have affected the IPO valuation in the long-term.

2.3.4. Signalling hypothesis

As mentioned above, the signalling hypothesis demonstrates that in order to reveal their true values, firms need to employ some signals to the investors prior to flotation. Although it is meant to explain the IPO puzzle in the early days of trading, there are some implications to the longer time horizons.

As the signalling models assume that the IPOs are followed by seasoned equity offerings, Jegadeesh *et al.* (1993) argue firstly, that firms raising further equity financing after their IPO are high value and hence outperform non-issuing firms in the long-term. Secondly, firms that underprice exhibit superior post listing returns relative to those that do not, and finally, the greater their quality, the more capital firms retain initially, and the better they perform in the long-term. Therefore, it implies that there are at least three testable implications. The first is that there is a positive association between the underpricing and the long-run performance. Secondly, a positive relation is expected between the quality of the firm and its long-run performance. Finally, there is an expectation of a negative relation between percentage of equity retained on the flotation and the long-run performance.

The empirical evidence shows mixed results. Using US data, Welch (1989) finds that firms that underprice the IPO are more likely to return to the market for further issues. Further more, he finds that those IPOs outperform the non-issuing firms. However, some studies show that firms that underprice do not exhibit superior post-listing returns relative to those that do not. (Ritter, 1991; Jain and Kini, 1994; Ljunqvist, 1996).

Using Singaporean data, Koh *et al.* (1996) demonstrate that the more equity retained by the old shareholders on the flotation, the better the IPO long-run performance. However, based on Germany data, Ljungqvist (1996) fails to find support for that proposition.

2.3.5. Problem with long-run returns measurement

The mixed results regarding the IPO long run performance may be attributable to several factors. One, which is debated widely, is the proper measurement method for share long run return. A growing amount of literature questions the methodology used in many empirical long horizon studies. Firstly, there are two choices of long run return measurement; Cumulative Abnormal Return (CAR) and Buy and Hold Return (BHR).

Testing for the fairness of both methods, Barber and Lyon (1996) find that the CAR method suffers from measurement bias, as it is a biased predictor for BHR. Consequently, they favour the use of the BHR method in tests designed to detect long run abnormal stock returns.

The second issue in long run performance measurement is the choice of benchmarks. There are several benchmarks used in such event studies; the matching control firm portfolios, the market index, and Fama-French three-factors. Barber and Lyon (1997) specify some biases of using market indices. They argue that using market indices would lead to some biases: rebalancing bias, skewness bias, and new listing bias. They suggest the use of matching control firm as a benchmark, as a control firm matched to sample firms on the basis of specified firm characteristics. However, Kothari and Warner (1997) argue that the use of matching control firm may lead to another bias, referred to as pre-event survivorship bias.

Finally, scholars also discuss the power of statistical tests for the long run abnormal returns. Loughran and Ritter (1995), and Brav (2000) argue that the test statistics suffer from failure of independence of observations, as the long-run performance of different firms may be correlated in calendar time. Jenkinson and Ljunqvist (2001) take an example of internet companies during the bubble period. This will tend to reduce the cross sectional variance in abnormal returns.

2.4. IPO long-run performance in the UK

A study on IPO long run performance based on UK data is conducted firstly by Levis (1993). He investigates the UK long-run performance of a sample of 712 UK IPOs floated during 1980-1988. He recognizes the importance of the size effect for UK stocks and reports long-run abnormal returns based on three alternative benchmarks: the Financial Times Actuaries All Shares (FTA) index, the Hoare Govett Smaller companies (HGSC) index, and a specially constructed all-shares equally-weighted index. The result confirms that over 3 years after the flotation, IPOs suffer from underperformance of between –8% and –23% depending on the market benchmark. Using a similar method, but a longer time period to Levis' study, Khurshed *et al.* (1999) examine the UK IPO long-run performance during 1991-1995. They find an average of -17.8% abnormal returns over 5 years after the IPOs.

Espenlaub *et al.* (2000) re-examine the long-run performance of UK IPOs. Using more up to date data (1985-1995), they compare the IPO long-run abnormal returns based on a number of alternative methods: CAPM, Size control portfolio (SD), Value weighted multi-index using HGSC index, Fama-French value weighted three factor model, and Ibbotson Returns Across Securities and Times (RATS) approach. In line with other studies, they find that the long-run abnormal returns vary across the benchmarks. The result shows a range of negative and statistically significant abnormal returns over 60 months after the IPO dates for CAPM, SD, Fama-French factor, and RATS. Slightly negative and statistically insignificant abnormal returns are found when using the HGSC index.

In addition to examining the UK IPO long-run performance, Khurshed *et al.* (1999) also investigate the relationship between some firms' conditions pre-IPO and the long-run performance. They hypothesise that the long-run performance of IPO is a function of the managerial decisions and performance of the firm prior to going public. Similar to other studies, they find a negative and strong relation between the IPO underpricing and the long-run performance for the sample as a whole. However, when the sample is split into small and big firms, the significance disappears in the small firm sample. They also find a negative relationship between the firms' pre-tax profit for the last three years before listing and the long-run performance. This implies that firms, which gained more profits before the listing, tend to underperform the market after 3 years traded. Moreover, they find some moderate relations between the IPO long-run performance and flotation cost, net asset a year before listing, and the percentage of equity retained at the flotation date. Interestingly, they find that the long-run performance of multinational companies (MNCs) is better than domestic companies. However, in contrast to other studies they do not find significant evidence for the relation between the underwriter reputation, firm size, and the long-run performance.

2.5. Hot/Cold market anomaly

The last anomaly is the hot/cold market issue. This phenomenon was first documented in the US by Ibbotson and Jaffe (1975). Besides the fact that there are 'hot/cold issues' markets, they also examine the relationship between new issue performance in a calendar month and the performance of other new issues in the previous calendar month. The result is that the first month series exhibits strong serial dependency, indicating that 'hot issue' markets are predictable. Although it is sensible for the issuers to go public in the 'hot' market (as the investment bankers often advise their clients), Ibbotson and Jaffe argue that the issuers would be better off in 'cold' markets rather than in 'hot 'markets, since their objective is to minimise the 'amount of money left on the table'. The implication to the investors is to avoid IPOs following the 'cold' market, and concentrate their investment in those months, which have the largest premia.

They also examine the relationship between the number of offerings and IPO returns. They hypothesise that the number of offerings may be related to the past level of returns. The regression model results in insignificant regression coefficient. Therefore the result does not suggest that the timing of new issue offering is related to the first month performance of the IPO.

Additionally, they examine the relationship between past market performance and new issue returns. However, the result shows there is not any relationship. Therefore, the market index cannot be expected to serve as a useful guide to issuers in selecting a month to offer their issues.

The Ibbotson and Jaffe's study is extended by Ibbotson *et al.* (1994) using longer periods, and Ritter (1984). The evidence is consistent with the prior study. Ritter attempts to explain the 'hot' issue using Rock's implication. He argues that if the risk composition through time of firms going public is correlated then this can explain the time series correlation of initial returns. Hot issue markets would be a result of a higher than usual proportion of risky firms coming to market a in given period.

Another possible explanation for hot issue markets relies on irrationality on the part of investors rather than issuers and their advisers. Hot issue markets may exist because there are periods when investors are particularly receptive to new issues. During these periods, investors are willing to pay a high price for earnings and market to book multiples for new issues. Firms rush to the market to exploit this receptiveness and receive good prices for their equity offerings. The optimism of investors regarding the prospects of these firms results in aftermarket prices being bid above intrinsic values and high initial returns are observed. (Byrne and Rees, 1994)

The recent studies conducted by Loughran and Ritter (2000) has given a valuable contribution to the IPO hot market puzzle. They argue that existing literatures offer no explanation that is consistent with investors' rational behaviour. Therefore, they propose an explanation that is called prospect theory. It predicts that when the market rises, there will be an increase in the expected underpricing of all IPOs that are in the selling period. It implies that short-term abnormal returns will be higher following market rises, and this effect will be present in all IPOs where the selling period includes the period of the market rise.

2.6 Equity Valuation

Equity valuation models in the finance literature are generally based on Miller and Modigliani (1961). Miller and Modigliani (MM) posit that the market value of a firm's common equity is equal to the discounted value of present and future economic earnings. They define economic earnings as earnings minus net investments, and the discount rate as the required rate of return for that level of risk.

After MM's model, equity valuation has been an important issue both in academia and practice. Most finance textbooks discuss several valuation models, including the comparable firm approach, the discounted cash flow (DCF) approach, and the asset-based approach (Benninga and Sarig, 1997). The comparable firm approach is typically implemented by capitalising the earning per share (EPS) of the firm under consideration at the average or median price-earnings (P/E) ratio of comparable publicly traded firms. Among other comparable multiples usually used in this approach are market-to-book, price-to-sale, and price-to-operating earnings. The DCF approach, which is heavily based on the MM model, uses the future cash flow and appropriate discount rate to determine the market value of a firm. The asset-based approach looks at the underlying value of the company's assets to indicate value.

Based on the residual income model (RIM), Ohlson (1995) propose an alternative valuation model, which links the fundamental accounting information to the value of the firm. The model has been extensively discussed among accounting and finance scholars. Since it was published in 1995 up to 1999, an average of 9 annual citations in the social science citation index (SSCI) has been found (Lo and Lys, 2000). Basically, this model provides a simple accounting based equivalent to the traditional dividend discounting approach. Its contribution comes from his modelling of the information dynamics. Empirical studies using this model seem to work very well (Lo and Lys, 2000).

2.6.1. Non-IPO valuation

The Ohlson's valuation model has been used widely for non-IPO cases. Based on US data, Frankel and Lee (1996) find a robust result with very high R^2, suggesting that for non-IPO cases, the market value of a firm is strongly related to equity value and earnings. More robust evidence is found by Hand and Landsman (1998), who show that dividends also take a major role in setting the market price.

Using time series data, Collins *et al.* (1997) examine systematic changes in value relevance of earnings and book values over time. In contrast to practitioners' claims, they generally do not find a decline in the combined value-relevance of earnings and book value. Although they vary over time, in fact they appear to have increased slightly. The empirical result also shows that when value-relevance of earnings decline, it is replaced by increasing value-relevance of book values. Moreover, they find that among other factors, the increasing frequency of negative earnings explains the shift in value-relevance from earnings to book values. This confirms previous work by Hayn (1995) that demonstrates that stock prices are affected differently by negative income, as compared to positive income.

The impact of negative earnings (income) on valuation is also observed by Rees (1999). Using UK data, he corroborates that negative income affect the firms' values. He also shows that incorporating the negative income variables into the valuation model results in shifting the value-relevance from net incomes to equity.

While Collins *et al.* (1997) show that the value-relevance of earnings and book values vary over time, Rees (1998) finds that they also vary across countries. Many scholars have tried to simplify the Ohlson's model and examine the impact of different firm characteristics on the parameter estimates. Fama and French (1998) investigate the value relevance of dividend taxation and debts. While many capital market research studies often exclude financial firms in research samples, Danbolt and Rees (2002) particularly investigate the valuation of financial firms in Europe. Using some fundamental accounting information, they find that the accounting valuation models works well to explain the variation in the market to book ratio.

Other valuation methods used widely in practice are the comparable multiple and the DCF methods. Kaplan and Ruback (1995) investigate the accuracy of the DCF methods to estimate firms' market values. Using 3 CAPM-based approaches to assess the discount rate, they find that the methods provide a reliable estimation of firms' value. Moreover, they also compare the result with one using the comparable-based methods. The evidence shows that the DCF methods perform as well as the comparable-based methods.

Focusing particularly on bankrupt firms, Gilson *et al.* (2000) employ the DCF and comparable multiple methods. They find that these methods generally yield unbiased estimates of value, however the range of valuation errors is very wide. They argue that the sources of errors could be attributed to finding the proper discount rate or the long-term growth rate as well as the lack of information about bankrupt firms.

Assuming that greater information about a stock increases the market's precision in valuing stocks, Ebenhart (2001) argues that the comparable multiples methods facilitate the market for more information access. Instead of using commonly used multiples such as book-to-market, price-to-cash flow, etc, he proposes a new simple proxy for differential information, a number of multiples provided by comparable firms. He finds a negative relationship between the amount of information provided by comparable firms and a firm's stock return volatility, suggesting that the more information about comparable firms available to the market, the more accurate the stock valuation.

Recently, Liu *et al.* (2002) examine the valuation performance of a comprehensive list of value drivers. They find that multiples derived from future earnings estimation explain stock prices remarkably well. Other value drivers, which work well are cash flow measures and the book value of equity. In contrast to other studies, they find that historic earnings also have been a proficient driver, while sales figures apparently are the worst driver. Additionally, they test more complex measures of intrinsic value, however the value performance declines.

2.6.2 IPO Valuation

As discussed above, for non-IPO shares there are a number of valuation methods used. However, the choice becomes limited when it is applied to IPOs. Since very little information is available in the market prior to flotation, the DCF methods are seldom suitable. Usually, the prospectuses enclose up to three years financial statements, which are not sufficient to have appropriate cash flow forecasts. Additionally, IPO firms are typically young firms with high prospective growth rate. This makes it even more difficult to determine an appropriate discount rate.

Another valuation method is the comparable firm multiples methods. According to McCarthy (1999), this is the most common method used by issuers and sponsors in setting the IPO offer price. Kim and Ritter (1999) investigate the usefulness of the comparable firm multiples method to value IPOs. Firstly, they use price-earnings ratios as a denominator of an IPO market price. This approach results in very poor precision when historical accounting numbers are used. However, the accuracy of the valuation improves substantially when forecasted earnings are used. They, then, test other multiples, such as the market-to-book, price-to-sale, enterprise value-to-sales and enterprise value-to-operating cash flow. They find these multiples are somewhat more accurate than the use of historical accounting. Furthermore, they experiment using two types of benchmarks; recent IPOs in the same industry, and a portfolio of firms chosen by a leading investment banker. The result shows that the accuracy of valuation increases when the latter benchmark is used. This implies that although the comparable firm multiples approach is popular, other information, such as the underwriter's information regarding market demand results in much more accurate pricing.

Closely related to Kaplan and Ruback's study (1995), Berkam *et al.* (2000) examine the accuracy of the comparable firm multiples methods and the DCF methods in valuing IPOs. Using a data set from a relatively thin market (New Zealand Stock Exchange), they use forecasted accounting information on both methods. Unsurprisingly, in line with Kaplan & Ruback (1995), they find that both methods have similar accuracy in valuing IPOs. However, the empirical result depends highly on the benchmark used. They conclude that using the market-based benchmark produces more accurate estimation than using the industry-based benchmark.

As discussed above, the signalling hypothesis has been notable in IPO theory. Downes and Heinkel (1982) are amongst others who investigate the valuation of new equity offerings in relation to signalling the firm value. They test the Leland-Pyle model (1977) using US IPO data during 1965-1969 and find that the firms, which retain high fractional ownership, do indeed have higher values. They argue that the ownership retention at the IPO signals the old shareholders' believes in the firms' future value. The old shareholders of the 'good' firm, therefore, tend to retain a high fraction of shares at the IPO. Hence a positive relationship is expected between the ownership retention at the IPO and the value of a firm. As mentioned earlier in the underpricing section, one implication of the signalling models is that the owners of the good firms are likely to retain a high fraction of the ownership at the IPO. The argument is that the management use the underpricing to signal the firm's true value, in expectation to have a higher price at the subsequent seasoned equity offerings. The old shareholders (owners) ought to retain a high fraction of shares in order to offset the cost of underpricing at the SEOs.

Based on Leland and Pyle's (1977) model, Krinsky and Rottenberg (1989) argue that the net proceeds, as indicated in the offering prospectus, might also convey the insiders' private information regarding the future planned projects in the firms. Therefore, it is regarded as a signal to the firm value. In their empirical investigation, Krisnky and Rottenberg (1989) find positive relationships between the proceeds and the IPO (subscription and market) prices. Using the UK USM data, Short and Keasey (1997) also finds a support for the positive net proceeds-firm value relationship.

Other variables employed as signals to the value of IPO are such as auditor quality (Beatty, 1989; Datar *et al.*, 1991; Feltham *et al.*, 1991), and investment banker quality (Titman and Trueman, 1986), and the relationship between the issuers and the banks (Slovin and Young, 1990). Others use the firm's accounting information, such as the earnings forecast, to value the issue (Kim and Ritter, 1999; Firth and Liau-Tan, 1998; Keasey and McGuinness, 1991).

While Heinkel (1982), Ritter (1984), and Clarkson *et al.*. (1991) use financial information in order to control for the effects of sample heterogeneity, Kim *et al.*. (1995) focus on the value relevance as well as the predictive ability of the information in Korean IPOs. They develop two regression models. The first model is based on the pricing formulae prepared by the Korean authority, which was heavily dependent on future earnings, net asset value after the offerings, and industry characteristics. The second model, called the augmented model is an expansion of the first model by incorporating three signal variables, which are ownership retention, underwriters' quality, and investment level.

The empirical result shows that earnings and industry characteristics have positive and significant relationships with the market price. It also indicates that these variables tend to have a significant role in explaining and predicting the after-market price. However, the evidence fails to detect any significant relationship between the potential signals and the market price.

How and Yeo (2001) investigate the impact of earnings and dividend forecasts on the pricing of Australian IPOs. They argue that earnings and dividends disclosure in the prospectus minimise the IPO information asymmetry. Consequently, they postulate that earnings and dividend forecasts disclosure is related to IPO initial valuation. However, the empirical evidence does not support the hypothesis. They explain that Brown *et al.*'s (2000) study on Australian non-IPO cases finds that earnings forecasts are subject to error as they are noisy estimates of future cash flows. They, consequently, question the relevance of forecast information in the valuation process.

Firth (1998) examines the role of profit forecast published in the prospectus as a signal of IPO value. His previous study (Firth *et al.*., 1995) shows that historical earnings, which are required to be disclosed in the prospectus, are poor predictors of future earnings because of typically fast growth of the IPO firms. Moreover, they also do not incorporate the effects of the expanded activities of the firm financed by the new issue proceeds. Using the forecasted earnings disclosed in the prospectus, the study finds a strong positive relationship between earning forecasts and IPO market valuation. This result is consistent with Clarkson *et al.*. (1992), who use Canadian data.

Klein (1996) investigates the relation between the information provided in the prospectus and the pricing of IPOs. Her motivation is to examine whether investors could use the prospectus to price an IPO. Based on Modigliani-Miller (1966), she argues that equity value is a linear function of accounting earnings, book value of equity, expected earning growth, and market or firm specific risk factors. She posits the hypothesis that the IPO price is an increasing function of earning per share, book value, expected growth, and a decreasing function of risk. Using the pre-IPO accounting information, such as earnings and book value, she finds that some accounting information disclosed in the prospectus are significantly related to both offer and one-week prices. This result seems to be different from Kim and Ritter (1999). Furthermore, Klein finds that the offer and one-week prices appear to be significantly related to the percentage of equity retained, the underwriter reputation, and whether the offer includes a warrant or not (usually referred to as unit IPOs). In general, the result confirms findings of other studies. Another robust finding is that the prospectus information explains the variation of the offer price more than it does the one-week price. This implies that having traded one week in the market, other information revealed is also taken into consideration in valuing the newly listed firms. While studies mentioned above exhibit the important role of earnings forecast information on the IPO pricings, DuCharme *et al.* (2001) argue that since so little information about the firm is available pre-IPO, there is an incentive for issuers to manipulate, or manage, the reported earnings. Therefore, they posit that pre-IPO earnings management by issuers is positively related to the initial firm value.

Since earning management is an unobservable variable, they use a number of management of accruals as proxies. Using 171 IPOs that went public in the US market during the period 1982-1997, they find evidence to support the hypothesis of the positive relationship between the earnings management and the IPO offer price. The result implies that the issuers, who try to manage the accounting accruals prior to IPO, report better earnings forecasts, and thus have a high initial price in the market.

In the second part of their study, they also test a hypothesis regarding the relationship between the earnings management and the subsequent performance of IPOs. They posit that pre-IPO earnings management is negatively related to IPO returns in the after-market. However, they find no evidence to support the hypothesis.

Recently, Beatty *et al.* (2002) investigate the IPO pricing based on accounting information. They focus their investigation on the explanatory power of revenue, accounting earnings, and book value as cash flow surrogates, to the three IPO prices (the offer price, the filing price, and the initial market price. They try several models and find that changes in models result in big differences in the explanatory power of the models. They conclude that the modelling is more critical with IPOs than with establish firms.

In their study, three general models are developed. The first model is the offer price against the accounting information. They use 5 different proxies for the offer price (unscaled per share, unscaled total value, total value scaled by book value, total value scaled by revenue, and natural log of total value). They employ pre-IPO earnings per share and pre-IPO book value per share as the predictors. The empirical results show that earnings and book value is positively and significantly related to all offer price proxies. The explanatory power of the model varies among the different offer price proxies. The earnings and book value explain as much as

17.6 % to the variation of per share data and the highest at 65.9% on the natural log model. This suggests that the historical accounting information does provide information to explain the variability of the offer price.

Using the natural log of total value, they expand the model by including a number of predictors (revenue, IPO year dummy, percentage of shares retained at the IPO, and the residual from the previous natural long model). They also transform the earnings and book value data to the natural log form. They find all predictors are significant and of expected signs, and the explanatory power rises to 75.05%.

The above model is then expanded by adding pre-IPO market return and the natural log of the filing price as new predictors. Such inclusion makes a big impact to the change of model explanatory power. It rises up to 98.18%. Interestingly, the earnings, book value, and retained ownership coefficients become negative and lose their significance. Since the inclusion of filing value captures what the underwriters thought the offer price would be, the result suggests that underwriters tend to overweight the importance of these fundamental variables when setting the filing price.

The following analysis in their study is of the market value model. This model relates the initial market price and the accounting information and control variables. The empirical evidence shows that all three fundamentals are negatively related to the market price. They argue that the result indicates that firms with high fundamentals are underpriced to a lesser degree than those with weaker fundamentals. To examine whether the lower market price is a result of risk adjustment, they develop a proxy for the ex-ante risk measure. They find that the standard deviation of the after market returns for 1 year is an unbiased proxy to the ex-ante risk measure. A cross sectional analysis is undertaken to examine the impact of the accounting information, risk, size, industry on the initial returns. In addition, the model also includes the offer value residuals to investigate the partial adjustments. The results show that the accounting information is significantly related to the initial returns. They also find a positive relationship between the risk and the initial returns. A positive and significant coefficient of offer value residual confirms the partial adjustment made by the underwriters during the marketing period.

In sum, there are several equity valuation models applied in the literature, however the choice becomes limited when it is applied to IPOs since very little information about the firm is available to the market prior to the admission. The prospectus is regarded as the most comprehensive information about the issuing firms, which is available prior to the IPOs. Using US data, Klein (1996) investigates the usefulness of the prospectus information on the IPO pricing. In line with Klein's study, this study examines the impact of the prospectus information on the IPO offer price and market price. The prospectus information is defined as the firm accounting fundamentals, the ex-ante risk factors, and the signals. The basic model used is the accounting-based valuation model, which analyses the impact of the firm accounting fundamentals on the IPO prices. Following prior studies (e.g., Beatty and ritter, 1986; Krinsky and Rottenberg, 1989), the research model is expanded by including the risk factors and the signals.

2.7 Risk

As mentioned in the Introduction chapter, one of this study's objectives is to investigate the relationship between the IPO ex-ante risk factors and its valuation and long-run performance. This section reviews a number of existing studies in finance regarding risks.

2.7.1. Risk conceptualisation

The two key factors in any investment decision are return and risk. Under the assumption that investors are risk-averse and seek to minimise the risk for any level of expected return, intuition suggest that additional return must compensate investors for assuming additional risk (Aaker and Jacobson, 1987).

In classical decision theory, risk is defined as reflecting variation in the distribution of possible outcomes, their likelihood, and their subjective values. In statistical term, that definition is known as variation, or its derivative, standard deviation.

March and Shapira (1987) conduct research regarding manager perspectives on risk. They argue that in the managerial perspective, the managers see risk in ways that are less precise and different from risk as it appears in decision theory. Firstly, most managers do not treat uncertainty about positive outcomes as an important aspect of risk. They treat risk as a danger or hazard in their businesses. Secondly, risk is not primarily a probability concept. In their study, a majority of managers felt that risk could be better defined in terms of amount to lose, or expected to be lost. Thirdly, managers seek precision in estimating risk. Most managers show little desire to reduce risk to a single quantifiable construct.

Although definitions of risk abound, there is a common notion that these definitions attempt to convey that risk is associated with the chance of something undesirable happening. Mocks and Vertinsky (1985) argue that undesirable consequences can be identified in terms of: (1) some natural reference points such as zero separating gains from losses; or (2) reference points provided by a specific problem context and rules, perhaps professional standards specifying reasonable levels of report accuracy; or (3) programs used by decision maker and risk assessors to formulate the problem while solving it such as target profits set by corporate plans.

2.7.2 Some important studies on risk

The study regarding risk has been an important and long discussion topic in several areas, such as economic, finance, and strategic management. In the economic area, risk is usually related to the choice under uncertainty conditions. It is Irving Fisher (1906) who firstly discussed the uncertainty of future asset returns that is described in terms of a probability. However, the most fundamental theory on risk is Knight's study (1921) that discusses risk versus uncertainty. The theory says that risk exists when the economic agent can assign numerical probabilities to events in a certain situation. If the probabilities cannot be assigned, then uncertainty exists. Referring to previous studies, Hicks (1934) suggests that preferences for investments could be represented as preferences for the moments of the probability distributions of their returns. He also proposes that preferences could be represented by indifference curves in mean-variance space. Then, this study is expanded by von Neumann and Morgenstern's study (1947), which is well known as 'The Expected Utility Theory'. Within this theory, an individual's attitude towards risk is reflected in the shape of his or her utility function. Eventually, Hick's study has led to the spread of risk research to other disciplines. (The New Palgrave Dictionary of Money and Finance, 1994).

In the finance area, risk is usually discussed in the context of modern portfolio theory. Markowitz (1952) assumed explicitly that investor preferences were defined over the mean and variance of the aggregate portfolio return, which could be referred to as risk-return analysis. After that, several studies try to relate investor preferences with the expected utility theory [Markowitz and Tobin (1958), Merton (1969), Samuelson (1970)]. They find similar conclusions that the investor preference, which is known as the mean-variance preferences, is applicable to the certain part of his or her expected utility function.

This finding leads to the famous Tobin's analysis (1958), which deals with the choice between a single risky asset and cash. He demonstrates that there is nothing essential changed if there are many risky assets as they can be treated as a single composite asset. Tobin's theory is known as the first separation theorem in portfolio theory. Sharpe (1964) and Lintner (1965) develop the Tobin's theory. They propose the Capital Asset Pricing Model (CAPM).

In his study, Sharpe builds a model that explains the relationship between the risk and the expected return of a risky asset. The term systematic risk was firstly introduced in this paper. This type of risk describes the portion of an investment's total risk that cannot be avoided by combining it with other investments in a diversified portfolio. Because it cannot be avoided, investors require compensation for bearing systematic risk. The other part of total risk is the unsystematic risk, which is related to factors that are unique to specific investments. Investors do not require compensation for this component of risk because it can be avoided by diversification.

2.7.3. The capital asset pricing model

The CAPM is a significant asset pricing model, not only because it was the first equilibrium model of asset pricing under uncertainty, but also because it shows the importance of portfolio separation for tractable equilibrium models. Many scholars attempt to test the CAPM empirically. They find some support for the theoretical model. (Black, Jensen and Scholes, 1972; Fama and Macbeth, 1973). However, with different time periods, there have been some mixed results as well (Banz, 1981; Basu, 1983; Rossenberg *et al.*, 1985; Chan *et al.*, 1991). Fama and French's study (1992) attempts to test the model empirically. Using 50 years of data on stock prices on three major US exchange markets, they find mixed results. There has been a positive relationship between beta and stock returns during the 1926-1968 period, however for the entire period of 1926-1990 they find no relationship between beta and returns. This result has been discussed in the Roll's (1977) analytical study. He argues that the positive relationship between beta and returns will be obtained if and only if the market proxy is exactly on the mean-variance efficient frontier. If the market proxy is off the efficient frontier, that relationship may be null. Since the exact efficient frontier can never be verified, he concludes that CAPM is of little practical use in explaining stock returns.

The other area that usually involves risk in the studies is strategic management. Many scholars use the CAPM concept in strategic management literature. The considerable logic in directly applying CAPM concepts to problems in strategic management is when discussing about corporate diversification strategy or in situations where maximisation of stockholders wealth is taken as the primary objective of the firm.

The majority of studies explicitly employing a CAPM risk measure have employed one or more of the measures of systematic risk, unsystematic risk, or alpha to represent an independent variable in the models [Montgomery & Singh (1984), Aaker & Jacobson (1987), Lubatkin & O'Neill (1988), Barton (1988), Lubatkin & Chaterjee (1991)]. They directly incorporated the CAPM paradigm of risk in research directed at clarifying the relationships among diversification strategies and risk.

In their study, Montgomery and Singh (1984) find that related and unrelated diversifiers differ along the risk-return relationship. The unrelated diversifiers tend to have higher levels of systematic risk than the related diversifiers do. They predict that high systematic risk associated with the unrelated diversification might be attributed to low market power, low capital intensity, and high debt position. Barton (1988) conducted a study that explicitly tests the relationship between those three variables and diversification strategy. The result supports the previous work.

In reviewing strategic management articles involving risk during 1980-1995, Ruefli *et al.* (1999) find there are 53 studies employing the CAPM systematic risk as a company risk measure. This shows that the market based risk measure, as determined in the finance area, is generally accepted by strategic management scholars.

The CAPM implies that unsystematic risk should not influence investors' decision. However, in a strategic context, Aaker and Jacobson (1987) argue that managers should not ignore this type of risk. The justification is that two of CAPM assumptions are inappropriate to strategy decisions. Firstly, the assumption regarding investors as price takers, who can invest as much as they like, by using portfolio diversification, and receive expected returns. However, they are still bounded with the feasibility of the portfolio in the market. This implies that if investors do not find the expected returned for their investment by diversification, they might take the unsystematic risk into consideration in their investment decisions.

Secondly, CAPM assumes that bankruptcy cost is zero and firms can sell their assets at their economic value. However, if a firm goes bankrupt, it may have to sell assets at prices below market price because of legal fees, expensive delays, or a premature collapse of sales. Therefore, in turn, investors may need additional return to compensate for those costs. This implies that to avoid bearing those additional costs, investors should invest in low unsystematic risk firms.

Bettis and Hall (1982) argue that managers should be concerned primarily with the unsystematic risk. The management of this risk is at the heart of strategic management. Further, Aaker and Jacobson (1987) also argue that there are some incentives for managers to reduce unsystematic risks, such as bonuses or job security.

In their study, Aaker and Jacobson (1987) investigate the relationship between systematic risk, unsystematic risk, and firm performance. They find that both components of total risk have substantial, significant, and different effects upon firm performance. The relationship between performance and systematic risk is found to be positive and significant, while the relationship between performance and unsystematic risk is found to be positive but not significant.

A number of scholars employ Jensen's alpha [Johnson *et al.* (1987), Lubatkin & Rogers (1989), Amit & Wernerfelt (1990), Nayyar (1992), Woo *et al.*

(1992), Hoskisson (1993)]. They have similar results, which show that business risk has a negative effect on firm value.

2.7.4. Accounting-based risk measures

Ruefli *et al.* (1999) also record the variance as the second most widely used measure of risk in strategic management articles. What they mean with variance is simply the variance of time series of accounting returns. Beaver *et al.*'s study (1970) is among the first articles that discuss the accounting based risk measures. The motive behind their study is that there are some variances in security prices, which cannot be explained by CAPM. They argue that although CAPM provides a measure of security riskiness, the knowledge of risk determination is incomplete if the exogenous data (non-price data) is unknown. Therefore, by examining some accounting based risk measures, they expect to shed some light to the risk determination. The other reason why they investigate the accounting risk measures is that the accounting measures are used widely by investors as proxies for company risk. In this study, they also attempt to know to what extent a strategy selecting portfolios according to the traditional accounting risk measures is equivalent to the market based risk measures.

Unlike CAPM, which can divide the total risk into its two important components, the accounting risk measures can be viewed as surrogates for the total variability of return of a firm's equity securities. Thus, accounting measures reflect both the systematic and unsystematic risk. Additionally, Bildersee (1970) argue that the accounting data can be considered as a summary of all company events and decisions. As such, it summarises, in some form, information basic to the measurement of total risk associated with the firm and with the securities supporting the firm. Theoretically, it can be said that there should be an association between the accounting risk measure and the market *beta*.

The study using accounting data faces a problem of selection of the appropriate accounting data and financial ratios. This problem arises as usually such ratios are often highly correlated. To avoid such a problem, Bildersee (1975) suggests selecting only one ratio from each class of ratios. In their study, Beaver *et al.* (1970) investigate 7 accounting risk measures: dividend payout, asset growth, leverage, liquidity, asset size, variability of earnings, and the covariability in earnings.

It is often affirmed that firms with low dividend payout ratios are more risky. This can be justified as follows: if the firm sets a stable dividend payout policy, then firms with greater volatility of earnings will pay out a lower percentage of expected earnings. Therefore, the payout ratio can be viewed as a proxy for management's perception of the uncertainty linked to the firm's expected earnings.

Asset growth is defined as the average of the annualised rate of change in assets over the time period. Expectedly, the more new assets invested within the firm, the more earnings they produce. However, Beaver *et al.* (1970) argue that the addition of new assets to the firm could mean an increasing uncertainty in expected returns. Therefore, they presume that there is a positive relationship between the asset growth and company risk.

Modigliani and Miller (1965) show that the introduction of debt to the firm's capital structure induces greater volatility of the firm's earning stream for ordinary shares. It could be inferred that the firms' debt affects the riskiness of the firms equity, hence, it is predicted that the higher the debt ratio of the firm, the greater the risk.

Compared to fixed assets, current assets can be reckoned to have less volatile return. However, the relationship between current assets and current liability has a similar pattern to that of leverage. Therefore, it could be conjectured that the less liquid the firm, the greater the risk. However, it is presumed that the relationship between liquidity and risk tends not to be as high as that between leverage and risk (Beaver *et al.*, 1970).

It is widely believed that larger companies are less risky than smaller companies. In term of default risk, the evidence shows that the chance of failure has been lower for the large size companies (Assadian and Ford, 1997). Additionally, Ballantine *et al.* (1993) argue that firm size reflects the uncertainty in the firm's profit and loss rates. They find that small firms have greater variations in profits than large firms do. In their seminal paper, Fama and French (1993) also identify the firm's size as one of the risk factors in the common stock returns.

As firm's earnings have been a main focus in risk, Beaver *et al.* (1970) include the variability in earnings in their analysis as a measure of risk. The proxy used is the standard deviation of the earning price ratio. The higher standard deviation of the earnings price ratio describes increasing risk. They also include the accounting *beta* into the analysis. It can be derived in a similar manner to the market *beta* with the earning price ratio as dependent variable and the market-earning price as the independent variable and is defined as the sensitivity of firm's share price to the changes in the market index. The higher value of accounting *beta* infers that the share price is more sensitive to the market index changes, which reflects the high riskiness of the firm's value.

In his study, Bildersee (1975) employ 10 accounting-based risk measures: the asset-to-equity ratio, the debt-to-equity ratio, the preferred-to-common equity ratio, the current ratio, the sales-to-equity ratio, the cash flow per debt plus preferred ratios, equity, asset growth, the standard deviation of the earning-price ratio, and the accounting *beta*.

In terms of the source of company risk, there are some similarities between the approaches used by Beaver *et al.* (1970) and Bildersee (1975). Both studies agree with leverage, profitability, liquidity, asset growth, and the earnings stream as sources of company risk. However, Bildersee put the efficiency and coverage of fixed obligations as other sources of risk. They also differ in employing financial ratios to those sources of risk.

Both studies also end up with similar conclusions regarding the association between accounting- and market-based measures of risk. They find a high degree of association between both types of risk measures. Additionally, Beaver *et al.* state that a strategy of selecting accounting risk measures is essentially equivalent to a strategy of ranking those same portfolios according to market-determined risk measures.

Although focusing mainly on risk with regard to corporate strategic management, Miller and Bromiley (1991) also employ some accounting risk measures. They identify nine measures of risk that have been used in research relevant to the strategic management area: systematic risk, unsystematic risk, the debt to equity ratio, capital intensity, R&D intensity, the standard deviation of return on assets (ROA), return on equity (ROE), stock analysts' earning forecasts, and the coefficient of variation of stock analysts' earnings forecasts. They group the variables into three categories: stock return, financial ratios, and income stream uncertainty. They argue that factor one is generally believed to be the measure of risk most relevant to general management. Factor two, stock return risk, captures risk from the perspective of shareholders. Factor three; strategic risk has risk implications for multiple external stakeholders groups.

Similar to previous studies, Miller and Bromiley argue that the debt-to-equity ratio is a standard measure of corporate financial leverage, which reflects a company's risk of bankruptcy. The second financial ratio employed is the capital intensity. This measure is not included in previous studies. Miller and Bromiley argue that capital intensity increases company risk in two ways. Firstly, if a firm choose to produce a given output with high capital intensity and low amount of labour, it increases its fixed costs and lowers its variable costs. Thus, it increases company risk. Secondly, a firm using a large amount of capital runs a high risk of capital obsolescence. There have been some studies that attempt to seek the relationship between capital intensity and variability in returns (Lev, 1974; Hurdle, 1974). Hurdle finds a negative association between capital intensity and variability in returns. In contrast, Lev (1974) finds a positive association between those variables. The different findings seem to stem from different ratios employed. While Hurdle uses the ratio of capital to sales as a proxy for capital intensity, Lev uses the ratio of fixed costs to variable costs. The first ratio shows that the higher the ratio, the riskier the firm. The second one shows the higher the ratio, the less risky the firm. In Miller and Bromiley's study, the ratio of total assets to sales is employed as a proxy for the capital intensity.

The third accounting risk measure used is R&D intensity. This reflects the extent to which a company chooses to develop new processes or products. Miller and Bromiley (1990) argue that since technology and markets keep changing, a firm face some level of uncertainty regarding its investment in R&D.

The last accounting risk measures used in Miller and Bromiley's study are the standard deviation of ROE and ROA. These measures are used in some previous studies [Bowman (1980), Fiegenbaum & Thomas (1985), Woo (1987)].

Moreover, Miller and Bromiley try to compare the risk measures. Before processing the risk measures into the model, they run the factor analysis method. The result of the principal component analysis shows that several distinct empirical risk factors exist and are stable over time. Hence, three risk factors, income stream risk, stock return risk, and strategic risk, are substantially different and valid. This result implies that the three risk factors could be used as separate independent risk measures.

Although the arguments above highlight some advantages of accounting risk measures, there are some limitations in using them as company risk measures. The critiques emphasise that a mean-variance approach of the firms' incomes, to estimating the relationship between return and risk, suffers from an identification problem (Ruefli, 1990). Moreover, the accounting returns reflect past investment decisions. They also do not appropriately capture the expected future cash flow that a firm's stock of assets could generate. Finally, the differences in tax laws across industries and in accounting conventions regarding R&D and advertising expenses may distort accounting based measures (Amit and Wenerfelt, 1990).

2.7.5. Risk-return relationship

Most investment textbooks explain the positive association between risk and the expected return of an asset. The riskier the assets, the higher the expected return. However, studies of the influence of risk and performance have yielded mixed result. Bowman (1980) finds a negative association between risk and returns. In his study, he employs the variance in returns as a risk measure. Testing Bowman's (1980) risk-returns paradox, Fieganbaum and Thomas (1985) find that the risk-return relationship varied over time. In a subsequent study in 1986, they find no association between the systematic risk of a firm's stock returns and returns that is measured using accounting data. Aaker and Jacobson (1987) find a positive relationship between firm performance and its total risk. In this research, they use an accounting risk measure, the variance of the firms' earnings, as a proxy for the risk, and the return of the firms' share in the market, as a proxy to the firm's performance.

Using different explanatory variables, Miller and Bromiley (1990) categorise risk into three groups (income stream uncertainty, stock return risk, and strategic risk). They also use industry classification as a dummy variable in the model. The accounting earnings figure is used as a proxy for firms' performance. The empirical evidence shows that there is a negative association between income stream risk variables and performance. On the other hand, the association between the strategic risk and performance varies across industries and performance levels. They find no relationship between the stock return risk and performance.

From the above findings, it can be concluded that the risk-return relationship depends on the risk and returns measures employed in the study. This implies that different measures may capture different dimensions of risk. Furthermore, the relations among risk measures and between risk and performance may vary over time and across industries.

2.7.6. Risk, IPO valuation and performance

There have been few IPO studies investigating the relationship between the risk and IPO valuation and performance. Based on the timing and the risk measure, such studies could be classified into 2 groups. The first group is studies that use the ex-ante risk and the second is ones that use the ex-post risk. Below is the review of such studies. The former group of studies is explained after the review of the latter.

Ritter's study (1984) is the initial study, which examines the relationship between uncertainty and IPO underpricing in the US market. In this study, he argues that the ex post uncertainty is positively correlated to the degree of underpricing. He employs the standard deviation of daily returns for days two through five as a proxy for the ex post risk measure. The empirical result to this argument finds a significant positive correlation coefficient between this risk measure and the degree of underpricing.

Using a sample of 510 US IPOs that went public in 1982-1983, Miller and Reilly (1987) also investigate the relationship between the uncertainty and the underpricing. They use the ex-post and ex-ante measures of risk. The ex-post risk employed is measured by two proxies, the trading volume and the bid-ask spread

They argue that the level of trading may signify the extent to which investors disagree about the value of a security. If the underpriced issues are subject to the greatest uncertainty, this would imply that they should exhibit greater trading volume. They use daily trading volume as a proxy for the uncertainty. The empirical result is robust. The evidence shows that the underpriced issues experience significantly higher volume for days two through five.

The bid-ask spread is known to be a function of inventory risk and adverse information risk. Inventory risk depends upon the price volatility and the number of trades for each issue in inventory. Adverse information risk affect the bid-ask spreads since market makers are obliged to trade with investors who might possess superior information. The larger bid-ask spread exists when informed investors are present. This implies that the initial spread should be greater for IPOs that are underpriced because informed investors are involved in these offerings.

In order to examine the relationship between the inventory risk and the underpricing, they use the absolute value of daily returns as a proxy for price volatility and the daily volume as a proxy for the frequency of trades. The result shows that on day one the underpriced issues have a significantly larger positive price volatility coefficient and a larger negative trading volume coefficient. However, this result is not significant for days two through five. As there is no explicit measure of adverse information risk in the model, they do not test this risk.

In addition to the ex-post risk measure, Miller and Reilly (1987) also employ the ex-ante risk, which is proxied by the use of the inverse of gross proceeds. They likewise find a significant positive correlation between the ex ante uncertainty and the degree of underpricing. They also find a significant positive correlation between the ex ante uncertainty and the degree of underpricing.

Carter *et al.* (1998) investigate the relationship between risk, the IPO underpricing and the long-run performance. Using the standard deviation of daily IPO returns for a year, they find that the IPO ex-post risk is related positively to the degree of underpricing and negatively to the IPO long-run performance. This result implies that the uncertainty during the early IPO period produces the improper pricing in this period. In the long run, with more information available, the pricing error is corrected by the market, which is shown by the declining IPO returns.

Based on the source of risk, the above studies employ measures using the IPO prices, returns, and trading volume data, which are the results of the investors' actions. However, for helping investors in pricing IPOs, it is more useful to examine the ex-ante risk. Below is a review of prior IPO studies that use the ex-ante risk. Most of the risk indicators used in the studies is related to the firm specific risk or business risk.

Beatty and Ritter (1986) attempt to relate the ex ante uncertainty and the IPO performance. They argue that as the value of an issue would not be revealed until it is traded, the IPO contains ex ante uncertainty. As the ex ante uncertainty increases, the winner's curse problem among investors intensifies. Following Rock's study (1986), the uninformed investors will only submit purchase orders, if, on average, the IPOs are underpriced. Consequently, in the case of an issue with greater ex ante uncertainty, the uninformed investors demand more money be 'left on the table'. In other words, the greater the ex ante uncertainty, the greater the degree of underpricing. Furthermore, they emphasise that the ex ante uncertainty, which leads to the underpricing, does not correspond to the CAPM concept of systematic risk.

In order to test the hypothesis empirically, Beatty and Ritter (1986) employ two proxies for the ex ante uncertainty: the log of one plus the number of uses for the proceeds, and the reciprocal of the gross proceeds. Most issuers disclose their intention of the usage of net proceeds received from the flotation in their IPO prospectuses. In the UK listing rules, the Financial Service Authority requires the disclosure of such information in the prospectus (FSA, 2001). Following Rock

(1986), Beatty and Ritter (1986) argue that providing investors with the number of proceeds usage reduces the uncertainty, which leads to reduction in IPO risk. The evidence shows that there is a negative relationship between the number of proceeds usage to the degree of underpricing.

The second proxy for the ex ante uncertainty is the reciprocal of the gross proceeds. They argue that gross proceeds reflect the firm's size. It is understood that large firms are less risky than the small ones. The results confirm the positive relationship between the uncertainty and the degree of underpricing. Moreover, an implication of this finding is that, if the level of ex ante uncertainty is endogenous, an issuer has an incentive to reduce this uncertainty by voluntary disclosing information.

Recently, Leone *et al.* (2003) investigate the disclosure of intended use of proceeds and the underpricing in more detail. They assess the paragraphs in prospectuses, which explain the firms' intentions regarding the use of the proceeds. They categorise the IPOs into 7 classes of usage, such as paying debt, paying old shareholders, investment, marketing, working capital, R&D, and others. Their first interesting finding is that IPOs that disclose higher percentage of proceeds to any specific use, tend to have lower initial return, while IPOs that vaguely disclose such information tend to have higher initial returns. The second result is that the use of proceeds for paying debt and investment is significantly related to the underpricing. The implication of this is that specific information disclosed prior to the IPO leads to reducing the uncertainty and then the error in IPO pricing.

Other studies (Simunic and Stein, 1987; Beatty and Welch, 1996) employ the number of risk factors provided in the prospectus as a proxy to IPO risk. Usually, the risk factors mentioned in the prospectus are firm specific risks, such as related operating risks. Although the more information disclosed in the prospectus means reducing uncertainty, the greater number of risk factors shows increasing firm riskiness. Both studies use US data and find a significant positive association between the number of risk factors and the IPO initial returns.

Klein (1996) hypothesises that the IPO value is a decreasing function of firm risk. This implies that the riskier the IPO, the lower the price. Having examined a number of proxies for risk used in the IPO studies, she claims that they may mislead the result interpretation. In contrast to Beatty and Welch (1996), she disagrees with the use of the number of risks disclosed in the prospectus as a proxy for firm risk. Such a proxy implies that a firm, which discloses 4 types of risk in the prospectus, is twice as risky as another, which reports 2 types of risk. She argues that it misleads, as it is not always the case. Therefore, she proposes a dummy variable as a proxy for risk. In her research design, she assigns dummy 1 for IPOs, which have a boldface risk reference on the prospectus cover, and 0 otherwise. She argues that the disclosure of the risk reference on the prospectus cover shows the issuers' concerns of the business risk that they face. Therefore, it should draw the investors' attention when they buy the IPOs.

Using a sample of 193 IPOs during the period 1980-1991 on the NYSE, the results on the offer and market price show support for the hypothesis, which confirms the negative relationship between firm risk and the offer and market prices.

The studies reviewed above use risk measures derived directly from the prospectus provided by issuers. There are a couple of studies that try to use several risk measured derived from the accounting information which is also disclosed in the prospectus.

Myers and Majluf (1984) investigate the corporate financing and investment decisions under information asymmetry. For their IPO sample, they find that debt does not play a signalling role to the firm's value. Their analysis implies that leverage increases with the extent of information asymmetry. Since prior studies show a positive relationship between underpricing and information asymmetry, they postulate that underpricing is positively related to the debt ratio.

In line with Myers and Majluf (1984), Su (1999) examines the role of pre-IPO leverage in explaining the underpricing puzzle. He employs three different proxies (the debt to total asset ratio, the debt to equity ratio, and the debt to net asset ratio). Using a data set from China, he finds a similar result to the above study. The evidence shows that firm's pre-IPO leverage is positively related to the degree of underpricing (or IPO initial returns). However, only the debt to net asset ratio is found to be significantly related to the IPO initial return.

A similar study using UK data is conducted by Khurshed *et al.* (1999). They use the pre-IPO debt ratio as a proxy for the firm financial risk among other explanatory variables to explain the variation in IPO long-run performance. They find a negative relationship between the debt ratio and IPO buy and hold returns. However, the relationship appears to be insignificant.

In contrast to the two studies above, Hedge and Miller (1996) argue that the firm's pre-IPO debt has an important role in signalling the firm's value. They argue that prior to going public, the issuers of high-quality firms use debt to signal inside information about the expected value and standard deviation of returns on assets. A larger debt ratio allows the issuers of high-quality firms to increase the expected return on equity. Therefore, debt is a credible signal of firm quality. This argument is in line with Slovin and Young (1990), who find that low-risk firms signal their type by borrowing prior to IPO.

Based on this argument, Hedge and Miller (1996) posit three hypotheses. Firstly, they expect that the risk of a firm is a decreasing function of its pre-IPO debt ratio. Secondly, the expected value of a firm is an increasing function of the level of its pre-IPO debt. And thirdly, the degree of underpricing is negatively related to the pre-IPO debt ratio. To test these hypotheses, they use the post-market value of equity (i.e., the number of shares outstanding times the first day closing price) as a proxy to the firm value, the standard deviation of daily share returns over the first 15 trading days as a proxy for the firm risk. They employ 2 measures for debt; the level of pre-IPO book value of debt and the debt ratio, which is computed as the pre-IPO book value of debt divided by the sum of debt and post-market value of equity.

Using 890 IPOs in the US during the period 1981-1985, they find that there is a negative and slightly significant association between the firm's risk and the pre-IPO debt ratio. Moreover, they find robust results for the second and third hypotheses. The level of pre-IPO debt appears to be positively related to the post-IPO firm's value, and the pre-IPO debt ratio is negatively related to the degree of underpricing. This result implies that the leverage plays a significant role in IPO signalling.

Conclusion

IPO literature documents three anomalies in the market; the persistent underpricing, the long-run underperformance, and the hot market. There is no single consensus hypothesis that could explain the anomalies. The current explanations of the underpricing are mostly based on the information asymmetry among the market participants, which leads to mis-pricing the IPOs on the early days of trading.

Although the evidence of the long-run underperformance of IPOs is less consistent than the underpricing facts, some studies, assuming markets are efficient, suggest that the anomaly is a result of a market correction of the IPO mis-pricing. The hot market anomaly, so far, is only confirmed in studies of the US market. The current explanations are also related to the investors' behaviour in certain economic states, which, in turn, results in the underpricing and eventually in the long-run underperformance.

This study aims to fill some gaps in the literature. Firstly, this is the first UK study to use the accounting-based valuation model. Most IPO valuation studies investigate the pricing of the IPO on the first trading day, only few attempts to examine the offer price (e.g., Klein, 1996; Beatty *et al.*, 2002). This study offers an explanation of the pricing of the UK IPOs both, at the firm level and the market level. Finally, most IPO studies try to examine the association of the IPO underpricing and the long run performance. This study examines the relationship between the IPO pricing and the underpricing, and/or the association between the IPO pricing and the underpricing and the long run performance, in the hope that it could provide new explanations to the IPO anomalies.

Chapter 3

Chapter 3

Research Design

Introduction

This chapter will explain the research methods and the data used to carry out the investigation into IPO valuation and performance in the UK main market. A number of IPO valuation models have been discussed in the literature review as well as current explanations regarding IPO performance. The next section outlines and discusses the research models used in this study. The exposition includes a discussion of the theoretical foundations of the models, the IPO valuation models, the initial return models, and the long run performance models. This chapter also describes and defines each research variable used in the empirical models. The working hypotheses that the IPO valuation and performance models are designed to evaluate are presented in the second section. This is followed by a section that discusses the research methods used, the main features of the UK institutional framework, and the sample of IPOs used in the empirical analysis.

3.1. Research models

This section discusses the models used in this study. The section starts with a discussion of the theoretical foundation on which the empirical models are based. This is followed by a discussion of the empirical models for IPO valuation, short-run performance and long run performance.

3.1.1. Theoretical Foundations

Going public is often a long and hectic process for a firm that wishes to raise funds by offering its shares to the public. There is a long list of requirements that have to be fulfilled before a firm can obtain permission to list its shares on the stock market. One requirement is to disclose all relevant information to the public in a document, called the prospectus.

According to the UK Listing Authority, a prospectus for the admission of shares must contain a list of information items, including the issuer's assets and liabilities, financial position, profit and losses, and also the recent development and prospects of the firm. (The Listing Rule, Chapter 6).

Prior studies have examined the role of fundamental accounting figures (for example, pre-IPO and forecasted earnings, pre-IPO and pro-forma book value, pre-IPO and forecasted dividend), which are disclosed in the prospectus, on IPO valuation (Korean market: Firth, 1995; Firth et al, 1998; US market: Klein (1996); Kim and Ritter, 1999). From both regulatory and empirical perspectives, the impact of fundamental analysis on IPO valuation and long run performance is of central importance and it would therefore be valuable to undertake further examination of these issues.

As discussed in the literature review, most IPO studies agree that the IPO underpricing is an increasing function of risk (Beatty and Ritter, 1986; Clarkson and Simunic, 1994; Klein, 1996; Houge et al, 2001). Moreover, it can also be concluded that some variables reported by issuing firms can serve as effective signals regarding firm value (see Welch (1989), Carter (1990)).

This study aims to investigate the impact of prospectus information that is proxied by the firm's fundamentals, ex-ante risk factors and signals, which are available to the market prior to the admission, on IPO valuation and performance in the UK main market. The IPO valuation is examined using an accounting-based valuation model. To the researcher's knowledge, none of the prior IPO studies employ this model. This study also examines the impact of IPO pricing factors on the performance in the short run as well as in the long run. Keasey and Short (1992) investigate the association between the degree of underpricing and the level of *ex-ante* uncertainty in the USM market during 1984-1988. This study will analyse the impact of fundamentals, ex-ante risk factors, and signals, which are disclosed in the offering prospectus, on the initial returns (the degree of underpricing) in the UK main market during 1987-1997. Additionally, this study also investigates the relationship between the prospectus information and the long run performance, which are defined as the investors' abnormal returns in subsequent years. Before discussing the empirical models used in this study, the theoretical foundation will be explained first.

A general motivating assumption behind this and most other models of financial decision making is that investors are risk averse. In IPO cases, it is also usually assumed that the issuers' objective when making an offering is to maximise the number of shares sold and their price in order to obtain the maximum possible amount of funds from new investors (Loughran and Ritter, 2002). Based on those assumptions, the pricing of IPOs is (or should be) affected by firms' ex ante risk characteristics. In order to persuade investors to buy riskier IPOs, issuers and sponsors need to offer an incentive, which is a lower price. Therefore, it can be inferred that riskier IPOs are priced lower than less risky IPOs.

When IPOs come to the market, investors begin to estimate the prices based on their assessment of a firm's ex ante risk characteristics. As investors tend to avoid buying riskier assets, the demand for riskier IPOs can be expected to be lower than the demand for less risky IPOs. Hence, holding the supply of IPOs constant, the market-determined price of riskier IPOs would be lower than the market prices of their less-risky counterparts. As the number of shares of all IPOs is limited, there are some investors, who will be left with riskier IPOs. However, they would not be prepared to bid the same price as for the less risky IPOs. As a result, the market determines lower prices for riskier IPOs. Therefore, in line with Klein's hypothesis (1996), it could be posited that IPO prices (the offer prices and the market prices) are a decreasing function of firms' ex ante risk factors.

Most IPO signalling studies show evidence of the role of underpricing as a signal of firm value. They conclude that there is a positive relationship between the degree of undepricing and firm value. Based on the risk-return relationship theory, in order to be induced to hold riskier assets, investors demand a higher return from such investments. Since the degree of underpricing will be negatively related to the expected rate of return for investors who buy the shares at the offering price and then sell them at the first day closing price, it could be posited that investors demand a higher degree of underpricing for riskier IPOs.

In the long run, as more information about the quality of the firm becomes available in the market, the relationship between the ex-ante risk factors and IPO pricing is anticipated to weaken. However, the relationship is expected to follow the general risk-return hypothesis, which posits a positive association between risk and expected returns.

In addition to the fundamentals and the ex-ante risk factors, this study also examines the relationship between a number of signals and the IPO prices and performance. In IPOs, issuing firms try to reveal the firm value by signalling. From the firms' point of view, firm value is not determined solely by reference to current information, but rather the future prospects of the firm is also relevant. Since issuers are "insiders" that are better informed about the firms' prospect than potential outsider investors, the insiders of firms with good prospects will be motivated to reveal (i.e., signal) this valuable inside information to prospective investors. If the signal works effectively, it should influence investors' decision making in respect of IPO pricing, and perhaps be associated with reduced mispricing. If the signal influences the IPO pricing process, it can be expected to consequently also affect IPO performance in the short run and possibly also in the long run.

3.1.2. The basic IPO valuation model

As discussed in the literature review, many studies use different methods in valuing IPOs. From a practical perspective, McCarthy (1999) argues that the IPO pricing process contains both science and art. The scientific part enters the process when the underwriters and issuers utilise historical information provided by the firm to set the IPO price. The art component comes when market information such as price-earnings multiples of comparable firms are taken into consideration to value the IPO. From an academic point of view, Kim and Ritter (1999) analyse the usefulness of the comparable firms' multiple methods. They find that the comparable firms multiple methods are helpful. However, they conclude that adding the information regarding market demand into the analysis will also enhance the pricing accuracy. In another study, Berkman et al (2000) find that the comparable firms multiples and the DCF methods provide similar accuracy levels in explaining the IPO prices. Using UK USM data, Keasey and Short (1997) examine the relationship between firm value and a number of signals, in particular focusing on the retained equity.

This research will employ different valuation methods from the studies discussed above. Richardson and Tinaikar (2004) argue that the role of the accounting based valuation model has been of fundamental interest to analysts, investors and researcher alike. The accounting based valuation model, principally, argues that the value of the firm is a function of its book value of equity and the earnings.

There have been many empirical models based on the accounting based valuation model (e.g., Easton and Harris, 1991; Ohlson, 1995; Francis and Schipper, 1999). Some of them expand the model by including a number of firm characteristics, such as negative earnings (Collins et al., 1997; Rees, 1999), capitalisation and leverage level (Rees, 1997), or taxes (Fama and French, 1998). While the applications of the accounting based valuation model have been used widely in non-IPO cases, to date it has been relatively little used in IPO studies.

The advantages of using the application of the accounting-based valuation model to IPOs can be explained as follows. Firstly, unlike the comparable firms multiples and the DCF methods, this model is much simpler, as it does not require information regarding other firms nor cash flow forecasting, which are rarely available for young IPO firms. Secondly, the model allows the inclusion of other characteristics of the firms, such as IPO firms.

The basic valuation model used in this research is based on price as a function of book value of equity and earnings (Easton and Harris, 1991), as expressed below:

$$P = f(BV, E) \qquad (1)$$

P is the IPO price per share. Since there are two different levels of IPO prices, the offer price and the initial market price, *P* is defined as the offering price (P_0) and the initial market price (P_1). *BV* is the book value of equity and *E* is earnings.

Prior studies show that the inclusion of negative earnings to the valuation model allows us to differentiate the impact of the loss making firms on the valuation (Hayn, 1995; Collins et al, 1997; Rees, 1999). Since most IPO firms are young, it is expected that some of them have not produced profits at the time of the IPO. Hayn (1995) argues that firm's losses are less informative than profits about firm's future prospects. Her study also proves that pooling profitable and loss making firm observations in the sample leads to a downward bias in the estimated earnings response coefficient. Therefore, it is reasonable to control for the negative earnings impact by including a dummy for negative earnings (*D*) and the interactive term (*D**E*) into the model.

Using non-IPO firm data, Rees (1997) finds that dividends, as a proxy for permanent income, give a significant and positive signal to the firm value. The research sample in this study is drawn from the UK main market, which includes big and small firms. Most big firms paid dividends prior to the IPOs and disclosed the dividends forecast in the prospectus, while most small firms did not pay dividends prior to the IPOs nor promised any dividend in the near future.

Therefore, the pro-forma dividend is included in the basic valuation model, to examine whether the dividends contains signalling information to the firm value.

With inclusion of the dummy for negative earnings, the interactive term and the dividends, the basic valuation model could be expressed as

$$P = f(BV, E, D, D*E, Div) \qquad (2)$$

where P is the offer (initial market) price, BV is the book value of equity, E is earnings, D is a negative earnings dummy, $D*E$ is an interactive term, and Div is the proforma dividends.

To implement equation (2) to the empirical model, a number of considerations are taken to suit the IPO firms. Firstly, when the issuers/sponsor set up the offering price, they base the pricing on the enlarged number of shares (the number of firm shares following the admission), and so does the market on the first trading day. Therefore, other explanatory factors should be based on the enlarged number of shares[1]. Secondly, prior IPO literature show that the future accounting number, such as book value of equity post IPO (Kim and Ritter, 1999) and earnings forecasts (Firth et al, 1998) have a higher predictability power to the valuation than the historic accounting numbers. Plausibly, it could also be argued that since IPOs are typically young and high growth firms, the expected future figures are likely to be more important than the reported pre-IPO figures.

Considering the arguments above, the empirical basic IPO valuation model can be written as,

$$P_i = \alpha_0\, pBV_i + \alpha_1\, fE_i + \alpha_2\, D_i + \alpha_3\, D*fE_i + \alpha_4\, pDiv_i + \varepsilon_i \qquad (3)$$

[1] Thanks to Professor Michael Brennan for this valuable comment in an informal meeting with PhD students at Strathclyde University, 2000.

where P_i is the offer price (or initial market price) per share of IPO i, pBV_i is the pro-forma book value of equity per share of IPO i, fE_i is forecasted earnings per share (EPS) of IPO i, D_i is a dummy variable for forecasted negative earnings, it takes 1 where EPS is negative, D^*fE_i is an interactive term between the negative earnings dummy variable and forecasted EPS, $pDiv_i$ is pro-forma dividend per share of IPO i[2], and ε_i is the error term.

It is mentioned earlier that the research sample that is taken from the UK main market is a mix of big and small IPO firms. The market capitalisation – as one of the proxies for firm size – of the research sample ranges between £4 and £5500 millions, with a mean of £167.39 millions and a standard deviation of 539.86. It is clear that among the IPO firms in the sample, there is a scale difference, which may cause problems in interpreting the results.

Brown et al (1999) and Rees (1999) argue that researchers have recognized the presence of scale effects in the firm level analysis. They also argue that using per share data – as suggested by Kothari and Zimmerman (1996) and Barth et al (1992) – can reduce the heteroscedasticity problem, but does not adequately control for the scale effects, as shares come in different sizes. Easton and Sommer (2003) put forward arguments for the need to overcome the scale effect. Barth and Kallapur (1996) suggest two ways for dealing with the scale effect: deflation by a scale proxy or inclusion of a scale proxy as an additional independent variable. They explain, furthermore, that including a scale proxy as an independent variable can mitigate coefficient bias. However, researchers often

[2] Pro-forma book value disclosed in the prospectus is the firm's book value after the inclusion of net proceeds received from the offering. Forecasted EPS is a one year forecasted EPS disclosed in the prospectus. Pro-forma dividend is the last dividend payout ratio employed before the offering times the forecasted EPS.

deflate regression variables by scale proxies because deflation can mitigate heteroscedasticity as well as coefficient bias.

Following the literature as discussed above, the method chosen to deal with the scale effect in the valuation model here is deflation by scale proxy. The justification to the choice is firstly, as pointed out by Barth and Kallapur (1996), deflation can mitigate heteroscedaticity as well as coefficient bias problems.

Akbar and Stark (2003) identify four deflators previously employed in cross-sectional valuation models as proxies for scale: Sales (used in, for example, Hirschey, 1985); Number of shares (used in, for example, Rees, 1997; Hand and Landsman, 1999); Opening market value (used in, for example, Lo and Lys, 2000); and Book value (used in, for example Green, et al, 1996; Easton, 1998; Danbolt and Rees, 2002; Core et al, 2003).

Arguably, not all four deflators identified by Akbar and Stark (2003) above are appropriate to the research model in equation (3). The data used in this study is per share data, which automatically is deflated by a number of shares. However, as argued by Brown et al (1999) per share data does not adequately control for the scale effects, as shares come in different size. Therefore, the number of shares is not an appropriate deflator for the research model.

Using the opening market value as a deflator might be problematic in this study. This study analyses the IPO valuation on both the offer and initial market prices. Applying the opening market value as a deflator in the IPO offer price analysis results in a constant dependent variable of 1 (P_0/P_0)– then the analysis should be carried out using more complicated model, such as WLS regression, as suggested by Easton and Sommer (2003). Applying the opening market value as a deflator in the IPO initial market analysis results in a returns-form dependent variable (P_1/P_0), which has been a separate analysis as a part of this research (the IPO initial returns analysis).

Based on Barth and Kallapur's (1996) suggestion on dealing with the scale effect, it is clear that as a scale factor, book value is more appropriate than the opening market value or sales for two reasons. Firstly, it is included as an independent variable in the research model (equation 3), which, according to Barth and Kallapur (1996) could mitigate the coefficient bias. Secondly, using the book value as a deflator, transform the dependent variable to price to book ratio, which is a more common ratio used in the valuation, rather than price to sales ratio, or a constant (price to price ratio).

If the book value is used as a deflator, the question now is which book value (pre-IPO book value or pro-forma book value) to employ. Prior non-IPO valuation studies use the actual book value of equity (BV_t). Using IPO data, Kim and Ritter (1999) find that using the market to book value post IPO increases the predictive power of their valuation model, which is based on the comparable multiple within industry. The book value post IPO used in Kim and Ritter (1999) is measured by adjusting the book value pre-IPO with the net proceeds received from the offerings. Keasey and McGuiness (1992) also deflate their price model by the net assets at the IPO – including net proceeds – as disclosed in the prospectuses. There have indeed been a number of studies using the book value of equity post IPO – which is measured exactly in the same way as the deflator used by Keasey and McGuiness, 1992 – as a scale factor (e.g., Firth and Liau-Tian, 1998; Chen and Firth, 1999; How and Yeo, 2000). Since the objective of this study is to value the IPOs based on the information that is available at the IPO date, it uses the pro-forma book value, as it is disclosed in the prospectus.

As explained in footnote 2, the pro-forma book value is the firm's book value of equity after the inclusion of net proceeds from the offering. One might argue that the pro-forma book value contains a signalling attribute, which could lead to an issue of whether the pro-forma book value is a biased factor. However, having taken the IPO sample that was brought to the market by offer for sale and/or placing methods, it could taken as virtually certain that the firms get the expected net proceeds after the offerings. Moreover, the empirical data shows that only 3 out of 161 IPOs in the final sample actually received a different amount of money from the expected net proceeds[3]. The mean value of the expected net proceeds – recorded from the prospectus – is £93.97 millions, and the mean value of the realised net proceeds – recorded from the KPMG new issues statistics – is £94.05 millions. The difference is small and a statistical test shows that it is not statistically different to zero, which implies that the mean value of the expected net proceeds is not different to the realised net proceeds[4]. Therefore, it is sufficient to say that the pro-forma book value is not biased.

The basic valuation model is as follows,

$$\frac{P_i}{pBV_i} = \alpha_0 \frac{pBV_i}{pBV_i} + \alpha_1 \frac{fE_i}{pBV_i} + \alpha_2 D_i + \alpha_3 \frac{D * fE_i}{pBV_i} + \alpha_4 \frac{pDiv_i}{pBV_i} + \varepsilon_i \qquad (4)$$

The description of variables is similar to the ones in equation (3) deflated by pro-forma book value per share. Since many prior valuation studies employ the realised book value as the scale factor, this study also runs equation (4) using the book value pre IPO as a sensitivity analysis. This is discussed further in section

[3] All 3 IPOs received more net proceeds that expected. The deviation ranges from £700 thousands to £4.30 millions, or approximately about 0.5% - 7.1%

[4] A statistical test for a mean difference of paired sample is undertaken. The result cannot reject the null hypothesis of the equal mean of the expected and the actual net proceeds at 95% level.

4.7.2 of Chapter 4. It should be noted that the results are generally insensitive to the choice of pro-forma book value of book value pre IPO as scale factors.

3.1.3. The IPO valuation model

The main objective of this research is to analyse the impact of risk factors and signal variables on IPO valuation and performance. As discussed in the literature review chapter, to some extent, firms' ex ante risk can be expected to affect the IPO valuation as well as its subsequent performance (Johnson and Miller, 1988; Ritter, 1984; Beatty and Ritter, 1986; Klein, 1996). Many IPO signalling studies use a range of different signals to value IPOs and find that some signals have been very significantly related to IPO valuation. This section presents empirical models, which are used to test the research hypothesis, particularly, on IPO valuation. The empirical models, which explain the relationship between ex-ante risk factors, signals and IPO performance, will be presented in the next two sections.

Firstly, using equation (4) above, the model tests the relationship between the fundamental accounting information to the IPO offer price (P_0) and the closing price on day one or the initial price (P_1). The model will be then extended to include the ex-ante risk factors and signals variables. As explained in the introduction chapter, the ex-ante risk factors proxies employed in this study are based on the Arthur Andersen Business Risk Model (AABRM). However, after doing a thorough content analysis of the prospectus obtained, only 5 out of 55 risk factors identified in the AABRM appear to be consistently disclosed and measured in the documents. A detailed content analysis of the prospectuses on the AABRM is presented in section 3.4 of this chapter. The 5 ex-ante risk factors identified are divided into two groups; financial risk and non-financial risk factors. The financial risk factors are leverage risk and capital availability risk. The non-financial risk factors are efficiency risk, capacity risk, and industry risk.

The leverage risk factor (*Lev*) is the risk that occurs because of the external capital used by firms. Modigliani and Miller (1966) show that introducing debt increases the systematic risk of a firm's equity. As more debt is used in firms' capital, consequently firms are liable to pay more interest. Moreover, increasing debt in a firm's capital structure means a higher probability of the firm going bankrupt. Therefore, it is commonly accepted that the higher the leverage, the riskier the firm's equity. As discussed in the literature review chapter, there have been a number of studies, which have examined the relationship between firm leverage and valuation, although few have been done for IPO samples. Rees (1997) examines the value relevance of debt for non-IPO firms. Using debt to book value as a proxy for leverage, he does not find robust evidence that equity value is affected by the level of debt. Still, give the possibility of leverage increasing the risk of equity, this study employs the debt ratio as a proxy for firm's ex-ante leverage risk. Since the listing rules require that the IPO prospectus should disclose at least three years pre-IPO financial statements, the ex-ante leverage risk employed in this study is the average of the pre-IPO debt ratios from all financial statements disclosed in the prospectus to capture the information content of all disclosed financial statements[5].

The other financial risk factor examined in this study, is capital availability (*Cap*). There are two sources of capital; internal and external. As

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[5] Although the listing rules require a disclosure of at least the last three years pre-IPO financial statements, it is possible to present less than three years statement if the firms are young.

described above, using external capital, such as debt, increases the firm's financial risk. Meanwhile, internal capital, such as retained earnings, is less risky. Therefore, a larger fraction of earnings retained in the firm means higher capital availability and less financial risk. The capital availability risk is measured by an average of the ratios of retained earnings over net income from the financial statements disclosed in the prospectus. Mathematically, the ratio of retained earnings over net income could be expressed as one minus the firm's payout ratio.

Additionally, the IPO valuation model also includes a number of non-financial risk factors. The first non-financial risk factor examined is the efficiency risk (*Effr*), which describes the firms' production effectiveness. In economic terms, production effectiveness is measured as a production cost. The more efficient the firms' operation, the less is the production cost and efficiency risk. As discussed earlier in the literature review chapter, a number of studies show a positive relationship between the production effectiveness and the economic performance of the firms. Jain and Kini (1994) specifically examine the operating performance of IPO firms after listing. They find that IPOs, which are more underpriced, tend to have worse operating performance. The inclusion of the efficiency risk factors into the IPO valuation model is because very little information regarding a firm is available prior to the offering. Such information can help investors to assess the IPOs value. The efficiency risk is measured by an average of the pre-IPO ratios of the cost of good sold over firm sales from all financial statements disclosed in the prospectus. The greater ratio describes the larger efficiency risk, which means that the IPO firms operate less efficiently.

The main reason why firms go public is to raise more funds for their operations. Most issuing firms claim that the proceeds received from the offering is proposed to fund a specific investment projects for business expansion. However, in many cases part of the IPO proceeds is used for other non-investment activities, such as to redeem preference shares, repaying debt or to provide an exit of the pre-IPO investors. A number of IPO studies investigate the impact of the IPO net proceeds on the IPO underpricing or prices (e.g. Beatty and Ritter, 1986; Klein, 1996; Espenlaub et al, 1999; Leone et al, 2003). This study examines the impact of the proportion of net proceed that is allocated in the investment plan, which is called Capacity risk (*Cpy*) on the IPO values. In the AABRM, capacity risk is defined as the risk of new firm projects to the firm's capacity. In this study, *Cpy* shows the risk of the utilisation of the IPO net proceeds. The bigger the part of IPO proceeds used for investment activities, the bigger uncertainty of the return of the investment, hence the higher the capacity risk. This study uses the ratio of proposed investment plan over IPO proceeds as a proxy for capacity risk. The greater the ratio indicates higher capacity risk. To some extent, the use of this variable is unique, since none has ever looked at the investment plan figures that are disclosed in the prospectus as a research variable.

Beaver *et al* (1970) argue that the accounting (firm) *Beta* (β) is an essential element to assess the riskiness of the firm's value. The firm β is defined as the sensitivity of the firm's share price to changes in the level of the market index. However, due to limited information of the firms' share price before the admission, the industry β used here provides a proxy to the pre-IPO firm β.

Moreover, the Arthur Andersen Business Risk Model (AABRM) includes the riskiness of the industry as the firm's risk factor. Therefore, the inclusion of the industry β in this model is not only for the proxy of the firm β, but also as a measure of the industry risk. The quarterly β of the industry on the offering date is used as a proxy for industry risk. The β is obtained from the Quarterly Risk Measurement Service from London Business School.

Signal variables used in the models are the commonly used variables from previous studies of IPO signalling models, such as sponsor reputation [Beatty and Ritter (1986), Byrne and Rees (1994), Keasey and McGuiness (1992)], firm age (Feltham et al, 1991), and the proportion of equity sold at the flotation [Welch (1989), Firth and Liau-Tan (1998)].

In addition to the robust empirical evidence from previous studies, the inclusion of sponsor reputation into the IPO valuation model also has a theoretical foundation. Baron (1982) explains how investment bankers take a significant role in determining the subscription and allocation of the shares on IPOs. However, the underwriting contract also reflects a certain degree of firm quality certification. By sponsoring an IPO, the investment banker is bound into a contract with the issuing firm to market the shares being offered. If the issue is fully underwritten, investment bankers will make great efforts to sell all shares since any shares that are left unsold will become their responsibility. Since investment bankers know the risk of underwriting these contracts, the prestigious investment banker will only sponsor good quality firms. Hence, lower quality firms would be sponsored by less prestigious sponsors since they could not bear paying the high fee for the prestigious sponsor. Therefore, in this study, sponsor reputation is chosen as one among other credible signals of firm value. It is posited that IPOs, which are sponsored by prestigious sponsors, will be priced higher than IPOs brought to market by less prestigious sponsors. In this study a dummy variable is used as a proxy for sponsor reputation taking the value of 1 for prestigious sponsors and 0 for less prestigious ones. The reputation classification is a modification of the method used by Keasey and McGuiness (1992). The classification is based on how many IPOs were sponsored by an investment bank in a preceding quarter period, prior to an IPO comes to the market. Investment banks that sponsor more than 3 IPOs during the specified quarter are classified as prestigious sponsors and investment banks that sponsor 3 IPOs or less are classified as less prestigious sponsors.

There have been many attempts to use firm age as a variable to explain the IPO anomalies. However, very little empirical evidence shows a significant relationship between firm age and the IPO anomalies. In this study, age is viewed as a non-financial ex ante risk factor. It is presumed that firm age reflects the extent of experience gained by firms regarding the business operations, which in turn indicates the stability of the business. In terms of business risk, it could be said that more stable firms have lower risk. Older firms are expected to have more experience, which facilitate the business stabilisation and thus lower risk. Hence, firm's age could influence the IPO valuation. Another reason for the insertion of age in the model is that one of IPOs main characteristics is that they tend to be young firms. Therefore, it is interesting to examine whether firm age explains the variability between the offer and initial IPO prices. A proxy for firm age is measured as years since it was incorporated up to the flotation date.

Initially, Leland and Pyle (1977) propose that the proportion of shares retained by insiders on equity offerings contains important information for investors. This is even more important for IPO cases since very limited information regarding the firm's value is available prior to the offering. Most stock exchanges (markets) require a certain minimum fraction of shares to be sold to the public. This also means that there is a maximum proportion of shares that could be retained by the existing shareholders and managers (hereafter, insiders). Leland and Pyle (1977) perceive that insider's decision on ownership retention indicates insiders' expectations of the firm's future prospects. When insiders are more confident regarding the firm's prospects, the more shares they will want to retain. Alternatively, it could be said that the greater the fraction of shares sold at the IPO, the less confidence of insiders' in the firm's prospects. The prior empirical evidence on the association of retained ownership and IPO valuation is robust. There have been a number of proxies for retained ownership used in IPO signalling studies. This study employs the percentage of shares sold at the offering as an inverse proxy for the retained ownership variable since this is ready information available in the prospectus.

Previous studies show that privatisation IPOs have significantly different value and performance in the market [Keasey and McGuiness (1992), Dewenter et al (1997)]. According to Martin and Parker (1997), UK privatisations have a significant impact on corporate performance. They find that there is an increasing performance after privatisation. Based on those results, it is important to control for the privatisation IPOs effect on the research sample. Most of UK privatisation IPOs took place between the late 80s and early 90s, which overlaps with the research period used in this study. During the sample period, there were

23 privatisation IPOs, 10 of which are included in the research sample. The model includes privatisation as a control variable. A dummy variable is included, where 1 is allotted for privatisation IPOs and 0 for private IPOs.

The empirical model used to test the relationship between the IPO valuation and risk factors and signal variables is formulated in the following equation:

$$\frac{P_i}{pBV_i} = \alpha_0 \frac{pBV_i}{pBV_i} + \alpha_1 \frac{fE_i}{pBV_i} + \alpha_2 D_i + \alpha_3 \frac{D * fE_i}{pBV_i} + \alpha_4 \frac{pDiv_i}{pBV_i} +$$

$$+ \alpha_5 Lev_i + \alpha_6 Cap_i + \alpha_7 Effr_i + \alpha_8 Cpy_i + \alpha_9 Ind_i + \tag{5}$$

$$+ \alpha_{10} Spo_i + \alpha_{11} Age_i + \alpha_{12} Eq_i + \alpha_{13} Priv_i + \varepsilon_i$$

where Lev_i is the ex-ante leverage of a firm proxied by the average of the natural log of the pre-IPO debt ratios, Cap_i is the availability of internal capital of a firm prior to flotation proxied by the average of the ratio of retained earnings to net income, $Effr_i$ is the ex-ante efficiency risk proxied by the average of the ratio of the cost of goods sold to sales, Cpy_i is the IPO proceed utilisation plan proxied by the ratio of the cost of specific investment plan disclosed in the prospectus to net proceeds, Ind_i is the industry risk of a firm at the flotation proxied by industry β, Spo_i is a dummy variable for the sponsor reputation taking 1 when IPO is sponsored by prestigious investment banks, Age_i is the age of a firm, Eq_i is the percentage of equity sold at the flotation, and $Priv_i$ is a dummy variable taking 1 when an IPO is a privatisation. The measure of each risk factors and signals are described above and summarised in table 3.1 below.

Table 3.1. Research variables, measures and data sources

Variables	Measure	Source
P_0/pBV	The offer price scaled by proforma book value of equity per share	Prospectus
P_1/pBV	Share price on the 1st trading day scaled by proforma book value	Prospectus-Datastream
IR	Natural log of P_0/P_1	Prospectus-Datastream
BHRxy	Buy and hold return of an IPO from day 1 to x year (x=1,2,3)	Datastream
fE/pBV	Forecasted EPS scaled by pro-forma book value of equity per share	Prospectus
D	Dummy variable for negative forecasted earnings. 1 for negative earnings	-
D*fE/pBV	Interaction term of negative forecasted earnings	-
Leverage (Lev)	An average of the natural log of total debt to assets ratio for all financial statements disclosed in prospectus	Prospectus
Capital availability risk (Cap)	An average of the ratio of retained earnings to net income for all financial statements disclosed in prospectus	Prospectus
Efficiency risk (Effr)	An average of the ratio of cost of good sold to sales for all financial statements disclosed in prospectus	Prospectus
Capacity risk (Cpy)	An average of the ratio of investment plan cost to IPO net proceed ratio for all financial statements disclosed in prospectus	Prospectus
Industry risk (Ind)	Beta for industry on the yearly quarter when IPO taken place	Risk Measurement Services
Sponsor reputation (Spo)	Dummy variable for Sponsor reputation. 1 for prestigious investment bankers (underwrite more than 3 IPOs in preceding quarter)	KPMG new issues statistics
Firm age (Age)	Natural log of company age at the IPO	Prospectus
Equity sold at the IPO (Eq)	% of equity sold at the IPO to the post- IPO (enlarged) number of shares	Prospectus
Privatisation (Priv)	Dummy variable for privatisation. 1 for privatisation IPO	Prospectus

3.1.4. The IPO initial returns model

The IPO valuation model aims to answer the question of whether the issuers/sponsors, and investors use the prospectus information to price the IPOs. Moreover, it is also expected to highlight the divergence of opinion among the market participants regarding the usefulness of prospectus information in pricing the IPOs. Therefore, it is interesting to analyse whether the opinion divergence has any significant impact on the IPO performance in the short run as well as, subsequently, in the long run.

As discussed widely in the IPO literature, the persistence of underpricing on the first day is still an unresolved puzzle. Many studies also show that the underpricing continues up to 5 days after the first trading. The IPO initial return model tries to examine whether the source of the opinion divergence (fundamentals, ex-ante risk factors and signals) could resolve the underpricing problem.

Beatty and Ritter (1986) argue that the underpricing degree is an increasing function of IPO ex-ante uncertainty, while Feltham et al (1991) show that the firm risk characteristics disclosed in the prospectus significantly influence the IPO underpricing.

The role of earnings forecasts on IPO valuation has been discussed widely in the previous section and the literature review chapter. However, very few scholars examine the impact of earnings on the IPO after-market performance (Firth, 1998). Using the earning forecasts, Firth (1998) finds that the accuracy of earning forecasts is positively related to the 1-year post-IPO cumulative abnormal returns (CAR). Furthermore, he expands his investigation up to 3-year returns and finds that the impact of the pre-IPO earning forecasts loses its significance. Using non-IPO data, Easton and Harris (1991) investigate the earnings-return relationship. They find a positive and significant association. As previous studies show robust evidence of the role of earnings on returns, this study also aims to investigate the earnings-returns relationship for IPO cases.

While a number of studies have discussed the relationship between the earnings forecasts and IPO returns, none have looked at the impact of the book value of equity on the IPO returns. Therefore, to some extent, this study contributes a new insight of the book value of equity role in IPO performance.

While the IPO valuation model in equation 5 includes a negative earnings dummy and dividends as parts of the fundamentals information, the IPO Initial Returns (IR) model only includes the forecasted earnings and the pro-forma book value of equity variables. The reason for the exclusion of the negative earnings and dividends is to make the IR model simple. Further analysis has been undertaken including those variables into the IR model, however the result indicated the variables were not significant. Therefore, the IR models used in this study exclude the negative earnings and dividends. Moreover, it is believed that the forecasted earnings to price ratio and the pro-forma book to market ratio provide adequate information for the fundamentals, which have been used in prior studies.

The ex ante risk factors mentioned in the valuation model above are also expected to have a significant relationship with the IPO initial return. Su (1999) finds a positive relationship between a firm's pre-IPO leverage and the degree of underpricing (or IPO initial returns). However, from three different proxies (debt to total asset ratio, debt to equity ratio, and debt to net asset ratio), only the debt to net asset ratio is found to be significantly related to the IPO initial return. In line with general hypotheses on the risk impact on initial return, this study anticipates a positive relationship between leverage and IPO initial return.

As explained in the previous section, the availability of internal capital is viewed as a financial risk factor. It is expected to influence the decision on IPO pricing and also the initial return. The more internal capital available to the firms reflects lower risk, so lower initial return is expected.

To date, no study has discussed the relationship between the IPO initial returns and the pre-IPO operating efficiency. Jain and Kini (1994) examine the after-market operating efficiency of IPO firms. They find that IPOs, which have greater initial returns, tend to be less efficient after the offering. Since it is likely that operation efficiency affect the whole performance of the firms, it exposes the firm to a degree of risk. Therefore, it is expected that the efficiency risk is positively related to IPO initial returns.

A number of IPO studies discuss the association between the net IPO proceeds and the underpricing. In some studies, IPO net proceeds are also used as a size control. However, this study argues that it is more important to view the utilisation of the IPO proceeds since it could expose a degree of risk in the future. As disclosed in the offering prospectuses, an investment purpose is the most common reason why firms go public. The fraction of the IPO net proceeds proposed for investment discloses a degree of risk, so called capacity risk. The higher fraction reflects the lower capacity risk, which in turn is expected to result in a lower initial return. [6]

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[6] As part of the robustness check, the net proceed has been included as an independent variable in the IPO valuation model in Chapter 4, section 4.7.2. The results show that the net proceed is not significantly to the IPO prices.

Many IPO studies document the robust industry effect on the underpricing. This study does not investigate the industry effect in a similar way to the previous studies. The reason is to preserve the degree of freedom. Since the research sample is restricted to 161 IPOs, using the industry dummies (5 standard industry classifications) reduces the model degree of freedom substantially. However, this study examine the impact of the industry risk on the IPO initial returns. As discussed earlier in the previous section, the quarterly industry β at the IPO date is used as a measure of the industry risk as well as a proxy to the firm β. The higher the industry β, the riskier the industry, and the higher the initial returns is expected.

There has been robust evidence on the underpricing of privatisation IPOs. This study attempts to contribute more evidence on the different impact of privatisation IPOs compared to other IPOs. Dewenter and Malatesta (1997) argue that the significant underpricing of privatisations could lead to a verdict of government deliberation in the pricing of privatisation IPOs. However, they do not find any evidence to support their hypothesis. Although this study does not try to test the government deliberation, it still holds that there is a positive relationship between privatisation and initial returns, as a result of underpricing.

Johnson and Miller (1988) investigate the relationship between the investment banker prestige and the underpricing. They find that IPOs brought to market by prestigious bankers tend to be less underpriced than IPOs brought by less prestigious bankers. Age and size also significantly affect the degree of underpicing (Feltham *et al.*, 1991). Finally, Koh and Walter (1992) find that equity retained by shareholders is negatively related to the underpicing.

In addition to those variables mentioned above, this study also considers unobservable variables, which may affect the underpricing. Although this study specifically investigates the relationship between fundamentals, a number of risk factors and signals and IPO initial returns, it is important to also examine other factors, which may have an impact on IPO performance. Therefore, similar to Beatty *et al* (2002), this study includes an unobservable variable into the IPO initial return model. Since the underpricing happens as a result of different valuation on the offer price and the initial market price, the standardised residual errors from the IPO valuation model on offer price is included into the IPO initial return model. It is expected that the greater the residuals, the lower the initial returns. In other words, the initial return is expected to be negatively related to the valuation residuals.

Considering the possible influence of fundamentals, risk factors, signals, and offer price residual errors, the IPO initial return model is formulated as follows;

$$IR_i = \alpha_0 + \alpha_1 \frac{pBV_i}{P_{0i}} + \alpha 2 \frac{fE_i}{P_{0i}} + \alpha_3 Lev_i + \alpha_4 Cap_i + \alpha_5 Effr_i + \alpha_6 Cpy_i + \alpha_7 Ind_i + \\ + \alpha_8 Spo_i + \alpha_9 Age_i + \alpha_{10} Eq_i + \alpha_{11} Priv_i + \alpha_{12} \mathrm{Res}_i + \varepsilon \tag{6}$$

IR_i is the initial return on the first trading day of IPO_i, which is measured by the natural log of the initial market price (P_1) divided by the offer price (P_0), or in mathematical term it could be expressed as,

$$IR_i = Ln(P_1 / P_0) \tag{7}$$

The fundamentals used to explain the variation in the IPO initial returns are proforma book value of equity and forecasted earnings, both scaled by the offer price (P_0). The variables, then, become the book-to-market and the earning-price ratios.

The description of ex ante risk factors and signals are as explained in the IPO valuation model section above and summarised in table 3.1, while Res_i is a proxy to unobservable ex-ante factors of firm i, and measured as the standardised residual from the IPO valuation model with the offer price as the dependent variable.

3.1.5 The IPO long run return model

Besides the puzzle relating to the high initial market return, the IPO market is also perplexed by the apparent underperformance of IPOs in the long run. This suggests that investors, who buy the IPO shares and hold them for up to three years, will benefit less than investors who hold comparable firms or the market index. In addition, Ritter (1991) found that there is a significant negative relationship between the degree of underpricing and the long run performance. In other words, it could be said that IPOs that are heavily underpriced tend to have lower return in the long run, which implies the evidence of reversion in the long run. However, the empirical evidence show mixed results (see table 1.2)

In contrast, signalling theory suggests that the good quality firms use underpricing as a signal of their true values. This implies that the good quality firms will have greater initial returns. They are also expected to perform better in the long run, and resulting in higher long run returns.

In this study, it is realised that the impact of fundamentals, ex-ante risk factors and signals on the IPO long run performance is likely to be weaker than on the short run performance, since more information is available to the market to price the IPOs in the long run. However, some variables may still have an effect in the long run.

Earnings are often observed as signals to the quality of firms in the valuation process. Usually, the earning forecast disclosed in the prospectus is supposed to reveal the insider's information about the firms' prospects. It is assumed that the higher earning forecasts reflect the higher quality of the firms. The high-quality firms are expected to perform well in the long run. Therefore, it could be hypothesised that the disclosure of earning forecasts is positively related to the IPO long run performance. However, such impact is not expected to last longer than 1 year, since the actual earnings figures will be available to the market after that.

It is also interesting to examine the impact of the pro-forma book value of equity on the IPO long run returns. Prior studies show mixed results on the relationship between the book-to-market ratio and share returns. Fama and French (1995) argue that the book-to-market ratio also measures the riskiness of the shares. They find that there is a positive association between the book-to-market ratio and the share returns. This study also posits the similar hypothesis, however parallel to the forecasted earnings, the impact of book-to-market on the IPO long run returns is not expected to be of significance on the IPO returns for 2 and 3 years, as new book-to-market figures become available to the market after the firms publish their post-IPO reports.

In this study, the general assumption of a positive risk-return relationship is used to investigate the association between the ex-ante risk factors and IPO long run returns. There have been no empirical results investigating the impact of pre-IPO firm's leverage to IPO long run performance. However, as discussed in the previous section, leverage is a common variable used as a risk indicator. The higher the leverage, the higher the financial risk of the firm. In line with the theoretical explanation on the impact of risk factors on IPO long run performance, it is expected that higher leverage expose the firm to higher risk, which in turn is expected to result in higher long run returns. Khurshed et al (1999) are among the first to investigate the impact of pre-IPO firm's leverage on the long run performance, however, they do not find any significant relationship.

The explanation of the impact of other risk factors (capital availability risk, efficiency risk, capacity risk, and industry risk) on IPO long run returns is similar to the explanation written in the previous section. This study is among the first to examine the ex-ante risk factors mentioned above in relation to IPO long run performance. Given a positive risk-returns relationship, it is expected that the relationship between the ex-ante risk factors and the IPO long run performance is positive.

Menyah et al (1995) present evidence on the long run performance of UK privatisations. They conclude that they are different from private IPOs, and privatisations IPOs do not underperform the market. Martin and Parker (1997) also confirm the difference in corporate performance in the long run regarding UK privatisations. It could be inferred that somehow privatisation has a different impact on long run performance.

As discussed in the previous section, firm age could be a proxy for business stability. Rationally, it is expected that a stable firm could perform better in the long run. Therefore, here it could be conjectured that firm's age has a positive relationship with the IPO long run performance. Khurshed et al (1999) investigate the impact of firm age on IPO long run performance. However, they find an insignificant result in relation to a statistical association between firm age and IPO long run performance.

Based on previous studies, a number of signal variables seem to have some impact on IPO long run returns, such as agent reputation (Brav and Gompers, 1997), and equity retained by insiders at the flotation (Koh and Walter, 1992).

Carter et al (1998) investigate the association between underwriter reputations on IPO long run performance and find a robust significant positive relationship. They argue that in the long run as more information becomes available in the market, there are adjustments to the more underpriced IPOs (as a consequence of less prestigious underwriter contract), which result in lower long run returns. Therefore, this study also posits a positive relationship between sponsor reputation and IPO long run performance.

Additionally, this study also re-examines the association between the ownership and IPO long run performance. Based on financial signalling theory, the retained ownership is an effective signal regarding the firm's true value. The higher proportion of shares retained by the old shareholders reflects their insider information regarding the firm's good prospects. Therefore, it is expected that there will be a positive relationship between the retained ownership and IPO long run performance. The inclusion of the ownership variable in the IPO long run model in this study is to re-examine such a relationship with UK data.

Considering fundamentals, ex-ante risk factors, and signals, the IPO long run return model is as follows:

$$BHAR_{xy_i} = \alpha_0 + \alpha_1 \frac{pBV_i}{P_{0i}} + \alpha 2 \frac{fE_i}{P_{0i}} + \alpha_3 Lev_i + \alpha_4 Cap_i + \alpha_5 Effr_i + \alpha_6 Cpy_i + \\ + \alpha_7 Ind_i + \alpha_8 Spo_i + \alpha_9 Age_i + \alpha_{10} Eq_i + \alpha_{11} Priv_i + \alpha_{12} \mathrm{Re}s_i + \varepsilon \qquad (8)$$

where $BHAR_{xy\,i}$ is the market adjusted IPO long-return of IPO_i from day 1 to x =1, 2, and 3 years, which is measured by the equation below:

$$BHAR_{xi} = \prod_{t=1}^{n}(1 + R_{t\,i}) - \prod_{t=1}^{n}(1 + MR_t) \qquad (9)$$

where $R_{t\,i}$ is the monthly dividend adjusted returns of IPO_i in month t, MR_t is the Financial Times Small Companies (FTSCO) market index returns in month t, n is 12, 24, and 36 months. When IPOs are delisted before their 1st, 2nd, or 3rd anniversary, the buy and hold returns are calculated up to the last month before they were delisted. Other variables in equation (7) are as described on the initial return model and summarised in table 3.1.

As discussed earlier in the literature review chapter, both buy and hold returns (BHR) and cumulative abnormal returns (CAR) have some limitations in calculating the long run return. However, Barber and Lyon (1997) suggest that BHR is a better measure compared to CAR, since the CAR appears to be a biased predictor for the BHR. Therefore the BHR is used in this study. In addition, FTSCO is used here as a benchmark. This index is replacing the Hoare Govett index for small companies, which is used by others (Levis, 1993; Khurshed, 1999). Since most of the research sample are small companies, using FTSCO index is likely more appropriate than using broader indices such as the FTSE all share index[7]. The benchmark choice has also been a long-standing debate in the IPO literature. Espenlaub *et al* (2000) re-examine the UK IPO long run abnormal returns using 5 different benchmarks. The results show that the outcomes are very sensitive to the benchmark used. Therefore, using the FTSCO index as the benchmark in this study is acknowledged to have some degree of limitation. To minimize such effect, a control variable, Size, is used in the IPO long run performance models, as applied in other studies (e.g., Gleason and Lee, 2002). In this study, the normal log of the market capitalisation at the IPO is used as a proxy for Size

Many IPO studies have investigated the relationship between the IPO underpricing (initial returns) and its performance in the long run. Based on the signalling hypothesis, the high-quality firms use the underpricing as a signal of their value. It is also anticipated that the high-quality firms perform well in the long run, which results in higher long run stock returns. Therefore, signalling theory suggests a negative relationship between the IPO initial returns and long run returns. However, Welch (1989) does not find any support for this hypothesis. In fact, Ritter (1991) and Levis (1993) find that there is a significant negative relationship between the IPO underpricing (initial returns) and the long run performance. They argue that the underpricing is a result of optimistic

[7] The analysis is also done using the FTSE All share index as the benchmark. The main results remain robust.

investors, and then as more information becomes available in the wider window, the returns are corrected by the market as a mean reversion effect. This study also tries to re-examine such a relationship and seeks to narrow the divergence of opinion on the relationship between IPO initial returns and the long run returns.

The inclusion of variables Size and IR in the long run model is expressed as follows:

$$BHAR_{xy_i} = \alpha_0 + \alpha_1 \frac{pBV_i}{P_{0_i}} + \alpha 2 \frac{fE_i}{P_{0_i}} + \alpha_3 Size_i$$

$$+ \alpha_4 Lev_i + \alpha_5 Cap_i + \alpha_6 Effr_i + \alpha_7 Cpy_i + + \alpha_8 Ind_i \qquad (10)$$

$$+ \alpha_9 Spo_i + \alpha_{10} Age_i + \alpha_{11} Eq_i + \alpha_{12} Priv_i + \alpha_{13} \mathrm{Re}s_i + \alpha_{14} IR_i + \varepsilon$$

where $BHARx_i$ is the buy and hold returns of IPO_i for period x, as measured in equation (9). IR_i is the initial return of IPO_i, as measured in equation (7). Other variables are identical to those explained and measured in the previous section.

3.2 Hypothesis development

This section tries to outline the development of testable research hypotheses. Based on the literature review and research models formulated above, the research hypotheses can be divided into three main hypotheses as presented in figure 1 (see Introduction chapter). The first main hypothesis is that the IPO valuation is related to the offering prospectus information. It is also expected that such information may provide the explanation to the IPO short run performance, however it is anticipated that the impact of the prospectus information in the long run is minimal. The second hypothesis is related to the underpricing anomaly, which is that if any mispricing is identified on the first trading day, it is expected that the underpricing is negatively related to the valuation residuals. The last main hypothesis is related to the IPO long run performance, which is that if any mispricing is identified on the first trading day, the market corrects the IPO prices in the long run.

The three main hypotheses are explained in more detail in a number of working hypotheses, which are presented and discussed in the next section.

3.2.1 Hypotheses regarding IPO valuation.

The hypotheses regarding IPO valuation are tested using the models in equations (4) and (5). Based on previous empirical studies and the basic model shown in equation (1), it could be inferred that price is an increasing function of the book value of equity and earnings. This leads to the formulation of the first two hypotheses (H1a and H1b)

H1a: There is a positive relationship between IPO offer (initial) prices and pro-forma book value of equity,

and

H1b: There is a positive relationship between IPO offer (initial) prices and forecasted earnings.

Next are the dummy variable and the interactive term. Previous studies show that negative earnings give a significantly different impact on share valuation. Hayn (1995) argues that losses (negative earnings) are less informative than profits (positive earnings) about the firm's future prospect. Therefore, the coefficient of interactive term (*D*fE/BV*) in the valuation model is expected to be more or less equal to the forecasted earnings (*fE*) coefficient, so that the two offset each other, and the negative earnings are expected to have little impact on the IPO prices. When earnings are negative, the book value of equity may become more important as a predictor of firm value. Consequently, the negative earnings dummy is expected to be positive.

> *H2: The negative earnings dummy is positively related to the IPO prices, while the negative earnings interactive term is expected to be negatively related to the IPO prices with the magnitude approximately equals to the forecasted earnings coefficient.*

The last variable of the fundamentals are dividends. Prior studies find a significant role of dividends in seasoned stock and IPO valuation. Moreover, as dividends could be categorised as permanent earnings, the inclusion of dividends describes how the transitory and permanent earnings could explain the variation in share price. Similar to the earnings variable, the dividends are also expected to be positively related to the IPO prices (H3)

> *H3: There is a positive relationship between the offer (market) prices and the pro-forma dividends*

As explained earlier, it is hypothesised that the riskier the IPOs, the lower the market price (H4). The rational explanation of this is based on the risk-aversion assumption. The risk-aversion assumption holds that based on available information, investors attempt to avoid risk. This implies that risky assets will face low demand in the market that result in lower market price. From the issuers' perspective, in order to sell the IPO shares, the riskier issuers will set a lower offer price. Below are working hypotheses on the association between each risk factor and the IPO offer (initial) prices.

> *H4a: There is a negative relationship between firm's pre-IPO leverage and IPO offer (initial) prices.*

H4b: There is a positive relationship between firm's pre-IPO capital availability and IPO offer (initial) prices.

H4c: There is a negative relationship between firm's pre-IPO efficiency risk and IPO offer (initial) prices.

H4d: There is a positive relationship between firm's pre-IPO capacity risk and IPO offer (initial) prices.

H4e: There is a negative relationship between industry risk and IPO offer (initial) prices.

Based on previous studies and the discussion in section 3.1.2.2, it could be posited that the signals are expected to give positive impacts on the IPO valuation (H5). A number of working hypotheses regarding the relationship between signal variables and IPO valuation is set below.

H5a: Sponsor reputation is positively related to IPO offer (initial) prices.

H5b: Firm age is positively related to IPO offer (initial) prices.

H5c: Percentage of equity sold at the IPO is negatively related to IPO offer (initial) prices.

Prior studies show that privatisation IPOs are priced differently to other IPOs. From the government's point of view, privatisation is a way to get more funds from the public. In order to ensure that privatisation IPOs could achieve the target of proceeds received and to ensure that investors would participate in subsequent privatisations, government may have underpriced the IPOs. In this study, the privatisation dummy variable is expected to have a negative association with the IPO valuations (H6)

> *H6: There is a negative relationship between the privatisation dummy and the IPO offer (initial) prices.*

3.2.2 Hypotheses regarding initial return model

Based on a discussion regarding the relationship between fundamental accounting and the stock returns in the prior section, a number of working hypotheses of such a relationship are set out below.

In the IR model, the pro-forma book value of equity to offer price ratio is used. Higher value of this ratio implies that the issuers/sponsors set the offer price at a low multiple to the book value of equity. Therefore, it could be hypothesised that the higher book-to-market ratio may suggest greater underpricing (H7a).

> *H7a: The pro-forma book value of equity to offer price ratio is positively related to IPO initial returns*

Prior studies show the important role of earnings in explaining the variance of stock returns (e.g. Easton and Harris, 1991). In this study, it is expected that the earning forecasts is positively related to the IPO initial returns (H7b)

> *H7b: The forecasted earnings to offer price ratio is positively related to IPO initial returns*

Based on previous studies [Ritter (1984), Beatty and Ritter (1986), Miller and Reilly (1987)], it could be posited that the riskier firms will experience greater initial return (H8). A number of testable hypotheses on risk factors and IPO initial return are established as follows.

H8a: There is a positive relationship between firm's pre-IPO leverage and IPO initial returns.

H8b: There is a negative relationship between firm's pre-IPO capital availability risk and IPO initial returns.

H8c: There is a positive relationship between firm's pre-IPO efficiency risk and IPO initial returns.

H8d: There is a positive relationship between firm's pre-IPO capacity risk and IPO initial returns.

H8e: There is a positive relationship between industry risk and IPO initial returns.

A number of signalling studies on IPOs show that the signal variables used in this study, to some degree, are expected to signal the true value of the firms. Therefore, the signals are expected to reduce the information asymmetry and lead to a reduction in the probability of mispricing, hence lower subsequent initial returns are expected (H9).

Carter et al (1998) explicitly test the relationship between the underwriter reputation and the underpricing. They find that the more prestigious the underwriters, the less the underpricing. Although using different proxies for underwriter reputation, other studies also reach similar conclusions (Johnson and Miller, 1988; Carter and Manaster, 1990). From the investors' point of view, the sponsor reputation gives a particular certification to the offer. Investors believe that prestigious investment banks only sponsor good firms' IPOs. Regarding the pricing, investors believe that prestigious sponsors set the IPO price more appropriately than others do. Therefore, this study sets the following hypothesis:

H9a: Sponsor reputation dummy is negatively related to IPO initial returns.

Beatty and Ritter (1986) find that the firm's age is significantly related to the underpricing. Here, age is assumed to be one of the risk factors that may affect the IPO performance in the short-run and long run. Age describes how long a firm has been established before it goes public. Older firms are assumed to have more business experience, which in turn reducing the business risk. Hence, it is expected that older firms are less underpriced than younger ones as it states in the next hypothesis.

H9b: Firm age is negatively related to IPO initial returns.

The very well known signal used in IPO signalling papers is the insider retention, which in this study is proxied by the percentage of equity sold at the flotation (*Eq*). Previous studies conclude that the more shares retained by insiders at the flotation give a good signal to investors. In this study, the percentage of shares sold at the IPO is used as a proxy to an inverse of insider retention. Therefore, this study also tests the following hypothesis:

H9c: The percentage of equity sold at the flotation is positively related to IPO initial returns.

It is argued in section 2.1, that in order to ensure the privatisation IPOs achieve the target proceeds, government set the IPO offer price lower than its true value. Therefore, it is expected that the privatisation IPOs experience greater initial returns than private IPOs (H10).

H10: There is a positive relationship between the privatisation dummy and the IPO initial returns.

The initial return model (Eq.9) includes the unobservable variable, *Resi* that is measured by the residual of the full IPO valuation model with the offer price as the dependent variable. The relationship between the residual and the IPO initial return is explained as follows. A positive residual indicates the IPO was offered at a high issue price relative to other IPOs in relation to their fundamentals. This may indicate over pricing of the IPOs and hence, it is anticipated that the residual is negatively related to the IPO initial return.

H11: There is a negative relationship between the residuals and IPO initial returns.

3.2.3. Hypotheses regarding the IPO long run performance

The hypotheses relating to the long run performance model are tested using equation (9). In the long run, more information is available in the market that could be used by investors in their pricing decision. Therefore, as argued previously, the impact of the three groups of variables (fundamental, ex-ante risk factors, and signals) prior to and on the IPO, on the IPO long run performance, tends to be weaker. However, prior studies also show that the impact of some variables could last longer than others. Therefore, this study tries to examine the relationship between the three groups of variables and the IPO long run performance. In general, it is expected that the relationship between the three groups of variables and the IPO long run returns are similar to the ones in the initial return model.

Fama and French (1995) find a positive association between the book-to-market ratio and stocks returns. They argue that the book-to-market ratio could be used as a proxy to risk factors in returns. The high book-to-market ratio is usually related to a distress firm. Therefore, based on the risk-return relationship, it is posited here that the pro-forma book-to-offer price ratio is expected to be positively related to IPO buy and hold abnormal returns.

H12a: The pro-forma book value of equity to offer price ratio is positively related to IPO long run abnormal returns

The disclosure of earnings forecasts in the prospectus is usually considered as a way by which a firm may signal its future prospect to the market. It is shown by prior studies that there is a positive relationship between the earnings forecasts and the stock valuation. It implies that the higher earnings forecasts reflect the high-quality firms. It is presumed that high-quality firms perform better in the long run than their counterpart firms. Therefore, in the long run, it is expected that firms that disclose higher earnings forecasts produce higher returns.

H12b: The forecasted earnings to offer price ratio is positively related to IPO long run abnormal returns

The next variable in the IPO long run performance model is size. Fama and French (1992) argue that simultaneously book-to-market ratio and firm size contain information of the riskiness of the shares. In this study, firm size is proxied by the normal logarithm of the market capitalisation at the IPO. The lower market capitalisation is defined as riskier IPOs. Therefore, based on the positive risk-return association, it is posited in this study that the small firms are expected to produce higher returns (H13)

H13: There is a negative relationship between the size and IPO long run abnormal returns

Based on previous studies, it could be inferred that to some extent the firm specific risk factors are related to the IPO long run performance. The general risk-return relationship is used in developing the hypotheses of the relationship between the ex-ante risk factors and the IPO long run returns. Thus, it is posited that the buy and hold returns is an increasing function of the ex-ante risk factors (H14)

A number of testable hypotheses regarding risk factors and IPO long run performance are set below.

H14a: There is a positive relationship between firm's pre-IPO leverage and IPO long run abnormal returns

H14b: There is a negative relationship between firm's pre-IPO capital availability risk and IPO long run abnormal returns

H14c: There is a positive relationship between firm's pre-IPO efficiency risk and IPO long run abnormal returns

H14d: There is a positive relationship between firm's pre-IPO capacity risk and IPO long run abnormal returns

H14e: There is a positive relationship between industry risk and IPO long run abnormal returns

A number of working hypotheses regarding signals and IPO long run performance are listed below. The issuers/sponsors employ the signals to reveal the firm true value. The signals are aimed at making a separation between the good firms to the bad ones. Therefore, it is expected that the signals affect the firm long run performance in positive ways (H15)

Similar to the explanation above, the firm's chosen sponsor is also understood as a way to signal the quality of the firm. Another explanation is that investment bankers often choose the firms that they would like to sponsor. The prestigious sponsors may tend to choose sponsoring the high-quality firms in order to preserve their credibility in the market. Therefore, in the long run the IPOs that are sponsored by the prestigious investment bankers are expected to have higher long run returns.

H15a: There is a positive relationship between the sponsor reputation dummy and IPO abnormal long run returns

As discussed earlier, firm's age is usually used as a proxy for the firms experience in business. It is anticipated that the more experienced firms tend to have stable profits. As it is assumed that investors are risk averse, they tend to put higher demand for the IPOs of the more experienced firms, which results in a higher market price. In the long run, if the perception of investors regarding the firms' value is retained, it is anticipated that the IPOs of more experienced firms perform better.

H15b: There is a positive relationship between firm age and IPO long run abnormal returns

The retained ownership is a common signal used to reveal the firm true value. It is presumed that the higher the percentage of equity sold at the flotation reflects the old shareholders' doubts regarding the future value of the firms, which is understood by investors as low-quality firms. Therefore, it is posited that there is a negative relationship between the percentage of equity sold at the flotation and the IPO long run returns.

H15c: There is a negative relationship between the percentage of equity sold at the flotation and IPO long run abnormal returns

Based on a number of studies of UK privatisations, it could be inferred that on average privatisation firms show better performance than their counterpart firms (private firms). Using two measures of long run return and three types of benchmarks, Samat (2000) finds that privatisation IPOs overperform the benchmarks. While Levis (1993) finds that all IPOs (private and privatisation) underperform the market, it could be conjectured that on average the long run performance of privatisation IPOs behaves differently to the private IPOs (H16).

H16: The privatisation dummy is positively related to IPO long run abnormal returns

The IPO long run performance models include the valuation residual (Resi) in the analysis, to capture any "mispricing" that takes place on the first trading day. However, this study assumes that the market is efficient, so any "mispricing", eventually is corrected in the long run. Therefore, it is expected that the IPOs with higher residuals (overvalued relatively to their fundamentals) on day 1, will have lower returns in the long run. (H17)

H17: Valuation residuals are negatively related to the IPO long run abnormal returns.

The IPO long run returns model includes the initial returns as an explanatory variable. Prior studies show that a mean reversion effect takes place in the IPO market, which means that IPOs that are more underpriced tend to have lower long run returns. However, the IPO signalling theory argues that the high-quality firms use the underpricing as a signal to their values. Therefore in the long run, they are also expected to perform better than the low-quality firms do. Thus, the increasing initial returns reflect the higher quality of the firms, and in turn result in higher returns in the long run. Based on the assumption that the market is efficient, this study posits a negative association between IPO initial returns and its long run abnormal returns.

H18: There is a negative association between IPO initial returns and the long run abnormal returns.

In sum, this section presents the development of a number of testable hypotheses in this study. The hypotheses are built on the theoretical framework considering the results of prior studies. Tables summarising the working hypotheses summary are presented in the appendix (see table A.3.1, A.3.2, and A.3.3).

The next section presents the research method, which includes the market institutional framework and the research sample.

3.3. Research method

3.3.1. UK Institutional Framework

A firm seeking admission to the London Stock Exchange (LSE) before 1995 could choose either to list in the Unlisted Securities Market (USM) or the official list. The USM was created in 1981, prior to the 'Big Bang' in 1986. It was intended to accommodate small firms looking for additional funding through providing them with a relatively low-cost method of seeking outside equity. These firms were characterised by their small size, unknown and/or risky nature and, often, the lack of an earnings record. Conditions for listing in the USM were simpler, cheaper, and less onerous than on the official list (Michie, 1999).

However, in the wake of the 1987 stock market crash, small firms listed on the USM were the ones that suffered most. Faced with these difficulties, small firms ceased to make new issues, as they were poorly received. Consequently, capital raised by USM firms dropped from £ 308m in 1988 to only £ 11.6m in 1991. Due to fewer firms being listed and less capital raised on the USM, the Stock Exchange announced its plan to close down the USM in 1993. At the end of 1996, the USM was abolished and replaced by the Alternative Investment Market (AIM), which had been launched in 1995. Similar to the USM, the AIM was designed to facilitate small, new, and growing firms to seek outside equity investors. Meanwhile the Stock Exchange continued the operation of its global market for big firms, the official list, which eventually was renamed as the main market (Michie, 1999). As a comparison, table 3.2 below highlights the main differences in the admission criteria for the main market and the AIM.

Table 3.2. Main differences in the admission criteria for the Main market and the AIM

Criteria	Main market	AIM
Minimum shares in public hands	Minimum 25% of shares	No minimum shares
Trading record	Normally 3 year trading record required	No trading record required
Shareholder approval	Prior shareholder approval required for substantial acquisitions and disposals	No prior shareholder approval required for transactions
Admission documents	Pre-vetting of admission documents by the UKLA (UK Listing Authority)	Admission documents not pre-vetted by Exchange or UKLA
Minimum market capitalisation	Minimum market capitalisation of £700,000	No minimum market capitalisation

Source: Financial Service Authority (2002)

Besides the market type, the issuing firms could also choose the marketing method used to bring the offers to the market. The most common methods used in the UK IPO market are the offer for sale and placing[8]. In an offer for sale, issuers could offer the shares at fixed price or tender. In a fixed price offer, the sponsor (and the issuer) fixes the offer price about two weeks before the admission date and undertakes the distribution of the shares at this price. In a tender offer, the offer price is set in a certain range and investors are invited to bid. However, most offer for sale IPOs in the UK market use the fixed price method. While applications for the offer for sale are invited from the public, the issue is sub-underwritten, at the same price, by a group of financial institutions. The placing is the most popular marketing method used on the LSE. The sponsor

[8] Other marketing methods available are introduction, offer for subscription, and intermediaries offer. The introduction method is used when a firm simply wishes to obtain a stock exchange quotation for its existing shares without issuing new shares to the market. An offer for subscription is an invitation to the public by an issuer to subscribe for shares not yet in issue or allotted. This method is usually used for investment trust IPOs. An intermediary offer is a marketing of shares already or not yet in issue, by means of an offer by the issuer to intermediaries for them to allocate to their own clients.

underwrites the entire issue for a short period and distributes them to specified persons or its clients.

3.3.2. Research Sample

The research sample is taken from UK firms that went public by either offer for sale and/or placing between 1986 and 1997 in the Official market. A total of 1653 equity offerings were floated on the LSE during the period. Similar to other IPO studies, the research sample excluded financial firm IPOs and closed-end mutual fund offerings. This results in a total of 811 IPOs. In relation to the marketing method description that is discussed in the UK institutional framework section, only offer for sale, placing, and the combination of both are appropriate to be included in the research sample. The reason is that the Introduction method is used by firms wishing only to have a quotation on the LSE and not wanting to raise any funds from investors, while offers for subscription is only distributed to very limited institutional investors. Therefore, excluding marketing methods other than offer for sale and/or placing results in 492 IPOs, which spread across the years (Panel A – table 3.3), industry sectors (Panel B – table 3.3), and firm size (Panel C- table 3.3) as indicated in the tables below.

Panel A shows the distribution of the IPO population over the research periods. The number of firms that went public during the period varies across the years. According to Michie (1999) after the 'Big Bang' in the late 1980s, many firms went to the market, and then during the recession period in the early 1990s very few firms went public. This is reflected in the research population distribution as shown in panel A. The early period shows a reasonable number

Table 3.3. The distribution of research population

Panel A

Year	Number of IPOs
1987	42
1988	39
1989	35
1990	14
1991	20
1992	30
1993	51
1994	80
1995	53
1996	71
1997	57
Total	492

Panel B

Industry sector	Number of IPOs
Consumer goods	73
General Industries	124
Mineral extraction	36
Services	226
Utilities	33
Total	492

Panel C

Percentile (£million)	Number of IPOs
Smallest	50
10.24-14.05	49
14.05-18.67	49
18.67-23.39	49
23.39-29.80	49
29.80-40.45	49
40.45-53.64	49
53.64-88.66	49
88.66-224.09	49
Largest	50
Total	492

of IPOs taking place in the UK main market. The figures went down in the later period (early 1990s), as a result of the economic recession. Then, in the late period, the data shows an increasing number of firms that went public on the UK official market.

Panel B shows the IPO population spread over the main industry sectors. Each firm is assigned to a specific industry sector according to the 1995 FTSE Actuaries industry classification. Excluding the Financial sector, the classification includes the Consumer goods sector, the General industries sector, the Mineral extraction sector, the Services sector, and the Utilities sector. Panel B demonstrates that the number of IPOs in each sector varies. Almost half of the IPOs (49.5%) that came to the market during the research periods were firms in the Service sector. It is followed by the General industries sector (25.2%), the Consumer goods sector (14.8%), the Mineral extraction sector (7.3%), and the Utilities sector (6.7%). It is worth noting that most of the firms (28 out of 33 firms) in the Utilities sector were the UK privatisation IPOs, such as the electricity and water firms.

Panel C shows the distribution of the IPO population based on the firm size. The market capitalisation of the IPO firms in the research periods ranges from £1.05 to £5,500 millions, of which about 90% of the population are relatively small firms with a market capitalisation below £ 224 million. The privatisation IPOs, the Utilities firms, the Mineral extraction firms are among the largest 50 firms.

As mentioned earlier in the Introduction chapter, one of the study objectives is to examine the impact of the firms' ex-ante risk factors on the IPO valuation and the long run performance. Following the ICAEW study (1998), the

Arthur Andersen Business Risk Model (AABRM) is used in this study as a framework to assess the firms' ex-ante risk factors. The risk assessment is conducted by undertaking a detailed content analysis of each of the offering prospectuses, to try to identify the disclosure regarding each of the 55 risk factors. This is discussed further in section 3.4. This is a very time consuming task, and consequently this study draws a research sample.

The initial sample is chosen randomly from the population, by numbering each of the 492 IPOs consecutively, and then using the three-digit random numbers table, to draw a random sample of 200 IPOs. The chosen 200 IPOs are distributed over the research period, industry sectors, and firm size as shown in table 3.4 below. The table shows the actual number of IPOs in each classification (year, industry sector, and firm size) in the initial sample together with the number of observations one would have expected in each category if the sample of 200 were a perfect representation of the overall population of 492 (i.e., as it would have been drawn using the stratified sampling method). For example, in 1987, there were 42 IPOs out of 492 IPOs in the research period (about 8.54% of the population). If a sample of 200 IPOs had been drawn using the stratified sampling method, one would expect to have the same population proportion of IPOs in the sample of 1987, which is about 17 IPOs.

Panel A shows that the initial sample is spread across the years in a similar fashion to that found in the underlying population. The yearly expected number of IPOs based on 200 IPOs is shown in column 3 of panel A. Although,

Table 3.4 The distribution of actual and expected initial sample of 200 IPOs

Panel A - Year

Year	Actual number of IPOs in the initial sample	Expected number of IPOs based on 200 IPOs
1987	16	17
1988	15	16
1989	16	14
1990	7	6
1991	8	8
1992	12	12
1993	20	21
1994	33	33
1995	21	22
1996	31	29
1997	21	22
Total	200	200

Panel B – Industry sector

Industry sector	Actual number of IPOs in the initial sample	Expected number of IPOs based on 200 IPOs
Consumer goods	31	30
General Industries	50	50
Mineral extraction	12	15
Services	94	92
Utilities	13	13
Total	200	200

Panel C – Firm size

Decile (£million)	Actual number of IPOs in the initial sample	Expected number of IPOs based on 200 IPOs
Smallest	19	20
10.24-14.05	19	20
14.06-18.67	21	20
18.68-23.39	19	20
23.40-29.80	18	20
29.81-40.45	20	20
40.46-53.64	18	20
53.65-88.66	21	20
88.67-224.09	22	20
Largest	23	20
Total	200	200

only three out of 11 years show that the actual number IPOs in the initial sample match the expected number of IPOs based on the underlying population, the deviations in the remaining 8 years are trivial. It is clear that the overall yearly distribution of the number of IPOs is very similar. A chi-square test is carried out to check the similarity of the distribution of the actual and the expected initial sample. The result, which is discussed further below, shows that there is no significant difference in the distribution across years of the population and the initial sample.

Panel B of table 3.4 shows the distribution of IPOs across the industry sectors. Similar to the population distribution, the initial sample spreads among the 5 non-financial industry sectors. Moreover, similar to the order of the population distribution, the firms in the Service sector dominate the initial sample, followed by the General industries sector, the Consumer goods sector, the Utilities sector, and the Mineral extraction sector. Panel B also exhibits the expected number of IPOs in each industry sector based on the characteristics of population distribution. Although, the comparison between the expected and the actual distribution demonstration a little variation, in general it could be said that the initial sample is distributed across the industry sectors similarly to as the expected sample.

Panel C shows the distribution of the initial sample based on the deciles of firm size. The deciles classification used in Panel C is the one applied to the population (see table 3.3 Panel C). The number of IPOs in the actual initial sample marginally varies across the percentile groups. Only the £29.80-40.45 millions group perfectly match the number of IPOs in the actual sample and what one would have expected if the sample perfectly matched the population. However, the variations in the other percentile groups are small.

Each panel in table 3.4 shows some small variation between the actual and the expected initial sample. According to Snedecor and Cochran, (1989) a goodness of fit test can be used to test if a sample of data comes from a population with a specific distribution. Therefore, a number of goodness of fit tests are carried out to verify whether the initial sample of 200 IPOs is statistically representative to the research population. The general null hypothesis (H_0) states that the data follows a specified distribution. Applied to this study, the null hypothesis states that the distribution of the actual initial sample is similar to the distribution of the expected initial sample. If the test cannot reject the H_0, then it could be concluded that the actual and the expected initial samples have similar distributions, and *vice versa*.

The test statistics for the Goodness of fit test is as follows,

$$\chi^2 = \sum_{i=1}^{k} (O_i - E_i)^2 / E_i$$

where,

O_i is the observed/actual frequency
E_i is the expected frequency
k is the number of classification
χ^2 is the chi-square score with the degree of freedom of k-1

Using the information in table 3.4, the results of the goodness of fit tests are summarised in the following table:

Table 3.5 Results of Goodness of fit test for the initial sample of 200 IPOs

Distribution base	Null hypothesis (H_0)	χ^2 score (p-value)	Statistical conclusion
Yearly	The yearly distribution of the actual initial sample is similar to the one of the expected initial sample	1.09 (0.99)	Cannot reject H_0
Industry classification	The distribution of the actual initial sample in the industry classification is similar to the one of the expected initial sample	0.598 (0.96)	Cannot reject H_0
Firm size	The distribution of the actual initial sample in the Size percentile groups is similar to the one of the expected initial sample	1.228 (0.99)	Cannot reject H_0

Since the tests cannot reject the null hypotheses, the results mean that the initial sample follows the distribution of the population. In other words, the initial sample is statically representative to the research population.

The crucial point of data collecting in this research is to obtain the offering prospectuses. The main source to obtain the prospectuses is the Global Access online database. However, at the time of data collection, the database only provides the documents from 1992 onwards. Therefore, other means of collecting the IPO prospectuses was required for the 1986-1991 period. The first mean used is to contact the firms directly. Only 38 out of 51 sample firms for year 1987 to 1991 were still in business. However, only 35 prospectuses could be collected from those firms. Three other firms replied that they no longer hold any copy of their IPO prospectuses.

A significant effort has been exercised to obtain 16 prospectuses (for 3 firms were in business and 13 firms had gone out of business at the time of data collection the prospectuses) through various organisations, such as Companies

House, the Institute of Chartered Accountants in Scotland (ICAS), the Institute of Chartered Accountant sin England and Wales (ICAEW), and the Mitchell library in Glasgow. However, they do not keep the offering prospectuses. After undertaken various attempts to collect the prospectuses, only 184 prospectuses from 200 IPOs initially planned, are available, and four of them are mini prospectuses (pathfinders), which contain very limited information They are, therefore, considered as incomplete prospectuses. This reduces the sample to 180 IPOs.

Most of the research variables are drawn from the prospectus manually; however there is still a number of missing data items, such as forecasted EPS. There are 13 prospectuses that do not disclose the EPS forecasts. Because of the specification of the research model that employs the EPS forecasts, IPOs that do not disclose the information are excluded from the sample. This leaves the sample to 167 IPOs (see table 3.6).

Similar to other finance research using accounting numbers, the data set contains a number of outliers, which results in skewed distributions of some variables. The outlier in this study is defined as any observation that has extreme values in any research variable[9]. A Trimming method is used to treat the outliers. The outliers are eliminated with a cut-point of 1.5% at the top and bottom of the distribution of all variables. The deletion of the outliers reduces the final sample to 161 valid cases as detailed in table 3.6 below.

[9]After examining the distribution of each variable, the extreme values are defined as observations that have values within 1.5% top and bottom of the distributions. In this study, 6 outliers are detected (2 observations in the P_0/pBV and P_1/pBV distributions, 1 observation in the Lev distribution, 1 observation in the BHR1y distribution and 2 observations in the BHR2y distribution).

The distribution of the final sample over the research periods, the industry sectors, and the firm size percentile is as shown in table 3.7 below. For comparison, the table also includes the number of observation one would have expected in each category had the final sample of 161 IPOs been distributed in an identical fashion to the underlying research population of 492 IPOs.

Panel A demonstrates that there are some differences between the expected and the actual number of IPOs in the different years. As explained earlier, this is due to the fact that the prospectuses are not available in the database. Prior to 1992, prospectuses had to be hand collected from various sources (as discussed above). However, it was not possible to obtain all prospectuses, particularly when firms had gone out of business when the data collection took place. Nonetheless, from 1992 onwards, the actual sample distribution is relatively similar to the expected distribution.

Since the final sample loses 39 cases (about 19.5% of the initial sample of 200 IPOs), another goodness of fit test is carried out to verify the representation of the final sample. The results are shown in table 3.8 below.

Panel A of table 3.8 shows that the probability of the actual final sample is distributed similarly to the expected one is 98%, which leads to the results of acceptance of the null hypothesis. Therefore, it can be clearly concluded that regarding the yearly distribution, the final sample of 161 is representative.

Table 3.6. Final sample derivation

Reasons/Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total
Initial sample	16	15	16	7	8	12	20	33	21	31	21	200
Uncollectable	6	2	5	3	-	-	-	-	-	-	-	16
Incomplete	-	-	2	-	-	1	-	-	1	-	-	4
Missing data	2	-	3	2	1	1	2	1	-	1	-	13
Outliers	1	-	-	-	1	-	1	1	1	1	-	6
Final sample	7	13	6	2	6	10	17	31	19	29	21	161

Table 3.7. The distribution of actual final sample of 161 IPOs

Panel A

Year	Actual number of IPOs in the final sample	Expected number of IPOs based on 161 IPOs
1987	7	14
1988	13	13
1989	6	11
1990	2	5
1991	6	7
1992	10	10
1993	17	17
1994	31	26
1995	19	17
1996	29	23
1997	21	19
Total	161	161

Panel B – Industry sector

Year	Actual number of IPOs in the final sample	Expected number of IPOs based on 161 IPOs
Consumer goods	23	24
General Industries	39	41
Mineral extraction	8	12
Services	86	74
Utilities	5	11
Total	161	161

Panel C – Firm size

Decile (£million)	Actual number of IPOs in the final sample	Expected number of IPOs based on 161 IPOs
Smallest	16	17
10.24-14.05	14	16
14.06-18.67	15	16
18.68-23.39	15	16
23.40-29.80	14	16
29.81-40.45	16	16
40.46-53.64	15	16
53.65-88.66	20	16
88.67-224.09	20	16
Largest	16	16
Total	161	161

Table 3.8 The results of Goodness of fit test for the final sample

Panel A

Distribution base	Null hypothesis (H_0)	χ^2 score (p-value)	Statistical conclusion
Yearly	The yearly distribution of the actual final sample is similar to the one of the expected initial sample	0.598 (0.98)	Cannot reject H_0

Panel B

Distribution base	Null hypothesis (H_0)	χ^2 score (p-value)	Statistical conclusion
Industry classification	The distribution of the actual final sample in the industry classification is similar to the one of the expected initial sample	6.383 (0.17)	Cannot reject H_0

Panel C

Distribution base	Null hypothesis (H_0)	χ^2 score (p-value)	Statistical conclusion
Firm size	The distribution of the actual final sample in the Size percentile groups is similar to the one of the expected initial sample	2.694 (0.97)	Cannot reject H_0

Panel B of table 3.7 exhibits the actual and the expected distribution based on the industry classification. There are some variation between the actual and the expected distribution; the order of the IPOs based on industry sector is similar to the one of the population. There are, however, more services firms and fewer mineral extraction and utilities firms in the final sample than one would expect based on the underlying population.

The largest difference in the proportion of IPOs in the sample and the population is to be found in the Utilities sector. From 13 Utilities firms that are included in the initial sample, only 6 prospectuses can be obtained. The other seven uncollectable prospectuses are due to a number of reasons, such as merger after the offerings (of 2 water companies and 2 regional electricity firms – these companies refused to send the prospectuses) or no respond. From 6 Utilities firms of which the prospectuses are available, 1 firm is excluded from the final sample due to missing data. As explained earlier, most the firms in Utilities sectors are privatisation IPOs. While the Utilities may be somewhat under represented, it should be noted that the five Utilities firms in the final sample are all the privatisation IPOs. Prior literature suggests that privatisation IPOs may be priced differently to other IPOs. Later on, in the research analysis, this study conducts separate analysis for the non-privatisation IPOs (Menyah et al, 1995; Dewenter and Malatesta, 1997). This effectively restricts the analysis to the other four industries represented in the sample for which the actual distribution is closed to the expected.

A goodness of fit test is undertaken for the final sample distribution based on the industry category. The result of the test (table 3.8 – panel B) shows that the probability of the actual distribution to be similar to the expected one is low. Nevertheless, the result is not enough to reject the null hypothesis. Therefore, statistically it could be concluded that the distribution of the actual final sample is similar to the expected one.

The distribution of the final sample of 161 based on firm size is shown in panel C of table 3.7. The distribution of the final sample is similar to that expected, with only small differences. The goodness of fit test (table 3.8 – panel C) confirms that the differences are insignificant, which leads to the conclusion that the actual distribution of the final sample based on the firm size is similar to the expected one.

In sum, during the research period, 492 of the non-financial firm IPOs in the UK official (main) market are identified as the research population. Since most of the research data are collected manually from the offering prospectus, the research sample is limited to 200 IPOs. An initial sample of 200 IPOs is manually and randomly selected from the research population. A number of statistical analyses confirm that the initial sample is a representative sample of the research population across the years and industry sectors.

While collecting and analysing the data, the initial sample loses 39 IPOs that makes a final sample of 161 IPOs due to various reasons (see table 3.6 and table 3.9) Although there are some differences, statistical analyses confirm that both the initial and the final samples are representative samples of the research population.

Table 3.9 IPO Sample derivation

All new listed offerings during 1987-1997		1653
Financial firms and closed-end offerings during 1987-1997		811
Introduction and offer for subscription IPOs		319
Offer for sale and placing IPOs		492
Initial sample – random sample from 492 IPOs	200	
Collected Prospectus	184	
Unreadable prospectus	4	
Final sample	180	
Missing data	12	
Outliers deletion	7	
Valid cases	161	

3.4. Content analysis for the Arthur Andersen Business Risk Model

This section aims to provide a detailed explanation of the prospectus content analysis undertaken to assess the firms' ex-ante risk factors. As mentioned in the introduction chapter, the prospectus information is categorised as fundamentals, ex-ante risk factors, and signals. It should be noted that the ex-ante risk factors used in this study are adopted from the Arthur Andersen Business Risk Model™ (AABRM) (Appendix A.3.5).

The AABRM is widely used by practitioners as a model to assess the firm's business risk. According to Mingay (2003), the model is a useful generic framework that needs to be customised for specific industries and enterprises. Originally, the model is used by the risk auditors of Arthur Andersen to help their clients to self assess their own business risk. A number of methods of assessment are needed to apply the model, such as analysing the firm's documents (annual reports, company circulars), interviewing managers and employees, and observations on daily activities.

The AABRM has not attracted much academic attention. To my knowledge, there have been 2 studies by ICAEW trying to look at the implication of the model. The first study (ICAEW, 1997) is a proposal of reporting risk in the firm annual reports. Having examined annual reports from 5 firms, they find that to some extent firms do report their business risks as defined in the AABRM. As a follow-up to the results found in the first study, they conduct another study (ICAEW, 1999) to compare the risk reporting in the offering prospectus and the firms annual reports published after the IPOs. The analysis uses the AABRM as a framework to assess the business risks of 5 non-financial firms from different industries and of different size. The method used is content analysis of the offering prospectus and the annual reports. The result shows that firms tend to disclose business risk more in the prospectus than in the annual reports. It also finds that the type of risk factors disclosed vary across the firms observed. Examining 5 prospectuses, they find only a total of 23 risk factors are disclosed in the documents, of which only 18 factors provide the risk measures. The number of risk factors disclosed in each prospectus ranges from 9 to 19 risk factors.

The fact that more risk factors are found in the offering prospectus than in the annual reports becomes one of the motivations of this study to use the AABRM as a tool to assess the ex-ante risk factors disclosed in the prospectus. A number of IPO studies find a positive relationship between the risk and the underpricing (e.g., Beatty and Ritter, 1996). However, they use the standard deviation of the IPO prices for the first 5 days as a proxy to the risk, which indicate the ex-post risk of the IPOs. One objective of this study is to examine the ex-ante risk, as part of the prospectus information, which is available to the market at the IPO. Other studies use the number of risk factors disclosed in the prospectus as a proxy to the risk factors (e.g., Feltham *et al.*, 1991). However, as they acknowledge, the measure is a "crude" proxy, which could lead to misinterpretation of the results. This measure implies that the more risk factors disclosed in the prospectus, the riskier the firm, which is questionable. The AABRM, as it is shown in the ICAEW's study (1999) enables the users to identify the risk factors and the measures. In this study, the ex-ante risk factors should be identified and measured based on the prospectus information, as it requires the ability to identify which firms are riskier than others.

The AABRM identifies three main sources of risk: environment, process, and information for decision making risk. Environment risk arises from external factors, while process and information for decision making arise from internal factors. The ICAEW studies find that the process risk is the risk most reported in the offering documents and the annual reports, while the environment risk is the one least reported.

Using the AABRM, this study conducts a content analysis of the 180 collectable and readable prospectuses. The analysis is undertaken in two stages. The first stage is to identify each of the AABRM risk factors in the prospectuses by looking at any statement that mentions or points to the risk factors. For example, the Customer satisfaction risk factor is derived from the following quoted statement: *"The market demand for most of the Group's existing pottery products, particularly the Botanic Garden and Pomona designs, has been higher than production capacity in recent years"* (page 6 of the offering prospectus of Portmeirion Potteries, 1988). The statement indicates that there was a positive trend of market demand for the products, and possible customer satisfaction risk. The second stage is to look whether the risk factor is measured or not. It is important to have a measure for each of the risk factors because it enables me to compare the risk levels of each firm in the sample. For example, the Customer satisfaction risk factor is derived from the following quoted statement: *"Unipalm currently has approximately 2,450 active customers with between 80 and 100 new customers being added each month. In the six months ended 31st October 1993, the ten largest customers accounted from 11.2 to 15.7 per cent of sales by Unipalm"*. The statement indicates growing customer satisfaction, and also provides the measure (percentage of sales from the largest customers). The result of the content analysis is shown in the table 3.10 below.

Table 3.10 The results of content analysis of 180 IPO prospectuses

Risk factors	Indentified?		Measured?	
	Yes	No	Yes	No
Environment risk				
Competitor	31	149	11	20
Sensitivity	0	180	-	-
Shareholder relations	5	175	0	5
Catastrophic loss	0	180	-	-
Soveregin/Political	0	180	-	-
Legal	0	180	-	-
Regulatory	7	173	0	7
Industry	180	0	180	0
Financial markets	0	180	-	-
Process risk				
Customer satisfaction	91	89	72	19
Human resources	176	4	164	12
Product development	86	94	19	67
Efficiency	180	0	180	0
Capacity	180	0	180	0
Performance gap	0	180	-	-
Cycle training	0	180	-	-
Obsolescence/Shrinkage	0	180	-	-
Compliance	0	180	-	-
Business interruption	0	180	-	-
Product/Service Failure	0	180	-	-
Health and Safety	75	105	0	75
Leadership/Authority	17	163	0	17
Performance incentives	0	180	-	-
Communications	0	180	-	-
Relevance	0	180	-	-
Integrity	0	180	-	-
Access	0	180	-	-
Infrastructure	0	180	-	-
Fraud/Illegal acts	0	180	-	-
Reputation	23	157	0	23
Interest rate	169	11	169	0
Currency	119	61	119	0
Equity	180	0	165	15
Financial instrument	0	180	-	-
Liquidity	180	0	180	0
Capital availability	180	0	180	0
Default credit	180	0	180	0
Settlement	0	180	-	-
Collateral	36	144	22	14

Risk factors (continued)	Identified ?		Measured?	
	Yes	No	Yes	No
Information for decision making risk				
Pricing	0	180	-	-
Performance measurement	0	180	-	-
Alignment	0	180	-	-
Completeness & accuracy	0	180	-	-
Budget & Planning	0	180	-	-
Accounting information	180	0	0	180
Financial reporting evaluation	180	0	0	180
Taxation	180	0	0	180
Pension fund	63	117	0	180
Investment evaluation	0	180	-	-
Regulatory reporting	0	180	-	-
Environmental scan	51	129	-	51
Business portfolio	123	57	101	22
Valuation	-	180	-	-
Organisation structure	159	21	0	159
Resource allocation	0	180	-	-
Planning	0	180	-	-
Lifecycle	4	176	0	4

In general, table 3.10 shows that not all the risk factors in the AABRM are disclosed in the prospectuses, particularly for the environment and the information for decision making risks. This is similar to the results found by ICAEW (1999), as discussed previously.

Table 3.10 demonstrates that from the prospectuses examined, only 4 environment risk factors are found. Additionally, only the competitor and industry risk factors provide measures of the level of risk.

Fifteen process risk factors are identified in the prospectus, of which only 12 risk factors are measured. From the information for decision making, 8 risk factors are found, and only the business portfolio risk factor provides a measure of the level of risk.

In sum, a total of 31 risk factors of the comprehensive AABRM framework are identified from the 180 prospectuses, and of those, companies provide a measure of the risk for only 15 risk factors. Therefore, since only few of the AABRM risk factors are identified, at this point the research cannot pursue the application of the AABRM as a whole. It is, therefore, decided to focus only on the 15 measurable risk factors.

Further examination shows that out of the 15 measurable risk factors, only 6 risk factors appear to be consistently identified and measured in the prospectuses. The other risk factors are identified, however few prospectuses provides the risk measures, therefore they are excluded in the further analysis. This left only 6 risk factors (industry risk, efficiency risk, capacity risk, liquidity risk, capital availability risk, default credit risk) to be examined further. The correlation analysis among the 6 risk factors is carried out. The result shows that the liquidity risk is highly correlated to the default credit risk (see table 3.11). This is understandable as both risk factors measure the leverage of a firm. Therefore, only one leverage risk factor will be used in the research model. Using a number of leverage risk measures, Su (1999) finds that the debt ratio is significantly related to

Table 3.11 - Correlation matrix of 6 risk factors

	Industry	Efficiency	Capacity	Credit	Liquidity
Efficiency	0.029				
Capacity	-0.119	***0.154***			
Credit	-0.007	-0.109	***0.209***		
Liquidity	0.016	0.083	-0.106	***-0.797***	
Capital availability	-0.013	-0.117	0.021	***0.171***	***-0.218***

Note: the coefficients in bold and italic are significant at the 10% level the IPO values and underpricing, while the current ratio appears to be insignificantly related to either IPO value or underpricing. Therefore, based on the prior empirical result, this study chooses the default credit risk factors – as proxied by debt ratio – to be included in the research model.

In sum, the study objective is to examine the impact of the prospectus information on the IPO valuation and performance. The prospectus information is defined as fundamentals, risk factors, and signals. Motivated by prior studies by ICAEW, initially this study uses the AABRM as a framework to identify the firm's risk prior to the admission. However, the result from the content analysis of 180 prospectuses shows that only 31 risk factors are reported in any of the prospectuses, and only 15 risk factors are measured. It is, therefore, decided not to pursue the whole AABRM application in this study, but only focus on the risk factors found and measured in the prospectuses. Due to the sample size and the further statistical limitation, further selection of risk factors is undertaken. The research only includes the risk factors that are consistently found and measured in all prospectuses. This selection results in 6 risk factors. The correlation analysis of the risk factors shows that the liquidity and the credit default risk factors are highly correlated. Based on prior study (Su, 1999), the liquidity risk factor is excluded for further analysis. The results in a final selection of 5 risk factors (industry risk, efficiency risk, capacity risk, capital availability risk, and default credit risk) that are included in the research models in the main analysis.

Later in the analysis (chapter 4 – IPO valuation), a number of robustness tests are undertaken to examine whether the number of risk factors disclosed in the prospectuses affect the IPO valuation. These tests provide evidence as to whether the more risk factors could be identified in the prospectuses would affect the IPO valuation. The disclosure indices are developed for each risk factor group (Environment risk, Process risk, and Information for decision making risk) as well as total disclosure index. They are put in the left hand side of the model equations, as predictors, to substitute for the 5 ex-ante risk factors included in the main analysis.

Conclusion

This chapter explains the methodology applied to this study. Firstly, a theoretical explanation is presented in order to justify the inclusion of each variable into the model and how it fits to the objectives of the study.

The explanatory research variables can be grouped in to three groups of variables; fundamentals, ex-ante risk factors, and signals. In addition, two more variables, privatisation and firm size, are also included as control variables.

A number of empirical models are also presented in this chapter. The three general empirical models are the valuation model, the initial return model, and the long run performance model. The valuation model analysis is developed in two stages. Firstly, the analysis only includes the basic fundamental information and the IPO offer and initial price. Secondly, the model is expanded, to the full valuation model, by an inclusion of ex-ante risk factors, signals, and the control variables. The IPO valuation analysis will also includes a number of robustness test by considering alternatives measures (proxies) for predictors as well as the deflator.

The initial return model analyses the relationship between the initial return and the three group variables. Additionally, it also examines the impact of the residual from the IPO valuation model on the initial returns.

The long run returns model is developed to investigate the relationship between the three groups of variables and the IPO long run returns. In order to re-examine the relationship between the IPO underpricing and the long run performance, the long run returns model is expanded by including the initial return to the model, based on signalling theory.

This chapter also describes the definition and the measures of each research variables and the development of working research hypotheses and is followed by a discussion of the UK institutional framework. A detailed sampling procedure is presented the research sample section. Finally, this chapter provides a broad discussion of the use of the AABRM as a tool in the prospectus content analysis to identify and measure the IPO ex-ante risk factors.

Appendices

for

Chapter 3

Appendix

Table A.3.1 Working hypotheses for the IPO valuation models

Hypothesis	Variables	Expected signs
H1 **IPO valuation is an increasing function of IPO firms future fundamentals**		
H1a *There is a positive relationship between IPO offer (initial) prices and proforma book value of equity*	***pBV/pBV***	+
H1b *There is a positive relationship between IPO offer (initial) prices and forecasted earnings*	***fE/pBV***	+
H2 *The negative earnings dummy is positively related to the IPO prices, while negative interactive term is expected to be negatively related to IPO offer (initial) prices.*	***D/pBV*** ***D*fE/pBV***	+ -
H3 *There is a positive relationship between IPO offer (market) prices and proforma dividend*	***pDIV/pBV***	+
H4 **IPO valuation is a decreasing function of the ex-ante risk factors**		
H4a *There is a negative relationship between firm's pre IPO leverage and IPO offer (initial) prices*	***Lev***	-
H4b *There is a positive relationship between firm's pre-IPO capital availability risk and IPO offer (initial) prices*	***Cap***	+
H4c *There is a negative relationship between firm's pre-IPO efficiency risk and IPO offer (initial) prices*	***Effr***	-
H4d *There is a negative relationship between firm's pre-IPO capacity risk and IPO offer (initial) prices*	***Cpy***	-
H4e *There is a negative relationship between industry risk and IPO offer (initial) prices*	***Ind***	-

Hypothesis	Variables	Expected signs
H5 **Signals are significantly related to the IPO valuation**		
H5a *Sponsor reputation is positively related to IPO offer (initial) prices*	***Spo***	+
H5b *Firm age is positively related to IPO offer (initial prices*	***Age***	+
H5c *Percentage of equity sold at the IPO is negatively related to IPO offer (initial) prices*	***Eq***	-
H6 *Privatisation IPOs are priced lower than private IPOs*	***Priv***	-

Table A.3.2 Working hypotheses for the IPO initial returns model

Hypothesis	Variables	Expected signs
H7 **IPO initial return is an increasing function of IPO firms fundamentals**		
H7a *The pro-forma book value of equity to offer price ratio is positively related to IPO initial returns*	pBV/P_0	+
H7b *The forecasted earnings to offer price ratio is positively related to IPO initial*	fE/P_0	+
H8 **IPO initial return is an increasing function of the ex-ante risk factors**		
H8a *There is a positive relationship between firm's pre-IPO leverage and IPO initial returns*	***Lev***	+
H8b *There is a negative relationship between firm's pre-IPO capital availability risk and IPO initial returns.*	***Cap***	-
H8c *There is a positive relationship between firm's pre-IPO efficiency risk and IPO initial returns*	***Effr***	+
H8d *There is a positive relationship between firm's pre-IPO capacity risk and IPO initial returns*	***Cpy***	+
H8e *There is a positive relationship between industry risk and IPO initial returns*	***Ind***	+

Hypothesis	Variables	Expected signs
H9		
Signals are significantly related to the IPO initial returns		
H9a *Sponsor reputation is negatively related to IPO initial returns*	***Spo***	-
H9b *Firm age is negatively related to IPO initial returns*	***Age***	-
H9c *Percentage of equity sold at the flotation is positively related to IPO initial returns*	***Eq***	+
H10 *There is a positive relationship between privatisation dummy and IPO initial returns*	***Priv***	+
H11 *There is a negative relationship between the residuals and IPO initial returns*	***Resi***	-

Table A.3.3. Working hypotheses for the IPO long run performance model

Hypothesis	Variables	Expected signs
H12 **IPO long run return is an increasing function of IPO firms fundamentals**		
H12a *The pro-forma book value of equity to offer price ratio is positively related to IPO long run abnormal returns*	pBV/P_0	+
H12b *The forecasted earnings to offer price ratio is positively related to IPO long run abnormal returns*	fE/P_0	+
H13 *There is a positive relationship between size and IPO long run abnormal returns*	***Size***	-
H14 **IPO long run return is an increasing function of the ex-ante risk factors**		
H14a *There is a positive relationship between firm's pre-IPO leverage and IPO long run abnormal returns*	***Lev***	+
H14b *There is a negative relationship between firm's pre-IPO capital availability risk and long run abnormal returns*	***Cap***	-
H14c *There is a positive relationship between firm's pre-IPO efficiency risk and IPO long run abnormal returns*	***Effr***	+
H14d *There is a positive relationship between firm's pre-IPO capacity risk and IPO long run abnormal returns*	***Cpy***	+
H14e *There is a positive relationship between industry risk and IPO long run abnormal returns*	***Ind***	+

Hypothesis	Variables	Expected signs
H15 **Signals are significantly related to the IPO long run returns**		
H15a *There is a positive relationship between sponsor reputation dummy and IPO long run abnormal returns*	***Spo***	+
H15b *There is a positive relationship between firm age and IPO long run abnormal returns*	***Age***	+
H15c *There is a negative relationship between percentage of equity sold at the flotation and IPO long run abnormal returns*	***Eq***	-
H16 *Privatisation dummy is positively related to IPO abnormal returns*	***Priv***	+
H17 *Valuation residuals is positively related to IPO abnormal returns*	***Resi***	+
H18 *There is a negative association between IPO initial returns and the long run abnormal returns.*	***IR***	-

Table A.3.4 Privatisation IPOs in the research sample

No	Company name	IPO date
1	British Airways	11-02-1987
2	British Airport Authority (BAA)	28-07-1987
3	Corus (British Steel)	05-12-1988
4	Kelda (Yorkshire Water)	12-12-1989
5	Severn Trent	12-12-1989
6	International Power (National Power)	12-03-1991
7	Powergen	12-03-1991
8	Viridian (Northern Ireland Electricity)	21-061993
9	British Energy	15-07-1996
10	AEA Technology	26-09-1996

Appendix A.3.5

The Arthur Andersen Business Risk Model™

ENVIRONMENT RISK

Competitor Sensitivity Shareholder Relations Catastrophic loss
Sovereign/Political Legal Regulatory Industry Financial Markets

PROCESS RISK

OPERATIONS RISK	EMPOWERMENT RISK	FINANCIAL RISK
Customer satisfaction	Leadership/Authority	Interest rate
Human resources	Performance incentives	Currency
Product development	Communications	Equity
Efficiency		Financial Instrument
Capacity	INFORMATION PROCESSING/ TECHNOLOGY RISK	Liquidity
Performance gap	Relevance	Capital Availability
Cycle training	Integrity	Default credit
Obsolescence/Shrinkage	Access	Settlement
Compliance	Infrastructure	Collateral
Business interruption		
Product/Service Failure	INTEGRITY RISK	
Health and Safety	Fraud/ Illegal acts	
	Reputation	

INFORMATION FOR DECISION MAKING RISK

OPERATIONAL	FINANCIAL	STRATEGIC
Pricing Performance measurement Alignment Completeness and accuracy	Budget and planning Accounting information Financial reporting evaluation Taxation Pension fund Investment evaluation Regulatory reporting	Environmental scan Business portfolio Valuation Organisation structure Resource allocation Planning Life cycle

Chapter 4

Chapter 4
IPO Valuation analysis

Introduction

The previous chapter outlined how the empirical analysis in this research into IPO valuation has been carried out. Chapter 3 provides the general theoretical explanation regarding the role of risk factors and signals in the IPO valuation process and the analysis of subsequent IPO performance. This was followed by a presentation of the empirical models used in this study and the working hypotheses empirically evaluated. Finally, the chapter discussed the criteria and the process of selecting a suitable research sample for the study.

This chapter discusses the research data, and the results and analysis of the IPO valuation model. It aims to answer the first research question of whether the prospectus information is useful to value the IPOs. As described in figure 1 in the Introduction chapter, the main hypothesis in the IPO valuation analysis is that the IPO price is related to the prospectus information. As explained in the previous chapter, the prospectus information is categorised into three groups: the fundamentals, the ex-ante risk factors, and the signals. The accounting based valuation model is used to analyse the IPO valuation. Thirteen testable hypotheses that are set in the IPO valuation analysis have been presented in the Research design chapter (chapter 3). The empirical models used in this chapter are the basic valuation and the IPO valuation models as set out in equations 4 and 5 (see Research design chapter). Two levels of IPO prices, which are the offer price (P_0) and the initial market price (P_1), are examined. A summary of what is done in this chapter is presented in the following diagram (figure 4.1).

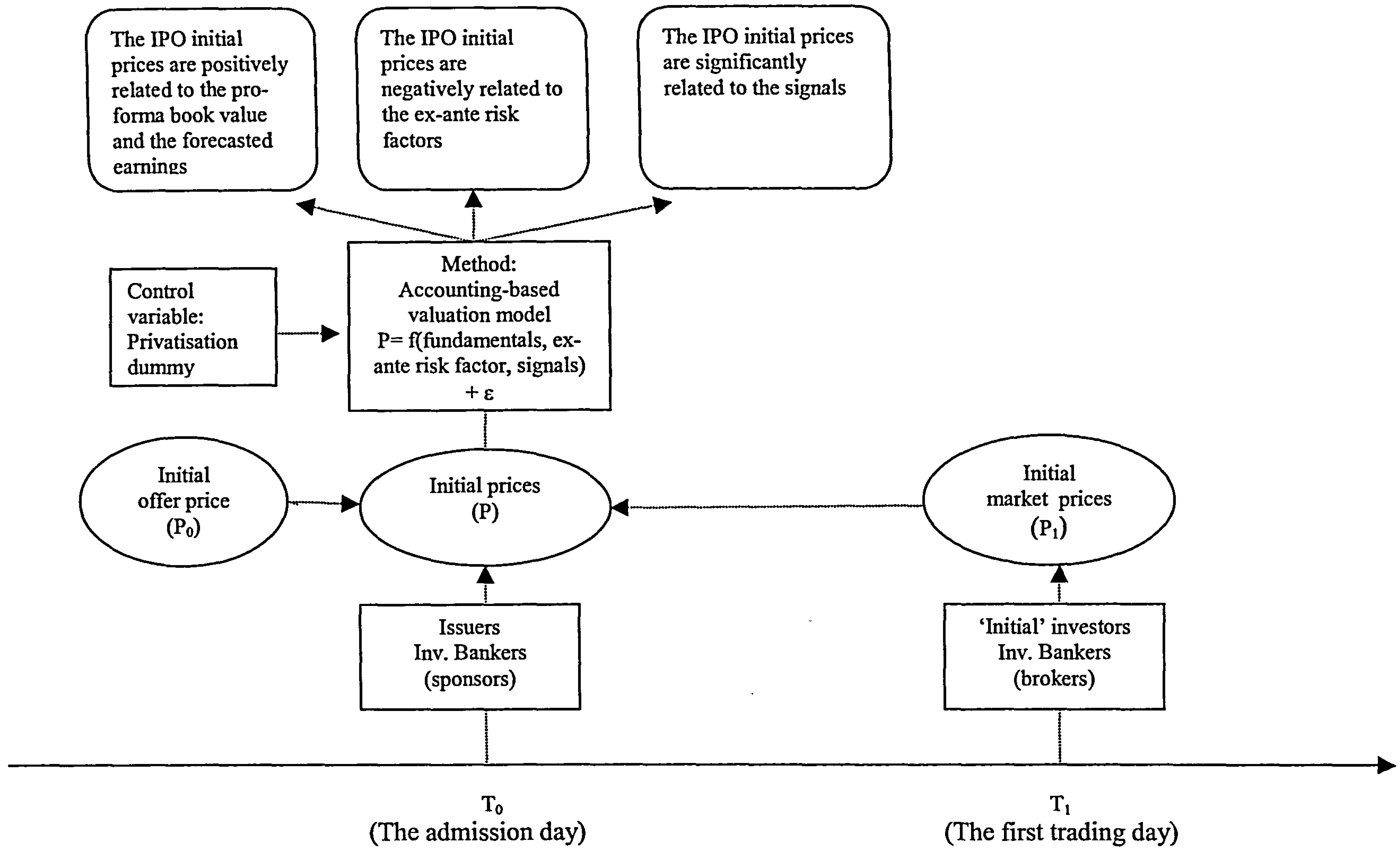

Figure 4.1. Summary of the main working hypotheses for the IPO valuation analysis

The chapter begins by presenting descriptive statistics relating to the variables used in the valuation models. This is followed by a discussion of the hypotheses and their empirical evaluation using the basic valuation model. The next section is a discussion of the impact of a number of ex ante risk factors and signals on the full IPO valuations. This is followed by a section that reports the results of sensitivity analyses, which are undertaken to examine whether the main analysis is sensitive to the choice of measures (proxies) used in the IPO valuation models. Finally, a brief summary of the main findings of this chapter is presented.

4.1 Data

The descriptive statistics of the variables used in the valuation models are shown in table 4.1 below. The observations for the IPO sample are cross-sectional during the period 1987-1997. For the IPO sample, the offer price scaled by pro-forma book value variable (P_0/pBV) has a mean value of 3.15, which ranges between 0.858 and 9.274, and a standard deviation of 3.136. Compared to P_0/pBV, the initial market price scaled by pro-forma book value variable (P_1/pBV) has a higher mean value of 3.637, which ranges between 0.874 and 10.454. The higher mean value indicates the possibility of the existence of the underpricing anomaly in the IPO sample. Furthermore, the simple statistical paired t-test shows that the IPO offer price scaled by pro-forma book value is statistically and significantly lower than the initial market price scaled by pro forma book value[1]. This result

[1] The analysis uses the hypothesis testing of paired sample. The H_0 is that the mean of IPO prices between the two different periods (day 0 and day 1) is equal, with the mean of difference of –0.324, and a standard deviation of 0.453. The test shows that a mean of difference between P0/pBV and P1/pBV is different to zero with the t-statistics of –9.08, and p-value of 0.00. Hence, it rejects the H_0.

suggests that the IPO sample is underpriced at the offering, compared to the initial market price.

Table 4.1a. Descriptive Statistics of research variables in IPO valuation model

The table contains descriptive statistics for the IPO sample of variables in the valuation analysis. ***P0/pBV*** refers to the offer price scaled by pro-forma book value, ***P1/pBV*** to the initial market price to pro-forma book value, ***fE/pBV*** to forecasted earning per share scaled by pro-forma book value, *D* to a negative forecasted EPS dummy variable, ***D*fE/pBV*** to the interactive term between dummy variable and forecasted EPS scaled by pro-forma book value, ***Div/pBV*** to pro-forma book value, ***Lev*** to ex ante leverage risk, ***Cap*** to ex-ante capital availability risk, ***Effr*** to ex ante efficiency risk, ***Cpy*** to ex-ante capacity risk, ***Ind*** to ex ante industry risk, ***Priv*** to privatisation dummy variable, ***Ln(age)*** to firm's age, ***Spo*** to sponsor reputation dummy variable, and ***Eq*** to percentage of equity sold at the IPOs.

Variables	N	Mean	Median	Std.dev	Min	Max
P_0/pBV	161	3.150	2.732	1.981	0.858	9.274
P_1/pBV	161	3.474	3.050	2.241	0.799	11.861
fE/pBV	161	0.189	0.183	0.183	-0.481	0.757
D	161	0.087	-	-	-	-
D*fE/pBV	161	-0.016	0.000	0.068	-0.481	0.000
Div/pBV	161	0.037	0.013	0.056	0.000	0.331
Lev	161	-0.444	-0.375	0.516	-3.730	1.506
Cap	161	0.685	0.762	0.492	-1.213	3.063
Effr	161	0.656	0.688	0.230	0.037	1.420
Cpy	161	0.380	0.336	0.338	0.009	0.963
Ind	161	0.898	0.900	0.068	0.740	1.090
Priv	161	0.056	-	-	-	-
Age	161	2.229	2.080	1.036	-2.300	4.200
Spo	161	0.678	-	-	-	-
Eq.	161	0.426	0.370	0.205	0.070	1.000

The descriptive statistics of earnings forecasts (*fE/pBV*) shows that on average the IPO sample takes a value of 0.189. The descriptive statistics of the negative earnings dummy variable (*D*) and the interactive term (*D*fE/pBV*) shows the IPO sample records 8.7% of firm reported forecasted losses. The dividends variable (*Div/pBV*) takes a low average value. It should be noted that only 99 out of 161 firms paid dividends prior to the admission.

The remaining variables reported in table 4.1a are the ex ante risk factors and signals. These variables are used in the full IPO valuation model and the IPO performance models. As explained in the previous chapter and summarised in the research variables table, the *Lev* variable is measured by the natural log of the 3-year arithmetic mean of the firm's debt ratios. The descriptive statistics show high figures of mean and median values, of –0.465 and –0.393, respectively (approximately an average of 62.81% and 67.51% debt ratios). These figures indicate that IPO firms are typically exposed to quite high financial risks. This sample statistics are far higher than prior studies. Using US data, Miller and Hedge (1996) find an average of 17.86% debt ratios across their sample, while a sample of Chinese IPO reports a 37.0% debt ratio (Su, 1999).

The next variable, *Cap*, is a proxy for the capital availability risk. As IPO firms are characterised as young firms that need more investment, the availability of capital is important for the continuation of the firms. *Cap* is measured by an average of the ratio of retained earnings over net income for the last 3 years prior to going public. The mean value is 0.653, while the median value is 0.750. These figures show that most IPO firms tend to retain their earnings and re-invest in the firm, rather than distributing it as dividends. This corroborates the reading of the pro-forma dividend statistics.

Besides the financial risks mentioned previously, there are a number of non-financial risk measures used in this study. *Effr* is a proxy for production efficiency risk, which is measured by the ratio of cost of goods sold (production cost) over the firm's sales. The sample mean value of *Effr* is 0.647 and the median value is 0.673. It means that on average, the production cost of the IPO firms is approximately 64.7% of the sales they produce. The lower the *Effr* value shows the more efficient production system and the less efficiency risk.

As described in the previous chapter, most firms state that part of the IPO proceeds are intended to fund investment activities within the firms. *Cpy* is a proxy for capacity risk. It is measured by the ratio of the value of the investment plan disclosed in the prospectus, over the net IPO proceeds. The greater the fraction of IPO proceeds planned for investment activities indicates higher capacity risk. The descriptive statistic table shows that a maximum of 96.3% and a minimum of 0.9% of net IPO proceeds are planned for the investment activities. An average of 38.1% of net IPO proceeds is proposed for investment activities.

The Industry risk factor is surrogated by industry beta in the corresponding quarter when an IPO takes place. The maximum value for *Ind* is 1.09 (British Steel plc) and the minimum value is 0.74 (Burn Steward Distillers plc). The average value for *Ind* is 0.896.

As described in the literature review and research design chapters, most UK privatisations took place between the mid 1980's up to the mid 1990's. Additionally, previous studies show that the privatisation IPOs are different to private IPOs. There are 10 privatisations included in the research sample, and a dummy variable is included to control for the possible privatisation effect.

Many studies refer to IPO firms as young firms. In this research, the firm's age is measured as the number of years from when a firm was incorporated until the IPO date in year. It is recorded that the youngest firm in the research sample was only incorporated for 3 months when it went public, while the oldest was about 75 years. Because of such a gap, the natural log of firm age is used as a proxy for the age risk factor.

The sponsor reputation, as a signal variable, is proxied by a dummy variable. The investment bankers, which sponsored more than 3 IPOs in the quarter prior to the quarter when an IPO took place is categorised as a prestigious investment banker. In this research sample, there are 122 IPOs, which were sponsored by prestigious investment bankers.

The percentage of equity sold at the IPO is also a signal variable. The descriptive statistics of *Eq* show that on average, IPO firms sold 42.6% of the enlarged number of outstanding shares to the public at the IPOs. However, the median value is lower, at only 37.0%. The mean figure above is affected by privatisations, which most sold 100% of equity at the IPOs. If the sample excludes the privatisations, the percentage of equity sold drop to 38.89% on average.

4.2. Univariate analysis

Although the hypotheses testing will be based on the valuation models described in the previous chapter, the univariate analysis is aimed at explaining the simple correlation between each predictor and the IPO prices.

Table 4.1b exhibits the (Pearson) coefficient of correlation between each variable in the full IPO valuation mode. In this section, the discussion focuses,

Table 4.1b Correlation matrix for IPO valuation model

The table contains of (Pearson) correlation coefficients of the research variables. The coefficients in bold and italic are statistically significant at 10%.

	P0/pBV	P1/pBV	fE/pBV	D	D*fE/pBV	pDiv/pBV	Priv	Spo	Age	Eq	Lev	Cap	Effr	Cpy
P1/pBV	***0.985***													
fE/pBV	***0.574***	***0.542***												
D	0.050	0.068	***-0.638***											
D*fE/pBV	-0.087	-0.086	***0.644***	***-0.776***										
pDiv/pBV	***0.370***	***0.379***	***0.429***	***-0.206***	***0.160***									
Priv	***-0.268***	***-0.253***	***-0.142***	0.012	0.024	***-0.163***								
Spo	0.058	0.061	0.063	0.057	0.064	0.038	***0.168***							
Age	0.098	0.090	***0.163***	***-0.143***	***0.139***	0.074	-0.128	-0.015						
Eq	***-0.329***	***-0.329***	-0.094	-0.086	0.121	***-0.155***	***0.705***	0.080	-0.069					
Lev	***0.223***	***0.209***	0.090	-0.015	***-0.167***	0.064	***-0.207***	***-0.131***	-0.071	-0.097				
Cap	0.052	0.058	0.002	-0.039	-0.03	-0.056	0.055	-0.007	***-0.254***	-0.058	***0.148***			
Effr	-0.127	***-0.131***	0.095	***-0.131***	***0.166***	-0.043	***0.152***	-0.083	-0.012	***0.187***	***-0.166***	-0.082		
Cpy	0.103	0.119	***0.152***	0.124	***0.131***	***0.208***	***0.290***	***0.201***	0.004	0.122	***0.268***	-0.079	***0.142***	
Ind	0.043	0.007	***0.181***	***-0.135***	0.129	0.123	0.008	-0.009	0.064	0.007	-0.016	-0.049	0.078	-0.122

specifically, on the correlation between the predictors (fundamental, risk factor, and signals) and the IPO offer (initial) price.

The fundamental univariate analysis shows expected correlations. The correlation coefficient of earnings forecasts (*fE/pBV*) appears to be positive and strongly significantly related to the IPO offer price at the 95% level of confidence (and to the initial market price at the 95% level of confidence). The coefficient demonstrates a moderate correlation between earning forecasts and the IPO prices. This implies that earnings forecasts figures disclosed in the prospectus appear to be used to some extent by the issuers, the sponsors, and the investors in their pricing decision process. The negative earning forecasts dummy (D) and negative earnings forecasts interactive term (*D*fE/pBV*) are correlated to the IPO prices as expected – a positive coefficient of D and a negative coefficient of (*D*fE/pBV*) – but appear to be statistically insignificant. The pro-forma dividend is positively correlated to the IPO offer (initial) price. The coefficients demonstrate that the pro-forma dividend has a weaker correlation to the IPO prices than does the earning forecasts, suggesting that the earnings forecasts seem to be more important than the dividend in the pricing decision. This may be related to high-growth IPO firms that tend to pay small dividends, and reinvest the remaining incomes within the firms.

The correlation coefficients of risk factors and the IPO prices appear to be generally insignificant. Only the leverage risk seems to be correlated to the IPO offer price, while the leverage risk and the efficiency risk are significantly correlated to the IPO initial market price. However, the coefficients of correlation between the leverage and the IPO prices are, unexpectedly, positive and significant at 95% level of confidence, suggesting that the higher leverage, the higher the offer (initial) price. This contradicts the theoretical expectation, which posits that the leverage risk as a risk factor is negatively related to the IPO prices. However, this is in line with the theory of the signalling role of debt, which is proposed by Slovin and Young (1990). They argue that prior to the IPO, firms tend to increase their borrowing from financial institution, such as bank. This action is observed as a third party certification to the credibility of the firms. Additionally, this corroborates the findings by Hedge and Miller (1996).

The correlation between the efficiency risk and the IPO initial market price appears to be negative – as expected – and slightly significant. This implies that firms that operate less efficiently are to some extent priced lower in the market. Although the coefficient is insignificant, the correlation between the capital availability risk and the IPO prices is as expected, and so is the capacity risk. The correlation between the industry risk and the IPO prices is positive, which suggests that the IPO firms from riskier industries are priced higher by issuers and sponsors and also in the market. This is contrary to expectation, although the correlation is statistically insignificant.

The correlation between the signals and the IPO prices are as expected, but only the percentage of equity sold at the IPO appears to be significant. Even though the correlation coefficient suggests that IPOs brought to market by prestigious sponsors are priced higher, statistically, the sponsor reputation is not significantly related to the IPO prices. Although the correlation coefficient is positive, as expected, the firm's age also seems insignificant in valuing IPOs.

The correlation matrix (table 4.1b) demonstrates that the percentage of equity sold is negatively related to the IPO offer (initial) price. This implies that the IPOs that sell a higher percentage of equity are priced lower by the market. This is clearly supporting the signalling role of the ownership retained. The percentage of equity retained by the old shareholders signals their confidence in the future prospect of the firm. Therefore, the higher percentage of equity retained indicates higher firm value.

Finally, table 4.1b exhibits the correlation coefficients between privatisation, and IPO prices. Previous studies demonstrate that the privatisation IPOs are priced differently to the private IPOs. In this study, the correlation between the privatisation dummy and the IPO offer (initial) price is negative and strongly significant. In the relation to the IPO offer price, the result suggests that the privatisation IPOs are underpriced. It could be speculated that privatisation IPOs are underpriced in order to ensure the net proceeds is achieved and to enhance the market's participation in the subsequent privatisations. However, while the result shows the persistence of underpricing in privatisations, no one has evidence for the government's deliberation.

In sum, the univariate analysis demonstrates mixed results of the correlation between each predictor and the IPO prices. The fundamentals are correlated to the IPO prices as expected. Of the risk factors, only leverage and the efficiency risk appear to have significant relations to the IPO prices, while of the signal variables, only the percentage of equity sold at the IPOs is related significantly to the IPO prices. However, the result of univariate analysis is not aimed to test the research hypotheses listed in the research design chapter. The hypotheses testing are based on the proposed valuation models, which is discussed in the next three sections.

4.3. Basic valuation analysis

The univariate analysis above provides a description of the relationships between the individual predictors used in the valuation model (basic and full models). However, such an analysis is not enough. Since this study tries to examine the relationship between the three groups of prospectus information (fundamentals, risk factors, and signals) and the IPO offer (initial) prices, multivariate analysis is used to allow the interaction of a group of predictors in IPO valuation. This section discusses the results of the basic valuation analysis, while the IPO full valuation analysis is discussed in the next section.

Principally, the basic valuation models analyse the fundamental relationship on share valuation. This kind of model is usually used in non-IPO shares valuation, which as discussed in the literature review tend to work very well. From the practical point of view, McCarthy (1999) argues that accounting data, such as earnings and book value are vital information, which is used by the investment bankers and the issuers to set up the offer price.

The basic valuation model is expressed by equation (4) in the research design chapter. The empirical results of the basic valuation model are presented in table 4.2 below. The table itself is divided into 2 panels. The first panel (Panel A) exhibits the result of the basic valuation model for the entire IPO sample on both the issue price and the initial market price. Since prior studies find that the privatisation IPOs are somehow differently priced, this study discusses separate analyses for the full sample and the non-privatisation sample. Panel B exhibits the results of the basic valuation model for the non-privatisation sample.

Table 4.2. Regression results for Basic IPO valuation model

The table contains output from OLS regression of the offer price and initial market price scaled by pro-forma book value (***P_0/pBV*** and ***P_1/pBV***) on pro-forma book value scaled by pro-forma book value (***pBV/pBV***), forecasted earnings scaled by pro-forma book value (***fE/pBV***), a dummy variable for negative earnings (***D***), an interactive term of negative earnings scaled by pro-forma book value (***D*fE/pBV***), and pro-forma dividend scaled by pro-forma book value (***Div/pBV***). All variables are in per share value. Heteroscedasticity-adjusted t-statistics are reported in brackets.

Panel A – All IPO sample

Variable	P_0/pBV	P_1/pBV
pBV/pBV	0.280*	0.347*
	(1.96)	(1.88)
fE/pBV	12.345***	13.128***
	(16.66)	(14.51)
D	2.524***	3.097***
	(2.82)	(2.70)
D*fE/pBV	-15.896***	-15.909***
	(-4.53)	(-3.59)
pDiv/pBV	1.508	3.075
	(0.75)	(1.24)
N	161	161
Adj. R^2	0.729	0.670
Wald	1733.42	242.20
(p-value)	(p-value=0.00)	(p-value=0.00)

*Note: *** significant at 1%; *significant at 10%*

Panel B – Non-privatisation IPO sample

Variable	P_0/pBV	P_1/pBV
pBV/pBV	0.354**	0.415**
	(2.33)	(2.07)
fE/pBV	12.222***	13.033***
	(15.96)	(13.88)
D	2.763***	3.425***
	(3.13)	(2.98)
D*fE/pBV	-15.043***	-14.894***
	(-4.32)	(-3.36)
pDiv/pBV	1.211	2.765
	(0.59)	(1.09)
N	151	151
Adj. R^2	0.723	0.662
Wald	304.79	219.28
(p-value)	(p-value=0.00)	(p-value=0.00)

*Note: *** significant at 1%; **significant at 5%; *significant at 10%*

In each panel of table 4.2, the first column lists the accounting information variable (pro-forma book value of equity, forecasted earnings and pro-forma dividends) and other important variables (negative earning dummy and the interactive term). The second and third columns demonstrate the regression coefficients of variables listed in the first column, with two levels of IPO price; the offer price (P_0) and the initial market price (P_1).

The second column of table 4.2 panel A shows the results of the basic valuation model with the offer price scaled by pro-forma book value of equity (P_0/pBV) as the dependent variable. The intercept is positive and significantly related to the offer price. Based on the basic model discussed in the research design chapter, the intercept coefficient of the model represents the impact of book value of equity on the share price – in this case, it would be the impact of the pro-forma book value of equity on the IPO offer price. The coefficient shows a value of 0.280 (between 0 and 1), which is both theoretically and empirically normal for the valuation model. The impact of book value is also significant at the 10% level.

The result of the book value of equity is consistent with the theoretical model. It confirms the hypothesis *H1a*, which predicts a positive relationship between the IPO offer price and the book value of equity. Moreover, since the book value figures used in this study are the pro-forma book values, this result evidences the usefulness of the future value of book value on valuation and confirms the findings from previous studies (e.g., Firth, 1998).

The regression coefficient of the *fE/pBV* exhibits a positive impact of forecasted EPS scaled by book value variable on the dependent variable, P_0/pBV. The regression coefficient of *fE/pBV* has a value of 12.345, which is somewhat higher than the usual empirical figures for non-IPO cases from prior studies (e.g., Rees, 1997)[2].

The high-growth characteristic of IPO firms results in the higher coefficient of earnings than what is normally observed for non-IPO firms. Moreover, since the accounting information that is available to investors prior to the IPO is very limited, it is possible that the investment bankers and the issuers emphasise the potential earnings growth in the IPO valuation and put a greater weight on earnings valuation and lesser weight on book value of equity. The hypothesis test shows a robust significant result of *fE/pBV*, which also confirms the hypothesis *H1b*.

As discussed in the literature review chapter, prior IPO valuation studies, which examine the role of earnings in valuing IPOs, could be divided into two groups. The first is a group that use the pre-IPO accounting earnings (Klein, 1996; Beatty et al, 2002) and the other is a group that use the earnings forecasts disclosed in the prospectus (Firth, 1995; Kim and Ritter, 1999, How and Yeo, 2001). Although different measures of earnings are applied between the two groups of studies, the results suggest similar conclusions, in that earnings (or earnings forecasts) could explain a large portion of the variance in the IPO offer (initial) price. However, a sensitivity analysis is undertaken to examine whether the historic earnings explains the IPO valuation better than the forecasts. The results – as presented later in the sensitivity analysis section (section 4.8) – shows that using

[2] Using a UK non-IPO sample, Rees (1999) finds an average earnings response coefficient of 9.896, which varies yearly between 6.530 and 12.257 during the 1987-1997 period.

historic earnings do not alter the implication of the main results, but it produces a substantially lower explanatory power.

Kim and Ritter (1999) find a mixed result when they deliberately compare the result of IPO valuations based on historical earnings and the analyst earnings forecasts. They show that historical earnings figures explain little of the variance in the IPO initial market price and the model explanatory power increases significantly when the earnings forecasts and pro-forma book value are used.

In this study, the measure of earnings used is the 1-year earning forecasts. The result shows the important role of forecasted earning on the IPO valuation, confirming the results of prior studies (Keasey and McGuiness, 1992; Firth, 1998; How and Yeo, 2001). The result also verify the findings by Kim and Ritter (1999), who conclude that using the forecasted accounting numbers is more useful than using the historical numbers.

The signalling theory argues that a good firm uses signals to reveal its true value to the market. Prior to the IPO, the issuers have an option to disclose the earnings forecasts in the prospectus or not. When they decide to disclose such information, they choose to employ the earning forecast as a signal to the firms' true values. Moreover, the theory also argues that the chosen signal is credible if it could separate a good firm from the bad ones, which means that not all earning forecasts are a credible signal. The result in this study shows the robust relationship between the earnings forecasts and the IPO offer price, which could be inferred that the earning forecasts serve as a credible signal to the firm's value. This signalling role of earnings forecasts is even clearer in the discussion of the initial market price (P_1) below.

The next two rows of column 2 show the statistical results on the negative earnings forecasts dummy variable and the interaction terms. These variables allow the weighting parameter to vary for cases that have negative earnings. The result appears to be normal – the coefficient of negative earnings forecasts dummy (D) takes a positive value of 2.524, and the interactive term *(D*fE/pBV)* coefficient takes a negative value of 15.896 – which is more or less similar to the earnings forecasts *(fE/pBV)* coefficient. The result indicates that earnings forecasts have limited explanatory power when negative as the two earnings forecasts coefficients approximately offset each other. In these circumstances, the importance of book value of equity (here the pro-forma book value of equity) increases, as reflected in the positive coefficient of the negative earnings forecasts dummy (D). In other words, for cases where negative earnings forecasts appear, the investment bankers and issuers tend to draw attention to the firm's pro-forma book value figures. The statistical results on the negative earnings dummy and the interactive term confirm the hypothesis *H2.* Moreover, the result also corroborates the result from previous studies using non-IPO (e.g., Rees, 1999).

The coefficient of dividends scaled by the pro-forma book value has the expected positive sign, but appears to be statistically insignificantly different from zero. The lack of significance of the dividends in this valuation model suggests that the investment bankers and issuers consider that dividends, which feature permanent incomes, are less important to highlight the potential growth of the firms than forecasted earnings itself. The empirical result indicates that in the presence of the forecasted earnings, dividend becomes less important, as the manager expectation has been reflected in the forecasted earnings. Additionally, as many IPOs are young firms, they do not have a record of dividends[3]; therefore dividend becomes irrelevant to most IPOs. The result does not support the working hypothesis H3.

One might argue that the lack of significance of the dividends variable could be as a result of spurious effect. Small firms are usually trying to grow and do not pay dividends, while large and more mature firms tend to pay dividends. To address this issue, some sensitivity analyses have been undertaken and the results show that dividends remain insignificantly related to the IPO prices across the firm-size groups[4]. Another analysis has also been undertaken by restricting the sample to the 99 firms that paid dividends prior to the offering. The results are similar to the ones using the full sample of 161 IPOs, with dividends remaining insignificant.

Overall, the basic valuation model on the offer price seems to have a high explanatory power. The adjusted R-square shows that the fundamental accounting information (pro-forma book value, forecasted earnings, and pro-forma dividends) explains up to 72.9% of the offer price variance. This shows that the accounting information has important roles in the IPO pricing process. The result is also supported by the Wald statistic, which demonstrates the validity of the model and the robust joint impact of fundamentals on the IPO offer prices. In sum, the result of the basic valuation model on the offer price is consistent with the underlying

[3] From 161 IPO sample, 62 firms have not paid any dividend in the year prior to the admission. A value of zero is applied to the proforma dividends for those firms.
[4] To examine whether the impact of dividends may be different across the firm size based on the firms' market capitalisation at the IPOs, the sample is split into three groups (small, medium, and large). There is approximately 43% of the small groups are zero dividends firms, and respectively, 44% and 28% of the medium and the large firms. The results of the basic valuation model for each firm-size group show that the dividends remain insignificantly related to both IPO offer and initial market prices.

model where the pro-forma book value and positive forecasted earnings are value relevant. The result also shows that when negative forecasted earnings appear, the investment bankers and issuers pay more attention to the pro-forma book value figures.

The third column of table 4.2 shows the empirical results of the basic valuation on the initial market price scaled by pro-forma book value (*P_1/pBV*). Almost all variables produce slightly higher coefficients, except for the interaction term (*D*fE/pBV*). The statistical significance of each variable remains the same as the result on the offer price. The model result on the initial market price indicates that forecasted earnings, pro-forma book value and pro-forma dividend are even more important factors used by investors to price the IPOs on the first day of trading.

The intercept coefficient, which represents the book value of equity response coefficient, takes a positive value, implying that IPOs that report higher pro-forma book value of equity in the prospectus are priced higher in the market. This result verifies hypothesis *H1a* as it is demonstrated in the offer price (P_0) result.

The forecasted earnings coefficient also shows the value relevance of the earnings on the initial market price. This result is consistent to findings from prior studies (Firth et al, 1995; Firth, 1998; Ghikas, 2000). The negative earnings dummy and the interaction terms also demonstrate a consistent result to the theoretical framework. The dividends coefficient appears to be much higher for the market price than for the issue price, suggesting that in fact the market puts more weigh on the dividend as, other studies suggest they do for the non-IPO shares.

The t-statistics also shows a greater value, although it is not enough to reject the null hypothesis in the hypothesis testing.

Although the results of the basic valuation model appears to be similar for both IPO price levels, the coefficient of determination for the basic valuation model on the initial market price is lower (adjusted R-square = 67.0%). It implies that although fundamental accounting information is important in pricing the IPOs, investors do consider other factors' influence on the IPO prices. This is understood as more information is revealed as IPOs are traded in the market.

Similar to the IPO offer price results, the Wald statistic of the model on the initial market price demonstrates the validity of the model and the strong impact of the fundamentals on the initial market price. However, the magnitude of the Wald statistics on the initial market price is lower than the one on the offer price, which implies that the fundamentals affect the offer price more robustly than they do on the initial market price.

Panel B of table 4.2 demonstrates the result of the basic valuation model using the non-privatisation sample of 151 IPOs. It shows a consistent result for both the issue price and the initial market price to the previous result for the full IPO sample. All the fundamentals coefficients are consistent with the theoretical hypotheses, however similar to the result for the full IPO sample, the dividends coefficient appears to be statistically insignificant. Therefore the non-privatisation results suggest that the fundamentals are priced similarly in PIPOs as well as in the private IPOs. However, as demonstrated by the Wald statistics, the joint restriction of the fundamentals on the IPO prices is less for the PIPOs.

Although the results for both price levels (firm and market) and segmentation of the sample (full IPO and non-PIPO) appear to be similar, further

Table 4.3. Testing the difference of regression coefficient in the basic IPO valuation model results

The table contains output from OLS regression of the difference of the initial market price and the offer price scaled by pro-forma book value [$(P_0 - P_1)/pBV$] and the initial returns (***IR***) on pro-forma book value scaled by pro-forma book value (***pBV/pBV***), forecasted earnings scaled by pro-forma book value (***fE/pBV***), a dummy variable for negative earnings (***D***), an interactive term of negative earnings scaled by pro-forma book value (***D*fE/pBV***), and pro-forma dividend scaled by pro-forma book value (***pDiv/pBV***), for all sample and non-privatisation sample. All variables are in per share value. Heteroscedasticity-adjusted t-statistics are reported in brackets.

Panel A – full IPO sample

Variable	$(P_1 - P_0)/pBV$ (full sample)	*IR* (full sample)
pBV/pBV	0.067	0.892***
	(1.09)	(6.03)
fE/pBV	0.782***	-0.097
	(2.74)	(0.33)
D	0.573	-0.020
	(1.26)	(-0.67)
D*fE/pBV	-0.013	-0.126
	(-0.01)	(-1.17)
pDiv/pBV	1.567*	0.173
	(1.83)	(1.16)
N	161	161
Adj. R^2	0.124	0.002
Wald	13.20	9.87
(p-value)	(p-value=0.01)	(p-value=0.04)

Panel B- non-PIPO sample

Variable	$P_1 - P_0/PBV$ (non-PIPO sample)	*IR* (non-PIPO sample)
pBV/pBV	0.061	0.812***
	(0.89)	(5.28)
fE/pBV	0.811***	-0.012
	(2.75)	(-0.21)
D	0.662	0.099
	(1.34)	(0.89)
D*fE/pBV	0.149	0.295
	(0.09)	(0.84)
pDiv/pBV	1.555*	0.230
	(1.79)	(1.58)
N	151	151
Adj. R^2	0.128	0.008
Wald	6.47	3.40
(p-value)	(p-value=0.00)	(p-value=0.49)

*Note: *** significant at 1%*

analysis is examined to analyse the difference between the two price levels, and presented in Table 4.3. The analysis is undertaken by running the OLS regression analysis with the fundamentals as the regressors and the difference between the initial market and the offer prices as the dependent variable. The full sample and the reduced non-PIPO sample demonstrate similar results.

The intercepts take positive values though they are statistically insignificant. It implies that there is no significant difference in the perception towards the value relevance of the book value of equity among the market participants during the early days of IPOs. Interestingly, there is a significant difference of the perception regarding the value-relevance of the forecasted earnings. The *fE/pBV* coefficients are positive and significantly different to zero at the 99% level of confidence. This suggests that although both the issuers/sponsors and the market believe that forecasted earnings could be used as a signal to the firms' true value, the market puts more weight on the forecasted earnings than the issuers/sponsors, which results in positive coefficients of forecasted earnings in the model.

While the dividend appears to be insignificant in the basic valuation model result, surprisingly, it is positively and significantly related to the difference between the two levels of IPO prices. As discussed in the literature review chapter, many IPO studies propose a number of explanations to the IPO underpricing anomaly. Although later in this dissertation, the underpricing (initial returns) is discussed in more detail, this section includes an analysis of the differential impact of the fundamentals on the offer and initial market price.

For comparison, table 4.3 also includes an overview of the initial returns $[(P_1-P_0)/P_0]$. The result shows that the fundamentals do not work on the IR as well as on the IPO prices. The constant is positive and strongly significant, suggesting the underpricing. However, the fundamentals are insignificant[5]. The result also demonstrates the low explanatory power of the fundamentals to explain the variation of IRs. Despite the lack of statistical significance, overall the Wald statistics show that at least the joint restriction of the fundamentals on the IR is significant for the full sample; yet, it has no influence in the initial returns of PIPOs.

In sum, the basic valuation model appears to work well for IPOs. The future numbers of fundamentals (book value of equity and earnings) are positively related to the IPO prices both at the issue price (P_0) and when initially traded (P_1). The model featuring the role of negative earnings, also demonstrates their significance in valuing the IPOs. However, the dividend, which usually has an important role in non-IPO share valuation, appears to be insignificant in IPO cases. Similar results are found when applying the basic valuation model for the non-privatisation sample. Further analysis shows that the different perceptions towards the valuation exist among the market participants. The market seems to put more weight on the future incomes (forecasted earnings and pro-forma dividends) than the issuers/sponsors do.

[5] Sensitivity analyses have been undertaken to examine whether the results are different across the firm-size groups by splitting the research sample into 3 groups (small, medium, and large). Overall, the results for each group remain the same. A slightly improved result of dividends is found in the large firms, however it still fails to obtain a significant result at the 10% level.

4.4. IPO full valuation analysis

The basic valuation model discussed above exhibits a high explanatory power of the fundamentals on the IPO valuation. However, there are many independent variables that could still explain the variance in IPO offer and initial market prices. The main objective of this research is to analyse the influence of a number of risk factors and signals to IPO valuation. As discussed in the literature review chapter, there have been various studies that examine the relationship between the risk factors and the IPO underpricing and long run performance, although none appears to have been done on the IPO valuation. It is emphasised in the research design chapter that the risk factors examined in this research are categorised as business risk prior to the admission. This section discusses, particularly, the impact of each risk factors examined on the IPO prices. The impact of signals on the IPO valuation is discussed in the next section.

Table 4.4 and 4.5 below present the results of the full valuation models, both on the offer price scaled by pro-forma book value (P_0/pBV) and the initial market price scaled by pro-forma book value (P_1/pBV), as the dependent variables. The model is run in two stages. In first stage, the IR model only includes the prospectus information variables. The model is then extended to incorporate the privatisation dummy, to examine the impact of the PIPOs on the results.

Compared to the results of basic valuation model (table 4.2), the inclusion improves the explanatory power of the model by 2.0% and 2.6%, respectively for P_0/pBV and P_1/pBV as the dependent variables. However, the inclusion of the privatisation dummy appears to have no impact on the overall explanatory power of the model.

Table 4.4 Regression analysis on the full IPO valuation model for the offer price ($P_0/pPBV$)

The table contains output from OLS regression, of the IPO offer price scaled by pro-forma book value (P_0/pBV) on pro-forma book value scaled by pro-forma book value (*pBV/pBV*), forecasted earning scaled by pro-forma book value (*fE/pBV*), a dummy variable for negative earnings (*D*), an interactive term of negative earnings scaled by pro-forma book value (*D*E/pBV*), pro-forma dividend scaled by pro-forma book value (*Div/pBV*), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), and privatisation dummy (*Priv*), Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	P_0/pBV (t-stat)	P_0/pBV (t-stat)
Fundamentals		
pBV/pBV	2.638**	2.546**
	(2.37)	(2.26)
fE/pBV	11.899***	11.889***
	(16.47)	(16.47)
D	2.589***	2.590***
	(3.05)	(3.08)
D*fE/pBV	-14.059***	-14.133***
	(3.73)	(-3.74)
pDiv/pBV	0.544	0.454
	(0.30)	(0.25)
Risk factors:		
Lev	0.161	0.145
	(0.86)	(0.77)
Cap	0.131	0.144
	(0.75)	(0.82)
Effr	-0.674*	-0.672*
	(-1.81)	(-1.81)
Cpy	0.490**	0.531**
	(2.02)	(2.16)
Ind	-1.416	-1.408
	(-1.31)	(-1.31)
Signals:		
Spo	-0.041	0.029
	(-0.27)	(0.18)
Age	0.084	0.081
	(1.18)	(1.10)
Eq	-1.130**	-1.012
	(-2.86)	(-1.55)
Priv	-	-0.321
		(-0.75)
N	161	161
Adj.R-sq	0.749	0.748
Wald regression (p-value)	591.16 *(0.000)*	566.11 *(0.00)*
Wald fundamental (p-value)	314.52 *(0.00)*	318.17 *(0.00)*
Wald e-a risk ftrs (p-value)	11.51 *(0.04)*	11.81 *(0.04)*
Wald signals (p-value)	9.84 *(0.02)*	3.28 *(0.35)*

*Note: *** significant at 1%; ** significant at 5%; * significant at 10%*

The coefficients of the fundamentals have the same sign as in the analysis above; however their magnitudes change with the inclusion of the additional variables. The coefficients of book value of equity (the constant) increase to a value exceeding 1, while the forecasted earnings coefficients decrease slightly. The inclusion of other factors appears to have an impact on the importance of equity as a basis for IPO valuation. The dividend coefficients are smaller in value and remain insignificant.

However, the impact of the fundamental accounting information on IPO valuation overall is robust, so the inclusion of other variables barely changes their impact on IPO valuation. In general, it is clear that there are no substantial differences in results for the offer price and the initial market price. All variables appear to have the same signs and significance of regression coefficients.

Prior studies (e.g., Menyah et al, 1995) show that privatisation IPOs (PIPOs) are priced differently to other IPOs. Since, 10 out of 161 IPOs in the research sample are PIPOs, a sensitivity analysis has been undertaken by running the model using the non-PIPOs, as presented in table 4.6 below. The results of the fundamentals for non-PIPOs sub-sample are similar to the ones for the full sample.

4.4.1. Ex-ante risk factor analysis

As discussed in the research design chapter, the hypotheses developed for the risk factors are based on the risk aversion assumption. It is posited that the IPO value is a decreasing function of the ex-ante risk factor. Therefore, at the firm level, the riskier IPOs are priced lower at the offer price in order to persuade the investors to buy. At the market level, as the investors demand a compensation for holding the riskier investments, they are also priced lower.

Table 4.5 Regression analysis on the full IPO valuation model for the initial market price ($P_1/pPBV$)

The table contains output from OLS regression, of the IPO initial market price scaled by pro-forma book value (P_1/pBV) on pro-forma book value scaled by pro-forma book value (pBV/pBV), forecasted earning scaled by pro-forma book value (fE/pBV), a dummy variable for negative earnings (D), an interactive term of negative earnings scaled by pro-forma book value ($D*E/pBV$), pro-forma dividend scaled by pro-forma book value (Div/pBV), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), and privatisation dummy (*Priv*), Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	$P_1/pPBV$ (t-stat)	P_1/PBV (t-stat)
Fundamentals		
pBV/pBV	4.150***	4.102***
	(2.94)	(2.84)
fE/pBV	12.633***	12.629***
	(14.73)	(14.78)
D	3.185***	3.186***
	(3.02)	(3.03)
D*fE/pBV	-13.653***	-13.689***
	(-2.93)	(-2.92)
pDiv/pBV	1.900	1.856
	(0.86)	(0.83)
Risk factors:		
Lev	0.203	0.194
	(0.86)	(0.80)
Cap	0.179	0.186
	(0.81)	(0.83)
Effr	-0.779*	-0.778*
	(-1.82)	(-1.78)
Cpy	-0.696**	0.717**
	(-2.39)	(2.41)
Ind	-2.750*	-2.745*
	(-1.94)	(-1.94)
Signals:		
Spo	-0.065	0.059
	(-0.33)	(0.30)
Age	0.095	0.093
	(1.13)	(1.09)
Eq	-1.362***	-1.235*
	(-2.89)	(-1.79)
Priv	-	-0.165
		(-0.31)
N	161	161
Adj.R-sq	0.696	0.695
Wald regression (p-value)	464.94 *(0.000)*	440.31 *(0.00)*
Wald fundamental (p-value)	240.49 *(0.00)*	242.63 *(0.00)*
Wald e-a risk ftrs (p-value)	15.89 *(0.01)*	15.78 *(0.01)*
Wald signals (p-value)	9.80 *(0.02)*	3.88 *(0.27)*

Note: *** significant at 1%; ** significant at 5%; * significant at 10%

Table 4.4 shows that only 2 (*Effr* and *Cpy*) of the 5 ex-ante risk factors employed appear to be significantly related to the IPO offer price, while table 4.5 shows another risk factor (*Ind*) appears to be related to the IPO initial market price. The coefficients for leverage (*Lev*) variable are positive, but insignificant. This result is inconsistent to findings from Fama and French (1998), who find a negative relationship between debt and firm values. However, they acknowledge that such a relation is sensitive to how the debt is measured. Using a model more similar to the one applied here, Rees (1999) also fails to find a significant relationship between debt and firm values.

A number of IPO studies examine the impact of debt to IPO initial returns (e.g., Myers and Majluf, 1984; Slovin and Young, 1990; Hedge and Miller, 1996). However, very few studies investigate the impact of the pre-IPO debt on the IPO valuation. Empirically, Hedge and Miller (1996) find a significant positive association between the pre-IPO debt and the after market IPO values.

The positive coefficients for leverage found in this study imply that pre-IPO debt tend to have a signalling role rather than a risk factor. However, the impact appears to be insignificant. This result cannot confirm the previous results that show the impact of the firm's leverage on the IPO prices.

The next risk factor examined is the capital availability (*Cap*). Table 4.4 and 4.5 exhibit positive coefficients of *Cap* on both price levels, although its impact on the IPO values is statistically insignificant. As explained in the research design, the capital availability risk is measured by the ratio of retained earnings over net income. Fama and French (1998) argue that a pecking order is applied to the firms prior to their listings. The pattern is that firms finance the investments first with retained earnings, then with debt, and finally by issuing stocks. Greater

Table 4.6 Regression analysis of the full valuation model for Non privatisation IPOs

The table contain output from OLS regression, of the IPO offer price and the initial market price scaled by pro-forma book value (*P_0/PBV* and *P_1/PBV*) on pro-forma book value scaled by pro-forma book value (*PBV/PBV*), forecasted earning scaled by pro-forma book value (*E/PBV*), a dummy variable for negative earnings (*D*), an interactive term of negative earnings scaled by pro-forma book value (*D*E/PBV*), pro-forma dividend scaled by pro-forma book value (*Div/PBV*), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), and percentage of equity sold (*Eq*). Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	*P_0/pPBV* (t-stat)	*P_1/PBV* (t-stat)
pBV/pBV	2.322**	3.872***
	(2.09)	(2.73)
fE/pBV	11.917***	12.688***
	(16.22)	(14.53)
D	2.969***	3.663***
	(3.53)	(3.49)
D*fE/pBV	-13.225***	-12.543***
	(-3.45)	(-2.94)
pDiv/pBV	0.468	1.844
	(1.16)	(0.83)
Risk factors:		
Lev	0.245	0.314
	(1.16)	(1.16)
Cap	0.172	0.213
	(0.92)	(0.89)
Effr	-0.736*	-0.872*
	(-1.95)	(-1.94)
Cpy	-0.589**	-0.777**
	(-2.34)	(-2.59)
Ind	-1.184	-2.470*
	(-1.06)	(-1.79)
Signals:		
Spo	-0.043	-0.086
	(-0.26)	(-0.42)
Age	0.113	0.124
	(1.40)	(1.32)
Eq	-0.824	-1.189*
	(-1.42)	(-1.94)
N	151	151
Adj.R-sq	0.738	0.685
Wald regression (p-value)	569.04 (0.00)	440.20 (0.00)
Wald fundamental (p-value)	319.37 (0.00)	240.46 (0.00)
Wald ex-ante risk factors (p-value)	13.02 (0.02)	16.49 (0.01)
Wald signals (p-value)	3.88 (0.27)	4.40 (0.22)

*Note: *** significant at 1%; ** significant at 5%; * significant at 10%*

internal capital availability to the firms could be viewed as beneficial to the firms to continue their business. Therefore, the greater *Cap* could be inferred as lower business risk. The positive coefficients of *Cap* mean that higher capital availability, which indicates lower risk, results in higher IPO prices. The result is entirely consistent with the theoretical foundation and supports the working hypothesis H4b. However, the impact of Cap on IPO valuation seems to be insignificant. Table 4.1b detects no multicollinearity problem on the single correlation between *Cap* and any other predictor. Moreover, excluding the privatisation IPO from the sample (table 4.6) does not change the statistical significance. Another sensitivity analysis (see appendix tables A.4.1a and A.4.2b) also shows that *Cap* keeps the positive coefficients but fails to exhibits a significant impact on either, the offer or the initial market prices. Thus, the lack of significance of *Cap* is robust.

Besides financial risk factors, this study also examines the non-financial risk factors, efficiency risk (*Effr*) and capacity risk (*Cpy*). As, explained in the research design chapter, *Effr* measures the firms' operational efficiency. The rationalisation is that the more efficient the firm runs its business, the more profit produced, and it, in turn, may increase the income for the shareholders.

The ratio of the cost of goods sold over sales is used as a proxy for *Effr*. The result (table 4.4) shows that *Effr* is negatively and significantly related to IPO prices. This means that less efficient IPO firms are priced lower at the offering date and on the first trading day. The result demonstrates a significant impact of the firm's operational efficiency on the IPO prices, on both the offer and initial market prices. Hence, it supports the working hypothesis H4c. In relation to portfolio selection, this result indicates that it is not only the systematic risk that matters in the pricing of securities, but also the unsystematic risk. By assessing the firms' unique risk before the selection, investors could have better portfolios.

Table 4.4 and 4.5 show that the *Effr* coefficient on the offer price is smaller than the one on the initial market price, suggesting that the market price is more sensitive to the efficiency risk, which could be driven either by the operational efficiency or the pre-IPO sales. However, the difference between the coefficients appears to be statistically insignificant (see table 4.7).

The correlation matrix (table 4.1b) shows that there is a positive and significant correlation between *Effr* and *Priv*, however the coefficient demonstrates a weak relationship. Therefore, no multicollinearity problem detected regarding this variable. Consequently, the result remains unchanged when the model is analysed using the non-privatisation sample. Another sensitivity analysis that includes only *Effr* into the model (see appendix table A.4.1a and A.4.1b) also exhibits consistent results to the prior analysis.

The capacity risk (*Cpy*) shows the risk associated with the firms' decision regarding the use of the IPO proceeds. The empirical results (table 4.4 and 4.5) shows that the *Cpy* coefficients are negative and significant at the 5% level. This implies that IPO firms that propose a higher portion of IPO proceeds for investment activities are riskier; therefore they are priced lower by market participants (the issuers, the investment bankers, and the investors). In such a way, it also reflects the negative relationship between the risk factors and the IPO valuation, which in turn, confirms the working hypothesis H4d.

Using a different proxy, Keasey and Short (1997) finds a positive association between the net proceeds and the IPO market value. They argue that the new proceeds (new money) as it is disclosed in the prospectus is a signal to the firm's value. A similar result is also found by Leone *et al* (2003) who investigate the impact of the net proceeds usage to the IPO valuation. They use the amount of net proceeds usage disclosed in the prospectus as a proxy. They record that the net proceed usage varies from the investment purpose to daily operation expenses. They find that the firms that disclose a greater number of net proceeds usage are priced significantly higher in the market. Since this study is interested to examine the impact of the risk factors on the IPO valuation, the proxy used here is more fitting than the Leone et al's proxy as the proxy, particularly, observes the risky investment activities proposed by the firms.

The *Cpy* coefficient on the initial market price is somewhat greater than the one on the offer price. Furthermore, table 4.7 shows that the difference between the two coefficients is significantly different to zero, suggesting that *Cpy* is priced differently at the IPO offer price and at the initial market price. Table 4.1b demonstrates significant positive correlation coefficients between *Cpy* and other predictors: forecasted earnings, pro-forma dividend, privatisation, sponsor reputation, pre-IPO leverage, and pre-IPO efficiency risk. However, they show weak relationship; therefore the multicollinearity problem is not expected in relation to the result of *Cpy*. A sensitivity analysis using the non-privatisation sample (table 4.6) indicates the similar result to the main analysis.

The last risk factor is the industry risk, *Ind*. This risk is proxied by industry betas (β) in the quarter when the IPOs took place. The higher β suggests riskier industry. Therefore, a negative *Ind* coefficient on the IPO valuation model is expected (*H4e*). The evidence shows negative coefficients for *Ind*, which supports the negative relationship hypothesis between the pre-IPO risk factors and the IPO valuation. However, the impact of *Ind* on IPO valuation appears to be mixed. It is statistically insignificant on the offer price (table 4.4), but significant at the 90% level on the initial market price (table 4.5). This suggests that the market put more weight on the industry effect than the issuers/sponsors do. The coefficients are significantly different to zero at the 95% level of confidence (table 4.7).

The correlation matrix exhibits no multicollinearity problem between *Ind* and the other predictors. Consequently, the result remains unchanged when the valuation model is applied using the non-privatisation sample (table 4.6). Similar results are obtained in another sensitivity analysis that includes one ex-ante risk factor in the model at a time (see appendix tables A.4.1a and A.4.1b). The impact of *Ind* on the offer price is negative but appears to be insignificant, although it keeps the significance on the initial market price.

Despite the mixed results found with regard to the relationship between pre-IPO risk factors and the IPO valuations, the Wald statistics show that the joint restriction of the ex-ante risk factors is statistically significant at the 95% level of confidence (table 4.4 and 4.5). Therefore it could be concluded that the ex-ante risk factors have small, but significant impact on the IPO pricing.

Although the impact of ex-ante risk factors on the offer price appears to be similar to the one on the initial market price, some risk factors shows a significantly different magnitude. Table 4.7 below presents the regression coefficients of fundamentals, ex-ante risk factors, and signals on the IPO price difference. The results of the fundamentals show an interesting difference to the prior results of the basic valuation model. As discussed above, the inclusion of the ex-ante risk factors and signals to the model shifts some weighs from forecasted earnings (*fE*) to the pro-forma book value of equity (*pBV*), which is shown in

Table 4.7 Testing the difference of regression coefficients in full IPO valuation model (all–IPO sample and non-privatisation sample)

The table contains output from OLS regression, the difference of the initial market price and the offer price scaled by pro-forma book value [$(P_0 - P_1)/pBV$] on pro-forma book value scaled by pro-forma book value (*pBV/pBV*), forecasted earning scaled by pro-forma book value (*fE/pBV*), a dummy variable for negative earnings (*D*), an interactive term of negative earnings scaled by pro-forma book value (*D*fE/pBV*), pro-forma dividend scaled by pro-forma book value (*pDiv/pBV*), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), and privatisation dummy (*Priv*). Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	$(P_1-P_0)/PBV$ (Full IPO sample)	$(P_1-P_0)/PBV$ (non-PIPO sample)
pBV/pBV	1.556***	1.551***
	(2.95)	(2.96)
fE/pBV	0.739***	0.771***
	(2.77)	(2.81)
D	0.59	0.693
	(1.36)	(1.44)
D*fE/pBV	0.444	0.682
	(0.51)	(0.39)
pDiv/pBV	1.402*	1.376*
	(1.74)	(1.67)
Risk factors:		
Lev	0.049	0.069
	(0.58)	(0.71)
Cap	0.042	0.041
	(0.65)	(0.59)
Effr	-0.106	-0.136
	(-0.73)	(-0.86)
Cpy	0.186**	0.189
	(2.08)	(1.61)
Ind	-1.337**	-1.287**
	(-2.48)	(-2.36)
Signals:		
Spo	0.029	0.043
	(0.49)	(0.54)
Age	0.013	0.011
	(0.49)	(0.29)
Eq	-0.352*	-0.364
	(-1.69)	(-1.51)
Priv	0.156	-
	(0.97)	
N	161	151
Adj.R-sq	0.151	0.157
Wald regression (p-value)	36.91 *(0.00)*	440.31 *(0.00)*
Wald fundamental (p-value)	14.15 *(0.01)*	242.63 *(0.00)*
Wald ex-ante risk factors (p-value)	3.88 *(0.27)*	15.78 *(0.01)*
Wald signals (p-value)	3.28 *(0.35)*	3.88 *(0.27)*

*Note: *** significant at 1%; ** significant at 5%; * significant at 10%*

decreasing *fE* coefficients and increasing *pBV* coefficients[6]. Moreover, the *pBV* escalation is greater on the initial market price than on the offer price, and the difference of the two coefficients appears to be robustly significant. The impacts of the other fundamentals appear to be similar to the previous result (table 4.3), which shows the significant difference between the impact of forecasted earnings and pro-forma dividends on both the IPO offer and initial market prices.

Leverage (*Lev*), Capital availability (*Cap*), and Efficiency risk (*Effr*) appear to have similar impacts on the offer price and the initial market price. However, Capacity risk (*Cpy*) and Industry risk (*Ind*) demonstrate significantly different impacts on the IPO prices. Both risk factors are significantly related to the IPO prices; however, the market appears to put more weighs on those risk factors than do those determining the IPO offer price.

In sum, mixed evidence is found on the impact of the ex-ante risk factor on IPO prices. All risk factors appear to be of expected sign, except leverage risk. However, only two factors, efficiency risk and capacity risk, have significant impact on both levels of price, while *Ind* has a significant impact only on the initial market price. Although prior evidence shows that the privatisation IPOs are differently priced, the sensitivity analysis using the non-privatisation sample does not change the results of the *ex-ante* risk factors on IPO valuation. Another set of sensitivity analysis using different models (the model keeps all the fundamentals

[6] The results of the basic valuation model (table 4.2) shows that the forecasted earnings (*fE*) response coefficients are 12.345 and 13.128, on the offer price and initial market price, respectively, while they slightly decrease to 11.889 and 12.629 as a result of the inclusion of the ex-ante risk factors and signals in the full valuation model (table 4.5). Meanwhile, the pro-forma book value coefficients increase significantly from 0.280 and 0.347 on the offer price and the initial market price, respectively, to 2.546 and 4.102.

and a risk factor at a time – tables A.4.1a and 4.1b) also demonstrates the similar result to the ones in the main analysis.

4.4.2. Signalling analysis

Another set of predictors is a group of signals. In the research design chapter, it is explained that signals are the means chosen by the issuers to gesture the firm's value. The signalling theory argues that the chosen signal could be effective if it could separate the firm from others. The signals employed in this study have been widely used in prior IPO studies. In the UK, a number of studies (e.g., Keasey and McGuiness, 1992, Khurshed *et al*, 1999) demonstrate that the three signals work very well in explaining the IPO anomalies. However, only few examine them directly to the IPO valuation. Therefore, this study contributes to the explanation of factors influencing IPO prices.

Despite different methods used to measure the reputation of the underwriters, prior studies in US, in general, conclude that the prestigious underwriters reduce the uncertainty of the IPO, which results in lower initial returns in the early days of IPOs. However, mixed results are found in other markets, including the UK. Using USM data, Keasey and McGuiness (1991) find no evidence of a negative relationship between sponsor reputation and the degree of underpricing, while Byrne and Rees (1996) using the UK main market and USM data find a significant association.

In this study, the sponsor reputation is measured by a modified proxy used by Keasey and McGuinness (1991). Using the KPM 'New Issues Statistics' from 1987-1997, the sponsor is classified as the prestigious sponsor when it sponsors more than 3 IPOs in the quarter prior to the IPO date, and as the less prestigious one when less than 3 IPOs are brought to the market. A dummy variable for sponsor reputation (*Spo*) is used in the valuation model. The dummy takes 1 for the reputable sponsors and 0 for the less reputable ones. The expectation is that the issuers hire the reputable sponsor – which it is assumed are paid more than the less reputable – to ensure the investors that the firms are the high-value ones. Consequently, the investors willingly pay higher prices for such IPOs. Therefore, a positive coefficient is expected for the dummy *Spo*.

The result in tables 4.6 and 4.7 exhibit the positive coefficients of *Spo* on the offer price and the initial market price. This suggests that the IPOs brought to market by prestigious sponsors are priced higher at the offering date and the first day as posited in the working hypothesis H5a. This result is consistent with most of the previous IPO studies on agent reputation (e.g., Beatty & Ritter, 1986; Feltham et al, 1991; Carter et al, 1998). Specifically on IPO valuations, this result also supports the findings of Klein (1996). However, while the sign of the coefficients are as expected, they are statistically insignificant. Although the *Spo* coefficient on the market level is greater than the one on the offer price, the magnitudes of the coefficients are very small, and the difference between the coefficients appears to be insignificantly different from zero (table 4.7).

The correlation matrix (table 4.1b) demonstrates that there is a significant positive correlation between sponsor reputation and privatisation, but it appears to be a weak relationship. Hence, no multicollinearity problem is expected. The valuation model analysis using the non-privatisation sample shows a similar result of *Spo* on IPO prices. Positive but insignificant *Spo* coefficients are also found in the valuation model that includes the fundamentals and a single signal at a time (see appendix tables A.4.1a and A.4.1b).

The inclusion of *Age* as a signal used by the issuers is because the issuers have options as to when they go public. It is expected that the older (more mature) firms have established business, so they have lower uncertainty in doing the business. The decision of when the firms go public is used by the issuers to signal the firms' value. The valuation analysis in tables 4.6 and 4.7 shows that the result of the *Age* variable is positive. This implies that the older firms are priced higher. Although Klein (1996) uses a different measure for *Age*, the result of this study is consistent to hers, which also finds a positive association between firm's age and the IPO prices. However, neither result appears to be statistically insignificant. Therefore this study could not confirm the working hypothesis H5b.

The correlation matrix in table 4.1b exhibits that *Age* is significantly correlated to the forecasted earnings variable, the negative earnings dummy, the negative earnings interactive term and the capacity risk. However, they emerge to be low relationships. Therefore, no multicollinearity problem is detected. The sensitivity analysis using the non-PIPO sample demonstrates the similar result to the main analysis (see tables 4.8). Furthermore, other sensitivity analyses confirm the finding in the main analysis (see appendix – tables A.4.1a and A.4.1b)

The most popular signal used in the IPO studies is the ownership retained at the offerings. Prior studies demonstrate robust results of the impact of the ownership retention on the IPO prices and performance. In this study, the ownership retention is measured by the percentage of equity sold at the admission (*Eq*). The greater percentage of equity sold at the admission signals the lower belief of the old shareholders in the future firm values. Therefore, it is expected that the IPO valuation is a decreasing function of the percentage of equity sold at the admission, as hypothesised in H5c.

The result in table 4.4 and 4.5 exhibits a negative association between the proportion of equity sold at the admission and the IPO valuations, implying that IPOs selling greater percentage of equity are priced lower. This is completely consistent to the retained ownership theory, which suggests that the proportion of equity retained by the old shareholder reflects the value of the firms. The old shareholders tend to retain greater fraction of equities when they believe in higher firms' value in the future. While the *Eq* coefficient is significant at the 90% level of confidence on the IPO initial market, such an impact appears to be insignificant on the IPO offer price. The possible explanation could be the multicollinearity problem between the *Eq* and other predictors.

Table 4.1b demonstrates that there is a strong correlation (+0.705) between the *Eq* and *Priv.* This is understandable since 9 of 10 PIPOs in the sample offer 100% of the equity for sale at the offerings. Therefore, it is reasonable to suspect multicollinearity explains the lack of significance of the *Eq* coefficient for the offer price, when the model includes by the privatisation dummy (see table 4.4). However, the result using the non-PIPOs sample (table 4.6) demonstrates the similar result. The impact of *Eq* on the IPO offer price remains insignificant. Another sensitivity analysis using the IPO valuation as a function of the fundamentals and another single predictor (see appendix – table A.4.1a) shows a robust result in which *Eq* is negatively related to the IPO offer price and significant at the 99% level of confidence. This is to confirm the evidence that the lack of significance of the *Eq* coefficient in the full valuation model is because of the existence of multicollinearity problem.

The result of *Eq* is consistent to Byrne and Rees's (1996) finding. Using UK data, they find that the percentage of equity retained (sold) in the offering is positively (negatively) and significantly related to the IPO offer price and market price for the full sample. However, when they split the sample by market, the results of the official list (now called the main market) sample show similar results to the ones in this study that the coefficient of the equity retained appears to be statistically insignificant on the IPO offer price, but becomes significant on the initial market price. Using US data, Klein (1996) finds that the ownership retention is positively and significantly related to the IPO offer price and market price. Other prior studies (e.g.: Firth *et al*, 1995; Firth, 1998) find a significant impact of *Eq* on the IPO market price.

In sum, the results of the signal variables seem to be consistent theoretically and empirically to previous studies. However, only the impact of *Eq* on IPO valuations is found to be statistically significant. Despite mixed results found regarding the impact of the individual signals on the IPO prices, the Wald statistics show that collectively they put significant impact on the IPO offer price (table 4.4) and the initial market price (table 4.5) when the model does not include the privatisation dummy. However, the joint restriction of the signals becomes insignificant when the privatisation dummy is included in the valuation models. This is due to the high correlation between the percentage of equity sold at the IPO and the privatisation dummy.

4.5. Privatisation

The last variable in the full valuation model is controlling for privatisations. It is used as a control variable since previous studies (e.g., Dewenter et al, 1998) show that privatisation IPOs (PIPOs) are priced differently to private IPOs. Dewenter et al (1998) argue that governments deliberately underprice the privatisation to achieve the target proceeds from the offerings. Their result shows that PIPOs in the UK are underpriced. However, they do not find evidence of deliberation. Other studies, with different motives, also demonstrate robust results of the PIPOs underpricing. Therefore, a negative coefficient of the privatisation dummy on the IPO values is expected in this study.

The empirical result of the privatisation dummy is of the expected sign (negative), indicating that PIPOs are underpriced at the offer and the initial market prices. However, in contrast to prior findings, the impact of privatisation dummy appears to be statistically insignificant.

Having observed the robust correlation coefficient between the privatisation and the offer and initial prices in the univariate analysis, it is surprising here that the privatisation dummy appears to be insignificant in the multivariate valuation model. However, as discussed above, the correlation matrix (table 4.1b) exhibits a high correlation coefficient between the privatisation dummy (*Priv*) and the percentage of equity sold at the offering (*Eq*) suggesting that a multicollinearity problem may exist between the two predictors Consequently, at least one variable could appear insignificant. The result of *Eq* appears to be mixed. The impact of *Eq* on the initial market price is significant, but loses the significance on the offer price. Here, the impact of *Priv* appears to be insignificant at both prices. Therefore, the result does not confirm hypothesis H6. The existence of multicollinearity is also supported by a sensitivity analysis in tables A.4.1a and A.4.1b (appendix). When the valuation model analyses only the fundamentals and a single other predictors (*Priv*), the result shows that the impact of privatisation on both prices becomes statistically significant at least at the 10% level suggesting that PIPOs are indeed priced differently. As the *Priv* coefficients take negative values, it could be inferred that PIPOs have lower prices at the offer price and the initial market price.

4.6. Validity of the IPO valuation model

Tables 4.6 and 4.7 presents the Wald statistics of the full valuation model and the joint restriction of the predictor groups in the model. The Wald statistics of the full valuation model are statistically significant across the IPO prices (the offer and initial market prices) and the sensitivity analyses. It implies that the joint restriction of all predictors significantly affecting the pricing of IPOs on both the offer price and the initial market price. The model is predominantly explained by the fundamentals.

Despite mixed results of the impact of the ex-ante risk factors on the IPO prices, the Wald statistics for the joint restriction of the ex-ante risk factors demonstrates that all together they are significantly related to the IPO prices. Furthermore, the Wald statistics show that the ex-ante risk factors are significantly relevant in pricing the IPOs for the full sample and the reduced using non-privatisation sample.

As discussed above, the signals relationship to the IPO prices is vague. The joint restriction statistic for the signals shows that they are significantly related to the IPO offer price and the initial market price. However, when the model is controlled for the privatisation dummy, the signals relationship to IPO prices become unclear. This is confirmed in the results of the non-PIPO sample, which exhibits the insignificance of the Wald statistics of the signals' joint restriction.

In sum, all predictors, jointly, are significantly related to the IPO prices for the full sample as well as for the non-PIPOs sub-sample. Undoubtedly, the fundamentals are strongly relevant to the pricing. While the ex-ante risk factors also demonstrate a robust relationship to the IPO prices, the signals appear to have weak relationship, once privatisations are controlled for.

Additionally, the researcher also attempts to run the model using the Stepwise regression. The results are presented in the appendix (table A.4.2). The results of the Stepwise regression are consistent to the outcomes of the OLS regression. The fundamentals are strongly related to the IPO offer and initial market prices for the full sample and the non-PIPO samples. Mixed results are found for the ex-ante risk factors and the signals.

4.7. Sensitivity analyses

This section presents a number of robustness tests for the IPO valuation main analysis presented in previous sections. Some adjustments have been made in the IPO valuation models to suit the IPO firms' characteristics, such as the use of forecasted earnings rather than historic ones, the use of proforma book value as a model deflator rather than realised ones. Therefore, it is useful to check whether the use of competing variables results in different outcomes.

4.7.1. Forecasted earnings vs. historic earnings

The main analysis of the basic valuation model in this study employs the earnings forecasts, since a number of prior IPO studies (e.g., Firth and Liau-Tian, 1998, Chen and Firth, 1999, How and Yeo, 2000) finds that earnings forecasts provides a better prediction of the price than the historic earnings does. However, using US data, Klein (1996) employs the earnings from the last audited financial statement prior to the IPO. With the tighter legal environment, usually the US firms do not provide the management's earnings forecast in the prospectus.

Moreover, prior non-IPO studies using the accounting-based valuation model usually employ the realised earnings. Therefore, as a robustness check, the basic valuation model (equation 4) is analysed using the historic earnings. The results are shown in table 4.8 below.

Table 4.8. Regression results on the basic IPO valuation model using the historic earnings and dividend

The table contains output from OLS regression of the offer price and initial market price scaled by pro-forma book value (***P_0/pBV*** and ***P_1/pBV***) on pro-forma book value scaled by pro-forma book value (***pBV/pBV***), Realised earnings pre-IPO scaled by pro-forma book value (***E/pBV***), a dummy variable for negative earnings (***D***), an interactive term of negative earnings scaled by pro-forma book value (***D*E/pBV***), and dividend scaled by pro-forma book value (***Div/pBV***). All variables are in per share value. Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variable	Expected sign	P_0/pBV (t-stat)	P_1/pBV (t-stat)
pBV/pBV	+	1.783***	2.015***
		(5.18)	(5.37)
E/pBV	+	6.142***	6.383***
		(2.86)	(2.82)
D	+	1.342*	1.274*
		(1.81)	(1.72)
D*E/pBV	-	-7.835**	-8.066**
		(-2.60)	(-2.79)
Div/pBV	+	1.915	2.869
		(0.79)	(1.02)
N		157	157
Adj.R-square		0.285	0.253
Wald statistics		*18.21*	*16.73*
(p-value)		*(0.00)*	*(0.00)*

Note: *** significant at 1%; **significant at 5%; **significant at 10%*

First of all, the valid case for the analysis is reduced from 161 IPOs to 157, due to the outliers of the *E/pBV* variable. Overall, the results are similar to the main results reported in table 4.2 (p. 182). All the fundamentals have the expected signs and retain their significance. The earnings coefficient takes a positive value, which confirms the results of prior study by Klein (1996). However, it takes lower values than the earnings forecasts coefficients in the main result. Although the inference of the results using the historic earnings is similar to the main analysis using the earnings forecast, the explanatory power of the model is substantially lower (28.5% and 25.3% for the offer and initial market prices, respectively), compared to the main analysis (72.9% and 67% for the offer and initial market prices, respectively). This confirms that the main analysis has more information content, although the overall conclusions are the same. This result corroborates Kim and Ritter's findings (1999), which suggest that the future accounting numbers have higher explanatory power in explaining the IPO values than the historic numbers.

The analysis is extended by including the ex-ante risk factors and signals to the model, and controlling for privatisation IPOs. The results are shown in table 4.9. Similar to the basic valuation analysis, the outcome demonstrates similar inferences to the main results (table 4.4 and 4.5), although there are some differences. The historic earnings coefficients take lower values than the forecasted earnings, which confirm the greater price predictability of the earnings forecasts. The dummy for negative earnings take the expected positive sign although appears to be insignificant. However, the interactive term remains highly significant, which firms, as is also implied by the main results.

Another difference is found in the signal, *Eq* on the offer price analysis. The main result shows that once the analysis controls for privatisations, the percentage of equity sold at the IPO (*Eq*) becomes insignificant for the offer price, although it remains significant for the initial market price. Using the historic earnings, *Eq* retains its significance for both prices, although it is marginally significant for the offer price. Similar to the findings of the main results, the *Eq* results in the expected negative coefficient suggesting that firms, which sell higher

Table 4.9. Regression analysis on the full IPO valuation model
using the historic earnings and dividends

The table contains output from OLS regression, of the IPO offer price scaled by pro-forma book value (*P₀/pBV*) on pro-forma book value scaled by pro-forma book value (*pBV/pBV*), realised earnings pre-IPO scaled by pro-forma book value (***E/pBV***), a dummy variable for negative earnings (***D***), an interactive term of negative earnings scaled by pro-forma book value (***D*E/pBV***), and dividend scaled by pro-forma book value (***Div/BV***), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), and privatisation dummy (*Priv*), Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	Expected sign	P_0/pBV (t-stat)	P_1/pBV (t-stat)
pBV/pBV	+	5.453***	5.400***
		(3.53)	(3.87)
E/pBV	+	6.091***	6.377***
		(3.05)	(3.03)
D	+	0.951	0.857
		(1.08)	(1.05)
D*E/pBV	-	-6.929***	-7.901***
		(-2.90)	(-3.08)
Div/pBV	+	1.242	2.161
		(0.66)	(0.99)
Risk factors:			
Lev	-	0.181	0.174
		(0.79)	(0.74)
Cap	+	0.132	0.135
		(0.57)	(0.51)
Effr	-	-0.631*	-0.941*
		(-1.84)	(-1.87)
Cpy	-	-0.866**	-1.069**
		(2.49)	(-2.69)
Ind	-	-2.061	-2.589
		(-1.35)	(-1.69)
Signals:			
Spo	+	0.301	0.323
		(1.06)	(1.00)
Age	+	0.083	0.191
		(1.31)	(1.64)
Eq	-	-1.024*	-1.235*
		(-1.92)	(-1.79)
Priv		-0.578	-0.167
		(-1.10)	(-0.27)
N		157	157
Adj.R-sq		0.428	0.403
Wald regression (p-value)		133.52*(0.00)*	127.67 *(0.00)*
Wald fundamental (p-value)		21.78 *(0.00)*	20.53 *(0.00)*
Wald e-a risk ftrs (p-value)		12.27*(0.01)*	19.30 *(0.00)*
Wald signals (p-value)		8.28 *(0.03)*	7.65*(0.04)*

*Note: *** significant at 1%; **significant at 5%; *significant at 10%*

suggests that loss making firms are valued very differently from profit making fraction of equities at the IPOs, are expected to have lower IPO values. The results also confirm the findings of prior studies (e.g. Downes and Heinkel, 1982; Firth et al, 1995, Klein, 1996, Keasey and Short, 1997).

The explanatory power of the full valuation model using the historic earnings is substantially lower than the main analysis based on the forecasted earnings. This implies that the use of earnings forecasts in the analysis has increased the predictive power of the model. All the Wald statistics confirm that each group of prospectus information (fundamentals, ex-ante risk factors, and signals) are significantly related to the IPO offer and initial market prices.

4.7.2. Pro-forma book value vs. Pre-IPO book value as a deflator

Another robustness check is undertaken by considering an alternative for the scale factor. It is discussed earlier in chapter 3, that book value is chosen as the appropriate scale factor. Some IPO studies (e.g., Kim and Ritter, 1999, Firth et al, 2000) use the post IPO book value as the scale factor, while non-IPO studies (e.g. Danbolt and Rees, 2002; Core et al, 2003) employ realised book value. Therefore a sensitivity analysis using pre-IPO book value is undertaken as a robustness check to the results of the main analysis. The results are reported in table 4.10 below.

In this sensitivity analysis, the net proceeds per share scaled by book value pre IPO is also included to capture its signalling role as suggested by some studies (e.g.,. Keasey and Short, 1997). As argued by Krinsky and Rottenberg (1989) net proceeds as indicated in the offering prospectus, might also convey the insiders' private information regarding the future planned projects in the firms. Therefore, it is regarded as a signal to the firm's future value. The expectation is that the more

Table 4.10. Regression results on the basic IPO valuation model using book value of equity pre-IPO as a scale factor

The table contains output from OLS regression of the offer price and initial market price scaled by pre-IPO book value (*P_0/BV_{pre}* and *P_1/BV_{pre}*) on pre-IPO book value scaled by pre-IPO book value (*BV_{pre}/BV_{pre}*), forecasted earnings scaled by pre-IPO book value (*E/BV_{pre}*), a dummy variable for negative earnings (***D***), an interactive term of negative earnings scaled by pre-IPO book value (*$D*E/BV_{pre}$*), and dividend scaled by pre-IPO book value (*Div/BV_{pre}*). All variables are in per share value. Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	Expected sign	P_0/pBV (t-stat)	P_1/pBV (t-stat)
BV_{pre}/BV_{pre}	+	0.212**	0.251**
		(2.61)	(1.98)
fE/BV_{pre}	+	11.400***	13.187***
		(10.14)	(9.26)
DfE	+	6.887**	6.093**
		(2.55)	(2.10)
DfE* fE/BVp_{pre}	-	-18.962***	-19.430***
		(-2.75)	(-3.18)
Div/BV_{pre}	+	0.975	1.26
		(0.59)	(0.61)
$NetPr/BV_{pre}$	+	1.495	2.247
		(0.65)	(0.76)
Adj.R-sq		0.589	0.544
N		146	146
Wald statistics		128.53	97.48
(p-value)		(0.00)	(0.00)

*Note: *** significant at 1%; **significant at 5%; *significant at 10%*

net proceeds received from the IPOs, the more projects would be undertaken in the firms to raise the firms' value. Therefore the new proceeds is expected to be positively related to the IPO prices.

The analysis is based on smaller sample (146 IPOs). There are 15 out of the final sample of 161 IPOs that have negative pre-IPO book values; hence they are excluded from the analysis. The results of the basic valuation model demonstrate similar inferences to the main analysis (table 4.2). All fundamentals, except the dividends, are as expected and significantly related to the IPO offer and initial market prices. The intercept, which is considered as the pre-IPO book value coefficient, and the forecasted earnings coefficients take slightly lower values than the pro-forma book value and the forecasted earnings in the main analysis. However, the negative forecasted earnings and the interactive term coefficients appear to be higher than the ones in the main analysis.

The net proceeds variable appears to be positively related to the IPO prices, although the association is insignificant. Therefore, the analysis fails to prove the signalling role of the net proceeds.

The results shows that the coefficients of determination of the model using the pre-IPO book value as a deflator are 58.9% and 54.4% for the offer price and the initial market price, respectively. They are substantially lower than the main results (72.9% and 67.0% for the offer price and the initial market price, respectively). This result suggests that the use of pro-forma book value as a model deflator explains the IPO basic valuation model better than the use of realised book value.

The full valuation analysis using the pre-IPO book value as the scale factor, as reported in table 4.11, also provides similar inferences to the main results (table 4.4 and 4.5). The fundamentals are of expected sign and maintain their significance. After controlling for risk factors, signals, and the PIPOs, the analysis still finds no evidence of the signalling role of the net proceeds. Similar to the results of the basic valuation model, the full valuation models show that the explanatory powers of the models are significantly greater when the models use the pro-forma book value as a deflator.

In sum, changing the pro-forma book value to the pre-IPO book value as a deflator for the IPO valuation model does not change the main results' inferences. Yet, the explanatory powers of the models are better when the pro-forma book

Table 4.11. Regression results on the basic IPO valuation model using book value of equity pre-IPO as a scale factor

The table contains output from OLS regression, of the IPO offer price scaled by pre-IPO book value (P_0/BV_{pre}) on pre-IPO book value scaled by pre-IPO book value (BV_{pre}/BV_{pre}), earnings forecast by pre-IPO book value (E/BV_{pre}), a dummy variable for negative earnings (*D*), an interactive term of negative earnings scaled by pre-IPO book value ($D*E/BV_{pre}$), and dividend scaled by pre-IPO book value (Div/BV_{pre}), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), and privatisation dummy (*Priv*), Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	Expected sign	P_0/BV_{pre} (t-stat)	P_1/BV_{pre} (t-stat)
BV_{pre}/BV_{pre}	+	2.056**	2.130
		(2.02)	(1.69)
fE/ BV_{pre}	+	10.753***	12.449
		(10.89)	(8.90)
DfE	+	6.901**	6.484
		(2.51)	(2.03)
DfE* fE/ BV_{pre}	-	-17.553***	-19.444
		(-3.15)	(-2.03)
Div/ BV_{pre}	+	1.107	1.394
		(1.56)	(1.39)
NetPr/ BV_{pre}	+	1.456	2.233
		(0.93)	(1.62)
Risk factors:			
Lev	-	0.377	0.591
		(0.36)	(0.54)
Cap	+	-0.389	-0.306
		(-0.98)	(-0.67)
Effr	-	-1.451*	-3.257*
		(-1.77)	(-1.97)
Cpy	-	-0.722*	-0.861*
		(-1.75)	(-1.83)
Ind	-	-4.434	-5.093
		(-1.69)	(-1.69)
Signals:			
Spo	+	0.205	0.664
		(0.37)	(1.51)
Age	+	-0.169	-0.164
		(-0.76)	(-0.59)
Eq	-	-2.765**	-3.143***
		(-2.81)	(-3.35)
Priv	-	0.067	0.309
		(-0.48)	(0.17)
N		146	146
Adj.R-sq		0.633	0.617
F-stat		18.87	17.69

*Note: *** significant at 1%; **significant at 5%; *significant at 10%*

value is used as a deflator. The results also fail to find evidence for the signalling role of the net proceeds.

4.7.3. Ex-ante risk factors vs. Risk disclosure index

The main analyses (table 4.4 and 4.5) show mixed results are found on the relationship between 5 ex-ante risk factors and IPO prices. Only Efficiency risk (*Effr*), Capacity risk (*Cpy*), and Industry risk (*Ind*) are significantly related to the IPO prices. Yet, as a group, they have significant impact on the IPO prices as shown in the Wald statistics for the ex-ante risk factor group.

Having discussed the content analysis of the offering prospectus using the AABRM framework in chapter 3, another sensitivity analysis is undertaken to examine the impact of the amount of risk factors disclosed in the prospectus. The risk disclosure index is proxied by the number of AABRM risk factor disclosed in the prospectus, regardless of whether measures of the level of risk are provided or not. Based on the AABRM classification, this study comes up with four risk disclosure indices; the environment index, the process index, the information index, and the total index. The descriptive statistics of the risk disclosure indices are presented in appendix table A.4.3.

This robustness check is undertaken with two analyses. In the first analysis, the 5 ex-ante risk factors are substituted by the three group indices (the environment index, the process index, and the information index). Then, in the second one, the total index is used as a substitute to all ex-ante risk factors. The results are shown in the appendices to this chapter (chapter 4) in table A.4.4. None of the indices are found to be significant, which implies that how many risk factors disclosed in the prospectus is not important to the IPO pricing. Moreover, the

Wald statistics for the risk disclosure indices show that the indices have insiginificant impacts on the IPO prices. The main results show that the ex-ante risk factors are important for the IPO valuation, however the sensitivity analysis suggests it is not the simple number of risks disclosed that matters, but more detailed measures of the individual risk factors.

4.7.4. Industry β vs. Industry dummy

Industry β is included in the IPO valuation model as a proxy for industry risk – a risk factor that is identified in the AABRM. Moreover, since there is no market valuation for the firms' shares prior to the IPO, a proxy to the firm's β is not available at the IPO, therefore the industry it is also used as a proxy to the firm's β. The hypothesis is that the higher the β, the riskier the industry, and the lower the IPO prices. The main results show mixed results. The industry risk (*Ind*) coefficent is of the expected sign. However, it is only significantly related to the initial market price (P_1), while its relationship with the offer price (P_0) is unclear.

Many IPO studies use industry dummy to examine the impact of industry on the IPO valuation (e.g., Keasey and Short, 1997; Beatty *et al,* 2002). Therefore, another sensitivity analysis is undertaken to examine whether different proxies for industry effect could make a different impact on the IPO valuation.

As discussed earlier in Chapter 3, the research sample is classified into 5-industry groups based on the 1995 FTSE Actuaries industry classification. Therefore, 4 industry dummies (D_{Min}, D_{Con}, D_{Gen} D_{Ser}) are included as a substitution to *Ind* in the IPO valuation model. The results are reported in the appendix (table A.4.5).

The results show similar outcomes to the main results. All other predictors (the fundamentals, the ex-ante risk factors, and the signals) are of expected sign and maintain their significance. All industry dummies are positively related to the IPO prices, however only a dummy for service industry has a significant impact on the IPO prices.

4.7.5. Rank regression analysis

As explained in the Research sample section, the treatment for the outliers has been undertaken by deletion of IPOs with extreme values. However, to make sure that there is no more outliers that could still significantly affect the results, the rank regression analysis is undertaken. The results are reported in the appendix (tables A.4.6)

To test the robustness of the IPO full valuation model results to the outliers, the rank regression analysis is run. The results are presented in the appendix table A.4.6. The rank regression analysis demonstrates that there is no substantial differences in the coefficients that could potentially alter the inferences of the main results. Therefore, it could be concluded that there is no outliers problem and the main results are robust.

Conclusion

This chapter investigates the impact of the fundamental accounting (pro-forma book value, forecasted earnings, and pro-forma dividend), the ex-ante risk factors, and the signals on the IPO valuation. The IPO values are examined at the offer price and the closing price on day 1. The analysis is based on the accounting-based valuation model. The model hypothesises that the IPO price is an increasing function of the fundamentals and signals, but a decreasing function of the ex-ante risk factors. The analysis is divided into two empirical models. The first model is called the basic valuation model. It analyses the interaction between the fundamentals and the IPO prices. The second model is the extended valuation model, including the ex-ante risk factors and the signals. Since the sample includes 10 privatisation IPOs (PIPOs) and prior studies show robust results on the PIPOs pricing being different to that of other IPOs, the full valuation model includes a privatisation dummy variable.

The analysis on the basic valuation model demonstrates that the fundamental accounting variables play a vital role in valuing IPOs. The IPO valuations, both at the offer price and the initial market price, heavily depend on those accounting numbers, which results in a high explanatory power of the model. This result is consistent to previous valuation studies using non-IPO cases that also find accounting valuation models to work well. Particularly, pro-forma book value and forecasted earnings appear to be strongly and significantly related to the offer price and the initial market price. The basic valuation model analysis also confirms the significant impact of negative earnings on the IPO valuations. This is also consistent to the findings from prior studies (Hayn, 1995; Rees, 1999) using seasoned stocks.

The analysis on the full valuation model exhibits mixed result. All risk factors appear to be consistent to the theoretical foundation, except leverage risk. While leverage appears to have a signal role rather than being a risk factor, the other results show that the IPO price is a decreasing function of the ex-ante risk factors. The riskier IPOs are priced lower at the offer price and the initial market price. Only two risk factors, efficiency risk and capacity risk, have statistically significant influence the IPO valuations. However, the Wald statistic of the ex-ante risk factors as a group shows that the group have a significant impact on the IPO prices.

Similar to the analysis on risk factors, the results of the signals show that sponsor reputation, firm age, and the percentage of equity sold at the offering induce the movement of IPO prices as expected. It implies that the IPO price is an increasing function of the signals. However, only the impact of the percentage of equity sold on the initial market price appears to be significant. Therefore the results could not confirm the working hypotheses relating to the sponsor reputation and firm age. A sensitivity analysis confirms there is a multicollinearity problem between the percentage of equity sold (*Eq*) and the privatisation dummy, which results in the lack of significance of the *Eq* on the initial market price. While the privatisation dummy coefficients have the expected sign, the result shows that the impact of privatisation on the valuation appears to be statistically insignificant. This could be explained by the multicollinearity problem between the *Priv* and the *Eq* variables, as the sensitivity analysis confirms that the variables are significant separately, but becomes insignificant when both variables are included in the regression.

Despite mixed results regarding the influence of ex-ante risk factors and signals on the IPO valuation, the inclusion of those predictors to the valuation models increases the adjusted R-square by 1.9 and 2.5% respectively for the offer price and the initial market price implying that to some extent the ex-ante risk factors and the signals do explain parts of the variations in the IPO prices. The Wald statistics show that collectively all predictors have a significant impact on the IPO prices. It is also shown that the joint restriction of the fundamentals and the

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ex-ante risk factors are significant and valid to predict the IPO prices, while the joint restriction of the signals becomes insignificant once the model control for privatisations.

Finally, a number of sensitivity analyses demonstrate that the main IPO valuation models are not sensitive to the choice of predictors (fundamentals and risk factors). Confirming prior IPO studies (e.g. Firth, 1998; Kim and Ritter, 1999), the sensitivity analyses show that the future accounting numbers, such as forecasted earnings, explain the IPO valuation better than the historic numbers.

Appendix

Table- A.4.1a. Regression analysis of the IPO offer price on the reduced model for full IPO sample

The table contain output from OLS regression, of the IPO offer price scaled by pro-forma book value (*P_0/PBV*) on pro-forma book value scaled by pro-forma book value (*PBV/PBV*), forecasted earning scaled by pro-forma book value (*E/PBV*), a dummy variable for negative earnings (*D*), an interactive term of negative earnings scaled by pro-forma book value (*D*E/PBV*), pro-forma dividend scaled by pro-forma book value (*Div/PBV*), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), privatisation dummy (*Priv*), and size control variable (*Ln(asset)*).

Variables	Dep var: *P_0/pBV*	Dep var: *P_0/pBV*	Dep var: *P_0/pBV*	Dep var: *P_0/pBV*	Dep var: *P_0/pBV*	Dep var: *P_0/pBV*	Dep var: *P_0/pBV*	Dep var: *P_0/pBV*	Dep var: *P_0/pBV*
pBV/pBV	***0.365***	0.140	***0.850***	***0.373***	1.584	0.282	0.127	***0.909***	***0.392***
fE/pBV	***12.233***	***12.322***	***12.367***	***12.342***	***12.413***	***12.346***	***12.302***	***11.984***	***12.120***
D	***2.592***	***2.580***	***2.514***	***2.528***	***2.513***	***2.526***	***2.537***	***2.443***	***2.511***
D*E/pBV	***-15.314***	***-15.652***	***-15.456***	***-15.987***	***-15.874***	***-15.890***	***-15.927***	***-15.027***	***-15.441***
pDiv/pBV	1.542	1.650	1.235	1.254	1.615	1.509	1.491	1.061	1.173
Risk factors:									
Lev	0.1385								
Cap		0.202							
Effr			***-0.848*****						
Cpy				***0.224*****					
Ind					-1.470				
Signals:									
Spo						0.003			
Age							0.074		
Eq								***-1.217******	
Priv									***-0.781*****
N	161	161	161	161	161	161	161	161	161
Adj.R-sq	0.729	0.73	0.737	0.729	0.730	0.728	0.729	0.743	0.737

Table- A.4.1b. Regression analysis of the IPO initial price on the reduced model for full IPO sample

The table contain output from OLS regression, of the IPO initial price scaled by pro-forma book value (P_I/PBV) on pro-forma book value scaled by pro-forma book value (*PBV/PBV*), forecasted earning scaled by pro-forma book value (*E/PBV*), a dummy variable for negative earnings (*D*), an interactive term of negative earnings scaled by pro-forma book value (*D*E/PBV*), pro-forma dividend scaled by pro-forma book value (*Div/PBV*), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), privatisation dummy (*Priv*).

Variables	Dep var: P_I/PBV	Dep var: P_I/PBV	Dep var: P_I/PBV	Dep var: P_I/PBV	Dep var: P_I/PBV	Dep var: P_I/PBV	Dep var: P_I/PBV	Dep var: P_I/PBV	Dep var: P_I/PBV
pBV/pBV	*0.447*	0.152	*1.013*	*0.496*	*2.805*	0.349	0.191	*1.096*	*0.462*
fE/pBV	*12.996*	*13.094*	*13.153*	*13.122*	*12.413*	*13.128*	*13.083*	*12.698*	*12.897*
D	*3.176*	*3.174*	*3.085*	*3.103*	*3.076*	*3.098*	*3.110*	*2.999*	*3.083*
D*E/pBV	*-15.229*	*-15.652*	*-15.397*	*-16.055*	*-15.868*	*-15.904*	*-15.941*	*-14.874*	*-15.442*
pDiv/pBV	3.115	3.272	2.757	2.671	3.278	3.076	3.058	2.544	2.731
Risk factors:									
Lev	0.1618								
Cap		0.281							
Effr			*-0.989***						
Cpy				*0.357***					
Ind					*-2.770**				
Signals:									
Spo						0.003			
Age							0.075		
Eq								*-1.449****	
Priv									*-0.802**
N	161	161	161	161	161	161	161	161	161
Adj.R-sq	0.669	0.672	0.678	0.671	0.675	0.668	0.669	0.685	0.675

Note: *** significant at 1%; ** significant at 5%,;* significant at 10%.

Table A.4.2 Stepwise regression full valuation model

The table contains output form the Stepwise regression, of the IPO offer (initial market) price on prospectus information (fundamentals, ex-ante risk factors, signals) and control variables (privatisation dummy)

Panel A – Full sample; P_0 as dependent variable

Variable	Step 1	Step 2	Step 3	Step 4
pBV/pBV	0.280	0.909	1.306	1.567
fE/pBV	12.35	11.98	12.04	12.01
	(18.47)	(18.12)	(18.35)	(18.40)
D	2.52	2.44***	2.44***	2.44***
	(5.29)	(5.25)	(5.29)	(5.33)
D*fE/pBV	-15.9***	-15.00***	-14.80***	-14.8***
	(-7.93)	(-7.61)	(-7.53)	(-7.61)
pDiv/pBV	1.50	1.10	0.90	0.40
	(0.93)	(0.67)	(0.56)	(0.23)
Eq	-	-1.22***	-1.09**	-1.18***
		(-3.08)	(-2.74)	(-2.95)
Effr	-	-	-0.69*	-0.74**
			(-1.95)	(-2.14)
Cpy	-	-	-	-0.41*
				(-1.68)
Adj R-sq	0.73	0.74	0.74	0.75

*Note: *** significant at 1%; ** significant at 5%,;* significant at 10%,*

Panel B – Full sample; P_1 as dependent variable

Variable	Step 1	Step 2	Step 3	Step 4	Step 5
pBV/pBV	0.35	1.10	1.56	1.93	2.35
FE/pBV	13.13	12.70	12.76	12.72***	12.85***
	(15.72)	(15.32)	(15.50)	(15.57)	(15.79)
D	3.10***	3.00	3.00	3.00***	2.98***
	(5.19)	(5.14)	(5.18)	(5.23)	(5.23)
D*fE/pBV	-15.90***	-14.90	-14.60***	-14.70***	-14.70***
	(-6.35)	(-6.02)	(-5.92)	(-6.01)	(-6.06)
pDiv/pBV	3.10	2.50	2.30	1.60	1.80
	(1.52)	(1.28)	(1.18)	(0.81)	(0.90)
Eq	-	-1.45***	-1.30**	-1.42***	-1.42***
		(-2.99)	(-2.61)	(-2.89)	(-2.93)
Effr	-	-	-0.80*	-0.90**	-0.85*
			(-1.80)	(-2.33)	(-1.94)
Cpy	-	-	-	-0.58*	-0.62**
				(-1.88)	(-2.14)
Ind	-	-	-	-	-2.70*
					(-1.87)
Adj R-sq	0.67	0.69	0.69	0.69	0.70

Panel C – Non-privatisation sample; P_0 as dependent variable

Variable	Step 1	Step 2	Step 3	Step 4
pBV/pBV	0.35	0.88	1.19	1.48
fE/pBV	12.22***	12.30***	12.21***	12.12***
	(17.75)	(18.08)	(18.10)	(17.97)
D	2.76***	2.78***	2.79***	2.73***
	(5.49)	(5.60)	(5.68)	(5.57)
D*fE/pBV	-15.00***	-14.70***	-14.70***	-14.40***
	(-7.34)	(-7.23)	(-7.32)	(-7.19)
pDiv/pBV	1.20	1.00	0.30	0.20
	(0.73)	(0.59)	(0.16)	(0.14)
Effr	-	-0.81**	-0.88**	-0.83**
		(-2.21)	(-2.42)	(-2.27)
Cpy	-	-	-0.54**	-0.48*
			(-2.07)	(-1.84)
Eq	-	-	-	-0.83
				(-1.48)
Adj R-sq	0.72	0.73	0.74	0.74

*Note: *** significant at 1%; ** significant at 5%,;* significant at 10%,*

Panel D – Non-privatisation sample; P_1 as dependent variable

Variable	Step 1	Step 2	Step 3	Step 4	Step 5
pBV/pBV	0.42	1.07	1.60	1.87	2.16
fE/pBV	13.03	12.86	12.96***	12.88***	13.00***
	(15.07)	(-14.98)	(15.22)	(15.24)	(15.41)
D	3.42***	3.33***	3.35***	3.37***	3.30***
	(5.42)	(5.32)	(5.41)	(5.49)	(5.39)
D*fE/pBV	-14.90***	-14.40***	-14.00***	-14.10***	-14.20***
	(-5.79)	(-5.63)	(-5.52)	(-5.60)	(-5.68)
pDiv/pBV	2.80	2.50	2.30	1.50	1.60
	(1.33)	(1.24)	(1.12)	(0.73)	(0.79)
Eq	-	-1.50**	-1.38*	-1.19*	-1.19*
		(-2.13)	(-1.97)	(-1.69)	(-1.70)
Effr	-	-	-0.90*	-0.99**	-0.95**
			(-1.96)	(-2.16)	(-2.13)
Cpy	-	-	-	-0.62*	-0.66**
				(-1.89)	(-2.11)
Ind	-	-	-	-	-2.60
					(-1.62)
Adj R-sq	0.66	0.67	0.67	0.68	0.69

*Note: *** significant at 1%; ** significant at 5%,;* significant at 10%,*

Table A.3. Descriptive statistics of the disclosure index of AABRM

Index	Mean	Median	Standard deviation	Min	Max
Environmental risk	1.329	1.000	0.545	1.000	3.000
Process risk	9.683	10.000	1.539	5.000	14.000
Information risk	4.733	5.000	1.435	3.000	8.000
Total disclosure	15.745	16.000	2.335	10.000	22.000

Table A.4.4a. Regression analysis results on the full IPO valuation model for the offer price (P_0/pBV) using the disclosure index of AABRM.

Variables	Expected sign	P_0/pBV (t-stat)	P_0/pBV (t-stat)
Fundamental			
pBV/pBV	+	1.475**	1.531**
		(2.28)	(2.30)
fE/pBV	+	11.744***	11.908***
		(16.83)	(16.28)
D	+	2.608***	2.504***
		(3.19)	(3.00)
D*fE/pBV	-	-14.919***	-14.992***
		(-4.59)	(-4.45)
PDiv/pBV	+	0.855	0.908
		(0.43)	(0.45)
Disclosure index:			
Env.risk		0.076	-
		(0.52)	
Process risk		-0.085	-
		(-1.12)	
Inf. risk		0.004	-
		(0.07)	
Total disclosure index		-	-0.052
			(-1.58)
Signals:			
Spo	+	0.049	0.062
		(0.34)	(0.41)
Age	+	0.053	0.051
		(0.80)	(0.72)
Eq	-	-1.118*	-1.118**
		(-1.73)	(-2.05)
Priv	-	-0.238	-0.612
		(-0.56)	(-0.36)
N		161	161
Adj.R-sq		0.743	0.755
Walds regression		510.64(0.00)	478.61 (0.00)
Walds fundamentals		315.29(0.00)	296.21(0.00)
Walds risk disclosure index		4.85(0.18)	2.51(0.11)
Walds signals		6.85(0.10)	6.75(0.10)

*Note: *** significant at 1%; ** significant at 5%,;* significant at 10%,*

Table 4..4b. Regression analysis results on the full IPO valuation model for the initial market price (P_1/pBV) using the disclosure index of AABRM.

Variables	Exp. sign	P_1/pBV (t-stat)	P_1/pBV (t-stat)
Fundamental			
pBV/pBV	+	1.932**	1.846**
		(2.42)	(2.28)
fE/pBV	+	12.396***	12.345***
		(14.57)	(14.38)
D	+	3.200***	3.177***
		(2.95)	(2.92)
D*fE/pBV	-	-15.007***	-15.121***
		(-3.65)	(-3.68)
pDiv/pBV	+	2.397	2.471
		(0.98)	(0.99)
Disclosure index:			
Env.risk		0.003	-
		(0.01)	
Process risk		-0.087	-
		(-0.73)	
Inf. risk		-0.012	-
		(-0.16)	
Total disclosure index		-	-0.051
			(-1.32)
Signals:			
Spo	+	0.051	0.026
		(0.38)	(0.15)
Age	+	0.059	0.060
		(0.73)	(0.74)
Eq	-	-1.554**	-1.602**
		(-2.38)	(-2.38)
Priv	-	-0.127	-0.306
		(0.23)	(0.59)
N		161	161
Adj.R-sq		0.692	0.695
Walds regression		379.26 (0.00)	370.46 (0.00)
Walds fundamentals		228.41 (0.00)	222.57 (0.00)
Walds risk disclosure index		3.17 (0.37)	1.76 (0.19)
Walds signals		6.33 (0.10)	6.43 (0.10)

*Note: *** significant at 1%; ** significant at 5%,;* significant at 10%,*

Table A.4.5. Regression analysis results on the full IPO valuation model using the industry dummy

Variables	Expected sign	P_0/pBV (t-stat)	P_0/pBV (t-stat)
Fundamental			
pBV/pBV	+	1.830*	1.675*
		(1.98)	(1.89)
fE/pBV	+	11.761***	10.397***
		(16.44)	(14.40)
D	+	2.698***	2.341***
		(3.43)	(3.33)
D*fE/pBV	-	-13.904***	-12.411***
		(-3.76)	(-2.98)
pDiv/pBV	+	0.245	1.579
		(0.13)	(0.69)
Risk factors:			
Lev	-	0.176	0.232
		(0.95)	(0.96)
Cap	+	0.136	0.189
		(0.80)	(0.84)
Effr	-	-0.670*	-0.799*
		(-1.87)	(-1.70)
Cpy	-	-0.521**	-0.667**
		(-2.11)	(-2.21)
Industry dummy:			
D_{Min}		0.576	0.660
		(1.22)	(1.20)
D_{Con}		0.723	0.657
		(1.28)	(1.26)
D_{Gen}		0.852	0.931
		(1.37)	(1.29)
D_{Ser}		1.399**	1.716**
		(1.99)	(2.08)
Signals:			
Spo	+	0.296	0.306
		(0.22)	(0.30)
Age	+	0.089	0.098
		(1.21)	(1.15)
Eq	-	-0.945*	-1.344*
		(-1.79)	(-1.94)
Priv	-	0.476	0.802
		(1.02)	(1.20))
N		161	161
Adj.R-sq		0.721	0.665
Walds regression		531.73 (0.00)	497.01 (0.00)
Walds fundamentals		216.18(0.00)	212.21(0.00)
Walds e-a risk		8.96(0.06)	10.31(0.05)
Walds signals		3.65(0.30)	4.35(0.22)

Table A.4.6 – Rank regression result for full valuation model

The table contains output from Rank regression, of the IPO offer price, the initial market price, and the differential price scaled by pro-forma book value (*P_0/PBV* and *P_1/PBV, and (P0-P1)/PBV*) on pro-forma book value scaled by pro-forma book value (*PBV/PBV*), forecasted earning scaled by pro-forma book value (*E/PBV*), a dummy variable for negative earnings (*D*), an interactive term of negative earnings scaled by pro-forma book value (*D*E/PBV*), pro-forma dividend scaled by pro-forma book value (*Div/PBV*), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), and privatisation dummy (*Priv*), Heteroscedasticity-adjusted t-statistics are reported in brackets.

Panel A – Full IPO sample

Variables	Expected sign	*P_0/pBV* (t-stat)	*P_1/pBV* (t-stat)
Fundamentals:			
pBV/pBV		2.005**	3.136**
		(2.09)	(2.61)
fE/pBV		11.892***	12.700
		(21.53)	(18.36)
D		2.329***	2.475***
		(5.98)	(5.07)
D*fE/pBV		-13.757***	-14.189***
		(-8.10)	(-6.67)
pDiv/pBV		-0.345	0.241
		(-0.26)	(0.15)
Risk factors:			
Lev		0.143	0.161
		(1.00)	(0.90)
Cap		0.063	0.101
		(0.45)	(0.58)
Effr		-0.471*	-0.677
		(-1.82)	(-1.89)
Cpy		-0.357**	-0.530**
		(-2.13)	(-2.27)
Ind		-1.178	-2.745*
		(-1.21)	(-1.91)
Signals:	-		
Spo		0.062	0.011
		(0.42)	(0.06)
Age		0.027	0.014
		(0.41)	(0.17)
Eq		-0.785	-1.194*
		(-1.07)	(-1.73)
Priv		-0.425	-0.425
		(-1.05)	(-0.84)
N		161	161

*Note: *** significant at 1%; ** significant at 5%,;* significant at 10%,*

Panel B – Non-privatisation sample

Variables	P_0/PBV (t-stat)	P_1/PBV (t-stat)	P_1-P_0/PBV (t-stat)
pBV/pBV	1.932*	3.132**	0.926**
	(1.92)	(2.40)	(2.32)
fE/pBV	11.847***	12.717***	0.701***
	(21.185)	(17.57)	(3.16)
D	2.766***	2.99***	0.228
	(6.68)	(5.58)	(1.39)
D*fE/pBV	-12.260***	-12.618***	-0.640
	(-7.07)	(-5.62)	(-0.93)
pDiv/pBV	-0.307	0.170	0.835
	(-0.233)	(0.10)	(1.60)
Risk factors:			
Lev	0.261	0.283	0.021
	(1.73)	(1.45)	(0.35)
Cap	0.080	0.115	0.007
	(0.56)	(0.63)	(0.13)
Effr	-0.517*	-0.754*	-0.132
	(-1.74)	(-1.96)	(-1.11)
Cpy	-0.418*	-0.608**	-0.164*
	(-1.90)	(-2.13)	(-1.89)
Ind	-1.128	-2.018	-0.625
	(-1.10)	(-1.52)	(-1.54)
Signals:			
Spo	0.077	0.001	-0.078
	(0.52)	(0.01)	(-1.32)
Age	0.069	0.060	-0.005
	(0.97)	(0.66)	(-0.17)
Eq	-0.442	-0.494	-0.172
	(-0.97)	(-0.84)	(-0.96)
N	150	150	150

*Note: *** significant at 1%; ** significant at 5%,;* significant at 10%,*

Table A.4.7. The summary of IPO valuation hypothesis testing

Hypothesis	Variable	Expected sign	Evidence	
			P0	P_1
H1a There is a positive relationship between IPO offer (initial) prices and proforma book value of equity	*pBV/pBV*	+	✓	✓
H1b There is a positive relationship between IPO offer (initial) prices and forecasted earnings	*fE/pBV*	+	✓	✓
H2 The negative earnings dummy is positively related to the IPO prices, while negative interactive term is expected to be negatively related to IPO offer (initial) prices	*D/pBV*	+	✓	✓
	*D*fE/pBV*	-	✓	✓
H3 There is a positive relationship between IPO offer (market) prices and proforma dividend	*pDIV/pBV*	+	✗	✗
H4a There is a negative relationship between firm's pre IPO leverage and IPO offer (initial) prices	*Lev*	-	✗	✗
H4b There is a positive relationship between firm's pre-IPO capital availability risk and IPO offer (initial) prices	*Cap*	+	✗	✗
H4c There is a negative relationship between firm's pre-IPO efficiency risk and IPO offer (initial) prices	*Effr*	-	✓	✓
H4d There is a negative relationship between firm's pre-IPO capacity risk and IPO offer (initial) prices	*Cpy*	-	✓	✓

Hypothesis	Variable	Expected sign	Evidence	
H4e There is a negative relationship between industry risk and IPO offer (initial) prices	*Ind*	-	✗	✓
H5a Sponsor reputation is positively related to IPO offer (initial) prices	*Spo*	+	✗	✗
H5b Firm age is positively related to IPO offer (initial) prices	*Age*	+	✗	✗
H5c Percentage of equity sold at the IPO is negatively related to IPO offer (initial) prices	*Eq*	-	✗	✓
H6 Privatisation IPOs are priced lower than private IPOs	*Priv*	-	✗	✗

Chapter 5

Chapter 5

IPO initial returns analysis

Introduction

The previous chapter presents and discusses the results relating to the IPO valuation analysis. The analysis tries to answer whether the prospectus information is useful to price the IPOs. The prospectus information is categorised into three groups: the fundamentals, the ex-ante risk factors, and the signals. The model used in the analysis is based on the accounting-based valuation model, which then is developed to two empirical models: the IPO basic valuation model and the full valuation model.

The evidence shows that the basic IPO valuation model works well with both the offer price and the initial market price scaled by pro-forma book value. The basic model was extended to include other prospectus information, such as the ex-ante risk factors, signals and a privatisation dummy as control variable. The empirical results show that two ex-ante risk factors, the efficiency risk and capacity risk factors, appear to be consistent with the working hypotheses. Industry risk is significantly related to the IPO initial market price, although its impact on the IPO offer price is insignificant. The results relating to the signalling variables support the findings from previous studies. However, only the ownership-retained variable, which is proxied by the percentage of equity sold at the IPO, is significantly related to the IPO valuation. The results relating to the control variable (privatisation dummy) is unclear. The sign of the *Priv* coefficients is as expected, but is found to be insignificant.

The prospectus information variables seem to interact in a similar way towards the offer price and the initial market price. However, a number of variables (forecasted earnings, dividends, capacity risk, industry risk, and the percentage of equity sold) appear to have significantly different impacts on the IPO offer and initial market prices, which may lead to the well-documented IPO underpricing anomaly.

This chapter presents and discusses the empirical results relating to the IPO underpricing analysis. As explained in the research design chapter, the short-run return or initial return is defined as the rate of return received by the 'initial' investors, by the close of the first trading day. In the IPO literature, the initial return is also identified as the underpricing phenomenon. In this study, both terms are used interchangeably.

The *IR* analysis tries to answer the second research question: *Does the prospectus information have a predictive power towards the IPO performance in the short run?* The analysis also examines whether there is 'mispricing' of IPOs which results in a significant positive initial return, as referred to in the IPO literature as the underpricing anomaly. An empirical model has been developed to undertake the IPO initial returns analysis. The model includes the prospectus information variables, the control variable (privatisation dummy), and the valuation residual as a proxy for the unobservable pricing variable.

The diagram in figure 5.1 below presents the main hypotheses in this empirical chapter. As discussed in the research design chapter, to simplify the IPO performance models (the initial returns models and the long run performance models), the fundamental variables are reduced to two variables: the proforma book to offer price ratio (pBV/P_0), and the forecasted earnings to offer price ratio (fE/P_0). Moreover, the results of the regression of the IR and the basic fundamentals, as shown in table 4.3 (p.188) in the previous chapter, shows that those proxies for the fundamentals have very low explanatory power to explain the IR[1]

It has been discussed in the research design chapter that the pro-forma book value to offer price and the forecasted earnings to offer price are expected to be positively related to the *IR*s. The rationale for each of the working hypotheses relating to IPO performance and the relationship to each of the ex-ante risk factors have been based on the theoretical positive risk-return relationship. Hence, in general a positive relationship between each of the ex-ante risk factors and the *IR*s is expected. Based on IPO signalling

[1] Column 3 of table 4.3 (p.188) shows the OLS regression results of IR and fundamentals (fE, Dummy and Interactive term for negative fE, and Dividends, all scaled by pro-forma book value). None of the fundamentals are significantly related to the IRs.

theory, it has been posited that the signals, which are sponsor reputation, and firm age will be negatively related to the IPO initial returns, while the percentage of equity sold at the IPO is positively related to the IPO *IR*s. In line with previous studies, it is also hypothesised that the privatisation variable will be positively related to the IPO initial returns. Finally, to capture the impact of other unobservable factors in the IPO valuation, the residuals (*Resi*) variable[2] is included in the *IR* model. The inclusion of *Resi* into the *IR* models has a similar motivation to the Beaty *et al*'s (2002) study. A negative relationship is expected between the IPO initial return and the residuals. More detailed working hypotheses regarding the *IR* analysis has been presented in the research design chapter table A.3.2 (appendix)

[2] The *Resi* variable is the standardised residuals from the IPO valuation model with the P_0/BV as the dependent variable.

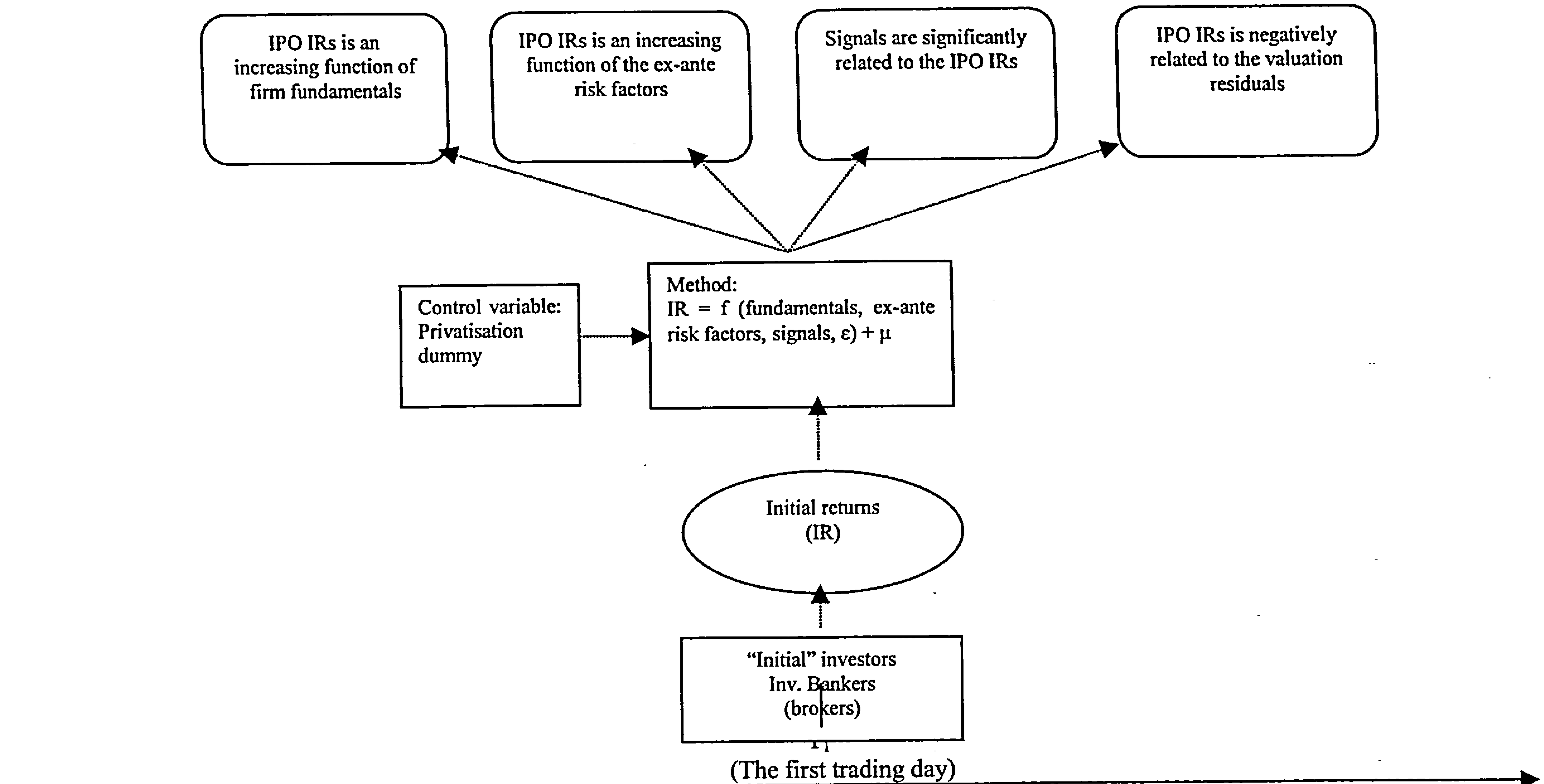


Figure 5.1. A summary of the main working hypotheses for the IPO initial returns analysis

The structure of this chapter is as follows. After the introductory section, descriptive statistics of the variables used in the *IR* models are presented. As the descriptive statistics of the main predictors has been discussed in the IPO valuation chapter, the descriptive statistics analysis in this chapter focuses on the IPO short run performance (*IR*s), and the *Resi* variables. This is followed by discussions of the results of the fundamentals, the ex-ante risk factors, the signals, the control variables, and the residuals. Finally, a brief summary of the chapter is presented.

5.1 Data

The data used in the *IR* models is from the sample of 161 IPOs used in the valuation analysis. Similar to the valuation analysis, the *IR* analysis also employs data from the IPO prospectus. Moreover, the prospectus information is also classified into the similar groups (fundamentals, ex-ante risk factors, and signals). However, as it is explained in the research design chapter, different proxies are used for the fundamentals[3]. Additionally, the *IR* models include the standardised residuals from the valuation model as a proxy for the unobservable factors on the pricing.

Table 5.1 below contains the descriptive statistics of IPO *IRs*, pBV/P_0 and fE/P_0 as proxies for fundamentals, and the residuals (*Resi*). The ex-ante risk factors and signals data is not presented in table 5.1, as the same figures from table 4.1 in previous chapter are used.

5.1.1. IPO initial returns

As mentioned above, the initial returns are the returns for the initial investors on the closing of the first trading day. Table 5.1 shows that *IR* has a mean (median) positive value of 0.089 (0.067), and is significantly different from zero at the 99% levels of

[3] In the IPO valuation model, five proxies for fundamentals (proforma book value of equity, forecasted earnings, negative earnings dummy, the interactive term of negative earnings dummy, and proforma dividends) are employed. To simplify, fewer and different proxies for fundamentals (proforma book value to offer price, and forecasted earnings to offer price) are used in the IPO IR analysis.

confidence, indicating the existence of underpricing in the research sample. It implies that on average, investors, who buy the IPOs at the offer prices and sell them at the closing prices of the first trading day, are better off by 8.9% from their investments.

Table 5.1. Descriptive statistics for initial return analysis

The table contains descriptive statistics for IPO sample of variables in the IPO performance analysis. ***IR*** to IPO initial returns, which is measured by the percentage of the difference of the closing price on day 1 and the offer price to the offer price $[(P_1-P_0)/P_0$, ***pBV/P₀*** to proforma book value to offer price, ***fE/P₀*** to forecasted EPS to offer price, and ***Resi*** to standardised residuals from the IPO valuation model with P_0/BV as the dependent variable.

Variable	N	Mean	Median	StDev	Min	Max
IR	161	0.095***	0.068	0.110	-0.171	0.700
pBV/P_0	161	0.454	0.366	0.281	0.108	1.165
fE/P_0	161	0.064	0.075	0.046	-0.120	0.149
Resi	161	0.003	-0.182	1.022	-2.413	3.843

Note: ***significant at 1%

Most of the IPOs (155 IPOs) in the research sample are underpriced, 18 IPOs are overpriced, and 6 IPOs are accurately priced. The maximum *IR* is 53.1% (Virtuality Group plc) and the minimum is –18.7% (Betacom plc).

Levis (2001) documents a higher average first day return of 60.1% for the LSE in 2001. These figures include all IPOs for all three UK markets. However, the figure is much lower for the main market, which records an average of 5.9% for the first day return. Since the research sample is drawn from IPOs on the UK main market, it appears that the research sample has a higher average initial return than the recent figures documented by Levis (2001).

The research sample of this study includes 10 privatisations. Prior studies conclude that PIPOs are priced differently, which results in the higher *IR*s of PIPOs than the private IPOs. Table 5.2 below presents the comparison of IPO *IR* of the non-privatisation and privatisation sub-samples. The privatisation sub-sample shows that PIPO prices closed at an average of 13.7% higher than the offer price on the first trading day. The non-privatisation IPOs shows that they are less underpriced. Further statistical analysis reveals that the initial returns (IRs) of PIPOs are significantly different to the initial returns (*IR*s) of non-privatisation IPOs at the 99% level of confidence[4].

It is also known that over the next 3 years after the admission, 17 IPOs of the research sample have not survived to their 3rd anniversary[5]. Therefore, it is interesting to examine further the comparison of the performance between the survivors and non-survivor IPOs.

Table 5.2 The descriptive statistics of IRs across the research sub-samples
The table contains the IPO initial returns of privatisation, non-privatisation, survivors, and non-survivors sub-samples.

IPO sub-sample	N	Mean	Median	StDev	Min	Max
Privatisation	10	0.137***	0.147	0.094	-0.025	0.302
Non-privatisation	151	0.080***	0.064	0.087	-0.187	0.351
Survivors	144	0.086***	0.069	0.089	-0.187	0.351
Non-survivors	17	0.058**	0.064	0.084	-0.082	0.307

*Note: ** significant at 5%; *** significant at 1%*

Table 5.2 above also includes the descriptive statistics of the *IR*s of the survivors and non-survivors sub-samples. Like other IPOs, the non-survivors shows a significant positive initial returns, suggesting that the non-survivors are also underpriced on the first day although they are less underpriced than their counterparts (survivor IPOs). However, the difference of *IR* means between the two groups appears to be insignificant statistically.

IPO studies have also documented the third anomaly called the hot market. During the research period, there is a sub-period when the UK economy, in general, was in recession (early 1990s). Therefore, it is interesting to see the IPO performance during different economic states. Table 5.3 below presents the distribution of average initial returns (*IR*) for the research sample by year when the IPOs took place. The maximum average *IR* per year is 20.1% in 1987, and the lowest is 2.5% in 1992. All years show that *IR*s take positive values significantly different to zero, except for *IRs* in 1990. Although the *IR* distribution over the years, as demonstrated in figure 5.2 (see Appendix A.5.1.),

[4] The hypothesis testing of the mean difference between two populations is undertaken. The t-test results in a rejection of the hypothesis of equal means of IRs between the PIPOs and the non-PIPO at 1% level.
[5] More detailed information regarding the 17 non-survivor IPOs in the research sample will be explained in the IPO long-run performance chapter.

does not show any clear pattern throughout the research period[6], it could be inferred that during the recession phase (early 1990s), few firms went public (cold market) and the market demand also appears to have been low, which is shown in the low *IR*s. Then, the market peaked again on the mid 1990s up to the Internet bubble era. The distribution shows that an increasing number of firms went public and so did the market demand, which is shown in the increasing *IR*s.

Table 5.3 The IR of all sample by year

The table consists of the average of initial returns (*IR*) of the research sample by year when the IPO took place.

Year	No.of IPO sample	Mean	Median	Standard deviation
1987	7	0.201***	0.229	0.124
1988	13	0.048**	0.046	0.087
1989	6	0.128**	0.153	0.107
1990	2	0.040	0.040	0.161
1991	6	0.098**	0.071	0.095
1992	10	0.025**	0.039	0.078
1993	17	0.111***	0.093	0.164
1994	31	0.085***	0.063	0.083
1995	19	0.109***	0.096	0.097
1996	29	0.112***	0.078	0.117
1997	21	0.072***	0.066	0.094

*Note:** significant at 5%; ***significant at 1%*

5.1.2. Fundamental and Residual Analyses

As many studies using return models employ a number of fundamental accounting ratios, such as the book to market ratio, this study also uses proforma book value of equity to the offer price (pBV/P_0) ratio and forecasted EPS to the offer price (fE/P_0) ratio. Additionally, the standardised residuals from the valuation model are included as a predictor in the performance models as a proxy for the ex-ante unobservable factors.

The descriptive statistics shown in table 5.1 above demonstrates that the pro-forma book to market ratio of the sample has a mean (a median) of 0.454 (0.366), which means

[6] The research sample shows a correlation coefficient of 0.002 between the number of IPOs and the IRs, which is statistically insignificant.

that on average, the IPOs were offered at more than twice their net book value of equity per share, suggesting that the expectations regarding the future possible earnings plays an important role in IPO pricing as well as the net asset of the firm. However, the numbers are higher than the ones in the US market[7], implying that the US IPO pricing depends even more on the expected future earnings.

Fama and French (1995) argue that the book to market ratio contains the information of the shares riskiness. Moreover, they argue that the firms with high book to market ratios tend to be persistently distressed. Conversely, firms with low book to market ratios are associated with sustained strong profitability. Therefore, the implication of such information to the IPO initial investors is that IPOs with the higher pBV/P_0 are riskier; therefore greater *IR*s are expected to compensate for the additional risk. On the other hand, IPOs with lower pBV/P_0 are less risky, hence lower IRs are expected. To examine that relationship, the research sample is divided into the low and high pro-forma book value to offer price groups based on the median. Then the average of initial returns of each group is examined. Table 5.4 below presents the comparison of IPO initial returns between the pro-forma book value to offer price groups.

Table 5.4. The IPO performances of Fundamentals groups
The table contains the IPO *IR*s of the low and high pBV/P_0 groups

Fundamentals		IR
pBV/P_0	Low	0.0974***
	High	0.0695***

Note: *** significant at 1%

Surprisingly, the result shows the opposite. The low pBV/P_0 group demonstrates a significant higher average initial return (*IR*). Further examination shows that the *IR*s of the IPOs with pBV/P_0 is statistically different to the *IR*s of the IPOs with high pBV/P_0[8]. The result implies that IPOs that are offered at the higher price relatively to the book value

[7] Using US data for 1980-1991 period, Klein (1996) finds the mean (median) of pro-forma book value to offer price is 0.3241 (0.2967).
[8] The hypothesis testing of mean difference between two populations is undertaken. The t-test results in a rejection of hypothesis of the equal means of IRs between the low pBV/P_0 IPOs and high pBV/P_0 IPOs at the 5% level.

(lower pBV/P_0) are priced higher in the market, which results in greater *IR*s. On the other hand, IPOs that are seemingly 'underpriced' relatively to the book value (higher pBV/P_0) are valued lower in the market, which results in lower subsequent *IR*s. This suggests market momentum.

Referring to the Fama and French's proposition regarding the information content of the book-to-market ratio, the result shows that the market favours the low pBV/P_0 IPOs (less risky IPOs) than the high pBV/P_0 IPOs (riskier IPOs), so that it pushes the demand for low pBV/P_0 IPOs up, which results in higher price and higher *IR*s. Therefore, it could be inferred that in the short-run the initial demand for the IPOs drives the *IR*s more than the risk-return relationship.

Another fundamental used in the *IR* models is the forecasted earnings to price ratio. Similar to the book to market ratio, prior studies (e.g., Fama and French, 1988) show that the earnings/price ratio captures information about stocks risk and has the ability to predict stocks returns. Table 5.1 above exhibits that forecasted earnings to offer price ratio of the sample has a mean (a median) of 0.064 (0.075).

The standardised residual of the IPO valuation model (*Resi*) has an average value of 0.003. By construction, the mean of *Resi* is expected to be zero; further examination confirms that the mean value is not statistically different to zero. However, the negative value of the median is significantly different to zero at the 90% level of confidence. It also shows that *Resi* is not normally distributed.

5.2. Univariate analysis

Table 5.5 below exhibits the correlation coefficients between each of the research variables in the *IR* models. This section analyses on a one-to-one basis the relationship between the predictors and the IPO short run performance (*IR*s) that are statistically significant.

Table 5.5 – Correlation matrix
The table contains the (Pearson) correlation coefficients of all variables in the IPO performance models using all-sample IPOs

	IR	pBV/Po	fE/P0	Lev	Cap	Effr	Cpy	Ind	Spo	Age	Eq	Priv
pBV/Po	***-0.130***											
fE/P0	-0.010	***0.140***										
Lev	-0.060	***-0.229***	***-0.134***									
Cap	0.101	-0.111	0.032	***0.148***								
Effr	-0.001	0.112	***0.201***	***-0.166***	-0.082							
Cpy	***-0.169***	0.016	-0.098	***0.267***	-0.079	***-0.143***						
Ind	***-0.182***	0.087	***0.165***	-0.016	-0.049	0.078	-0.122					
Spo	-0.012	0.011	-0.057	***-0.131***	-0.007	-0.083	***-0.201***	-0.009				
Age	-0.065	-0.058	0.122	-0.071	***-0.254***	-0.012	0.004	0.064	-0.015			
Eq	0.052	***0.452***	0.159	-0.097	-0.058	***0.187***	-0.121	0.007	0.080	-0.069		
Priv	***0.156***	***0.470***	0.078	***-0.207***	0.055	***0.152***	***-0.290***	0.008	***0.168***	-0.128	***0.705***	
Resi	***0.209***	***-0.269***	***-0.215***	-0.004	-0.001	-0.005	***-0.001***	-0.004	-0.006	0.004	-0.007	-0.004

Note: the coefficients in bold and italic are statistically significant at the 10% level.

Overall, it could be said that the correlation matrix shows that generally, no multicollinearity problem exist among the research variables, except a high correlation between the percentage of equity sold at the IPO and the privatisation dummy.

As discussed in the previous section, the working hypothesis posits a positive association between the pBV/P_0 and the *IRs*. However, the correlation matrix (table 5.5) shows that pBV/P_0 is negatively and significantly related to the *IR*s. This implies that the IPOs, which were valued higher relatively to this fundamental at the admission, are valued higher on the first trading day, suggesting the investors' over optimism on the earning potential of the 'hot' IPOs.

The other fundamental variable is the earning-price ratio, which is proxied by the forecasted EPS to offer price (fE/P_0). Prior research suggests that such a variable contains information regarding the shares risk. Therefore, a positive association between the fE/P_0 and the IPO returns is expected. Table 5.5 exhibits a negative correlation between fE/P_0 and *IRs*, although statistically insignificant.

In the research design chapter (chapter 3), it is argued that the hypotheses of the ex-ante risk factors and the IPO performance are developed on the general risk-return relationship. Therefore, this study posits positive relationships between the ex-ante risk factors and the IPO short-run and long run returns. However the correlation matrix shows all the ex-ante risk factors to be negatively related to the *IR*s, implying that riskier IPOs are less underpriced. Nonetheless, only 2 out of 5 ex-ante risk factors (Capacity risk and Industry risk factors) are significantly related to the *IR*s. All signal variables in the model (*Spo*, *Age*, and *Eq*) turn out to be insignificantly related to the *IR*s.

Many studies document evidence of underpricing of privatisation IPOs (PIPOs). Prior sections demonstrate that the PIPOs in the research sample are more underpriced than the rest of the sample. The univariate analysis, here, shows that the dummy for privatisation (*Priv*) is positively related to the *IR*, confirming that PIPOs are more underpriced than ordinary IPOs. Moreover, the descriptive statistics analysis also demonstrates that in the long run, PIPOs perform significantly different to their private IPO counterparts.

It is argued in the research design chapter that the inclusion of the standardized residuals (*Resi*) into the performance model is to capture the unobservable factors affecting the IPO pricing. Theoretically, the greater *Resi* means the IPOs are more overpriced relatively to the fundamentals, hence lower *IR*s are anticipated. Thus, *Resi* is expected to be negatively related to the *IR*s, assuming that the market does not misprice the IPOs on the first trading day. However, the correlation coefficient between the *IR*s and *Resi* turns out to be positive and statistically significant, suggesting that the IPOs with greater residuals, meaning those that are more overpriced relatively to the fundamentals, are valued higher on day 1. This corroborates with the pBV/P_0 univariate analysis, suggesting market momentum on the first trading day. This is in line with Beatty *et al.*. (2002), who find that the offer price residuals are positively related to the standard deviation of the IPO returns for the first 5 days as a measure of the IPO risk. They also find that the IPO risk is positively related to the offer price, which result in higher *IR*s. Hence, they conclude that 'hot' IPOs appear to be priced higher on the first day and generate greater *IR*s.

In sum, the univariate analysis suggests that the IPO short-run performance is affected by the investors' over optimism. The analysis also indicates that only some of the ex-ante risk factors (*Cpy*, *Ind*) appear to be correlated to the IPO *IRs*, but none of the signals are individually related to *IRs*. It also confirms the evidence of the PIPOs underpricing.

5.3. The IPO initial returns analysis

Table 5.6 below demonstrates the results of the IPO initial return model for the full IPO sample. The results of the IPO valuation models in the previous chapter demonstrate that the behaviour of each predictor is similar for both P_0/pBV and P_1/pBV. It is, therefore, unsurprising that those predictors do not help much in explaining the *IR*s. However, there are a number of interesting findings in the results of the *IR* models.

Table 5.6 presents the OLS regression results of three *IR* models. The first model includes the fundamentals, ex-ante risk factors, and signals. It is then extended by including a dummy for PIPOs into the second model. Finally, the third model includes all variables in the second model and the standardised residual variable (*Resi*).

The presentation of the analysis is split into to the separate predictor variable groups. The next sub-section analyses the result of *IR* models on the fundamentals, followed by the analysis of the ex-ante risk factors, signals, privatisation, standardised residuals, and finally, the model as a whole. A number of sensitivity analyses to the result of the *IR* model are also presented at the end of this section.

5.3.1. Fundamental analysis

The constant coefficients of all the IPO initial return models are positive and significant. This, again, confirms the underpricing anomaly of the research sample as an addition to the evidence demonstrated in the descriptive statistics of *IR*. The *IR* model result shows the persistence of the underpricing of the research sample after adjusting and controlling for other variables.

One conclusion of the IPO valuation analysis is that although the fundamental variables are priced similarly on the IPO offer and initial prices, it is found that there are significant impacts of pro-forma book value and forecasted earnings on the price differences between day 1 and day 0, scaled by pro-forma book value$[{(P1 - P0)}/{pBV}]$.

Therefore, it is expected that both fundamental variables could explain the variations in the *IR*s. The working hypothesis posits a positive coefficient of pBV/P_0.

Table 5.6 Regression analysis on the IPO initial return model

The table contains output from OLS regression for all IPO sample, of the initial return (*IR*) on pro forma book value scaled by the offer price (*pBV/P₀*), forecasted earnings scaled by the offer price (*fE/P₀*), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), privatisation dummy (*Priv*), and standardised residual from the valuation model (*Resi*). Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	Model I (t-stat)	Model II (t-stat)	Model III (t-stat)
Constant	0.329***	0.350***	0.356***
	(3.62)	(3.49)	(3.65)
pBV/P_0	-0.054*	-0.071**	-0.056
	(-1.93)	(-2.41)	(-1.63)
fE/P_0	0.09	0.041	0.115
	(0.06)	(0.26)	(0.72)
Risk factors:			
Lev	-0.012	-0.009	-0.004
	(-0.75)	(-0.64)	(-0.25)
Cap	0.011	0.007	0.012
	(0.73)	(0.47)	(0.71)
Effr	-0.010	-0.011	-0.016
	(-0.34)	(-0.35)	(-0.48)
Cpy	-0.44*	-0.031	-0.031
	(-1.91)	(-1.38)	(-1.08)
Ind	-0.239**	-0.232**	-0.370**
	(-2.58)	(-2.25)	(-2.42)
Signals:			
Spo	-0.013	-0.016	-0.011
	(-0.79)	(-1.03)	(-0.60)
Age	-0.003	-0.003	-0.003
	(-0.57)	(-0.42)	(-0.38)
Eq	0.048	-0.014	-0.036
	(1.16)	(-0.29)	(-0.57)
Priv	-	0.091**	0.084**
		(2.07)	(2.01)
Resi	-	-	0.015**
			(2.18)
N	161	161	161
Adj.R-sq	0.044	0.065	0.088
Wald regression	26.43***	41.38***	49.85***
Wald fundamental	3.30	5.32*	2.74
Wald ex-ante risk factors	15.40***	9.91*	10.18*
Wald signals	2.20	1.65	1.72

*Note: * significant at 10%; ** significant at 5%; *** significant at 1%*

It has been explained in the research design that the higher pBV/P_0 implies that the IPOs are more underpriced relatively to the fundamentals; therefore a greater *IR* is expected. Additionally, Fama and French (1995) argue that the book-to-market ratio contains information regarding the shares riskiness. Beatty and Ritter (1986) also conclude that the greater uncertainty, the greater the degree of IPO underpricing. Based on those arguments, the working hypothesis posits a positive relationship between the pBV/P_0 and the IPO *IR*s. However, the evidence in table 5.6 demonstrates that the impact of the pBV/P_0 on *IR* is negative. The result means that IPOs with higher pBV/P_0 result in greater *IR*s. While the result corroborates the univariate analysis, it rejects the working hypothesis (H7a). As suggested in the univariate analysis,s the explanation for this appears to be down to the investors' optimism on such 'hot' IPOs.

As argued by Fama and French (1995), high book-to-market ratios are typical of firms that are relatively distressed, that signals sustained low earnings on book equity. Conversely, low book-to-market is typical of firms with high average returns on capital. Therefore, the result implies that IPOs with low book-to-market (signalling potential high growth) are valued higher in the market as a reflection of the investors' optimism on the potential earnings growth of the firms.

The impact of pBV/P_0 on the *IR*s is significant in model I and II, yet, it loses its significance when *Resi* is introduced in model III. Although the correlation coefficient between pBV/P_0 and *Resi* is significant, the magnitude of the coefficient suggests a weak correlation (-0.269). Therefore, it is sufficient to say that there is no multicollinearity problem.

The working hypothesis expects that the earnings forecast is positively related to the returns as the earnings forecast is usually used as a signal to the firm's value, as demonstrated in the IPO valuation chapter. Moreover, the IPO valuation analysis also concludes that the impact of forecasted earning is significant on the IPO pricing differences $[{}^{(P1-P0)}\!/_{pBV}]$

The result in table 5.6 above shows a positive association, although the impact appears to be insignificant in all IR models. Using the USM data, Keasey and McGuiness (1991) find that the disclosure of the forecasted earnings in the prospectus reduces the information asymmetry, which in turn results in the lower *IR*s. However, the proxy for the forecasted earnings applied in their study is different to that adopted in this study. They employ a dummy variable for the forecasted earnings. The dummy takes a value of 1 when the forecasted earnings is disclosed in the offering prospectus. Other IPO studies examining the prospectus forecasted earnings tend to focus on the association between the accuracy of the earning forecasts (the forecast error) and the underpricing (e.g. Firth, 1998, How and Yeo, 2000). This study examines a direct impact of the earnings forecast on the IPO initial returns based on the information available to the market at the admission. Moreover, it does not only analyse whether the voluntary disclosure of the earnings forecast in the prospectus has a different impact on the IPO initial returns, but also provides more information on the explicit association between the earnings forecasts and the IPO initial returns.

In sum, the impact of the fundamentals on the IPO initial returns is not as robust as it is on the IPO valuation. The proforma book value of equity to offer price ratio is negatively related to the *IR*s, suggesting market momentum. The impact of earnings forecast to offer price on the *IR*s appears to be insignificant. Moreover, the Wald statistics in table 5.6 demonstrates that the joint restriction of the fundamentals as a group is mixed. The fundamental group only has significant impact on *IR*s in model II, when the privatisation dummy is included in the model. However, the impact loses significance once the model includes the valuation residuals.

5.3.2. Ex-ante risk factors analysis

As explained in the research design chapter, the general hypothesis regarding the relationship between the risk factors and the IPO return is in line with the traditional risk-return relationship, which posits a positive association. However, it is noted here, since the *IR* is the one-day return, the expected risk-returns relationship in the short-run may not be as strong as expected in the long-run window of returns.

Row 4 to 8 of table 5.6 above indicate the estimated coefficients on the ex-ante risk factors in relation to the *IR*. As shown in the univariate analysis, each ex-ante risk factor appears to be negatively correlated to the *IR*, which is contrary to the testable hypotheses. After controlling for other variables (fundamentals, signals, privatisation, and residuals), these associations remain unchanged. For example, the results of all *IR* models (model I, II, and III) show that the leverage risk factor (*Lev*) is negatively related to *IR*, implying that IPOs with higher leverage tend to have lower returns on day 1. This appears to be inconsistent with the hypothesis (H8a). However, it is in line with the results of Hedge and Miller (1996), which examine the signalling role of debt in IPO pricing and find a negative association between the debt ratio and the degree of underpricing. However, the coefficients are insignificant.

The second risk factor examined is the capital availability (*Cap*). The result shows positive coefficients of Cap in all the *IR* models, implying that the more internal capital is available to the firms, the less risky the IPOs, and the higher the initial returns. This is contrary to the working hypothesis (H8b) regarding the *Cap-IR* relationship. It could be argued that there is a higher demand for the IPOs with greater capital availability, which results in higher *IR*s. However, the results are statistically insignificant across the *IR* models.

The efficiency risk (*Effr*) appears to be negatively related to *IR*, suggesting that the IPO firms with lower operating efficiency tend to have lower *IR*. In other words, the less efficient the firm's operating system, the riskier the firm, the lower the *IR*. This result rejects the general hypothesis of a risk-return relationship, which in turn also does not support the working hypothesis (H8c). Yet, it shows the investors' favour towards less risky IPOs. However, the impact appears to be statistically insignificant.

Capacity risk (*Cpy*) is measured by the ratio of investment proposed in the prospectus over the net IPO proceeds. It is hypothesised that IPOs, which disclose in the prospectus that the usage of the net proceeds is mainly for investment activities, are considered as riskier IPOs. Therefore, it is expected that such IPOs produce higher returns, in the short run and the long run. However, the evidence in the *IR* models shows that *Cpy* is negatively related to *IR*, implying that the more proceeds are used for the investment activities, the riskier the IPOs, the lower the *IR* on day 1. The result appears to be inconsistent to the working hypothesis (H8d). However, after controlling for privatisations (model II) and the valuation residual (model III), *Cpy* loses its significance. The correlation matrix (table 5.6) demonstrates a low but significant correlation between *Cpy* and *Priv*. Thus, the impact of *Cpy* on *IR* becomes weaker, once privatisations are taken into consideration.

Another risk factor that appears to have a significant relationship to *IR*, consistently throughout all *IR* models, is the Industry risk (*Ind*). The *Ind* is measured by industry Beta in the quarter when firms go public. Higher beta reflects higher industry risk. The working hypothesis (H8e) regarding the *Ind-IR* relationship posits a positive association. Table 5.6 above presents negative coefficients of *Ind* for all models. This result implies that IPOs from riskier industries tend to have lower initial returns. Hence, it does not support the working hypothesis, yet it confirms the higher market short run demands for the IPOs in the less-risky industry.

In sum, the empirical results on the ex-ante risk factors impact on *IR*s appear to be contrary to the general hypothesis of a risk-return relationship. Despite the general lack of statistical significance, the results of the ex-ante risk factors suggest a negative relationship between IPO riskiness and the *IR*s. This suggests that in the short run, investors favour the less risky IPOs, which pushes up the market price, and thus results in higher *IR*s for the less risky IPOs. This suggestion is consistent with the fundamentals-*IR* association that has been discussed in the previous section. However, regarding the statistical matter, only industry risk has a significant impact on the *IR*s, while the impact of capacity risk vanishes when the model is adjusted by the privatisation dummy and the valuation residuals.

Despite mixed results regarding the impact of the ex-ante risk factors on the *IR*s, the Wald statistics (see table 5.6) shows that the joint restriction of the ex-ante risk factors group is consistently significant across the *IR* models. This implies that as a group, they are significantly related to the *IR*s.

5.3.3 Signalling analysis

The relationships between the signals examined in this study and IPO initial returns have been discussed widely in the prior IPO literature. In general, 3 working hypotheses regarding the signals-*IR* relationship are based on expected positive associations. The evidence presented in table 5.6 above shows that the results are in line with the hypotheses as well as previous findings. However, unexpectedly, none of the signals appear to be statistically significant.

The sponsor reputation (*Spo*) coefficients are negative, which implies that IPOs sponsored by prestigious investment bankers appear to have lower returns. The result corroborates the working hypothesis (H9a), which sustain that prestigious investment bankers price the IPOs more accurately than less prestigious bankers. It also suggests that prestigious investment bankers choose to sponsor the less risky firms, which results in lower *IR* (or less underpricing). This means that less prestigious investment bankers are left with the riskier IPOs, which in turn results in higher *IR* (or more underpricing) (Johnson and Miller (1988), Carter and Manaster (1990)). Compared to prior UK studies, the result does not confirm the findings by Byrne and Rees (1994) who find a significant relationship between the sponsor reputation and the IPO initial returns; however it is in line with results in Keasey and McGuiness (1992) and Keasey and Short (1992). Using IPO data from the USM, they find an insignificant impact of sponsor reputation on the *IR*s. Moreover, the result, here, fails to corroborate with the recent paper by Logue *et al.* (2002) based on the US market.

The testable hypothesis regarding the *Age-IR* relationship posits that older firms are expected to have lower *IR*. The evidence seems to support the testable hypothesis (H9b). The negative Age coefficient implies that the more experienced IPO firms tend to have lower *IR*. This confirms the results from a previous study by Ritter (1984) that also finds a negative relationship between firm age and the level of underpricing. However, this study finds that the relationship is statistically insignificant. It is in line with the findings from previous UK studies (e.g., Keasey and Short, 1992) that find no evidence of an *Age-IR* association. The ownership variable is the most popular signalling variable used in IPO studies to explain the abnormal return in the short-run and long run. The IPO signalling hypothesis (Welch, 1989) shows strong support for a positive association between ownership retention and IPO valuation, and a negative relationship between the ownership retention and the IPO abnormal short-run performance. However, prior evidence demonstrates mixed results (e.g., Jegadeesh *et al.*, 1993). In the IPO valuation analysis, this study finds support for the IPO signaling theory. As explained in the Research design chapter, this study uses the percentage of equity sold at the IPOs as a proxy to the ownership. Therefore, a positive relationship between the percentage of equity sold at the IPO dates and *IR* is expected. However, table 5.6 demonstrates mixed results, although none of the *Eq* coefficients are statistically significant. In model I, without controlling for privatisation and valuation residuals, the *Eq* coefficient turns out positive. The suggestion, here, is that, the higher percentage of the enlarged share capital that is sold at the admission means the less confidence old shareholders of the firm have in its future value, which results in more underpricing in the market. Consequently, the higher *IR* is expected. This result appears to be consistent to the findings from prior UK studies (e.g., Keasey and Short, 1992). However, after introducing the privatisation variable in model II and, then, the valuation residuals in model III, the *Eq* coefficients change to negative, which suggests that the higher the percentage of the enlarged share capital sold at the admission, the lower the *IR*s. The explanation for this is down to the *Eq-Priv* relationship. Although the univariate analysis concludes there is generally no multicollinearity problem among the research variable, the correlation matrix (table 5.5) does record a correlation coefficient of 0.705 between *Eq* and *Priv*, which is statistically significant at the 95% level of confidence. A further investigation of the PIPOs in the research sample shows that all PIPOs sold 100% of the enlarged number of shares at the admission. Therefore, it is sufficient to say that the changing sign of Eq in model II and III is due to the *Eq-Priv* correlation. Nonetheless, *Eq* is statistically insignificant in all *IR* models.

In sum, despite the lack of statistical significances, the results of the signalling analysis show that in general, the impact of signals (Spo, Age, Eq) on the *IR*s is as predicted. However, the role of the ownership retention variable, which is measured by the percentage of the enlarged number of shares sold at the admission, in explaining the *IR* variations becomes unclear, when the model is adjusted to privatisations. The proposed explanation to this matter is due to the significant relationship between the ownership retention variable and the privatisation dummy. Moreover, the Wald statistics in table 5.6 also demonstrates that the joint restriction of the signals as a group have insignificant impact on the *IR*s.

5.3.4. Analysis in respect of the control variable - Privatisation

Prior studies show robust evidence of the underpricing of privatisation IPOs (PIPOs). Somehow, PIPOs appear to be more underpriced (higher *IR*) than private IPOs (Martin and Parker, 1997; Dewenter and Malatesta, 1997; Florio and Manzoni, 2004). Based on findings from other studies, this research posits a positive relationship between *Priv* and the *IR*. The role of privatisation in the *IR* models is presented in models II and III. The results in table 5.6 shows positive and significant *Priv* coefficients, suggesting that PIPOs tend to have higher *IR*, i.e., they are more underpriced. This result confirms the descriptive statistical analysis that also finds PIPOs are more underpriced by 5.7%[9].

[9] Table 5.2 presents that the non-privatisation IPOs records an average of 8.0% IRs, while the PIPOs have an average of 13.7% IRs.

In their research, Dewenter and Malatesta (1997) raise the question of whether PIPOs in several countries are deliberately undepriced. However, their research sample, including some UK PIPOs, cannot conclude the underpricing deliberation of the PIPOs. In this study, having argued that government wants to ensure the participation of investors in the subsequent PIPOs, there is an incentive to underprice the PIPOs. The results of model II and III of the *IR* models confirms that PIPOs are more underpriced than their counterparts. Moreover, the result in the IPO valuation model shows a negative association between *Priv* and the IPO offer price, although this result appears to be statistically insignificant. Therefore, despite the robust result of the *IR* model regarding the role of privatisation, this study cannot conclude that PIPOs are deliberately underpriced.

In the main *IR* analysis, the *IR* models are adjusted by the inclusion of the privatisation dummy in model II and model III to control for the PIPO effect. However, to check whether other predictors' behaviours towards the *IR*s are similar between the PIPOs and their counterparts, it is valuable to perform a sensitivity analysis. Therefore, the *IR* models are applied once more using the non-privatisation sub-sample.

Table 5.7 below presents the results of the *IR* model for the non-privatisation sub-sample. Consequently, the privatisation dummy is dropped from the models, leaving only model I and model III to perform the analysis.

The analysis shows a number of interesting results. Firstly, the constants show a robust result of the underpricing of the non-PIPOs. The constant variables magnitudes are, on average, lower than the ones for the full sample. This is understandable, as the full sample includes the PIPOs that are proven to have higher *IR*s, as concluded in the descriptive analysis.

Table 5.7 Regression analysis on the IPO initial return model for non-privatisation IPOs

The table contains output from OLS regression for non-privatisation sub sample, of the initial return (*IR*) on pro forma book value scaled by the offer price (pBV/P_0), forecasted earnings scaled by the offer price (fE/P_0), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), privatisation dummy (*Priv*), and standardised residual from the valuation model (*Resi*). Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	Model I (t-stat)	Model III (t-stat)
Constant	0.307***	0.319***
	(2.99)	(3.33)
pBV/P_0	-0.064**	-0.046
	(-2.13)	(-1.36)
fE/P_0	-0.089	0.006
	(0.51)	(0.03)
Risk factors:		
Lev	-0.006	-0.005
	(-0.42)	(-0.31)
Cap	0.005	0.005
	(0.34)	(0.34)
Effr	-0.012	-0.013
	(-0.39)	(-0.44)
Cpy	-0.034	-0.035
	(-1.46)	(-1.46)
Ind	-0.193*	-0.201**
	(-1.86)	(-1.99)
Signals:		
Spo	-0.017	-0.015
	(-1.06)	(-0.99)
Age	-0.001	-0.002
	(-0.12)	(-0.23)
Eq	-0.011	-0.021
	(-0.23)	(-0.38)
Resi	-	0.014*
		(1.94)
N	151	151
Adj.R-sq	0.027	0.045
Wald regression	26.46***	33.80***
Wald fundamental	5.01*	1.86
Wald ex-ante risk factors	6.06*	6.79*
Wald signals	1.53	1.63

*Note: * significant at 10%, ** significant at5 %, ***significant at 1%*

The fundamentals perform similarly to the main result. The pro-forma book value to offer price is significantly related to the *IR*s (model I), but this relationship fades once the model controls for the valuation residuals. The forecasted earnings to offer price ratio remains insignificant.

An interesting outcome is found in the ex-ante risk factors result. For the full sample (table 5.6), the capacity risk (*Cpy*) is significantly related to the *IR*s in model I, but this impact becomes unclear in the subsequent models after controlling for the privatisation dummy and the valuation residuals. The result of *Cpy* for the non-privatisation sub-sample demonstrates the insignificance impact of such risk factors on the IRs. Although, it seems to be inconsistent to the main results of model I, it corroborates the result of model II for the full sample. Therefore, this result does not differ after all, since the results of model I for the non-privatisation sub-sample is equivalent to the results of model II for the full sample. The industry risk (*Ind*) shows consistent results, although the impact of *Ind* on the *IR*s is weaker for the non-privatisation sub-sample than it is for the full sample.

The signalling results remain unchanged. Sponsor reputation (*Spo*) performs slightly better, but the impact is still insignificant, while the impact of firm age is, literally, close to zero. The coefficient of the percentage of equity sold at the offering (*Eq*) appears to be of the opposite sign and insignificant. The residuals variable demonstrates a stable result, which confirms the momentum of the IPOs.

In sum, this study demonstrates that PIPOs are priced differently to private IPOs, so that on the first trading day the PIPOs record a significant higher *IR*s compared to the non-PIPOs. This confirms findings from previous studies. However, the impact of PIPOs is limited as shown by the similar result found in the main analysis and the sensitivity analysis using the non-PIPO sub-sample.

5.3.5. Analysis of offer price underpricing (residual)

Column 4 in table 5.6 above presents the result of model III of the *IR* models, in which the residual from the IPO valuation model (Resi) is included. This variable refers to other missing (unobservable) variables that are assumed to affect the IPO valuation at the offer price. It has also been presented in the earlier section of this chapter that, by construction, the average of *Resi* should be nil and the descriptive statistics show that on average, *Resi* is almost zero (0.003). The sign of *Resi* in model III is expected to be negative. Since the greater Resi arise when IPOs are priced higher relatively the firm's fundamentals, in turn, lower *IR*s are expected.

The empirical evidence shows that the *Resi* coefficient appears to be positive and significant, which rejects the working hypothesis H11. The result implies that IPOs, which are offered at higher prices relatively to their fundamentals, continue to get even more 'overvalued' on the first day of trading, suggesting market momentum. This verifies the findings of the impact of pBV/P_0 on the *IR*s.

Another possible implication as suggested by Purnanandam and Swaminathan (2002) is that the issuers/sponsors price these IPOs at a premium given their private information about the future growth prospects of the firms. If the market agrees with the issuers/sponsors, their prices would run-up further in the after-market.

Additionally, further analysis shows that IPOs offered at higher prices, on average, result in higher *IR*s. Table 5.8 below exhibits the distribution of the average of *IR* based on P_0 quartiles.

Table 5.8 The IR average and the offer price (P_0) distribution

Quartile	P_0 range (p)	IR average (%)
1	< 178.26	7.24
2	178.26 - 283.02	7.01
3	283.02 – 414.27	9.77
4	> 414.27	10.87

The table shows the pattern of *IR* average distribution based on P_0. In the research sample, the greatest *IR* average is found for Q4 or in the IPOs with P_0 greater than 414.27p per share, while the minimum *IR* average is found in the Q2. This suggests higher P_0 IPOs tend to be more underpriced. This result supports prior evidence found in the UK main market and USM during the period 1980-1988 (Levis, 1993) as well as in the Singaporean market (Firth, 1998).

If the IPOs are underpriced relatively to their fundamentals, the *Resi* is expected to be lower and the *IR*s is greater, hence a negative coefficient of *Resi* is predicted. However, since the evidence shows the opposite result, this study cannot confirm that the IPO are underpriced at the offer price. Rather, it suggests that the IPOs with greater *Resi* are surrounded by higher uncertainty, which results in the greater *IR*s. This suggestion is in line with the findings in Beatty and Ritter (1986).

5.4 Validity of the IPO short run performance models

Prior sub-sections analyse the impact of each predictor on the *IR*s. The predictors are categorised based on their roles in explaining the *IR*s (fundamentals, ex-ante risk factors, signals, control variables). However, it is also important to examine the model as a whole. The result of model I shows that the prospectus information, which is represented by fundamentals, ex-ante risk factors, and signals, explains 4.4% of the variation in the *IR*s. For cross-sectional research the adjusted R-square is quite low, yet as a whole the model is statistically significance at the 1% level (Wald statistics of 26.43, and p-value of 0.00).

The inclusion of control variables, such as a dummy for privatisation in model II shows a marginal improvement to the explanatory power and model validity. The adjusted R-square of model II increases to 6.5%, showing that the privatisation, itself, could explain an additional 2.1% of *IR* variations. Moreover, model II turns out to have higher and significant Wald statistics that confirms the validity of the model.

Similarly, the last *IR* model demonstrates that introducing the valuation standardised residuals increases the model's explanatory power. Along with the fundamentals, ex-ante risk factors, signals, and the privatisation dummy, the residuals explain about 8.8% variation in *IR*s. The Wald statistic also attests the statistical fitness of the model at the 99% level of confidence.

As discussed earlier in the corresponding sections, the Wald statistics for the fundamentals, the ex-ante risk factors, and the signals demonstrate mixed results. While the ex-ante risk factors group show consistent joint restrictions across the *IR* models, mixed results are found in the fundamental group, and finally, the joint restriction of the signal group is statistically insignificant.

A similar result is found for the non-PIPOs sub-sample (table 5.7). The explanatory powers of the *IR* models for the non-PIPOs sub sample are lower than the ones for the full sample. Only 2.7% of the variations in *IR*s could be explained by the prospectus information for the non-privatisation IPOs. This result confirms the substantial explanatory power of the privatisation dummy (*Priv*) to explain the variation of the *IR*s in the full sample. Adding the valuation residuals variable in model III does improve the explanatory power to 4.5%. The Wald tests for the regression are robustly significant at the 99% level of confidence. The joint restriction of the fundamentals is significant at the 10% level for model I, although the significance disappear when the model includes the valuation residuals. Similar to the results of the full sample, the non-PIPOs demonstrate that the joint restriction of the ex-ante risk factors is significant at the 10% level across the *IR* models, yet the Wald test fails to confirm the significance of the signal joint restriction on the *IR*s.

5.5 Sensitivity analysis

A number of sensitivity analyses have been performed to test whether the results of the *IR* models presented above are sensitive to other factors. In the earlier section regarding the impact of privatisations on the IPO initial returns, a sensitivity analysis is undertaken using the non-PIPOs sub-sample. The overall result is similar to that reported in the main analysis. Additionally, the analysis confirms the substantial impact of PIPOs on the *IR*s.

In this section, another sensitivity analysis is performed. To examine whether the main results are sensitive to outliers, a robust regression analysis is carried out, and the results are presented in table 5.9 below.

Table 5.9 Robust Regression analysis on the IPO initial return model

The table contains output from robust regression analysis for all IPO sample, of the initial return (*IR*) on pro forma book value scaled by the offer price (pBV/P_0), forecasted earnings scaled by the offer price (fE/P_0), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), privatisation dummy (*Priv*), and standardised residual from the valuation model (*Resi*).

Variables	Model I (t-stat)	Model II (t-stat)	Model III (t-stat)
Constant	0.278**	0.293**	0.296***
	(2.76)	(2.88)	(2.95)
PBV/P_0	-0.052*	-0.042*	-0.042
	(-1.87)	(-1.89)	(-1.33)
fE/P_0	0.009	0.122	0.123
	(0.06)	(0.74)	(0.75)
Risk factors:			
Lev	-0.013	-0.006	-0.006
	(-0.82)	(0.39)	(-0.40)
Cap	0.009	0.004	0.004
	(0.57)	(0.29)	(0.30)
Effr	-0.010	-0.014	-0.014
	(-0.30)	(-0.43)	(-0.44)
Cpy	-0.044*	-0.029	-0.029
	(-1.98)	(-1.26)	(-1.27)
Ind	-0.184*	-0.185*	-0.187*
	(-1.84)	(-1.98)	(-1.83)
Signals:			
Spo	-0.018	-0.017	-0.018
	(-1.14)	(-1.07)	(-1.10)
Age	-0.004	-0.003	-0.003
	(-0.61)	(-0.36)	(-0.35)
Eq	0.068*	-0.027	-0.028
	(1.81)	(-0.553)	(-0.56)
Priv	-	0.086*	0.085*
		(1.95)	(1.90)
Resi	-		0.017**
			(2.18)
N	161	161	161

*Note: * significant at 10%, ** significant at 5%, ***significant at 1%*

In general, the results of the robust regression analysis are similar to the results of the main analysis (the OLS regression analysis). The constant estimation is consistent with the previous results and confirms the underpricing of the research sample. The results relating to the fundamentals are also consistent with previous findings and shows that the pro-forma book value to offer price ratio (pBV/P_0) appears to be more influential in explaining the *IR*, while the explanatory power of the forecasted earnings to offer price ratio (fE/P_0) is weak. However, once the model is augmented by the inclusion of the residuals (model III), the impact of the fundamentals becomes less important.

The results of the ex-ante risk factors and the signals are also consistent with the main findings. Only the capacity risk (*Cap*) and the industry risk (*Ind*) are significantly related to the *IR*s, although *Cap* loses its significance when the *IR*s models are controlled by the privatisation dummy and the residuals. None of the signals appear to be significantly related to the *IR*s. Confirming the main findings, the result for the privatisation dummy remains significant in the robust regression. Additionally, the residuals also exhibit a consistent outcome with prior result, which confirms the market momentum on the first trading day.

In sum, the sensitivity analyses demonstrate that the results of the main findings are robust and not sensitive to issues, such as outliers and the privatisation effect. The impacts of the predictors on the *IR*s are similar to the main findings. However, the results of non-PIPOs sub-sample do highlight the important of the PIPOs in explaining the *IR* of the full sample.

Conclusion

This chapter has presented and discussed the performance of the research sample in the short-run (initial day returns). IPO initial returns have been defined as the investors' returns on the closing of the first trading day. The descriptive statistics demonstrate the persistence of the underpricing, which is reflected by the significant positive initial return. This result confirms the findings from prior studies in the UK and elsewhere.

The *IR* models produce evidence of a significant impact of pBV/P_0 on the *IR*s, when the model includes only the prospectus information (model I) and when a privatisation dummy is introduced to the first model (model II). Yet, it loses its significance when *Resi* is introduced into model III. However, the impact is in the opposite direction to that expected. The positive coefficient of pBV/P_0 suggests that the overvalued IPOs at the offering are likely to be valued higher in the first trading day, suggesting the market momentum. This result is supported by some findings in the univariate analysis. The fE/P_0 shows no evidence of its relationship with the *IR*s.

Mixed results are found on the relationship between the ex-ante risk factors and IPO *IR*s. The results of the ex-ante risk factors generate little evidence to support the working hypotheses; only the Industry risk factor appears to be consistent with the hypothesis. Despite the signals coefficients having the expected signs, they are statistically insignificant, hence this study cannot confirm the findings from prior studies.

The descriptive statistics show that the PIPOs are, on average, more underpriced. Additionally, both the univariate and cross sectional analyses confirm the significant impact of PIPOs on the IPO initial returns. Therefore, the *Priv* result is consistent to the findings from prior studies.

The *IR* model also includes the valuation residual (*Resi*) to capture any impact of the unobservable variable. Surprisingly, the result shows that *Resi* is positively related to *IR*s, suggesting that the IPOs that are overpriced relatively to their fundamentals at the time of issue are valued more highly in the market on the first trading day. This result corroborates the findings in the pBV/P_0, suggesting market momentum. Another implication is that such IPOs are priced at a premium as a signal to the firms' value.

Despite lack of significance of most coefficient (see Appendix table A.5.2) and low explanatory powers, the results show that the *IR* models are valid. The Wald statistics demonstrate that all predictors, as a whole, in the *IR* models are related to the *IR*s. The joint restriction of the ex-ante risk factors shows a consistent result across the *IR* models. However, mixed results are found on the impact of the fundamentals to *IR*s, while the joint restriction of the signals appears to be insignificant. The sensitivity analyses show that the main result is robust to the privatisation and the outlier effects.

In sum, this chapter provides a number of explanations to the research questions presented in the introduction section. The prospectus information has some, albeit rather low, predictive power to the IPO initial returns, and the joint restriction of the ex-ante risk factors shows a significant impact on the *IR*s.

Appendices

for

Chapter 5

Appendix

A.5.1

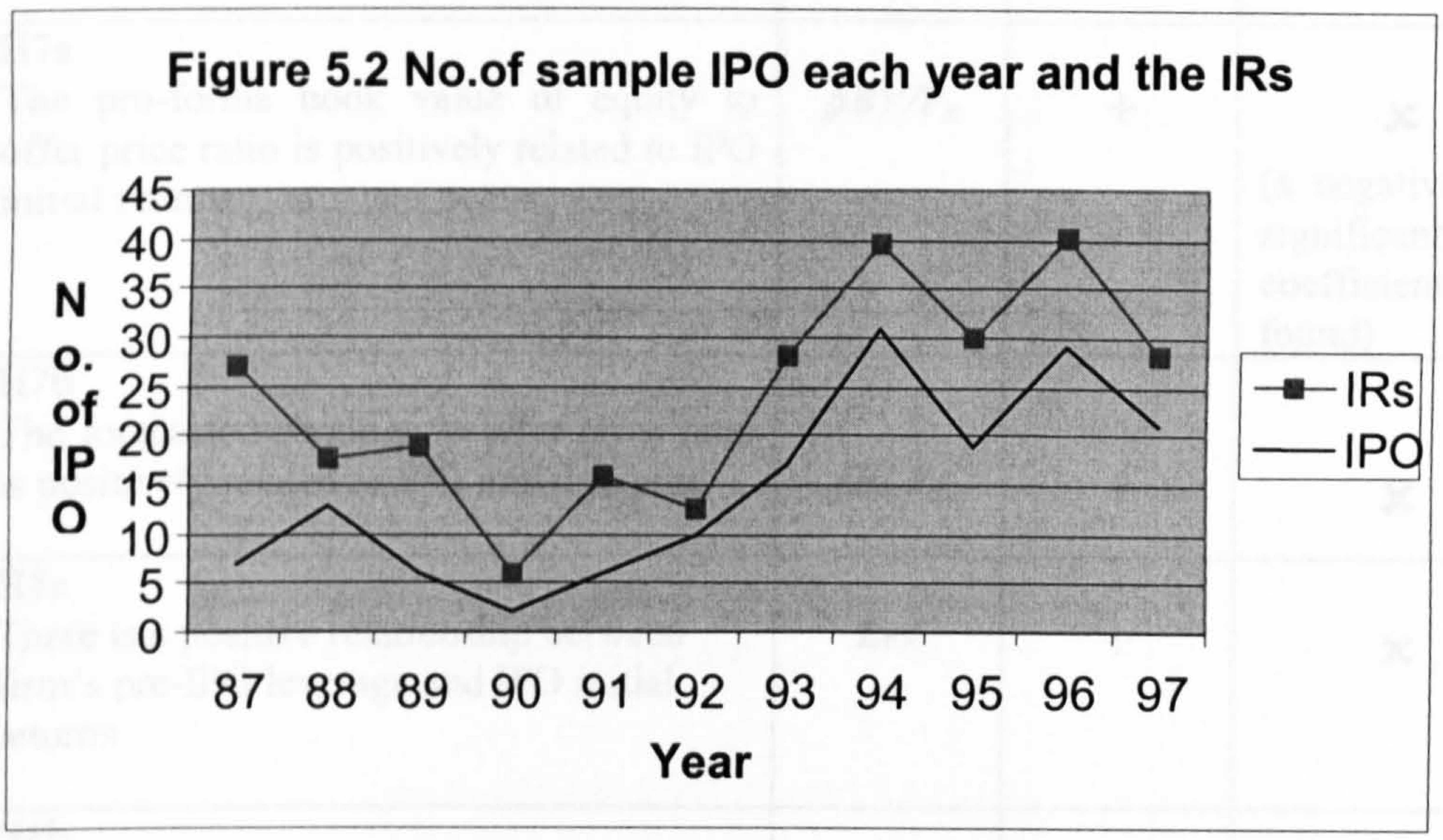


Figure 5.2 No.of sample IPO each year and the IRs

Table A.5.1 Summary of IR analysis hypothesis testing

Hypothesis	Variables	Expected signs	Evidence
H7a The pro-forma book value of equity to offer price ratio is positively related to IPO initial returns	pBV/P_0	+	✗ (a negative and significant coefficient is found)
H7b The forecasted earnings to offer price ratio is positively related to IPO initial returns	fE/P_0	+	✗
H8a There is a positive relationship between firm's pre-IPO leverage and IPO initial returns	*Lev*	+	✗
H8b There is a negative relationship between firm's pre-IPO capital availability risk and IPO initial returns	*Cap*	-	✗
H8c There is a positive relationship between firm's pre-IPO efficiency risk and IPO initial returns	*Effr*	+	✗
H8d There is a positive relationship between firm's pre-IPO capacity risk and IPO initial returns	*Cpy*	+	✗
H8e There is a positive relationship between industry risk and IPO initial returns	*Ind*	+	✗ (a negative and significant coefficient is found)

Hypothesis	Variables	Expected signs	Evidence
H9a Sponsor reputation is negatively related to IPO initial returns	***Spo***	-	✗
H9b Firm age is negatively related to IPO initial returns	***Age***	-	✗
H9c Percentage of equity sold at the flotation is positively related to IPO initial returns	***Eq***	+	✗
H10 There is a positive relationship between privatisation dummy and IPO initial returns	***Priv***	+	✓
H11 There is a negative relationship between the residuals and IPO initial returns	***Resi***	-	✗ (a positive and significant coefficient is found)

Chapter 6

Chapter 6

The IPO long run performance analysis

Introduction

The previous chapter discusses the short run IPO performance, which is well known as the IPO underpricing. In particular, the chapter address the research question whether the prospectus information has predictive power towards the IPO underpricing. In general, the evidence demonstrates that the prospectus information has relatively little role to explain the IPO underpricing. The fundamentals provide an interesting finding on the relationship between the proforma book value of equity and the IPO initial returns (*IR*s). The result shows that IPOs with the lower proforma book value of equity to offer price ratio, tend to be more underpriced (higher *IR*s). The result implies that IPOs, which are priced highly relatively to the pro-forma book value of equity, continue to be valued more highly on the first day of trading, suggesting market momentum. This result is supported by the finding on the relationship between the valuation residual and the initial returns (*IR*s). The second implication is that the issuers/sponsors set the offer prices at the premium as a signal to the firms' true value. If the market agrees, they push up the prices of such IPOs in the after-market.

The results of other prospectus information (the ex-ante risk factors, and the signals) are mixed. Although of the ex-ante risk factors coefficients lack of significance, the joint restriction of the ex-ante risk factor as a group is robust across the *IR* models. The signals demonstrate consistent signs of coefficients, although none of them appear to be significant.

Although the main purpose of the prospectus is to reduce the information asymmetry, the *IR* analysis shows that there is a divergence of opinion towards some prospectus information among the market participants (the issuers/sponsors and the investors) on the first day of trading. Therefore, it is interesting to examine whether a divergence of opinion towards the prospectus information is still found in the longer period.

This chapter is aimed to answer the research question: *Does the prospectus information still have any impact on the IPO long run performance?* As explained in the Research design chapter, the IPO long run performance is defined as the investment abnormal returns for the 'loyal' investors, who buy the IPOs on day 2 and hold them up to the IPOs' subsequent anniversaries. In this study, the IPO long run performance is measured by the buy and hold abnormal returns (*BHAR*s) as suggested by Barber and Lyon (1997). Similar to the two previous empirical chapters, the prospectus information is defined as the information regarding the accounting fundamentals, the ex-ante risk factors, and the signals that are disclosed in the offering prospectus.

In this analysis, a number of general OLS returns models are developed, which are referred to as the IPO long run performance models. Besides the main predictors (the fundamentals, the ex-ante risk factors, the signals), the IPO long run performance models control for a number of variables such as size, privatisation and the initial 'mispricing' on day 1. The initial 'mispricing' variables are proxied by the valuation residuals and the initial returns (*IR*s) on the first trading day. Research methods used in this chapter and the main working hypotheses are summarised and presented in the diagram below (see Figure 6.1).

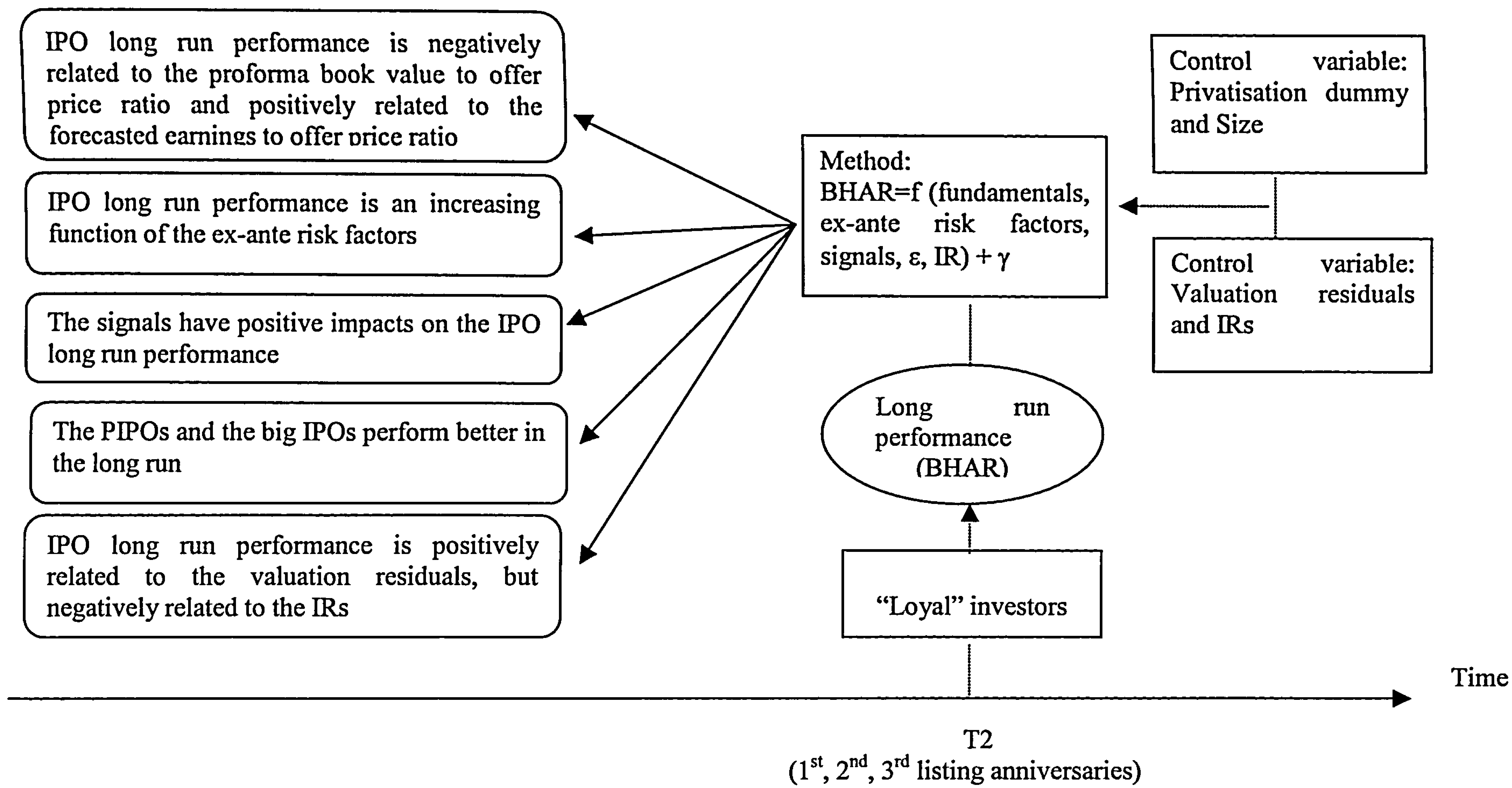


Figure 6.1 The Research methods and main working hypothesis for the IPO long run performance analysis

The structure of this chapter is as follows. After the introduction section, the descriptive statistics of variables used in the IPO long run performance (*BHAR*) models are presented. As the descriptive statistics of the main predictors has been discussed in the IPO valuation chapter, the descriptive statistics analysis in this chapter focuses on the *BHAR*s and the Resi variables. This is followed by discussions of the results of the fundamentals, the ex-ante risk factors, the signals, and the control variables. The sensitivity analysis is presented and is followed by a discussion of the validity of the IPO long run performance models. Finally, a brief summary of the chapter is presented.

6.1 Data

As explained in the research design chapter, the long-run performance measure used in this study is the buy and hold return (*BHAR*). Although there are some limitations of this measure compared to other measures for long-run return (e.g., cumulative abnormal returns), Barber and Lyon (1996) argue that *BHAR* is still better than others. A broad discussion of this matter has been reviewed in the research design chapter.

The *BHAR*s employed are adjusted by the market index, which is the FTSE small companies index. Hence, the result of *BHAR*s represents the market adjusted abnormal returns for investors, who buy the IPOs on day 1 and hold them for a specified period (in this study, the holding periods examined are 1-year, 2-year, and 3-year periods).

Table 6.1. Descriptive statistics for long run return analysis

The table contains descriptive statistics for IPO sample of variables in the IPO performance analysis. ***BHARiy*** refers to the abnormal buy and hold returns for i = 1,2, and 3 years period, pBV/P_0 to pro-forma book value to offer price, fE/P_0 to forecasted EPS to offer price, and *Resi* to standardised residuals from the IPO valuation model with P_0/BV as the dependent variable.

Variable	N	Mean	Median	StDev	Minimum	Maximum
BHAR1y	161	0.115***	0.097	0.395	-1.011	1.105
BHAR2y	161	0.006	0.008	0.823	-2.126	2.121
BHAR3y	144	-0.033	-0.169	0.883	-1.769	2.359
Size	161	3.841	4.361	1.099	3.002	8.429

*Note: *** significant at 1%*

Table 6.1 demonstrates that investors still gain positive abnormal returns up to 2 years after the admission, suggesting that the research sample outperforms the market. Then, the returns decrease and on the third listing anniversary, the abnormal returns become negative, implying the long-run underperformance of the research sample. However, statistically, only the buy and hold abnormal returns (*BHAR*) for the 1-year period is significantly different from zero at the 1% level. The statistical tests for *BHAR* year 2 and 3 fail to reject the alternative hypothesis asserting that the *BHAR* for years 2 and 3 are significantly different from zero. However, the median of *BHAR*3y takes a value of –16.9%, implying that half of the research sample underperforms the market by 16.9% or more.

The sign test is also undertaken for the *BHAR*s. The result shows that the median of *BHAR*y1 is positive and significantly different from zero at the 1% level. The test also confirms that the median of the *BHAR*3y is negative and significantly different from zero. However, the test shows that the median of *BHAR*2y is statistically insignificant.

The results of the means of the *BHAR*s appear to be contrary to prior UK studies (Levis, 1993; Espenlaub *et al.*, 1999) that find, on average, UK IPOs underperform the market or other benchmarks after the first 3 years. However, both studies also demonstrate that the IPO underperformance is less severe when using the FTA index as a benchmark. Other studies using the *BHAR* measure and equally weighted market index show similar results to the ones found in this study (Ben Naceur, 2000; Crutchley *et al.*, 2002).

Moreover, the research samples of both Levis (1993) and Espenlaub *et al.* (1999) exclude privatisations, while the sample of this study includes 10 PIPOs. Table 6.2 below presents the IPO performances of the non-PIPO and PIPO sub-samples. The long-run performance measures for the PIPOs show increasing significant abnormal returns in the subsequent years. The positive *BHAR*s indicate that, on average, PIPOs outperform the market. The figure for *BHAR*3y for the PIPOs means that investors, who buy the PIPOs at the admission and hold the shares up to their third anniversary of listing, are better off by 54.0%, on average, compared to the market.

Table 6.2. IPO performance of PIPOs and non-PIPOs sub-samples

The table contains the IPO performances of privatisation sub-sample, and non-privatisation sub-sample. ***BHARiy*** refers to the abnormal buy and hold returns for i = 1, 2, and 3 year period

IPO sample	No. of IPOs	Average BHAR1y	Average BHAR2y	Average BHAR3y
PIPOs	10	0.231**	0.439***	0.540**
Non-PIPOs	151	0.107***	-0.023	-0.065*

*Note: * significant at 10%; ** significant at 5%; ***significant at 1%*

In contrast to the PIPOs, the non-PIPOs exhibit decreasing abnormal returns in the subsequent periods. The average of the *BHAR* shows a positive and significant value for the 1-year period and eventually declining to a negative and significant abnormal return in year 3, suggesting that non-privatisations underperform the market after 3 years trading. The figures for *BHAR*3y of the non-privatisation sub-sample could be interpreted, as investors, who buy non-PIPOs and hold them until their third anniversary of listing, are worse-off by 6.5% compared to the market. This result confirms the UK IPO underperformance found by Levis (1993) and Espenlaub *et al.* (2000).

Further examination also confirms that the differences between the *BHAR*s of the two sub-samples for year 2 and 3 are significant at the 1% level. However the difference in *BHAR*s for year 1 is insignificant.

Table 6.1 also demonstrates that in year 3, the sample size is reduced to 144, which indicate that 17 IPOs did not survive up to their third anniversary[1]. Therefore, it is interesting to examine whether the performance of the survivors IPOs is different to the non-survivors' performance. Table 6.3 below exhibits the *BHAR*s in year 1 and year 2 for the survivors and non-survivors sub-samples.

Table 6.3. IPO performance of survivors and non-survivors sub-samples

The table contains the IPO performances of survivors sub-sample, and non-survivors sub-sample. *BHARiy* refers to the abnormal buy and hold returns for i = 1 and 2 year period

IPO sample	No of firms	Average BHAR1y	Average BHAR2y
Survivor	144	0.136***	0.157***
Non-survivor	17	-0.066	-1.275***

*Note: **significant at 5%; *** significant at 1%*

In the long run, the two sub-samples show big differences in *BHAR*s. The non-survivor sub-sample shows that they underperform the market since year 1 up to year 2 before they exit the market, while the survivor sub-sample show

[1] The 17 IPOs that have not survived to the 3rd anniversary of listing are IPOs from year 1992 onwards. The non-survivors are due to delisting (3 IPOs), taken-over/acquired (11 IPOs), merged (2 IPOs), or went private (1 IPO), as explained in more detail in appendix A.6.1

increasing positive abnormal returns during those periods. Therefore, further analysis confirms that the two sub-samples have significantly different long-run returns[2].

The analysis above indicates how the PIPOs and the non-survivor performance affect the figures for the full sample performance. Hence, the performance analyses presented in this chapter include separate analyses of the full sample and the two sub-samples (i.e., the non privatisation sub-sample and the survivor sub-samples).

In the previous chapter, it is shown that the *IR*s varies across the research period. The research period covers different economic states in the UK (recession in the early 90s, and the beginning of the internet boom in the late 90s). The data could not conclude a significant relationship between the *IR*s and the economic states. Here, the examination of how IPOs perform in the long run during different economic states is presented in table 6.4 below. The table presents the distribution of average abnormal returns (*BHAR*s) for the research sample by year when the IPOs took place. In general, it could be said that there is no significant correlation between the number of IPOs that took place in a particular year and the IPO long run returns[3]

The *BHAR*s of IPOs that went public in 1987 demonstrate that on average, the IPOs outperform the market throughout the 3-year period, while the sample for 1992 shows long-run underperformance since the first anniversary. The research

[2] The t-test results in a rejection of the hypothesis of equal means of *BHAR*1y and *BHAR*2y between the survivor and non-survivor sub-samples at, respectively, the 5% and 1% level.
[3] The correlation coefficients of the number of IPOs and *BHAR*1y, *BHAR*2y, *BHAR*3y, respectively, are -0.218, -0.401, and -0.424. None of the coefficients are statistically significant.

Table 6.4. Performance of full sample by year

The table consists of the average buy and hold abnormal returns (*BHAR*) for periods 1-year, 2-year, and 3-year of the sample by year when the IPO took place.

Year	No.of IPO sample	Average BHAR1y	Average BHAR2y	Average BHAR3y
1987	7	0.306*	0.602*	0.581
1988	13	0.328***	0.258	0.301
1989	6	0.368**	0.531***	0.831***
1990	2	-0.015	0.078	0.066
1991	6	0.117	0.042	0.150
1992	10	-0.034	-0.188	-0.266*
1993	17	0.116	-0.008	-0.156
1994	31	0.163**	0.223	0.102
1995	19	0.096	-0.208	-0.642***
1996	29	0.025	-0.159	-0.228
1997	21	-0.003	-0.314**	0.166

*Note: * significant at 10%; ** significant at 5%; *** significant at 1%*

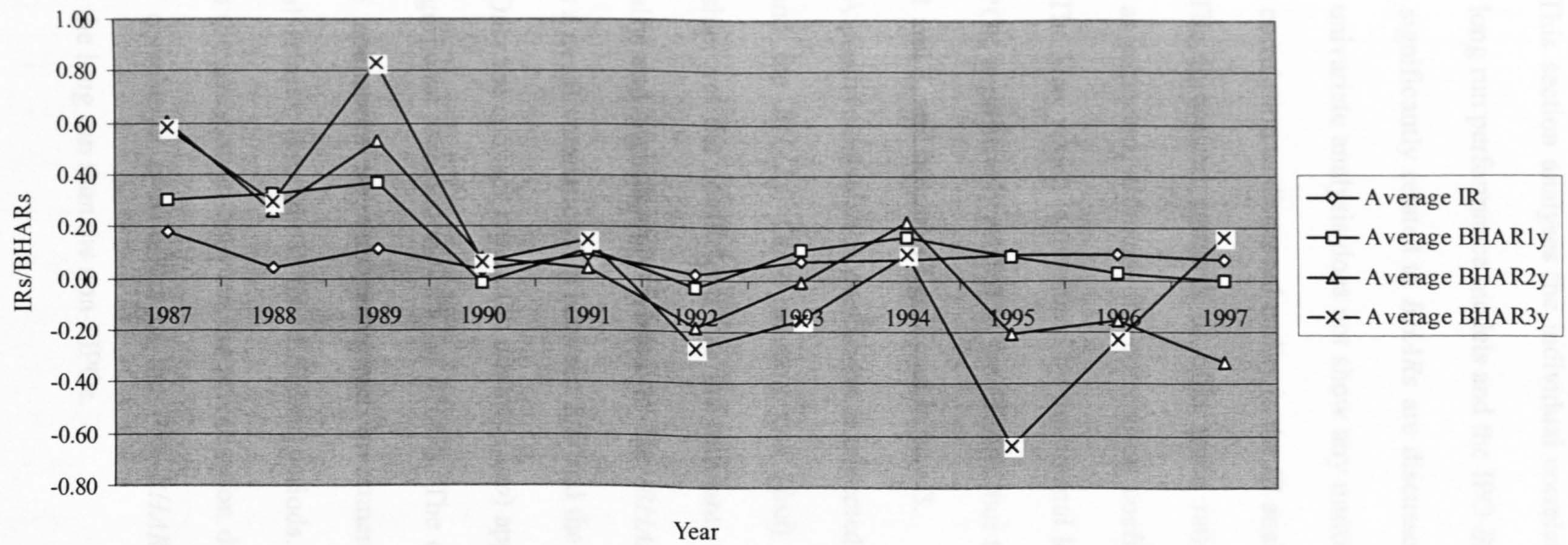
sample does not show any clear pattern of abnormal returns over the period. However, the table shows that there is no sign of long-run underperformance for IPOs that taken place in the late 1980s, in fact – the IPO sample for 1989 show surprising positive abnormal returns from year 1 to year 3. On the other hand, IPOs that took place in the mid 1990s (1995 and 1996) show negative abnormal returns in the long. Therefore, it could be inferred that IPOs, which come to the market in 'hot' period tend to suffer long run underperformance. The similar notion is also found in the non-PIPOs and the survivor sub-samples (see appendix – tables A.6.2a. and A.6.2b).

Another interesting figure is the relation between the *IR*s and *BHAR*s, as it is shown in figure 6.2 below. The first pattern occurs in the IPO samples that come to the market in 1987-1992. IPOs in 1992 show the lowest *IR* and the lowest *BHAR*3y, while IPOs in 1987 shows the greatest *IR* and the second best *BHAR*3y. Therefore, in that period it could be inferred that IPOs that are less underpriced tend to perform worse in the long run. On the other side, IPOs that are more underpriced tend to enjoy better long-run performance.

However, this notion is in contrast to the current proposition of the IPO underpricing and the long-run performance. The overoptimism hypothesis argues that the positive *IR*s are the results of investors' optimism in the IPO early days of trading. Then, the market adjustment brings the reversion effect, which results in the declining performance in the long run. Nevertheless, the IPO signalling hypothesis argues that good firms deliberately underprice the IPOs to reveal their firm value. Therefore, it is expected that good firm IPOs are more underpriced but perform better in the long run.

The second period 1993-1997 exhibits a different pattern of the *IR*s and *BHAR*s movement to the prior period. IPOs in this period show a reversion effect is taking place after the excitement in the early days of the IPOs. IPOs in 1996 shows the greatest *IR*s in that period, then 3 years after, they suffer the second lowest abnormal returns, while IPOs in 1995 shows the second highest *IR*s, yet they produce the lowest *BHAR*3y during the research period. Unlike the full sample, the PIPOs and the survivor sub-samples do not show any observable pattern of the *IR*s-*BHAR*s movement (see appendix, figures A.6.2a and A.6.2b).

Figure 6.2 - IPO performances by year



6.2. Univariate analysis

This section analyses the individual correlation between the predictors in the IPO long run performance models and the IPO *BHAR*s. However, only the ones that are significantly related to *BHAR*s are discussed. In general, it could be said that the univariate analysis does not show any multicollinearity problem, apart the *Priv-Eq* correlation as discussed earlier in the *IR* analysis.

The forecasted earnings to offer price ratio is positively related to the *BHAR*s as expected, although the correlation coefficients is significant only for year 1. The *Size*, which is measured by the normal log of the market capitalisation at the IPOs, is positively related to the *BHAR*s, but the relationship is insignificant in year 1 and 2, and becomes significant in year 3.

A positive correlation coefficient is expected between the each ex-ante risk factor and the *BHAR*s. Only Industry risk (*Ind*) appear to have an expected relationship, yet the coefficients are insignificant. Only Efficiency risk (*Effr*) is statistically and significantly related to the *BHAR*s, however, the correlation suggests a negative relationship between *Effr* and the *BHAR*s.

Only the sponsor reputation dummy (*Spo*) appears to be a signal factor that has a significant association with the *BHAR*s. The coefficient suggests that IPOs that are sponsored by the prestigious investment bankers experience better abnormal returns throughout the different periods. Another consistent result is found in the association between the privatisation dummy (*Priv*) and the *BHAR*s. Positive correlation coefficients of the *Priv-BHARs* imply that PIPOs perform better in the long run than the non-PIPOs.

Table 6.5 Correlation matrix for the IPO long run performance models

The table contains the (Pearson) correlation coefficients of all variables in the IPO performance models using full sample IPOs

	BHAR1y	BHAR2y	BHAR3y	pBV/Po	fE/P0	Size	Lev	Cap	Effr	Cpy	Ind	Spo	Age	Eq	Priv	Resi
BHAR2y	***0.642***															
BHAR3y	***0.558***	***0.741***														
pBV/Po	-0.025	0.117	0.079													
fE/P0	***0.186***	0.015	0.112	***0.14***												
Size	-0.001	0.089	***0.155***	***0.403***	0.023											
Lev	-0.094	-0.114	-0.11	***-0.229***	***-0.134***	-0.120										
Cap	-0.044	-0.04	0.044	-0.111	0.032	-0.060	***0.148***									
Effr	***-0.158***	***-0.197***	***-0.238***	0.112	***0.201***	-0.033	***-0.166***	-0.082								
Cpy	-0.001	-0.05	0.086	0.016	-0.098	***-0.145***	***0.267***	-0.079	***-0.143***							
Ind	0.101	0.096	0.077	0.087	***0.165***	0.039	-0.016	-0.049	0.078	-0.122						
Spo	***0.118***	***0.135***	***0.166***	0.011	-0.057	***0.268***	***-0.131***	-0.007	-0.083	***-0.201***	-0.009					
Age	0.038	-0.103	-0.096	-0.058	0.122	-0.058	-0.071	***-0.254***	-0.012	0.004	0.064	-0.015				
Eq	-0.068	-0.054	0.029	***0.452***	0.159	***0.277***	-0.097	-0.058	***0.187***	-0.121	0.007	0.08	-0.069			
Priv	***0.076***	***0.136***	***0.175***	***0.47***	0.078	***0.582***	***-0.207***	0.055	***0.152***	***-0.29***	0.008	***0.168***	-0.128	***0.705***		
Resi	-0.012	-0.088	-0.08	***-0.269***	***-0.215***	0.036	-0.004	-0.001	-0.005	***-0.001***	-0.004	-0.006	0.004	-0.007	-0.004	
IR	***0.138***	***0.178***	0.090	***-0.130***	-0.01	-0.066	-0.06	0.101	-0.001	***-0.169***	***-0.182***	-0.012	-0.065	0.052	***0.156***	0.008

Note: the coefficients in bold and italic are statistically significant at 10%

Many scholars argue that the IPO underpricing is caused by investors' overoptimism in the early days of IPOs. Eventually, the reversion actions take place in the market, resulting in the long-run underperformance. It implies that the IPO *IR*s are negatively related to their long-run returns, which in this study, are proxied by *BHAR*s. However, table 6.5 demonstrates positive correlation coefficients between *IR*s and *BHAR*s, although such coefficients are only significant with *BHAR*1y and *BHAR*2y, and it appears to be insignificant with *BHAR*3y. This implies that IPOs, which are more underpriced, are valued significantly higher up to 2 years after the admission, suggesting the market momentum does not last beyond the second anniversary of the IPO.

6.3. IPO long-run performance analysis

This section presents the results and the discussions of the IPO long-run returns models. As conversed earlier in this chapter, the IPO long run performances are proxied by the adjusted buy and hold returns for 1 year, 2 years, and 3 years after the admission. The models assume that prospectus information, privatisation, initial and day 1 valuation have impacts on the IPO pricing in the long-run, which in turn affect the IPO performance. Therefore, 3 nested long-run returns models are developed to analyse the behaviour of those predictors towards the movement of IPO prices in the long run.

The first model analyses the relationship between the prospectus information and the IPO long run performance (Model I). Then, the model is extended by including the privatisation dummy (Model II). Finally, to examine the impact of the initial 'mispricing' on day 1, the valuation residuals (*Resi*) and the IPO initial returns on day 1 (*IR*s) are included in the model (Model III).

This section follows the structure of the *IR* analysis in the previous chapter. It starts with the presentation of the results for the IPO long-run performance models (table 6.6, 6.7, and 6.8) then followed by a series of discussions on the role of fundamentals, signals, privatisation, initial valuation, day 1 pricing, in determining the IPO long-run performance. Then, this is followed by a discussion of the IPO long-run returns models, a number of sensitivity analyses are presented, and finally a chapter conclusion.

6.3.1 IPO abnormal returns analysis

It has been discussed widely in the descriptive statistics analysis that, contrary to prior studies, the research sample as a whole does not underperform the market in the long run, up to 3 years after the admission. The constant coefficient of the long-run performance models represent the average buy and hold abnormal returns for corresponding periods, after controlling for other information, such as prospectus information, privatisation, initial and day 1 valuation effect. Table 6.6, 6.7 and 6.8 exhibit that all of the constant coefficients appear to be negative, which may indicate the long run underperformance of the research sample.

6.3.2 Fundamental analysis

The *IR* model shows that, to some extend the fundamental – in this case, the pro-forma book value to offer price ratios – affects the determination of *IR*s. However, the results of the long-run returns models demonstrate different outcomes. The working hypothesis maintains that the IPO long-run performance is an increasing function of the fundamentals, implying that positive coefficients

Table 6.6 Regression analysis of the IPO long-run performances on the prospectus information (Model I)

The table contains output from OLS regression analysis for all IPO sample, of the buy and hold abnormal returns for 1 year, 2 years, and 3 years (*BHAR*1y; *BHAR*2y; *BHAR*3y) on pro forma book value scaled by the offer price (pBV/P_0), forecasted earnings scaled by the offer price (fE/P_0), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), and percentage of equity sold (*Eq*). Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	BHAR1y (t-stat)	BHAR2y (t-stat)	BHAR3y (t-stat)
Constant	-0.202	-0.337	-1.350
	(-0.52)	(-0.44)	(-1.57)
pBV/P_0	-0.051	0.425	-0.067
	(-0.32)	(1.62)	(-0.23)
fE/P_0	1.99***	0.957	0.758
	(3.46)	(0.67)	(0.88)
Size	-0.008	-0.041	0.081
	(-0.29)	(-0.09)	(1.32)
Risk factors:			
Lev	-0.077	-0.155	-0.259**
	(-1.12)	(-1.25)	(-2.41)
Cap	-0.049	-0.120	0.0479
	(-0.83)	(-0.88)	(0.35)
Effr	-0.349**	-0.822***	-0.975***
	(-2.59)	(-2.88)	(-2.91)
Cpy	0.046	-0.101	0.470**
	(0.45)	(-0.55)	(2.26)
Ind	0.509	1.135	1.306
	(1.24)	(1.37)	(1.40)
Signals:			
Spo	0.179*	0.191*	0.247**
	(1.81)	(1.87)	(2.21)
Age	-0.011	-0.479**	-0.100
	(-0.39)	(-2.33)	(-1.67)
Eq	-0.120	-0.479*	0.094
	(-0.72)	(-1.85)	(0.30)
N	161	161	144
Adj R-square	0.049	0.058	0.086
Wald regression	32.50***	28.07***	39.34***
Wald fundamental	11.98***	3.14	3.53
Wald ex-ante risk factors	10.82*	10.86*	17.47***
Wald signals	2.76	10.42**	6.82*

*Note: * significant at 10%; ** significant at 5%; *** significant at 1%*

are expected for the pBV/P_0 and fE/P_0. Table 6.2 above shows that in year 1, pBV/P_0 appears to be negatively related to the *BHAR*1y, which is inconsistent to the theoretical base. In year 2 and year 3, they change to become positive. However, none of the pBV/P_0 coefficients appear to be statistically significant. Hence, this study is not able to confirm the impact of *pBV/P0* on the IPO long-run performance.

In the subsequent tables (table 6.7, page 302 and table 6.8, page 305), introducing other predictors does not improve the impact of pBV/P_0 on *BHAR*s. Even more, the coefficients in year 3 alter to become negative, yet remain insignificant. Therefore, it could be inferred that in the long run, the pro-forma book value is no longer important to price the IPOs, since the actual book-value figures, which are more relevant, have been available to the market at that time. As prior studies have revealed, the actual book value to market ratio is robustly and significantly related to the stock returns.

Nonetheless, an interesting finding is the relationship between the forecasted earnings to offer price ratio and the *BHAR*1y. Table 6.6 demonstrates that the forecasted earnings is positively and significantly related to the *BHAR*1y, implying that the IPOs that report higher forecasted earnings tend to have greater returns in the following year after the admission. This fact is understandable since the forecasted earnings figures disclosed in the offering prospectuses are the 1-year forecasts. Therefore, it shows the relevancy of the forecasted earnings to the IPO pricing from the first trading day up to a year after the offerings. To the researcher's knowledge, since there have been no prior studies examining the relationship between the forecasted earnings and IPO long run performance, this study is the firsts to find such a significant relationship. Moreover, the result adds valuable knowledge about the usefulness of the earning forecasts disclosures.

The results of the extended models also prove that the impact of the forecasted earnings to offer price ratio on the *BHAR*1y is robust to the inclusion of any additional control variable. Even more, the magnitudes of the coefficients show increasing figures, suggesting that when the models are controlled for privatisation, valuation residuals, and initial market pricing effects, the forecasted earnings put greater weights on the *BHAR*1y.

However, the forecasted earnings to offer price ratio loses its significance in the subsequent years. All IPO long-run returns models fail to find any evidence of the forecasted earnings impact on *BHAR*2y and *BHAR*3y, suggesting that for the longer periods, such information is not relevant any more to the IPO returns. At those times, the actual earnings figures have been made available to the market, which presumably, is more relevant to the IPO pricing and their performances.

As explained in the research design chapter, the IPO long run performance models include the *Size* variable in the analysis. The inclusion of *Size* is purposed to control for the common risk factors in the stock returns as suggested by Fama and French (1992), and frequently applied in long run returns studies (e.g., Gleason and Lee, 2002).

The working hypothesis posits a negative relationship between firm size (*Size*) and the IPO long run performance. The results of model I demonstrate negative coefficients for Size, as expected. However, none of the *Size* coefficients are significant in model I. The coefficients gain significance for year 1 when the privatisation dummy is introduced into the model (models II and III). However, the significance disappears in the longer periods. The results imply that IPOs with greater market capitalisation at the IPO tend to have lower abnormal returns on their first anniversary. The association between Size and the IPO abnormal returns becomes unclear in the longer period (year 2 and 3), which is possibly because more relevant figures of the market capitalisation is available to the market.

In sum, mixed results are found regarding the association between the fundamentals in the prospectus and the IPO long-run performance. The pro-forma book value to offer price ratio appears to have no impact on the IPO long-run returns, while the forecasted earnings to offer price ratio is robustly related to the *BHAR*1y, but irrelevant in the subsequent years.

6.3.3 Ex-ante risk factor analysis

Similar to the testable hypotheses on *IR*s, the working hypotheses regarding the relationship between the ex-ante risk factors and the IPO long run performance are based on the general positive risk-returns association. Additionally, it is also expected that the impact of the ex-ante risk factors on the IPO performance is weaker in the longer period.

The results of model I, which is shown in table 6.6 exhibit interesting findings. While little evidence is found to explain the association between the ex-ante risk factors and the *BHAR*1y, a number of substantial results are found in year 3, which is not as expected. A similar pattern is also found in the successive IPO long-run performance models (Model II and III).

The result of model I shows that Leverage risk (*Lev*) is negatively related to *BHAR*s. This suggests that IPOs with higher leverage risk tend to have lower *BHAR* up to 3 years after the admission, which contradicts to the hypothesis.

However, it is in line with the result of Hedge and Miller (1996), who argue that instead of risk, debt is often used as a signal to the firm's value. It implies that high-quality firms deliberately increase firm's debt prior to IPOs in order to reveal its true value. Therefore, it could be inferred that a higher debt ratio reflects the higher quality of the firm, which is then expected to produce higher returns in the long run. Another explanation is that the higher debt preceding the offering date could play as a certification of firm's quality from the third party, such as banks. Slovin and Young (1990) argue that the firms, which successfully obtain borrowing from the banks prior to the public offering, have been through the extensive assessment on their qualities. Such firms are considered as good firms. Therefore, it is unsurprising that in the long run they produce greater returns.

However, while the *Lev-BHARs* relationship is statistically significant 3 years after the admission, the coefficients are insignificant during the 1-year and 2-year period. It suggests that it takes times for the market to fully take *Lev* into account as a signal to the firm's quality.

The *Lev* coefficients remain unchanged in model II and III. It implies that the result is robust to any additional predictors in the models. However, controlling the models for the privatisation, valuation residuals, and initial market pricing effects, does slightly reduce the magnitudes of the *Lev* coefficients.

The impact of capital availability risk (Cap) to *BHAR*s is in line with the hypothesis. The negative coefficients imply that the more internal capital available to the IPO firms, the less risky the IPOs, then it results in the lower expected return. However, the *Cap-BHAR* relationship is statistically insignificant.

The efficiency risk (*Effr*) is the only ex-ante risk factor that appears to have consistent results over the periods and across the *BHAR* models. The *Effr* is negatively and significantly related to *BHAR*s. This implies that the less efficient IPO firms, which are considered as riskier IPOs, tend to have lower returns. This result rejects the working hypothesis, which expects a positive association based on the theoretical risk-return relationship. As defined in the research design chapter, *Effr* is measured by the ratio of the cost of goods sold over sales. Therefore, the higher *Effr* could be understood as less operating efficiency, which implies the firm is defined as more risky. However, apparently, the investors do not interpret the *Effr* as a common risk. It seems that they identify the operating efficiency as a firm performance measure. The low performance firms tend to be valued lowly in the market, which in turn result in lower return. Hence, less efficient firms result in lower *BHAR*s.

The consistency of the *Effr* results throughout all the IPO long run performance models, after controlling for the privatisation, valuation residuals, and initial market pricing effects, demonstrate the robustness of its impact on the *BHAR*s.

Model I in table 6.6 demonstrates mixed results for Capacity risk (*Cpy*). The signs of the coefficient alter in every period. *Cpy* is positively related to *BHAR*1y and *BHAR*3y, but it turns to be negatively related to *BHAR*2y. However, the coefficient becomes more consistent in other extended models after controlling for the privatisation, valuation residuals, and initial 'mispricing' effects (table 6.7 and 6.8). Yet, the *Cpy-BHARs* relationship appears to be significant only in year 3.

Since *Cpy* is measured by the ratio of investment plan cost over the IPO net proceeds, it means that the higher the investment plan cost, the lower the capacity risk, the greater the expected long-term returns. The result presented in table 6.6 suggests a positive coefficient of *Cpy*. This result rejects the testable hypothesis, which predicts a positive relationship between capacity risk and IPO long-run performance. Similar to the explanation to the efficiency risk (*Effr*), the investors, apparently, interpret such information differently. From the issuer's point of view, the greater the investment plan cost means the lower the probability that the firms is under their optimal production capacity, which indicates the lower capacity risks. However, from the investors' point of view, the greater fraction of net proceeds allocated for the investment means greater funds go to uncertain project, indicating higher risks. Consequently, from the investors' perspective, the greater investment cost, relatively to IPO net proceeds, the riskier the IPOs, and the greater IPO long-run returns expected. That argument could explain the positive *Cpy-BHARs* associations. Additionally, the relationship is insignificant for the shorter period; perhaps, as the investment proposal disclosed in the prospectuses are usually long-term projects. Therefore, it needs a longer period to detect its impact on the IPO performance.

Prior studies (e.g., Klein, 1996; Leone *et al.*, 2003) examine the usefulness of the usage of IPO net proceeds for pricing the IPOs. Although using different proxies for the usage of the proceeds, they find similar results that conclude the value relevance of such information. However, to the researcher's knowledge, the result from this study is among the first to find a significant impact of the information of the IPO net proceeds usage on the IPO subsequent performance.

The last ex-ante risk factor is industry risk (*Ind*). The testable hypothesis on its relation to IPO long-run performance expects positive coefficients, which suggests the IPOs in riskier industries are expected to have higher long-run returns. The results for all models show positive *Ind-BHARs* association; however, they appear to be significant only for the 3-year period in models III and IV. The *Ind* is insignificantly related to *BHAR*s when the models only include the prospectus information, and when the privatisation dummy is included as a predictor (model II and III). It does, however, become relevant to the IPO 3-year performance once the models include additional control variables, such as the valuation residuals and the *IR*s.

In sum, mixed results are found on the relationship between each ex-ante risk factor and the IPO long-run performance. Efficiency risk (*Effr*) is the only risk factor that demonstrates consistent results throughout the periods and models, while Capital availability risk (*Cap*) is the one that appear to have no significant impact on *BHAR*s. Among the market participants, there is evidence of different views of risk recognition in a number of ex-ante risk factor examined, such as Leverage risk (*Lev*), Efficiency risk (*Effr*), and Capacity risk (*Cpy*). The impacts of most of the ex-ante risk factors take longer than expected, Leverage risk and Capacity risk appears to be insignificant during the 1-year and 2-year periods but eventually turn out to be significantly related to the IPO long-run returns. The results of Industry risk are mixed. They appear to be sensitive to the model specifications. The impact of Industry risk on the *BHAR*s is significant once the models control for the effects of privatisation, valuation residuals, and initial market pricing.

In sum, the ex-ante risk factors demonstrate mixed results throughout the research periods. The impact of the ex-ante risk factors on the IPO performance is limited in the shorter period (1-year period), but it is more influential in the longer period (3-year period). This suggests the market needs a longer period to detect the impact of the ex-ante risk factors on the IPO performance. Moreover, the ex-ante leverage risk and the efficiency risk take the opposite signs of coefficients to those expected, implying that those proxies are perceived as signals rather than ex-ante risk factors. The results of Industry risk are robust, suggesting that IPOs in the riskier industries tend to have greater *BHAR*s. A similar result is found for the Capacity risk, however the impact is significant in the longer period (3-year period). No evidence is found to support the Capital availability risk having an impact on the IPO long run performance.

6.3.4 Signalling analysis

The signals used in this study have been used widely in the IPO literature. Therefore, the working hypotheses on each signal are based on the empirical evidence found in prior studies. The sponsor reputation dummy (Spo) is expected to have positive coefficients, implying that IPOs brought to market by prestigious sponsors tend to have higher long-run abnormal returns.

In all models and all periods, *Spo* appears to be positively related to the *BHAR*s, which is consistent to the hypothesis. However, the coefficients are statistically significant only for the 3-year abnormal returns for all models, implying that IPOs brought to the market by prestigious sponsors tend to show significant higher returns after 3 years traded in the market. In terms of time, the results are quite surprising, as it is expected that the role of sponsor reputation as the third party's certification of the firm's value, would have an important impact in the early days of the IPOs, rather than in the longer run.

The results tend to go along with another implication of agent reputation. Carter and Manaster (1990) refer it to the 'picking' game. Having robust result of the impact of underwriter reputation on both IPO initial and long run returns, they claim that there is an incentive for the prestigious underwriters to pick 'good' firms, such as to maintaining their reputation. Meanwhile, the less prestigious underwriters are left with 'bad' firms. Consequently, it appears that IPOs with the prestigious underwriter are expected to perform better than ones with the less prestigious underwriter. Based on this argument, it is reasonable to expect the delay of the impact of *Spo*, as the IPO performance, then, is as a result of 'good' firms. The market may need time to observe the firm's quality in the long run.

The empirical evidence supports the working hypothesis H15a, which claims a positive relationship between sponsor reputation and the IPO long run performance. It also corroborates the findings from previous findings (Hogue *et al.*, 2002), although it contradicts the result from other studies (e.g., Carter *et al.*, 1998).

Having argued that older firms tend to have more experience in business, the firm's age could be a good signal to reveal the firm's value. In the long run it is also expected to have stable operations, which is eventually reflected in the market prices. Therefore, the testable hypothesis expects positive coefficients for *Age*.

The results for *Age* are mixed. In all models, it appears that the firm's age is insignificantly related to *BHAR*1y. Yet, eventually, the empirical evidence shows that firm's age is negatively related to IPO abnormal returns in year 2 and 3, implying that older firms tend to have lower returns. The result is contrary to the working hypothesis H15b.

The result infers that younger firms are likely to have significantly higher abnormal returns in years 2 and 3. This could be explained as follows. Most of the

IPO firms are young firms when they go public[4]. One of main characteristics of young firms is high growth of earnings. If the market believes on the high potential earnings growth of the IPO young firms, it is likely the young firms are valued higher, which in turn results in higher returns.

Many studies attempt to examine the impact of firm's age at the IPO on its initial and subsequent performance. However, most of them fail to find a significant impact of firm's age on the IPO performance. Therefore, this study is one of the few that find evidence of firm's age having an impact on the IPO long-run returns.

The last signal examined is the percentage of equity sold at the offerings (*Eq*). It could be argued that this variable is the most used signal in the IPO literature, since it shows very consistent results over different time periods, markets, and regimes. The testable hypothesis posits negative coefficients of *Eq*, implying that the greater the fraction of the enlarged shares sold at the offerings signals inferior firm value. The signal involves the old shareholder's perception of the firm's value in the future. Therefore the *Eq-BHARs* association is expected to be negative.

The results show interesting findings. In model I, where the model only includes the prospectus information, *Eq* is negatively related to *BHAR*s, yet, this relationship appears to be significant only in years 2 and 3. However, in the extended models (models II, III, and IV), the results are more consistent. *Eq* is negatively and significantly related to *BHAR*s for all periods. It indicates that firms that sold higher percentages of equity tend to have lower IPO returns.

[4] The mean of firm's age at the IPO of the research sample is approximately 9 years after they are incorporated, and the median of approximately 7.5 years.

This finding implies that Eq serves as an efficient signal for IPOs, as the more equity sold at the IPOs indicates that the old shareholders have lower expectations regarding future firm value. Consequently, investors put lower values on such IPOs, which in turn results in lower IPO long-run returns. This result corroborates the finding from previous studies (e.g., Koh *et al.*, 1992; Khurshed *et al.*, 1999). However, it contradicts the conclusion of another study (e.g., Ljungqvist, 1996).

In sum, mixed results are found on the relationship between the signals and IPO long-run performance. The results of sponsor reputation tend to demonstrate that the Sponsors are likely to pick 'good' firms, which then, eventually produce higher returns in the long run. The result of firm's age does not support the testable hypothesis. The evidence shows that younger firms tend to generate higher long-run abnormal returns. The percentage of equity sold at the IPO turn out to be as predicted and confirms prior studies.

6.3.5 Privatisation and IPO long run performance analysis

As presented earlier in the descriptive analysis and throughout the section, in the long run PIPOs are priced differently to the non-privatisation IPOs, and as such robustly affect the results for the full IPO research sample. One attempt to control for the privatisation effect on the results is to include a dummy variable. Model II is an extended model of the IPO long run performance that considers the privatisation effect. Based on prior research, it is predicted that the coefficients of the privatisation dummy (Priv) are positive. Table 6.7 and 6.8 exhibit strong results for *Priv*, which support the testable hypothesis H16. The results imply that in the long run, PIPOs perform better than the non-PIPOs.

Table 6.7 Regression analysis of the IPO long-run performance on the prospectus information and privatisation dummy (Model II)

The table contains output from OLS regression analysis for all IPO sample, of the buy and hold abnormal returns for 1 year, 2 years, and 3 years (*BHAR*1y; *BHAR*2y; *BHAR*3y) on pro forma book value scaled by the offer price (pBV/P_0), forecasted earnings scaled by the offer price (fE/P_0), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), and privatisation dummy (*Priv*) Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	BHAR1y (t-stat)	BHAR2y (t-stat)	BHAR3y (t-stat)
Constant	0.138	0.301	-0.799
	(0.35)	(0.39)	(0.89)
pBV/P_0	-0.095	0.342	-0.139
	(-0.60)	(1.30)	(-0.46)
fE/P_0	2.223***	1.399	0.134
	(3.83)	(0.99)	(0.13)
Size	-0.064*	-0.107*	-0.031
	(-2.04)	(3.95)	(-0.47)
Risk factors:			
Lev	-0.049	-0.104	-0.219**
	(-0.71)	(-0.91)	(-2.15)
Cap	-0.092	-0.199	-0.047
	(-1.59)	(-1.48)	(-0.33)
Effr	-0.382***	-0.886***	-1.017***
	(-2.99)	(-3.26)	(-3.15)
Cpy	0.126	0.019	0.635***
	(1.27)	(0.25)	(3.08)
Ind	0.570	1.250	1.557*
	(1.49)	(1.53)	(1.79)
Signals:			
Spo	0.113*	0.206*	0.264*
	(1.77)	(1.94)	(1.86)
Age	-0.005	-0.102**	-0.089
	(-0.18)	(-2.20)	(-1.52)
Eq	-0.610**	-1.398***	-0.877**
	(3.09)	(3.96)	(-2.17)
Priv	0.768***	1.442***	1.461***
	(4.33)	(3.95)	(3.42)
N	161	161	144
Adj. R-square	0.112	0.108	0.134
Wald regression	59.74***	61.11***	59.18***
Wald fundamental	14.65***	2.84	4.61
Wald ex-ante risk factors	18.12***	13.92**	22.37***
Wald signals	11.42***	22.80***	10.63**

*Note: * significant at 10%; ** significant at 5%; *** significant at 1%*

From the investors' point of view, this means that buying PIPOs and holding them in the long run result in higher profit than if they invest in the non-PIPOs. For example, the results of model II shows that the *Priv* coefficient takes a value of 1.334, meaning that after controlling for other characteristics of the IPOs, investors, who buy the PIPOs and hold them until the PIPOs' third anniversary, on average, gain 133.4% more profits than if they buy the non-privatisation IPOs. This result is in line with the findings of previous studies (e.g., Menyah *et al.*, 1995; Dewenter and Malatesta, 1997; Samat, 2000).

Additionally, the magnitudes of the coefficients show increasing figures over the periods, implying that for the longer period the gap between PIPOs performance and their counterparts is greater. This supports the descriptive statistics analysis that exhibits an escalating superiority of PIPOs abnormal returns to the non-privatisation IPOs. As the evidence shows the important effect of the privatisation to the overall results, this study also attempt to totally isolate such effects by splitting the research sample into the privatisation/non-privatisation sub-samples, and examine whether other predictors behave differently. The results of the non-privatisation IPOs are presented later in the Sensitivity analysis section.

6.3.6 Valuation residuals, initial returns and long-run performance

It is argued here that the valuation residual (*Resi*), to some extend, may affect the long-run performance. In the hypothesis development, it is discussed that the IPOs with higher *Resi* are expected to have lower initial returns (*IRs*). Hence a negative association between the *Resi* and the *IRs* is expected. It is also assumed that if the markets are efficient, any 'mispricing' in the early days of IPOs is corrected in the long run. Thus, it is expected that IPOs with higher *IRs* will have lower long run performance. This sequence predicts a negative relationship between *IR*s and *BHAR*s (H18). Therefore, if the valuation residuals are greater, *IR*s are expected to be lower, and in turn, higher *BHAR*s are expected. Hence, the valuation residuals are expected to be positively related to the *BHAR*s (H17).

However, the result in the previous chapter (*IR* analysis) shows that *Resi* is positively related to the IPO *IR*s. Two possible implications have been discussed in the *IR* analysis chapter. The first implication refers to the market momentum, and the second is to the signalling theory. The IPO long run model III includes *Resi* and *IR*s in the analysis, which is presented in table 6.8 below.

The prediction is that if the *IR*s on day 1 is driven by the market momentum, the market corrects the IPO prices in the long run (reversion effect). Thus, the results are expected as posited in the working hypothesis. However, if the *Resi* is a signal to the firms' true value, it is expected the greater *Resi* results in the higher *IR*s and higher *BHAR*s.

The results in table 6.8 show that *Resi* is positively related to the *BHAR* in year 1, and negatively related to *BHAR*s in the longer period. The result in year 1 is in line with the signalling theory, while the results in year 2 and 3 are aligned with the reversion effect. However, none of the *Resi* coefficients are statistically significant. Therefore, the results do not confirm working hypothesis H17.

In contrast, the *IR*s shows more robust results. Surprisingly, the coefficients on the *IR*s are positive and statistically significant for the 1-year and 2-year periods. The significance during the 3-year period disappears, but the coefficient still retains the positive sign. The result implies that on average, IPOs

Table 6.8 Regression analysis of the IPO long-run performances on prospectus information, privatisation dummy, valuation residuals, and initial returns (Model III)

The table contains output from OLS regression analysis for all IPO sample, of the buy and hold abnormal returns for 1 year, 2 years, and 3 years (*BHAR*1y; *BHAR*2y; *BHAR*3y) on pro forma book value scaled by the offer price (pBV/P_0), forecasted earnings scaled by the offer price (fE/P_0), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), privatisation dummy (*Priv*), valuation residuals (*Resi*), and initial returns (*IR*). Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	BHAR1y (t-stat)	BHAR2y (t-stat)	BHAR3y (t-stat)
Constant	-0.769	-0.525	-1.289
	(-0.19)	(-0.64)	(-1.33)
pBV/P_0	-0.565	0.348	-0.135
	(-0.34)	(1.39)	(-0.41)
fE/P_0	2.219***	0.969	0.818
	(3.769)	(0.69)	(0.92)
Size	-0.057*	-0.072	-0.008
	(-1.79)	(-1.29)	(-0.12)
Risk factors:			
Lev	-0.044	-0.106	-0.223**
	(-0.64)	(-1.01)	(-2.25)
Cap	-0.094	-0.203	-0.055
	(-1.61)	(-1.60)	(-0.41)
Effr	-0.373***	-0.834***	-0.982***
	(-2.97)	(-3.34)	(-3.19)
Cpy	0.141	0.116	0.685***
	(1.41)	(0.61)	(3.23)
Ind	0.689*	1.739**	1.841*
	(1.75)	(2.07)	(1.92)
Signals:			
Spo	0.119*	0.211*	0.263*
	(1.78)	(1.75)	(1.92)
Age	-0.003	-0.098**	-0.089
	(-0.12)	(-2.13)	(-1.56)
Eq	-0.591***	-1.261***	-0.801*
	(-3.07)	(-3.77)	(1.94)
Priv	0.689***	1.161***	1.298***
	(3.97)	(3.29)	(2.99)
Resi	0.005	-0.067	-0.047
	(0.87)	(-0.85)	(-0.64)
IR	0.546*	1.886**	1.108
	(1.72)	(2.56)	(1.39)
N	161	161	144
Adj. R-square	0.114	0.134	0.133
Wald regression	67.09***	74.70***	64.03***
Wald fundamental	14.49***	2.35	3.79
Wald ex-ante risk factors	19.55***	17.04***	23.76***
Wald signals	11.45***	21.52***	10.73**

*Note:*significant at 10%; **significant at 5%; *significant at 1%*

that have higher *IR*s on day 1 will perform better in the long run, which is contrary to the working hypothesis. This result is also supported by further analysis of the relationship between *IR*s and *BHAR*s as shown in table 6.9 below. The table exhibits the average of *BHAR*s on the *IR* quartile distribution. It is clearly seen that for year 1, IPOs that have lowest *IR*s generate the lowest abnormal returns. On the other hand, the IPOs that have highest *IR*s produce the highest average abnormal returns on their first listing anniversary. In fact, that pattern continues in the following years up to the third listing anniversary.

Table 6.9 The BHARs averages on the IR distribution

The table contains the average of *BHAR*1y, *BHAR*2y, and *BHAR*3y on the *IR* quartile distribution.

Quartile	IR range (%)	BHAR1y (%)	BHAR2y (%)	BHAR3y (%)
1	IR<=2.23	-4.52	-9.76	-22.27
2	2.23<IR<=6.70	-0.73	2.43	-16.23
3	6.70<IR<=13.63	2.34	9.84	-1.03
4	IR>13.63	8.74	17.20	-0.12

Earlier in the *IR* analysis, results of several predictors (*pBV/P0* and *Resi*) on the *IR*s indicate market momentum on day 1 that results in the IPOs, which are overvalued relatively to their fundamentals at the offering, are valued even higher on day 1. In relation to that finding, the IPO long run performance result suggests that the market momentum that may drive the *IR*s on day 1, still continue up to year 2. It seems that the momentum does not stop promptly, rather it continues at least up to the 2^{nd} listing anniversary. Thus, the IPO prices still go up until their 2^{nd} listing anniversary. In year 3, the momentum may start to diminish, which results in a significant decreasing *IR* coefficient, although it appears to be insignificant.

Even though the results do not confirm the working hypothesis, which is based on the efficient market hypothesis, the results are in line with the prediction of the signalling theory. However, while Welch (1989) argue that the issuers deliberately underprice the IPOs to signal the firm's 'true' value, the result of this study may imply that the issuers/sponsors of 'good' firms set the offer price at a premium as a signal to the firm's true value, which results in higher *IR*s on day 1, and the greater abnormal returns in the long run.

The result cannot confirm the findings from previous studies (e.g., Ritter, 1991; Levis, 1993). However, there are a number of differences between prior studies and this one. The first is that the results from prior studies are based on the relation between the *IR*s and the longer windows (long run performance covering from 3 up to 5 years post IPO). A recent study by Purnanandam and Swaminathan (2003) finds that after 4 ½ years listed, IPOs, which have higher *IR*s underperform the IPOs that have lower *IR*s. However, they do not find such an evidence for the shorter period (up to 1 year).

The second difference is that prior studies use different benchmarks in calculating the long run abnormal returns. Although Levis (1993) also attempts to calculate the long run performance using the *BHAR* measure and the Hoare Govett Index as the benchmark, he uses the CAR measure and the matching firm benchmark in the cross-section analysis. However, in general, he finds no evidence of a significant difference between the different benchmarks used. Therefore, it is expected that the benchmark employed in this study (FTSECO index) is not the cause of the different result.

Finally, prior studies do not include the PIPOs in their analysis, while this study, as explained earlier, includes 10 PIPOs. As discussed earlier, the descriptive statistics demonstrate that on average the *BHAR*s for the PIPOs are significantly higher than the *BHAR*s for the non-PIPOs. Therefore, separate analysis for the non-PIPOs are also undertaken and reported in the next section.

In sum, mixed results are found on the relationship between the initial 'mispricing' (the valuation residuals and the *IR*s) and the IPO long run performance (*BHAR*s). The analysis does not find any significant impact of *Resi* on *BHAR*s, although more robust results are found on the relationship between *IR*s and *BHAR*s. In contrast to the working hypothesis, the *IR*s is positively related to *BHAR*s, suggesting that IPOs that have higher *IR*s on day 1 continue to have greater *BHAR*s after 1 and 2 years. In conjunction to the findings from the *IR* analysis, there are two possible explanations to the results. Firstly, it may imply that the market momentum on day 1, as suggested in the *IR* analysis, continue up to the IPOs' 2nd listing anniversary. Secondly, it may also imply that the issuers/sponsors of 'good' firms price the IPOs at the premium to signal the firms' true value, which results in higher IRs on day 1 and greater subsequent *BHAR*s.

6.4 Sensitivity analysis

In the prior section, it has been demonstrated and discussed the robust impact of PIPOs on the IPO long run performance. In the main analysis using the full sample, the PIPOs impact is controlled for by including the privatisation dummy (*Priv*) in the model. Another way to test the robustness of the results of the main analysis is to totally exclude the PIPOs in the analysis, by running the

OLS regression analysis for each long run performance model using the non-PIPOs sub sample.

The results are presented in tables 6.10 and 6.11 below. Since the analysis uses the non-PIPOs sub sample, there will be no sensitivity analysis for model II – the IPO long run performance model that examines the impact of the prospectus information and the privatisation dummy on the *BHAR*s.

Overall, the results indicate that the models work as well as with the full sample. The constant term shows negative coefficients, although only in year 3 is it statistically significant for both models (I and III), suggesting that after controlling for other factors, the non-PIPOs underperform the market after 3 years trading.

Another improvement is observed in the *Eq* variable. The main results for model I show that *Eq* is insignificant related to *BHAR*1y, however it turns out to be significant in the non-PIPOs sub-sample (table 6.6). Moreover, the *Eq* demonstrates statistically robust results. It implies that the impact of the *Eq* on the IPO *BHAR*s is strong, although its impact in the main analysis is influenced by the interaction between the *Eq* and the privatisation dummy. Therefore, after excluding the PIPOs, the result highlights the robust impact of Eq on the IPO long run performance. Other results remain unchanged.

As mentioned above, the sensitivity analysis is carried out in order to test the robustness of the IPO long-run performance models. Although the data has been treated for outliers (see the research design chapter regarding outliers treatment), it is still necessary to check the results for that effect. Therefore, all IPO long run performance models are tested by using the robust regression.

Table 6.10 Regression analysis of the IPO long-run performances on the prospectus information (Model I) for Non-PIPOs sub-sample

The table contains output from OLS regression analysis for all IPO sample, of the buy and hold abnormal returns for 1 year, 2 years, and 3 years (*BHAR*1y; *BHAR*2y; *BHAR*3y) on pro forma book value scaled by the offer price (pBV/P_0), forecasted earnings scaled by the offer price (fE/P_0), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), and percentage of equity sold (*Eq*). Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	BHAR1y (t-stat)	BHAR2y (t-stat)	BHAR3y (t-stat)
Constant	-0.267	-0.525	-1.517*
	(0.61)	(-0.63)	(-1.82)
pBV/P_0	-0.072	0.396	-0.108
	(-0.43)	(1.46)	(-0.35)
fE/P_0	1.979***	0.525	0.165
	(2.93)	(0.34)	(0.35)
Size	-0.064**	-0.104	-0.026
	(-2.04)	(-1.81)	(-0.38)
Risk factors:			
Lev	-0.040	-0.085	-0.221**
	(-0.55)	(-0.71)	(-2.05)
Cap	-0.088	0.189	-0.056
	(-1.47)	(-1.37)	(-0.39)
Effr	-0.373***	-0.889***	-0.989***
	(-2.95)	(-3.20)	(-3.06)
Cpy	0.122	0.035	0.643***
	(1.22)	(0.18)	(3.15)
Ind	0.726*	1.671*	2.274**
	(1.71)	(1.89)	(2.32)
Signals:			
Spo	0.114*	0.201*	0.261*
	(1.69)	(1.74)	(1.80)
Age	-0.007	-0.094*	-0.081
	(-0.25)	(-1.84)	(-1.31)
Eq	-0.609	-1.369***	-0.847*
	(-3.07)***	(-3.84)	(-1.97)
N	151	151	133
Adj R-square	0.097	0.098	0.133
Wald regression	47.07***	37.13***	37.74***
Wald fundamental	8.64**	2.33	1.86
Wald ex-ante risk factors	16.99***	13.92**	23.50***
Wald signals	11.22***	20.53***	9.22**

*Note: * significant at 10%; ** significant at 5%; *** significant at 1%*

Table 6.11 Regression analysis of the IPO long-run performances on prospectus information, valuation residuals, and initial returns (Model III) for Non-privatisation sub-sample

The table contains output from OLS regression analysis for all IPO sample, of the buy and hold abnormal returns for 1 year, 2 years, and 3 years (*BHAR*1y; *BHAR*2y; *BHAR*3y) on pro forma book value scaled by the offer price (pBV/P_0), forecasted earnings scaled by the offer price (fE/P_0), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), valuation residuals (*Resi*), and initial returns (*IR*). Heteroscedasticity-adjusted t-statistics are reported in brackets.

Variables	BHAR1y (t-stat)	BHAR2y (t-stat)	BHAR3y (t-stat)
Constant	-0.196	-0.916	-1.951*
	(-0.43)	(-1.01)	(-1.95)
pBV/P_0	-0.047	0.349	-0.144
	(-0.27)	(1.34)	(-0.43)
fE/P_0	2.001**	0.011	0.735
	(2.93)	(0.01)	(0.73)
Size	-0.056*	-0.061	0.003
	(-1.71)	(-1.04)	(0.05)
Risk factors:			
Lev	-0.039	-0.095	-0.231**
	(-0.53)	(-0.87)	(-2.18)
Cap	-0.088	-0.184	-0.054
	(-1.53)	(-1.38)	(-0.39)
Effr	-0.361**	-0.838***	-0.949***
	(-2.73)	(-3.30)	(-3.09)
Cpy	0.139	0.108	0.692***
	(1.39)	(0.57)	(3.28)
Ind	0.826*	2.146**	2.549**
	(1.87)	(2.36)	(2.45)
Signals:			
Spo	0.119*	0.201*	0.251*
	(1.78)	(1.74)	(1.85)
Age	-0.007	-0.087*	-0.080
	(-0.24)	(-1.76)	(-1.33)
Eq	-0.584**	-1.198***	-0.7444*
	(-2.98)	(-3.51)	(-1.77)
Resi	-0.001	-0.093	-0.072
	(-0.03)	(-1.12)	(-0.94)
IR	0.540*	1.861**	1.047
	(1.75)	(2.67)	(1.26)
N	151	151	133
Adj. R-square	0.097	0.125	0.108
Wald regression	53.42***	48.43***	41.13***
Wald fundamental	8.11**	1.79	1.34
Wald ex-ante risk factors	18.18***	16.91***	24.31***
Wald signals	10.77**	17.76***	8.69**

The results of the robust regressions are presented in tables 6.12, 6.13 and 6.14. Overall, the robust regression analysis for model I (table 6.8) shows similarity to the results of the OLS regression. The fundamentals work as well as it does in the OLS regression analysis, suggesting that outliers do not affect the impacts of fundamentals on the *BHAR*s. The results also maintain negative coefficients for *Size*, as predicted, and they are only significant for year 1, as found in the main analysis. Overall, the ex-ante risk factors also perform similarly; however, Capacity risk (*Cpy*) demonstrates a slightly different performance. While it appears to be insignificantly related to the *BHAR*s in the main analysis, the robust regression analysis finds a robust result of *Cpy*, implying that IPOs that disclose a higher fraction of net proceeds for the investment tend to have greater *BHAR*s in 3 years. The different results found in the main analysis and the robust regression analysis is possibly due to some extreme values, in which some IPOs propose 100% of net proceeds to fund an investment project.

Other differences are detected in results for the signals: firm's age (*Age*) and the percentage of equity sold at the IPO (*Eq*). In the main results, *Age* appears to be significantly related to the *BHAR*2y and *BHAR*3y. However, the rank regression analysis cannot find the evidence for year 3. The similar problem is also found with regard to the *Eq*. The main results show the significant *Eq-BHAR*s relationship in years 2 and year 3, but it loses significance in the rank regression.

In other models, the robust regression analyses highlight the same changes in the results with regard to *Cpy* and *Age*. However, there is no difference found for *Eq*, once the models are controlled for privatisations, or in the subsequent models.

Table 6.12 Robust Regression analysis of the IPO long-run performance on the prospectus information (Model I)

The table contains output from robust regression analysis for all IPO sample, of the buy and hold abnormal returns for 1 year, 2 years, and 3 years (*BHAR*1y; *BHAR*2y; *BHAR*3y) on pro forma book value scaled by the offer price (pBV/P_0), forecasted earnings scaled by the offer price (fE/P_0), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), and percentage of equity sold (*Eq*).

Variables	BHAR1y (t-stat)	BHAR2y (t-stat)	BHAR3y (t-stat)
Constant	-0.295	-0.409	-1.125
	(-0.64)	(-0.42)	(-0.96)
pBV/P_0	-0.113	0.395	0.157
	(-0.87)	(1.46)	(0.48)
fE/P_0	2.295***	1.531	0.784
	(3.21)	(1.02)	(0.58)
Size	0.001	0.001	0.103
	(0.03)	(0.01)	(1.45)
Risk factors:			
Lev	-0.108	-0.156	-0.243*
	(-1.63)	(-1.13)	(-1.78)
Cap	-0.047	-0.073	-0.011
	(-0.70)	(-0.52)	(-1.48)
Effr	-0.315**	-0.779**	-0.880**
	(-2.21)	(-2.61)	(-2.30)
Cpy	0.099	-0.147	0.337*
	(0.99)	(-0.70)	(1.79)
Ind	0.494	1.111	1.362
	(1.05)	(1.13)	(1.12)
Signals:			
Spo	0.076	0.203	0.294*
	(1.09)	(1.40)	(1.84)
Age	-0.002	-0.128*	-0.124
	(-0.06)	(-1.89)	(-1.54)
Eq	-0.066	-0.430	0.007
	(-0.38)	(-1.20)	(0.02)
N	161	161	161

*Note: * significant at 10%; ** significant at 5%; *** significant at 1%*

Table 6.13 Robust Regression analysis of the IPO long-run performance on the prospectus information and privatisation dummy (Model II)

The table contains output from robust regression analysis for all IPO sample, of the buy and hold abnormal returns for 1 year, 2 years, and 3 years (*BHAR*1y; *BHAR*2y; *BHAR*3y) on pro forma book value scaled by the offer price (pBV/P_0), forecasted earnings scaled by the offer price (fE/P_0), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), and privatisation dummy (*Priv*).

Variables	BHAR1y (t-stat)	BHAR2y (t-stat)	BHAR3y (t-stat)
Constant	-0.103	-0.124	-0.883
	(-0.57)	(-0.35)	(-0.97)
pBV/P_0	-0.171	0.243	-0.187
	(-1.09)	(0.87)	(-0.81)
fE/P_0	2.227***	1.422	1.190
	(2.94)	(0.93)	(1.23)
Size	-0.055*	-0.111	-0.014
	(-1.85)	(1.72)	(-0.16)
Risk factors:			
Lev	-0.083	-0.136	-0.219*
	(-0.97)	(-1.42)	(-1.98)
Cap	-0.073	-0.186	-0.012
	(-1.07)	(-1.47)	(-0.08)
Effr	-0.322**	-0.790***	-0.906**
	(-2.37)	(-2.97)	(-2.54)
Cpy	0.107	-0.157	0.391*
	(1.39)	(-0.51)	(1.93)
Ind	0.666	1.011	1.329*
	(1.48)	(1.55)	(1.77)
Signals:			
Spo	0.083	0.177	0.213*
	(1.29)	(1.71)	(1.93)
Age	-0.002	-0.105*	-0.077
	(-0.15)	(-1.83)	(1.51)
Eq	-0.322**	-0.780**	-0.807**
	(-1.99)	(-2.69)	(-2.42)
Priv	0.543**	1.044**	1.371**
	(2.88)	(2.32)	(2.70)
N	161	161	144

*Note: * significant at 10%; ** significant at 5%; *** significant at 1%*

Table 6.14 Robust Regression analysis of the IPO long-run performances on prospectus information, privatisation dummy, valuation residuals, and initial returns (Model III)

The table contains output from robust regression analysis for all IPO sample, of the buy and hold abnormal returns for 1 year, 2 years, and 3 years (*BHAR*1y; *BHAR*2y; *BHAR*3y) on pro forma book value scaled by the offer price (pBV/P_0), forecasted earnings scaled by the offer price (fE/P_0), leverage risk (Lev), capital availability risk (*Cap*), efficiency risk (*Effr*), capacity risk (*Cpy*), industry risk (*Ind*), sponsor reputation dummy (*Spo*), firm's age (*Age*), percentage of equity sold (*Eq*), privatisation dummy (*Priv*), valuation residuals (*Resi*), and initial returns (*IR*).

Variables	BHAR1y (t-stat)	BHAR2y (t-stat)	BHAR3y (t-stat)
Constant	-0.344	-0.866	-1.14
	(-0.78)	(-0.93)	(-0.96)
pBV/P_0	-0.154	0.253	-0.069
	(-1.16)	(0.91)	(-0.20)
FE/P_0	2.340***	1.250	0.968
	(3.39)	(0.87)	(0.77)
Size	-0.059*	-0.069	0.003
	(-1.81)	(-1.06)	(0.03)
Risk factors:			
Lev	-0.083	-0.118	-0.201
	(-1.32)	(-0.90)	(-1.29)
Cap	-0.078	-0.172	-0.124
	(-1.23)	(-1.30)	(-0.70)
Effr	-0.312**	-0.789***	-0.851**
	(-2.35)	(-2.90)	(-2.40)
Cpy	0.203**	0.133	0.616**
	(2.07)	(0.65)	(2.33)
Ind	0.639	1.777*	1.643*
	(1.42)	(1.89)	(1.69)
Signals:			
Spo	0.072	0.189	0.260*
	(1.08)	(1.37)	(1.78)
Age	0.007	-0.119*	-0.109
	(0.21)	(-1.87)	(-1.41)
Eq	-0.451**	-1.124**	-0.904*
	(-2.19)	(-2.60)	(-1.70)
Priv	0.494**	0.912**	1.321**
	(2.58)	(2.28)	(2.67)
Resi	-0.001	-0.096	-0.052
	(-0.00)	(-1.49)	(-0.61)
IR	0.592*	1.946**	1.033
	(1.69)	(2.62)	(1.09)
N	161	161	144

*Note: * significant at 10%; ** significant at 5%; *** significant at 1%*

Overall, the results of model II and III appear to be more consistent to the main results.

In sum, two sensitivity analyses are conducted to detect any problem that may affect the results of the main analysis. The first analysis is to test whether the models perform differently when the non-privatisation sub-sample is used. The results show a robust effect of privatisations influencing the models' explanatory power. The rank regression analysis indicates a slight change to the main results with regard to the capacity risk and firm's age variables, which become less significant than in the main analysis.

6.5 Validity of the IPO long run performance models

To this point, there have been several interesting findings, although a surprising result is the evidence that demonstrates how the prospectus information appear to be irrelevant in years 1 and 2, yet they turn out to be significant related to the *BHAR*3y. Therefore, it is predictable that the adjusted R-square of all IPO long-run returns will be highest in year 3. This result is contrary to the findings of Bhabra and Pettway (2003). Using Canadian data, they find the adjusted R-squares declining throughout the periods, suggesting that the prospectus information is less relevant for the longer period.

The adjusted R-square for model I (table 6.6) ranges from 4.9% to 8.6%, meaning that the prospectus information could explain 4.9% of the variation in *BHAR*1y and up to 8.6% of the variation in *BHAR*3y. The Wald statistics of model I shows that the model is statistically significant across the different time periods, suggesting that the prospectus information as a whole has a significant impact on the IPO long run performance. Moreover, the Wald statistics for each classification of the prospectus information show that the joint restriction of the fundamentals information is significant in year 1, but loses significance in the longer periods. In contrast, the joint restriction of the signals appears to be insignificant in year 1, but gains significance in the longer period. Meanwhile, the more robust results are found in the joint restriction of the ex-ante risk factors, which are significant throughout the different time periods.

Model II is the extended model I after adding the privatisation dummy into the model (see table 6.7). The explanatory power of model II improves significantly to the range from 11.2% to 13.4%. Similar to the previous model, the Wald statistics of model II shows that it is a valid model at least at the 99% level of significance across the different periods. The joint restriction of the fundamentals shows a similar pattern to the previous model. However, the joint restriction of the signals improves in model II in which the signals as a unit is significantly related to the *BHAR*s through the different periods.

Model III is the extended model II after the inclusion of the valuation residual and the IPO initial returns into the model (see table 6.8). With robust results for the association between the *IR*s and the *BHAR*s in years 1 and 2, the explanatory power of model III for those periods slightly increase. However, in year 3, the explanatory power of model III is virtually similar to the explanatory power of model II. The joint restrictions of each group of the prospectus information are similar to the results of model II.

In terms of the model's explanatory power, the non-privatisation sub-sample exhibits stronger results in model I. For example, the adjusted R-square of model I in year 1 using the full sample is 4.9%, while the non-PIPOs sub-sample demonstrates a significantly higher explanatory power of 9.7% (see table 6.10). It means that by totally isolating the privatisation effect, the prospectus information explains higher variations in *BHAR*1y. Additionally, it confirms the robustness of the privatisation effect that influences the performance of the IPO long-run returns model.

However, the privatisation effect does not appear to have a similar influence for the subsequent models. The results of model III (table 6.11) demonstrates that instead of increasing, the explanatory power of the model is lower than the ones of the full IPO sample. Yet, the outcomes confirm the fact that the privatisation effect significantly influences the IPO long run returns models.

The Wald statistics shows that using the non PIPOs sub sample does not change the validity of the IPO long run performance models. The models are valid across the different periods. The joint restrictions of the prospectus information classifications for the non-PIPOs sub sample perform similarly to the ones for the full sample. The joint restrictions of the ex-ante risk factors are robust. The fundamentals joint restriction is significant only in year 1. Meanwhile, the joint restrictions of the signals are more robust for the non-PIPOs, as they are statistically significant across the models and the different periods.

Conclusion

This chapter has presented and discussed the IPO performance of the research sample in the long run (up to 3 years post-IPO). IPO long run performance has been defined as the investors' abnormal returns from a day after the IPOs to the 1^{st}, 2^{nd}, and 3^{rd} listing anniversaries. In contrast to prior studies (e.g., Ritter, 1991; Levis, 1993), the descriptive statistics of the buy and hold abnormal returns (*BHAR*s) demonstrate that the research sample outperform the market in year 1. The *BHAR*s start to decrease in year 2, and have a negative mean value in year 3, yet the statistical test cannot confirm the significance of the research sample underperformance.

However, when the research sample is broken down into the privatisation/non-privatisation and the survivor/non-survivor sub-samples, the non-PIPOs estimates uncover evidence of the long-run underperformance in year 3, and so do the non-survivors.

Mixed results are found on the relationship between the prospectus information and the IPO long run performance. From the fundamentals group, only the forecasted earnings to offer price ratio is significantly related to the IPO *BHAR*s in year 1, but loses significance for the longer periods. The result is understandable as the earnings figure used in this study is the 1-year forecasted earnings, therefore this information is relevant to the IPO pricing after 1 year trading. Additionally, the actual figures of earnings and book value of equity have been available to the market, which are more relevant in pricing the IPOs in the longer periods. Since the analysis only finds evidence of the fundamentals impact on the *BHAR*s for year 1, it is not surprising that the joint restriction of the fundamentals is significant only for year 1.

Mixed results are found on the relationship between the ex-ante risk factors and IPO performance. In the shorter period, the impact of the ex-ante risk factors generates little evidence to support the working hypotheses. Nevertheless, the impact becomes more important in the long run, particularly over 3 years after the offering. The efficiency risk is the only ex-ante risk factor, which shows consistent results throughout the periods. An interesting finding for this predictor group is that seemingly the market perceives the proxies as firm performance measures, rather than as risk measures. Despite mixed results for the individual ex-ante risk factors, the joint restrictions of the group are robust across the models and throughout the different periods.

The signals appear to perform as expected, despite the lack of statistical significance for the firm's age (*Age*) variable. The sponsor reputation (*Spo*) shows robust results across the models and the different periods. The result implies that IPOs that are sponsored by the prestigious investment bankers perform better in the long run than IPOs that are sponsored by the less prestigious investment bankers. The evidence for the percentage of equity sold at the IPO (*Eq*) appears to be weak in model I. However, once the models control for the privatisations, the impact of *Eq* on *BHAR*s becomes significant throughout the periods. The result implies that IPOs that sell lower percentages of the enlarged shares at the offering perform better in the long run than do the IPOs that sell higher percentages of the enlarged share capital. Mixed results are found in the joint restriction of the signals across the models. In model I, it is significant only in year 2 and 3, although, it becomes more consistently significant in the subsequent models.

A robust result is found on the relationship between the privatisation and the IPO performances. The results lend further support to the prior findings that demonstrate the significant impact of privatisations on the IPO long run returns. The PIPOs appear to have better performance in the long run (up to the 3-year period). Hence, it corroborates the prior UK studies on the IPO long-run performance.

Another interesting finding is demonstrated in the relationship between the initial 'mispricing' (valuation residuals and *IR*s) and the *BHAR*s. There is no evidence to support an association between *Resi* and the *BHAR*s. Prior studies find a negative relationship between the *IR*s and the *BHAR*s, suggesting mean reversion. However the result in this study suggests differently. The positive *IR-BHARs* relationship continues up to year 2, and then loses the significance in year 3. In conjunction to the findings in the *IR* analysis, the results imply that the market momentum continues up to the IPOs' 2nd listing anniversary. Another implication is that the higher *IR*s on day 1 is a result of the signalling action of the issuers/sponsors of 'good' firms. Therefore, in the long run, such IPOs are expected to have greater *BHAR*s, which results in a positive relationship between the *IR*s and the *BHAR*s.

Despite mixed results and lack of significance of a number of predictors (see appendix – table A.6.4), all IPO performance models demonstrate increasing explanatory powers throughout the periods. The Wald statistics shows that the models are valid. The sensitivity analyses demonstrate that the results of the main analysis are generally robust.

Appendices

for

Chapter 6

Appendix

Table A.6.1. The reason for the non-survivor IPOs

Company name	Reason
International Food Machinery plc	Delisted
Parkdean Leisure plc	Taken-over
Parkside International plc	Taken-over
Unipalm Group plc	Merged
GRT Bus plc	Taken-over
Rainford Group plc	Taken-over
Brunner Mond plc	Private
Oliver Ashwort plc	Taken-over
Car Group plc	Delisted
Penna Holdings plc	Taken-over
SDX Business System plc	Taken-over
Ushers of Trow plc	Delisted
Gremlin plc	Merged
Primesight plc	Taken-over
Newsquest plc	Taken-over
BCH group plc	Taken-over
Tetra	Taken-over

Table A.6.2a Performance of non-privatisation sub-sample by year

Year	No.of IPO sample	Average BHAR1y	Average BHAR2y	Average BHAR3y
1987	5	0.281	0.613	0.528
1988	12	0.330**	0.248	0.228
1989	4	0.292	0.524*	0.693**
1990	2	-0.015	0.078	0.066
1991	4	0.116	-0.201	-0.145
1992	10	-0.034	-0.188	-0.266*
1993	15	0.095	-0.039	-0.201
1994	31	0.163**	0.223	0.102
1995	19	0.096	-0.208	-0.642***
1996	28	0.043	-0.179	-0.242*
1997	21	-0.003	-0.314**	0.166

Table A6.2b Performance of survivor sub- sample by year

Year	No.of IPO sample	Average BHAR1y	Average BHAR2y	Average BHAR3y
1987	7	0.306*	0.602*	0.581
1988	13	0.328***	0.258	0.201
1989	6	0.368**	0.531***	0.831***
1990	2	-0.015	0.078	0.066
1991	6	0.117	0.042	0.150
1992	9	0.021	0.027	-0.266*
1993	16	0.105	0.053	-0.156
1994	28	0.157**	0.359**	0.102
1995	17	0.126	-0.089	-0.642***
1996	24	0.042	0.064	-0.242*
1997	15	0.057	0.099	0.166

*Note :*significant at 10% ; **significant at 5% ; *** significant at 1%*

Figure A.6.2a - IPO performance of non-privatisation sub sample by year

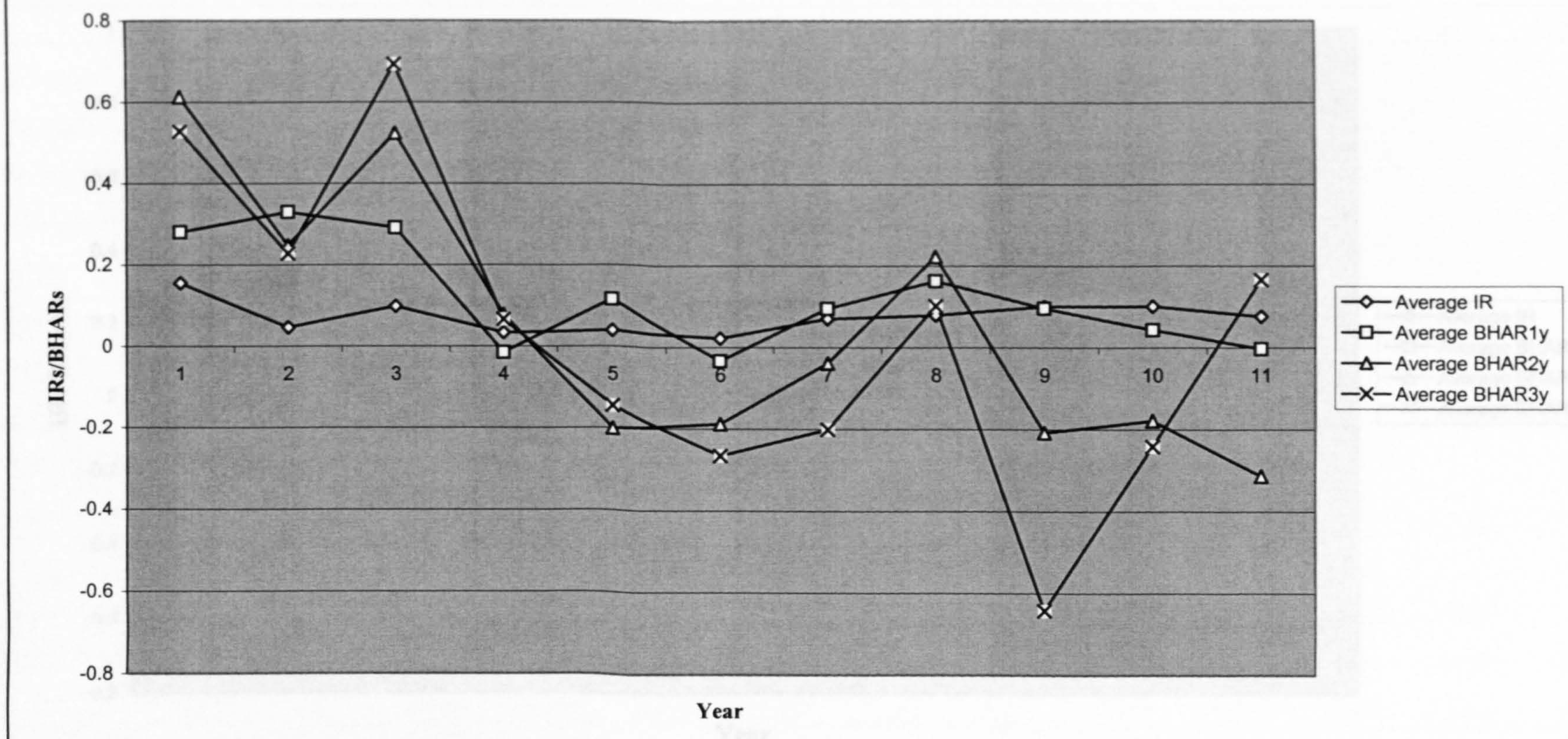


Figure A.6.2b - IPO performances of non-survivors sub-sample by year

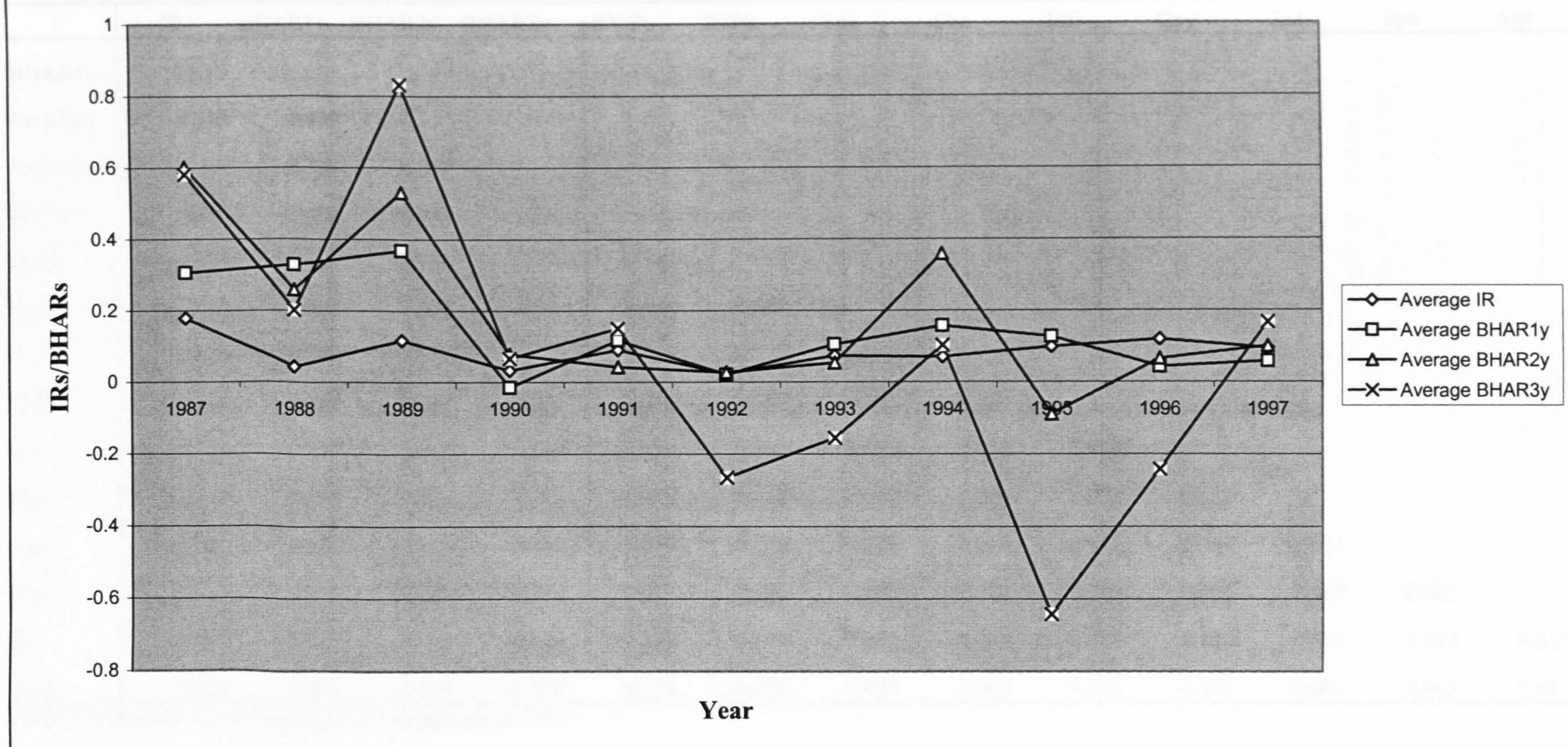


Table A.6.3 correlation matrix for non-PIPOs sample
The table contains the (Pearson) correlation coefficients of all variables in IPO performance models for non-privatisation IPO sample

	IR	BHAR1y	BHAR2y	BHAR3y	pBV/Po	fE/P0	Lev	Cap	Effr	Cpy	Ind	Spo	Age	Eq
BHAR1y	0.112													
BHAR2y	***0.150***	***0.639***												
BHAR3y	0.037	***0.549***	***0.737***											
pBV/Po	***-0.222***	-0.056	0.067	0.004										
fE/P0	-0.094	***0.147***	-0.030	0.059	***0.143***									
Lev	-0.012	-0.066	-0.080	-0.069	***-0.155***	-0.087								
Cap	0.075	-0.038	-0.049	0.024	***-0.166***	0.041	***0.155***							
Effr	-0.037	***-0.179***	***-0.235***	***-0.283***	0.044	***0.183***	-0.123	-0.089						
Cpy	***-0.135***	0.023	-0.011	***0.150***	***0.184***	-0.085	***0.230***	-0.068	-0.106					
Ind	***-0.146***	***0.142***	0.122	0.132	0.068	***0.252***	-0.034	-0.035	0.078	-0.132				
Spo	-0.040	0.109	0.116	0.141	-0.079	-0.076	-0.104	-0.017	-0.113	***-0.162***	-0.011			
Age	-0.027	0.031	-0.083	-0.072	0.017	0.146	-0.119	***-0.225***	0.026	-0.036	0.052	0.007		
Eq	-0.085	-0.175	***-0.215***	***-0.146***	***0.198***	0.159	0.073	***-0.139***	0.115	0.122	0.002	-0.054	0.032	
Resi	***0.209***	-0.034	-0.109	-0.104	***-0.319***	***-0.279***	0.029	0.008	-0.026	-0.002	0.003	-0.005	0.017	-0.006

Note: Coefficients in bold and italic are significant at 10%

Table A.6.4 Summary of long run performance analysis hypothesis testing

Hypothesis	Variables	Expected signs	Evidence
H12a *The pro-forma book value of equity to offer price ratio is negatively related to IPO long run abnormal returns*	pBV/P_0	+	✗
H12b *The forecasted earnings to offer price ratio is positively related to IPO long run abnormal returns*	fE/P_0	+	✓ (only in year 1)
H13 *There is a positive relationship between size and IPO long run abnormal returns*	*Size*	-	✓ (only in year 1)
H14a *There is a positive relationship between firm's pre-IPO leverage and IPO long run abnormal returns*	*Lev*	+	✗ (a negative and significant coefficient is found in year 3)
H14b *There is a negative relationship between firm's pre-IPO capital availability risk and long run abnormal returns*	*Cap*	-	✗
H14c *There is a positive relationship between firm's pre-IPO efficiency risk and IPO long run abnormal returns*	*Effr*	+	✓ (negative and significant coefficients are found in years 1,2, and 3)
H14d *There is a positive relationship between firm's pre-IPO capacity risk and IPO long run abnormal returns*	*Cpy*	+	✓ (only in year 3)

Hypothesis	Variables	Expected signs	Evidence
H14c *There is a positive relationship between industry risk and IPO long run abnormal returns*	***Ind***	+	✓
H15a *There is a positive relationship between sponsor reputation dummy and IPO long run abnormal returns*	***Spo***	+	✓
H15b *There is a positive relationship between firm age and IPO long run abnormal returns*	***Age***	+	✓ (a negative and significant coefficient is found only in year 2)
H15c *There is a negative relationship between percentage of equity sold at the flotation and IPO long run abnormal returns*	***Eq***	-	✓
H16 *Privatisation dummy is positively related to IPO abnormal returns*	***Priv***	+	✓
H17 *Valuation residuals is positively related to IPO abnormal returns*	***Resi***	+	✗
H18 *There is a negative association between IPO initial returns and the long run abnormal returns.*	***IR***	-	✓ (positive and significant coeffients are found in years 1 and 2)

Chapter 7

Chapter 7

Conclusion

Introduction

This chapter aims to summarise the findings from the research that is presented in the prior chapters. It also presents the final conclusion, which is to address the main research question: Can investors use the prospectus information to price the Initial public offerings (IPOs) in the short-run and the long run? This question leads to three empirical questions analysed in this study. The first part of the research is to examine whether issuers and sponsors (the investors) use the prospectus information to set the IPO offer price (the initial market price). The results and analysis of the first part of the research are presented in chapter 4. The second part of the research is presented in chapter 5, which is to observe whether the prospectus information offers an explanation to the IPO underpricing anomaly. The final part, which is presented in chapter 6, is to address the impact of the prospectus information on the IPO long run performance.

The main focus of this study is to analyse the impact of the prospectus information on the IPO valuation in the short-run and their long run performance. The prospectus information is believed to be comprehensive information available to the market at the admission; therefore it is interesting to examine how the market participants value the IPOs given such limited information.

Operationally, the prospectus information is classified into three different groups (fundamentals, ex-ante risk factors, and signals). Additionally, this research also controls for a number of research sample characteristics, such as the privatisations, that may play an important role and influence the results.

The research is based on a sample of 161 IPOs in the UK main market that took place during the 1987-1997 period. An accounting valuation method is used in the IPO valuation analysis. This is a unique contribution of this study to the IPO research area, since, to the researcher's knowledge, no prior IPO valuation study uses the accounting valuation model. Very limited information regarding the IPO firms is available to the market prior to the admission, which makes the IPO valuation more difficult than the valuation for the seasoned stock. The offering prospectus is believed to be the most comprehensive information that is available at the admission. The advantage of using the accounting valuation model is its simplicity. It requires limited basic information included in the offering prospectus, while other valuation methods require additional information – such as projected cash flow – which may not be available to investors at the admission.

A review of the major IPO literature that is reasonably associated to the research is provided as a background and reference to the empirical investigation, and is presented in chapter 2. The research design is explained in detail in chapter 3. It presents the research models, which are the IPO valuation and the IPO performance models. The IPO valuation models analyse the impact of the prospectus information on the IPO offer price and the initial market price. The IPO performance models analyse the impact of the prospectus information on the IPO performance in the short run and long run. Chapter 3 also presents a list of the working hypotheses of the research.

The structure of this chapter is as follows. The next section summarises the findings and conclusions of the IPO valuation analysis. It is followed by a section that reviews the findings and conclusions of the IPO long-run performance analysis. Then, the limitations of the research are discussed in the next section.

There are a number of possible future avenues of research as extended studies based on the findings of this research, which is presented in the following section. And finally, the thesis is concluded in the last section.

7.1 IPO valuation analysis

This IPO valuation analysis investigates the impact of prospectus information on the IPO offer price and the initial market price. The prospectus information is categorised as fundamental information (pro-forma book value of equity, forecasted earnings, and pro-forma dividend), ex-ante risk factors (leverage risk, capital availability risk, efficiency risk, capacity risk, and industry risk), signals (sponsor reputation, firm's age at the time of admission, and the percentage of ownership that is sold at the IPO) and various control variables, such as privatisation. The analysis is based on the accounting-based valuation model. The model hypothesises that the IPO price is an increasing function of the fundamentals and signals, but a decreasing function of the ex-ante risk factors.

The results show that the fundamental accounting variables play a vital role in valuing IPOs. The IPO valuations, both at the offer price and the initial market price, heavily depend on those accounting numbers, which results in impressive explanatory power of the model. Particularly, pro-forma book value and forecasted earnings appear to be highly and significantly related to the offer price and the initial market price. However, in contrast to prior findings for non-IPO samples, the dividends seem to have an insignificant impact. The basic valuation model analysis also confirms the significantly different impact of negative earnings on the IPO valuations, which is consistent to the findings from prior non-IPO studies (Hayn, 1995; Rees, 1999). Overall, the fundamentals seem to be a major factor in valuing the IPOs, as demonstrated by the high explanatory power of the basic valuation models (the adjusted R-square of 72.9% and of 67.0%, respectively, for the offer priced and the initial market priced scaled by the pro-forma book value).

The analysis on the full valuation model exhibits mixed results. Only two out of five ex-ante risk factors, efficiency risk and capacity risk, significantly influence the IPO valuations and confirm that the IPO prices are a decreasing function of the ex-ante risk factors. The results of such prospectus information are robust, as a number of sensitivity analysis exhibit unchanged results.

Amongst the signals, only the impact of the percentage of equity sold at the IPO on the initial market price appears to be significant. The result implies that the IPOs, where a higher percentage of the equity is sold at the admission, are valued lower in the market. The market perceives the fraction of the firm's equity sold at the offering as a signal to the firm's true value. The higher the percentage of equity offered at the admission reflects the management's low expectations regarding the firms' future value. Meanwhile, there is no evidence to support the signalling role of the sponsor reputation and the firm's age. Therefore, this study cannot confirm the findings from previous studies that find a robust result of the signals, particularly the sponsor (underwriter) reputation (e.g., Clarkson et al, 1992). However, this result is similar to results from a number of UK studies (e.g., Keasey and Short, 1992).

The results of the privatisation dummy show no empirical evidence of its impact on the IPO prices. Prior studies (e.g., Menyah et al, 1995) find that the PIPOs are priced differently, hence resulting in a significantly greater degree of underpricing. However, the IPO valuation analysis in this study fails to find evidence to confirm such previous findings. The collinearity problem between the privatisation dummy and the percentage of equity sold at the IPO is suspected to be the cause of lacking statistical significance in this case, as the univariate analysis records a correlation coefficient of 0.705 between the two variables.

Despite mixed results of the influence of ex-ante risk factors and signals on the IPO valuation, the inclusion of those predictors to the valuation models increases the adjusted R-square for the offer price and the initial market price to a maximum of 74.8% and 69.5%, respectively, implying that to some extent the ex-ante risk factors and signals do explain parts of the variations in the IPO prices. A number of sensitivity analyses also show that the main results are robust and the model is not sensitive to the choice of measures (proxies) of the predictors, such as the use of forecasted earnings as a predictor, and the pro-forma book value as a model deflator. Additionally, the Wald test demonstrates that the IPO valuation models are statistically valid.

7.2 IPO performance analysis

The IPO performance analysis aims to address two IPO anomalies: the underpricing and the long run underperformance. Therefore, the analysis is divided into two empirical analyses. The first analysis examines the investors' returns on the closing of the first trading day. This is referring to as the underpricing phenomenon in the IPO market. The second analysis is to observe the investors returns at subsequent IPO listing anniversaries.

The results of the first analysis show robust evidence of the underpricing in the research sample. Even when the sample is separated to the privatisation IPOs (PIPOs) and non-PIPOs sub-sample, the undepricing fact significantly exists in both sub-samples. However, in contrast to previous UK studies on IPO long-run performance, this study does not find a support for the hypothesis of the underperformance of the IPOs based on the full sample. In contrast, the results suggest that, on average, the research sample outperforms the market during the first two years of their lives, which is shown by the positive and significant means of the 1-year buy and hold abnormal returns (*BHAR*s). In turn, the average of the *BHAR*s in year 2 is also positive, but statistically insignificant, while in year 3, the average of the BHARs takes a negative value, although does not significantly different to zero. Further analysis is undertaken by, splitting the research sample into the PIPOs/non-PIPOs and the survivor/non-survivor sub-samples. The above results seems to have been driven by the privatisations, as analysis of the non-PIPOs sub- sample finds evidence of the long-run underperformance in year 3, as is also the case for the non-survivors.

While the fundamental accounting variables are found to be substantially influencing the IPO prices, their impact is weaker in explaining the IPO performance. An interesting finding is the relationship of the pro-forma book value of equity to offer price ratio and the Initial returns (*IR*s), which demonstrates a significant result but in the opposite direction to that predicted. This study posits a positive coefficient of the proforma book value to offer ratio variable, however the result shows a negative sign, which implies that the IPOs that are priced more highly compared to their book value at the offering are likely to be valued even more highly on the first trading day. Another possible explanation offered in this study is that the issuers/sponsors priced the 'good' IPOs at the premium to signal the firms' true value. If the market agrees with the issuers/sponsors, the market demand push-up the prices, which in turn results in the higher *IR*s. This result is consistent with the later results of the impact of valuation residuals on the IRs. However, the impact of the pro-forma book value to offer price ratio disappears for the longer period.

While weak evidence is found on the relationship between the forecasted earnings and the IPO short run performance (IRs), its impact on the IPO 1 year performance (BHAR1y) is significant. This is understandable, since the forecasted earnings figures disclosed in the prospectus is a 1-year forecast. Therefore, the figures is relatively relevant in pricing the IPOs after 1 year listed. The impact of the forecasted earnings disappears over the longer periods, since the actual earnings figures are available to the market in the subsequent years.

The impact of the ex-ante risk factors on the IPO short run performance generate little evidence to support the working hypotheses; only Industry risk is significantly related to the IRs. However, the Industry risk coefficient is of the opposite sign to that predicted, which implies the IPOs in riskier industries experience lower IRs. Nevertheless, the impact of the ex-ante risk factors becomes more important in the long run, particularly over the 3-year period after the offering. The efficiency risk is the only ex-ante risk factor, which shows consistent results throughout the periods. The leverage risk also appears to be significantly related to *BHAR*3y. However, the coefficients of the two variables take the opposite signs to those hypothesised. This means that the riskier IPOs perform worse in the long run. This suggests that the market perceives the ex-ante risk proxies as firm performance measures, rather than as risk measures. The results of the other ex-ante risk factors are mixed. While the Capital availability risk appears to have no impact to the IPO performance, the impacts of Capacity risk and Industry risk become significant in year 3.

The signal group exhibits mixed results. In the short run, no evidence is found to support the expectation of a negative association between the signals and *IRs*. However, the analysis shows more robust results in the long run. Both the Sponsor reputation and the Percentage of equity sold at the IPO are consistently and significantly related to IPO long run performance throughout different periods. To the researcher's knowledge, this study is among the first UK studies to document evidence of an association between the Sponsor reputation and the percentage of equity sold at the admission and the IPO long run performance. Weak evidence is found on the relationship between the firm's age and the IPO performance.

The privatisation variable shows robust results in explaining the IPO performance. The evidence supports the claim that the PIPOs tend to be more underpriced (have greater *IR*s on day 1) but have better performance in the long run up to the 3-year period. Hence, it corroborates the findings from prior UK studies on the privatization IPOs (e.g., Menyah *et al.*, 1995; Dewenter and Malatesta, 1997)

Another interesting finding is demonstrated on the relationship between the IR and the BHARs. Prior studies find a negative relationship (e.g., Levis, 1993), however the results in this study suggests differently. The positive *IR-BHARs* relationship continues up to year 2, and then loses the significance in year 3. The results imply that the overvalued IPOs at the offering are valued higher in the market from day 1 up to at least their second listing anniversary. Two possible explanations have been discussed in the IPO long run performance analysis. The first explanation is down to the market momentum. In the IR analysis, it is found that the IPOs that are priced higher relatively to their fundamentals (greater valuation residuals) appear to be valued higher in the market. This phenomenon is explained by the market momentum for such IPOs. The results in the long run analysis shows that such IPOs perform significantly better up to their 2nd anniversary, suggesting the momentum continues up to, at least, year 2. The second explanation is related to the signaling theory. In conjunction to the IR analysis, it is suggested that 'good' IPOs are priced at a premium at the offering as a signal to the firms' true value. When the market concurs with the signal, it pushes up the demand for 'good' IPOs that results in higher IPOs returns. Since such IPOs are 'good' firms, it is expected they perform better in the long run. Therefore, the positive *IR-BHARs* relationship is explained.

All IPO performance models are statistically valid. The tests of the joint restriction of the predictors show mixed results. The fundamentals have a significant impact only in year 1, the signals significantly predict the IPO long run performance for year 2 and 3, while the joint restrictions of the ex-ante risk factors are consistently significant across the different models and periods. The explanatory power of the models increases when control variables are introduced into the model. The sensitivity analyses demonstrate that the main results are generally robust.

7.3 Research limitations

The main source of data for this research is the offering prospectus. Therefore, the accomplishment of the research depends on the ability to obtain the prospectus. With limited financial resources, the researcher manages to attain 180 IPO prospectuses during the 1987-1997 periods. Moreover, to analyse the prospectus manually is reasonably time consuming. Some missing data and deletion of extreme cases reduce the sample to 161 valid cases. For an empirical study in the Finance area, the final sample is possibly small, which may encounter a few econometric/statistical problems in producing better results, when further analysis is needed. In particular, this study cannot pursue the sensitivity analysis for the non-survivor sub-sample, since only 17 IPOs of the research sample are found to be non-survivors IPO. However, the research sample sufficiently represents the population, as there are only 492 appropriate IPOs in the UK main market during the research period. Therefore, the research sample is approximately 32.7 % of the population. Moreover, a comprehensive analysis of the research sample has been undertaken and the results show that the sample is representative of the population of IPOs during the sample period.

As presented in the thesis, there is limited information, which is consistently disclosed in the prospectuses, such as the risk factors. However, a robustness check shows that the main results are robust.

Similar to the prior studies examining the IPO long-run performance, the measures of IPO abnormal returns may be sensitive to the benchmarks employed. Since most IPOs in the research sample are small firms, it is sensible to use the small companies market index, as employed in this study. Moreover, Espenlaub *et al.* (2000) re-examine the UK IPO long-run performance using 5 different benchmarks, yet they cannot conclude which one is the best benchmark. Therefore, it could be said that using different benchmarks in calculating the IPO long run abnormal returns does not certify the free-bias results. Finally, as applied by other studies (e.g., Gleason and Lee, 2002), the risk element in calculating the long run returns is controlled by including firm size variable in the right hand side of the IPO long run performance models.

Finally, Since the research sample is drawn from the main market only, the results could not be generalized for other UK markets.

7.4 Possible future research

A number of interesting findings in the two empirical sections of this study lead to several opportunities for future research. This study provides evidence of the association between the prospectus information and the IPO valuation. It also presents evidence on the undepricing anomaly to the research sample. Based on the economic law of supply and demand, the underpricing could be seen as the results of the offering excess demand. Prior studies also confirm that the oversubscribed IPOs tend to produce higher initial returns. Therefore, it would be interesting to analyse whether the prospectus information has the ability to predict the subscription of IPOs.

This study also demonstrates that the performances of IPOs, which survive to their third listing anniversary, are significantly different to the non-survivors. Therefore, it would be interesting to observe whether the prospectus information can be used to predict the company failures.

This study demonstrates the strong impact of the prospectus forecasted earnings on the IPO valuation and the buy and hold abnormal returns in year 1. However, it loses the significance in the following years, as the actual earnings figures are already available in the market at that time. Prior studies using non-IPO data provide evidence of the influence of the earnings forecast errors to the stock returns. Therefore, a study concerning the effect of the prospectus earnings forecast errors on the IPO valuation and performance in the long run could be a worthwhile area of research.

Concluding remarks

This thesis consists of two main parts. The first part examines the usefulness of the prospectus information to the IPO offer price as well as the initial market price. The results show that the prospectus information is useful in the pricing process. In particular, the 'future' fundamental information performs an important role in the IPO pricing. Moreover, such information explains almost 75% of the variation in the IPO prices. Furthermore, while the results somewhat mixed, this study also demonstrates some impact of the ex-ante risk factors and signals, which are also parts of the prospectus information, on the IPO prices.

The second part of the empirical analysis investigates whether the prospectus information still have significant impacts on the long-run IPO performance. The evidence shows mixed results. As expected, the 'future' fundamental information is found to be related to the IPO 1 year performance and becomes irrelevant in the longer period. On the other hand, the ex-ante risk factors do not show any significant impact on the first two years of the IPOs, but becomes significant in year 3. Meanwhile, the results of signals are more consistent. Confirming prior studies, this part of the study also proves the distinction of the pricing of the PIPOs. They are significantly underpriced on the first trading day, but perform far better in the long run.

This thesis offers a number of contributions to the research area. The first one is to give empirical evidence of the robustness of the accounting-based valuation model. This model is widely used in the non-IPO literature. This study demonstrates that it works well in the case of IPO as well. Secondly, to some extent, the prospectus information can be used to price the IPOs. Some information is relevant for predicting the short-run prices; others are more appropriate for longer period returns.

While many IPO studies present cross-sectional analysis of the IPO underpricing, very few have been done for the IPO long run performance. Therefore, this study provides a new explanation of the factors affecting the IPO long run performance. Lastly, this thesis provides additional evidence of the peculiarity of the pricing of the privatisation IPOs' pricing.

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