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AN EMPIRICAL STUDY OF UNIT IPOS IN THE UK: WHY DO FIRMS INCLUDE WARRANTS IN INITIAL PUBLIC OFFERINGS?

A thesis submitted in fulfilment of the degree of
DOCTOR OF PHILOSOPHY
In Accounting and Finance

By

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DEDICATION

I dedicate this thesis to:

My Grandmother and Grandfather
Mum and Dad

With love

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Gratitude is the fairest blossom, which springs from my heart.

Lei Yulan Zhang

12th March 2010

ABSTRACT

The main objective of this thesis is to identify the primary reasons why firms choose to issue unit IPOs instead of share-only IPOs. A sample of unit IPOs issued in the UK between 1994 and 2006 is investigated in examination of two competing hypotheses concerning the inclusion of warrants. The popular Agency Cost hypothesis of Schultz (1993b) explains the application of unit IPO as a form of staged financing for relatively young firms. The competing Signalling hypothesis proposed by Chemmanur and Fulghieri (1997) emphasises on the signalling mechanism unit IPOs provide in a market characterised by information asymmetry.

My results support both the Agency Cost and the Signalling hypotheses' common predictions that unit firms are smaller and riskier than share-only firms. In unique support to the Agency Cost hypothesis, evidence is found that the unit IPOs which are underwritten by less reputable underwriters raise smaller proceeds than that of share-only IPOs. In direct test of the Agency Cost hypothesis, the levels of agency costs are measured by the 'efficiency ratios', which are found to be significantly lower for unit firms, indicating higher level of agency costs. On the other hand, in direct test of the Signalling hypothesis, both the standard deviations of share returns and the delay between announcement of unit IPOs and the first trading day are calculated to proxy for the level of information asymmetry. These measurements suggest that unit firms possess higher levels of information asymmetry than that of share-only firms, which is consistent with the Signalling hypothesis.

Evidence from the initial underpricing provides strong support to the Agency Cost hypothesis that unit IPOs is significantly more underpriced than share-only IPOs. Post-listing survival and subsequent financing evidence is also in line with the Agency Cost hypothesis' prediction

that unit firms have lower survival rate than that of share-only IPO firms; however, unit firms that do survive are more likely to issue seasoned equity offerings (SEOs) for further funding. A clear pattern of price run-up is observed before SEO announcements by unit firms and a significant negative price adjustment is found when the SEOs are announced.

In the long-term, however, this thesis provides evidence that unit IPOs present significantly worse underperformance comparing to both the matching share-only IPOs and various market indices, regardless of the methods adopted to calculate abnormal returns. Such long-term results contradict both the Agency Cost and the Signalling hypotheses and imply that unit firms, being smaller and riskier businesses before they are publicly listed, cannot significantly improve performance by simply attaching warrants, regardless as whether they are used to reduce agency costs or to signal firm value. However, the choice to include warrants in IPOs is not in vain. This thesis provides evidence that in the UK, several warrant characteristics can influence the long-term performance of unit firms positively. The number of warrants, the firm value sold as warrant proceeds, and the ratio of warrant exercise price to offer price, are all positively and significantly related to the long-term abnormal returns of unit firms.

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CHAPTER 1

INTRODUCTION

1.1 Competing hypotheses and the motivation of this research

In a unit IPO, the firm going public issues a combined package of shares and warrants rather than share equity alone. If potential investors were to subscribe in a unit IPO, they will immediately hold the company's new ordinary shares in the offer. As warrant holders at the same time, they will have the option to hold or trade the warrants attached in the unit until expiration and then the option to exercise the warrants or let them expire. The warrants could usually be detached from the shares after the IPO and traded separately until expiration.

Theoretical justifications for the use of unit offerings were initiated by two competing but not mutually exclusive hypotheses. Firstly, the popular Agency Cost hypothesis of Schultz (1993b) explains the application of unit IPO as a form of staged financing for relatively young firms. Using the US data, Schultz illustrates that unit IPOs are used to limit agency costs by bonding managers to optimal investment decisions, and in turn reducing the probability of excess waste of free cash flows in less profitable projects. A unit offering usually provides relatively little proceeds at the initial public offering since the exercise of attached warrants can potentially materialise further cash infusion post-listing. Therefore, managers' available cash flow immediately after the IPO is limited and they have to spend their money 'wisely' by investing in value-generating projects. After all, if the initial investment is not successful, the stock price will not exceed the warrant exercise price and the second round of financing will fall through almost automatically, as in protection of shareholders' interests. On the other hand, if managers choose to invest in value-revealing projects, the stock price of the company will exceed the warrant exercise price, and warrant holders will certainly exercise these warrants for a profit and the second round of cash infusion occurs in favour for the company's growth. Such staged financing arrangements reduce the opportunities for managers to 'squander' money on unprofitable projects, especially for young firms in their early development stage.

As an alternative explanation for including warrants in an IPO, the Signalling hypothesis proposed by Chemmanur and Fulghieri (1997) emphasises on the signalling mechanism unit IPOs provide in a market characterised by information asymmetry. In such a market, information about the issuing firm is not transparent between the firms' managers (i.e. insiders) and the public investors (i.e. outsiders). From the investors' perspective, it is difficult to value distinctly whether the firm is a 'good' or 'bad' candidate in terms of potential investment outcome. On the other hand, managers have all the information of their own companies, but find it difficult to convey them to investors. Especially in a competitive environment, 'bad' firms constantly trying to imitate the market image of 'good' firms and to disguise themselves. It is in the interest of 'good' firm insiders to signal favourable information on firm values and distinguish themselves from the 'bad apples'. In the signalling model, Chemmanur and Fulghieri present three costly signalling mechanisms, namely, the fraction of equity retained by insiders, underpricing of the new issue and inclusion of warrants in an IPO. Adding warrants to an IPO means sharing firm value with warrant-holders; therefore, without doubt is one of the signals of firm quality that would be too costly for 'bad' firms to mimic. However, to the issuing firms' advantage, such cost will only be realised if a favourable state of the company occurs, in which there is a higher realisation of firm value.

Subsequent studies on unit IPOs are scarce and have been focused to examine the two competing hypotheses, most of which aim to test the proposed predictions from both theories, and find it difficult to conclude which is the more viable explanation. The Agency Cost and the Signalling hypotheses have received both partial support and challenges. By the time of this research, the reasons why firms include warrants in their IPOs are inconclusive. I am therefore, motivated to add further evidence from the UK to the growing unit IPOs literature. The main objective of this thesis is to identify the primary reasons for including warrants in an IPO, and the inter-relations between the inclusion of warrants and the after-market stock performance of unit firms (Firms that conduct unit IPOs are defined as *unit firms* in the remaining paper as opposite to share-only IPO firms). I also straightforwardly focus on the conflicting areas across different previous studies of unit IPOs and tests several on-going debates with a unique sample of unit IPOs issued in the UK between 1994 and 2006.

1.2 Contributions of this research

1.2.1 New evidence adding to the unit IPO literature

The first reason I claim for the importance of this thesis is that my research focuses on *unit* IPOs rather than share-only IPOs. The pricing and performance of IPOs have been one of the most extensively researched areas in finance literature. The post-listing behaviour, such as short and/or long-term performance of IPOs has been at the centre of academics' attention. However, very few studies associate the IPO pricing and aftermarket performance with the issuing firms' choice of offer type (unit IPO versus share-only IPO). A significant proportion of IPO firms choose to include warrants in their offerings in addition to common shares. Schultz (1993b) recorded that 167 of 797 IPOs (21%) in the US are unit IPOs over the period of 1986 to 1988; How and Howe (2001) reported that 134 out of 394 Australian IPOs (34%) issued from 1979 to 1990 choose to include warrants in the offerings. With a growing interest in unit-type offerings instead of the traditional share-only IPOs, a more focused investigation into the reasons why firms choose such 'packaged' IPOs is intriguing. My research incorporates the examination of both short-run and long run patterns for unit IPO firms in comparison to share-only IPO matching firms and various market indices. The literature on both initial underpricing and long-term performance of IPOs has been thoroughly reviewed. I replicate several conventional methodologies in calculating abnormal returns whilst extending them along several dimensions around my research focus of the unit IPOs.

1.2.2 Original data from the UK

The second contribution of this thesis is the regional choice of data. I collect and investigate a sample of 350 IPOs listed on the London Stock Exchange. The empirical tests of several competing hypotheses of unit IPO theories conducted in this thesis have not been examined with UK data before. I believe the unique environmental setting of the UK market, such as exchange listing requirements and tax regulations etc., is valuable for reassessing the robustness of the existing theories and inspiring new directions for future research.

The originality of the UK data is explored from several angles. Firstly, the London Stock Exchange has two markets, the Official Listing and the Alternative Investment Market (AIM). AIM is launched in June 1995 for smaller companies. The thesis provides evidence that in the UK more unit IPOs are listed on AIM than those listed on the Official Listing. The segregated study of unit IPOs listed on AIM and the Official Listing in the UK may provide a benchmark for international comparisons of unit IPOs in different market settings.

Secondly, the regional market indices in the UK can provide unique benchmarks in testing the robustness of existing unit IPO literature worldwide. Since unit IPO firms tend to be younger and smaller comparing to share-only IPO firms, I employ regional UK index for smaller firms, Hoare Govett Smaller Companies (HGSC) Index as the main benchmark to account for firm size. When calculating long-term market-adjusted returns, the FTSE All Share (FTA) Index include all the listed companies regardless of firm sizes is also employed, which provides an overall indication of the market performance. Furthermore, since the listings of unit IPOs in my sample are highly concentrated on the Alternative Investment Market, I also apply AIM Index as alternative benchmark to test the sensitivity of the long-term performance measures.

Last but not least, the choices of IPO issue methods in the UK are also unique, especially in comparison to the US IPO studies. Both the Agency Cost hypothesis of Schultz (1993b) and the Signalling hypothesis of Chemmanur and Fulghieri (1997) studied unit IPOs in the US, where most IPOs are issued through either firm commitments or best efforts. In the UK, firms go public mainly through a public offer or a placing (Goergen, Khurshed and Mudambi, 2006). In a public offer, the underwriter offers the company's shares to private and/or institutional investors. Public offers in the UK are very similar to US firm commitments, both of which are mainly used by larger firms, and underwritten by the sponsors who commit themselves to pick up any remaining unsold shares. However, UK public offers are generally sold to individual investors whilst the target of firm commitments in the US is institutional investors. A placing, as another popular method of going public in the UK, is similar to best effort contracts in the US, both of which are usually adopted by smaller firms and the underwriter does not provide a guarantee like a public offer. If there is insufficient interest from investors, the issue is withdrawn. However, a placing of shares is sold to a chosen group of institutional investors whilst best efforts in the US are usually sold to individual investors. Roughly, 82% of the IPOs in my UK sample (regardless of offer type) are issued through placement. I believe the unique contractual features of UK IPOs can provide fresh insight into the different fashions in which companies choose to go public.

1.2.3 A focus on the conflicting findings in unit IPO theory

Contributing to the limited research on unit IPO theory, my thesis directly stresses two contradicting areas from the existing literature, aiming to explain the reasons why some companies include warrants in their IPOs. A wide range of extant literature has been reviewed.

In summary, most previous studies have concurred on the characteristics of unit IPO firms to be smaller, younger and riskier than share-only IPO firms; unit firms also tend to have lower levels of insider ownership, possess less income and fewer assets prior to the offering. However, so far there have been ambiguous findings regarding two aspects: Firstly, evidence from the degree of underpricing of unit firms comparing to share-only firms has been debatable. How & Howe (2001) and Lee, Lee and Taylor (2003) found no difference in underpricing between the two types of firms. Jain (1994) and Chemmanur and Fulghieri (1997) found lower levels of underpricing for unit firms and contrarily, Schultz (1993b) presented evidence that unit firms are more underpriced than share-only firms. Secondly, there has not been a solid conclusion about the role of underwriter reputation. Schultz (1993b) and his supporters contributed evidence that unit IPO firms are more likely to use less prestigious underwriters; whilst How and Howe (2001) conclude that the reputation of underwriters in Australia, which choose to underwrite unit offerings, are just as good if not better than underwriters that choose to underwrite share-only IPOs. My thesis aims to reassess the two controversial topics with UK data, and provide evidence that unit IPOs in the UK are significantly more underpriced than share-only IPOs, and the reputation of underwriters that market for those unit offerings plays a crucial part in their aftermarket performance.

1.2.4 The study of seasoned equity offerings (SEOs) issued by unit IPO firms

Another contribution this thesis offers is the study of unit firms that decide to issue a seasoned equity offering within three years of the initial public offering. Most existing studies on seasoned equity offerings have examined the fact that firms tend to issue additional equity when their stock is experiencing a price appreciation and they tend to cluster right after the release of earnings announcements. However, very few studies associate the managers' decision to issue additional shares with the choice of warrant-share unit offerings at the beginning of firms' public life. I believe a study into the seasoned offerings within five years of a unit IPO and the resulting price reaction to the announcements can further our understanding of relationships between the corporate decisions to include warrants at the time of IPOs and the issuance of additional shares in the after-market.

1.2.5 Original discussion of the warrant characteristics

Finally yet importantly, the originality of my research roots from the investigation into warrant characteristics, in association with unit IPO underpricing and aftermarket performance. With the rapid development of various financial instruments across the market segments, academics are paying increasing attention to the characteristics of securities (Barclay and Smith; 1995a, 1995b). A warrant, being a class of financial derivative itself, has been introduced into initial public offerings as an important source of financing for many firms. However, the attention warrants have received in the finance literature is rather limited. This paper has the intention to reveal the characteristics of UK warrants comparing to warrants issued in US, Australia and Hong Kong. In each chapter, warrant characteristics are analysed in association with test results. Models included in the paper are designed to capture the relationship between warrant inclusion/characteristics and any abnormal returns, aiming to identify determinants of the performance immediately post-listing and over a period of three years after the initial offering, and to examine whether the inclusion of warrants is a structured strategy that influences the company's stock performance. The comparative analyses on unit IPOs' stock performance on both the short-term and long-term perspective, together with carefully conducted cross-sectional analyses, allow my research to provide refreshing evidence in the role of warrants in an IPO process. For example, in examination of the underpricing of unit IPOs, linear regressions were conducted with independent variables such as firm value sold as warrants, number of warrants included in the unit offering, life of warrants until expiration, the ratio of warrant exercise price to offer price, etc. I believe the research outcomes can provide insight for both managerial insiders and investors.

1.3 The structure of this thesis

The thesis consists of six chapters, including the current one. CHAPTER 2 reviews related literature of unit IPOs. Theoretical predictions and arguments from Schultz (1993b) and Chemmanur and Fulghieri (1997) are thoroughly explained and illustrated. Subsequent academic papers in discussion of the two original studies are reviewed systematically. Since the existing literature on unit IPOs is limited, selective studies from the (share-only) IPO literature are also surveyed for reference.

The empirical results of my research are structured into three chapters, each stressing a specific research angle. CHAPTER 3 investigates the characteristics of unit IPOs in comparison to share-only IPOs issued in the UK; and analyses, theoretically and empirically, the short-term economic effects of a dual share-warrant financing strategy through unit IPOs and the factors that might affect issuing firms' decisions to choose unit IPOs instead of share-only IPOs. Two competing hypotheses regarding the inclusion of warrants in IPOs are tested directly and with a short-term focus. Direct tests on the Agency Cost and the Signalling hypotheses conclude that unit firms exhibit significantly higher agency costs than matching share-only firms, measured by 'efficiency ratios'; in addition, unit firms present higher levels of information asymmetry than share-only firms do, prior to the IPOs. The initial returns and after-market short-term buy-and-hold returns of unit IPOs in comparison to share-only IPOs for up to 21 days post-listing are examined. Strong evidence is found that both unit IPOs and share-only IPOs generate positive abnormal returns on the first day of trading (IR_D2) but unit IPOs are significantly more underpriced comparing to matching share-only IPOs, which is consistent with the Agency Cost hypothesis. As alternative measure of underpricing, the first-week initial returns (IR_W2) are calculated and compared between unit and share-only IPOs. Despite a mild decline in the magnitude of underpricing, unit IPOs in the UK still significantly outperform share-only IPOs. Such outperformance persisted into the first week post-listing. Analysis using both linear square regressions and binary probit regressions are conducted in examination of the determinants of underpricing and the choice of offer types. Regression results provide strong support to the Agency Cost hypothesis, that the choice to include warrants has a great impact on the degree of initial underpricing. The UNIT dummy variable is positive and highly significant at 1% level. Furthermore, both unit IPOs and share-only IPOs share some common features that determine their degree of underpricing. The size, profitability, and debt leverage of the firms prior to the IPO, and the reputation of underwriters are all negatively and significantly related to the degree of underpricing. However, the regressions do not support any significant impacts on underpricing from the firm age, listing years, and industry effect. To sum up, the initial underpricing is a common IPO feature shared by both unit and share-only IPOs. However, unit firms in general tend to be smaller, riskier, and less profitable firms with greater information asymmetry than share-only firms prior to the IPO, and unit IPOs are more likely to use less reputable underwriters to market for smaller issues. These unique features determine that unit IPOs will be significantly more underpriced at the first trading day than share-only IPOs.

CHAPTER 4 abstracts a sub-sample of unit IPO firms that issued a seasoned equity offering within three years from the initial public offering. Schultz (1993b) argues that fewer unit firms will survive comparing to firms, which issue share-only IPOs; however, unit firms that do survive are more inclined to receive additional financing through seasoned equity offerings (SEOs) post-IPO because the value-revealing projects have established the attractiveness and profitability of their investment opportunities. In this chapter, tests are conducted focusing on examining the post-listing survival and subsequent financing of unit firms; determinants of firms' decision to issue SEOs within three years of their unit IPOs are also analysed. Evidence is found that unit firms have lower survive rates than share-only firms after their IPOs; and the survived unit firms are more likely to issue SEOs than share-only firms are. These results provide support to the Agency Cost hypothesis. In addition, with a 'comparison period' approach, the SEOs are proven to be issued when the unit firms' shares are overvalued, and a negative price reaction is associated with the SEO announcements by unit firms.

CHAPTER 5 focuses on the long-term stock performance of unit firms three years after the IPO. Following Mazouz et al. (2007), I extend both the Agency Cost and the Signalling hypotheses into a longer time-scale and test the two competing theories for including warrants using the long-term price performance approach. According to the Agency Cost hypothesis, if warrants are included in IPOs to reduce agency cost, then unit firms are expected to possess better management performance and therefore, higher long-term returns than share-only IPOs. In testing the Signalling hypothesis, the unit firms are riskier than share-only IPO firms. If the favourable information about firm value successfully conveyed to the market by costly signals such as including warrants, insider holdings, and underpricing the IPOs, unit firms should yield higher long-term returns to compensate investors for bearing the extra risk (Mazouz et al., 2007). Although explaining the long-term performance from different angles, both the Agency Cost and the Signalling hypotheses predict that firms that choose unit IPOs outperform firms, which choose to issue shares alone. In CHAPTER 5, long-term abnormal returns of unit firms are therefore calculated using different methods against different benchmarks, and compared with the long-term returns of share-only firms matched on size and industry. Results from the cumulative abnormal returns, the buy-and-hold abnormal returns, and the wealth relatives all provide strong evidence that unit IPOs in the UK significantly underperform both the market indices and the matching share-only firms, which contradicts both the Agency Cost and the Signalling hypotheses. Additionally, the long-term performance of unit IPOs are also analysed cross-sectionally in relation to the characteristics of unit IPOs and attached warrants. Evidence is found that unit IPOs issued during years of high market levels, bigger unit issues with larger proceeds, and unit firms from high risk industries display significantly worse long-term underperformance. Such results support the Agency Cost theory, that unit firms intentionally limit the size of their offers to bind managers to optimal investment decisions. Moreover, unit IPOs with higher initial returns exhibit more severe underperformance against both the market indices and the matching share-only IPOs. The negative relation between initial returns and long-term performance is consistent with the Agency Cost theory, that unit firms are more underpriced than share-only firms and have lower survival rate than share-only firms in the long term. Finally, three linear least square regressions are conducted on the 3-year BHARs of unit IPOs, the results of which confirm that certain characteristics of the unit firms, the unit issues, and the attached warrants can significantly affect the long-term performance of unit IPOs.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Usually, companies go public through a sale of common stock, or alternatively they can also choose a packaged offering. One such example of packaged security issues is the use of warrants in initial public offerings (IPOs), popularly referred to as 'unit IPOs' or 'unit offerings'. It has been noticed by extant literature that a significant minority of IPO firms choose a unit offering in preference to a share-only offering by adding warrants to their IPOs. Warrants are included in over one-fifth of US IPOs (Schultz, 1993a) and in over one-third of Australian IPOs (How and Howe, 2001). While considerable attention in previous literature has focused on share-only IPOs, unit offerings representing a significant fraction of the IPO population has not been sufficiently researched especially in the UK financial market. Warrants included in the unit offerings are often cursorily described as a 'sweetener', which is used to induce public interests for less popular issues. However, more precise and formalised explanations have been proposed and dissensions genuinely debated.

Schultz (1993b) proposes the Agency Cost hypothesis and maintains that smaller, younger, and riskier firms choose to issue unit IPOs to reduce agency cost by forming staged financing through attached warrants. Chemmanur and Fulghieri (1997) argue with the competing Signalling hypothesis that the inclusion of warrants in unit IPOs serves as a costly signal to conveying firm information to investors rather than sequential financing instrument. Subsequent studies of unit IPOs largely reassess the two competing hypotheses with different data set. Both How and Howe (2001) and Lee et al. (2003) investigate Australian unit IPOs and provide more support to the Signalling hypothesis than to the Agency Cost hypothesis. However, none of these papers can reject the Agency Cost hypothesis completely. So far, the studies on unit IPOs are inconclusive as which hypothesis should be the primary reason for the inclusion of warrants in unit IPOs.

The main objective of this survey is to review studies on the unit IPOs and theoretical background related to the three empirical chapters: initial underpricing (CHAPTER3), seasoned equity offerings (CHAPTER 4), and the long-term performance of unit IPOs (CHAPTER 5). The first two sections present the popularly researched Agency Cost hypothesis (section 2.2) and the Signalling hypothesis (section 2.3), which have been the centre of most recent debate about unit IPOs. Section 2.4 is arranged to review the subsequent academic studies and to epitomise the successive discussions around the two hypotheses' rivalry. The related literature on seasoned equity offerings (Section 2.5) and the long-term performance of IPOs (Section 2.6), provides the theoretical background for CHAPTER 4, and CHAPTER 5.

2.2 Staged financing and the Agency Cost hypothesis

2.2.1 Rationale of the Agency Cost hypothesis

Jensen (1986) contends that firms in their development stage will typically use some of the proceeds of their IPO to complete research on a product or to conduct test-marketing. If the initial investment is successful, the remaining funds can be used to begin production. If product development or test marketing fails, the remaining funds from the IPO constitute a free cash flow that management can squander on other negative net present value projects.

Motivated by Jensen's (1986) free-cash flow theory, Schultz (1993b) examines 797 US IPOs issued over the period of 1986-1988 and claimed that unit IPOs that combine shares and warrants together are a type of strategically staged financing arrangement. He started his argument with a commonly observed phenomenon that after raising capital from an IPO, if a negative investment outcome is demonstrated after using a portion of the IPO proceeds, managers are tempted to over-invest for the sake of their job security. If given sufficient capital up front, inefficient management will end up depleting money on unprofitable projects. Similar to the problem in venture capital-backed projects, Sahlman (1990) brought forth that 'an entrepreneur will almost never stop investing in a failing project as long as others are providing the capital'. Venture capitalists control such agency cost by providing the capital funding in a sequence of infusions; a unit IPO can also achieve such staged financing without the intervention of demanding venture capitalists. As a response to agency costs, Schultz (1993b) inserts that including warrants in an IPO provides a form of multistage financing imitating the sequential capital infusions in venture capital firms. A unit IPO usually proceeds relatively little funding at the initial offering: just enough for necessary development and test marketing for a new firm, but not enough for managers to squander away on negative NPV projects. A future equity infusion depends more explicitly and therefore more objectively, on the results from the limited initial investments. Schultz (1993b) also argues that unit offerings may be preferable to relying on venture capitalists, despite the fact that those specialists concerned with their own money are apt to provide efficient monitoring. However, they also charge a premium for providing financing and this premium may be sufficient for many IPO firms to prefer a unit public offering, which does not normally require an extra issuing cost to add warrants.

Schultz (1993b) explains that if the initial investment is successful, the profitability of the project will reflect in the stock price that it exceeds the warrant exercise price. The exercise of warrants will be triggered and the second round of financing occurs, meaning that this sequential funding can then be materialised to begin production. On the other hand, if the initial investment shows that the project is not viable with a negative NPV and the company is not able to profitably inject additional funds, the stock price of the firm fall below the warrant exercise price. Warrants will not be exercised and then the second round of financing will automatically vanish, as is in shareholders' (also warrant holders') best interest.

Schultz (1993b) also points out the staged equity financing through unit IPOs can also be accomplished by a share-only IPO shadowed with a seasoned equity offering (SEO) or a rights issue. However, a share-warrant unit IPO has the advantage of setting the warrant exercise price (as the offer price of the seasoned issue of shares) in advance (equal to or above the current stock price) comparing to SEOs issued after the initial public offerings. As a result, managers' motivation of investing the IPO proceeds is no longer to secure their jobs; instead, they are motivated to make optimal investment decisions so that excess cash will not be wasted in negative net present value projects. More importantly, by setting the price at which subsequent equities will be raised, managers are stimulated to convey sufficient information about the firm value to ensure warrants will be exercised post-IPO and the agency costs are more effectively mitigated than by relying on a costly secondary offering. In addition, many warrant agreements require a reduction in the exercise price and an increase in the number of shares purchased by a warrant if the firm sells additional shares at prices below the warrant exercise price. Therefore, warrant in unit IPOs can be structured to prevent firms from selling shares for a second round of equity financing without first determining the value of their projects. In general, warrant agreements of this type make it more difficult for management to sell large amounts of equity at prices below the warrant exercise price by effectively limiting the proportion of a firm's fully diluted equity that can be sold in a seasoned offer.

2.2.2 The testable predictions of the Agency Cost hypothesis

Schultz (1993b)'s Agency Cost hypothesis has a few testable implications that have been examined with his US IPOs data sample. These implications have inspired future researchers including myself to reassess the Agency Cost hypothesis with different dataset.

2.2.2.1 Ex ante uncertainty and the choice to issue unit IPO

Schultz (1993b) reasons that firms that have chosen unit IPOs have shorter operating histories and need the proceeds from the initial sale of shares to determine whether their potential investments are worthwhile. Such firms would be expected to have little sales or earnings and few assets or technologically sophisticated products prior to the offerings. In turn, their pre-IPO assets and income are a smaller proportion of IPO proceeds comparing to share-only offering firms. His test results confirmed that for each offer-size group, income and sales per asset are lower for unit offerings and the differences are statistically significant at the 1% level for offer-size categories of \$3- \$20 million. It will be difficult for investors, and even the management themselves, to evaluate and predict the project's future performance. In such state of high uncertainty about the future prospect, both issuing firms and market investors will benefit more from the staged financing arrangement provided through a unit IPO. Therefore, the Agency Cost hypothesis conjectures that firms with greater ex ante uncertainty about their value or the profitability of the investments are more likely to choose unit IPO.

Schultz (1993b) proposed to measure the ex ante uncertainty in several ways. The first indicator of ex ante uncertainty is firm age. Since by nature there is commonly more uncertainty about the future prospect of newly established businesses, the Agency Cost hypothesis predicts that firms choosing unit IPOs will be younger than firms choosing share-only offerings, measured by the number of calendar days between the incorporation of firms and the Admission date of their IPOs. Secondly, greater ex ante uncertainty could also depend on firm size. Within Schultz (1993b)'s US IPO sample, most firms that issue unit IPOs have not yet made principal investments in products or technologies and hence are small in size, measured both in market capital value and total assets. Unit firms are therefore expected to be smaller than share-only firms are. Last but not least measure of uncertainty is the post-IPO volatility of the firm's stock returns (Beatty 1989). Accordingly, the Agency Cost hypothesis anticipates that comparing to firms choosing share-only IPOs, unit IPO firms will have greater standard deviation of returns after the IPO.

2.2.2.2 Insider ownership and the choice of warrant exercise price

It is precedented and logical to expect that if managers have a smaller stake in the company's equities there will be less incentive for better performance since there is less impact on their personal wealth for making poor investments, and therefore higher agency cost is induced. Unit IPOs, having part of the funding arranged in the future through the conditional exercise of warrants, can provide limit proceed available to managers immediately after the initial offerings. Therefore, managers are motivated to make optimal investment decisions and invest in value-generating projects in order to materialise the second round of financing in form of warrants. Forasmuch the Agency Cost hypothesis predicts that firms with a lower level of managerial ownership have a greater agency problem and will be more likely to choose unit IPOs in order to alleviate such conflict. Because of the implicit incentive mechanism, a unit IPO can serve to minimise agency cost; Schultz (1993b) infers that warrant exercise price shall be set above the expected stock price to motivate managers to discover and invest in profitable projects and convey such information to the public to assure exercise of warrants.

2.2.2.3 Post-IPO survival rate and subsequent financing of unit IPO firms

Since a unit IPO's proceed (the first round of financing) is used to 'test the water', and determine the viability of the potential investment, it automatically encourages managers to focus on the profitability of the prospective projects and only invest in profitable projects with positive net present values. Schultz (1993b) pointed out that ironically many firms applying unit IPO will discover that there are not always positive net present value projects for them to invest in. If this is the case, the warrants will be left to expire and the second of financing is automatically aborted. Under such ‘all or nothing’ scenario, unit firms are more likely to go out of business and result in final delisting from the stock exchange. Therefore, fewer unit firms will survive comparing to share-only firms. Subsequently, the Agency Cost hypothesis also predicts that unit IPO firms have a lower survival rate after the offering.

Conjointly, the theory anticipates that survived unit firms are inclined to receive additional equity financing post-listing, because the value-revealing projects have established the attractiveness and profitability of their investments. After the exercise of warrants carrying through, further funding are likely to be demanded with the company’s growth. Therefore, Schultz (1993b) predicts that survivors among unit firms are more likely to issue seasoned equity offerings in the future as the third, fourth round of financing and so on.

2.2.2.4 The initial underpricing of unit IPOs

It has been commonly documented that on average initial public offerings are issued at a discount (Ibbotson, 1975; Ritter, 1984; Rock, 1986). Recent studies explained the reasons for the underpricing phenomenon based on asymmetric information about the true value of the issuing firms (Beatty and Ritter, 1986; Grinblatt and Hwang, 1989; and Welch, 1989). Commonly, they argue that information asymmetry is the main reason that firms are inclined to underprice their new shares to signal the true value of the firms to investors. These firms will expect to recoup the loss from underpricing by issuing future seasoned offerings at a higher price, when the popularity and market share of the company’s stocks have been established. Given their younger age and smaller size, unit IPO firms have greater uncertainty about their future performance, which will lead to greater underpricing (Beatty and Ritter 1986). The Agency Cost hypothesis anticipates that firms tend to issue unit offerings when the value of their projects cannot be easily accessed and evaluated. Such companies will encounter higher information asymmetry and therefore a higher degree of underpricing will be required to convince the investors to buy their shares. In short, another testable implication of the Agency Cost hypothesis proposed the possibility that unit IPOs will be more underpriced than share-only IPOs after controlling for other determinants of underpricing.

2.2.2.5 Underwriter reputation

Since there is more uncertainty about unit firms' future performance, it will be more challenging to sell shares from such companies. Prestigious underwriters tend to avoid marketing for unit firms in consideration of their own reputation in case the issue failed. Schultz (1993b) predicts that underwriters of unit IPOs are more likely to be less reputable than those who market for share-only IPOs. He also suggests that larger fees/compensation may be required from firms that choose to issue unit IPOs. Therefore, underwriters will require higher fees for the extra effort and to compensate for the extra risk they take on if they agree to underwrite such issues. Barry, Muscarella and Cetsuypens (1991) documented that a large number of warrants have been granted to the unit firms' underwriters and they most likely to take up a significant portion of the underwriting compensation. Schultz (1993b)'s result extended the argument and claims that underwriters are more likely to receive warrants with a unit IPO than firms that only issue shares in the offerings.

2.2.2.6 Industry effect and the choice of unit IPOs

Since it is more difficult to determine the potential profitability of investments in some industries than others, Schultz (1993) also expects differences in the frequency of unit offerings across industry groups. To examine such character, he obtained Standard Industry Classification Codes (SIC) from the Standard and Poor's Directory. He reports industries with most unit IPOs are business services, engineering, accounting, and management firms, health services and personal services; there are mild fraction of unit IPOs in industries such as mining, fishing and farming, transportation, construction and financial services; but surprisingly, only 2 out of 52 firms in the transportation industry chose unit offerings.

2.2.3 Limitations of the Agency Cost Hypothesis

A number of limitations of the Agency Cost hypothesis have been demonstrated by academics over the years. First, over-investing in negative NPV projects is a possibility that occurs in almost all companies across industries, yet only a minority of IPOs are unit offerings. If the main driving factor for choosing a unit offering is to minimize agency cost, such merit shall be valued by firms in general. Unit IPOs shall be favoured as an economical and effective financing instrument by most firms rather than only high-risk firms which are smaller in size and younger in age. Therefore, the fact that not most IPO firms choose a unit offering as their financing vehicle indicate that agency cost theory does not provide a complete explanation for including warrants in IPOs. Secondly, the sample Schultz (1993b) collected includes a significant proportion of mining firms, which indicate a higher propensity to use unit offerings. By virtue of risky nature, many mining IPOs apply a short-lived ‘exploration lease’ and the proceeds are used almost solely for geological assessment. But the result of the assessment and prospect of the investment could be revealed within a certain period of time: if the natural resources exist, warrants will be exercised and second round of financing will be brought forward; if the natural resource is not found, warrants will lapse without any further exploration. The third limitation of his study is that Schultz (1993b) paid relatively little attention to post-listing behaviour, in terms of survival rate and subsequent capital raisings. The Agency Cost hypothesis seems less reliable without validating the real value appreciation brought to the unit firms subsequent to the IPO by choosing a unit IPO rather than share-only IPO. The limitation of the Agency Cost hypothesis suggests that the application of unit IPOs cannot be solely explained with minimising agency cost alone.

2.3 Information asymmetry and the Signalling hypothesis

2.3.1 Information asymmetry and the rationale of the Signalling Theory

Information asymmetry is commonly referred to in economics and contract theory. Asymmetric information is present when one party to a transaction has more or better information than the other party. In financial markets, information asymmetry is much prominent. Especially in the case of initial public offerings, a unique situation of information asymmetry surrounding market value between sellers of a firm and its would-be buyers will occur endogenously and efforts are required to transfer information[1] between different market participants.

Leland and Pyle (1977) among brought forth a more systematic understanding of a financial market characterised with informational asymmetries. They portray the informational differences between 'borrowers' and 'lenders' in the financial market: borrowers tend to have more sufficient information of their collateral, industriousness, and moral rectitude than 'lenders'. Lenders would benefit from knowing the true quality of borrowers. However, moral hazard[2] arises when an individual or institution does not bear the full consequences of its actions, and therefore has a tendency to act less carefully than it otherwise would. Because of asymmetric information, borrowers in a transaction that has more information about its own actions and intentions than the lenders is insulated from risk and the other party might end up paying for the negative consequences of the risk. As a result, borrowers cannot be trusted to be completely honest about their true characteristics because of the substantial rewards for exaggerating positive qualities. In such dilemma, moral hazard obstructs the efficient communication between market participants. It is especially the case when verification of true value by third parties may be rather costly, sometimes even impossible. Nonetheless, Leland

[1] Signals have been generally classified as both financial information (e.g., cash flows, dividends) and non-financial information (e.g., advisers' reputation, board experience) (Lev and Zarowin, 1999; Reber, Berry and Toms, 2005).
[2] Moral hazard is the prospect that a party insulated from risk may behave differently from the way it would behave if it were fully exposed to the risk.

and Pyle (1977) contend that information on firm (or project) quality may be conveyed if 'actions' of firm insiders (or entrepreneurs) is in view to the public investors. One of the observable actions, which may serve as a signal to the lending market about the true quality of the firm, is the insiders' willingness to invest in their own firms or projects. Such willingness provides a signal of commitment and confidence and was captured by Leland and Pyle (1997) as proportion of shares retained by company insiders. The insiders' fractional holding of the firm's equity signals its expected future cash flows, i.e., higher levels of retained equity by insiders are argued to signal larger cash flow in the future and in turn higher level of firm value. This is simply because investors perceive that insiders would only be willing to hold relatively undiversified portfolios of their own shares in expectation of compensating future returns.

2.3.2 Costly signals in IPO process

Signal No. 1: Equity retained by insiders

Leland and Pyle (1977) initiated a simple signalling model in which entrepreneurs (borrowers) seek financing from shareholders (lenders) for their projects. They classified two types of firms in the mean of their future cash flows and conjecture that risk-averse insiders have private information about the mean of their own project's cash flows. On such horizon, insiders of a project with higher expected future cash flows are constrained to signal true value to the equity market only through retaining a larger fraction of their firm's shares than the poorer type firms. As expected, retaining their own share will inevitably sacrifice the value from selling them to the investors in the open market (also known as 'money left on the table'). Nevertheless, comparing the cost of retaining a larger fraction of the firm's own equity to that of purely risk-sharing considerations, the former is lower and therefore optimal for firms with higher future cash flows.

Such signalling rationale also explains the existence of financial intermediaries. Although transaction costs could explain intermediation, their magnitude is not sufficient to be the sole cause. Leland and Pyle (1977) propound that informational asymmetries may be a primary reason that intermediaries exist. They argue that information about certain classes of asset such as mortgages or insurance is not always publicly available but can be obtained with an expenditure of resources. Such information can be beneficial to potential shareholders (lenders) and they might expect certain organisations to exist to gather and sell such information. To overcome the problem of the appropriability of selling information for profit and to insure the credibility of the information being sold, the organisations are expected to become intermediaries who buy and hold assets based on its specialised information.[3]

The resulting equilibrium in Leland and Pyle's (1977) paper was highly distinguished from models, which ignore informational asymmetries. Although their proposition only held under very strict presumptions[4], it has been considered as a benchmark and more importantly as a starting point for further discussion of such signalling mechanisms, from where equity retention by firm insiders has emerged as one of the most popular determinant of firm value. Ritter (1984a) extended the analysis of retained equity and claimed that a positive relationship between percentage equity retention and firm value could also be explained by the agency and wealth effect arguments. The agency effect reasons that the firm insiders who have retained a certain fraction of their own firm's shares have greater incentives to control agency problems and thereafter lead to higher firm value. On the contrary, Ritter (1984a) also proposed the wealth effect argument in opposition to his agency effect stating that the higher the firm value, the less equity that firm insiders need to offer to the public investors in order to obtain the

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[3] The appropriability problem refers to the 'public good' aspect of information that purchasers of information may share or resell their information to others. The existence of intermediary solves such a problem because the firm's information is embodied in a private good- the returns from its portfolio without diminishing returns to the resellers.

[4] Leland and Pyle (1997) made the 'perfect competition' assumption that the project is small relative to the market as a whole; the entrepreneur perceives his decision with respect to the project to have a negligible effect on the returns and value of his share of the market portfolio.

capital they are trying to raise. In the overall attempt to separate the signalling effect from the agency effect, Ritter concluded that the positive relationship between equity retention and the value of the firm was optimally explained by the Agency Cost hypothesis.

Keasey and McGuinness (1992) rebut Ritter (1984a)'s proposition and dispute that the attempted separation of agency and signalling effects are flawed at both the conceptual and empirical levels. They pinpointed the assumption that firm insiders seek to raise a constant amount of capital, is notably dubious. Instead, they corrected wealth effect with an 'institutional effect' reasoning that firm size could be the determinant of the fraction of equity retained by insider. In particular, small firms may be inclined to issue more shares to create a larger market and to assure trading volume in the aftermarket. They also indicate that the basic argument of signalling theory is the firm insiders' motivation to signal private information concerning the potential of the firm, and the ability to control future agency problem should be inherited as part of the potential. Therefore, Ritter (1984a)'s attempt to separate effects that are in fact inter-penetrable is misleading. A number of other subsequent econometric models consistently proved the positive relationship between equity retention and firm value with high degrees of significance. However, Krinsky and Rotenberg (1989) using data for 115 Canadian IPOs for the period between 1971 and 1983 and surprisingly found the equity retention variable is overall insignificant across several regression equations. Nonetheless, the fractional retention of shares by insiders has been commonly used to signify favourable information about the firm value.

Signal No. 2: Level of underpricing

Investment banks, consider many factors when pricing an IPO, and attempt to reach an offering price that is low enough to stimulate interest in the stock, but high enough to raise an adequate amount of capital for the company. Historically, initial public offerings are very often underpriced to generate additional interest in the stock when it first becomes publicly traded.

This can lead to significant gains for investors who have been allocated shares of the IPO at the offering price. However, underpricing an IPO results in ‘money left on the table’ – lost capital that could have been raised for the company had the stock been offered at a higher price.

Grinblatt and Hwang (1989) apply a two-parameter signalling model as a generalisation of Leland and Pyle’s (1977) retained equity signalling argument. Besides the retained equities (Signal No. 1), insiders can also take advantage of a second signal--- the underpricing of the firm’s equity. Such signal is also considered as another costly separating equilibrium that good firms use to distinguish themselves from the bad firms. A firm’s intrinsic value is therefore positively related to the level its new issue is underpriced. Grinblatt and Hwang (1989) pinpoint that, in some cases, the insiders’ fractional holding of their own company’s shares is not sufficient to signal the true value of the project, for which they seek financing. Furthermore, the shares must be offered at price lower than the spot market price (i.e., at a discount) so that the uninformed investors could earn a zero risk-adjusted and ration-adjusted return. From a different angle, Grinblatt and Hwang (1989) focus on the familiar phenomenon of the underpricing of unseasoned new issues of common stock and demonstrate that rather than a disengagement from the efficient market hypothesis, the underpricing phenomenon is a consequence of the actions of rational agents to signal company’s true value. Grinblatt and Hwang (1989)’s paper is very appealing in the sense that their model proved several previous propositions about underpricing to be perfectly rational. Firstly, the model is consistent with the rationale of underpricing proposed by many investment professionals arguing that the investors’ interest created by a lower-priced initial offering is inclined to lead to higher-priced shares in the post-listing market. Secondly, their theory also provides support to Ibbotson (1975)’s disputation that new issues may be underpriced in order to ‘leave a good taste in investors’ mouths’. However, in Grinblatt and Hwang’s (1989) assumptions firms are allowed to invest in negative net present value projects. Such potential issuers are endogenously deterred from floating an unseasoned offering. Moreover, a seasoned offering soon after the initial public offering could reveal true firm value and might cause underpricing itself and thus weakens the signalling property of underpricing as an explanation for the use of unit IPOs.

Signal No. 3: Inclusion of warrants in initial public offerings

Apart from equity retained by insiders and underpricing, Ross (1977) was the first to propose the idea that including warrants in an IPO could also be used as a signalling mechanism in an environment of information asymmetry. Chemmanur and Fulghieri (1997) developed a more sophisticated theory of unit offerings in the context of a one–shot equity offering where a second, seasoned equity offering is no longer a necessary consideration to generate the use of underpricing as a signal in IPOs. In their study, all three signalling devices are incorporated into the IPO process, namely, equity retention by insiders, the underpricing of new shares and inclusion of warrants in initial public offerings. Spring from the previous investigation, they exploit a two-type model in which they identified type G firms to be firms with a higher expected future cash flow (Good firms) and type B firms to be those with a lower expected value of future cash flows (Bad firms). The two types of firms are allowed to differ in their riskiness as well as in the mean of their future cash flows. As a result, type G firms may have greater, equal, or lower riskiness comparing to type B firms.

They reason that in a full information setting, the application of unit offerings combining share issues with contingent warrants should not favour firms with any advantages comparing to share-only IPOs. However, in a simplified asymmetric information environment, Chemmanur and Fulghieri (1997) demonstrate insiders' concern about revealing their true firm value; prior to an IPO, the company's insiders know their own firm's type. Having private information about the quality and riskiness of their own company, they know the mean and variance of their company's future cash flows. However, even insiders are not certain which firm-value state will occur after the IPO. On the other hand, public investors do not have much information about the true value of the firms approaching the capital market for financing and therefore cannot discriminate 'good firms' from 'bad firms'. Based on publicly available information, investors will intuitively assess the underlying firms and form a broad belief. However, after observing insiders actions, investors might change their initial assessment accordingly. Consequently, it is in the best interest of insiders from good firms to take actions in order to distinguish themselves from the bad firms. Insiders from bad firms, on the other hand, are motivated to imitate the good firms with higher firm value and disguise themselves to appear to have the same quality; unless, of course such attempt is too costly for them. Accordingly, Type G firms (good firms) will structure their IPO with certain unique qualities in order to distinguish themselves. Any attempt by the Type B firms (bad firms) to mimic such qualities will impose a rather dear cost. Eventually, they cannot afford the camouflage and recede to sell their securities in the IPO at their true value. In their model, Chemmanur and Fulghieri (1997) define their equilibrium strategies as those that constitute a 'separating sequential equilibrium', in which the dissipative costs of separation incurred to distinguish Type G firms from Type B firms. All three signals, namely insider retention, underpricing, and inclusion of warrants are costly separating devices. It is down to the firm management as of which signal(s) to apply and the degree of combination if more than one device is employed.

2.3.3 The three-signal equilibrium

Chemmanur and Fulghieri (1997) began by allowing the firm to make the equilibrium choice between insider holding and underpricing as two costly signals, in terms of maximising wealth at the same time minimising signalling costs. Insiders from firms with higher future value are able to cut back on the fraction of retained equity and simultaneously underprice their shares to distinguish themselves from the firms with lower future value.

Subsequently, Chemmanur and Fulghieri (1997) introduced a third component into the equilibrium signalling mix, namely the issue of warrants in unit IPOs. Firm insiders may use any combination of the three signals to distinguish themselves. In this case, the good firm's concern is to select the optimal weight to maximise the expected utility. Both underpricing and issuing warrants as signalling devices impose dissipative costs on the firm. However, it is worthwhile to examine how issuing warrants differs from underpricing as a signalling device in the interest of seeing how the conclusion of warrants in IPOs allows good firms to signal true firm value more efficiently. As previously mentioned, giving away firm value to investors by underpricing together with the retained equity of insiders' own firms could potentially form an effective signalling mix that facilitate insiders from the good firms to distinguish themselves from the bad firm, whilst cutting back on the fraction they retain within the firm. In contrast, warrants offer a way only to impose these expenses selectively, in the higher realisations of the firm's future value. Such quality easily makes sense for risk-averse insiders to dissipate value selectively in only the higher states of the company, comparing to scantily selling underpriced equity at the cost of losing company value. This ability shall also become more attractive to insiders when their assessment of the firm riskiness is very high, since the warrants attached along with the equity in the IPO allow good firms with high risk to satisfy the incentive compatibility more efficiently. As a result, this option-like claim embedded into the IPO helps to minimise the extravagant costs associated with asymmetric information, leaving the firm's insiders better off in the situations where the firm's cash flow stream is highly risky. In conclusion, the fraction of retained shares by insiders, the degree of underpricing, and the inclusion of warrants are all costly signals that companies apply to reveal the true value of the firms. Chemmanur and Fulghieri (1997) demonstrate the conditions of a separating equilibrium in which risk-averse insiders of good firms choose a balanced combination of insider holdings, the degree of underpricing and the number of warrants (if any) that will maximise their utility.

2.3.4 The testable predictions of the Signalling hypothesis

After proposing the Signalling hypothesis to explain the inclusion of warrants in IPOs, Chemmanur and Fulghieri (1997) also promote their theory with a range of testable predictions, some of which are empirically supported by existing literature, while some others contribute a new outlook in contrast to the previous research.

First of all, they predict that within a indistinguishable pool of firms prior to the IPO, the subset of firms that employ unit IPOs will be riskier with a higher variability of future cash flows compared to firms that issue shares alone in an IPO. In other words, unit firms are usually riskier than share-only IPO firms are. Significant empirical support for this prediction is also sustained by Schultz (1993b) in his Agency Cost explanation.

Secondly, since signalling mechanism is only meaningful in the context of information asymmetry, which is customarily measured by residual stand deviation; Chemmanur and Fulghieri (1997) predict that firms that choose a unit IPO will exhibit higher level of information asymmetry than will share-only IPO firms will.

Thirdly, the Signalling hypothesis does not anticipate higher underpricing for unit IPOs comparing to their share-only counter-parts. Instead, they predict that the underpricing of an IPO (either unit or share-only) increases with firm riskiness. Chemmanur and Fulghieri (1997) further demonstrate that Issuers can trade off the signalling costs of greater underpricing with the costs of other signals such as insiders holding and including warrants.

The fourth prediction is that the exercise price of the warrants is likely to be set equal to the expected stock price; different from the Agency Cost hypothesis that the exercise price of warrants are tend to be set above the expected share price.

A fifth prediction of the signalling framework demonstrates that in an unit IPO holding the proportion of firm value sold as warrants constant, the fraction of equity retained by firm insiders will decrease in firm riskiness. Chemmanur and Fulghieri also indicate in a share-only IPO, there is also a negative relationship between fraction of equity retained by insiders and the firm riskiness.

Another prediction is that in a unit IPO, holding the fraction of equity retained constant, the proportion of firm value sold as warrants will increase with firm riskiness. The firm value sold as warrants is defined as the ratio of number of warrants attached in unit IPOs, to the total number of shares in the firm's enlarged capital following the IPO.

Last but not least, the Signalling model confirms the commonly observed fact that unit IPO firms are apt to use less prestigious underwriters. Chemmanur (1993) develop a model of reputation acquisition by investment banks, who act as information producing intermediaries in an equity market characterised by asymmetric information. Such model illustrates that more reputable investment banks tend to set stricter standards in terms of the kind of firms for which they will underwrite an equity issue. Therefore, it is intrinsically more risky firms that choose unit IPOs and such unit offerings are marketed by less established underwriters.

2.4 The rivalry and interaction of the two competing hypotheses

The Agency Cost hypothesis of Schultz (1993b) and the Signalling hypothesis of Chemmanur and Fulghieri (1997) are competing propositions but not mutually exclusive. Some predictions from the Signalling hypothesis cannot be distinguished and cut off from those of the Agency hypothesis. Firstly, both models indicate that in an equity market characterised by informational asymmetry, insiders have private information about their own companies that the potential public investors do not know. Secondly, Chemmanur and Fulghieri (1997)'s prediction that unit IPO firms will be riskier with greater variability of future cash flows comparing to share-only IPO firms. Such prediction is consistent with Schultz (1993b)'s argument that unit IPO firms have a lower survival rate post-listing and unit IPOs are associated with smaller firms which tend to be concentrated in speculative industries with shorter operating histories, lower value of sales and less assets. Thirdly, both academic groups mentioned that unit IPOs tend to be marketed by less reputable underwriters. This was sustained by both theoretical and empirical literature on investment bank prestige, that more prestigious underwriters are more willing to underwrite the IPOs for less risky firms. Accordingly, both the Agency Cost hypothesis and Signalling hypothesis predict that unit IPOs are commonly underwritten by less reputable underwriters. Last but not least, both theories specify that high-risk firms prefer to package their equity offering with warrants and the package as a whole tends to be underpriced. Furthermore, both hypotheses maintain that the percentage of underpricing increase in firm riskiness.

However, there are also several important divarications between the two hypotheses. Firstly, unlike Schultz (1993b), Chemmanur and Fulghieri (1997) do not expect the underpricing phenomenon to differ significantly between unit IPOs and share-only IPOs. The Agency Cost hypothesis implies that unit IPOs tend to be more underpriced than share-only IPOs. On the other hand, the Signalling hypothesis argues that both unit and share-only IPOs are underpriced. High-risk firms choose to combine their equity with warrants and the unit as a whole is underpriced; correspondingly, lower risk IPO firms prefer to issue underpriced equity alone. Secondly, as a unique contribution from Chemmanur and Fulghieri (1997)'s research, their model predicts that the proportion of firm value sold as warrants by unit IPOs increases with firm riskiness after controlling for the extent of ownership retained by insiders. Similarly, holding constant the proportion of firm value sold as warrants, the fraction of equity retained of insiders decreases firm riskiness. They also imply a negative relationship between the fraction of retained equity and the firm riskiness for IPOs without warrants. The Agency Cost hypothesis makes no such predictions.

Several academics, inspired by both of the two competing hypotheses, have been debating which one should be the primary explanation for including warrants in an IPO. Using data from different regions and different periods, those following researchers showed support for some of the applications and found evidence against others.

2.4.1 Evidence from Australia

2.4.1.1 Test one

How and Howe (2001) attempted to distinguish between the Agency Cost hypothesis and the Signalling hypothesis for the use of unit IPOs. In the hope of testing the robustness of the two existing theories of unit IPOs with the unique environmental setting, a large data sample of 396 Australian IPOs issued between 1979 and 1990 is examined. In the sample, 134 issues (34%) are unit offerings and 262 (66%) are share-only IPOs, which suggest that unit offerings are more common in Australia than in the United States. On one hand, How and Howe (2001) provide some evidence that is consistent with the Agency Cost hypothesis. Their analysis was stressed firstly to reveal firm characteristics for unit firms in comparison to share-only IPO firms. The descriptive statistics indicate that unit IPO firms are significantly younger, smaller, and riskier than share-only IPO firms are. The average percentage of ownership retained by issuers is about 13.5% higher for share-only IPO firms than for unit firms; and therefore with lower levels of insider ownership, unit firms tend to have greater agency costs. Those findings are consistent with both the Agency Cost hypothesis and the Signalling hypothesis. The proportion of the unit IPO firms sold as warrants is found to be positively related to the firm riskiness, which provides strong support to the Signalling hypothesis.

On the other hand, How and Howe (2001) attained evidence that is contrary to the Agency Cost hypothesis. Firstly, contrary to Schultz (1993)'s prediction that unit IPO firms are associated with less prestigious underwriters, How and Howe (2001) argue that Australian unit IPOs' underwriters have reputations that are at least as good as those who market for share-only IPOs. Secondly, contradicting the Agency Cost hypothesis that unit firms are more likely to fail after IPO comparing to share-only firms, How and Howe (2001) find more Australian unit firms survived than share-only firms. Thirdly, three different efficiency ratios are defined and calculated as measures of agency costs: operating revenue divided by total assets, EBIT standardised by total assets and operating profit after tax as percentage of total assets. However, in no case is there a significant difference in efficiency ratios between unit and share-only IPO firms, which fail to support the Agency Cost hypothesis. Fourthly, the result for choice of exercise price indicates that most unit IPOs set their exercise price near or equal to the offer price of the new shares, which is contrary to the prediction of the Agency Cost hypothesis, that unit IPO firms tend to be more underpriced. Finally, How and Howe (2001) examine the size of the offers across samples of unit IPOs and samples of share-only IPOs. They conclude that the proceeds from the IPOs are not significantly different across the two samples, which contradict the Agency Cost prediction that unit IPOs tend to raise smaller proceeds than share-only IPOs.

Towards the Signalling hypothesis, How and Howe (2001) find more supporting evidence. Firstly, using a regression, they proved that the proportion of the firm value sold as warrants increases with firm riskiness after controlling for the fractional equity retained by insiders. Secondly, a direct test is conducted to examine the level of information asymmetry. Following Krishnaswami et al. (1999), the levels of information asymmetry are measured as the residual standard deviations and unit IPO firms exhibit higher level of information asymmetry as predicted by the Signalling hypothesis. The differences are significant at the 5% level for both parametric and nonparametric tests. Finally, industry and time-period effects are examined as well, and evidence was found for both effects: the residual standard deviation is higher for unit IPO firms comparing to share-only IPO firms for the ‘other industry’ category. The earliest time period (1979-1984) is not characterised by differences in information asymmetry across the two samples but in the later period (1985-1990), comparing to share-only IPO firms, unit IPO firms do exhibit significantly higher level of information asymmetry measured as the residual standard deviation; which is consistent to the Signalling hypothesis’ prediction.

How and Howe (2001) made their own unique contributions to the unit IPO literature by introducing debt leverage and the level of informed demand. Sample IPO firms’ debt to total tangible asset ratios prior to listing are calculated to demonstrate the company’s leverage; and unit firms present significantly lower leverage than share-only firms, which is not predicted by either existing hypothesis. Such lower level of debt might echo the fact that it is harder for unit firms to resort to debt financing for creditability issues. And the lower debt leverage in turn suggests that unit firms are subject to less monitoring by banks and other creditors that usually occur to firms with high level of debt financing, and therefore, reflect on higher vulnerability towards agency cost. An alternative measure of leverage is calculated as total debt as the percentage of market value of equity and such indicator also supports the conclusion. The numbers of calendar days between the registration of prospectus and listing are calculated to proxy for level of informed demand. Subsequently they use such proxy as a control variable in the analysis of underpricing but no significant relation is found between the level of informed demand and the level of underpricing for unit IPOs.

Finally, a logistic regression is conducted on the probability for a firm to choose a unit IPO in relations to the firm specific characteristics. Several variables are regressed against the dummy variable of offer type, which takes the value of 1 if firms issue unit IPOs. The results reveal that smaller, younger, and riskier firms and firms with lower level of insider holdings are more likely to issue unit IPOs. These findings support both the Agency Cost and Signalling hypothesis. In addition, evidence is found that mining firms are more likely to issue unit IPOs. However, unit firms are not necessarily associated with prestigious underwriters or reputable auditors; and the decision to choose a unit IPO is not affected by the sample period.

In conclusion, while predictions common to both Agency Cost hypothesis and Signalling hypothesis are justified and confirmed by the Australian data, there is very little unique support for the Agency Cost explanation, but some support for predictions unique to the Signalling explanation. However, judging from their tests and support given to both explanations, the extent of How and Howe (2001)'s argument and conclusion is rather nonaligned between the two competing hypotheses reflecting a fair 'horse race'. Such limitations are caused by their less strict design of some test variables and measurements, and the absence of other tests such as survival rate, subsequent financing, and the long-term price performance of unit firms, which are covered in my thesis.

2.4.1.2 Test two

Also with Australian industrial firms over a wider horizon[5], Lee, Lee, and Taylor (2003) made further attempts to examine the competing Agency Cost hypothesis and Signalling hypothesis and endeavour to enforce understanding of the use of unit IPOs. They investigate a larger sample of 394 IPOs made between 1976 and 1994, in which 66 firms (17%) are unit IPOs.

Lee, Lee and Taylor (2003) start with more strictly examining the original Agency Cost hypothesis of Schultz's (1993b), and re-stressed the limitations of the hypothesis and the over-strict assumptions, which weaken the argument. They argue that as the result of agency problem, over-investment in negative NPV projects is common for almost all IPOs, and yet

[5] Lee, Lee, and Taylor (2003) investigate a sample of 394 IPOs made between 1976 and 1994, in which 66 firms (17%) are unit IPOs.

only a minority of which are unit offerings. The fact that unit offerings are not entirely the most popular choice of financing vehicle for most IPO firms also suggests that the Agency Cost hypothesis cannot provide profound explanation as to why companies choose to include warrants in their IPOs. Further to How and Howe (2001)'s illustration of distinguishable features between Australian unit offerings and US unit offerings in term of warrant contract characteristics, Lee, Lee and Taylor (2003) listed more differences mostly in market setting and the IPOs themselves: Firstly, Australian unit IPOs are typically smaller and younger than in the US. Secondly, there is no organised venture capital market in Australia, leaving Australian IPO firms to face a relatively straightforward choice of financing vehicles. Thirdly, the design of the warrant component of Australian unit offerings is more restricted by legislative considerations. They illustrate that Australian unit IPOs typically contain one warrant for every two shares with the maximum life of 2.7 years on average, which is in general more limited than warrants used in the US unit IPOs. In addition, different from US unit IPO warrants setting exercise price at a premium to the offering price; Australian IPO warrants mostly have the same exercise price as the initial selling price of the IPO shares. Such difference explains the fact that the expected proceeds from warrant conversion relative to the initial offering proceeds in Australia is lower than US unit offerings reported by Schultz (1993b). Finally, the use of the 'B warrant', which confer additional warrants when exercised, is also reported to be relatively rare for Australian unit IPOs comparing to US unit offerings.

On one hand, Lee, Lee, and Taylor (2003) validate the firm characteristics of unit IPOs which were justified in both hypotheses and with which the signalling explanation simply cannot be clearly distinguished from those of Schultz's (1993b) Agency Cost theory. They confirm that under both hypotheses unit firms are customarily younger, riskier and smaller, with higher levels of information asymmetry between insiders and potential investors, with insiders of unit IPO firms retaining a smaller fraction of firm's own equity. Evidence is provided that unit offerings also have a significantly higher variation in the post-listing stock returns, lower assets, income, and sales relative to issue proceeds; which is also consistent with these firms being riskier than share-only IPOs.

On the other hand, Lee, Lee and Taylor (2003) highlighted several major conflicting results from testing of the competing theories. Firstly, they point out that Schultz (1993b) expects unit IPO firms have higher level of underpricing, whilst Chemmanur and Fulghieri (1997) find no significant difference in underpricing between unit and share-only IPO firms. Instead, the signalling model predicts that the percentage of underpricing is increasing with firm riskiness in both unit and share-only IPOs. Lee, Lee and Taylor (2003) reported a measure of the elapsed time between registration of the IPO prospectus and the commencement of trading. They argue that variation in this measure should proxy for fluctuations in the level of informed demand, and show that it is positively associated with the level of underpricing. Opposite to Schultz (1993b)'s prediction, the results indicate marginally less (rather than more) underpricing for unit IPOs. Such results instead shed light on the signalling explanation that riskier firms intentionally trade off cost of underpricing to incorporate a third signal, namely inclusion of warrants in an IPO. Secondly, Schultz (1993b) claims that unit IPO firms are found to have higher failure rate than share-only firms and unit firms that did survive are more likely to receive a subsequent issue after the initial offering. Lee, Lee, and Taylor (2003) find no evidence that Australian unit IPOs have a higher failure rate, or that they are more frequently subject to takeover than share-only IPO firms. Again, they find no evidence of a systematic relation between choice of offer type and subsequent equity issuance, which fails to support the agency cost explanation. However, evidence was found that there is a significant positive relation between initial underpricing and the SEO issuance, which is in support of a signalling role for IPO underpricing. Finally, as a unique proposition, the signalling model anticipates that after controlling for the extent of retained insider ownership of company shares, the proportion of firm value sold as warrants by unit IPO firms shall increase in the firm riskiness. Lee, Lee, and Taylor (2003) confirmed such prediction.

Testing both the competing hypotheses with Australian data, Lee, Lee and Taylor (2003) stressed the limitations on the extent to which How and Howe's (2001) conclusions managed to separate the competing explanations in terms of sample composition (1979-1990; 134 unit IPOs and 262 share-only IPOs, 34%), the design of some tests and the absence of other tests. They point out firstly, there are a large proportion of mining firms included in How and Howe's (2001) sample (60 out of 130 firms are mining firms, 46%), which demonstrate a significant higher propensity to use unit offerings, given the nature of mining industry.[6] To make up for such demerit, Lee, Lee and Taylor generalised the industry clustering to a wider range of industry using the 23 two-digit Australian Stock Exchange (ASX) industry codes and provide evidence on the relationship between choice of IPO type and industry that unit offerings are not uniformly spread across industry groups. Surprisingly, there are a large number of IPOs in the investment and financial services group, and 'the proportion of IPOs using unit offerings is two and half times the expected figure'. Secondly, How and Howe (2001) neglect one of Schultz's predications that there are significant differences in the proposed uses of IPO proceeds between unit firms and share-only firms, and also fail to discuss the post-listing behaviour in depth. Instead, Lee, Lee, and Taylor (2003) form five categories based on prospectus disclosures: working capital, debt repayment, capital expenditure, payments to vendor shareholders and 'other' to test the Agency Cost hypothesis. Therefore, it is expected that unit IPO firms should allocate a significantly larger proportion of IPO proceeds to planned capital expenditure. However, the results indicate otherwise: for unit IPOs, the 'catch-all' category ('other') is significantly higher than for share-only IPOs, implying that unit IPOs are less specific about the planned use of IPO proceeds. In such case, no support is found for the agency cost explanation

[6]'Many of the mining IPOs own a short-lived exploration lease and the proceeds are used almost solely for geological assessment. As this is a fairly transparent process, i.e. either a commercial resource is identified or it is not, the source of agency costs is unclear.' Lee, Lee and Taylor (2003)

for the use of warrants. Thirdly, How and Howe (2001) overlook Schultz (1993b)'s proposition about the cost of going public; that unit IPOs tend to incur relatively higher underwriter fees, as well as greater underpricing because of higher uncertainty about the future investment outcomes. Lee, Lee, and Taylor (2003) calculate the underwriter fees, brokerage fees, commission fees, management fees, and other expenses and find no significant differences between unit IPOs and share-only IPOs in terms of direct costs or other expenses incurred as part of IPO process. They also reported market-adjusted underpricing, which can be thought of an indirect costs to issuers and in contrast to Schultz's prediction, no evidence was found that unit offerings are more underpriced than share-only offerings. Furthermore, when direct and indirect costs of going public are combined, the net result is that the total costs do not differ significantly across the unit and share-only IPO samples. Last but not least, How and Howe (2001) used underwriting frequency as a measure of underwriter reputation, which is considered inaccurate. Lee, Lee, and Taylor (2003) rely on a binary rating system as the underwriter classifications designed to capture the extent to which an underwriter will be viewed as prestigious.

To sum up, Lee, Lee and Taylor (2003) tested the two competing hypotheses typically used to explain the choice between a unit IPO and a share-only IPO. They claim no difference is found in underpricing between unit IPOs and share-only IPOs, which is not in line with the Agency Cost hypothesis, but agree with the Signalling hypothesis. They are also unable to find evidence supportive of Schultz's post-listing behaviour proposition and seasoned equity offerings as well as the planned use of the IPO proceeds. Above all, they provide the exclusive feature that distinguishes the Signalling hypothesis by confirming the positive relation between the fraction of the firm sold as warrants and the firm riskiness after controlling for the level of insider ownership. As a result, Lee, Lee, and Taylor (2003) conclude that the use of unit IPOs with warrants attached reflects their role as a signalling mechanism raised by Chemmanur and Fulghieri (1997) rather than an attempt to minimise agency costs as proposed Schultz (1993b).

2.4.2 Evidence from Hong Kong

Aiming to enhance the understanding of why firms include warrants as a bundle in their IPOs, Mazouz, Saadouni and Yin (2007 a) examine the robustness of the agency cost and signalling explanations of unit offerings with a unique dataset of listed Hong Kong IPO firms between the year 1990 and 1997.

Using a sample of 130 (35%) unit IPO firms and 242 (65%) share-only IPO firms, they reviewed the competing Agency Cost hypothesis and the Signalling hypothesis from their own standpoint and come to three central conclusions. Firstly, they find that unit IPO firms have higher profitability and better asset utilization rates than share-only IPO firms in the sample. This finding contradicts the prediction from the Agency Cost hypothesis that warrants are applied by firms with greater agency problem to reduce agency cost. Secondly, they demonstrate that the proportion of firm value sold as warrants increase in the firm’s riskiness, after controlling for the level of retained equity by insiders. Such proposition has been proved by both How and Howe (2001) and Lee et al. (2003), and once again evidence is provided by data from Hong Kong in support of the Signalling hypothesis. Finally, the study employs a self-selection regression methodology to test whether firms include warrants in their IPOs to reduce underpricing comparing to what it would have been in the absence of warrants.

Considering Hong Kong’s regional environment setting in terms of stock exchange listing requirement and taxes, the characteristics of the warrants included in Hong Kong IPOs are apt to have their unique features. This study compares the main warrants characteristics in Hong Kong, the US and Australia. Descriptive statistics of warrant design are illustrated compared, such as shares per warrant, warrant exercise price, proceeds from the exercise of warrants, and years to expiration. Firstly, unlike the US and Australian unit IPOs which usually contain one warrant for every two shares, the unit IPOs issued in Hong Kong customarily contain one warrant for every five shares issued. Secondly, the exercise price of warrants of unit IPOs is set above the offer price of the IPO shares by up to 39% in Hong Kong. In comparison, US IPO warrants are issued at a premium of up to 25% above the offer price (Schultz, 1993b); whereas the exercise price of Australian warrants are set to be the same as the IPO offer price (How and Howe, 2001). Thirdly, the average expected proceeds from the exercise of warrants relative to the IPO proceeds in Hong Kong is nearly 89% when an average of 75% is reported for the US study and an average of 58% is recorded for Australian unit IPOs. Finally, the average life of Australian IPO warrants is reported to be 2.7 years (Lee, Lee and Taylor, 2003) and 4.1 years for US IPO warrants (Garner and Marshall, 2005). This study recorded the life of Hong Kong IPO warrants ranges from 1.25 years to 5 years with an average life of 2.69 years, which is similar to Australian warrants but much shorter than the US warrants.

2.5 Related literature from seasoned equity offerings (SEOs)

CHAPTER 4 of this thesis investigate the subsequent financing of unit firms via their first seasoned equity offerings (SEOs) within five years of their unit IPOs. Therefore, related literature on SEO issuance is selectively reviewed.

Existing literatures that investigate into the firm's decision to raise additional funds through seasoned equity issues is based on a fundamental theory brought forth by Myers and Majluf (1984) that there is asymmetric information between the managers and public investors about the potential investment opportunities and market value of the firm. Such asymmetric information creates a pooling equilibrium between good firms with promising investment opportunities and those firms that do not. The managers of firms that do not have good investment opportunities will only approve a seasoned offering if they believe, based on their superior information, the firm is currently overvalued. Issuing additional shares of a currently overvalued firm could create a wealth transfer from new shareholders to existing shareholders. This of course, is based on the assumption that manager decisions are made in the existing shareholders' best interest; that they will gain if additional stock is sold when it is overvalued and lose if additional stock is sold when it is undervalued, according to managers' superior information. Therefore, rational new investors are inclined to put a downward revision on the firm's equity value every time the managers announce an SEO and stock prices are expected to drop immediately after the SEO. Not surprisingly, empirical studies of the publicly traded firms' decision to conduct a SEO mainly focus on empirical evidence of a negative market reaction on SEO announcements and SEO issues. Most of these studies conclude that the drop on the stock price at the SEO announcement and SEO issue date is a result of new investors making a downward revision on their valuation of the firms since they view the SEO announcements as a signal that the managers believe the firm is currently over-valued.

Several empirical studies examine whether managers time a window of opportunity to issue additional shares when the firm is overvalued. Korajczyk et al. (1991) unearthed that IPO firms tend to conduct an SEO immediately after a favourable earnings announcement. They claim that an earnings disclosure dilutes the asymmetric information between managers and external investors. Spiess and Affleck-Graves (1995) stressed the managers' market-timing ability through analysing the abnormal returns in the early aftermarket. They document that following the first two months after the announcement of SEO, the performance of seasoned offering firms is strongly negative. The findings of these studies support the argument that managers announce seasoned equity offerings when the firm's stock is overvalued, but the market does not reassess the stock appropriately and the stock is still overvalued when it is issued, implying that managers behave opportunistically by exploiting market misevaluation and investors are slow to react due to information asymmetry.

Harjoto and Garen (2003) examine the reason why the IPO firms decide to conduct a primary seasoned equity offering (SEO), with a sample of 481 US IPOs issued during 1992 to 1997, in which 42% of the IPO firms issued a SEO within the four years following their IPO. They assume that the initial owners try to maximise the value of IPO proceeds and determine on the optimal shares of insider and public shareholders based on anticipated growth of the firm at the IPO stage. Nevertheless, the initial owners may decide to raise further funding when there are unexpected growth opportunities post-listing. Using a two two-period model, the authors investigate the factors that affect an IPO firm's decision to issue seasonal equities due to the shock that was not predicted by the managers at the time of listing and the size of a SEO during the four years after the IPO. In the two-period context, their model indicates that the large shareholder of an IPO firm has incentive to issue an SEO when the firm is experiencing an unanticipated positive shock post-IPO. They measure the IPO firm's unanticipated growth in two ways: an accounting measure, which is annual growth in net income; and a market measure, which the excess stock return-drift in a year. Those indicators are found to increase the firm's likelihood of conducting a seasoned equity offering and increase the relative size of an SEO. The authors also provide some evidence that the firm's ex-ante uncertainty negatively affects the firm's decision to issue additional shares post-IPO.

Asquith and Mulins, Jr. (1986) examine the effect of 531 seasoned equity offerings on stock prices and find evidence that the announcement of seasoned offerings reduces stock price significantly. For industrial issues, regression results suggest that the announcement-day price reduction is significantly related to the size of the equity offering. The results also indicate that primary stock issues are more likely to occur after a run-up in stock prices. Regression results show that the announcement-day price reduction is negatively related to the stock price performance in the year prior to the announcement day, which explained why firms tend to issue equity after a rise in their share price. After exploring the timing of seasoned equity sales, they found positive average cumulative excess returns in the two years preceding the announcement of the issue, and the average cumulative excess returns in the two years following the equity issue are at first slightly positive then negative. Therefore, Asquith and Mulins, Jr. (1986) argue that firms sell stock following a period in which the stock outperforms the market. However, they point out the decision to issue equity is more related to the performance of the firm's stock price relative to the market, than to the performance of the market as a whole. Evidence is found that the market returns are positive in the two years preceding the announcement of issue. Despite the fact that equity is sold following an increase in the general level of index returns, the results reveal no ability by sellers to time the market. The general index returns continues to rise in the two years following the equity issue. In conclusion, the authors concur that although announcement of common equity offerings are proven to reduce stock prices, implying a timing pattern for market-adjusted stock price performance, but no evidence of an ability to time the general level of stock market is apparent in the data. So far, only Schultz (1993b) proposed that survived unit firms are more likely to receive additional funding than share-only firms. However, no existing research has discussed in depth about the factors that affect unit firms' decision to conduct SEO or the announcement effect of SEOs, both of which are covered in the present thesis.

Byoun and More (2003) investigate the inclusion of warrants in seasoned unit offerings issued between 1980 and 1997 in the US. In examination of the Signalling hypothesis, they calculate the degree of underpricing as the percentage difference between the last trade price on the offering date and the offer price. Their results indicate that the average underpricing is 1.74% with 54% positive for unit offerings and 1.08% with 59% positive for share-only offerings. The two estimates are not significantly different; therefore, no substantial support concerning underpricing has been observed in the seasoned equity offerings. As a major implication from the Agency Cost hypothesis, the incremental abnormal returns from unit offerings relative to the forecast abnormal returns under share-only offerings are calculated and compared. In line with the Agency Cost hypothesis, Byoun and More (2003) provide evidence that firms with lower insider ownership experience a higher announcement period abnormal return by issuing units rather than shares alone. However, it is worth mentioning that in this thesis, all the unit sample firms are IPO firms that included warrants at the time of listing, not SEO firms. Nonetheless, this academic paper has been reviewed for reference. So far, only Schultz (1993b) proposed that survived unit firms are more likely to receive additional funding that share-only IPO firms. However, no existing research has discussed in depth about the factors that affect unit firm insiders' decision to conduct SEOs, which are tested with UK data in this thesis in CHPATER 4. The pricing of SEOs following unit IPOs is not covered in the present study but it might lead to future research interest.

2.6 International insight on the IPO long-term performance

CHAPTER 5 examines the competing Agency Cost and the Signalling hypotheses with a long-term price performance approach. Since there is only one paper studying the long-term performance of unit IPOs by the time of this research, selected papers on the long-term performance of share-only IPOs are reviewed for reference. The literature on the long-term performance of unit IPOs in Hong Kong and UK IPOs is reviewed in CHAPTER 5. This section focuses on the international insight of IPO long-term performance from other markets.

2.6.1 The long-term performance of IPOs from different countries

Ritter (1991) examined the performance of 1526 US IPOs issued between 1975 and 1984 and reported that for a 3-year holding period, IPOs substantially underperformed a control sample of comparable seasoned firms matched by size and industry. Both the 3-year buy-and-hold returns and the cumulative returns confirm that IPOs indeed underperform the matching portfolio. To interpret the 3-year BHAR, wealth relatives are calculated as another performance measure, which are less than one on average indicating significant underperformance. In conclusion, Ritter (1991) provide evidence that US IPOs exhibit bad medium- to long-term performance. Substantial variation are found in the underperformance year-to-year and across industries, with companies that went public in high-volume ‘hot issue’ years performing the worst. The patterns portray an IPO market in which investors are periodically overoptimistic about the earning potential of young growth firms, and where firms time their offerings of shares to take advantage of these ‘windows of opportunity’ .

Brav and Gompers (1997) present findings of US IPO long-run performance from a sample of 934 venture-backed IPOs from 1972-1992 and 3407 non-venture capital-backed IPOs from 1975-1992. Firstly, they test whether venture capitalists, especially who pursue investment in promising young companies and bringing them public, affect the performance of newly public firms in the long term. Their results suggest that when returns are weighted equally, venture-backed companies enjoy better long-run performance comparing to non-venture-backed IPO firms over a five-year holding period. Furthermore, Brav and Gompers (1997) reveal that underperformance is *not* exclusively an IPO effect. When IPO firms are matched by size and book-to-market reference portfolios, the underperformance disappeared. As a result, they claim that underperformance is a characteristic of small, low book-to-market firms regardless of whether they are IPO firms or not.

Although most IPO performance papers have been studying US data (e.g. Ritter, 1991; Loughran and Ritter, 1995; and Gompers and Lerner, 2003; etc), there is a growing empirical literature for countries outside the US. Data from non-US markets is not conclusive because of the shorter time period employed and the cross-sectional correlation between returns of US IPOs and the return of IPOs in other markets. These correlations are potentially driven by common economic shocks and common movements in fads and sentiment. Nonetheless, non-US IPO studies are also important for adding to the growing body of international insight on the long run performance of IPOs. Loughran and Ritter (1994) summarise international evidence on the short-term and long-term performance of companies going public in many countries, in attempt to explain some of the inter-country patterns that have been observed. On examining the timing and long-term performance of IPOs, returns on IPOs during the three years after going public are equally weighted in their respective samples across 15 countries. Significant long-run underperformance is found with riskier firms performing worse in the long-term and when the market is at a higher level (‘hot period’). In addition, Loughran and Ritter (1994) find in 14 out of 15 countries investigated, the IPO activity level is positively related to the inflation-adjusted level of the stock market. A clear tendency is unearthed for high volume years to be associated with worse long term performance. The returns on IPOs during the three years after going public are calculated for a number of countries; Brazil, Finland, Germany, Singapore, the UK, and the US all have negative adjusted returns in the aftermarket despite some of them having positive raw returns before adjusting for market returns. Such findings are interpreted as evidence that private firms around the world take advantage of ‘windows of opportunities’ to intentionally time their offerings for periods when market valuations are high, with investors receiving low returns in the long run. In other words, if companies are successfully timing their offerings for periods when the cost of equity capital is relatively low, this should manifest itself in low returns subsequently being earned by investors.

The IPO market in Germany only started growing since the mid-1980s comparing to more mature markets like the US and UK. Although the number of IPOs in Germany is still significantly lower than the Anglo-American countries, there has been a tremendous booming of IPO activities within the last decade, making German IPO market a merging object in the IPO literature. Ljungqvist (1993, 1994, and 1997) analyses the long-run performance of German IPOs. In his first two papers, he concludes that German IPOs underperform the broad stock market indexes significantly. However, in his third paper, Ljungqvist revised his finding of underperformance by taking into account different IPO cohorts by year of listing: a neutral performance of IPOs that went public during the years 1970-1987; but underperformance by 27.2% for 1988-1990 cohorts. Ehrhardt (1997) claims that German IPOs perform neutrally, comparing to the market index and size reference portfolios. Stehle and Ehrbardt (1999) also provide evidence of a neutral performance of 187 IPOs for the year 1960-1992 in comparison to value-weighted and equally weighted reference portfolios. But Stehle et al. (2000) report a long-run underperformance of roughly 6% over three years.

Alvarez and Gonzalez (2005) investigate 52 firms that went public in Spain during the period of 1987–1997 in different windows of one, three and five years. Long-term event studies of stock returns are adopted aiming to assess the value of investing in the average sample firm with respect to an appropriate benchmark over the horizon of interest. Long-run abnormal returns are computed as the returns on a buy-and-hold investment in the sample firms minus the return on a buy-and-hold investment in a benchmark for the corresponding period. Following Barber and Lyon (1997) the author claim that long-term investor experience is better captured by compounding short-term returns to obtain long-term buy-and-hold returns. The opposing explanations for long-term performance, namely the Signalling hypothesis and the Overreaction hypothesis are tested against each other. This study’s results confirmed the predictions made by the Signalling hypothesis that IPO firms with higher initial underpricing should exhibit higher long-term performance. According to the signalling hypothesis, IPO firms pursue a multiple issue strategy when they choose both the offer price and the proportion of the firm they offer at their IPO. To minimise the information asymmetry exists between issuers and investors, the high-quality firm owners can signal the 'true value' through the price and the retained company shares, since only good firms will be able to recover the initial loss from underpricing through subsequent seasoned offerings. In conclusion, Alvarez (2005) reveals that the Spanish IPO firms have not underperformed for the first 12 months post-listing. However, coming into the periods of 36 months and 60 months, negative abnormal stock returns have been observed. Such result is in line with the international literature on long-term underperformance.

Controversial results on the long-term performance of IPO have also been recorded from several Asian markets. In Hong Kong, McGuinness (1993b) reports a significant negative market-adjusted return of -18.26% for the 500 day post-listing. Paudyal et al. (1998) uncover that the long term market-adjusted performance of IPOs and privatization IPOs in Malaysia are not significantly different but that initial return and underwriters' reputation are important determinants of long run performance. Jelic et al. (2001) confirm that in Malaysia IPOs with higher initial return suffer worse underperformance in the long term but they find no significant relation between underwriter reputation and long run performance. Instead they find that optimistic management earnings forecasts, percentage of shares sold and size of issues are weakly associated with poor performance in the long term.

2.6.2 Theoretical explanations for the long-term performance of IPOs

Ritter (1991), Lerner (1994), and Loughran and Ritter (1995, 2000) all try to provide a behavioural explanations for poor performance subsequent to the IPOs. They suggest that stock prices periodically diverge from the fundamental values and managers and investment bankers take advantage of overpricing by selling stock to overly optimistic investors. Such explanation is on one hand consistent with the broadly observed evidence, but on the other hand is anathema to those who argue the market efficiency.

Teoch, Welch, and Wong (1998) proposed the earnings management hypothesis to explain the relation between earnings management of the IPO firm measured by discretionary current accruals, and its aftermarket underperformance. Their analysis show that conservative IPOs with less discretionary accruals exhibit little underperformance, but aggressive IPOs with high discretionary accruals suffer significant underperformance in the aftermarket.

Sapusek (2000) reviewed several possible explanations for the underperformance of IPO firms. Firstly, the Decline-of-profitability hypothesis suggests that to achieve a share price as high as possible for the issue, owners, or managers inflate the firm's earnings before the issue and the profitability of IPO firms declines after going public. Secondly, Sapusek (2000) proposed that the aftermarket underperformance in German IPO market might also be explained by the Continuous-selling hypothesis. She pinpointed that the original owners of the IPO firms in her sample – especially families, who are the major shareholders of non-quoted German firms – do not tend to sell their shares all at once; rather they prefer to sell shares in smaller lots in the months and years after the issue. 'The transfer of control is carried out in various stages and not at once'. Such continuously offered shares can partially explain the decline of profitability of the company itself, which in turn have a downward impact on the share price. Moreover, the increased supply of shares causes a decline of stock prices over the years following the issues. The continuous-selling hypothesis is to some degree related to the Downward-sloping demand-curve hypothesis, as an explanation for underperformance in the long term, which suggest that an increased amount of shares offered leads to a decline of the equilibrium prices and eventually result in aftermarket underperformance. Thirdly, Sapusek (2000) brings forth the Index-firm-investment hypothesis or the negative small-firm effect, which insert that in Germany most investors, especially foreign investors, prefer to buy stocks of more established firms that are listed on the main market indexes. As a result, the index-listed firms are the liquid and most requested stocks in German capital market. On the other hand, since IPO firms are often smaller firms, whose prices are commonly priced too optimistically at the time of issue; such initial underpricing will reverse in the aftermarket. Therefore, the Index-firm-investment hypothesis predicts that IPO firms will suffer worse performance in the aftermarket.

Schultz (2003) proposed *pseudo market-timing* hypothesis[7] to explain the poor performance of stocks that have recently issued equity. He argues that equity sales will concentrate at peak prices ex-post, even though companies cannot determine market peaks ex-ante. Because of such pseudo market timing, the probability of observing long-term underperformance ex-post in event-time may far exceed 50%. If IPOs perform well, even more firms will go public in the period. However, the likelihood of losing money on average is in turn increased. Such potential explanation is consistent with Loughran and Ritter (1994)'s observation that the volume of IPO activity increase with the level of the market in 14 out of the 15 countries examined. On the other hand, the pseudo market-timing explanation believes that the poor performance of equity issuers is real and significant ex-post, since IPOs only have underperformed relative to their ex-ante expected returns. Such explanation stays in line with the efficient market hypothesis. In addition, pseudo market timing is also different from the methodological concerns from Barber and Lyon (1997) and Lyon et al. (1999). Using simulations Schultz (2003) show that poor performance following IPOs can be expected even with proper benchmark, no bid-ask bounce, correctly estimated t-statistics and normally distributed returns.

To sum up, the various theoretical explanations for the long-term performance of (share-only) IPOs provide a background, in which the long-term abnormal returns of unit IPOs are tested.

[7] An example of pseudo market timing please see Schultz (2003) page 485.

Although the aim of this thesis is not focused on explaining the long-term underperformance, the results from CHAPTER 5 suggest that unit IPOs suffer significantly worse performance in the long run, comparing to share-only IPOs. Such outcome is in line with behavioural explanation suggesting that firm insiders might be able to take advantage of overly optimistic investors. The potential exercise of warrants can enlarge the market-share of unit firms and increase the supply of shares, which can also be contributing to the long-term underperformance.

CHAPTER 3

SHORT-TERM PERFORMANCE OF UNIT IPOs IN THE UK

3.1 Introduction

The ability and means to raise capital to finance growth is a major challenge to new and small businesses. Banks and other lenders tend to require higher premiums for non-traded shares and sometimes even impose restricted covenants on private firms for the information asymmetry and agency problems. Constrained by the limited sales history and the absence of publicly available information on their future aspects, these young and small firms seek certain mechanisms to go public on relatively favourable terms, and issuing unit IPOs is one of them.

This chapter investigates, theoretically and empirically, the short-term economic effects of a dual share-warrant financing strategy through unit IPOs and the reasons that might affect firms' decision to choose unit IPOs instead of share-only IPOs. According to the literature survey in CHAPTER 2, two major hypotheses explaining the inclusion of warrants in IPOs are still competing to be the primary reason why firms choose to include warrants in their IPOs. Schultz (1993b)'s Agency Cost hypothesis claims that firms attach warrants to reduce agency costs by forming a staged financing through the conditional exercise of warrants. Chemmanur and Fulghieri (1997)'s Signalling hypothesis argues that including warrants in IPOs is not for the purpose of solving the agency problem, but instead as a signalling mechanism to more efficiently convey favourable information about firm value to the public. The primary aim of this study is to reassess the two competing hypotheses, regarding the inclusion of warrants in IPOs with a short-term focus. Characteristics of firms issuing unit IPOs, initial returns and short-term performance are compared with their share-only counter-parts. Variables of interest and other control variables are defined in TABLE 3.1.

INSERT TABLE 3.1 HERE

Firstly, to identify differences between unit IPOs and share-only IPOs, I examine the distributions of IPOs by year, trading locations, issuing methods and industry sectors. A portfolio of matching share-only IPOs is selected according to firm size and industry; descriptive statistics emphasising on firm characteristics and financial features are compared and illustrated. Descriptive results indicate that comparing to share-only IPOs, unit IPOs are generally issued by smaller and riskier firms with less assets and income prior to IPOs; the fraction of insider holding is also lower for unit IPO firms than share-only IPO firms. These results are consistent with both the Agency Cost and the Signalling hypotheses. However, I do not find any evidence that unit firms are younger than share-only IPO firms, which provides conflicting evidence to the existing literature with UK data.

Secondly, following How and Howe (2001), I conduct 'direct tests' of the two competing hypotheses in Section 3.5.3. On one hand, two out of the three 'efficiency ratios' as direct measures of agency cost are significantly lower for unit IPO firms, indicating that unit firms suffer more agency cost than share-only firms do. On the other hand, residual standard deviations of daily share prices are examined as measurement of information asymmetry and unit firms appear to be riskier and suffer more information asymmetry than share-only IPOs. Therefore, the results from direct tests provide supporting evidence to both the Agency Cost and the Signalling explanations for including warrants.

Thirdly, in Section 3.5.4 and 3.5.5, I examine the initial returns of unit IPOs in comparison to that of share-only IPOs. The focus is on the conflicting predictions about the relation between choice of offer types and the degree of underpricing from the Agency Cost hypothesis (unit IPOs are more underpriced) and the Signalling hypothesis (underpricing increases with firm riskiness). Initial returns for both the first trading day and first trading week are compared and the results indicate that unit IPOs are significantly more underpriced than share-only IPOs in both measures, which is consistent with the Agency Cost hypothesis. Furthermore, linear regressions on determinants of underpricing are conducted. In support to both the Agency Cost and the Signalling hypotheses, smaller, riskier firms with worse profitability prior to listing exhibited higher underpricing.

Overall, the results from my research on the short-term performance of unit IPOs in comparison to share-only IPOs provide partial support to both the Agency Cost and the Signalling hypotheses. The UK data do not prefer any hypothesis to be the sole reason for including warrants. Nonetheless, the warrants represent a potential opportunity for additional capital infusions into the firm. UK companies are obviously attracted to this opportunity in the IPO process. The rest of this chapter is organised as follows: Section 3.2 provides a brief literature review on short-term performance of unit IPOs in the background of short-term underpricing of IPOs. In Section 3.3, a number of testable hypotheses in examination of the short-term performance of unit IPOs are motivated; Section 3.4 outlines the data collection process and related methodologies, the results of which are tested and presented in Section 3.5. Finally, Section 3.6 summarises the results to draw conclusions of this chapter.

3.2 Literature Review

Schultz (1993b) proposes with the Agency Cost hypothesis that unit IPOs are applied as a multistage financing strategy to reduce agency costs by limiting the probability that excess capital will be invested in negative net present value projects all in one shot. Schultz (1993b) maintains that young, small, risky firms are more likely to employ less reputable underwriters to issue unit IPOs with warrants attached. These firms are generally high technology companies or service oriented. The Agency Cost hypothesis makes several predictions about unit IPOs: Firstly, unit IPOs will be intentionally underpriced; more so than share-only IPOs in compensation of the higher uncertainty to induce investors' interests. Secondly, unit IPOs are generally smaller issues than share-only IPOs. Unit IPOs can only raise limited proceeds as the first round of financing in order to restrict the amount of free cash flow available to managers before the profitability of the investment is assured. Thirdly, firms choosing to form staged financing through unit IPOs are expected to suffer more agency problems and should have lower fraction of insider holding. Last but not least, by including warrants in IPOs, a potential second round of financing is formed, but only if the initial investment funded by IPO proceeds is successful and the company's stock price exceeds the warrant exercise price. Therefore, the warrant exercise price is expected to be set above the offer price to provide an incentive mechanism for the managers.

The competing justification for including warrants in IPOs is the Signalling hypothesis brought forth by Chemmanur and Fulghieri (1997). In a world characterised by information asymmetry, they develop a theory that good quality high-risk firms issue units to convey information about true firm value to public investors. Such theory is closely related to the initial underpricing of new shares and the proportion of insider holding. Chemmanur and Fulghieri (1997) argue that 'good' firms with higher risk tend to adopt a combination of three costly signals to convey information to investors and repel competitors with lower firm value. Several predictions are proposed about unit IPOs: Firstly, consistent with the Agency Cost hypothesis, they expect unit IPOs to be issued by younger, smaller, riskier firms; the true value of which are more difficult for investors to assess. Secondly, the firm value sold as warrants is anticipated to be positively related to riskiness, after controlling for insider holding. Thirdly, the fraction of insider holding is predicted to be negatively related to firm riskiness, holding firm value sold as warrants constant. Additionally, Chemmanur and Fulghieri (1997) do not claim that unit IPOs are more underpriced than share-only IPOs. Instead, they insert that the package of equity and warrants is underpriced as a whole and the degree of underpricing is positively related to firm riskiness. Last but not least, the Signalling hypothesis recognises warrants as a signalling mechanism for firm value rather than an incentive mechanism for management performance and therefore Chemmanur and Fulghieri (1997) predict that the exercise price of the attached warrants is set equal to (not above) the offer price of new shares.

One of the most distinguished conflicts between the Agency Cost and the Signalling hypotheses for the use of unit IPOs is the degree of underpricing. On one hand, Schultz (1993b) claims that unit IPOs are chosen by smaller, younger, and riskier firms to reduce agency cost. Such firms tend to have more uncertainty about their future prospect and therefore are more underpriced than share-only IPOs. On the other hand, Chemmanur and Fulghieri (1997) do not support such relation between unit firms and underpricing. Instead they predict that the degree of underpricing will hold positive relation to firm riskiness after controlling the fraction of insider holding; the firm value sold as warrants is also positively related to firm riskiness after holding insider retained ownership as constant.

Testing of the two competing hypotheses has been conducted by several academic papers. How and Howe (2001) investigate why firms include warrants in their IPOs with a sample of Australian IPOs. They found that the unique implications of the Agency Cost hypothesis are generally not supported by Australian data. Using four different measures, How and Howe (2001) claim that despite the seemingly greater underpricing for unit IPOs, the difference in means is not significant at conventional levels. However, their results are largely in line with the predictions of the Signalling hypothesis. Results from linear regressions indicate that the degree of underpricing is significantly related to firm riskiness. Overall, the evidence from Australian unit IPOs favours the Signalling hypothesis in that the warrants included in IPOs serve as a signalling mechanism to convey information about firm value to the public.

Also using Australian data, Lee, Lee, and Taylor (2003) examine the inclusion of warrants in unit IPOs issued by Australian industrial firms. They report that out of a sample of 394 IPOs issued between 1976 and 1994, the 66 unit IPOs are typically issued by riskier, smaller firms with lower level of retained ownership, using less reputable underwriters than share-only IPOs do. These results support both the Agency Cost and the Signalling hypotheses. Lee, Lee, and Taylor (2003) do not find any significant difference in underpricing between unit and share-only IPOs as the Agency Cost hypothesis predicted. However, they do provide evidence consistent with a prediction unique to the Signalling hypothesis; that the proportion of firm value sold as warrants is positively related to firm riskiness when the fraction of insider holding is kept constant. Overall, they conclude that the inclusion of warrants reflects their role as a signalling mechanism rather than an instrument to reduce agency costs.

Mazouz, Saadouni and Yin (2006a), using a sample of unit IPOs from Hong Kong, provide evidence that firms include warrants in their IPOs to reduce underpricing relative to what it would have been in the absence of warrants. Such results contradict the Agency Cost hypothesis that unit IPOs tend to be more underpriced than share-only IPOs. However, consistent with the Signalling hypothesis, Mazouz, Saadouni and Yin (2006a) reveal that after controlling for the level of insider holding, the proportion of firm value sold as warrants increase in firm riskiness, which implies that holding other signalling mechanisms constant, such as the fraction of insider holding, unit IPOs should incur lower underpricing comparing to share-only IPOs. Therefore, the evidence from Hong Kong unit IPOs also supports the Signalling hypothesis but conflicts with the Agency Cost hypothesis. Warrants in Hong Kong IPOs are more likely to be included for signalling purposes rather than as a mechanism to reduce the agency costs of excessive free cash flow.

3.3 Hypotheses

3.3.1 Common predictions from both the Agency and the Signalling hypotheses

The Agency Cost hypothesis proposed by Schultz (1993b) delineates that smaller, younger, riskier firms exhibit more agency problems. These firms are more likely to choose unit IPOs instead of share-only IPOs in order to reduce agency costs and restrict management's investment decisions through the staged financing provided by the attached warrants. Some predictions from the Signalling hypothesis on characteristics of unit firms cannot be distinguished from those of Schultz (1993b)'s. Chemmanur and Fulghieri (1997) conjecture that firms with higher uncertainty about future cash flow are more difficult for investors to evaluate and therefore are more motivated to signal firm value through unit IPOs. These firms tend to be younger, smaller, and riskier than those issuing shares without warrants.

How and Howe (2001) support these predictions common to both the Agency cost and the Signalling hypotheses. They confirm that Australian unit IPOs issued between 1979 and 1990 are indeed younger, smaller, and riskier than share-only IPOs. Lee, Lee, and Taylor (2003) substantiate the Australian evidence with a new sample of unit IPOs issued over a longer period of 1976-1994. They confirm that unit IPOs are younger and riskier than share only IPOs but they did not compare firm size between unit and share-only IPOs in absolute terms. Instead, they report unit firms to have lower assets relative to issue proceeds than share-only IPO firms. Marciukaityte and Pennathur (2007) investigate unit placements in the US and provide evidence that unit firms are smaller and younger than share-only placing firms in the US. Mazouz et al. (2007a) examine the unit IPOs from Hong Kong. Consistent with evidence from the US and Australia, they report that the issuers of unit IPOs are significantly younger, smaller, and riskier than the share-only IPO issuers.

To test the robustness of the three common predictions from Agency Cost and the Signalling hypotheses on firm age, firm size and riskiness of unit IPOs comparing to share-only IPOs, I retrace the same testable predictions (shown as $H_{3.1}$, $H_{3.2}$, and $H_{3.3}$) with a new sample of IPOs issued in the UK from a more recent period of 1996-2006. Firm age (AGE), is calculated as the number of calendar days between firm incorporation to the date of listing. Firm size is measure with both the market capitalisation (MKTCAP) on offer price immediately post-listing and the total asset of the issuing firm prior to the IPO (TTLASSET). Firm riskiness (RISK) is measured, following How and Howe (2001), as the residual standard deviations of the share prices 200 days following the IPOs.

$H_{3.1}$: Unit firms are younger than share-only IPO firms
$H_{3.2}$: Unit firms are smaller than share-only IPO firms in terms of market capitalisation and total asset
$H_{3.3}$: Unit firms are riskier than share-only IPO firms

Schultz (1993b) also predicts that unit firms tend to employ less reputable underwriters to market for the offers than those employed for share-only IPOs. Unit firms are normally younger, smaller with higher agency costs and less profitability prior to the IPOs. These firms are less likely to be accepted as creditable clients by highly reputable underwriters. The Signalling model consents that it is intrinsically riskier firms that choose unit IPOs and such unit offerings are apt to be marketed by less established underwriters. Chemmanur (1993) develops a model of reputation assessment by investment banks, who act as information producing intermediaries in an equity market characterised by asymmetric information. Such model illustrates that more reputable investment banks tend to set stricter standards in terms of the kind of firms, for which they will underwrite an equity issue. How and Howe (2001) adopt underwriting frequency[8] to proxy for an underwriter's reputation. Contrary to the Agency Cost hypothesis, their results indicate that the underwriter's reputation is significantly higher for unit IPOs than for

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[8] How and Howe (2001) define the underwriting frequency as the number of times an underwriter was chosen to underwrite the sample firms.

share-only IPOs. They conclude that in Australia the underwriters who market for unit IPOs are at least as reputable as those who underwrite share-only IPOs. Lee, Lee, and Taylor (2003) find evidence that share-only IPOs use high quality underwriters more frequently than unit IPOs do. This is consistent to the agency cost prediction that prestigious underwriters, concerned with the upkeep of their own reputation, might be less willing to market riskier issues and therefore, unit IPOs are more likely to be underwritten by less reputable underwriters. Mazouz et al. (2007a) report that Hong Kong unit IPOs tend to be brought to the market by less reputable underwriters, which is consistent with US and Australian evidence. However, the authors use international operations as a proxy for underwriters' reputation. Any international underwriters are considered as more reputable than the local underwriters, which might not always be the case. As a result, the grounding of the underwriter reputation proxy may not be robust. Since evidence on the reputation of underwriters that market for unit IPOs is inconclusive, I introduce the dummy variable REPUTATION to take the value of 1 if an IPO is issued by reputable underwriters; 0 if otherwise. Classification of the UK prestigious underwriters from Jelic (2008)[9] is adopted, which select the top 5% of the most reputable underwriters in the UK ranked by the number of new issues an underwriter has been involved as leading underwriting and/or advisory roles since 1980. In turn, I propose Hypothesis 3.4 that unit IPOs in the UK are more likely to be underwritten by less reputable underwriters ($H_{3.4}$).

$H_{3.4}$: Unit IPOs are issued by less reputable underwriters

3.3.2 Predictions exclusively motivated by the Agency Cost hypothesis

The first unique prediction by the Agency Cost is on the fraction of insider holding. Schultz (1993b) promotes the implicit monitoring mechanism of a unit IPO to motivate insiders and

[9] Jelic (2008)[9]To Disclose or not to Disclose: Earnings Forecasts in IPO Prospectuses- European Financial Management Symposium on Initial Public Offerings at Oxford University - Said Business School (April 2008). In this study, a list of all banks involved in 4,807 previously identified listings in the UK primary market is created. From the list, banks that played leading underwriting and/or advisory roles are identified. The top 5% of the most reputable investment banks are selected by the number of underwritten deals.

minimise agency costs. If managers from unit firms invest the IPO proceeds in value generating projects, the share price will exceed warrant exercise price, and the second round of financing through exercise of warrants occurs and these new funds can then be used to begin production. On the other hand, if the initial investment of IPO proceeds failed with a negative NPV and the company is not able to profitably inject additional funds, the warrants will not be exercised and then the second round of financing will automatically vanish, as is in shareholders' (also warrant holders') best interest. Agency Cost hypothesis therefore, predicts that firms with a lower level of managerial insider ownership have a greater agency problem and will be more likely to choose unit IPOs in order to alleviate such conflict.

However, Mazouz et al. (2007a)'s data from Hong Kong does not support such prediction that unit firms have significantly lower level of insider ownership. They report that the level of ownership retained by the insiders is not significantly different between unit and share-only IPO firms. However, they insert that such results should not necessarily be concluded as evidence against the prediction of the Agency Cost hypothesis, as this might be a result of the clustering in the retained ownership among Hong Kong IPOs[10]. Chemmanur and Fulghieri (1997) predict that the fraction of insider holding is negatively related to firm riskiness but their Signalling hypothesis does not mention any difference of insider holding between unit and share-only firms. How and Howe (2001) provide evidence that the average percentage ownership retained by issuers is about 13.5% higher for Australian share-only IPOs than for unit IPOs, which is in line with the Agency Cost hypothesis. They maintain that firms with lower level of insider holding are more likely to have greater agency costs and therefore are more likely to include warrants in IPOs to alleviate agency problem. However, the authors warn that they do not have complete data on the share holdings of managers. Instead they calculate the percentage retained shares held by issuers, which include common employee holdings, to

[10] The authors explain that in the Hong Kong listing regulations require a minimum of 25% of any class of listed securities to be held by the public.

proxy for managerial ownership. Such an approach casts doubt on the precision of the insider holding result. Lee, Lee, and Taylor (2003) on the other hand, report that in Australia the proportion of IPO proceeds that are paid to existing owners is significantly larger for share-only IPO firms, despite the fact that insiders retain a larger post-issue proportion of the shares in share-only IPOs than for unit offerings. The post-issue insider holding has limited power of explanation for firms' decision to include warrants at the time of IPOs. Therefore, to reassess the Agency Cost theory's prediction on the insider ownership with UK data, hypothesise that in the UK, unit firms have lower level of insider ownership than that of share-only IPOs ($H_{3.5}$). Furthermore, to correct for the less promising measures of insider holdings applied in previous studies, I calculated the percentage of insider holdings by directors and senior management (without the common employee holdings) of the issuing firm prior to the IPO (INSIDER).

$H_{3.5}$: Unit IPO firms have lower levels of insider holding comparing to share-only IPO firms

Another testable prediction of the Agency Cost hypothesis is that unit firms are less profitable and have less asset unitisation prior to listing comparing to share-only IPO firms. How and Howe (2001) conducted a direct test on the Agency Cost hypothesis, to assess whether unit firms exhibit higher agency costs than share-only firms. They use three 'efficiency ratios' to measure the profitability and asset utilisation and also to proxy for the degree of agency costs: (1) total revenue over total assets, (2) earnings before interest and taxes (EBIT) to total assets, and (3) the after tax net income (NI) over total assets. Evidence is found that unit firms present significantly lower efficiency ratios; indicating higher agency costs than share-only firms. Mazouz et al. (2007a) calculate these efficiency ratios with data from Hong Kong. Contrary to the predictions of the Agency Cost hypothesis, they show that the profitability and asset utilisation of Hong Kong unit firms are higher than that of share-only IPO firms. Aiming to provide further evidence on the testing of the Agency Cost hypothesis with UK data, I hypothesise that unit firms have less income by the end of the fiscal year prior to the IPOs (**$H_{3.6}$**).

Furthermore, measured by the three efficiency ratios, unit firms have higher level of agency costs than share-only IPOs ($H_{3.7}$).

$H_{3.6}$: Unit firms have less income (Revenue) prior to IPO comparing to share-only IPO firms
$H_{3.7}$: Unit firms have higher agency costs in terms of profitability and asset utilisation ratios

Schultz (1993b) also maintains that unit IPOs exhibit several unique characteristics of the offering when going public that differ from those of share-only IPOs. Firstly, he conjectures that the size of unit IPOs is intentionally limited to raise relatively little funding as the first round of financing, in order to restrain the amount of free cash flows available to managers immediately after the IPO: just enough for necessary development and market testing for a new firm but not enough for managers to 'squander away'. Future equity contributions depend more explicitly and therefore more objectively on the outcome of the initial investments. As such, the Agency Cost hypothesis predicts that unit IPOs generally have smaller issue size in terms of gross proceeds comparing to share-only IPOs. How and Howe (2001)'s study on Australian unit IPOs provides some degree of support to such prediction on smaller issue size for unit IPOs. They report that both the mean and median average gross proceeds of the unit IPOs are smaller than those of share-only IPOs. Contrarily, Lee, Lee, and Taylor (2003) report that the median proceeds for unit IPOs in their Australian sample is larger than that of share-only IPOs. However, the results on issue size from both papers are not significant at conventional levels. On the other hand, Marciukaityte and Pennathur (2007) find that average dollar proceeds from unit placements are smaller than share-only placements in the US. However, the fraction of proceeds as a percentage of market capitalisations at the placing price is significantly larger for unit placements than for share-only placements. Mazouz et al. (2007a) document that the gross proceeds from share-only IPOs are significantly larger than the gross proceeds of unit IPOs in Hong Kong, which is consistent with the Schultz (1993b)'s prediction. The above mixed findings on the issue size motivate me to reassess this specific prediction of the Agency Cost hypothesis with UK data. As such, I calculate and compare the expected gross proceed as the measure of issue size between the unit IPOs and their matching share-only counter-parts. Hypothesis 3.8 ($H_{3.8}$) predicts that in the UK, unit IPOs raise less gross proceeds than that of share-only IPOs.

$H_{3.8}$: Unit IPOs raise less expected gross proceeds than share-only IPOs (smaller issue size)

The most exclusive prediction of the Agency Cost hypothesis is that unit IPOs are more underpriced than share-only IPOs. According to Schultz (1993b), unit firms with less income and fewer assets prior to IPOs infuse more uncertainties about future prospects into the pricing of new shares. Riskier firms are subject to more divergence of investor opinion and therefore more difficult for the underwriter to price, which in turn may result in higher underpricing. Chemmanur and Fulghieri (1997)'s Signalling hypothesis argues that the degree of underpricing, for both unit and share-only IPOs increase with firm riskiness without giving conclusive prediction on whether unit IPOs are more underpriced than share-only IPOs. How and Howe (2001) report that despite the greater underpricing of unit IPOs in Australia, the difference in means is not significant at conventional level and hence fails to support the Agency Cost hypothesis. Lee, Lee, and Taylor (2003) also find no significant difference in underpricing between Australian unit and share-only IPOs. Mazouz et al. (2007a) on the other hand, extend the understanding of the Signalling hypothesis and explain that if warrants are included to signal unit firms' quality to the investors, the inclusion of warrants should be perceived as a creditable signal and unit IPOs should be underpriced less. Their results provide evidence that unit firms in Hong Kong actually incur lower underpricing than if they had issued share-only IPOs instead. To sum up, there are three groups of inconclusive results concerning underpricing of unit IPOs in comparison to share-only IPOs. Schultz (1993b) insists that American unit IPOs are more underpriced than share-only IPOs. How and Howe (2001) and Lee et al. (2003) document that there is no difference in underpricing between Australian unit

IPOs and share-only IPOs. Finally Mazouz et al. (2007) report that in Hong Kong unit IPOs incur less underpricing than share-only IPOs. To verify the conflicting results from different countries, I add to the literature by testing whether unit IPOs in the UK are more underpriced than share-only IPOs ($H_{3.9}$). The raw initial returns (IR_D1), market-adjusted initial returns (IR_D2) and the continuously compounded log initial returns (IR_D3) on the first trading day are calculated relative to the IPO offer price as underpricing measure. In addition, the market-adjusted first-week initial returns (IR_W1) and the continuously compounded first-week initial returns (IR_W2) relative to the IPO offer price are also computed as robustness test. To further examine the relationship between the degree of underpricing and offer type I also conduct a probit regression of underpricing later on, using a UNIT dummy as dependent variable, which takes the value of 1 if the IPO is a unit offering, 0 if it is a share-only IPO.

$H_{3.9}$: Unit IPOs are more underpriced than share-only IPOs

Last but not least, according to the Agency Cost hypothesis, warrants are included in unit IPOs to reduce agency costs by binding managers to optimal investment decisions. Schultz (1993b) predicts that the exercise price of warrants will be set *above* the IPO offer price to create incentives for managers to invest only in value-generating projects. Alternatively, the Signalling hypothesis considers the inclusion of warrants as a costly signal to convey favourable information about firm value. Chemmanur and Fulghieri (1997) predict that the warrant exercise price should be set *equal to* the IPO offer price to signal firm value. How and Howe (2001) discuss the choice of warrant exercise price in their study of Australian unit IPOs. They report that most unit IPOs in their sample set the exercise price of warrants near or equal to the offer price. This observation is contrary to the prediction of the Agency Cost hypothesis. However, their study does not provide any statistical inference and only weakly supports the Signalling hypothesis. Therefore, I am motivated to reassess the two competing hypotheses and their predictions on the choice of warrant exercise price by testing Hypothesis 3.10. I include a PRATIO variable, which is computed as the ratio of warrant exercise price to the offer price of the unit IPO. If PRATIO is above one, then the warrants in the unit IPO is issued out-the-money (by choice) in support to the Agency Cost hypothesis. On the other hand, if the PRATIO is equal to or below one, the warrants are issued on- or in-the-money in support of the Signalling hypothesis.

$H_{3.10}$: Warrant exercise prices will be set above the offer price

3.3.3 Predictions exclusively motivated by the Signalling hypothesis

The Agency Cost hypothesis, which stresses the importance of multi-stage financing for smaller, younger, and riskier firms, is supported by some academic papers but on the other hand confronted with challenging results. As a competing explanation for including warrants in an IPO, the Signalling hypothesis proposed by Chemmanur and Fulghieri (1997) emphasises on the signalling mechanism unit IPOs provide in a market characterised by information asymmetry. In such market, information about the IPO firm is not transparent between the two investment terminals: the firms' managers (i.e. insiders) and the public investors (i.e. outsiders). From the investors' prospect, it is difficult to value distinctly whether the firm is a 'good' or 'bad' candidate in terms of potential investment outcome. At the other terminal, insiders have all the information of their own companies but find it hard to convey them to investors. Especially in a competitive environment where 'bad' firms constantly trying to imitate the market image of 'good' firms and try to disguise themselves; it is in the interest of 'good' firm insiders to find separating mechanisms to distinguish themselves from the 'bad apples'. Chemmanur and Fulghieri (1997) present three costly signalling mechanisms, namely the fraction of equity retained by insiders, underpricing of the new issue and the inclusion of warrants in an IPO. Adding warrants to an initial public offering means sharing firm value with warrant-holders; and therefore, is too costly for 'bad' firms to mimic. However, such cost will only be realised if a favourable state of the company occurs, in which there is a higher realisation of firm value. Risk-averse insiders of high-quality firms will apply a mixture of all three signals in order to maximise their utility function. The Signalling hypothesis leads to the following predictions.

Firstly, Chemmanur and Fulghieri (1997) predict that unit firms have higher levels of information asymmetry and are therefore more likely to include warrants to convey information about firm value. However, Chemmanur and Fulghieri (1997) do not formulise variables to measure the degree of information asymmetry. Using Australian data, How and Howe (2001) conduct a 'direct test' on the degree of information asymmetry using the residual standard deviations of unit firms' stock prices for one year post-listing as a proxy for the level of information asymmetry. Their results indicate that the unit firms have significantly higher residual standard deviations than share-only IPOs, and therefore exhibit higher levels of information asymmetry, which is consistent with the Signalling hypothesis. Lee, Lee, and Taylor (2003) on the other hand, do not test for the difference in information asymmetry between unit and share-only IPO firms. Marciukaityte and Pennathur (2007) study a sample of unit placements issued in the US, predict that unit placements are attractive to a clientele of overoptimistic investors, and therefore are small and risky with high level of information asymmetry. Mazouz et al. (2007a) also investigate whether firms include warrants in their IPOs to signal firm quality in Hong Kong. They provide results for the relation between unit issuance and market conditions using a dummy variable for hot issue period. They find that unit IPOs are more likely to be issued in cold periods where both information asymmetry and risk are at their highest, which is supportive to the Signalling hypotheses. However, no direct test on the level of information asymmetry for unit firms and share-only firms is conducted. To reassess the Signalling hypothesis' prediction, I motivate two variables to measure the level of information asymmetry of the issuing firms, namely the residual standard deviations of share prices (RISK) and the time lag between prospectus publication and listing date (DELAY). In test of the Signalling explanation for including warrants, I hypothesise ($H_{3.11}$) that unit IPOs will exhibit higher level of information asymmetry than share-only IPO firms, indicated by higher RISK and longer DELAY.

I follow How and Howe (2001) and calculate the residual standard deviations of IPO firms' share prices for two years following the initial listing to proxy for the level of information asymmetry (also defined previously as RISK to measure firm riskiness). The RISK for both unit IPOs and their matching share-only counterparties are compared in test of the Hypothesis 3.3 that unit firms are riskier than share-only IPO firms are.

Another variable I employed to measure the level of information asymmetry, DELAY is defined as the number of days between the publication of company prospectus and the listing dates. How and Howe (2001) calculated DELAY as a proxy for Rock (1986)'s level of informed demand. They argue that issues, which sell more quickly, have a higher level of informed demand and these issues are expected to be more underpriced. Issues that sell more slowly are likely to be less underpriced due to lack of interest on the part of 'informed investors'. Despite being insignificant, the Australian evidence from How and Howe (2001) indicates that the mean DELAY of unit IPOs is significantly longer than share-only IPOs.

Furthermore, no previous paper has examined the DELAY of unit IPOs in comparison to share-only IPOs in the UK. The length of time lag between prospectus publication and listing date is influenced by many factors in the UK, such as offer size, industry sector, and structure of the issuing company, quality of underwriters and the method of flotation being used etc. A prospectus is central to a flotation. The document has two main functions: Firstly, it sets out all the information, which has to be made public to investors under the UKLA's Listing Rules.

Secondly, it plays a crucial role for the company itself, amounting to a coherent description of the business and its prospects. Pricing of the new shares is one of the most delicate decisions before finalising the prospectus, and may be affected by events and conditions outside the company's control. The underwriters and sponsors will aim for a realistic price, which the market will find attractive, whist the company wants to optimize the money raised. The offer or placing price is practically the last thing to be finalised in a prospectus before publication, which could happen any time between 6 weeks and 48 hours prior to official listing.[11]

According to the Signalling, hypothesis unit firms have higher level of information asymmetry, the interest from 'informed investors' are therefore expected to be lower. As a result, the underwriters might strategically prolong the time lag between the publication of prospectus and the initial trading, so that more information about firm value could be conveyed to the investors. Therefore, to test Signalling hypothesis's prediction that unit firms suffer higher level of information asymmetry, I expect that unit IPOs will have longer DELAY between the publication of prospectus and the listing day. Later on, I also apply DELAY as a control variable in the regression analyses of underpricing.

$H_{3.11}$: Unit IPO firms will exhibit higher level of information asymmetry than share-only IPO firms

The second unique prediction by the Signalling hypothesis is that the proportion of firm value sold as warrants increases with the firm riskiness, after controlling for retained equity by insiders[12]. How and Howe (2001) calculate the firm value sold as warrants as proceeds derived from warrant exercise divided by the sum of warrant proceeds plus IPO proceeds. Their results indicate that firm value sold as warrants are positively and significantly related to firm riskiness. However, How and Howe (2001) only use the proportion of warrant proceeds relative to total proceeds of unit IPO as the proxy of firm value sold as warrants, but does not measure the

[11] At least 48 hours before admission, the formal application for a listing is submitted to the UKLA. At the same time a formal application for admission to trading is submitted to the Exchange. The listing is officially granted by the UKLA in conjunction with admission to trading being granted by the Exchange.

[12] Proposition 5 of Chemmanur and Fulghieri (1997)

proportion of the firm's equity represented by warrants, as described by Chemmanur and Fulghieri (1997). On the other hand, Lee, Lee, and Taylor (2003) conduct a similar test by regressing the fraction of firm value sold as warrants on retained insider holding and firm riskiness. Their results also identify a significant positive relation between firm riskiness and firm value sold as warrants, which is measured by proceeds from the potential exercise of warrants as percentage of the market capitalisation at offer price immediately after IPOs. Mazouz et al (2007a) also directly examine Chemmanur and Fulghieri (1997)'s prediction that firm value sold as warrants increases with firm riskiness while maintaining the insider holding as constant. An OLS regression is estimated with firm value sold as warrants as the dependent variable, with insider holding and firm riskiness as independent variables. Significant positive relation is found between firm value sold as warrants and the firm riskiness after controlling for the level of insider ownership, which is consistent to the predictions of the Signalling hypothesis. Following Lee, Lee, and Taylor (2003)'s suggestion I calculate the firm value sold as warrants using potential proceeds from the exercise of warrants as percentage of the market capitalisation of the unit IPOs at offer price (VALUE). The VALUE variable is incorporated in several regression analyses to add fresh evidence from UK data in examination of this Signalling hypothesis' unique prediction. I therefore, hypothesise that the proportion of firm value sold as warrants will increase with firm riskiness, holding the fraction of equity retained constant ($H_{3.12}$).

$H_{3.12}$: The proportion of firm value sold as warrants will increase in firm riskiness, holding the fraction of equity retained constant

Finally, according to the Signalling hypothesis, the degree of underpricing increases with firm riskiness, after controlling for insider holding[13]. Such prediction only focuses on one determinant of underpricing but avoids the comparison of underpricing between unit IPOs and

[13] Proposition 7 of Chemmanur and Fulghieri (1997)

share-only IPOs. How and Howe (2001) find a positive coefficient on firm riskiness when it is regressed against the degree of underpricing. However, the positive relation between firm riskiness and underpricing is not significant with Australian data. Again, the testing of this proposition from the Signalling hypothesis was not covered in Lee, Lee, and Taylor (2003) and Mazouz et al (2007a). As a result, Hypothesis 3.14 tests this prediction with UK data. I use both the HGSC-adjusted initial returns on the first trading day (IR_D2) and the HGSC-adjusted first-week initial returns (IR_W1) as the underpricing measure.

$H_{3.13}$: The degree of underpricing increase in firm riskiness

3.3.4 Original testable predictions

In previous Section 3.3.1-3.3.3, I reassess the two competing hypotheses by providing new evidence with a sample of UK unit IPOs. Both the common and competing predictions of the Agency Cost and the Signalling theories are re-examined with UK data through proposed Hypotheses 3.1-3.14. However, to my best knowledge, existing empirical studies on unit IPOs largely focus on whether unit IPOs are more underpriced than share-only IPOs since this is the major divarication between the two competing explanations of including warrants in an IPO. Evidence from the possible determinants of underpricing, especially in relation to unit firm characteristics and warrant characteristics are very limited. The market setting in the UK is different from that in the US, Australia and Hong Kong, not only in terms of exchange listing regulations but also in the characteristics of the warrants attached to IPOs. As a contribution of this paper, I propose several original testable predictions to detect potential associations between unit firm characteristics, warrant contractual characteristics, and the degree of underpricing.

3.3.4.1 Unit firm characteristics

Firstly, regarding unit firm characteristics, both the Agency Cost and the Signalling hypotheses made predictions about the age, size, riskiness, and the profitability of unit firms comparing to share-only firms. However, neither theory mentioned the level of leverage (i.e. the debt component in the capital structure) and its potential impact on firms' decision to choose unit IPOs. Jenson (1986) stipulate that debt component in a capital structure can limits managerial discretion, since debt service limits free cash flow, and lenders have incentive to monitor management to ensure the repayment. Since unit firms are generally younger, smaller, riskier firms comparing to share-only IPOs, they are expected to have fewer assets and less trading history prior to IPOs. Such firms will not be recognised by banks and other lenders as creditable candidates for cheaper debt financing, which confirm why these firms decide to include warrants for potential future capital infusion. Therefore, to examine whether there is any difference in the capital structure between unit firms and share-only firms, my first original hypothesis predicts that unit firms will have less debt component in their capital structure. The debt leverage is calculated as the ratio of total debt to total asset comparing to those of share-only firms matched on firm size and industry. The variable LEVERAGE is also included in the regression analysis for underpricing later on.

$H_{3.14}$: Unit firms have lower leverage than matching share-only IPO firms have

Chemmanur and Fulghieri (1997) claim that for the degree of underpricing will increase in firm riskiness. Schultz (1993b) conjectures that unit IPOs will be more underpriced than share-only IPOs. How and Howe (2001) segment their Australian unit IPO sample by the Main Board and the Second Board. In Australia, the Second Board generally listed shares of newer firms, which are not large enough to join the Main Board. How and Howe (2001) document that two-thirds of the IPOs in their sample are listed on the Main Board. However, none of these papers relates the degree of underpricing to the listing location of the IPOs. To fill this gap, in my UK sample, IPO listings are divided between the Main Board and the Alternative Investment Market (AIM).When choosing listing locations, managers are aware that the AIM is popularly chosen by smaller riskier firms because of the less strict listing requirements. Managers may intentionally underprice the IPOs to promote the sale of new shares. Thus, I expect unit IPOs that are listed on the Alternative Investment Market will be more underpriced than those listed on the Main Board. A dummy variable AIM is introduced in the regression analyses of underpricing later on to incorporate the listing location effect. The AIM dummy, which takes the value of 1 if a unit IPO is listed on the Alternative Investment Market, 0 if otherwise, is predicted to be positively related to the underpricing measure ($H_{3.16}$).

$H_{3.15}$: AIM-listed unit IPOs are more underpriced than those listed on the Main Market

3.3.4.2 Warrant characteristics

Schultz (1993a) studies the exercise-forcing calls of warrants and reports that the call announcement negatively affects the company's share price. Howe and Wei (1993) investigate the valuation effects of warrant life extension and provide evidence that the market perceives the announcement of extension as a favourable indication for the stock price. Howe and Su (2001) examine the discretionary reductions in warrant exercise price and conclude that the option to lower warrant exercise price is an efficient feature of the warrant contract. Howe et al. (2005) emphasise on a step-up provision in the warrant agreement where the underlying warrant has a scheduled increase in its exercise price, which is fully disclosed in the contract. They assert that the market correctly anticipates this event, and that warrant holders take their actions rationally to refrain from exercising.

The above studies are limited to investigate contractual characteristics of equity warrants independent of an initial public offering. Warrants are included in over one-fifth of US IPOs

(Schultz, 1993b) and in over one-third of Australian IPOs (How and Howe, 2001). In the unit IPO literature, most studies debate on whether issuing firms include warrants to reduce agency costs (Schultz, 1993b) or to signal firm value (Chemmanur and Fulghieri, 1997). Furthermore, Chemmanur and Fulghieri (1997) provide evidence that both the firm value sold as warrants and the degree of underpricing increase in firm riskiness after controlling for insider holding. Very few papers investigate the warrants characteristics or/and have examined any potential association between warrant contractual characteristics and the degree of underpricing. As one may expect, the proportion of firm value sold as warrants depends not only on the number of warrants issued, but also the exercise price and life of warrants. These warrant characteristics vary significantly across unit offerings (Garner and Marshall; 2005). It is reasonable to anticipate that certain contractual features of warrants in unit IPOs may affect underpricing of the unit as a whole. I am therefore, motivated to include several variables to examine warrant characters in relation to the underpricing of unit IPOs with a fresh sample from the UK. Such variables include the life and exercise price of warrant contract, any provisions for change of exercise price, and the callability of warrants, and finally the eventual outcome of the warrant contracts (exercised or lapsed).

Schultz (1993a) reports that warrants are included in unit IPOs as a potential second round of financing when they are exercised before or at expiration. The life of a warrant contract, also known as the exercise period or maturity of warrant, is therefore, defined as the time between issuance and expiration date. How and Wei (1993) insert that the longer maturity will increase the value of the warrants.[14] Chemmanur and Fulghieri (1997) imply that unit firms attaching warrants with longer life is riskier than a firm whose warrants have shorter life. How and Howe (2001) observe that warrants in Australian unit IPOs are generally shorter lived than US warrants. They explain the shorter maturity of warrants with a high concentration of unit IPOs

[14] Howe and Wei (1993) examine the valuation effects of warrant extensions. Such data were not available to me for warrants attached to unit IPOs in the UK. However, I consider this paper a valuable inspiration for future research.

in mining industry. Mining firms own a short-lived 'exploration lease' to decide the outcome of geological assessment of the fields, which is not a time-consuming process. No further examination of warrant maturity is covered their study. Garner and Marshall (2004) focus on the amendments of warrant terms and reveal that warrant life extension is less likely when the firm is riskier. Garner and Marshall (2005) report significantly higher underpricing among American unit IPOs whose warrants have longer exercise periods.

The existing discussions on the life of warrant and the information it conveys are not conclusive and no such studies have been carried out in the UK. I am therefore motivated to examine the maturities of warrants and its relationship with the underpricing of unit IPOs. According to the Signalling theory, if there is more time before the warrant expiration, more firm-value will be assigned to warrant-signals, given the same exercise price and number of warrants. Unit IPOs with high value-bearing warrants attached may send strong signals about firm-value and are expected to be less underpriced. On the other hand, the logic of Agency Cost theory suggests the longer the warrant life, the longer time lag between the two stages of financing (IPO proceeds and warrant proceeds). The monitoring and incentive mechanism brought forth by the inclusion of warrants could be interpreted by investors as less effective. As a result, unit IPOs with long-maturity warrants have to be underpriced more than those with short-lived warrants, in order to compensate the extra risk that investors believe they would bear if they are to subscribe such issues. In examination of the two competing hypotheses, I hypothesise that in the UK, the underpricing of unit IPOs decrease in the length of warrant maturity.

$H_{3.16}$: The maturity of warrant is negatively related to the underpricing of unit IPOs.

The second warrant character under discussion is the exercise price, which is specified in warrant agreements at the time of unit IPOs. Schultz (1993b) predicted that in order to create the incentive to reduce agency costs, issuing firms intentionally set the warrant exercise price above the offer price of the new issue. By doing so, the managerial insiders are bond to optimal investment decisions in order to increase the company's share price and exceed the warrant exercise price to materialize the second round of financing. On the other hand, Chemmanur and Fulghieri (1997) imply that issuers send signals of their future prospect to the public investors by setting the exercise price of warrants equal to the expected stock price. How and Howe (2001) also observe the choice of exercise price and the evidence from Australian unit IPOs is contrary to Schultz (1993b)'s prediction and weakly supports Chemmanur and Fulghieri (1997)'s. Such competing predictions have been examined in previous Section 3.3.2 of thesis with UK data (Hypothesis 3.10). According to either explanation, the exercise price of warrants is not decided randomly. However, neither the Agency Cost nor the Signalling theory discussed whether the choice of warrant exercise price has impact on the underpricing of unit IPOs. Garner and Marshall (2005) segregate the initial day returns of a sample of American unit IPOs with the median ratio of warrant exercise to IPO offer price but find no relation between the ratio and the level of underpricing. Therefore, I introduce the variable PRATIO, defined as the ratio of warrant exercise price to the IPO offer price to proxy for the probability of realizing expected future cash flows. The PRATIO is lower than 1, if the warrants are issued in-the-money (exercise price < offer price), in which case warrant holders may exercise the warrant straight after the unit IPOs or detach warrants from the unit and trade them independently. The PRATIO is equal to 1, if the warrant exercise price equals the expected offer price. On the other hand, when the warrant exercise price is intentionally set above the offer price of the IPOs, the PATIO is higher than 1. Warrants with PRATIO lower than one have immediate value to investors; whereas warrants issued either on- or out-of-money may have speculation value for investors in the future. According to the Agency Cost hypothesis, unit IPOs with low PRATIOs are less effective in monitoring management and reducing agency costs and as a result should be more underpriced to attract trading interest. On the other hand, the Signalling hypothesis implies that PRATIOs should be equal to 1 and therefore will be independent of the degree of underpricing. In test of the two competing theories, I propose Hypothesis 3.18 as below:

$H_{3.17}$: PRATIO is negatively related to the underpricing of unit IPOs

Some issuing firm include optional provisions in a warrant agreement and the right for issuing firm to 'call' warrants before expiration is one of them. Schultz (1993a) states that in a perfect market, value-maximising managers have the incentive to call warrants (if they are callable) as soon as they are in the money, in order to expropriate the time premium on the warrants. By forcing the exercise, the value of the remaining time premium from the warrant holders transfers to the shareholders. Managers will invest the proceeds from the forced exercise if the firm has good projects and otherwise return the proceeds to the shareholders. However, market imperfections such as agency costs imply that a warrant call indicates more free cash flows at managers' discretion (proceeds of the warrant call), which may not be applied to value-maximising uses. Such possibilities lead investors to react negatively towards the acquisition of additional equity capital through a warrant call if they have reasons to believe the issuing firm has poor investment opportunities or unused debt capacity.

Schultz (1993b) inserts that strategically attaching warrants in IPOs can help reducing agency costs for smaller, younger, and riskier firms. How and Howe (2001) documents that Australian warrants are not callable whereas most US warrants are. Alderson and Betker (2003) questioned the Agency Cost explanation for the inclusion of warrants in unit IPOs with their study of the announcement effect of warrant calls. They mention that forced warrant exercise is expected to elicit a stock price reaction in response to unanticipated increase in agency costs. They found firms calling warrants for redemption usually experience negative abnormal returns on the announcement date. Furthermore, evidence was provided that the negative share price reaction to the announcement is concentrated among inefficient firms with low leverage whose agency costs of managerial discretion may be high. In other words, the market reacts adversely to a warrant call when the announcement reveals that the firm is either issuing equity when debt capacity exists or planning to invest when it has poor investment opportunities. Evidence from Alderson and Betker (2003) suggests that some firms are likely to incur substantial agency costs when the warrants are called for redemption and the unit IPO is 'an imperfect instrument for controlling agency costs'.

However, no further examinations of the callability of warrants and its effect on the underpricing have been covered by previous unit IPO literature. A warrant call is a leverage-decreasing event, which results in the acquisition of unrestricted cash. If the issuing firm lacks good investment opportunities or has high debt capacity, a warrant call increases the agency costs of managerial discretion. Schultz (1993a) reports that warrant holders might sell their warrants rather than exercise them when they are called. Market makers or specialists who buy these warrants might then use them as part of their hedging or speculating strategies. In any case, both the possibility of a warrant call and the likely use of the exercise proceeds add further uncertainty to future involvement with the issuing firm. In the presence of agency costs of managerial discretion, forcing exercise, and injecting equity into the company is bad news because shareholders fear that the proceeds will be misapplied. Therefore, I suspect that unit IPOs with callable warrants attached might have to underprice the issue more to attract investors' interest. Hypothesis 3.19 is proposed to test such prediction with UK data.

$H_{3.18}$: Unit IPOs with callable warrants attached are more underpriced than those with non-callable warrants

3.4 Data and Methodology

3.4.1 Data collection

I originally collected a sample of 601 unseasoned issues of equity listed on the London Stock Exchange between 1994 and 2006, of which 216 are unit offerings and 385 are share-only offerings. Consistent with the previous literature, the following firms are excluded from the sample through 'data cleaning' process: (1) the closed-end funds, (2) investment trusts, (3) real estate holding companies, (4) companies without a copy of prospectus available and (5) companies with missing data. In addition, some IPOs are mere Introductions (or Admissions) to the Official Listing or the Alternative Investment Market (AIM). Since there is no new shares issued and in no case, warrants attached, such IPOs are also excluded from this study. Only firms go public with a first sale of shares, through either 'Placing' or 'Open Offer' or a combination of both, are included in the sample. After cross-referencing between DataStream and Thomas One Banker databases for any conflicting data[15], those restrictions result in a final sample of 350 initial public offerings consist of 258 share-only offerings and 92 unit offerings as shown in TABLE 3.2.

INSERT TABLE3.2 HERE

Prospectuses of all the sample firms are analysed and the information on the offerings is obtained including: the type of the IPO (unit IPOs with warrant attached or share-only IPOs), the name of the underwriter(s), industry sector of the issuing firm, incorporation date of the company, the publication date of the prospectus and the listing date of the offering, market segment (AIM or Main Board), placing (or offer) price, number of new shares in issue, enlarged share capital and market capitalisation at the placing (or offer) price following the IPO,

[15] Certain data recorded on DataStream is different from those reported in Thomas One Banker. Firms with conflicting data between the two databases are therefore excluded from the sample for the sake of precision.

expected gross proceeds, total expenses of the offering and net proceeds from the offering, insider subscription as percentage of the enlarged capital following the listing.

In case of unit IPOs, I also collect information on the warrant characteristics, including number of warrants, exercise price of the warrants and subscription price of warrants (in rare cases they are not given for free), conversion rate, and the issuance and expiration dates of the warrants. Information on the exercise or cancellation of warrants before expiration is mostly collected from company websites under the Investor Relationship or Press Release sections. To further perceive the characteristics of unit IPOs, I also obtained information from the prospectuses on whether the warrants are callable after issuance, and whether the issuing company assumes the right to change the exercise price of warrants given certain conditions after the IPO.

Other firm specific financial data and accounting information such as revenue, earnings before interest and taxation (EBIT), net income after taxation before dividend payment, and tangible asset, total assets, total liabilities for the year prior to IPO are also collected from the Prospectuses. The aftermarket daily share prices post-IPO are obtained from DataStream's equity return index datatype (RI) and cross-referenced with FAME database. DataStream provides adjusted price series for companies in their database excluding dividends. In most cases, the two sources of data provide consistent outcome. In case of any inconsistency, the DataStream return index is applied.

3.4.2 Selection of matching firms

Within the 258 share-only IPO firms in the sample, a portfolio of matching firms is created following the procedure adopted in Ritter (1991). 92 matching share-only IPO firms are selected individually for the unit IPO firms issued between 1994 and 2006. I firstly split the unit firms into four groups according to prospectus publication dates. 6 unit IPOs with prospectus dates from the year 1994-1995 are matched with share-only IPOs from the year 1994; 21 unit firms going public between 1996-1999 are compared with share-only IPOs from the year 1996; 27 unit IPOs from 2000-2003 are matched with share-only firms from the year 2000; and 38 unit IPOs from 2004-2006 are compared with 2004 share-only offerings. Secondly, matching firms with closest market value and the same industry are chosen. Matching share-only firms are only used once and when there is no share-only firms match the industry for the matching years, another sample firm with the same industry were selected from the closest year.

3.4.3 Abnormal returns on the first day of trading

To evaluate the degree of underpricing, the daily initial returns on the first trading day (IR_D) are calculated for both the unit and share-only IPOs. The first underpricing measure is the discrete initial return (i.e. raw initial return) shown as IR_D1 in EQUATION 3.1, which is calculated in the usual manner by using the first closing price of firm *i* on the day of listing, i.e. the first trading day ($P_{i,1}$) and the IPO offer price ($P_{i,0}$), which is assigned to the last day of the subscription period of firm *i*'s IPO. To account for market movement, IR_D2 is the market-adjusted initial return on the first trading day, computed as the difference between the raw initial return of firm *i* and the return of Hoare Govett Smaller Companies (HGSC) Index on the same day as illustrated in EQUATION 3.2, where $P_{HGSC,\,1}$ is the HGSC Index price at the end of the first trading day of firm *i* and $P_{HGSC,\,0}$ is the HGSC Index price at the last day of the subscription period of firm *i*'s IPO. The HGSC Index is a sub-Index for smaller firms. Since unit IPOs tend to be issued by smaller firms, using HGSC Index to account for market movement can adjust for firm size.

For robustness test purpose, I also examine the degree of underpricing by calculating weekly initial returns (IR_W) for the first trading week. IR_W1 in EQUATION 3.4 is the HGSC-adjusted first week initial returns, calculated using the offer price ($P_{i,\,0}$) and the closing price on the fifth trading day of the IPO ($P_{i,5}$); $P_{HGSC,0}$ is the HGSC Index price at the last day of the subscription period of firm *i*'s IPO and $P_{HGSC,5}$ is the HGSC Index price on the fifth trading day of firm *i*'s IPO. Following How and Howe (2001), the continuously compounded initial returns are also calculated. IR_D3 in EQUATION 3.3 is the natural logarithm of market-adjusted daily initial return; whereas IR_W2 in EQUATION 3.5 is the natural logarithm of market-adjusted weekly initial return. To examine the effect of different indices on the degree of underpricing, the FTSE All Shares (FTA) Index and the FTSE Alternative Investment Market (AIM) Index are also adopted as alternative market benchmarks to calculate initial returns in EQUATION 3.1-3.5. The results are very similar to the initial returns calculated against HGSC Index and therefore not discussed in the thesis.

$$IR_D1 = \frac{P_{i,1} - P_{i,0}}{P_{i,0}}$$ **EQUATION 3.1**

$$\mathrm{IR_D}2 = \left[\frac{(P_{i,1} - P_{i,o})}{P_{i,0}}\right] - \left[\frac{(P_{HGSC,1} - P_{HGSC,0})}{P_{HGSC,0}}\right]$$ **EQUATION 3.2**

$$IR_D3 = Ln(1 + IR_d2)$$ **EQUATION 3.3**

$$IR_W1 = \left[\frac{(P_{i,5} - P_{i,o})}{P_{i,0}}\right] - \left[\frac{(P_{HGSC,5} - P_{HGSC,0})}{P_{HGSC,0}}\right]$$ **EQUATION 3.4**

$$IR_W2 = Ln(1 + IR_d4)$$ **EQUATION 3.5**

3.4.4 The short-term after-market performance following the IPOs

After examining the initial underpricing on the first day of trading and the initial share price run-up in the first trading week relative to the offer price, I also investigate the short-term after-market share price performance for unit IPOs and matching share-only IPOs. The HGSC Index-adjusted buy-and-hold returns ($BHAR_t$) for 2, 7, 14, and 21 days post-listing, are calculated respectively, excluding the initial returns on the first trading day. Without the commonly observed abnormal positive returns on the first day of trading, I believe the short-term after-market buy-and-hold returns can provide further insight on the performance of unit firms immediately post-listing comparing to their share-only counter-parts. Another purpose of testing the short-term performance is to observe whether the positive returns at the first trading day caused by initial underpricing are persistent in the after-market; or are they only temporary and will vanish shortly after the IPO is completed. As presented in EQUATION 3.6, the market-adjusted *n*-day buy-and-hold returns (*n*= 2, 7, 14, and 21) are calculated as the difference between the raw buy-and-hold returns of the IPOs and the buy-and-hold returns of the Hoare Govett Smaller Companies (HGSC) Index for the corresponding period. $R_{i,\,t}$ is the raw daily return of IPO firm *i* for event day *t* post-listing, and $R_{HGSC,t}$ is the daily return of HGSC Index over the same period.

$$BHAR_n = \prod_{t=2}^{21}(1+R_{i,t}) - \prod_{t=2}^{21}(1+R_{HGSC,t}) \qquad \textbf{EQUATION 3.6}$$

3.5 Tests and Results

3.5.1 Data distribution

As shown in TABLE 3.3, the final sample of 92 unit IPOs are recorded between 1994 and 2006 and the number of unit IPOs for each cohort period are clearly increasing. Only 6.52% are issued during 1994-1995 period comparing to 22.83% during 1996-1999, 29.35% during 2000-2003, and the highest 41.30% during 2004-2006 period. On the other hand, a final sample of 258 share-only IPOs recorded between 1994 and 2006 allocates more evenly over the years with 16.67% during 1994-1995 period, comparing to a peak of 29.07% during 1996-1999, 26.36% during 2000-2003, and 27.91% during 2004-2006 period.[16] Both unit and share-only IPOs were more buoyant between 2000-2006 reflecting a strong stock market and a 'good

[16] 'The UK IPO market was so buoyant during 2005 that it has matched the activity generated during the boom times of the 2000 and 2001 dot com era'. Research by KPMG corporate finance has found in 2005, 307 new companies have joined AIM or the main board of the London Stock Exchange raising combined funds of £8.3bn.

supply of suitable companies', which is consistent with the boom times of the 2000 and 2001 ‘dot com era’ and more recently the ‘Bio-Tech boom’.

Sorted by trading locations, both unit IPOs and share-only IPOs have a higher percentage of sample firms that are listed on the Alternative Investment Market (AIM) (72.29% in total) comparing to those trading on the Official Listing (27.71% in total). However, unit firms are more concentrated on AIM (88.04%) than share-only IPO firms (66.67%). As a sub-market for smaller companies, the AIM market was established by the London Stock Exchange in 1995, with the intention that it should be a less costly route for smaller companies to raise capital with a more flexible regulatory system than is applied to the main market. Since then, the AIM market has continued to flourish, going from strength to strength. AIM was driving IPO growth, making it 'the natural market for smaller and many mid-cap companies'. Its popularity is rising, with overseas as well as UK companies appreciating the lighter regulatory touch and tax advantages. No requirement is made on the capitalisation or number of shares issued, which provide smaller firms the flexibility when floating shares. In 2005, 40 companies moved directly from the Main Market to AIM, whereas only 2 companies moved from AIM to the Main Market[17]. Considering that unit firms tend to be smaller, younger firms, it is not surprising that in my sample unit IPO firms are more concentrated on AIM than on the Main Market Official Listing.

In Panel C of TABLE 3.3 the sample IPOs are sorted by issue methods. Mudambi and Goergen (1999) investigate 240 IPOs of non-investment trust companies issued on the UK official List during the period of 1991-1995, and document a unique characteristic of the listing methods in the UK IPO market. They report that only 9 listings were pure offers whilst 98 listings were a mixture of placings and offers in their UK sample. They explain that in the late 80s placements became the favoured method to bring a company public to the market partially due to a

[17] London Stock Exchange AIM Fact Sheet 2005

relaxation of the placing rules.[18] Mudambi and Goergen (1999) also provide evidence that most of the small and medium sized companies in the UK choose placement for listing whist offers for sale tend to be adopted by larger firms. Goergen, Khurshed and Mudambi (2006) stipulate that the choice between public offers and placings has important implications in terms of who bears the risk of the issuing failing and of its costs. Their UK study find that firms with higher ex anti uncertainty are more likely to choose a placing contract, which is not necessarily underwritten by highly reputable sponsors and if the sponsor fails to place an agreed minimum number of shares then the placing is withdrawn. On the other hand, large and multinational firms tend to favour a public offer, in which reputable underwriters provide strict creditor screening and guarantee to pick up any unsold shares. In this UK unit study, the majority 82% of the 350 sample IPOs are issued through placing whist only 5% are issued through open offer (the rest 13% through a combination of placing and open offer). Such percentage distribution remains roughly the same in both the unit IPO and the share-only IPO subsamples, which suggest that the popularity of 'Placing' exist regardless of whether having warrants attached or not. Furthermore, after controlling for the combined 'Placing and Offer' issue method, fewer unit IPOs (4%) are issued through 'Offer' than share-only IPOs (5%) are. Such distribution in the sample is consistent with the evidence provided by Mudambi and Goergen (1999) and Goergen, Khurshed and Mudambi (2006). The sample firms' preference of issuing method can be explained by the contractual features of the two different issue methods and the characteristics of issuing firms themselves. A placing is a cheaper issuing method which popularly adopted by smaller companies. A placing of shares is usually sold to a selected group of large investors and any unsold shares are not guaranteed by underwriters. Unit firms are naturally younger smaller firms that will choose to issue their new shares through placing. The share-only IPOs also seem to share the preference for placing, possible due to the less

[18] The trend to use placings as a method of listing accelerated from 1986 onwards, when the London Stock Exchange increased the limit on the size of placings from £3 million to £15 million. Fro example the number of placings on the LSE increased from 3 in 1985 and 17 in 1986 to 46 in 1987.

expensive underwriting fees and more selective investors. On the other hand, an open offer has a wider ownership distribution being issued to both institutional and public investors and underwriters for an open offer, who take more commission fees, will bear the risk and cost for any unsold shares. Such issue method is therefore, more popular among larger and more prestigious companies.'

Sorted by industry groups (Panel D of TABLE 3.3), one outstanding feature of unit firms is the high concentration in mining industry. In my sample, 33.70% of the unit-IPOs are within the mining, resources, and energy industry group, which can be confirmed with the high concentration of AIM listing. The AIM market has proved particularly popular with mining and resource companies, but has attracted a whole range of entrants such as High Technology and IT. The high percentage of mining firms can also be explained by the nature of the mining industry. Most mining firms will issue an 'exploration lease' when any possible natural resources were proposed. The lease will only last for a limited period since the outcome of the project should become clear shortly after exploration. Such features of the mining and resources firms naturally encourage them to include warrants in the IPOs, so if the exploration succeeds, the second round of financing will go through; conversely, if the exploration failed, the further funding will fall through automatically to stop further loss. The similar high percentage of mining firms is presented in How and Howe (2001)'s study on Australian unit IPOs. Nevertheless, in Hong Kong, Mazouz et al. (2007) only document four mining firms in their sample. Such difference can be explained by the geographical locations of natural resources. Share-only IPOs have higher percentage of firms in all the other industry groups. Within the unit IPO sample, the second highest concentration is in the support service industry, then subsequently in the IT and High-tech industry.

INSERT TABLE 3.3 HERE

As illustrated in TABLE 3.4, whilst using market capitalisation and total asset as two proxies for firm size, it is obvious that unit firms are smaller than share-only IPO firms in every size quartile for both market value and book value. The mean market capitalisation at offer price for share-only IPO firms (£49.3 million) is more than twice as that of unit IPO firms' (£23.6 million). Unit firms' mean total asset one year prior to IPO is only £5.3 million comparing to share-only IPO firms' £15.7 million (nearly tripled). Such results confirm both the Agency Cost and Signalling hypotheses that unit firms are indeed smaller, comparing to share-only IPO firms. In examination of unit firms' profitability before the unit IPOs, the revenue and net income after tax are also sorted into quartiles. The results indicate that one year prior to the IPO, unit firms have significantly less sales in every quartile both before and after taxation than share-only IPO firms do, which is consistent with Schultz (1993b)'s prediction. In addition, this result also contributes to the Signalling hypothesis in that it is more difficult for investors to evaluate unit firms' profitability in the future, and therefore less profitable IPO firms signify future potential to investors by including warrants in the IPO.

Four quartiles of the IPO offer size are calculated. Unit IPOs raise much less gross proceeds than share-only IPOs do in every quartile. The mean gross proceeds for unit IPOs is only £6.5 million, while the mean gross proceed for share-only IPOs is about £16.6 million (nearly three times the unit IPO issue size). This outcome supports the Agency Cost argument that warrants are included in unit IPOs as a second stage of financing to reduce agency cost, therefore the size of initial offerings as the first round of financing to 'test the water' is intentionally limited comparing to share-only IPOs. In this way, managers of unit firms will have less free cash flow immediately after IPO and will be motivated to invest the initial proceeds in value-generating projects in order to trigger the exercise of warrants and materialise the second round of financing. The Signalling hypothesis made no prediction regarding offer size.

INSERT TABLE 3.4 HERE

3.5.2 Descriptive data and the differences between unit IPOs and share-only IPOs

According to both the Agency Cost and Signalling hypotheses, we expect that unit IPOs are preferred by younger ($H_{3.1}$), smaller ($H_{3.2}$), riskier ($H_{3.3}$) firms with lower insider ownership ($H_{3.5}$), less income ($H_{3.6}$), higher agency costs ($H_{3.7}$), and smaller offering size ($H_{3.8}$). To test the hypotheses set up in section 3.3, descriptive data to indicate firm characteristics is identified and calculated from the information collected for both the unit sample and the matching share-only IPO sample. The definitions of variables are summarised in TABLE 3.1 and descriptive results are illustrated in TABLE 3.5. The age of the firm (AGE), is defined as the number of calendar days between the firm incorporation date and the date of listing; in a few cases when the listing date is not available, the date when the trading of new shares commences is applied. The riskiness of the issuing firm (RISK) is measured by the standard deviations of after-market returns[19] spanning 200 days after the IPO, excluding the initial returns. The size of the firm is designated with both total asset (TTLASSET) and the market capitalisation (MKTCAP) at offering price immediately following the IPO. The total asset is collected from the balance sheet by the end of the fiscal year prior to the IPO and the market capitalisation is computed as the product of number of shares immediately after the IPO and the offer price. The size of the offering (PROCEEDS) is reported as the gross proceeds from the offering calculated by multiplying the number of new shares in the issue with the offer price. Insider ownership (INSIDER) is calculated as the percentage of the number of shares directors and senior management hold in the company to the enlarged share capital immediately following the listing. The number of shares under any executive option schemes is also taken into consideration in insider subscription. However, holdings of the company shares by common employees or any other companies are not identified as insider ownership. The profitability measure is the gross revenue (REVENUE) of IPO firms collected from the prospectus by the

[19] Since the standard deviation of aftermarket returns has become a widely accepted measure of risk in the IPO literature, it is also employed in this paper to mirror firm risk.

end of the fiscal year prior to the IPOs. (LEVERAGE) is the ratio of total debt to total assets, both collected from the prospectus as well.

In TABLE 3.5, the mean and median, minimum and maximum values of the descriptive statistics for both unit IPOs and matching share-only IPOs are compared. Student's *t*-tests and the non-parametric Mann-Whitney (MW) tests are undertaken to examine the significance level of difference in means and medians. The Pearson moment correlation coefficients between each pair of variables are calculated to measure degree of linear relationship between the two variables. The *p*-value of a two tailed hypothesis test of the correlation coefficient being zero is also presented in TABLE 3.5. Contrary to the Hypothesis 3.1 from Section 3.3 regarding firm age, the unit firms in the UK are in fact significantly older in both the mean (8.8 years) and median(1.1 years) age, comparing to the mean (3.4 years) and median (0.7 years) age of matching share-only IPO firms. (Hypothesis 3.1 is rejected).

Measured by the market capitalisation at offer price immediately following the IPO, unit firms are significantly smaller in firm size than share-only firms in both mean and median terms. The average market capitalisation of unit firms after IPO is £23.617 million, which is much lower than the average market capitalisation of share-only IPOs (£31.578 million). The difference is highly significant at 1% level. Another firm size measurement is the total asset by end of the fiscal year prior to the listing. The average total asset of unit firms is £5.325 million comparing to £9.772 million for share-only firms and the difference is marginally significant at 15%, which can be expected due to limited sample size. Nonetheless, by median values, unit firms are significantly smaller than share-only counterparts at 1% level indicated by the *p*-value from Mann-Whitney test. As a result, Hypothesis 3.2 cannot be rejected.

Firm RISK is estimated as the residual standard deviations of the sample firms using daily discrete returns for 200 days following the listing of the IPO (excluding initial returns). As

Hypothesis 3.3 predicted, unit IPO firms present significantly higher average standard deviations (Mean 0.045, Median 0.039) than share-only IPO firms (Mean 0.036, Median 0.033). The differences in both means and medians are highly significant at 1%. Thus, unit firms are indeed riskier than share-only IPO firms, which confirm both the Agency Cost and the Signalling hypothesis. Contrarily to the Agency Cost prediction, although unit firms appear to have lower insider ownership (mean 35.43%, median 33.57%) than that of share-only firms (mean 38.88%, median 38.83%), the difference in means and medians are not significant. As a result, Hypothesis 3.5 is not statistically supported by the UK data.

Measured by total revenue, the unit firms in the UK have less income prior to listing comparing to matching share-only firms, which is in line with the Agency Cost theory. The differences in means and medians are both significant at 5% level. The average revenue for unit firms is £5.462 million comparing to £10.648 million for share-only IPO firms. The less promising historical financial records reflecting higher level of uncertainty of the firm's profitability, which is consistent with the fact that unit firms are riskier than share-only IPO firms. Therefore, Hypothesis 3.6 proposed in Section 3.3 is not rejected.

Unit firms also exhibit much smaller issue size measured by the expected IPO proceeds. An average unit IPO can only raise £6.581 million before any expenses; whilst the average gross proceeds of share-only IPOs is £12.755 million, which is nearly twice the size of a unit offer. The difference in means is significant at 5% level as indicated by a Student *t*-test, whereas the difference in medians is highly significant at 1% level suggested by the *p*-value of a Mann-Whitney test. Therefore, Hypothesis 3.8 cannot be rejected. Expectedly, the total expenses of unit IPOs is also significantly lower than that of share-only IPOs.

Tested as one of this research's unique predictions (Hypothesis 3.14) on unit firm characteristics, unit firms also present lower leverage, calculated as the ratio of total debt to total asset (mean 47.3%, median 34.3%) than that of share-only IPO firms (mean 88.9%, median 66.2%), the differences in both means and medians are significant at 1% level. Therefore, the original Hypothesis 3.14 is supported by the UK data. The result on debt leverage before listing confirm that share-only firms are generally less risky with better historical trading records, and it is easier for them to secure cheaper debt financing with banks comparing to unit IPO firms that are not as creditable. It is therefore expected for unit firms to seek further financing after the IPO through exercise of warrants.

In conclusion, the descriptive statistics indicate that compared to share-only IPO firms, unit IPO firms in the UK are significantly smaller and riskier with less income prior to the IPOs, which confirms the common ground of both the Agency Cost and the Signalling hypotheses. Contrary to both hypotheses, my UK data does not support the common argument that unit firms are significantly younger than share-only IPOs. Unit IPOs also seemingly exhibit lower insider ownership than that of share-only IPOs but the difference is not significant and therefore unable to support the Agency Cost prediction. However, in unique support to the Agency Cost hypothesis, unit IPOs are significantly smaller offers than share-only IPOs are, which confirm the Agency Cost hypothesis that unit firms intestinally limit the size of the unit IPO proceeds so the managers will not have excessive free cash flow for careless investments. Instead, they only have enough money to start production and test the market. As a result, managers of unit firms are motivated to spend the proceeds carefully by only invest in value-generating projects so that the company's share price will increase to allow the exercise of warrants as the second round of financing. Considering the higher risk, naturally unit firms do not stand out as the best candidate for investors' choice. In such instance, including warrants in the IPO to form a staged financing can provide investors more open options for future involvement in the investments. If the unit firm enjoys better performance in the future, warrants will naturally be exercised and investors will be happy to be more involved with the company by holding more shares in it. If the unit firm suffers bad performance after the IPO, warrants will expire to protect investors' interest and no further involvement will occur.

INSERT TABLE 3.5 HERE

3.5.3 Direct tests of the Agency Cost and Signalling hypotheses

Following How and Howe (2001), the most straightforward test of the Agency Cost hypothesis is to examine whether unit IPO firms have a greater level of agency cost than share-only IPOs. The most straightforward test of the Signalling hypothesis is to see whether unit firms have higher levels of information asymmetry and therefore greater incentive to signal firm value than share-only firms do.

Following Ang et al. (2000), 'efficiency ratios' are employed as measures of agency cost. Three different efficiency ratios are calculated using data by end of the accounting year prior to the IPO: revenue divided by total asset (REV/TTLASSET), earnings before interest and taxes divided by total asset (EBIT/TTLASSET), and net income divided by total asset (NI/TTLASSET). The means and medians, minimum and maximum values of the three ratios with the *p*-values from both Student's *t*-test for means and the non-parametric Mann-Whitney test for medians are presented in Panel-A of TABLE 3.6. Results indicate that the first two efficiency ratios (revenue-to-total asset and EBIT-to-total asset) are significantly lower for unit IPO firms, suggesting lower levels of profitability and asset utilisation and therefore higher level of agency cost, comparing to those of share-only IPO firms. The third ratio of net income to total asset is still lower for unit IPOs, however the differences in means and medians are not significance at conventional level. Nonetheless, this paper provides partial support for the Agency Cost hypothesis with two efficiency ratios. It is safe to reason that unit firms exhibit significantly lower profitability and asset unitisation before listing than share-only firms matched on firm size and industry, therefore have more incentive to limit agency cost and encourage management to make optimal investment decisions by including warrants in their IPOs. Hypothesis 3.7 stating that unit firms have higher agency costs in terms of profitability and asset utilisation ratios than share-only counterparts cannot be rejected.

Following How and Howe (2001)'s direct test on the Signalling hypothesis, information asymmetry is measured as the residual standard deviations using daily discrete returns for 200 days following the listing (which is the same measure of RISK variable). The time lag as the number of calendar days between the registration of firm prospectus (i.e. when the information of a new issue is announced) and the listing of new issues (or the first trading day), is also calculated to proxy for the level of information asymmetry in the offering (DELAY). As shown in Panel-B of TABLE 3.6, unit firms present significantly higher residual standard deviations in both mean (0.045) and median (0.039) values than those of share-only firms (Mean, 0.036; Median, 0.033), suggesting unit IPOs are associated with higher level of information asymmetry. The *p*-values from both the Student *t*-test and the non-parametric Mann-Whitney test are highly significant at 1% level. Between registration of prospectus and commence of the trading (DELAY), unit firms on average experience longer time lag (13 days) comparing to that of share-only firms (10 days), the difference in means is significant at 5% level. The median days of delay between the announcement of IPO and the first trading day are both 7 days for unit IPOs and share-only IPOs. Such an outcome can be explained by the fact that unit firms tend to prolong the time lag between Prospectus publication and the listing day intentionally to convey more information on firm value. Overall, as predicted by Hypothesis 3.11 in this study, direct tests suggest that unit firms present higher levels of information asymmetry comparing to that of share-only offerings and therefore have greater motivation to signal the true firm value to the public by including warrants.

In conclusion, the direct test on Agency Cost hypothesis using three efficiency ratios provides partial support to Schultz (1993b) that unit IPO firms present much less efficient use of their total assets to generate profits and therefore have more agency problems, comparing to share-only IPO firms which exhibit higher efficiency ratios. On the other hand, the direct tests on the Signalling hypothesis provide conclusive support. The information asymmetry measured by the residual standard deviations indicates that unit firms suffer more asymmetric information and have more motivation to include warrants to signal true firm value. Such results are consistent with the signalling explanation (Hypothesis 3.11 cannot be rejected).

INSERT TABLE 3.6 HERE

3.5.4 Initial underpricing and short-term after-market performance of unit IPOs

Early research documents that initial public offerings are on average issued at a discount (Ibbotson, 1875; Ritter, 1984; and Welch, 1989). In other words, initial underpricing has been recognised as a feature of IPO in general. The Signalling hypothesis of Chemmanur and Fulghieri (1997) only predicts that the degree of underpricing will increase with firm riskiness, which is tested in the last section. More specifically, the Agency Cost hypothesis of Schultz (1993b) predicts that unit IPO firms are more underpriced than are share-only IPO firms. Schultz (1993b) interprets that firms tend to include warrants in their IPO when they suffer more agency cost and the value of their projects cannot be easily evaluated. In order to convince the investors to purchase their shares and participate in the company's future development, they choose to include warrants and to underprice their shares at the same time. To test whether unit IPOs are more underpriced than matching share-only IPOs, I examine both the initial returns and the short-term after-market performance of unit IPOs in comparison to share-only IPOs.

Following How and Howe (2001) and Jelic et al. (2001) I calculate the raw initial returns (IR_D1), HGSC Index-adjusted initial returns (IR_D2), and continuously compounded initial returns (IR_D3) on the first trading day (EQUATION 3.1-3.3 in Section 3.4) for both the unit IPOs and their share-only counterparts. The Hoare Govett Smaller Companies (HGSC) Index is chosen to adjust for general market movement. Since unit IPOs tend to be issued by smaller firms, HGSC Index as benchmark can account for firm size. As alternative underpricing measure for robustness check, I also calculated the weekly initial returns for the first trading week. IR_W1 in EQUATION 3.4 is the HGSC-adjusted first week initial returns, whereas IR_W2 in EQUATION 3.5 is the natural logarithm of market-adjusted weekly initial returns, both of which are calculated using the closing price on the fifth trading day relative to the IPO offer price.The mean, median, minimum, and maximum values with the standard deviations of each initial return measures are illustrated in TABLE 3.7 for 92 unit IPOs and 92 share-only IPOs matched on firm size and industry.

INSERT TABLE 3.7 HERE

Panel A of TABLE 3.7 illustrates the initial underpricing for the first trading day and first trading week before dealing with outliers. By all five IR measures, the UK unit IPOs exhibit significantly higher initial returns comparing to their share-only counterparts, in both their means and medians. The average raw initial return on the first trading day (IR_D1) for unit firms is 51.02% comparing to share-only IPO firms which average at only 7.55%; whereas the median raw initial return for unit IPOs is 25.00%, which is much higher than the 5.03% median for share-only IPOs. After adjusting for market movements from Hoare Govett Smaller Companies (HGSC) Index, the market-adjusted initial returns of unit IPOs (Mean 50.89%, Median 24.76%) are significantly higher than those of share-only IPOs (Mean 7.56%, Median 4.94%). As robustness check, IR_W1 measures the initial share price run-up during the first trading week relative to the offer price. The HGSC-adjusted weekly initial returns remain significantly higher for unit IPOs (Mean 47.09%, Median 21.59%) than for their matching share-only counterparts (Mean 17.58%, Median10.19). After comparing the first-day and first-week initial returns for both unit and share-only IPOs, a clear pattern can be recognised: after the first trading day the magnitude of underpricing decreased over the first week for unit IPOs whereas the initial returns of matching share-only IPOs inflated by the end of first trading week. Nonetheless, unit IPOs still remain significantly more underpriced than share-only IPOs. To correct for the high standard errors caused by extreme values of raw initial returns, I calculate the continuously compounded initial returns (EQUATION 3.3 and EQUATION 3.5). The log initial returns for both the first trading day (IR_D3) and first trading week (IR_W2) provide smoother results after controlling for extreme values by taking logarithm of the discrete returns.

The minimum, maximum values and the standard deviations in Panel A suggest possible outliers in the sample. The maximum raw initial return for unit IPOs is 431.25% whilst the minimum is -0.33%; and the standard deviation is 0.726. For matching share-only IPOs, raw initial returns range from -80% to 130% with standard deviation to be 0.290. To deal with possible bias from outliers, I ranked the initial returns, eliminated the top-5 and bottom-5 extreme values from the sample, and calculated the trimmed means and medians as robustness-test, the results of which are presented in Panel B of TABLE 3.7. After excluding outliers, the minimum and maximum values exhibit much smaller gaps with smaller standard deviations for both unit and matching share-only samples. The raw initial returns for unit IPOs vary between the maximum 183% and the minimum 4% with standard deviation of 0.390; whereas the raw initial returns for share-only IPOs range from the maximum of 39.76% and the minimum of -38.46% with a standard deviation of 0.143. All five underpricing measures remain highly significant with smaller magnitude in both the trimmed means and medians.

Overall, TABLE 3.7 strongly indicates that unit IPOs significantly outperform share-only IPOs on the first trading day and within the first trading week. The differences in both means and medians for all underpricing measures are significant at 1-5% level before and after dealing with outliers, which provide strong support to the Agency Cost hypothesis that unit IPOs are more underpriced than share-only IPOs.

To examine whether the abnormally high initial returns on the first trading day will sustain after the completion of IPOs, I also calculate the HGSC-adjusted buy-and-hold abnormal returns (BHAR) relative to the first trading day for 2, 7, 14, and 21 days in the after-market. The results of BHARs are presented in TABLE 3.8. Panel A illustrates the mean, median, minimum and maximum values of the HGSC-adjusted BHARs before dealing with outliers. Two days post-listing, the average HGSC-adjusted buy-and-hold return for unit sample is 9.2% comparing to the 3.49% for matching share-only sample. The difference in means is significant at 5% level. The 7-day interval generates very similar result as the 2-day interval. It is safe to conclude that unit IPOs are still significantly more underpriced than share-only IPOs one week post-listing. When the interval is extended to 14 days and 21 days post-listing, the unit IPOs still appear to outperform share-only IPOs matched on size and industry. However, the differences are only significant in median values. Nonetheless, Panel A of TABLE 3.8 presents clear evidence that up to three weeks after the completion of going public and the first trading day, unit IPO firms still experience significantly higher abnormal returns than those of matching share-only IPO firms.

The minimum and maximum values from Panel A of TABLE 3.8 suggest possible bias from extreme values. Unit 2-day BHARs vary between the minimum -32.43% and maximum 74.38% whilst the share-only counterparts range from the minimum -23.33% to the maximum 145.01%. By the end of the third week after the initial trading day, unit 21-day BHARs has the minimum of -40.88% and the maximum of 174.39%, whereas the share-only counterparts demonstrate much bigger gap between the minimum of -25.76% and the maximum of 220.84%. To deal with the outliers, Panel B exhibits the trimmed means and medians of BHARs after eliminating the top-5 and bottom-5 extreme outliers from the original sample, after which the gaps between minimum and maximum values decreased substantially. For all short-term intervals, unit IPOs keep outperforms their share-only counterparts 21 days into the after-market. The differences in trimmed means and medians for all intervals remain statistically significant at conventional levels.

INSERT TABLE 3.8 HERE

In conclusion, with UK data, this paper provides strong evidence that underpricing exists for both unit and share-only firms at the time of IPOs. Furthermore, in support of the Agency Cost hypothesis, unit IPOs indeed experience significantly greater underpricing than that of share-only IPOs on the first trading day and within the first week of trading. Furthermore, the positive abnormal returns persist for at least three weeks after the completion of IPOs. For the after-market 2, 7, 14 and 21-day BHAR returns, unit IPO firms still significantly outperform their share-only counterparts matched on firm size and industry. However, the magnitude of underpricing declined significantly. Overall, both the initial underpricing and the short-term after-market performance post-listing provide strong support to Agency Cost hypothesis that unit IPOs are more underpriced than share-only IPOs. Therefore, Hypothesis 3.9 cannot be rejected.

3.5.5 Determinants of underpricing

The Agency Cost hypothesis predicts that firms tend to issue unit offerings when the value of their potential investments cannot be easily valued by the public investors; and these firms tend to suffer higher agency cost. Schultz (1993b) found evidence that unit IPOs are issued by smaller, younger firms that have fewer assets and income than firms that choose share-only IPOs. Welch (1989) argues that management has information about firm value that cannot be noiselessly conveyed to the public, suggesting asymmetric information about firm value will encourage firms to underprice their IPOs to signal their value and expect to recoup the costs of underpricing by receiving a higher price for future seasoned offerings. All of these factors are consistent with greater uncertainty about the prospects of firms that issue units. Therefore, underpricing models based on uncertainty and asymmetric information about the firm's value implies that, all else being equal, unit IPOs should be more underpriced than share-only IPOs.

To more closely test the relation between the type of IPO and underpricing, an Ordinary Least Square regression is conducted with the HGSC-adjusted first-trading-day initial returns (IR_D2) as the dependent variable (EQUATION 3.7). Selected independent variables are included in examination of several empirical findings of determinants of IPO underpricing. UNIT dummy is firstly included to indicate offer types. Managers of smaller, less profitable firms might have to sacrifice higher discount in order to convince investors to purchase their shares. I therefore, include the ASSET/PROCEED and REV/PROCEED variables in measurement of the size and profitability of the issuing firm. Both variables are expected to be negatively related to the degree of underpricing. The debt component of an issuing firm can be required to support a company's operation and/or expansion. On one hand, lower debt leverage can put more pressure on issuing firm to underprice the equity issue more to raise the fund needed. On the other hand, larger debt leverage might indicate more desirable investment opportunities are present and the issuing firm might be in need for more equity funding. In turn, the IPO will need to be more underpriced to assure subscription. Therefore, I also include a DEBT/PROCEED variable to detect any association between the leverage of the issuing firm and the degree of underpricing of the IPO. ASSET/PROCEED, REV/PROCEED and DEBT/PROCEED are the total asset, total revenue and total debt of IPO firms prior to listing, all standardised by gross proceeds of the IPOs. The market-to-book ratio (MK2BK) is another indicator of firm size. It is computed as market capitalisation at the offering price divided by the total asset of the firm one year prior to the IPO. The size of the offering is determined as the natural logarithm of expected gross proceeds, noted as Ln(PROCEED). The dummy variable REPUTATION is employed to assess the prestige of underwriters, which brought the underlying company public; the variable takes the value of 1 if the underwriter has a high reputation ranking, 0 if otherwise[20]. Schultz (1993b) predicts that reputable underwriters are associated with less underpricing and therefore the REPUTATION dummy is expected to be negatively related to the degree of underpricing.

The OLS regression results are illustrated in Panel A of TABLE 3.9. UNIT dummy is positively related to the initial underpricing on the first trading day, suggesting that unit IPOs are substantially more underpriced than share-only IPOs. The positive coefficients on UNIT dummy remain highly significant at 1% level through out the group of regressions.

The first column presents an estimate when all variables are included in the regression. The standardised size (ASSET/PROCEED), profitability (REV/PROCEED), and debt leverage (DEBT/PROCEED) of issuing firms prior to listing and the REPUTATION of underwriters are all negatively and significantly related to the degree of underpricing on the first trading day, suggesting that firms with less asset, lower income, and less debt financing experience higher level of underpricing. Such results are consistent to Agency Cost theory that unit firms, which are smaller firms with less sales record prior to the IPO, are more underpriced than share-only IPOs. On the other hand, the market-to-book ratios and the size of the offerings (Ln(PROCEED)) are not significant determinants of the degree of underpricing, although the negative signs of coefficients are as expected.

[20] The reputation ranking is determined following Jelic (2008), in which a list of all financial institutions involved in 4,807 previously identified listings in the UK primary market is created. The number underwriting deals in which a bank played leading underwriting and/or advisory roles are identified to proxy for their reputation; and the top 5% of these banks are selected as having a high reputation ranking.

Regression 2 focuses on the profitability of the IPO firms in relation to the degree of underpricing. The efficiency to earn income measured by the ratio of total revenue to gross proceeds (REV/PROCEED) is regressed against the degree of initial underpricing, after controlling for the firm size (MKT2BK) and the offer type (UNIT). The standardised revenue is negatively related to the degree of underpricing and significant at 1% level. The result supports the argument that IPO firms, which have worse profitability, generate higher initial returns, which is in line with the Agency Cost hypothesis. IPO firms' degree of leverage measured by the ratios of total debt and asset to gross proceeds, and the market-to-book ratio are highlighted in Regression 3. Results indicate a negative relation between IPO underpricing and all three leverage ratios. Firms with less total assets and total debt relative to gross proceeds are significantly more underpriced. However, the coefficient on MKT2BK ratio is not significant at conventional level. Regression 4 emphasises on the features of the offerings by including variables indicating offer type (UNIT), market-to-book ratio (MKT2BK), offer size (Ln(PROCEED)), and the REPUTATION of underwriters. Coefficient on UNIT dummy remains significantly positive whereas a significant (at 10% level) negative relationship is confirmed between the degree of underpricing and the REPUTATION of underwriters, implying that IPOs marketed by less reputable underwriters are more underpriced than those which were brought public by more prestigious underwriters. The log gross proceeds do not have significant impact on the degree of underpricing when both unit and share-only IPOs are examined jointly.

Regression 5 summarises all the significant variables from the previous regressions. Overall, results from OLS regressions on the determinants of underpricing provide partial support to the Agency Cost hypothesis. A positive and highly significant relation between the UNIT dummy and the first-trading-day initial underpricing (IR_D2) is confirmed throughout all five regressions in strong support to Schultz (1993b)'s prediction that unit IPOs are more underpriced than share-only IPOs. Significantly negative coefficients on the standardised total assets, revenue, total debt, and the REPUTATION dummy are found, implying the degree of underpricing decrease in the size, profitability, debt leverage of issuing firms and reputation of the underwriters. The above outcomes are all consistent with the Agency Cost hypothesis. However, the OLS regressions do not support any statistically significant impacts on underpricing from the issue size (Ln (PROCEED)), and MKT2BK ratio.

Due to limited size of the unit IPO sample, potential omitted variable problem is suspected that decision to issue unit IPO is connected with unobservable factors in addition to the degree of underpricing. Therefore, I conduct a group of 2-Stage Least Square regressions using the same variables as in OLS regression. The UNIT dummy is selected as the instrumented variable in a first-stage regression (EQUATION 3.8). The instrument variables include: insider holding (INSIDER), firm riskiness (RISK), time lag between Prospectus publication and listing (DELAY), MINING industry dummy, POST2000 listing year dummy, firm age (AGE), total asset (TTLASSET), total debt (TTLDEBT), and net income (NI) of issuing firms prior to the IPOs, all of which are factors that may affect a firm's decision on offer type (UNIT). The instrumented offer-type dummy noted as 'Inst.UNIT' is then included in the second stage regression to test any relationship between the degree of underpricing and the offer type.

Panel B of TABLE 3.9 reports 2-Stage Least Square (2SLS) regression results using EQUATION 3.9 and the subsets of its variables. In comparison to Panel A, the 2SLS results are largely consistent to the OLS results. The coefficients on instrumented UNIT dummy remain positive and significant at 1% level for all five 2SLS regressions, indicating robustness of the model on the prediction that unit IPOs are more underpriced than share-only IPOs. The standardised firm size (ASSET/PROCEED), standardised profitability (REV/PROCEED), and the REPUTATION of underwriters are still significantly and negatively related to the degree of underpricing, with minor changes in magnitude and significance level of the coefficients. The debt-to-proceed ratio in the 2SLS regressions ceased being significant, whist the market-to-book ratio become significant determinant of the degree of underpricing. The log gross proceed measuring issue size remain insignificant. Overall, the TABLE 3.9 provide some support to the Agency Cost hypothesis that IPOs issued by smaller firms with less earning and debt component are more underpriced than those issued by bigger firms with higher profitability and debt leverage. In addition, IPOs marketed by more reputable underwriters are underpriced less than those brought public by more prestigious underwriters. Most importantly, unit IPOs are significantly more underpriced than share-only IPOs.

Robustness check on the models in TABLE 3.9 is carried out by using the first-week initial return (IR_W1) as the alternative underpricing measure, which provides very similar conclusions comparing to the original regressions using IR_D2. Both underpricing measures indicate that the offer type is positively related to the degree of underpricing and the UNIT dummy remains highly significant at 1% level. In other words, unit IPOs are significantly more underpriced relative to the offer price than share-only IPOs on both the first trading day and the first trading week. However, there are noticeable changes in magnitude and significance level of the coefficients. On one hand, the issue size (ln (PROCEED)) does not have statistically significant impact on the degree of underpricing when the first-day initial return (IR_D2) is used as the independent variable; whereas when the first-week initial return (IR_W1) is used as the alternative measure of underpricing, the coefficient on the Ln(PROCEED) variable becomes significant at 10% level indicating that smaller issues are more underpriced. On the other hand, a significant negative relationship was supported by the first-day initial underpricing (IR_D2) and the debt leverage of the issuing firm in the OLS regression in TABLE 3.9; however, the DEBT/PPROCEED leverage ratio, despite having the same negative signs, become insignificant determinant in both the OLS and 2SLS regressions when the first-week initial returns (IR_W1) is used as the alternative underpricing measure. Such differences are expected since the first trading day normally involves high volatility in trading volume and therefore the underpricing could be abnormally high (or low). Overall, the initial underpricing in the UK is a common IPO feature shared by both unit and share-only IPOs. However, as the Agency Cost hypothesis predicted, unit IPOs are significantly more underpriced than share-only IPOs.

Ordinary Least Square:

$$\begin{aligned} IR_d2_i = {} & \beta_0 + \beta_1 UNIT_i + \beta_2 (ASSET/PROCEED)_i + \beta_3 (REV/PROCEED)_i + \beta_4 (DEBT/PROCEED)_i \\ & + \beta_5 MKT2BK_i + \beta_6 Ln(PROCEED)_i + \beta_7 REPUTATION_i + \xi_i \end{aligned}$$

EQUATION 3.7

2-Stage Least Square:

Stage One:

$$\begin{aligned} \mathrm{UNIT}_i = {} & \alpha_0 + \alpha_1 INSIDER_i + \alpha_2 RISK_i + \alpha_3 DELAY_i + \alpha_4 AGE_i + \alpha_5 TTLASSET_i + \alpha_6 TTLDEBT_i \\ & + \alpha_7 NI_i + \alpha_8 \mathrm{MINING}_i + \alpha_9 \mathrm{POST2000}_i + \xi_i \end{aligned}$$

EQUATION 3.8

Stage Two:

$$\begin{aligned} IR_d2_i = {} & \beta_0 + \beta_1 Inst.UNIT_i + \beta_2 (ASSET/PROCEED)_i + \beta_3 (REV/PROCEED)_i + \beta_4 (DEBT/PROCEED)_i \\ & + \beta_5 MKT2BK_i + \beta_6 Ln(PROCEED)_i + \beta_7 REPUTATION_i + \xi_i \end{aligned}$$

EQUATION 3.9

INSERT TABLE 3.9 HERE

3.5.6 Warrant characteristics and underpricing of unit IPOs

3.5.6.1 Warrant characteristics

Warrants are included in over one-fifth of US IPOs (Schultz, 1993b) and in over one-third of Australian IPOs (How and Howe, 2001). In the unit IPO literature, most studies debate on whether issuing firms include warrants to reduce agency costs (Schultz, 1993b) or to signal firm value (Chemmanur and Fulghieri, 1997). Yet, very few papers provide in depth discussion on the characteristics of the warrants attached in unit IPOs. These warrant characteristics vary significantly across unit offerings (Garner and Marshall; 2005). Panel A of TABLE 3.10 summarises the characteristics of warrants attached to unit IPOs in the UK, with their mean, median, maximum and minimum values and standard deviations. The average LIFE of UK warrant is 4 years. The average warrant exercise price is £0.46 comparing to the average offer price of £0.44. The UK data provide support to Schultz (1993b)'s prediction that warrant exercise price is set above the offer price. Such result is confirmed by the average ratio of exercise price to offer price (PRATIO=1.25), implying UK unit firms on average, have 4 years to arraign a 25% appreciation in its share price in order to realise the additional inflow of equity capital from exercise of warrants. A PRATIO higher than 1 indicates that warrants are issued out-of-money, with their exercise price set above the offer price. In other word, these warrants will have no value until the share price rise above the warrant exercise price in the aftermarket. Consistent with the Agency Cost hypothesis, unit firms in the UK commonly set the warrant exercise price above the offer price of the unit IPO. In order to trigger the exercise of warrants and materialise the second round of financing, the management of the issuing firm will be motivated to increase the company's share price. On average 13.98 million warrants are issued along with a unit IPO in the UK, representing 54.08% of the new shares issued. In addition, the average firm value sold as warrants, calculated as the proceeds from exercise of warrants divided by the market capitalisation at offer price immediately after the unit IPO, is 15.02% in the UK.

As illustrated in Panel B of TABLE 3.10, certain warrant characteristics vary significantly across different unit offerings. 44.56% of the UK unit IPOs issued warrants whose exercise period is equal to or longer than 5 years but only 9.78% of warrants' life is less than a year. Only 13.04% of these warrants are in fact issued in-the-money with immediate value after issuance, whereas 32.61% of warrants have their exercise prices set above the offer price; but

54.35% of the sample is issued on-the-money with equal exercise price and IPO offer price. Interestingly, not all warrants have fixed exercise price for their entire life. In fact, more than half (56.52%) of the UK warrant contracts enclosed a provision for issuing firms to reserve the rights to change the warrant exercise price after issuance if certain criteria were met.[21] Moreover, before the expiration 26.09% of UK warrants are callable by the issuing firms, although the majority of the sample (73.91%) is not. The dummy variable CALLABLE is motivated to take the value of 1 if the unit IPO have callable warrants attached, 0 if otherwise. Later on, the CALLABLE dummy is included in regression analyses in relation to the underpricing of unit IPOs. Last but not least, the eventual outcomes of the warrants are classified. Only 16.30% of UK warrants are actually 'exercised', that is, the issuing firm announced such action after issuance on their websites. 58.7% of the warrants are considered 'lapsed', with no announcement made about exercising the warrants before or at the expiration date. Since the UK unit IPOs in my sample date up to the year 2007, by the time of this research there are still 25% warrants outstanding with the potential to be either exercised or lapse eventually.

INSERT TABLE 3.10 HERE

In TABLE 3.11, selected warrant features are compared across UK, Australia and the US. Evidently, warrants from different countries share some similar characteristics, whilst others differ. Firstly, warrants attached to unit IPOs in both Australian (2.8 years) and the UK (4 years) are shorter lived than US warrants (5 years) on average, although UK warrants still have longer exercise period than Australian counterparts. Secondly, in the US, warrants are 'typically issued out of the money' (Howe and Howe, 2001). Schultz (1993b) records that the exercise price of warrants is on average 25% above the issue price. Whereas Australian

[21] Due to limited availability of data at the time of this research, the 'direction' of the change in warrant exercise price is not discussed in this thesis. A reduction and an increase in warrant exercise price are expected to have different effects. Future research interests are welcome.

warrants are commonly issued on the money with the exercise price equal to the IPO offer price. In the UK, the average ratio of warrant exercise price to IPO offer price is the same as US figure (1.25). However, only 32.61% are issued strictly out of the money, whilst 54.35% are issued on the money. The third feature in comparison is the share-per-warrant ratio, which indicates number of shares per warrant in a unit. In both Australia and the US, it is the convention that a unit is combined with one new share and one warrant; whilst in the UK, a unit on average contain two shares and one warrant. That is to say, for every two shares an investor subscribe there will be one warrant attached bearing the right to buy another share in the future at exercise price. In addition, the ratio of warrant proceeds to IPO proceeds is also compared across countries. Schultz (1993b) documents that in the US, the warrant proceeds (if they were ever exercised) take up 75% of the IPO proceeds. How and Howe (2001) record that the ratio of warrant proceeds to IPO proceeds in Australia is on average 58%. The UK data indicate that the potential proceeds from exercise of warrants represent roughly 61% of the IPO proceeds. Furthermore, Australian warrants are not callable at all but most US warrants are (How and Howe, 2001). In my UK sample, 26.09% warrants are callable but the majority is not. Last but not least, the inclusion of any embedded B-warrant is observed and compared. In some unit IPOs, when the attached warrants are exercised, additional warrants, i.e. the B-warrants will be automatically issued to warrant holders. As the statistics indicate, in Australia and the UK, unit warrants rarely include embedded B-warrants but Schultz (1993b) documents that approximately 25% of the warrants attached to US unit IPOs contain B-warrants. Such provision creates a three-stage sequence of financing: the IPO proceeds, the exercise of the A warrants, and the exercise of the B warrants. How and Howe (2001) explain that in some industries, multiple stages of financing is necessary. For instance, the IPO proceeds can be used to support product development; the A warrant proceeds can be materialised to fund test marketing; and if the production and marketing proved to be successful, the B warrant can then be the third round of cash infusion to finance the full scare production and sales. The near absence of embedded B-warrants in Australia and the UK may be due to the different investment opportunity set compared to what US firms are subject to.

INSERT TABLE 3.11 HERE

3.5.6.2 The underpricing of unit IPOs

The underpricing of the unit IPOs, measured by the HGSC-adjusted initial return on the first trading day (IR_D2), are tested separately in association of selected characteristics of the issuing firms and the attached warrants. Four regressions using EQUATIONS 3.10 and the subsets of its variables are reported in TABLE 3.12. Firm value sold as warrants (VALUE) is calculated as warrant proceeds at exercise price divided by the enlarged capitalisation after IPO. The LIFE of warrants is the number of years between warrants issuance and expiration. As motivated in Hypothesis 3.16, the maturity of warrant is expected to be negatively related to the underpricing of unit IPOs. PRATIO is included to proxy for the issuing firms' choice of exercise price comparing to the IPO offer price and is predicted to be negatively related to initial returns of unit IPOs (Hypothesis 3.17). According to the Agency Cost hypothesis, I would expect that most warrants to be issued out-of-money, to create incentive for management to reduce agency cost and boost company's share performance – because the attached warrants as the second round of financing will only be exercised when the company's share price exceeds the warrant exercise price. Several dummy variables are included: CALLABLE dummy is predicted to be positively related to IR_D2, in test of Hypothesis 3.18, whilst REPUTATION and AIM dummy variables are included to control for underwriters reputation (Hypothesis 3.4) and the listing locations (Hypothesis 3.15) of unit IPOs, both of which are anticipated to be negatively related to the degree of underpricing. The distribution of unit IPOs by year and industry in TABLE 3.3 indicate clear clustering in listing year post 2000 and in the mining industry group. The industry-effect dummy MINING is therefore included to take the value of 1, if the underlying company belongs to the mining or natural resources industry sector; 0 if otherwise. In mining industry, the outcome of exploration and the performance of issuing firms largely depend on the location and existence of natural resources. How and Howe (2001) stipulate that the mining firms typically own a short-lived 'exploration lease', and the proceeds from the unit offering are used for a detailed geological assessment of the field(s). If the field shows a sufficiently high concentration of minerals, the firm will need additional financing soon after the IPO and the warrants will be exercised. Otherwise, the warrants will be leave to. High volatility and risk are expected in this sector of the IPO market. As result, to persuade investors to bear the extra risks involved in mining industry, I expect IPOs issued by mining firms will be more underpriced than issues from other industry sectors. The year-effect dummy POST2000 divides the sample period into two groups. It is set to equal 1 if an IPO is issued during the period 2000-2006; 0 if an IPO is issued during the period 1994-1999. Since both the Internet Bubble and the Bio-Tech Bubble took place post 2000, I predict that IPOs issued during the sample period 2000-2006 will be more underpriced than IPOs issued during the comparison period 1996-1999.

The results from the regressions are presented in TABLE 3.12. Regression 1 includes all the variables; results indicate that the initial returns of unit IPOs significantly increase when the issuing firms are riskier (RISK) with larger fraction of INSIDER holding prior to the listing. In addition, unit IPOs with CALLABLE warrants attached are significantly more underpriced on the first trading day than those with non-callable warrants attached. On the other hand, the debt LEVERAGE of issuing firm prior to listing, firm VALUE sold as warrants, the underwriter REPUTATION and the listing on AIM market are all negatively and significantly related to the initial returns of unit IPOs on the first trading day. The coefficient on LIFE of warrants is negative whereas the PRATIO of warrant exercise price to IPO offer price is found to be positively related to the degree of underpricing. However, the coefficients of both variables are not statistically significant. The coefficients on MINING and POST2000 dummies are both positive but not significant in any regressions and therefore, the listing year and industry effect do not theoretically affect the underpricing of unit IPOs.

In the second regression, I focus on variables that feature warrant characteristics. The firm VALUE sold as warrants is negatively related to the initial returns of unit IPOs whilst the callability of warrants (CALLABLE) is positively related to underpricing of unit IPOs. Both estimates are significant at 5% level. Results imply that unit IPOs with higher firm value assigned to warrants are less underpriced and unit IPOs with callable warrants attached are more underpriced. The ratio of warrant exercise price to offer price (PRATIO) and warrant LIFE remain insignificant at conventional levels.

Regression 3 tests all the dummy variables in relation to underpricing. The CALLABLE is positively related to the dependent variable whilst the REPUTATION and AIM dummy variables are significantly negative. Such results imply that callable warrants result in higher underpricing in unit IPOs whereas more prestigious underwriters and the listing on the Alternative Investment Market (AIM) are associated with less underpricing. On the other hand, the mining-industry effect and the year of issues do not affect the underpricing of unit IPOs significantly. Finally I group all the significant variables in Regression 4. Results confirm that the significance level and the signs of the variables are robust. The Adjusted R^2 are all relatively small for the regressions, which can be explained by the limited sample size. However, all four regressions have significant F-statistics, which substantiates the robustness of the tests results.

To further check for robustness of the regression, alternative underpricing measure IR_W1 is used as the dependent variable, which is HGSC-adjusted first-week initial return relative to the IPO offer price. The robustness check using IR_W1 as the dependent variable provides very similar evidence as the regressions using IR_D2 with minor changes in the magnitude and significance level of the coefficients, the results of which is presented in APPRENDIX II.

In conclusion, the linear regression analysis of underpricing for unit IPOs provide partial support to both the Agency Cost hypothesis and bring forth several unique predictions of this thesis. Firstly, consistent with the Agency Cost hypothesis, unit firms tend to underprice the new shares more when there is higher level of insider holding, higher firm riskiness, lesser proportion of firm value sold as warrants[22]; and/or when the unit IPOs are issued by less reputable underwriters. However, the mining-industry effect does not affect the degree of underpricing in unit IPOs, which fail to support Schultz (1993b)'s prediction. Secondly, debt leverage is found to be negatively and significantly related to the initial return on the first trading day[23], which is in line the first unique prediction of this thesis (Hypothesis 3.14). Thirdly, AIM dummy is significantly negative; implying that unit IPOs listed on the Alternative Investment Market is less underpriced than unit IPOs listed on the Official Listing, which contradicts Hypothesis 3.15. Such outcome may be explained by the fact that unit IPO firms, being smaller, riskier, and less profitable prior to listing, will encounter more competitors with better quality on the Official Listing, which has stricter listing requirements comparing to AIM. As a result, unit IPOs issued on the Official List will be more pressurised to underprice their new shares in order to attract subscription interests. Furthermore, none of the warrant LIFE or the PRATIO of warrant exercise price to IPO offer price significantly affect the degree of underpricing in unit IPOs and therefore the UK data fail to support predictions in Hypothesis 3.16 and 3.17. Last but not least, evidence is found that unit IPOs with callable warrants attached are more underpriced than their non-callable counterparts, which is consistent with Hypothesis 3.18 of this thesis. The possibility of a warrant call and

[22] The firm VALUE sold as warrants is only marginally significant in the robustness test with alternative underpricing measure IR_W1 (APPENDIX II)

[23] The LEVERAGE of unit firms prior to listing becomes only marginal significant in the robustness check when the alternative underpricing measure (IRW1) is adopted (APPTENDIX II).

the likely use of the exercise proceeds add further uncertainty to future involvement with the issuing firm and increase the agency costs of managerial discretion, especially if the issuing firm lacks good investment opportunities or has high debt capacity. Investors therefore, consider a callable warrant less favourable concerning that the proceeds might be misapplied.

$$IR_D 2_i = \alpha_0 + \alpha_1 \text{INSIDER}_i + \alpha_2 RISK_i + \alpha_3 LEVERAGE_i + \alpha_4 PRATIO_i + \alpha_5 VALUE_i + \alpha_6 LIFE_i$$
$$+ \alpha_7 \text{CALLABLE}_i + \alpha_8 REPUTATION_i + \alpha_9 \text{AIM} + \alpha_{10} MINING + \alpha_{11} POST2000 + \xi_i$$

EQUATION 3.10

INSERT TABLE 3.12 HERE

3.5.7 Choice of offer type

To test the determining factors of firms' decision to choose unit, I employ a probit model (EQUATION 3.11) using the UNIT dummy as the dependent variable. The independent variables are firm characteristics prior to the listing. In test of the previous findings that smaller, younger, and riskier firms tend to choose unit IPOs instead of share-only IPOs, the variables of firm AGE, TANGIBLE asset, and firm riskiness are included in the probit regressions. The Agency Cost hypothesis also argues that firms with lower insider ownership and more agency problem include warrants to create monitoring incentives. The variable of INSIDER ownership and the efficiency ratio of EBIT to total asset (EBIT/TTLASSET) are therefore included as proxies for agency costs. In examination of the Signalling explanation for including warrants, DELAY is included as measurement of asymmetry information. The LEVERAGE of issuing firm prior to the listing is also adopted in test of Hypothesis 3.14 that unit IPO firms have lower leverage than share-only IPO firms. Investigating whether the industry effect and the listing location have any impact on the firms' decision of offer type, the MINING and AIM dummy are incorporated in the regression as well.

$$\text{UNIT} = \theta_0 + \theta_1 AGE + \theta_2 TANGIBLE + \theta_3 RISK + \theta_4 INSIDER + \theta_5 (EBIT / TTLASSET) + \theta_6 DELAY$$
$$+ \theta_7 LEVERAGE + \theta_8 MINING + \theta_9 AIM + \zeta_i$$

Equation 3.11

Estimates of the probit regression and regressions that use subsets of the variables are illustrated in TABLE 3.13 reporting the marginal effects[24] of these variables on the choice of offer type. The first column (Regression 1) presents variables in test of the common predictions of both the Agency Cost and the Signalling hypotheses. Consistent with both theories, firm size measured by the TANGIBLE asset is negatively related to the UNIT dummy, whilst the firm riskiness is positively related to the UNIT dummy. Both results are highly significant at 1% level. The marginal coefficients of these variables indicate that with 1% decrease in firm size and 1% increase in firm riskiness, the probability of firms choosing unit IPOs will increase by 0.01% and 367.39%, respectively. It is apparent that firm riskiness has much greater impact on the firms' decision to issue unit IPOs than firm size has. Unexpectedly, the age of firm is positively related to the UNIT dummy, indicating higher chances of a unit offering to be issued among older firms. Despite being statistically insignificant, such estimate is contrary to the previous findings of the US studies by both Schultz (1993b) and Chemmanur and Fulghieri (1997) stating that unit firms tend to be younger in age comparing to share-only IPOs. The same positive relationship between firm age and underpricing is also found in linear regressions in this UK study (Section 3.5.5).Therefore, firm age is not necessarily the distinguishing factor that affects the choice to issue unit IPOs instead of share-only IPOs in the UK.

Regression 2 highlights predictions exclusively motivated by the Agency Cost hypothesis. Results indicate that the fraction of insider holding (INSIDER) and the efficiency ratio of EBIT to total assets (EBIT/TTLASSET) are negatively related to the UNIT dummy and are both significant at 10% level. The marginal effects of these variables indicate that with 1% decrease in insider holding and the efficiency ratio, the probability of a firm choosing to issue unit IPO will increase by 10.89% and 1.70%, respectively. Schultz (1993b) also predicts that

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[24] STATA reports marginal effects for all predictors but not for the constant terms. Therefore, the intercepts of regressions presented in TABLE 3.13 is estimated coefficients.

mining firms are more likely to choose unit IPOs over share-only IPOs, which is confirmed by the significantly positive coefficient on the MINING dummy in Regression 2. The marginal effect of 1% increase in the probability of a firm being in the mining industry increase the likelihood of unit IPO issuance by 19.42%.

Regression 3 focuses on testing the Signalling hypothesis. Firm RISK, INSIDER holding, DEALY between prospectus publication and listing date are proxies for information asymmetry in previous studies (Chemmanur and Fulghieri, 1997; How and Howe, 2001, etc.). Riskier firms with lower insider holding are expected to suffer higher information asymmetry; these firms will tend to prolong the time lag between prospectus publication and the final listing strategically to convey more information before the first sale of new shares. The industry dummy MINING and the listing location dummy AIM are also included to reflect level of information asymmetry. Being in mining industry and/or listed on AIM, implies higher uncertainty in firm value and hence more difficult for public investors to assess. Results from Regression 3 indicate that RISK, DELAY, MINING, and AIM are all positively related to the UNIT dummy at 1% significance level; whereas INSIDER holding is negatively and significantly related to the UNIT dummy at 5% level. These results are consistent with the Signalling predictions that firms with higher level of information asymmetry are more likely to include warrants in IPOs as a signal of firm value.

Regression 4 examines any impact on issuing firms' choice to include warrants, from the two firm characteristic variables originally motivated from this thesis: the LEVERAGE of issuing firm prior to the IPO, and the listing location dummy AIM. In Section 3.3.4, Hypothesis 3.14 and 3.15 are promoted to compare these two firm characteristics between unit IPOs and share-only IPOs. Descriptive statistics in Section 3.5.2 provide evidence that unit IPO firms tend to have statistically lower leverage prior to listing and are more concentrated on the

Alternative Investment Market (AIM) than share-only IPO firms do. In Regression 4 these two features of issuing firms are regressed against the choice of offer type, i.e. the UNIT dummy. The MINING dummy variable is also included to control for any industry effect since the distribution of unit IPOs by industry in TABLE 3.3 indicates clear clustering in the mining industry group[25]. Results of Regression 4 illustrate that the listing location dummy AIM is positively related to the UNIT dummy and the *p*-value is highly significant at 1% level. Such result implies that 1% increase in the likelihood of issuing firms being listed on AIM instead of the Official Listing can marginally increase the probability of these firms choosing unit IPOs instead of share-only IPOs by 21.96%. The coefficient on the industry dummy MINING is also positive and significant at 1% level. Despite the coefficient on LEVERAGE having a negative sign as Hypothesis 3.14 predicted, the marginal effect is not significant at conventional level.

Regression 5 includes all the predictors of EQUATION 3.11 as robustness check for the results of previous regressions. Consistent with the results from Regression 1–4, most variables are significant except for LEVERAGE, which remains statistically insignificant. Overall, the probit regressions support the following arguments: (1) Consistent with the common predictions from both the Agency Cost and the Signalling hypotheses, the probability of a firm choosing to issue unit IPOs (instead of share-only IPOs) increases when the issuing firm is small and risky. (2) Contrary to the results from US studies of unit IPOs (Schultz, 1993b; Chemmanur and Fulghieri, 1997), in the UK, the probability of firms choosing to include warrants in fact increase with firm age, although not significantly. (3) In support to the Agency Cost hypothesis, firms are more likely to include warrants in their IPOs when the proportion of insider holding and the efficiency ratio of EBIT to total asset are low (in other words, when the agency costs are high). (4) In line with the Signalling hypothesis,

[25] The listing year dummy variable POST2000 is eliminated from the regression since the variable was not significant and affects the overall quality of the model.

having higher level of information asymmetry, indicated by higher firm riskiness, lower insider holding, longer delay between prospectus publications and listing day, and being in the mining industry, can also increase the probability of firms' choosing unit IPOs. (5) The likelihood of an issuing firm choosing unit IPOs increases when the debt leverage in the firm prior to the IPO is low. However, this prediction is not statistically supported in the probit regression. (6) IPO firms listed on AIM are more likely to choose unit IPOs over share-only IPOs comparing to IPO firms listed on the Official Listing.

INSERT TABLE 3.13 HERE

3.6 Summary and Conclusions

This chapter has investigated the characteristics of unit IPOs issued in the UK between 1994 and 2006; and analysed, theoretically and empirically, the short-term economic effects of a dual share-warrant financing strategy through unit IPOs and the reasons that might affect firms' decisions to choose unit IPOs instead of share-only IPOs. Two competing hypotheses about the inclusion of warrants in IPOs, namely the Agency Cost and the Signalling hypotheses, are tested with a short-term focus by examining the initial returns (for both the first trading day and first trading week) and short-term after-market performance of a sample of UK unit IPOs in comparison to share-only IPOs.

Common predictions from both the Agency Cost and Signalling hypotheses are examined with UK data. As shown in Panel A of TABLE 3.14, the UK data support the predictions that unit firms are smaller and riskier than share-only IPO firms. However, unit firms in the UK are not necessarily younger than share-only IPO firms. Predictions exclusively proposed by Schultz (1993b) are tested and the results are presented in Panel B of TABLE 3.14. In the UK, unit firms suffer more agency cost measured by efficient ratios; and they are less profitable with less income and less asset prior to the unit IPOs. However, contrary to Agency Cost hypothesis' prediction, in the UK, unit firms actually appear to be older than their share-only counterparts; and do not have significantly smaller insider holding than share-only IPO firms. Furthermore, UK data also indicate that unit IPOs tend to issue smaller proceeds and are more likely to be marketed by less reputable underwriters. The package of equity and warrants as a whole is more underpriced than share-only IPOs. Unit IPOs experience significantly higher initial returns relative to IPO offer price both on the first day of trading and for the first trading week. Overall, Schultz (1993b)'s Agency Cost hypothesis is partially supported by UK data with exceptions of the age and insider holding of the firms.

Arguments of the Signalling hypothesis proposed by Chemmanur and Fulghieri(1997) are tested and results illustrated in Panel C of Table 3.14. Both the residual standard deviations of stock prices and the time delay between the prospectus publication and the IPO listing day are employed to proxy for the level of information asymmetry. The results indicate that unit firms in the UK present significantly higher levels of information asymmetry than share-only IPO firms, which implies that unit firms have strong incentives to include warrants as a signalling mechanism to convey information about firm value to public investors. The regression analyses in this chapter also confirm that the degree of initial underpricing and the proportion of firm value sold as warrants are both positively and significantly related to firm riskiness.

To supplement the existing literature on unit IPOs with UK evidence, I contribute a number of original predictions, the results of which are displayed in Panel D of TABLE 3.14. Firstly, the UK data support Hypothesis 3.14 that unit firms have lower leverage than share-only IPO firms prior to listing, which implies that having low debt component in their capital structure may encourage firms to add warrants in their IPOs to as additional financing. Secondly, unit IPOs listed on AIM market are found to be significantly less underpriced than those listed on the Official Listing. As a result, Hypothesis 3.15 is rejected. A final contribution of this chapter is the examination of warrant characteristics in relation to the short-term performance of unit IPO firms. In the UK, warrant exercise prices are commonly set above the offer price of the IPO, since the average PRATIO of warrant exercise price to IPO offer price is higher than one. If warrants can only be exercised when the share price exceeds warrant exercise price, then setting the warrant exercise price above the IPO offer price can serve as an incentive mechanism to motivate managers to spend the IPO proceeds carefully to reveal true value of the firm. This finding is consistent with the Agency Cost hypothesis. I also examine whether the maturity and call-ability of warrants have any impact on the initial underpricing of the unit IPO firms. Evidence was found that unit IPOs with callable warrants attached are significantly more underpriced than IPOs combined with non-callable warrants. Investors negatively consider the warrant calls as further uncertainty in their future involvement of the issuing firms (Hypothesis 3.18 cannot be rejected). However, the UK data does not support any significant relation between warrant maturity and the degree of underpricing and therefore Hypothesis 3.16 is rejected. Whether they affect unit firms' performance in median–to long-term is further investigated in CHAPTER 4 and CHAPTER 5.

INSERT TABLE 3.14 HERE

TABLES

TABLE 3.1
Definition of variables

Variables	Definition
AGE	Number of calendar days between firm incorporation and the listing date
AIM	Dummy variable that is equal to 1 if the IPO firm is listed on Alternative Investment Market (AIM), 0 if otherwise
ASSET/PROCEED	The ratio of total assets divided by the gross proceeds from IPO
$BHAR_n$	n-day buy-and-hold returns post-listing, excluding the first day of trading
CALLABLE	Dummy variable that is equal to 1 if attached warrants are callable before expiration, 0 if otherwise
DEBT/PROCEED	The ratio of total debt divided by the gross IPO proceeds
DELAY	Number of calendar days between the registrations of prospectus and commence of the trading
EBIT	Earnings before interests and taxes of the IPO firm by the end of the fiscal year prior to the IPOs
EBIT/TTLASSET	Ratio of earning before interests and taxes to total asset by the end of the year prior to the IPO
EXPENSE	Percentage total expense to gross proceeds of the IPOs
INSIDER	Percentage of directors' holdings in their own company immediately after the listing
IR_D1	Discrete raw initial return on first trading day (EQUATION 3.1)
IR_D2	HGSC-adjusted initial return on the first trading day (EQUATION 3.2)
IR_D3	The continuously compounded HGSC-adjusted initial return (EQUATION 3.3)
IR_W1	HGSC Index-adjusted weekly initial returns for the first trading week (EQUATION 3.4)
IR_W2	The continuously compounded HGSC-adjusted weekly initial return for the first trading week
LEVERAGE	Ratio of total debt to total asset by the end of the fiscal year prior to the IPOs
LIFE	Number of years before warrant expiration
Ln(PROCEED)	The natural logarithm of the expected gross proceeds from the IPO
MKTCAP	Market capitalisation of the issued share capital following the listing at the placing price
MKT2BK	Market-to-book ratio of IPO firms immediately post-listing
NI	Net income after taxes by the end of the fiscal year prior to the IPOs
NI/TTLASSET	Ratio of net income to total asset by the end of the year prior to the IPO
NUMBER	Number of warrants included in the unit IPOs
PRATIO	The ratio of warrant exercise price to the offer price
PROCEEDS	The expected gross proceeds of the IPOs
REPUTATION	Dummy variable that is equal to 1 if the underwriter has a high reputation ranking
REV/TTLASSET	Ratio of total revenue to total asset by the end of the year prior to the IPO
REV/PROCEED	The ratio of total revenue divided by the gross proceeds from IPO
RISK	Firm riskiness, measured by the residual standard deviations of the discrete share return 200 days following the IPO
TANGIBLE	The tangible asset of the sample firms by the end of the fiscal year prior to the IPO
TTLASSET	Total assets of the sample firms by end of the fiscal year prior to the IPO
TTLREVENUE	Total revenue of the IPO firm by the end of the fiscal year prior to the IPOs
UNIT	Dummy variable that takes the value of 1 if the IPO include warrants, 0 if otherwise
VALUE	Firm value sold as warrants calculated as warrant proceeds as percentage of firm market capitalisation after IPO

TABLE 3.2
Criteria for sample selection

Original sample	Unit (216)	Share-only (385)	All IPOs (601)
Less: Investment Trusts and funds	-96	-2	-98
Less: Warrants attached to Rights issues	-6	-0	-6
Less: Real Estate Holding & Development	-20	-10	-30
Less: Firms that cannot be matched to DataStream	-22	-7	-29
Less: Cross-listings from other exchanges	-6	-0	-6
Less: IPOs with missing data and pure Introduction IPOs[26]	-19	-8	-27
Final sample	**92**	**258**	**350**

[26] Some IPOs are pure Introduction or Admission to the Official Listing or Alternative Investment Market, without the sale of any new shares. Such IPOs are excluded from this study.

TABLE 3.3:
Distribution of IPOs by Year, Trading Location, Issue method and Industry

	Unit IPOs (92)		Share-only IPOs (258)		Total (350)	
	N	%	N	%	N	%
A. By year of listing						
1994-1995	6	6.52%	43	16.67%	49	14%
1996-1999	21	22.83%	75	29.07%	96	27.43%
2000-2003	27	29.35%	68	26.36%	95	27.14%
2004-2006	38	41.30%	72	27.91%	110	31.43%
B. By trading location						
Official Listing	11	11.96%	86	33.33%	97	27.71%
AIM	81	88.04%	172	66.67%	253	72.29%
C. By issue method						
Placing	75	81.52%	213	82.56%	288	82.29%
Offer	4	4.35%	14	5.42%	18	5.14%
Placing and Offer	13	14.13%	31	12.02%	44	12.57%
D. By industry Group						
Mining[27]	31	33.70%	43	16.67%	74	21.14%
IT & Hi-Tech[28]	12	13.04%	54	20.93%	66	18.86%
Healthcare& Pharmaceuticals[29]	9	9.78%	28	10.85%	37	10.57%
Support Service[30]	22	23.91%	71	27.52%	93	26.57%
General retail[31]	9	9.78%	34	13.18%	43	12.29%
General Industrials[32]	6	6.52%	25	9.69%	31	8.86%
Others	3	3.26%	3	3.26%	6	1.71%

*The share-only sample has not been matched at this stage for general comparison reason.

[27] Mining industry groups include: general mining, oil and gas producers and oil equipments, resources and energy companies

[28] IT & Hi-Tech industry groups include: software & computer development and service firms, other high technology businesses and fixed-line communication and telecommunication firms.

[29] Healthcare & Pharmaceuticals industry groups include: healthcare equipment & services, pharmaceuticals & biotechnology firms

[30] Support services industry groups include: media, publishing & marketing services, general financial services and other business support services.

[31] General retail industry groups include: food& drug, personal goods, household goods, beverage & wine, travel & leisure businesses.

[32] General industrials industry groups include: automobiles & parts, constructions & materials, industrial engineering, industrial metals, industrial transportation and technology hardware & equipments, electronic & electrical equipments businesses.

TABLE 3.4
Firm characteristics by quartiles

Two measures are calculated to proxy for firm size: Market capitalisation is computed as the product of total shares outstanding immediately after the IPOs and the offer price. Total asset is collected from the balance sheet prior to the IPOs. Profitability is measured by gross sales and net income (NI) after tax and interests. Both figures are also collected from the balance sheet prior to the IPO. Issue size of IPOs is measured by the expected gross proceed of the IPO, which is the product of number of new shares being offered and the offer price.

(£000)	Unit	Share-only	Total
A: Firm Size			
Market capitalisation			
Mean	23,618	49,330	42,492
1st Quartile	5,017	10,006	7,600
Median	10,053	25,155	20,111
3rd Quartile	26,918	49,729	43,260
Total Asset			
Mean	5,325	15,674	12,954
1st Quartile	279	935	635
Median	1,058	2,807	2,270
3rd Quartile	3,277	11,453	8,612
B: Profitability			
Sales			
Mean	5,462	20,386	16,463
1st Quartile	0	141	2
Median	69	3,035	2,041
3rd Quartile	3,739	14,871	11,741
NI			
Mean	-380	496	265
1st Quartile	-251	-285	-280
Median	-6	29	0
3rd Quartile	98	658	400
C: Issue size			
Gross Proceeds			
Mean	6,581	16,606	13,971
1st Quartile	1,323	2,750	2,156
Median	2,950	7,000	5,156
3rd Quartile	5,646	18,090	15,000

TABLE 3.5
Differences in firm characteristics for Unit IPOs and Share-only IPOs

The firm characteristics of the 92 unit IPOs are compared to their matching share-only counterparts. The AGE of firm is calculated as the calendar days between firm incorporation and the listing date. MKTCAP is the market capitalisation of the issued share capital following the listing at the offer price. TTLASSET is the total asset of the sample firms by end of the fiscal year prior to the IPO. The RISK of the issuing firm is measured as the residual standard deviations of the discrete share return 200 days following the IPO. TTLREVENUE is collected by the end of the fiscal year prior to the IPO. The INSIDER ownership is calculated as the percentage of directors' holdings in their own company immediately after the listing; executive options are also included in the holding. PROCEEDS represent the issue size of the offerings, i.e. the expected gross proceeds of the IPOs. EXPENSE defines the total expense of the IPOs. LEVERAGE is measure by the ratio of total debt to total assets. The means and medians, minimum and maximum values are presented with standard deviations. A paired *t*-test is conducted in testing any differences between means whilst the nonparametric Mann-Whitney test are undertaken to indicate differences in medians. The Pearson moment correlation coefficients between each pair of variables are calculated to measure degree of linear relationship between the two variables. The *p*-value of a two tailed hypothesis test of the correlation coefficient being zero is also presented in brackets.

		Unit IPOs (N=92)	Share-only IPOs (N=92)	*Correlation Coefficient*	*p-values from t-test or MV test*
AGE (Days)	Mean	3,229	1,249	0.14	*0.032[b]*
	Median	387	255.500	*(0.184)*	*0.081[b]*
	Min	11	17		
	Max	50,541	24,512		
	St.Dev	8,612	3,091		
MKTCAP(£m)	Mean	23.617	31.578	0.168	*0.001[a]*
	Median	10.053	14.847	*(0.110)*	*0.091[b]*
	Min	0.304	0.008		
	Max	10.053	329.755		
	St.Dev	38.180	49.465		
TTLASSET (£m)	Mean	5.535	9.772	-0.032	*0.153*
	Median	1.174	2.155	*(0.761)*	*0.012[a]*
	Min	0.025	0.050		
	Max	142.009	179.812		
	St.Dev	17.328	23.276		
RISK	Mean	0.045	0.036	0.263	*0.001[a]*
	Median	0.039	0.033	*(0.311)*	*0.002[a]*
	Min	0.003	0.003		
	Max	0.106	0.120		
	St.Dev	0.020	0.020		
INSIDER (%)	Mean	35.430	38.880	-0.057	*0.688*
	Median	33.570	38.830	*(0.589)*	*0.633*
	Min	0.350	0.240		
	Max	90.900	89.900		
	St.Dev	0.1952	0.2133		
TTLREVENUE (£m)	Mean	5.462	10.648	-0.051	*0.056[b]*
	Median	0.068	10.215	*(0.629)*	*0.034[b]*
	Min	0.000	0.000		
	Max	97.280	374.100		
	St.Dev	13.832	40.525		
PROCEEDS (£m)	Mean	6.581	12.755	0.091	*0.027[b]*
	Median	2.950	5.000	*(0.388)*	*0.003[a]*
	Min	0.168	0.300		
	Max	100.000	209.789		
	St.Dev	13.204	25.853		

(Continued)		Unit IPOs (N=92)	Share-only IPOs (N=92)	*Correlation Coefficient*	*p-values from t-test & MV test*
EXPENSE (%)	Mean	17.760	20.767	0.047	*0.005*[a]
	Median	16.150	16.19	*(0.658)*	*0.019*[a]
	Min	1.500	0.460		
	Max	52.950	96.800		
	St.Dev	0.1059	0.1652		
LEVERAGE	Mean	0.473	0.889	-0.023	*0.001*[a]
	Median	0.343	0.662	(0.830)	*0.000*[a]
	Min	0.000	0.000		
	Max	2.346	7.814		
	St.Dev	0.495	1.062		

* Share-only IPOs in this table represent the portfolio of 92 matching firms matched by issue years, market capitalisation and industries.

TABLE 3.6
Direct Tests of the Agency Cost and the Signalling hypotheses

Three Efficiency Ratios are calculated as the measurements of agency cost: the ratio of revenue to total asset (REV/TTLASSET), the ratio of earnings before interest and tax to total asset (EBIT/TTLASSET) and the ratio of net income to total asset (NI/TTLASSET). The mean and median value of each ratio for both unit IPOs and matching share-only IPOs are illustrated with their standard error in brackets. To measure information asymmetry, the residual standard deviation (Std.Dev) of the sample firms are estimated using daily data for the 200 days after the listing, excluding the initial return. Another proxy for the level of information asymmetry is the time lag as number of calendar days between registration of firm prospectus and the day of listing The means and medians, minimum and maximum values are presented with standard deviations. A student *t*-test is conducted to examine difference in means, and the non-parametric Mann- Whitney test is conducted to test for difference in medians. The p-values of both tests are presented to indicate significance level. The Pearson moment correlation coefficients between each pair of variables are calculated to measure degree of linear relationship between the two variables. The *p*-value of a two tailed hypothesis test of the correlation coefficient being zero is also presented in brackets.

Variables		**Unit IPOs (N=92)**	**Matching Share-only IPOs (N=92)**	***Correlation Coefficients***	***t-test & MV test***
A. Efficiency Ratios					
REV/TTLASSET	Mean	0.991	1.148	*-0.075*	*0.045*[b]
	Median	0.059	0.444	*(0.478)*	*0.090*[c]
	Min	0.000	0.000		
	Max	8.684	10.811		
	Std. Dev	1.550	1.852		
EBIT/TTLASSET	Mean	-0.385	0.165	*0.021*	*0.052*[b]
	Median	0.000	0.046	*(0.844)*	*0.080*[c]
	Min	-20.640	-2.9103		
	Max	2.750	2.702		
	Std. Dev	2.577	0.771		
NI/TTLASSET	Mean	-0.604	-0.3469	*-0.068*	*0.361*
	Median	-0.009	-0.0235	*(0.523)*	*0.481*
	Min	-20.640	-5.727		
	Max	3.348	3.408		
	Std. Dev	2.514	0.885		
B. Information Asymmetry					
RISK	Mean	0.045	0.036	0.263	*0.001*[a]
	Median	0.039	0.033	*(0.311)*	*0.002*[a]
	Min	0.003	0.003		
	Max	0.106	0.120		
	Std. Dev	0.020	0.020		
DELAY (Days)	Mean	12.960	10.413	-0.026	*0.101*[c]
	Median	7.000	7.000	*(0.804)*	*0.158*[d]
	Min	2.000	2.000		
	Max	60.000	57.000		
	Std. Dev	11.150	9.349		

TABLE 3.7
Initial underpricing of unit IPOs and matching share-only IPOs

Panel A illustrates the mean, median, minimum, and maximum values of the initial returns for the first trading day (IR_D) and first trading week (IR_W), respectively, for 92 unit IPOs and 92 share-only IPOs matched on firm size and industry. IR_D1, is the raw initial returns on the first trading day, calculated as (P_1/P_0)-1, whereas IR_D2 is the HGSC index-adjusted initial returns on the first trading day, calculated as $[(P_1/P_0)-1] - [(HGSC_1/HGSC_0)-1]$. IR_D3, is the continuously compounded log initial return on the first trading day, IR_D3=Ln (1+IR_D2). IR_W1 is the HGSC index-adjusted weekly initial return for the first trading week, calculated as $[(P_5/P_0)-1] - [(HGSC_5/HGSC_0)-1]$; whilst IR_W2 is the continuously compounded weekly initial return, IR_W2=Ln (1+IR_W1). P_0 is the IPO offer price assigned to the closing date of the subscription period. P_1 and P_5 are the closing share prices at the end of first and fifth trading days post-listing. $HGSC_0$, $HGSC_1$, and $HGSC_5$ are the HGSC Index prices on the same dates corresponding to P_0, P_1, and P_5 for each IPO sample. Panel B exhibits the same measures of initial underpricing after controlling for outliers by eliminating the top-5 and bottom-5 extreme values from each sample. The trimmed means, medians and the minimum, maximum values of the trimmed data are presented accordingly. In both panel, the differences in means are examined by paired Student's t-test, whist differences in medians are examined by non-parametric Mann-Whitney tests, the *p*-values of both procedures are presented to indicate significance levels (subscripts [a],[b],[c], represent significance at 1%, 5%, and 10% levels, respectively)

Panel A: Initial underpricing for the first trading day (IR_D) and first trading week (IR_W) before excluding outliers (N=92)										
	IR_D1 (Raw)		**IR_D2 (HGSC)**		**IR_D3=Ln (1+IR_D2)**		**IR_W1(HGSC)**		**IR_W2=Ln (1+IR_W1)**	
	Unit	**Match**	**Unit**	**Match**	**Unit**	**Match**	**Unit**	**Match**	**Unit**	**Match**
Mean	0.5102	0.0755	0.5089	0.0756	0.3408	0.0322	0.4709	0.1758	0.3080	0.1769
(t-Test)	*(0.000)[a]*		*(0.001)[a]*		*(0.000)[a]*		*(0.002)[a]*		*(0.033)[b]*	
Median	0.2500	0.0503	0.2476	0.0494	0.2212	0.0482	0.2159	0.1019	0.1955	0.1090
(MW Test)	*(0.000)[a]*		*(0.000)[a]*		*(0.002)[a]*		*(0.003)[a]*		*(0.003)[a]*	
Min	-0.0033	-0.8000	-0.0033	-0.8052	-0.0033	-1.6360	-0.1463	-0.8312	-0.1581	-1.7789
Max	4.3125	1.3000	4.3079	1.2995	1.6692	0.8327	4.4234	2.1086	1.6907	1.1342
(Std.Dev)	*(0.726)*	*(0.290)*	*(0.725)*	*(0.290)*	*(0.339)*	*(0.311)*	*(0.755)*	*(0.416)*	*(0.353)*	*(0.371)*
Panel B: Initial underpricing for the first trading day (IR_D) and first trading week (IR_W) after excluding outliers (N=82)										
	IR_D1 (Raw)		**IR_D2 (HGSC)**		**IR_D3=Ln (1+IR_D2)**		**IR_W1(HGSC)**		**IR_W2=Ln (1+IR_W1)**	
	Unit	**Match**	**Unit**	**Match**	**Unit**	**Match**	**Unit**	**Match**	**Unit**	**Match**
Trimmed Mean	0.3924	0.0655	0.3914	0.0671	0.2996	0.0522	0.3461	0.1444	0.2644	0.1195
(t-Test)	*(0.000)[a]*		*(0.000)[a]*		*(0.000)[a]*		*(0.000)[a]*		*(0.000)[a]*	
Trimmed Median	0.2500	0.0503	0.2476	0.0494	0.2212	0.0482	0.2159	0.1090	0.1955	0.1034
(MW Test)	*(0.000)[a]*		*(0.000)[a]*		*(0.000)[a]*		*(0.000)[a]*		*(0.000)[a]*	
Min	0.0400	-0.3846	0.0390	-0.3831	0.0382	-0.4831	-0.0057	-0.3476	-0.0057	-0.4272
Max	1.8333	0.3976	1.8360	0.3976	1.0424	0.3347	1.9554	0.9406	1.0836	0.6630
(Std.Dev)	*(0.390)*	*(0.143)*	*(0.391)*	*(0.142)*	*(0.236)*	*(0.143)*	*(0.399)*	*(0.207)*	*(0.242)*	*(0.176)*

TABLE 3.8
Short-term after-market performance of unit IPOs and matching share-only IPOs

Panel A presents the mean, median, minimum and maximum values of the HGSC Index-adjusted *after-market* buy-and-hold returns ($BHAR_n$) for 92 unit IPOs and 92 share-only IPOs matched on firm size and industry, respectively, *excluding* the initial returns on the first trading day (n= 2, 7, 14, and 21 days). Panel B exhibits the trimmed means and medians of BHARs for the same intervals after eliminating the top-5 and bottom-5 extreme outliers out of the original sample. The differences in means are examined by Student's t-test, whist differences in medians are examined by non-parametric Mann-Whitney tests, the *p*-value of which are presented to indicate significance levels (subscripts [a],[b],[c], represent significance at 1%, 5%, and 10% levels, respectively

Panel A: Short-term *after-market* buy-and-hold abnormal returns before excluding outliers (N=92)								
	BHAR2		**BHAR7**		**BHAR14**		**BHAR21**	
	Unit	**Match**	**Unit**	**Match**	**Unit**	**Match**	**Unit**	**Match**
Mean	0.0920	0.0349	0.0906	0.0346	0.0906	0.0413	0.0761	0.0373
(t-Test)	*(0.042)*[b]		*(0.039)*[b]		*(0.213)*		*(0.370)*	
Median	0.0311	0.0005	0.0355	0.0038	0.0532	-0.0034	0.0254	-0.0077
(MW Test)	*(0.004)*[a]		*(0.033)*[b]		*(0.012)*[a]		*(0.098)*[c]	
Min	-0.3243	-0.2333	-0.3097	-0.3269	-0.3685	-0.2999	-0.4088	-0.2576
Max	0.7438	1.4501	0.9890	1.3548	1.1734	2.0159	1.7439	2.2084
(Std.Dev)	*(0.182)*	*(0.180)*	*(0.203)*	*(0.187)*	*(0.230)*	*(0.266)*	*(0.274)*	*(0.277)*

Panel B: Short-term *after-market* buy-and-hold abnormal returns after excluding outliers (N=82)								
	BHAR2		**BHAR7**		**BHAR14**		**BHAR21**	
	Unit	**Match**	**Unit**	**Match**	**Unit**	**Match**	**Unit**	**Match**
Trimmed Mean	0.0787	0.0129	0.0824	0.0188	0.0746	0.0075	0.0536	0.0039
(t-Test)	*(0.000)*[a]		*(0.000)*[a]		*(0.000)*[a]		*(0.000)*[a]	
Trimmed Median	0.0311	0.0005	0.0355	0.0038	0.0532	-0.0034	0.0254	-0.0077
(MW Test)	*(0.001)*[a]		*(0.015)*[b]		*(0.003)*[a]		*(0.046)*[b]	
Min	-0.1242	-0.0985	-0.1063	-0.1608	-0.2067	-0.1486	-0.2195	-0.1713
Max	0.4080	0.2243	0.4363	0.2730	0.4817	0.3468	0.4766	0.3286
(Std.Dev)	*(0.123)*	*(0.062)*	*(0.138)*	*(0.085)*	*(0.144)*	*(0.095)*	*(0.144)*	*(0.107)*

TABLE 3.9
Determinants of underpricing and offer types

Panel A illustrates results from the Ordinary Least Square regression (EQUATION 3.7) on the determinants of underpricing examining 258share-only IPOs and 92 unit IPOs issued during the period of 1994-2006. The dependent variable is the HGSC-adjusted first-day initial return relative to the offer price (IR_D2). Due to limited sample size of the unit IPO sample, Panel B exhibits results from the Two-staged Least Square Regressions as robustness check for omitted variable problem (EQUATION 3.8-3.9). The offer type dummy UNIT is selected as the instrumented variable in the first-stage regression. The instruments include: insider holding (INSIDER), firm riskiness (RISK), time lag between Prospectus publication and listing (DELAY), MINING industry dummy, POST2000 listing year dummy, firm AGE, total asset (TTLASSET), total debt (TTLDEBT), and net income (NI) of issuing firms *prior to* the IPOs, all of which are potential factors that might affect a firm's decision to choose unit IPOs instead of share-only IPOs. In Stage two regressions, underpricing (IR_D2) is the dependent variable, defined as the HGSC-adjusted initial return relative to IPO offer price on the first trading day. The instrumented offer-type dummy (Noted as Inst.UNIT) and other motivated factors are then included in the second stage regressions to test for any relationship between the degree of underpricing and the offer type of the IPOs. Numbers in parentheses are the *p*-values of coefficients to indicate significance level. Regression 1 includes ALL variables in discussion, whereas Regression 2 and 3 respectively include variables on the 'profitability' and 'leverage' of the underlying IPO firms prior to listing. Regression 4 highlights the characteristics of the offering at the time of the IPO. Regression 5 summarise variables, which remain significant in all the previous regressions. Definitions of variables refer to TABLE3.1. [a], [b], and [c]: Significantly different from zero at 1%, 5%, and 10% level respectively

Panel A: OLS regressions on determinants of underpricing and offer type (N=350)

$$IR_D 2_i = \alpha_0 + \alpha_1 UNIT_i + \alpha_2 (ASSET/PROCEED)_i + \alpha_3 (REV/PROCEED)_i + \alpha_4 (DEBT/PROCEED)_i$$
$$+ \alpha_5 MKT2BK_i + \alpha_6 Ln(PROCEED)_i + \alpha_7 REPUTATION_i + \xi_i$$

N=350	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Intercept	-0.3052 (0.281)	-0.2053 (0.000)[a]	-0.1966 (0.000)[a]	-0.2470 (0.193)	-0.2134 (0.000)[a]
UNIT	0.3192 (0.000)[a]	0.3295 (0.000)[a]	0.3424 (0.000)[a]	0.3559 (0.000)[a]	0.3306 (0.000)[a]
ASSET/PROCEED	-0.0135 (0.100)[c]		-0.0040 (0.070)[c]		-0.0140 (0.091)[c]
REV/PROCEED	-0.0091 (0.019)[b]	-0.0067 (0.006)[a]			-0.0089 (0.021)[b]
DEBT/PROCEED	-0.1351 (0.104)[c]		-0.0145 (0.086)[c]		-0.0145 (0.085)[c]
MKT2BK	-0.0002 (0.228)	-0.0002 (0.205)	-0.0002 (0.174)	-0.0002 (0.124)	
Ln(PROCEED)	-0.0087 (0.610)			-0.0131 (0.477)	
REPUTATION	-0.0641 (0.107)[c]			-0.0267 (0.104)[c]	-0.0325 (0.051)[b]
Adjusted R^2	26.44%	26.96%	26.36%	25.22%	26.98%
F-statistic	16.68 (0.000)[a]	13.21 (0.000)[a]	15.99 (0.000)[a]	12.54 (0.000)[a]	12.49 (0.000)[a]

(Continued)

Panel B: 2SLS regressions on determinants of underpricing and offer type

Stage One:

$$\mathrm{UNIT_i} = \alpha_0 + \alpha_1 INSIDER_i + \alpha_2 RISK_i + \alpha_3 DELAY_i + \alpha_4 \mathrm{Ln}(Age)_i + \alpha_5 TTLASSET_i + \alpha_6 TTLDEBT_i + \alpha_7 NI_i + \alpha_8 \mathrm{MINING_i} + \alpha_9 \mathrm{POST2000}_i + \xi_i$$

Stage Two:

$$IR_D 2_i = \beta_0 + \beta_1 Inst.UNIT_i + \beta_2 (ASSET/PROCEED)_i + \beta_3 (REV/PROCEED)_i + \beta_4 (DEBT/PROCEED)_i + \beta_5 MKT2BK_i + \beta_6 Ln(PROCEED)_i + \beta_7 REPUTATION_i + \xi_i$$

N=350	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Intercept	-0.4054 (0.249)	-0.0724 (0.052)[b]	-0.0646 (0.084)[c]	-0.4252 (0.235)	-0.1029 (0.028)[b]
Inst.UNIT	0.8925 (0.000)[a]	0.8634 (0.000)[a]	0.8633 (0.000)[a]	0.9144 (0.000)[a]	0.9066 (0.000)[a]
ASSET/PROCEED	-0.0190 (0.039)[b]		-0.0105 (0.047)[b]		-0.0200 (0.030)[b]
REV/PROCEED	-0.0070 (0.105)[c]	-0.0043 (0.102)[c]			-0.0071 (0.101)[c]
DEBT/PROCEED	-0.0196 (0.134)		-0.0189 (0.146)		
MKT2BK	-0.0004 (0.035)[b]	-0.0004 (0.037)[b]	-0.0005 (0.030)[b]	-0.0005 (0.025)[b]	-0.0004 (0.033)[b]
Ln(PROCEED)	-0.0200 (0.355)			-0.0216 (0.325)	
REPUTATION	-0.0904 (0.064)[c]			-0.0858 (0.101)[c]	-0.1094 (0.098)[c]
Adjusted R^2	*9.89%*	*9.27%*	*9.81%*	*9.56%*	*10.16%*
F-statistic	*6.52* *(0.000)[a]*	*4.86* *(0.001)[a]*	*6.26* *(0.000)[a]*	*5.58* *(0.000)[a]*	*8.92* *(0.000)[a]*

TABLE 3.10
UK Warrant characteristics in Unit IPOs

In Panel A, the mean, median, maximum, and minimum values of several warrant characteristics with standard deviations are presented for the 92 UK unit IPO sample issued between the year 1994 and 2006. Panel B exhibits the distribution of the length of warrant life, the ratio of warrant exercise price to offer price (PRATIO), the possibility of any CHANGE in the warrant exercise price before expiration, the callability of warrants before expiration and finally the potential outcome of warrant contracts.

Panel A: Descriptive statistics					
Characteristics	**Mean**	**Median**	**Max**	**Min**	**Std.Dev**
Exercise price (£)	0.46	0.20	5.00	0.01	0.7390
PRATIO	1.25	1.00	12.50	0.08	1.3342
NUMBER (m)	13.98	5.13	285.70	0.06	31.7938
VALUE (%)	15.02	9.83	112.38	0.03	0.1905
LIFE(years)	4.00	4.10	10.00	0.21	2.2915

Panel B: Distribution of warrant characteristics		
Category	**Number**	**Percentage**
B1. Length of warrant life		
≤1 year	9	9.78%
2 years	13	14.13%
3 years	21	22.83%
4 years	8	8.70%
≥ 5 years	41	44.56%
B2. Ratio of exercise price to IPO price (PRATIO)		
Exercise price < IPO price (In-the-money; PRATIO < 1)	12	13.04%
Exercise price = offer price (On-the-money; PRATIO=1)	50	54.35%
Exercise price > offer price (Out-of-money; PRATIO >1)	30	32.61%
B3. Change of warrant exercise price after issuance		
With provision	52	56.52%
Without provision	40	43.48%
B4. Callability of warrants before expiration		
With provision	24	26.09%
Without provision	68	73.91%
B.5 Outcome of warrants		
Exercised	15	16.30%
Lapsed	54	58.70%
Outstanding	23	25.00%

TABLE 3.11
Comparison of warrant characteristics across countries

Warrant characteristics are compared across UK, Australian and the US. LIFE of warrant is the average number of years between the issuance and expiration of warrant contracts. PRATIO is the ratio of warrant exercise price to the offer price of the unit IPO. Shares per warrant, is the median number of shares per warrant in a unit. CALLABLE indicate whether the unit IPO prospectus contain a provision for the unit firm to reserve the right to call the warrants before expiration date. B-WARRANT examines whether the warrant agreements include any embedded B-warrants.

Characteristics	**UK**	**Australia**	**US**
LIFE	4.00	2.80	5.00
PRATIO	1.25	1.00	1.25
Share per warrant	2.00	1.00	1.00
Ratio of warrant proceed to IPO proceed	61%	58%	75%
CALLABLE	26.09%	*Not callable*	*Mostly*
B-WARRANT	*Rarely*	*Rarely*	25%

TABLE 3.12
Regressions of unit IPO underpricing and warrant characteristics

Linear Square Regressions are estimated for a sample 88 unit IPOs after excluding 4 outliers identified by Cook's Distance[33]. The first-day initial underpricing (IR_D2) is the dependent variable in regressions. Regression 1 include ALL the motivated variables. Regression 2 hightlight warrant characteristic variables. Regression 3 focus on all the dummy variables and Regression 4 confirms all the significant variables from previous regressions. The *p*-values of coefficients are reported in parentheses to demonstrate level of significance. INSIDER is the percentage managerial holding in the issuing firm. RISK of firm is calculated as the residual standard deviations of the share prices 200 days post-listing. EXPENSE is the total cost of IPOs as percentage of expected gross proceeds. LEVERAGE is the ratio of total debt to total asset one year prior to the IPO. PRATIO is the ratio of warrant exercise price to the offer price, PRATIO>1 indicates warrants are issued out-of-money, whereas PRATIO<1 imply that warrants are issued in-the-money. VALUE is the firm value sold as warrants, calculated as the potential warrant proceeds at exercise price as percentage of unit firms' market capitalisation at offer price immediately post-listing. LIFE is computed as the number of years from the issuance of warrants until expiration. CALLABLE takes the value of 1 if the warrants attached in the unit IPO are callable before expiration, 0 if the warrants are still outstanding or lapsed. REPUTATION is set to the value of 1 if unit IPOs are marketed by reputable underwriters, 0 if otherwise. AIM is equal to 1 if unit firms are listed on the Alternative Investment Market (AIM), 0 if otherwise. MINING is set to be 1 if the unit firm is from the mining industry, 0 if otherwise. POST2000 takes the value of 1 if the unit IPO is issued during the sample period 2000-2006, 0 if during the sample period 1996-1999.

N=88 (After excluding 4 outliers)	**Regression 1**	**Regression 2**	**Regression 3**	**Regression 4**
Intercept	0.2370	0.4267	1.0755	0.1433
	(0.487)	(0.016)[b]	(0.000)[a]	(0.634)
INSIDER	0.7049			0.6929
	(0.050)[b]			(0.050)[b]
RISK	2.1241			2.9574
	(0.024)[b]			(0.010)[a]
LEVERAGE	-0.2874			-0.2927
	(0.043)[b]			(0.035)[c]
PRATIO	0.0448	0.0646		
	(0.405)	(0.261)		
VALUE	-0.4596	-0.5403		-0.4714
	(0.053)[b]	(0.038)[b]		(0.099)[c]
LIFE	-0.0115	-0.0069		
	(0.709)	(0.832)		
CALLABLE	0.3737	0.3596	0.3323	0.3304
	(0.019)[b]	(0.039)[b]	(0.040)[b]	(0.030)[b]
REPUTATION	-0.6063		-0.5251	-0.5671
	(0.002)[a]		(0.005)[a]	(0.002)[a]
AIM	-0.3846		-0.5039	-0.4172
	(0.053)[b]		(0.012)[a]	(0.025)[b]
MINING	0.1601		0.2161	
	(0.304)		(0.158)	
POST2000	0.0560		0.1171	
	(0.731)		(0.471)	
F-statistic	*4.21*	*3.51*	*4.38*	*5.28*
	(0.001)[a]	*(0.003)[a]*	*(0.001)[a]*	*(0.000)[a]*
Adjusted R^2	*32.83%*	*10.16%*	*20.47%*	*30.79%*

[a]: Significantly different from zero at 1% level (two-tailed test).
[b]: Significantly different from zero at 5% level (two-tailed test).
[c]: Significantly different from zero at 10% level (two-tailed test).

[33] Four influential observations with both high Cook's Distance level and Leverage value higher than 0.42 (3p/n, where *p* is the number of model terms including constant; *n* is the number of observations) are identified. After removing these outliers the model improved significantly in terms of significant level and goodness of fit and hence these 4 outliers are excluded and the number of observation for TABLE 3.12 N=88.

TABLE 3.13
Probit Regressions of the probability that firms choose to include warrants in IPOs

Probit regressions are estimated for a sample of 258 share-only IPOs and 92 unit IPOs issued between the years 1994-2006. The offer type dummy UNIT is the dependent variable in each regression. Regression 1 tests the common predictions from both the Agency and Signalling hypotheses, whereas Regression 2 and 3 test each hypothesis' unique predictions, respectively. Regression 4 highlights the original predictions from this thesis whilst Regression 5 includes all the motivated predictors. Coefficients are presented after accounting for marginal effects. AGE is the number of days between firm incorporation day and the IPO admission day. TANGIBLE is the tangible asset of issuing firms prior to the IPOs. RISK is firm riskiness calculated as the residual standard deviations of firm's stock prices 200 days post-listing. INSIDER is the fraction of insider holding before listing. EBIT/ASSET is the efficiency ratio of earning before interests and taxes divided by total asset of issuing firm prior to IPO. DELAY is the number of days between prospectus publication and the listing of IPOs. MINING takes the value of 1 if the issuing firm is from the mining industry, 0 if otherwise LEVERAGE is the ratio of total debt to total asset. AIM is equal to 1 if the IPO is listed on the Alternative Investment Market, 0 if otherwise. Estimated marginal effects of variables are reported with *p*-values in parentheses to demonstrate significance levels. Subscripts [a], [b], [c], indicate that the estimates are significantly different from zero at 1%, 5%, and 10% level respectively (two-tailed *z*-test). Pseudo R^2, LR Chi^2, log likelihood, and correctly predicted percentage are presented to indicate the goodness of fit.

No. of Observation (N =350)	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Intercept	-1.0927 (0.000)[a]	-0.6388 (0.000)[a]	-1.7840 (0.000)[a]	-1.7060 (0.000)[a]	-1.7513 (0.000)[a]
AGE	0.0001 (0.204)				0.0002 (0.203)
TANGIBLE	-0.0001 (0.012)[a]				-0.0002 (0.079)[c]
RISK	3.6739 (0.001)[a]		3.0441 (0.009)[a]		2.5782 (0.024)[b]
INSIDER		-0.1089 (0.078)[c]	-0.1817 (0.0526)[b]		-0.1739 (0.077)[c]
EBIT/TTLASSET		-0.0170 (0.103)[c]			-0.0218 (0.106)[c]
DELAY			0.0074 (0.003)[a]		0.0050 (0.053)[b]
MINING		0.1942 (0.001)[a]	0.1557 (0.008)[a]	0.1664 (0.000)[a]	0.1436 (0.015)[a]
LEVERAGE				-0.0075 (0.472)	-0.0180 (0.129)
AIM			0.1956 (0.001)[a]	0.2196 (0.000)[a]	0.1984 (0.002)[a]
Pseudo R^2	8.16%	7.30%	14.54%	12.25%	16.83%
LR Chi^2 (n)	32.89 (0.000)[a]	16.85 (0.001)[a]	47.67 (0.000)[a]	38.77 (0.000)[a]	67.42 (0.000)[a]
Log Likelihood	-185.16	-186.88	-172.29	-176.92	-166.56
Correctly Classified	75.14%	74.00%	73.93%	73.93%	75.64%

TABLE 3.14
Summary of testable hypotheses and results

Hypothesis	Results
Panel A:Common predictions:	
$H_{3.1}$: Unit firms are younger than share-only IPO firms	Rejected
$H_{3.2}$: Unit firms are smaller than share-only IPO firms in terms of market capitalisation and total assets	Not rejected
$H_{3.3}$: Unit firms are riskier than share-only IPO firms	Not rejected
$H_{3.4}$: Unit IPOs are issued by less reputable underwriters	Not rejected
Panel B: In test of Agency Cost hypothesis:	
$H_{3.5}$: Unit IPO firms have lower levels of insider holding comparing to share-only IPO firms	Rejected
$H_{3.6}$: Unit firms have less income (TTLREVENUE) prior to IPO comparing to share-only IPO firms	Not rejected
$H_{3.7}$: Unit firms have higher agency costs in terms of profitability and asset utilisation ratios	Not rejected
$H_{3.8}$: Unit IPOs raise less expected gross proceeds than share-only IPOs (smaller issue size)	Not rejected
$H_{3.9}$: Unit IPOs are more underpriced than share-only IPOs	Not rejected
$H_{3.10}$: Warrant exercise prices will be set above the offer price	Not rejected
Panel C: In test of Signalling hypothesis:	
$H_{3.11}$: Unit IPO firms will exhibit higher level of information asymmetry than share-only IPO firms	Not rejected
$H_{3.12}$: The proportion of firm value sold as warrants will increase in firm riskiness, holding the fraction of equity retained constant	Not rejected
$H_{3.13}$: The degree of underpricing for unit firms is positively related to firm riskiness	Not rejected
Panel D: Unique predictions of this thesis:	
$H_{3.14}$: Unit firms have lower leverage than matching share-only IPO firms have	Not rejected
$H_{3.15}$: AIM-listed unit IPOs are more underpriced than those listed on the Main Market	Rejected
$H_{3.16}$: The maturity of warrant is negatively related to the underpricing of unit IPOs	Rejected
$H_{3.17}$: PRATIO is negatively related to the underpricing of unit IPOs	Rejected
$H_{3.18}$: Unit IPOs with callable warrants attached are more underpriced than those with non-callable warrants	Not rejected

CHAPTER 4
SURVIVAL AND SUBSEQUENT FINANCING OF UNIT IPOS IN THE UK

4.1 Introduction

An IPO indicates the beginning of the public life of a company. CHAPTER 3 examines the Agency Cost and Signalling hypotheses for the inclusion of warrants in IPOs by providing evidence with a short-term focus from the time around listing. Evidence can also be sought from post-listing events. This chapter examines the two competing hypotheses in the medium-to-long term aftermarket through the survival of unit firms and issuance of seasoned equity offerings by unit IPO firms, in comparison to share-only IPO firms.

Two unique implications of the Agency Cost hypothesis concern the post-listing survival and subsequent financing of unit firms. The fifth implication of Schultz (1993b) argues that since a unit IPO's proceed (the first round of financing) is used to 'determine the viability of the potential investment; it automatically encourages managers to focus on the profitability of the prospective projects and only invest in profitable projects with positive net present values. Schultz (1993b) pointed out that ironically, many firms issuing a unit IPO will discover that there are not always positive-NPV projects for them to invest in. If this is the case, the warrants will only be left to expire and the second round of financing is automatically aborted. Under such 'all or nothing' scenario, unit firms are more likely to go out of business and result in final delisting from the stock exchange. Therefore, the Agency Cost hypothesis predicts that fewer unit firms will survive comparing to share-only firms.

On the other hand, the Agency Cost hypothesis conjointly predicts that unit firms that do survive are inclined to receive additional equity financing in the near future, because the value-revealing projects have established the attractiveness and profitability of their investments. Further funding is likely to be demanded with the company's growth. Seasoned equity offerings (SEOs) represent another important source of funding for publicly listed companies either from existing shareholders or from new investors. Therefore, Schultz (1993b) predicts that survivors among unit firms are more likely to issue SEOs following the IPOs.

The Signalling hypothesis of Chemmanur and Fulghieri (1997) does not provide any specific predictions concerning the post-listing survival rate of unit firms. Alternatively, the signalling theory claims that IPO firms strategically adopt costly signals at the time of listing, such as insider holding, underpricing of new shares, and inclusion of warrants (in unit IPOs), to attract more after market interests; and will recoup the cost of signalling by issuing seasoned equity offerings at a higher price later on. However, the likelihood of unit firms to receive additional funding is not discussed in comparison to those of share-only IPO firms. Therefore, the primary objective of this chapter is to investigate the post-listing survival rates and subsequent equity financing of unit and share-only IPO firms in the UK.

Schultz (1993b) claims that a staged equity financing through unit IPOs can also be achieved by a share-only IPO followed by a seasoned equity offering (SEO). Both financing strategies involve a second round of capital infusion following the IPOs. For unit IPOs, the second round of financing will occur conditionally, if the company's stock price increases enough post-IPO to allow exercise of warrants. More shares will be issued just like a seasoned equity offering but through the exercise of warrants. For share-only IPOs followed by a seasoned equity offering, the second round of financing will occur whenever the management sees fit to issue additional shares. However, a unit IPO does have two advantages comparing to a share-only IPO followed by seasoned equity issues. Firstly, for a unit IPO, the price for the seasoned equity issues (i.e. the warrant exercise price) is set in advance. By doing so, managers could be motivated to use the IPO proceeds to reveal the firm quality and the profitability of the projects they invested in; because if the second round of equity financing is to be achieved through warrant exercise, the IPO proceeds must be used to ascertain the value of the firm's projects. Additionally, warrant agreements can be structured to prevent firms from selling shares for a second round of equity financing without determining the value of their projects first. If the initial investment is non-profitable, the share price will stay below the warrant exercise price and the warrants will not be exercised; therefore, the second round of financing will automatically fall through. On the other hand, seasoned issues following share-only IPOs do not serve to monitor and bond management investment decisions; neither are there any built-in criteria to protect shareholders interests in case the projects fail.

It is logical to ask the questions that, if the attached warrants in a unit IPO can serve as a seasoned offering and better, why do some unit IPO firms still decide to conduct a second sale of additional shares after the unit IPO. How many unit firms actually end up exercising the warrants attached in the IPOs? To answer these research questions, the second objective of this chapter is to examine the determinants of firms' SEO issuance. A sub-sample of unit IPO firms that decide to conduct a seasoned offering in comparison to the sub-sample of unit IPO firms that do not issue additional equity within three years of their unit IPOs is studied. No research has been carried out to examine the exercise of warrants after the unit IPOs have been issued, which is also covered in this pilot study. I believe these original tests can shed some new light on the existing unit IPO literature.

4.2 Literature Review

4.2.1 The Agency Cost hypothesis' predictions on the survival rate and subsequent financing of unit firms

Schultz (1993b)'s Agency Cost hypothesis stipulates that in development-stage firms, managers have an incentive to take on any projects without careful selection as long as they can keep their jobs, and they will not stop investing in negative NPV projects if given sufficient funding up front. Unit IPOs can effectively arrange staged financing and prevent management from taking non-profitable projects by providing a small amount of IPO proceeds to begin production and management cannot obtain a second round of financing before they can prove a project's value.

According to the Agency Cost hypothesis, inclusion of warrants in unit IPOs is a form of staged financing that will only occur in the firm value's higher realisation, when the stock price is above the warrant exercise price. Seasoned equity offerings (SEOs) have many similar features to the attached warrants; in the way that staged equity financing achieved by a share-warrant unit IPO can also be achieved through a share-only IPO followed by a seasoned share offering (SEO). However, an advantage of a unit IPO is that the price of the seasoned offering shares is set in advance as the warrant exercise price. If the second round of financing is to be achieved through exercise of the warrants, the proceeds from the IPO must be used to ascertain the value of the firm's projects. Interestingly, Schultz (1993b)'s US data shows that most of the warrant exercise prices in unit offerings are set above the current stock price. Schultz argues that such an offer would motivate management to use the IPO proceeds wisely to convey information about the firm's true value. Because only when the share price rises above the warrant exercise price would the second round of financing materialise. In my UK sample, most warrants attached to the initial public offerings are issued with their exercise price set equal to or above the offer price of the IPO. More specifically, 54.35% of the unit warrants are issued on-the-money, with their exercise price set equal to the placing price; 33.7% of the warrants are issued out-of-money, with their exercise price set above the placing price; and only 11.96% of the warrant exercise prices are actually set below the placing price, in which case those warrants could be exercised straight after the IPO for profits.

The Agency Cost hypothesis predicts that because the unit IPO proceeds are used to reveal the viability and profitability of potential investments, many firms that include warrants in their

IPOs will find that there are no value-generating projects available for them to invest in after the IPO. With the bonding limit from warrant agreements, these firms are unable to receive further funding through exercise of warrants to support company growth, and as a result, fewer of these firms will survive comparing to share-only firms. Schultz (1993b) reports that only 58.8% of unit firms in the US survive a full three years after their IPOs, comparing to 88.9% of share-only IPO firms. However, the sixth implication of Agency Cost also predicts that unit firms that did survive will be more likely to receive additional equity funding.

How and Howe (2001) examined the survival rates and subsequent financing of unit IPO firms. They define firms as survived if they are still listed on the Australian Stock Exchange (ASX) at the end of n^{th} year. Percentage survival rates of unit firms compared with share-only IPO firms are calculated for one, two, and three years after their IPOs. Results indicate that one year after the IPO, 99.3% unit firms and 99.6% share-only IPO firms survived; two years after IPO, 97.8% of unit firms comparing to 95.6% of share-only IPO firms survived; and after a full three years 89.6% of unit firms and 85.5% of share-only firms survived. Contrary to the US evidence, Australian data report that more unit firms survived than share-only IPO firms did three years after their IPOs. However, the difference is not significant. How and Howe (2001) also conduct logistic regressions on the profitability of failure within one, two, and three years post-listing. However, the coefficient on the dummy variable for unit offerings is not significant in any of the regressions. Furthermore, in examination of Schultz (1993b)'s sixth implication that survived unit firms are more likely to receive additional equity financing following their IPOs, How and Howe (2001) also investigate the subsequent financing activity of their Australian sample IPO firms. They select a subsample of IPO firms including 184 share-only and 90 unit IPOs, in which they can track each firm for three years after its IPO. They consider both rights offering and private placement as additional equity financing and identify the first date after the IPO on which additional financing was received. Results indicate that 52% of the share-only IPO firms made an SEO within three years of their

IPOs and 59% of the unit IPOs made an SEO over the same interval. The authors claim that although these proportions are consistent with the Agency Cost hypothesis, the difference is not significant at conventional level. Overall, How and Howe (2001)'s evidence on the survival and subsequent financing of Australian unit IPOs do not statistically support the Agency Cost hypothesis.

Lee, Lee, and Taylor (2003) investigating a different sample of Australian unit IPOs over a longer period, provide further evidence on the post-listing behaviours of unit firms in comparison to share-only firms. Firstly, they reason according to Schultz (1993b)'s argument, that unit firms have higher agency costs than those of share-only IPO firms; if this is the case, unit firms are expected to have higher rate of post-listing failure than that of share-only firms. The authors report the percentage failure rate for unit and share-only firms, one, two, and three years following the IPO respectively. No evidence is found that unit IPOs have a higher failure rate, or that they are more frequently subject to takeover than share-only firms. To confirm the result they also conduct a logistic regression for one, two and three year failure rates respectively, with the independent variables being; the decision to use a unit IPO, issue size, age, underwriter quality and initial underpricing. Again, they find no evidence that unit IPOs have higher probability of being delisted than share-only IPO firms. Secondly, Lee, Lee and Taylor (2003) also examine the subsequent equity financing activities of the unit and share-only IPO firms post-listing. They identified all subsequent equity issues during the first two post-listing years and find that around 52% of all IPOs make a seasoned equity offering (SEO) within two years of their IPOs. Although unit firms appears to have higher percentage SEO issuance (55%) than that of share-only firms (51%), no significant difference between unit and share-only IPO firms in their propensity to seek further equity within two years of their IPOs is found. They also run a logistic regression on a dummy dependent variable of SEO issuance (1 if the firm issues a SEO in the two years after listing, 0 if otherwise). Test results indicate that there is no systematic relation between choice of offer type and subsequent equity raisings, which contradicts the Agency Cost hypothesis. However, they do find a significantly positive relation between initial underpricing and the decision to issue a SEO, which is consistent with the Signalling hypothesis; that IPO firms intentionally underprice the issue or/and include warrants (in case of unit IPOs) and will recoup the signalling costs by issue seasoned equity offerings at a higher offer price after their IPOs. Overall, Lee, Lee, and Taylor (2003) are unable to support the Agency Cost hypothesis and its implications of post-listing survival and subsequent equity financing of unit IPO firms.

As suggested by the Agency Cost hypothesis, additional equity financing is delayed for unit IPOs until the profitability of their investment projects is verified by the market. Therefore, if the issuing firms of unit IPOs survive, they are more likely to receive additional equity financing following their IPOs. Mazouz et al. (2007) test this prediction with their sample of unit IPOs issued in Hong Kong, providing evidence that 25% of unit IPOs comparing to 23% of share-only IPOs raised additional capital via seasoned equity issues within three years of their IPOs. However, the difference is not statistically significant and therefore unable to support Schultz (1993b)'s prediction on the subsequent financing of unit IPO firms. Furthermore, the survival rate of unit IPO firms comparing to those of share-only IPO firms are not covered in Mazouz et al. (2007) and therefore their results on the likelihood of unit firms receiving additional funding are not based on the premise of the survival of unit firms.

4.2.2 The Signalling hypothesis' prediction on the subsequent financing

The Agency Cost hypothesis predicts that fewer unit firms will survive comparing to share-only firms, although survived unit firms are more likely to issue seasoned equity offerings for additional funding. The Signalling hypothesis does not make any prediction on survival rate or the probability of subsequent financing. Instead, the Signalling hypothesis of Chemmanur and Fulghieri (1997) demonstrate insider concerns about revealing their true firm value as; prior to an IPO, the company's insiders know their own firm's type. On the other hand, public investors do not have much information about the true value of the firms approaching the capital market for financing and therefore cannot discriminate 'good firms' from 'bad firms'. It is in the best interest of insiders from good firms to take actions and structure their IPO with certain unique qualities in order to distinguish themselves from the bad firms. Any attempt by the bad firms to mimic such qualities will impose a rather dear cost. Eventually, they cannot afford the 'camouflage' and recede to sell their securities in the IPO at their true value. In their model, Chemmanur and Fulghieri (1997) identify three costly signals, namely insider retention, underpricing, and inclusion of warrants. They predict that unit firms use three costly signals to convey information about firm value and attract more investors, and they expect issuing firms to recoup the costs of signalling at the IPO stage by issuing seasoned equity at a more favourable price after the market has verified the firms' quality in the post-listing period. However, the likelihood of unit firms to receive additional funding is not discussed in comparison to those of share-only IPO firms.

None of the other academic papers on unit IPOs including Chemmanur and Fulghieri (1997) have further examined the stock price performance around the SEO announcements in testing of the Signalling hypothesis. Therefore, no evidence has been provided whether unit firms did issue seasoned equity at favourable prices to recoup the cost of underpricing, including warrants and retention of insider holding at the time of their IPOs. However, several empirical studies on share-only seasoned equity offerings did examine whether managers time a window of opportunity to issue additional shares when the firm is at maximum value. Spiess and Affleck-Graves (1995) stressed the managers' market-timing ability through analysing the abnormal returns in the early aftermarket; they document that following the first two months after the announcement of SEO, the performance of seasoned offering firms is strongly negative. Spiess and Affleck-Graves (1995) also document that seasoned equity issuers experience poor long-term stock performance compared to matched non-issuers. Kale and Payne (1998) test the 'windows of opportunity' argument and also provide evidence that the previous months' stock prices are on the increase for firms that issue a seasoned offering. Harjoto and Garen (2003) examine the reason why the IPO firms decide to conduct a primary seasoned equity offering (SEO), with a sample of 481 US IPOs issued during 1992 to 1997, in which 42% of the IPO firms issued a SEO within the four years following their IPO. They assume that the initial owners try to maximise the value of IPO proceeds and determine on the optimal shares of insider and public shareholders based on anticipated growth of the firm at the IPO stage. Nevertheless, the initial owners may decide to raise further funding when there are unexpected growth opportunities that emerge after the initial public offering. Using a two-period model, the authors investigate the factors that affect an IPO firm's decision to issue an additional equity offering due to the shock that was not predicted by the managers at the time of the initial public offering, and the relative size of a SEO during the four years after the IPO. In the two-period context, their model indicates that the large shareholder of an IPO firm has an incentive to issue an SEO when the firm is experiencing an unanticipated positive shock post-IPO. They measure the IPO firm's unanticipated growth in two ways: an accounting measure, which is annual growth in net income; and a market measure, which is the excess stock return-drift in a year. Those indicators are found to increase the firm's likelihood of conducting a seasoned equity offering and increase the relative size of a SEO. The authors also provide some evidence that the firm's ex-ante uncertainty negatively affects the firm's decision to issue additional shares post-IPO.

Most of these empirical studies confirm that the firm's decision to issue additional equity is usually preceded by a positive stock price drift and/or favourable earnings releases, and then followed by downward revisions at the SEO announcement dates, and thereafter. The findings of these studies support the argument that seasoned equity offerings are announced when the firm's stock is overvalued, but the market does not reassess the stock appropriately and the stock is still overvalued when it is issued. This implies that managers behave opportunistically by exploiting market misevaluation and investors are slow to react due to information asymmetry. However, further evidence on unit firms recover cost of signalling strategy at the time of their IPOs by issuing seasoned equity at higher price, is still absent in the literature.

4.3 Hypotheses

4.3.1 Predictions on the survival of unit IPO firms

The fifth prediction of the Agency Cost hypothesis is that unit firms are more likely to fail than firms that issue share-only IPOs. Schultz (1993b) records 59% of unit firms in the US survived three years after their IPOs, comparing to 89% of share-only IPO firms. How and Howe (2001) report with conflicting results in Australia that more unit firms (89.6%) survived than share-only firms (85.5%) three years after their IPOs. However, the difference is not significant at conventional level. They also conducted a logistic regression on the probability of IPO failure within one, two, and three years post-listing but again, the results are not significant. Lee, Lee, and Taylor (2003), confirm that they cannot find any evidence that Australian unit firms experience higher failures than share-only firms do. Mazouz et al. (2007) only discussed the subsequent financing for unit and share-only firms in Hong Kong, but the survival of unit firms is not covered in this study. Viewed collectively, unit firms in the US provide evidence of lower survival rates than share-only IPO firms three years post-listing, whilst the evidence from the Australia is not conclusive. Research on the survival rate of unit and share-only IPO firms is absent from both Hong Kong and the UK. To reassess this unique implication of the Agency Cost hypothesis with UK data, I predict with Hypothesis 4.1 that unit IPO firms in the UK have lower survival rate than their matching share-only counterparts.

In order for a stock to be traded on an exchange, the company that issues the stock must meet the listing requirements set out by the exchange. If a company fails to satisfy exchange listing requirements such as minimum bid price, minimum publicly traded shares, minimum shareholders' equity, minimum market capitalisation or certain financial ratios, it will be involuntarily delisted from the exchange. Therefore, the survival rate is calculated as the number of IPOs, which are still actively trading n years (n= 1, 2, and 3) post-listing, as percentage of the total sample size at the time of listing. Furthermore, I also introduce the $ACTIVE_i^n$ dummy in the probit regression analysis of the unit IPO survival rate. The $ACTIVE_i^n$ takes the value of 1, if the sample IPO firm is still listed and actively trading on London Stock Exchange n years post-listing (n=1, 2, and 3), 0 if otherwise.

However, not all the delisted firms are removed from the exchange listing for negative reasons. It is worth mentioning that, some companies choose to voluntarily delist from an exchange. These companies would usually have merged with or been acquired by another company, or management has decided to take the company private.[34] Some smaller companies delist to save on the high cost of complying with regulations and exchange listing fees. In these cases, a voluntary delisting does not necessarily lead to bankruptcy. Future research is called for to incorporate data on the reasons of delisting.

$H_{4.1}$: Unit IPO s have lower survival rate than their share-only counterparts

4.3.2 Predictions on the subsequent financing of unit IPO firms

The sixth implication of the Agency Cost hypothesis maintains that unit firms intentionally delay equity financing until the profitability of their projects is verified by the market. Schultz (1993b) predicts that survived unit firms are more likely to receive additional equity financing following their IPOs. Chemmanur and Fulghieri (1997) made no similar conjectures regarding the subsequent financing of unit firms. How and Howe (2001) report that higher percentage of Australian unit firms (59%) made seasoned equity offerings than share-only firms (52%) did. However, the difference is not significant and therefore unable to support the Agency Cost

[34] Espenlaub, Khurshed and Mohamed (2009) find that at times half of delistings are due to M&A.

hypothesis. Lee, Lee, and Taylor (2003) provide similar results from Australia that more unit firms (55%) issue SEOs than share-only firms (51%) do. The difference, however, remains insignificant. Mazouz et al. (2007) confirm with evidence from Hong Kong that unit firms and share-only firms are not significantly different in terms of the propensity for SEO issuance. Viewed collectively, evidence on the subsequent equity financing for unit firms in comparison to share-only firms is inconclusive among US, Australian, and Hong Kong data. No previous study on this unique prediction of the Agency Cost hypothesis has been conducted for the UK data. This chapter, therefore, proposes Hypothesis 4.2 as shown below.

$H_{4.2}$: Survived unit IPO firms are more likely to issue SEOs than survived share-only IPO firms

Chemmanur and Fulghieri (1997) predict that unit firms use a combination of costly signals such as insider holding, underpricing and including warrants in their IPOs, to signal firm quality and broaden public interests in the issues. After the market has verified the firm quality and the profitability of their projects, these firms can recoup the signalling costs by issuing seasoned equity offerings at a higher price. Previous research on share-only SEOs has suggested that firms exploit the best time to issue additional equity when company's shares are potentially over valued (Loughran and Ritter, 1995). Such theory is also applied to share-warrant unit SEOs. For example, Marciukaityte et al. (2007) report a 40% mean one-year pre-placement holding-period return for the unit placing sample. On the other hand, from the investors prospective, Myers and Majluf (1984) brought forth the adverse selection model stating that rational investors tend to revise the firm value downwards when a seasoned equity offering is announced because they believe managers will only issue additional shares when they believe their company's shares are currently overvalued. As a result, a negative price adjustment following the SEO announcement is predicted.

However, none of Agency Cost and the Signalling hypotheses on unit IPOs has examined the stock price performance around their SEO announcements. To fill this gap between the unit

IPO and SEO literature, this chapter also investigates SEO announcements made by unit IPO firms. Hypothesis 4.3 predicts that there is a significant stock price run-up before SEO announcements made by unit IPO firms. In addition, Hypothesis 4.4 predicts that there will be a negative price effect after the SEO announcements were made by unit IPO firms. If UK data simultaneously supports both hypotheses, I can provide evidence that SEOs issued by unit IPO firms are announced when the company's shares are overvalued.

$H_{4.3}$: There is a significant stock price run-up before SEOs are announced by unit IPO firms

$H_{4.4}$: There is a negative price effect to the SEO announcements made by unit IPO firms

4.3.3 Predictions on SEO issuance and warrant characteristics

Schultz (1993b) predicts that unit IPOs are more underpriced than share-only IPOs and the survived unit firms are more likely to issue SEOs than survived share-only firms. However, whether the issuance of SEOs has any direct relation to the characteristics of the unit IPOs, especially to any warrant-specific characteristics, is not discussed. To extend the Agency Cost hypothesis' implications on the subsequent financing of unit firms with UK evidence, the last group of hypotheses are proposed, targeting to examine the decision for unit firms to issue seasoned offerings in association to the characteristics of the unit IPOs and more specifically the characteristics of attached warrants. According to the Agency Cost hypothesis unit IPOs are more underpriced than share-only IPOs at the time of listing. I therefore predict that unit IPOs that are more underpriced are more likely to conduct seasoned equity offerings within three years of their listing (Hypothesis 4.5). A dummy variable SEO is introduced to take the value of 1 if the issuing firm has conducted their first seasoned offering within three year post-listing, 0 of otherwise. According to Hypothesis 4.5, the initial underpricing should be negatively related to the SEO dummy.

$H_{4.5}$: Unit firms that are more underpriced at their IPOs are more likely to conduct SEOs

Concerning the choice of warrant exercise price, Schultz (1993b) documents that in the US most of the warrants attached to unit IPOs are issued out-of-money with warrant exercise price set above the IPO offer price. He explain that issuing firms do so on purpose to create incentives for managers to make optimal investment decisions so that the unit firms' share prices will increase enough to allow warrants to be exercised. Chemmanur and Fulghieri (1997) do not agree with the Agency Cost explanation, they argue that according to the Signalling hypothesis, issuing firms will set the warrant exercise price equal to the IPO offer price to signal true firm value. The debate of choice of warrant exercise price has been discussed in the previous CHAPTER 3. In extension of this argument, I predict that if warrant exercise price is set above IPO offer price to create incentive to reduce agency cost, the attached warrants are more likely to be exercised to materialise the second round of financing; in turn, the unit firm is less likely to issue additional SEO for further funding. A dummy variable OUT is motivated to take the value of 1 if the warrants are issued out-of-money with the warrant exercise price above the IPO offer price, 0 if otherwise. Therefore, I hypothesise that in the UK, unit firms, which issued warrants out-of-money at the time of their IPOs, are less likely to conduct a seasoned equity offerings three e years post-listing (Hypothesis 4.6).

$H_{4.6}$: Unit firms, which issued warrants out-of-money, are less likely to conduct SEOs

Contrary to Schultz (1993b)'s American results, How and Howe (2001) do not find evidence that in Australia survived unit firms are more likely to issue seasoned equity offerings. They also compare the characteristics of the warrants from Australia to the US warrants attached to unit IPOs, and report that Australian warrants are shorter lived than US warrants. However, in their study, whether there is any association between the life of warrants and the likelihood of SEO issuance is not discussed. The longer time unit firms have before the warrants expire, the better chance these warrants will be exercised, and the less need for seasoned equities. To test this potential relation, I define the variable LIFE as the number of years between warrant issuance date and the warrant expiration date and hypothesise that in the UK, unit firms whose attached warrants have shorter LIFE are more likely to issue seasoned equity within three years of their listing (Hypothesis 4.7). LIFE is therefore anticipated to be negatively related to the SEO dummy.

$H_{4.7}$: Unit firms whose attached warrants have shorter life until expiration are more likely to issue SEOs

The Agency Cost hypothesis also stipulates that unit IPOs choose to include warrants to reduce agency costs by staging a second round of financing through the attached warrants. The attached warrants if exercised, serve as a seasoned offering, except that the offer price of the seasoned issue (the warrant exercise price) is set in advance. On the other hand, if the company's share price stays below the warrant exercise price, the warrant will not be exercised and the second round of financing falls through automatically. In the latter case, the management are more likely to conduct a seasoned equity offering to replace the second round of financing by warrants. Therefore, I predict that the unit IPO firms, whose attached warrants have not been exercised or already expired, are more likely to conduct a second issue of shares within three years after the initial public offering (Hypothesis 4.8). The dummy variable EXERCISE of warrants is motivated to take the value of 1 if the warrants have been exercised within three years following the unit IPO, 0 if otherwise. The EXERCISE dummy is expected to be negatively related to the SEO dummy.

$H_{4.8}$: Unit firms, whose attached warrants have not been exercised or expired, are more likely to conduct SEOs within three years post-listing

4.4 Data and Methodology

4.4.1 Data collection

For all 350 sample IPOs, the delisting dates for all sample firms that are no longer trading, have been collected from DataStream database and cross-referenced with data from Thomas One Banker database. The delisting date is then compared to the listing date of the IPOs to decide the value of $ACTIVE_i^n$ dummy, which takes the value of 1 if firm *i* is still listed and actively trading *n* years post-listing, 0 if otherwise. The $ACTIVE_i^n$ dummy is employed to proxy for the survival of IPO firms in probit regression analysis later on. Information on the seasoned equity offering (SEO) events is collected from Thomas One Banker Database. A subsample of SEO unit firms is abstracted from the sample of unit IPOs. The firms are included in the SEO subsample if they met the following requirements: (1) the firm conducted a unit initial public offering (IPO) with warrants attached between 1994 and 2006; (2) the firm was listed on the London Stock Exchange (LSE); (3) the seasoned equity offerings are the primary offer that involves sales of new shares[35]; (4) the seasoned offering announcement date is available on Thomas One Bank or DataStream databases. Adjusted share prices post-listing excluding dividends are obtained from DataStream's Equity Return Index datatype (RI) and cross-referenced with FAME database. Financial data for the SEO firms are collected from DataStream and Thomas One Banker database; and firm specific information is collected from the IPO prospectus. The information on the exercise or expiration of attached warrants in case of unit IPOs are collected from the company's website under press release and confirmed by the company news on Thomas One Banker. If there is no available information on either exercising or expiration of warrants up to the expiration date of warrant contracts, I assume that the warrants are left to expire.

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[35] There are generally two types of SEOs, namely, the secondary seasoned offering and the primary seasoned offering. A secondary offering involves the sale of shares from a group of existing shareholders; as a result, the number of shares outstanding remains the same and the firm receives no proceeds from the sale. A primary offering consists of new shares issued by the firm, which receives the proceeds. In this study, I focus on the decision of unit IPO firms to issue additional shares after the unit IPOs, therefore, only primary seasoned offerings are considered.

4.4.2 Methodology

4.4.2.1 Comparison period returns

A 'comparison period return' approach is adopted to examine the stock price performance around the seasoned offering announcement date. Pre-announcement and post-announcement periods are defined as the 90 days immediately preceding and following the announcement period. The 'announcement period' is defined as the stock offering announcement date plus the following trading day, in the case that the announcement could have occurred after the close of trading on the event day. Each trading day is defined under the event-time framework by the number of trading days preceding or following the announcement date. The average daily return for the 90 trading days immediately following the announcement period is defined as the 'comparison period'.

A portfolio of daily returns is computed for each event day by taking an equally weighted average of individual securities' raw returns. The difference between the portfolio average daily return over the announcement and comparison periods are calculated to measure the average impact of SEO announcements on stock price performance. The significance level of the price reaction is tested by a one-tail t-test of the difference in the above two average returns, with the hypothesis that the announcement period average returns are higher than the comparison period average returns. The standard *t*-statistic of the difference in means of two independent samples is used. The standard deviations for the announcement period and comparison period mean daily returns are calculated from the time series of portfolio daily returns over the two-day announcement period and the 60-trading-day comparison period respectively.

4.4.2.2 Pre– and Post–SEO stock performance measures

Prior research in the UK market has favoured the use of both the cumulated abnormal returns (CARs) and buy-and-hold abnormal returns (BHARs) approaches. In this study, both measures of stock price performance are adopted. Firstly, average monthly adjusted-return (ARt) for 30, 60, and 90 trading days after the seasoned equity offering is computed as:

$$\mathrm{AR_t} = \frac{1}{n_t}\sum_{i=1}^{n_t}(R_{SEO,it} - R_{FTA,it}) \qquad \textbf{EQUATION 4.1}$$

Where, $R_{SEO,it}$ is the total return on seasoned equity offering firm *i* in event day *t*, and $R_{FTA,it}$ is the total return on the comparison FTSE All Share (FTA) Index over the same period. The cumulative adjusted return through event day *s* (CARs) is the sum of the average monthly adjusted-returns for event day 1 to month *s*. Alternatively, to check for robustness, I also calculate market-adjusted holding-period returns for the 30, 60 and 90 trading days, defined as EQUATION 4.2, where $R_{i,t}$ is the raw return of firm *i* on day *t*, R_{FTA} is the return on FTA Index over the responding period, and *k* is equal to 30, 60, and 90 trading days over which the holding period return is to be computed. If the offering firm is delisted prior to the 30, 60 and 90 trading days after its seasoned equity sale, the holding-period returns of that firm and responsive market index returns are truncated on the same day.

$$\mathrm{BHAR_t} = [\prod_{t=1}^{k}(1+R_{i,t}) - \prod_{t=1}^{k}(1+R_{FTA}) - 1 \qquad \textbf{EQUATION 4.2}$$

4.5 Tests and results

4.5.1 Survival of unit firms compared to share-only firms

One of the Agency Cost hypothesis' testable implications is that, after raising money from the unit IPOs, unit firms are often unable to find positive-NPV project to invest in and the attached warrants end up expiring without materialising further funding. As a result, Schultz (1993b) predicts that all else being equal, fewer of them will survive comparing to share-only IPOs. The Signalling hypothesis makes no prediction about relative survival rate and subsequent financing. To reassess this unique prediction of the Agency Cost theory with UK data through Hypothesis 4.1, I adopt a basic binary survival study using the listing membership on London Stock Exchange (LSE) to proxy for the survival of sample IPOs. A company is considered as survived if it is not delisted[36] from the London Stock Exchange. Reasons for delisting include: the sample firm has an insufficient number of market-makers, fails to pay fees, has insufficient capital, and acquired or merged with another company.[37] The delisting dates for all sample firms that are no longer trading have been collected from DataStream database and cross-referenced with Thomas One Banker database.

As shown in Panel A of TABLE 4.2, I reported the numbers of censored IPO sample which are still actively trading (N_1) and which have been delisted (N_2) by the end of 1, 3, and 5 years after their initial public offerings. One year immediately after the IPOs, 90 out of 92(97.83%) unit IPOs are censored as 'survived', whereas all of the share-only firms (100%) are still listed on the exchange. The disparity is much bigger when the time interval increases to three years post-listing: 88.76% of share-only firms remain actively trading, but only 72.83% unit firms survived. Five years following the IPOs, 187 share-only firms (72.48%) are censored as 'survived' comparing to only 58 (63.04%) of unit firms. These results are consistent with the Agency Cost hypothesis that unit firms are more likely to be delisted than firms that issue shares alone. Schultz (1993b) explains that managers will take on any (even negative NPV) projects to maintain their jobs, and will do so if given enough free cash flow up front. Incorporating warrants in an IPO effectively forms a second round of financing, but the

[36] It is worth mentioning that companies that are delisted are not necessarily bankrupt, and may continue trading over the counter. However, delisting can make it more difficult for a company to raise money, and in this respect, it sometimes is a first step towards bankruptcy.

[37] Due to lack of data on any acquisition or merger events of the sample firms, if the company is acquired or merged with another company, they are also classified as failed, since the stock under the current company name will also be delisted. However, it is rather a generalization to define acquisition and merger as 'failure' and more specific definition of 'failure rate' is encouraged in future research.

funding can only be materialised when the share prices exceed the warrant exercise price. Such an arrangement will prevent management from wasting capital on non-profitable projects. In reality, many unit firms will find that there are no positive-NPV projects to ascertain their company's value, resulting in unit warrants being left unexercised and expired. The potential second round of funding falls through almost automatically and therefore, without further funding, the company are more likely to go out of business.

A key characteristic of survival analysis is that survival data are usually censored. Censoring occurs when incomplete information is available about the survival time of some individuals. It is worth mentioning that the data collection of this thesis was finished by 31st December 2009, which is the cut-off date for censored data. The cumulative survival rates are calculated as the [N1/ (N_1+N_2)] by the end of year 1, 3, and 5, respectively. The robustness of this approach is limited in the sense that beyond the cut-off date, certain censored observations may continue to survive for a long time or fail shortly after, the possibilities of which are not incorporated in the survival rate calculated in TABLE 4.2. More sophisticated survival studies such as the Kaplan-Meier method[38] is recommended for future research interests.

I am aware that underlying factors other than the offer type might affect the survival of IPO firms. In order to analyse the survival rate of unit and share-only firms more precisely, I apply the probit model shown in EQUATION 4.3, using the dummy variable of firm *i* surviving for *n* years post-listing as the independent variable as motivated in Section 4.3.1 ($ACTIVE_i^n$, and n=1, 3, or 5). The likelihood that a firm will survive within one, three, or five years following its IPO is estimated in relation to several firm characteristics, the results of which are presented in TABLE 4.2. Definitions of variables are listed in TABLE 4.1. Dummy variable of offer type (UNIT) is included to test whether unit firms have lower survival rate as the

[38] Kaplan-Meier method of calculating survival rates accounts for the number of censored observations at risk of being delisted at the start of any one period, depends on how many have been delisted in the previous periods. As a result the total number of observations declines over time.

Agency Cost hypothesis predicted. The certification effect associated with using reputable underwriters is expected to imply a higher probability of survival after the offering. Therefore, the underwriter REPUTATION dummy is expected to be positively related to the survival dummy. HGSC-adjusted first-day initial returns (IR_D2) are incorporated to consider the market's expectations for the firms at the time of IPOs. Firms whose shares are not sold at considerable discount might fail to attract enough subscription to support their operating activities post-listing. Therefore, I expect that firms with higher initial returns at the time of their IPOs are more likely to survive. The proportion of insider ownership (INSIDER) is anticipated to affect a firm's chance to survive after IPO positively (Schultz, 1993b). The ratio of total debt to total asset is employed as an indicator of a firm's the ability to seek cheaper debt financing rather than equity financing (LEVERAGE). A lower debt component in a firm's capital structure might also affect the firm's ability to achieve cheaper financing to maintain its growth and ultimately their survival. Total asset of firms (ASSET) are included to reflect on ex ante uncertainty regarding firm value.

$$\mathrm{ACTIVE}_i^n = \varphi_0 + \varphi_1 UNIT_i + \varphi_2 REPUTATION_i + \varphi_3 IR_D 2_i + \varphi_4 INSIDER_i + \varphi_5 LEVERAGE_i + \varphi_6 TTLASSET_i + \zeta_i$$

EQUATION 4.3

Test results from three probit regressions reporting the marginal effects, are shown in Panel B of TABLE 4.2. When the dependent variable is the probability of a firm surviving within one year after IPO (*n*=1): The UNIT dummy is negatively significant at 1% level, implying that with 1% increase in the probability of firm *i* choose to issue a unit IPO (instead of share-only IPO), the chance of firm *i* surviving post-listing decrease by 15.23%. INSIDER ownership is positively significant, suggesting that 1% increase in insider holding will improve the probability of survival after one year of listing by 7.67%. Both results are consistent with Schultz (1993b)'s prediction that unit firms which have lower insider ownership than share-only firms are less likely to survive. The initial return is significantly positive at 10%

level. The coefficient indicates that 1% increase in the initial return on the first trading day will increase the survival rate of the issuing firm by 0.87%. REPUTATION of underwriters and issuing firms' ability to secure cheaper debt financing (LEVERAGE) are both positively related to survival rate but they are not significant determinants of the likelihood of a firm's survival one year after IPO. No significant relation is found between the survival rate of an IPO firm and its firm size (ASSET) for the 1-year period post-listing.

When test period is prolonged to three years post-listing, the initial return (IR_D2) stopped being a significant factor in determining a firm's survival. The underwriters REPUTATION on the other hand, becomes significantly different from zero at 1% level, suggesting that if the issuing firm's probability of using a prestige underwriter increases by 1% at the time of IPO, the possibility of firms' survival 3 years post-listing increase by 12.84%. INSIDER ownership also remains positively significant at 5% level. LEVERAGE and ASSET remain insignificant. For the five-year survival regression, initial returns (IR_D2) and INSIDER ownership at the time of IPO, no longer significantly affect the chance of the firms' survival in the long term. However, the offer type of the IPO (UNIT), the underwriters REPUTATION, and the firm size (ASSET) prior to listing do have a significant impact on a firm's long-term survival. The REPUTATION dummies remain highly significant at 1% level for both the 3-year and 5-year intervals, indicating that firms which employ relatively prestigious underwriters for their IPOs, have a better chance of surviving three to five years post-listing. ASSET become significantly negative at 10% level when the 5-year interval is applied, implying that 1% increase in firm size will increase the firm's long-term survival by 1.29%. For all three probit regressions, the UNIT dummy is significantly different from zero at 1% level; providing strong support for the Agency Cost hypothesis (Hypothesis 4.1) that unit firms are more likely to fail one, three or five years post-listing comparing to share-only IPO firms.

INSERT TABLE 4.2 HERE

In TABLE 4.3, I present the means and medians of selected firm characteristics for unit firms and share-only firms, which survived the full 3-year period following their IPOs[39]. In comparing certain features of unit firms and share-only firms that survived, I believe the UK data can provide some supporting evidence as in why unit firms have lower survival rates than that of share-only firms. Definitions of the variables are listed in TABLE 4.1. Unpaired Student's *t*-tests assuming different variances for survived unit portfolios and share-only portfolios are conducted in determining the significance of differences in means; whilst the nonparametric Mann-Whitney (MW) Test's *p*-values are also illustrated to indicate the significance of differences in medians.

Firstly, I examine the firm-specific characteristics such as size, age, risk, earnings, and leverage of the survived unit firms comparing to those of survived share-only firms. Three measures are selected to compare firm size: tangible assets (TANGIBLE), total asset (TTLASSET), and market capitalisation immediately after IPO (MKTCAP). As the results in TABLE 4.3 indicate, unit firms, which survived the full three-year period, are significantly smaller than the share-only firms are. All three measures are much lower for survived unit firms and the differences in both means and medians are highly significant at 1% level indicated by *t*-statistics and *p*-values from MW Tests. Firm riskiness is on the other hand, significantly higher for survived unit firms comparing to that of survived share-only firms. Both differences in means and medians are highly significant at 1% level. Survived share-only firms also have a much larger debt component in their capital structure than survived unit firms do. The total debt (TTLDEBT) for survived share-only firms averages at £12.85 million comparing to only £4.27 million for survived unit firms. The difference in medians for total debt between the two types of firms is also significant at 1% level. The earnings before interest and tax (EBIT) is much lower for survived unit firms (mean £0.75

[39] My reasoning for selecting the sub-sample of firms that survived the 3-year period after their IPOs is twofold: Firstly, there is a rather noticeable disparity between the survival rates of unit firms and share-only firms three years after listing, comparing to the 1-year post-listing subsample. Secondly, the characteristics of unit and share-only firms in the third year following their IPOs should have explanatory power for their survival rates in the fifth year post-listing.

million, median £0 million) comparing to that for survived share-only firms (mean £3.55 million, median £0.9 million). A *t*-statistic of 4.95 and a *p*-value of 0.0000 from the MW test indicate that both the differences in means and medians are highly significant at 1% level. The survived unit firms also appear to have older age and lower insider holding comparing to those of the share-only firms, which survived throughout the same period. However, these two results are not significant. As the above results indicate, unit firms which have already survived the three-year period after their IPOs are significantly smaller, riskier, with lower debt leverage and less earnings than share-only firms that survived the same time interval. Those firm-specific characteristics confirmed the survival rate results before, which states that fewer unit firms will survive comparing to share-only firms. In addition, those characteristics also determine that in a longer test-period of five years, fewer of these unit firms will survive with small firm size, higher risk, less earnings and limited ability to secure cheaper debt financing, which is consistent with the Agency Cost hypothesis.

Secondly, I examine the size, underpricing, and cost of the IPOs for unit and share-only firms that survived after three years of their IPOs. As illustrated in TABLE 4.3, survived unit firms have much less proceeds from their IPOs than those of survived share-only firms. Survived share-only firms on average raise £16.76 million from their IPOs, nearly three times the average proceeds from survived unit firms (£6.88 million). The *t*-value if 4.15 for difference in means is highly significant at 1% level so is the MW *p*-value (0.0000) for difference in medians. With more money raised from the IPOs to support their growth, share-only firms are more likely to survive than unit firms with limited IPO proceeds; which again supports the Agency Cost hypothesis. The HGSC-adjusted initial returns on the first trading day are significantly higher for survived unit firms than for share-only firms in both means and medians at 1% level. The abnormally high degree of underpricing for unit IPOs may attract more aftermarket trading; however, if there are no value-generating projects for unit firms to invest in, the bonding effect of attached warrants will discourage managers from wasting their

IPO proceeds on negative-NPV projects. As a result, unit firms are less likely to receive enough funding to support their growth and in turn, eventually run out of business. The total expense of the IPO is much higher for survived share-only firms than for survived unit firms. Considering the high underpricing cost of unit firms, it is safe to assume that the high cost of share-only IPOs are mostly spent on expensive underwriting fees, to hire more reputable underwriters. As proven previously in the logistic regressions, the certification effect of prestigious underwriters is significantly and positively related to a firm's long-term survival. Overall, the characteristics of the offerings confirmed that unit IPOs are smaller issues with high underpricing and less reputable underwriters. Such firms are less likely to survive comparing to share-only firms whose IPOs are underwritten by prestigious agents with much larger proceeds to support their growth.

Finally, in direct test of the Agency Cost hypothesis, I calculate the efficiency ratios defined in CHAPTER 3 for unit and share-only firms which survived the full 3-year period after their IPOs. The first ratio of total revenue to total asset (REV/TTLASSET) suggests that survived unit firms have much lower efficiency ratio than survived share-only firms. The difference in means is significant at 10% level and the difference in medians is significant at 1% level. The second ratio of EBIT to total asset (EBIT/TTLASSET) provides the same result. The third efficiency ratio of net income to total asset (NI/TTLASSET) is also lower for unit firms. Despite that the difference in means is not significant; the difference in medians is highly significant at 1% level. Lower efficiency ratios for survived unit firms suggest that unit firms have lower profitability in asset utilisation and therefore higher agency costs than share-only firms. In strong support to the Agency Cost hypothesis, the data from the UK proves that unit firms with higher agency costs have lower survival rates than share-only firms have.

INSERT TABLE 4.3 HERE

4.5.2 The subsequent financing of survived unit firms and share-only firms

The question that shall now be asked is; why do firms still choose unit IPOs if unit firms are 'more likely to fail'? Another implication of the Agency Cost hypothesis is that unit firms delay equity financing until the profitability of their projects is verified, implying that unit firms that did survive are more likely to receive further financing through seasoned equity offerings (SEOs) comparing to survived share-only firms. The Signalling hypothesis makes no comparable prediction. The hypothesis is reassessed in this section with UK data. I first construct three subsamples (ACTIVE1, ACTIVE 3, and ACTIVE 5) of firms that survived 1, 3, and 5 years post-listing. Within the three subsamples, I define survived unit firms as received subsequent funding if they conduct their first SEO at any time during the five years after their initial public offerings. The same definition for subsequent financing applies to survived share-only firms that issued their first SEO within five years post-listing.

4.5.2.1 Summary statistics and probit model

TABLE 4.4 illustrates the number of unit IPOs and seasoned equity offerings (SEOs) that were conducted by a unit IPO firm during different cohort years. Additionally selected characteristics of the underlying firms are presented. The cohort periods are determined according to the market conditions. Monthly returns on the FTSE All Share Index, the FTSE Small Cap Index, and Hoare Govett Smaller Companies Index (HGSC) are calculated and charted in FIGURE 4.1 to decide the 'hot' versus 'cold' market conditions. As indicated in FIGURE 4.1, the periods of 1994-95, 1999, and 2001-03, are when the market suffered severe declines of the index returns. In those sub-periods, the number of unit firms that decide to issue seasoned offerings is scarce (10 SEOs in total), comparing to the number of SEOs issued when the market exhibit strong performance (11 SEOs during 1996-98, 11 in the year 2000, and 27 SEOs during 2004-06).

INSERT TABLE 4.4 HERE

INSERT FIGURE 4.1 HERE

To test Hypothesis 4.2, that survived unit firms are more likely to issue subsequent financing, I firstly present descriptive statistics in Panel A of TABLE 4.5. The percentage of unit and share-only firms that decide to issue SEOs within three years post-listing and the percentage of SEO issuance among firms, which survived the full three-year period following their IPOs, are illustrated and compared. As the results indicate, 84.57% of the full sample of unit and share-only firms (350 firms in total) are still actively trading three years after their IPOs, 57.43% of which issued seasoned offerings within this three-year period. A much higher 82.09% of unit firms which survived the three-year period post-listing issued seasoned equity offerings comparing to only 50.22% for survived share-only firms. Such percentage results are in line with the Agency Cost hypothesis that despite the lower survival rate, unit firms, which did survive, are more likely to receive additional funding through SEOs.

I also run a probit regression on the propensity of issuing seasoned offers using a dummy variable SEO as the dependent variable shown in EQUATION 4.4. UNIT dummy is included to indicate offer type. ACTIVE3 dummy aims to capture any relationship between the probability of additional financing and firm survival rate three years post-listing. The HGSC-adjusted initial return on the first trading day (IR_D2) is employed to test whether initial underpricing will affect long-term financial decisions. Net proceeds of the IPOs (NETPROCEED) are included to detect any possible relation between offer size of the initial public offering and the possibility of a second offering. LEVERAGE is calculated as total debt divided by total asset to examine whether the debt component of the capital structure has any effect on equity financing decisions. The marginal effects of variables are reported in Panel B of TABLE 4.5. Both the UNIT dummy and survival dummy (ACTIVE3) are positively related to SEO dummy and are highly significant at a 1% levels, indicating that unit firms that did survive are more likely to receive subsequent financing. Net proceeds of the

IPO are negatively significant at a 5% level, implying that firms that raise less funding in the initial public offerings are more likely to issue additional shares within 3 years of the IPO. The initial returns of IPOs and debt leverage are not significant determinates on the likelihood of subsequent financing.

$$SEO_i = \lambda_0 + \lambda_1 UNIT_i + \lambda_2 IR_D 2_i + \lambda_3 NETPROCEED_i + \lambda_4 ACTIVE3_i + \lambda_5 LEVERAGE_i + \zeta_i$$

EQUATION 4.4

INSERT TABLE 4.5 HERE

4.5.2.2 Comparison of survived unit SEO firms and survived share-only SEO firms

To confirm the results on the issuance of SEOs from survived unit and share-only firms, in TABLE 4.6 I have illustrated means and medians of selected characteristics for unit SEO firms in comparison to share-only SEO firms within *n* years of their survival (*n*=1, 2, and 3). Unpaired Student's *t*-tests assuming different variances are conducted in determining the significance of differences in means, whilst the non-parametric Mann-Whitney (MW) tests are conducted to examine differences in medians. The *p*-values are presented to indicate the significance level of differences in means and medians.

Firstly, several variables are selected to compare firm-specific characters. Firm size, measured by both the tangible asset and the market capitalisation immediately after IPO, are significantly larger in both means and medians for share-only SEO firms than for unit SEO firms. The average riskiness of share-only SEO firms is significantly lower than that of unit SEO firms at 1% level but the difference in medians is not significant. With smaller firm size and higher risk, unit firms that survived may have a greater need to issue additional equity to support their growth comparing to survived share-only firms; which possess more assets, larger market shares and more stable growth. Unit SEO firms also seem to have much lower earnings before interest and tax (EBIT) than that of share-only SEO firms. Although the difference in means is not significant suggested by *t*-value, the difference in medians is significant at 5% level indicated by the *p*-value of the Mann-Whitney Test. Such results imply that although some unit firms survived, on average they generate much less income than survived share-only firms to support their growth. The amounts of total debt by the time of IPOs (TTLDEBT) are also compared between the two sub-samples to indicate the ability to secure cheaper debt financing. Despite the low significance level of difference in means, the median total debt of share-only SEO firms are significantly higher than that of unit SEO firms at 5% level. With less income and lower ability to secure debt financing, survived unit firms are more likely to issue seasoned offerings to support their on-going operation whilst share-only firms can reinvest their earnings or/and secure cheaper loans to expand.

In addition to firm-specific factors, I also compared characteristics of the IPOs between the unit SEO firms and share-only SEO firms. With high significance levels in both differences in means and medians, it is apparent that unit SEO firms raised much smaller proceeds from their initial public offerings than share-only IPOs. Given the nature of unit IPOs discussed in the previous chapter, the issue size of unit IPOs is intentionally limited at the starting-up stage for unit firms because they tend to be younger, smaller and riskier firms. After the profitability of the firms' investment projects have been verified by the market, the second round of financing will be materialised through the exercise of attached warrants. However, only very few warrants included in the IPOs are actually exercised before maturity (Schultz 1993b). This could be why survived unit firms are more likely to receive further funding through seasoned equity issues than share-only firms. Another two IPO-related characteristics are compared between unit SEO sample and share-only SEO sample. As a major part of the total cost of going public, the degree of underpricing is significantly higher for unit SEO firms than for share-only SEO firms. However, when the total expenses (EXPENSE) of IPOs for the two sub-samples are compared, the result reversed. Share-only SEO firms exhibit significantly higher total cost for their IPOs than the total cost of unit IPOs. Combining the low underpricing cost and high total cost of share-only IPOs, it is reasonable to assume that a share-only IPOs' high expense comes from the underwriting fees, while unit IPOs are likely to be underwritten by less reputable agents as the previous chapter has proven. For survived unit firms, they have strong motives to issue additional equity at lower discount to recoup the underpricing cost from their IPOs through less expensive underwriters. Survived share-only firms, which have less IPO underpricing cost to recover and more expensive SEO underwriting fees to pay, they will be more selective about any further equity issues.

Overall, the comparison results from both the firm-specific factors and the IPO-related characteristics confirm the previous probit regression results that survived unit firms are more likely to issue seasoned equity offerings than survived share-only firms do. The UK evidence on the subsequent financing of unit and share-only firms provides strong support to the Agency Cost hypothesis.

INSERT TABLE 4.6 HERE

4.5.3 Stock price performance around SEO announcements

4.5.3.1 The announcement effect

To test Hypotheses 4.3 and 4.4 proposed in Section 4.3, I first examine the stock price movement closely around the SEO announcement day with a 10-day window before and after the announcement. TABLE 4.7 illustrates average abnormal returns (ARs) and cumulative abnormal returns (CARs) from 10 days preceding and following the announcement day for the unit SEO firms in comparison to the benchmark index. In most cases, the news is announced on event day -1, i.e. the Announcement Day (AD), and reported the next day. Event day 0, i.e. the Publication Day (PD) is the day when the decision of a seasoned offering is published, as documented in the Thomas One Banker database or the DataStream database.

If an equity offering is announced before the market closes, then the market's reaction to the news actually predates the publication by one day. If the news is announced after the market closes, the market will respond the next day and the reaction in fact takes place on event day 0. I define both event day -1 and event day 0 as the 'Announcement Period' (AP).

As the results in Panel A of TABLE 4.7 indicate, the average raw return on event day 0 is 2.332% with several slight reversals before the announcement on event day -10, -3, and -2. Nonetheless, the average abnormal returns of unit SEO firms have been clearly increasing 10 days before the announcement period. Such pattern is confirmed by the pervasively positive and increasing cumulative abnormal returns (CARs). The 10-day cumulative return for unit SEO firms is 5.350% on the announcement day (AD) and 7.822% on the publication day (PD). However, the general level of market returns 10 days before the announcement does not show any sign of a stock price run-up. Rather, the average daily returns on the FTA Index are largely negative for the 10 days before announcement. Despite the market's less favourable movement before the announcement, the SEO firms show a more apparent pattern of stock price appreciation before the announcement. The market-adjusted cumulative abnormal returns are constantly positive 8 days before the announcements.

After the announcement day, the average raw returns on the SEO stocks deteriorate significantly. The SEO stocks fall sharply immediately after the announcement on event day +1, with all the 10 daily average raw returns being negative after the announcement day. The results from the cumulative returns also affirmatively underpin the negative price reaction to the announcement. The general level of market stays unaffected during the announcements, displaying consistent negative returns on the FTA Index as before. The market-adjusted mean abnormal returns after the announcement are significantly negative and declining with a very mild reversal on event day +5. The cumulative results confirm the deterioration of the stock performance for the 10 days after the seasoned offering has been announced.

In Panel B of TABLE 4.7, the two-day announcement period average CAR is computed, in particular, to capture the effect of an announcement due to its timing relative to the market's trading hours. As mentioned previously, if the decisions of SEO issuance are announced on event day -1 (the Announcement Day) after the market is closed, it will be reported on the next day (the Publication Day). If an equity offering is announced before the market closes, then the market will react to the news on the Announcement Day. Therefore, both event day -1 and event day 0 are defined as the 'Announcement Period'. As Panel B demonstrates, the cumulative returns for the two-day announcement period are significantly positive, which confirms the results from Panel A that there is an apparent price run-up 10 days before the SEO announcement.

INSERT TABLE 4.7 HERE

To explore the timing of SEO issuance over a longer period, the average cumulative abnormal returns 90 days preceding and following the SEO announcements are illustrated in TABLE 4.8. Positive average cumulative abnormal returns are observed for the 90-days preceding the announcement day. 90 days before the announcement, the average FTA-adjusted CAR is -0.103% whereas the FTA-adjusted average CAR for the 60-day period before the announcement is 4.05%. As the time draws closer to the announcement (30 days before the announcement), the stock price run-ups display signs of acceleration (8.501% after market adjustment). The average market-adjusted CAR five days before the announcement is 8.422%. On the announcement day, the market-adjusted CAR surged up to 12.635%. After the seasoned offerings have been announced, the average CARs decline significantly. From day +25 onwards, the cumulative abnormal returns become negative and the decreasing trend remained (-3.629% for day +30, -8677% for day +60, and -14.294% for day 90). Clearly, throughout the whole 180 days surrounding the SEO announcements, the market index provides very stable performance with very mild variation and remains unaffected by the events. To provide a visual conclusion; in FIGURE 4.2, I plot the average raw and market-adjusted cumulative returns of the portfolio of unit firms that conducted SEOs within three years of their unit IPOs, for 90 days before and after the SEO announcement. As clearly displayed, a pattern of stock price appreciation before the announcement of seasoned offerings and an apparent price decline afterwards is captured. The market index movements, on the other hand, remain unaffected throughout the event of seasoned offerings.

To sum up, the study of stock price performance around SEO announcements made by unit IPO firms supports both Hypothesis 4.3 that there is a significant price run-up before SEOs are announced; and Hypothesis 4.4 that there is a negative price reaction to the SEO announcements. Managerial insiders of these unit firms appear to sell additional shares following a period in which the stocks outperform the market. Subsequent to the SEO announcements, however, superior performance ceases and general underperformance of the SEO firms are observed. Such deterioration of stock performance after the SEO announcements can be explained by new investors 'adverse selection'. As rational investors, new subscribers expect the managers will only conduct an additional sale of shares when they believe their company's shares are overvalued. On behalf of the existing shareholders, the managers are trying to exploit the window of opportunity and sell overvalued shares. While such decisions are in the existing shareholders' interests, the benefit comes at the cost of new investors' interests if they buy the overvalued shares. As a result, the new investors rationally revise their valuation of the SEO shares downwards, which causes the stock price fall right after the seasoned issues have been announced. Despite the fact that seasoned issues are conducted following a period of price appreciation, the results in TABLE 4.8 and FIGURE 4.2 provide no evidence of managers' ability to time the market for their decision to issue new shares. The performance of the FTA Index does not show significant volatility that can be related to the SEO events. The results indicate increasing pre-announcement market-adjusted abnormal returns and decreasing post-announcement market-adjusted returns, but no timing pattern for the general level of market returns surrounding the announcement date.

INSERT TABLE 4.8 HERE

INSERT FIGURE 4.2 HERE

4.5.3.2 Potential causes of price reaction

In order to assess the potential causes for stock price appreciation before SEO announcements, a linear regression is conducted for individual announcement period returns, shown as EQUATION 4.5. The following variables are included in the regression in the projection that these indicators are used by the market in predicting any SEO announcement. The dependent variable, price run-up of the SEO firms (SEOUP), is calculated as the buy-and-hold abnormal returns 90 days before the announcement day. The market index level (MKTUP) is measured by the buy-and-hold returns for the same period. Firm characteristics prior to listing such as debt LEVERAGE, profitability (EBIT), INSIDER ownership, firm riskiness (RISK) are also included in explanation of the price appreciation before SEO announcements. The last variable is the FTA Index-adjusted monthly buy-and-hold abnormal returns of the SEO firms for 12 months after the initial public offering, indicating their medium-term performance.

$$\text{SEOUP} = \theta_0 + \theta_1 \text{MKTUP} + \theta_2 \text{LEVERAGE} + \theta_3 \text{EBIT} + \theta_4 \text{INSIDER} + \theta_5 \text{RISK} + \theta_6 \text{BHAR12} + \xi$$

EQUATION 4.5

As the results from TABLE 4.9 indicate the price run-up of the SEO firms (SEOUP), is positively related to the market index level (MKTUP) over the same period. The debt LEVERAGE of unit firms prior to listing is also significantly and positively related to the stock price appreciation before these unit firms announced to issue seasoned offerings. Such a positive correlation implies that the higher debt leverage unit firms possess at time of listing can significantly cause higher level of price increase before the SEO announcement. EBIT of unit firms prior to listing is negatively related to the level of price increase before the SEO announcement. The *p*-value for this coefficient, however, is not significant. The INSIDER holding of the unit firm at time of the IPO projects a significantly positive impact on the stock price run-up preceding the announcement and it is significant at 5% level. Investors assume that managerial insiders have more information about the expected future cash flows of their companies. Since it is costly for managers to hold a substantial fraction of their own company's shares, managers are motivated to hold large stock positions only if they expect higher future cash flows than the firm's current value. Therefore, rational investors will view managerial holdings as a credible signal of firm quality. A high level of insider holding even at time of the IPO can positively influence the investors' predictions of seasoned issues in the future. The riskiness of unit firms (RISK) also has significantly positive influence on the market expectation to predict a SEO announcement. Riskier unit firms experience higher price run-up before the SEO announcement. The 12-month BHARs post-listing are positively related to the level of price appreciation before the SEO announcements. The result is highly significant at 1% level, implying that unit firms, which exhibit better medium-term stock performance, will experience higher price run-up before issuance of SEOs. The coefficient of determination R^2 (46.79%) is presented to indicate the goodness of fit for the regression. The magnitude of R^2 is not high, which can be explained by the limited sample size. However, the F-statistic is highly significant at 1% level. The variance inflation factors (VIF) for included variables are all around the value of one, suggesting that there is no multicollinearity among the independent variables. Overall, the regression results provide reliable indications.

INSERT TABLE 4.9 HERE

4.5.4 Warrant characteristics and the decision to issue SEOs

Paul Schultz (1993) provides evidence that by issuing units, firms pre-commit to a seasoned offering at the exercise price of warrants, designed to take place when the warrants are called or voluntarily exercised. A sequential offering is applied for an IPO for the same reason that venture capitalists provide equity financing in stages. Giving management more money than it needs to fund current investments provides a free cash flow that might be squandered if investment opportunities fail to materialise.

Staged equity financing can also be achieved through a share-only IPO followed by a seasoned equity offering (SEO). However, an advantage of a unit IPO is that the price of the seasoned offering shares is set in advance as the warrant exercise price. In addition, if the second round of financing is to be achieved through exercise of the warrants, the proceeds from the IPO must be used to ascertain the value of the firm's projects. More interestingly, Schultz (1993)'s US data shows that most of the warrant exercise prices in unit offerings are set above the current stock price. Schultz (1993b) also argues that such an offer would motivate management to use the IPO proceeds wisely to convey information about the firm's true value; because only when the share price rises above the warrant exercise price would the second round of financing materialise. Without such monitoring mechanisms, management's incentive would be to invest IPO proceeds to ensure the security of their jobs. In my UK sample, 54.35% of the unit warrants are issued with their exercise price set equal to the placing price; 33.7% of the warrants are issued out-of-money with their exercise price set above the placing price; and only 11.96% of the warrants are actually issued in-the-money.

To examine the likelihood of a unit IPO firm issuing SEOs in association to the characteristics of warrants attached to the initial sale of shares, I conduct a probit regression presented as EQUATION 4.6. The independent variable is the SEO dummy, which is equal to 1 if a unit firm issued a seasoned equity offering within three years of its IPO. The initial underpricing on the first trading day (IR_D2) is included to test Hypothesis 4.5 that unit firms, which were more underpriced at the time of IPOs, are more likely to conduct SEOs within three years post-listing. In examination of Hypotheses 4.6-4.7, the OUT dummy takes the value of 1 if warrants are issued out-of-money, 0 if otherwise and the LIFE of warrants is calculated as the number of years between listing and warrant expiration day. The EXERCISE dummy takes the value of 1 if the attached warrants have been exercised three years post-listing, 0 if otherwise and is included to test Hypothesis 4.8.

$$SEO_i = \lambda_0 + \lambda_1 IR_D 2_i + \lambda_2 OUT_i + \lambda_3 LIFE_i + \lambda_4 EXERCISE_i + \lambda_5 WARRNTROCEED_i + \lambda_6 REPUTATION_i + \zeta_i$$

EQUATION 4.6

The results from probit regression are illustrated in TABLE 4.10. The initial underpricing is negatively related to the SEO dummy at 10% level, in rejection of Hypothesis 4.5. As previously documented in CHAPTER 3, unit IPOs are more underpriced than share-only IPO firms. According to the Signalling hypothesis, the managerial insiders intentionally underprice the initial sale of shares to signal firm quality in hope that they can recoup the cost of underpricing through issuing seasoned offerings at a more favourable price. As such with higher the initial underpricing, the management of unit firms should have higher incentives to recover the cost by issuing SEOs. On the contrary, the results from my unit IPO sample generate a significantly negative coefficient (-0.1580) on the initial return variable, which implies that unit IPO firms that achieved higher initial returns are less likely to conduct a seasoned offer within three years of their IPOs. Therefore, the UK evidence from subsequent financing of unit firms does not support the Signalling hypothesis' prediction.

The coefficient on dummy variable OUT is significantly negative (-0.6019) at 5% level, indicating that if the attached warrants in an IPO were issued out-of-money, it is less likely that the unit firm will conduct a second offering within 3 years of its IPO. If insiders intentionally attach out-of-money warrants in unit IPOs, these warrants could only be exercised when the company's share price exceed the warrant exercise price. Implicitly, this warrant feature creates an incentive for the management of unit firms to use the IPO proceeds wisely to increase their companies' share prices, so that the warrants will be exercised and the second round of financing materialised. Therefore, the UK data provide strong support to Hypothesis 4.6 that unit firms, which issued out-of-money warrants, are less likely to rely on SEOs for future funding. Such explanation is in line with the Agency Cost explanation for including warrants to reduce agency costs.

The coefficient on the gross proceeds from warrant subscription if they are to be exercised (WARRANTPROCEED) is positive, but not statistically significant. One explanation could be that, the higher the projected warrant proceeds at the time of the IPO, the more funds the unit IPO firm is planning to receive for the second round of financing to support future value-generating activities. With the low probability of the warrants ever to be exercised, it is more likely for those firms to turn to a seasoned equity issue for the funding of any projects with positive NPV. A similar implication is drawn from the coefficient on warrants' life. The negative coefficient implies that the shorter the warrants' life before expiration, the more likely for them to expire before meeting the criteria to be exercised; and so the higher the unit firms' reliance on a seasoned equity sale to raise the funds. Again, the significance level for this coefficient is relatively low and fails to support Hypothesis 4.7. The negative coefficient on the EXERCISE dummy is not significant and fails to support Hypothesis 4.8, which predicts that if unit firms did not exercise the warrants, they are more likely to issue SEOs as the second round of financing. The underwriter REPUTATION is positive and significant at 10% level, indicating that if the unit IPO is marketed by a reputable underwriter, the unit firm is more likely to conduct SEOs within three years post-listing.

In conclusion, the above analysis confirms that some characteristics of the warrants attached in a unit IPO possess predictive power over managerial decision of whether conducting a seasoned equity offer within three years post-listing. The more underpriced the unit IPOs, the less likely, that these unit firms will issue additional shares in the near future. Unit IPOs whose attached warrants are issued out-of-money, are less likely to issue SEOs. On the other hand, the warrant proceeds, time before warrant expiration, and the eventual outcome of warrant contract (exercised or expired) do not have statistically significant impact on management's decision to conduct seasoned equity offering three years post-listing.

INSERT TABLE 4.10 HERE

4.6 Summary and conclusions

Continuing the examination of the Agency Cost and the Signalling hypotheses in CHAPTER 3 with evidence from initial underpricing and short-term performance, CHAPTER 4 aims to investigate the post-listing survival and subsequent financing of unit IPOs in test of the competing explanations for including warrants. The test of the Agency Cost hypothesis are motivated by Schultz (1993b)'s unique prediction that fewer unit firms will survive comparing to share-only firms; but survived unit firms are more likely to issue seasoned equity offerings for further funding. The examination of the Signalling hypothesis are motivated by its prediction that unit firms which underprice the initial offering tend to issue seasoned equity at higher prices to recoup the costs of signalling (occurred in the underpricing, insider retention, and the inclusion of warrants) at the time of unit IPOs.

In Section 4.5.1, the descriptive results are consistent with the Agency Cost prediction that unit firms are more likely to be delisted than firms that issue shares alone. A probit regression analysis is conducted using survival dummy as the dependent variable and estimated in relation to offer type dummy UNIT and several firm characteristics for one, three, and five years post-listing respectively. For all three test-periods, the UNIT dummy is significantly negative at 1% level; providing strong support for the Agency Cost hypothesis that unit firms are more likely to fail comparing to share-only IPO firms. Evidence was found that firms with higher insider ownership are more likely to survive up to three-years post-listing; firms with higher initial returns are more likely to survive their IPO by one year. On the other hand, firms, which were brought to the market by reputable underwriters, have a better chance of surviving three to five years post-listing. No significant relation is found between the survival rate of an IPO firm and its leverage level.

The mean and median values of selected firm characteristics for unit firms and share-only firms, which survived the full 3-year period following their IPOs, are compared. Results indicate unit firms which have already survived the three-year period after their IPOs are significantly smaller, riskier, with lower debt leverage and less earnings than share-only firms that survived the same time interval. Those firm-specific characteristics confirmed the survival rate results before. The characteristics concerning the offerings, such as issue size, underpricing, and the cost of the IPOs for survived unit and share-only firms are also illustrated in comparison. Evidence is found that survived unit firms have significantly less proceeds from their IPOs than those of survived share-only firms. With less money raised from the IPOs to support their growth, unit firms are less likely to survive, which again supports the Agency Cost hypothesis. The HGSC-adjusted initial returns on the first trading day (IR_D2) are significantly higher for survived unit firms than for share-only firms in both means and medians at 1% level. The abnormally high degree of underpricing for unit IPOs may attract more aftermarket trading; however, if there are no value-generating projects for unit firms to invest in, the bonding effect of attached warrants will discourage managers from wasting their IPO proceeds on negative-NPV projects. As a result, unit firms are less likely to materialise warrant proceeds to support their growth and are more likely to run out of business. The total expense of the IPO is much higher for survived share-only firms than for survived unit firms, which confirms the previous finding that share-only IPOs tend to employ highly reputable underwriters to market for their issues; and the certification effect of prestigious underwriters significantly increase the chance of a firm's long-term survival. Lower efficiency ratios are also found for survived unit firms suggesting that unit firms have lower profitability and asset utilisation and therefore higher agency costs than share-only firms. Overall, in strong support to the Agency Cost hypothesis, the evidence from the UK proves that unit firms are smaller, riskier, with lower debt leverage, less earnings, and higher agency costs; and unit IPOs are smaller issues with high underpricing and less reputable underwriters. Such firms are less likely to survive comparing to bigger, less risky share-only firms with more earnings, higher debt leverage, and lower agency costs; and whose IPOs are underwritten by prestigious agents with less underpricing and much larger proceeds to support their growth.

The second objective of this chapter is to test whether survived unit IPO firms are more likely to issue seasoned equity offerings than share-only IPO firms are. As the results from Section 4.5.2 indicate, 84.57% of the 350 firms in total are still actively trading three years after their IPOs, 57.43% of which issued seasoned offerings within this three-year period. A much higher 82.09% of survived unit firms issued seasoned equity offerings comparing to only 50.22% for survived share-only firms. Such percentage results are in line with the Agency Cost hypothesis that despite the lower survival rate, survived unit firms, are more likely to receive additional funding through seasoned equity offerings. A probit regression on the propensity of SEO issuance is conducted. Both the UNIT dummy and survival rate dummy are positively related to SEO dummy and are highly significant at a 1% level, indicating that unit firms that did survive are more likely to receive subsequent financing. Additional evidence was found that firms, which raise less funding in their IPOs, are more likely to issue seasoned offerings. Overall, The UK evidence from the subsequent financing provides strong support to the Agency Cost hypothesis.

Section 4.5.3 investigates the stock price reactions to the SEO announcements made by unit IPO firms. Results suggest an apparent price run-up before the announcement of the seasoned issues, and a significant decline in share prices after the SEOs have been announced. Such results are robust for both the 10-day and 90-day windows. Evidence is found that managerial insiders of the SEO firms sell stock following a period in which the stock appears to outperform the market. Subsequent to the announcement of seasoned issues, superior performance ceases and general underperformance of the SEO firms is observed. Such deterioration of stock performance after the SEO announcement can be explained by new investors 'adverse selection'. Potential causes for stock price appreciation before the SEO announcements is assessed with a linear regression conducted on the level of price run-up 90 days before the announcement day. Results suggest that the general market level, the percentage of insider holding, the riskiness and the debt leverage of unit firms at time of the unit IPOs can significantly influence new investors' expectations in prediction of the announcement of a seasoned issue and cause higher level of price increase before the announcement day. Finally yet importantly, the FTA Index-adjusted 12-month buy-and-hold abnormal returns of unit IPOs, indicating their medium-term performance, are also significantly positive, implying that one year following the unit IPOs, well-performed unit firms are more likely to issue seasoned equity offerings.

Section 4.5.4 examines the unit firm's decision to issue SEOs in association of firm-specific characters and warrant features at the time of IPOs. Evidence was found that some characteristics of the warrants attached in a unit IPO possess predictive power over managerial decision to conduct a seasoned equity offer within three years post-listing. Unit IPOs, whose attached warrants are issued out-of-money, are less likely to issue SEOs. On the other hand, the warrant proceeds, time before warrant expiration, and the eventual outcome of warrant contract (exercised or expired) do not have statistically significant impact on the issuance of seasoned equity offering three years post-listing, possibly due to limited sample size. Last but importantly, the SEO dummy is found to be negatively and significantly related to the initial underpricing of unit IPOs, which implies that the more underpriced unit IPOs are less likely to issue additional shares in the near future. Such results contradict the Signalling hypothesis, which explain the inclusion of warrants and the underpricing are all costly signals of firm quality and the cost of signalling will be recovered through seasoned issues at higher price. Therefore, the UK evidence from subsequent financing of unit firms does not support the Signalling hypothesis' prediction.

Overall, the UK evidence from the post-listing survival and subsequent financing of unit IPO firms provide strong support to the Agency Cost hypothesis but fails to support the Signalling hypothesis. Unit IPO firms in the UK have lower survival rate than that of share-only IPO firms. However, survived unit firms are more likely to receive further funding through seasoned issues of shares than share-only firms are. In addition, there is a clear pattern of price appreciation (price run-up) before the SEO announcements, and a negative price reaction immediately after the SEO issuance. Evidently, the unit firms tend to issue seasoned shares when they are overvalued. However, the more underpriced unit IPOs are less likely to issue additional shares. The cost of underpricing, if it was meant for signalling firm quality, is not always recovered via SEO issuance. The next chapter will continue to investigate the reasons for choosing unit IPOs with a long-term focus.

TABLES

TABLE 4.1
Definitions of included variables

Variables	Definition
ACTIVE *n*	Dummy variable that is equal to 1 if the firm survived the full *n*-year pe following its IPO
AGE	Number of calendar days between firm incorporation and the listing date
AIM	Dummy variable that is equal to 1 if the IPO firm is listed on Alternative Investment Market (AIM), 0 if otherwise
BHAR-12	The HGSC Index-adjusted buy-and-hold returns of SEO firms 12 months after their unit IPOs
EBIT	Earnings before interest and tax of the IPO firm by the end of the fiscal year prior to the IPOs
EXERCISE	Dummy variable that is equal to 1 if the warrants attached to the IPO are already exercised at the time of this research, 0 if otherwise
EXPENSE	Percentage of total expense to gross proceeds of the IPOs
INSIDER	Percentage of directors' holdings in their own company immediately after the listing
IR_D2	HGSC-adjusted initial return on first trading day
LEVERAGE	Ratio of total debt to total asset by the end of the fiscal year prior to the IPOs
LIFE	Number of years before warrant expiration
Ln(PROCEED)	The natural logarithm of the expected gross proceeds from the IPO
MKT2BK	Market-to-book ratio of IPO firms immediately post-listing
MKTCAP	Market capitalisation of the issued share capital following the listing at the placing price
MKTUP	The price run-up in the HGSC Index over the 90 days before SEO announcements, which is measured by its buy-and-hold abnormal returns
NI	Net income after tax by the end of the fiscal year prior to the IPOs
DEBT	The ratio of total debt divided by the gross IPO proceeds
NETPROCEED	The proceeds net of any expenses from the IPOs
OUT	Dummy variable that takes the value of 1 if the warrants attached to the IPO are issued out-of-money, 0 if otherwise
PROCEEDS	The expected gross proceeds of the IPOs
REPUTATION	Dummy variable that is equal to 1 if the underwriter has a high reputation ranking, 0 if otherwise
REVENUE	The ratio of total revenue divided by the gross proceeds from IPO
RISK	Firm riskiness, measured by the residual standard deviations of the discrete share return 200 days following the IPO
SEO	Dummy variable that is equal to 1 if the firm issued the first seasoned equity offer within 5 years of its IPO; 0 if otherwise
SEOUP	The stock price run-up for SEO firms over the 90-day pre-announcement period, measured by its buy-and-hold abnormal returns
TTLASSET	Total asset of the sample firms by end of the fiscal year prior to the IPO
TTLREVENUE	Total revenue of the IPO firm by the end of the fiscal year prior to the IPOs
UNIT	Dummy variable that takes the value of 1 if the IPO includes warrants, 0 if otherwise
WARRANTPROCEED	The gross proceeds from the warrant subscription if the warrants are exercised

TABLE 4.2
Survival of unit IPO firms and share-only IPO firms.

The complete sample of 350 IPOs listed on London Stock Exchange during the period of 1994-2006, comprises of 92 unit firms and 258 share-only firms. Panel A exhibits the cumulative 1, 3, or 5-year survival rate of both the unit and share-only IPO samples. Companies are classified as failure if they are delisted from the London Stock Exchange because they have an insufficient number of market makers, fail to pay fees, have insufficient capital, or have similar problems. N1 represents the number of firms which are still actively trading on the exchange, whereas N2 represents the number of delisted firms by the end of year n (n=1,3,or 5). The cumulative survival rate is calculated as the N1/ (N1+N2) by the end of year 1, 3, and 5, respectively. Panel B presents three probit regressions, reporting marginal effects on the factors that affect the probability of an IPO firm's survival. The dependent variable in each regression, is the binary survival dummy $ACTIVE_i^n$, which takes the value of 1 if firm *i* is still listed and actively trading by the end of year *n (n=1, 3 ,and 5, respectively, in the three regressions)*, 0 if otherwise. Under each time interval, the number of censored observations (N1) and delisted observations (N2) are presented. The *p*-values of coefficients are reported in parentheses to demonstrate significance levels. Pseudo R^2, LR Chi^2, log likelihood, and correctly predicted percentage are presented to indicate the goodness of fit.

Panel. A: Survival rates for 1, 3 or 5 years after IPO

	Unit IPOs (92)			Share-only IPOs (258)			Total (350)		
Period	N_1	N_2	**Survival**	N_1	N_2	**Survival**	N_1	N_2	**Survival**
1 Year	90	2	97.83%	258	0	100%	348	2	99.42%
3 Years	67	25	72.83%	229	29	88.76%	296	54	84.57%
5 Years	58	34	63.04%	187	71	72.48%	245	105	70.00%

Panel B: Probit regression of survival within *n* years, reporting marginal effects

Number of observations N =350	$ACTIVE_i^1$ (N1=348, N2=2)	$ACTIVE_i^3$ (N1=296, N2=54)	$ACTIVE_i^5$ (N1=245, N2=105)
INTERCEPT	0.2232 (0.000)[a]	0.2526 (0.001)[a]	0.6983 (0.051)[b]
UNIT	*-0.1523* (0.000)[a]	-0.2838 (0.000)[a]	-0.5458 (0.000)[a]
REPUTATION	0.0122 (0.327)	0.1284 (0.005)[a]	0.4050 (0.000)[a]
IR_D2[40]	0.0087 (0.083)[c]	0.0137 (0.319)	-0.0022 (0.046)[b]
INSIDER	0.0767 (0.001)[a]	0.1361 (0.050)[b]	0.0385 (0.763)
LEVERAGE	0.0110 (0.165)	0.0142 (0.461)	0.0078 (0.591)
ASSET	-0.0161 (0.924)	-0.0164 (0.380)	-0.0129 (0.081)[c]
LR Chi^2	*76.65* *(0.000)[a]*	*77.38* *(0.000)[a]*	*144.42* *(0.000)[a]*
Pseudo R^2	*40.29%*	*27.49%*	*31.27%*
Log likelihood	*-56.78*	*-113.52*	*-158.69*
Correctly predicted percentage	*75.16%*	*76.13%*	*69.89%*

a: Significantly different from zero at 1% level (z- test).
b: Significantly different from zero at 5% level (z- test).
c: Significantly different from zero at 10% level (z- test).

[40] The HGSC-adjusted first-week initial return relative to the offer price IR_W1 is also adopted as alternative underpricing measure in the Probit regression in Panel B of TABLE 4.2. The results and conclusions are very similar and therefore not included in this thesis.

TABLE 4.3
Descriptive statistics of survived IPO firms 3 years post-listing

Means and medians of selected firm characteristics for share-only and unit firms, which survived the full 3-year periods following their IPOs, are presented. N is the number of survived firms, which are still listed on the London Stock Exchange. Definitions of the variables are listed in TABLE 4.1. Unpaired Student's *t*-Tests assuming different variances for survived unit firms and share-only firms are conducted in determining the significance of differences in means, whilst Mann-Whitney (MW) Test's *p*-values are illustrated to indicate the significance of differences in medians.

		Survived share-only firm	**Survived Unit firm**	***t-test and MWtest***
TANGIBLE(£m)	Mean	5.58	1.16	*0.010*[a]
	Median	*0.52*	*0.02*	*0.000*[a]
TTLASSET(£m)	Mean	16.01	5.61	*0.007*[a]
	Median	*2.98*	*1.01*	*0.000*[a]
MKTCAP(£m)	Mean	49.35	24.64	*0.003*[a]
	Median	*25.11*	*9.82*	*0.000*[a]
RISK	Mean	0.034	0.045	*0.009*[a]
	Median	*0.03*	*0.04*	*0.000*[a]
EBIT(£m)	Mean	3.55	0.75	*0.000*[a]
	Median	*0.90*	*0.00*	*0.000*[a]
TTLDEBT(£m)	Mean	12.85	4.27	*0.006*[a]
	Median	*1.82*	*0.39*	*0.000*[a]
INSIDER	Mean	0.40	0.38	*0.210*
	Median	*0.40*	*0.36*	*0.344*
GROSSPROCEEDS (£m)	Mean	16.76	6.88	*0.000*[a]
	Median	*7.00*	*2.84*	*0.000*[a]
IR_D2	Mean	0.07	0.46	*0.005*[a]
	Median	*0.05*	*0.20*	*0.000*[a]
TTLEXPENSE(£m)	Mean	4.47	0.80	*0.000*[a]
	Median	*1.00*	*0.00*	*0.000*[a]
REV/TTLASSET	Mean	1.32	0.93	*0.107*[c]
	Median	*0.94*	*0.03*	*0.000*[a]
EBIT/TTLASSET	Mean	0.16	-0.40	*0.070*[c]
	Median	*0.23*	*0.00*	*0.000*[a]
NI/TTLASSET	Mean	-0.35	-0.58	*0.472*
	Median	*0.01*	*-0.07*	*0.010*[a]

a: Significantly different from zero at 1% level (two-tailed test).
b: Significantly different from zero at 5% level (two-tailed test).
c: Significantly different from zero at 10% level (two-tailed test).

TABLE 4.4
Distribution of unit IPOs and SEOs by market condition

Average capital raised, is the average gross proceeds from the IPO in millions, average number of new shares offered (millions), average insider holding (%), average firm-value sold as warrants (%), earnings before interest and tax (EBIT) and total debt (TtlDebt). The sub-period of 1994-95, 1999, and 2001-03 are considered the cold market period; when the market suffers general loss and has less IPO activities, whereas, the sub-periods of 1996-08, 2000, and 2004-06 indicate overall price appreciation on the market index and display more IPO activities.

Issue Period	Total Unit IPOs	Total SEOs	Capital Raised (£m)	Share Offered (m)	Insider (%)	Firm-value sold as warrants (%)	EBIT (£m)	TtlDebt (£m)
1994-95	6	3	3.2	15.4	24.9	13.8	2.5	4.0
1996-98	17	11	4.3	16.6	31.6	6.7	1.5	5.5
1999	4	1	3.1	10.5	39.1	15.0	0.5	1.3
2000	16	11	7.9	62.2	38.4	9.6	2.0	2.4
2001-03	11	6	3.3	29.8	54.8	25.7	1.3	2.6
2004-06	38	27	8.9	28.5	33.4	18.2	0.06	4.6

TABLE 4.5
Subsequent financing for survived unit firms and share-only firms

The complete sample of 350 IPOs listed on London Stock Exchange during the period of 1994-2006, comprises of 92 unit firms and 258 share-only firms. ACTIVE3 is the number (percentage) of IPO firms that survived three years after the IPO. ACTIVE3 SEO indicates the number (percentage) of firms, which survived the whole three-year period post-listing and issued a seasoned offering. Probit regression is conducted on dummy variable SEO for all 350 IPOs in the sample, which takes the value of 1 if firm *i* issued its first seasoned equity offering within 3 years after its IPOs. The marginal effects of variables are reported with the *p*-values in parentheses to indicate significance level. Pseudo R^2, LR Chi^2, log likelihood, and correctly predicted percentage are presented to indicate the goodness of fit. Definitions of included variables please refer to TABLE 4.1.

Panel A: Proportion of sample firms issuing SEOs

	Unit IPOs (92)		Share-only IPOs (258)		All IPOs (350)	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Active3	67	72.83%	229	88.76%	296	84.57%
ACTIVE3 SEO	55	82.09%	115	50.22%	170	57.43%

Panel B: Probit regression of the probability of issuing SEOs (reporting marginal effects)

$$SEO_i = \lambda_0 + \lambda_1 UNIT_i + \lambda_2 IR_{2i} + \lambda_3 NETPROCEED_i + \lambda_4 ACTIVE3_i + \lambda_5 LEVERAGE_i + \zeta_i$$

Variable	**INTERCEPT**	**UNIT**	**IR_D2**[41]	**NETPROCEED**	**ACTIVE3**	**LEVERAGE**
Coefficient	-0.4717	0.2730	-0.0617	-3.56E-08	0.1879	-0.0302
	(0.000)[a]	(0.000)[a]	(0.237)	(0.038)[b]	(0.028)[a]	(0.233)

Pseudo R^2=15.44%	LR Chi^2= 26.40 (0.054)[b]	Log likelihood= -129.39	Correctly predicted percentage=61.09%

a: Significantly different from zero at 1% level (z- test).
b: Significantly different from zero at 5% level (z- test).
c: Significantly different from zero at 10% level (z- test).

[41] Alternative measurement of initial underpricing is adopted using the first-week initial underpricing relative to the offer price (IR_W1), which provide similar results only with lower significance level. To save space, the results are not included in this thesis.

TABLE4.6
Descriptive statistics for survived unit SEO firms and share-only SEO firms

Means and medians for selected firm characteristics of unit firms and share-only firms are compared for sub-samples of firms that survived the full 1, 3, and 5 years following their IPOs respectively. Unpaired Student's *t*-Tests assuming different variances for survived unit firms and share-only firms are conducted in determining the significance of differences in means, whilst Mann-Whitney (MW) Test's *p*-values are illustrated to indicate the significance of differences in medians.

		ACTIVE1			ACTIVE3			ACTIVE5		
Variables		**Share-only SEO**	**Unit SEO**	***t-test and MW test***	**Share-only SEO**	**Unit SEO**	***t-test and MW test***	**Share-only SEO**	**Unit SEO**	***t-test and MW test***
MKTCAP (£m)	Mean	48.31	24.89	*0.007*[a]	48.96	25.38	*0.047*[b]	47.88	24.93	*0.100*[c]
	Median	17.99	9.82	*0.018*[a]	18.18	9.82	*0.013*[a]	20.00	9.43	*0.018*[a]
TANGIBLE(£m)	Mean	3.14	1.28	*0.038*[b]	3.19	1.31	*0.097*[c]	3.41	1.43	*0.120*
	Median	0.21	0.03	*0.017*[a]	0.22	0.02	*0.021*[b]	0.22	0.03	*0.055*[b]
RISK	Mean	0.040	0.044	*0.004*[a]	0.0400	0.0447	*0.158*	0.039	0.044	*0.152*
	Median	0.04	0.04	*0.130*	0.0370	0.0387	*0.156*	0.04	0.04	*0.182*
EBIT(£m)	Mean	2.20	1.02	*0.270*	2.24	0.68	*0.045*[b]	2.07	0.62	*0.081*[c]
	Median	0.25	0.00	*0.039*[b]	0.25	0.00	*0.012*[a]	0.19	-0.004	*0.043*[b]
TTLDEBT(£m)	Mean	8.45	5.08	*0.324*	8.58	5.12	*0.377*	8.38	5.07	*0.440*
	Median	1.05	0.52	*0.048*[b]	1.05	0.39	*0.027*[b]	1.05	0.45	*0.036*[b]
GROSSPROCEED(£m)	Mean	11.80	7.37	*0.049*[b]	11.93	7.62	*0.125*	12.08	6.58	*0.061*[c]
	Median	5.02	2.84	*0.001*[a]	5.50	2.56	*0.001*[a]	5.50	2.45	*0.001*[a]
EXPENSE(£m)	Mean	3.43	0.82	*0.006*[a]	3.48	0.83	*0.009*[a]	3.51	0.82	*0.016*[a]
	Median	0.66	0.45	*0.001*[a]	0.70	0.40	*0.001*[a]	0.66	0.38	*0.002*[a]
IR_D2	Mean	0.06	0.51	*0.000*[a]	0.05	0.48	*0.001*[a]	0.02	0.54	*0.000*[a]
	Median	0.00	0.25	*0.000*[a]	0.00	0.24	*0.000*[a]	0.00	0.20	*0.000*[a]

a: Significantly different from zero at 1% level (two-tailed test).
b: Significantly different from zero at 5% level (two-tailed test).
c: Significantly different from zero at 10% level (two-tailed test).

TABLE 4.7
The immediate SEO announcement effect

Panel A: Stock performance surrounding the announcement day

The raw average return for the unit SEO firms on event day *t*, $\mathbf{R_{seo,t}}$, are calculated as the sum of all daily returns for event day *t* divided by the number of firms in the sample that trades on that day (n_t). The market movement, $\mathbf{R_{fta,t}}$, is measured by the average daily abnormal returns of the FTSE All Share (FTA) Index for the same time period. The market-adjusted average daily return for SEO firms on trading day t ($\mathbf{AR_t}$) is the difference between average abnormal returns of unit SEO firms and the average abnormal returns of the FTA Index, as $\mathrm{AR}_t = \frac{1}{n_t}\sum_{i=1}^{n_t}(R_{SEO,it} - R_{FTA,it})$. The cumulative abnormal returns (CARs) are computed as the summation of average abnormal returns (ARs) for the market-adjusted abnormal returns.

	SEO	FTA	MKT-ADJUSTED			
DAY	$\mathbf{R_{seo,t}}$ **(%)**	$\mathbf{R_{fta,t}}$ **(%)**	$\mathbf{AR_t}$ **(%)**	***t-Test for AR***	**CAR (%)**	***t-Test for CAR***
-10	-1.411	0.034	-1.445	*-1.45*	-1.445	*-1.45*[d]
-9	0.939	-0.085	1.024	*2.30*[a]	-0.421	*-0.37*
-8	1.248	0.186	1.062	*1.14*	0.642	*0.42*
-7	1.074	-0.017	1.091	*0.76*	1.732	*0.96*
-6	0.217	-0.007	0.224	*0.78*	1.956	*1.22*
-5	1.593	-0.060	1.652	*2.25*[a]	3.608	*1.66*[c]
-4	1.688	-0.118	1.806	*1.37*	5.414	*1.96*[b]
-3	-0.347	-0.124	-0.223	*-0.42*	5.191	*1.90*[b]
-2	-0.021	-0.026	0.005	*0.02*	5.196	*1.90*[b]
-1 (AD)	0.345	0.192	0.153	*0.33*	5.350	*1.88*[c]
0 (PD)	2.332	-0.140	2.472	*1.74*[c]	7.822	*2.17*[a]
+1	-3.654	-0.078	-3.576	*-1.74*[b]	4.246	*0.98*
+2	-0.626	-0.129	-0.497	*-0.83*	3.749	*0.84*
+3	-2.749	-0.274	-2.475	*-1.56*[c]	1.274	*0.26*
+4	-0.567	-0.049	-0.518	*-0.94*	0.756	*0.15*
+5	-0.090	-0.155	0.065	*0.14*	0.821	*0.16*
+6	-0.442	-0.146	-0.296	*-0.57*	0.525	*0.10*
+7	-0.429	-0.004	-0.425	*-0.91*	0.100	*0.01*
+8	-0.779	-0.158	-0.621	*-2.19*[a]	-0.521	*-0.12*
+9	-0.668	0.164	-0.833	*-2.46*[a]	-1.353	*-0.31*
+10	-0.970	0.112	-1.082	*-2.89*[a]	-2.435	*-0.54*

Panel B: The two-day announcement period stock reaction

The two-day return for firm *i* is $CAR_{i,-1,0}$, where $\mathrm{CAR}_{i,-1,0} = AR_{i,-1} + AR_{i,0}$ And $AR_{i,-1}$ is SEO firm *i*'s abnormal return on the day prior to a published announcement of seasoned offering, and $AR_{i,0}$ is the excess return to firm *i* on the day an announcement is published to the market investors.

	SEO	MKT-ADJUSTED
2-day announcement CAR (%)	2.68	2.63
(StDev)	(0.1455)	(0.1482)
t-statistic	2.41[a]	2.36[a]

TABLE 4.8
The price performance of unit SEO firms comparing to the FTA Index

Average cumulative abnormal returns (CARs) for 90 days before until 90 days after the announcement, for unit IPO firms which decide to issue an additional sale of sales within five years of the initial public offering in the period 1994-2006. The cumulative abnormal returns for both the SEO firms and the FTA Index are calculated as the summation of daily average abnormal returns: $CAR_{-90,t} = \sum_{t=-90}^{90} AR_t$ The market-adjusted CARs are the resulting difference between the SEO raw average CARs and the FTA Index CARs for the corresponding period.

DAY	$R_{seo,t}$ (%)	$R_{fta,t}$ (%)	MKT-Adjusted AR%	*t-Test for AR*	*p-value for AR*	MKT-Adjusted CAR%	*t-Test for CAR*	*p-value for CAR*
-90	-0.219	-0.116	-0.103	*-1.25*	*0.217*	-0.103	*-0.99*	*0.324*
-85	2.143	0.038	2.105	*1.24*	*0.221*	1.594	*0.90*	*0.373*
-80	-0.917	0.137	-1.055	*-1.73[c]*	*0.089*	1.288	*0.46*	*0.644*
-75	0.693	0.096	0.597	*1.34*	*0.185*	3.163	*1.27*	*0.211*
-70	0.826	-0.120	0.946	*1.75[c]*	*0.085*	5.770	*1.67[c]*	*0.100*
-65	-0.680	0.075	-0.755	*-2.00[b]*	*0.050*	5.691	*1.53*	*0.131*
-60	0.199	0.034	0.165	*1.23*	*0.224*	4.045	*1.43*	*0.158*
-55	0.579	-0.052	0.631	*1.12*	*0.266*	4.080	*1.07*	*0.290*
-50	0.653	0.122	0.530	*1.69[c]*	*0.097*	4.993	*1.06*	*0.295*
-45	-0.195	-0.125	-0.070	*-0.16*	*0.871*	4.433	*1.13*	*0.263*
-40	0.768	0.021	0.747	*2.07*	*0.043*	5.845	*1.31*	*0.197*
-35	0.785	0.230	0.556	*1.27*	*0.210*	6.170	*1.52*	*0.133*
-30	1.684	0.149	1.536	*1.48*	*0.144*	8.501	*1.56*	*0.125*
-25	-0.232	-0.159	-0.073	*-0.28*	*0.777*	6.080	*1.09*	*0.28*
-20	0.265	-0.023	0.288	*1.24*	*0.222*	5.340	*1.56*	*0.124*
-15	0.423	-0.237	0.661	*1.67[c]*	*0.101*	6.019	*1.93[b]*	*0.058*
-10	0.939	-0.085	1.024	*2.30[b]*	*0.025*	3.368	*1.45*	*0.154*
-5	1.593	-0.155	1.652	*2.25[b]*	*0.025*	8.422	*1.95[b]*	*0.054*
0	2.332	-0.140	2.472	*1.74[c]*	*0.087*	12.635	*1.96[b]*	*0.051*
5	-0.090	-0.155	0.065	*0.14*	*0.888*	5.635	*1.21*	*0.231*
10	-0.970	0.122	-1.092	*-2.89[a]*	*0.005*	2.378	*1.53*	*0.132*
15	-0.966	0.111	-1.077	*-2.37[b]*	*0.021*	0.677	*1.31*	*0.194*
20	-0.571	0.063	-0.634	*-1.66[c]*	*0.103*	0.688	*0.07*	*0.943*
25	-1.627	0.163	-1.789	*-1.93[b]*	*0.058*	-2.421	*-0.09*	*0.925*
30	-0.670	-0.095	-0.575	*-1.85[c]*	*0.070*	-3.629	*-0.72*	*0.475*
35	-0.953	0.027	-0.980	*-1.59[c]*	*0.114*	-5.627	*-0.77*	*0.447*
40	-0.129	-0.291	0.163	*0.18*	*0.862*	-6.022	*-0.89*	*0.376*
45	-0.501	0.026	-0.527	*-1.93[b]*	*0.054*	-7.445	*-0.95*	*0.348*
50	-1.557	0.056	-1.613	*-2.53[a]*	*0.014*	-9.707	*-1.21*	*0.232*
55	-0.645	0.041	-0.685	*-1.19*	*0.238*	-9.895	*-1.24*	*0.218*
60	0.218	-0.017	0.235	*0.35*	*0.726*	-8.677	*-1.03*	*0.306*
65	-1.164	0.200	-1.365	*-2.99[a]*	*0.004*	-8.322	*-0.87*	*0.390*
70	-0.720	0.166	-0.886	*-1.45*	*0.154*	-8.935	*-1.15*	*0.254*
75	-1.731	-0.084	-1.647	*-2.75[a]*	*0.003*	-10.503	*-1.25*	*0.216*
80	-0.459	-0.153	-0.306	*1.32*	*0.191*	-12.615	*-1.30*	*0.199*
85	-0.455	0.055	-0.510	*-1.43*	*0.157*	-12.475	*-1.42*	*0.162*
90	-1.485	0.007	-1.493	*-2.95[a]*	*0.005*	-14.294	*-1.96[c]*	*0.103*

TABLE 4.9
Linear regression on SEO price run-up before the announcement day

In order to assess the potential causes for stock price appreciation before SEO announcements, a linear regression is conducted on the 59 SEO unit firms shown as EQUATION 4.5. The dependent variable, price run-up of the SEO firms (SEOUP), is calculated as the buy-and-hold abnormal returns of the 90 days preceding the SEO announcements. The following variables are included in the regression in the projection that these indicators are used by the market in predicting any SEO announcement. The market index level (MKTUP) is measured by the buy-and-hold returns for the same 90-day period. Firm characteristics prior to listing such as debt LEVERAGE, profitability (EBIT), INSIDER ownership, firm riskiness (RISK) are also included in explanation of the price appreciation before SEO announcements. The last variable is the FTA Index-adjusted monthly buy-and-hold abnormal returns of the SEO firms for 12 months after the initial public offering, indicating their medium-term performance. The Variance Inflation Factors (VIF), adjusted $R^{2,}$ and F-statistics are presented to indicate general goodness of fit of the model.

Variable	**Coefficient**	**Std. Error**	***t*-Statistic**	***p*-value**	***VIF***
C	-0.4899	0.2416	-2.03[b]	0.048	
MKTUP	2.1400	0.7328	2.920	0.005[a]	1.06
LEVERAGE	0.1151	0.0403	2.674	0.010 [a]	1.08
EBIT	-1.65E-08	1.17E-08	-1.411	0.164	1.02
INSIDER	0.518855	0.2645	1.96	0.055[b]	1.01
RISK	8.1010	6.0462	1.90	0.064[b]	1.08
BHAR_12	0.5929	0.3361	4.35	0.000[a]	1.06
Number of observations = 59		Adjusted R^2= 0.3669			F-Statistic=6.58[a]

a: Significantly different from zero at 1% level (t- test).
b: Significantly different from zero at 5% level (t- test).
c: Significantly different from zero at 10% level (t- test).

TABLE 4.10
Probit regression on SEO issuance and warrant characteristics

A probit regression from EQUATION 4.6 is conducted on the independent variable SEO dummy, which is equal to 1 if a unit firm issued a seasoned equity offering within three years of its IPO. The initial underpricing IR_D2 on the first trading day relative to the IPO offer price is included to test Hypothesis 4.5 that unit firms, which were more underpriced at the time of IPOs, are more likely to conduct SEOs within three years post-listing. In examination of Hypotheses 4.6-4.7, the OUT dummy takes the value of 1 if warrants are issued out-of-money, 0 if otherwise and the LIFE of warrants is calculated as the number of years between IPO listing and warrant expiration day. The EXERCISE dummy takes the value of 1 if the attached warrants have been exercised three years post-listing, 0 if otherwise and is included to test Hypothesis 4.8. WARRANTPROCEED is the gross proceeds from warrant subscription if they are to be exercised, calculated as the number of warrants attached in unit IPO times the warrant exercise price. Dummy variable REPUTATION is included to control for the underwriter reputation.

Variable	Coefficient	*Std. Error*	*z-Statistic*	*p-Value*
C	0.6594	0.216206	3.050	0.002[a]
IR_D2	-0.1580	0.094542	-1.671	0.095[c]
OUT	-0.6019	0.309615	-1.944	0.052[b]
WARRANTPROCEED	4.59E-08	4.36E-08	1.054	0.292
LIFE	-0.0721	0.064975	-1.110	0.267
EXERCISE	0.0991	0.399083	0.248	0.804
REPUTATION	0.9006	0.694855	1.296	0.095[c]
Pseudo R^2 =36.98%	Log likelihood= -92.56	LR Chi^2=61.12 (0.000)[a]	Correctly predicted percentage=70.16%	

a: Significantly different from zero at 1% level (z- test).
b: Significantly different from zero at 5% level (z- test).
c: Significantly different from zero at 10% level (z- test).

TABLE 4.11

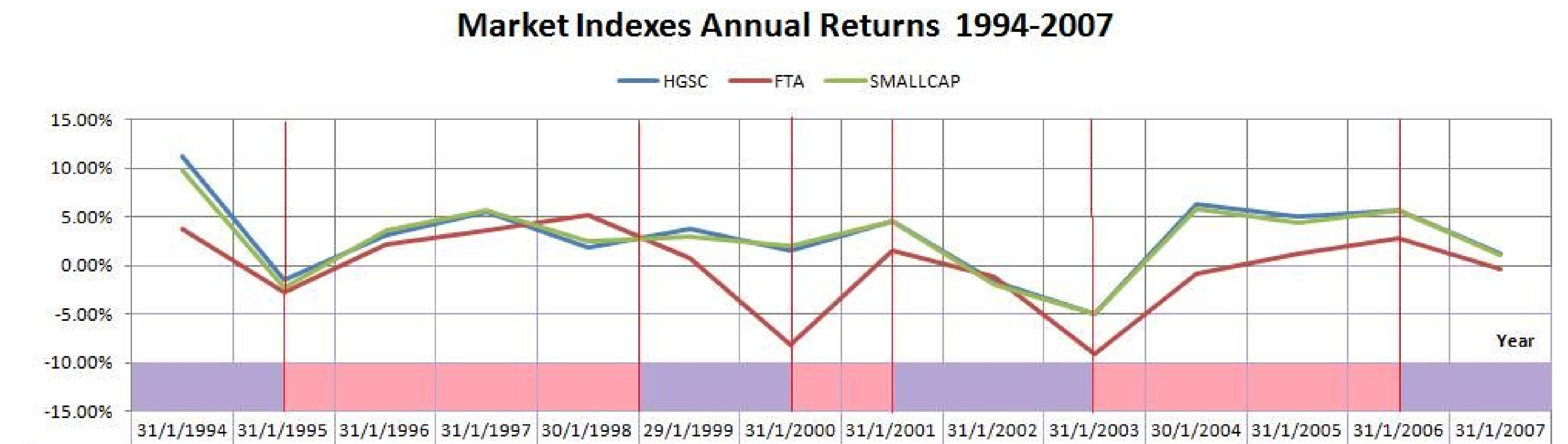
Summary of testable hypotheses and results

The hypotheses proposed in Section 4.3 and the test results are summarised in the table

Hypothesis	Results
Panel A:Predictions on the survival rate of unit IPO firms	
$H_{4.1}$: Unit firms have lower survival rate within n years of their IPOs than share-only firms	Not rejected
Panel B: Predictions on the subsequent financing of unit IPO firms	
$H_{4.2}$: Survived unit firms are more likely to issue SEOs than survived share-only firms	Not rejected
$H_{4.3}$: There is a significant stock price run-up before SEOs are announced by unit IPO firms	Not rejected
$H_{4.4}$: There is a negative price effect to the SEO announcements made by unit IPO firms	Not rejected
Panel C: Predictions on the SEO issuance and warrant characteristics	
$H_{4.5}$: Unit firms that are more underpriced at their IPOs are more likely to conduct SEOs	Rejected
$H_{4.6}$: Unit firms which issued warrants out-of-money at the time of their IPOs are less likely to conduct SEOs	Not rejected
$H_{4.7}$: Unit firms whose attached warrants have shorter life until expiration are more likely to issue SEOs	Rejected
$H_{4.8}$: Unit firms, whose attached warrants have been exercised, are less likely to conduct SEOs within five years post-listing	Rejected

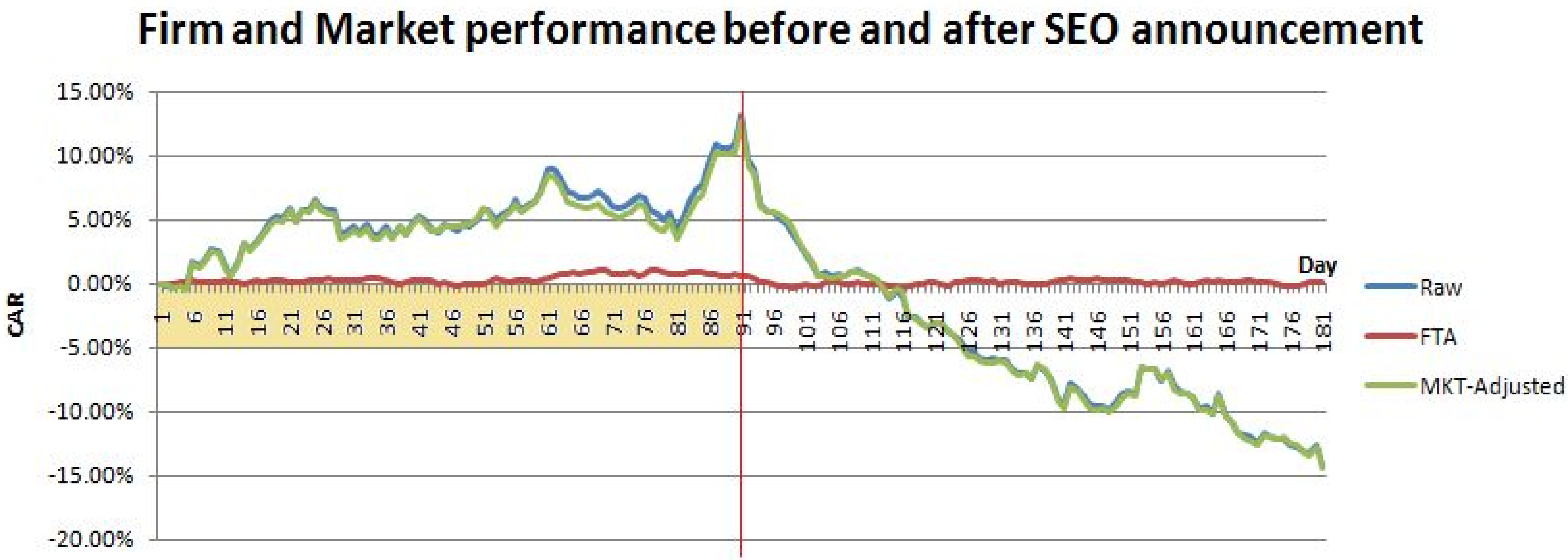
FIGURE 4.1

Monthly returns on the FTSE All Share Index, the FTSE Small Cap Index, and Hoare Govett Smaller Companies (HGSC) Index are calculated and charted to decide the level of the market. The periods of 1994-95, 1999, and 2001-03, are when the market suffered severe declines of the index returns (the 'bear' market); whereas, the sub-periods of 1996, 2000, and 2004-06 display overall price appreciation on the market index, indicating high market level.



	31/1/1994	31/1/1995	31/1/1996	31/1/1997	30/1/1998	29/1/1999	31/1/2000	31/1/2001	31/1/2002	31/1/2003	30/1/2004	31/1/2005	31/1/2006	31/1/2007
HGSC	11.29%	-1.40%	3.08%	5.46%	1.93%	3.76%	1.47%	4.63%	-1.69%	-4.91%	6.35%	4.97%	5.69%	1.22%
FTA	3.79%	-2.69%	2.16%	3.67%	5.21%	0.82%	-8.21%	1.55%	-1.10%	-9.05%	-0.92%	1.26%	2.86%	-0.30%
SMALLCAP	9.76%	-2.29%	3.55%	5.61%	2.57%	2.91%	2.03%	4.51%	-2.03%	-5.00%	5.84%	4.33%	5.64%	1.07%

FIGURE 4.2


Firm and Market performance before and after SEO announcement
15.00%
10.00%
5.00%
0.00%
-5.00%
-10.00%
-15.00%
-20.00%
CAR
Day
1 6 11 16 21 26 31 36 41 46 51 56 61 66 71 76 81 86 91 96 101 106 111 116 121 126 131 136 141 146 151 156 161 166 171 176 181
Raw
FTA
MKT-Adjusted

CHAPTER 5

THE LONG-TERM PERFORMANCE OF UNIT IPOS IN THE UK

5.1 Introduction

The IPO literature has documented two major anomalies in the pricing of IPOs: short-term underpricing and long-term underperformance. In the previous CHAPTER 3, I have examined the short-term underpricing phenomenon in relation to the inclusion of warrants in IPOs with a unique sample of unit IPOs issued in the UK. My results are consistent with the existing literature; pervasively positive abnormal initial returns are found on the first trading day and the unit IPOs are even more underpriced comparing to share-only IPOs matched by size and industry. Whilst the research on initial underpricing of IPOs and more specifically unit IPOs has been rather united and conclusive across different regions and sample periods, the evidence on long-term post-listing IPO performance has been controversial, with different researchers reporting mixed and contrasting results from different markets.

Ritter (1991) and Loughran and Ritter (1995) distinguish that the US IPO firms indeed experience significantly negative returns in the first three to five years post-IPO. Gompers and Lerner (2003) identify that IPO performance depends on the methodology employed to calculate abnormal returns. They find significantly negative value-weighted event-time buy-and-hold abnormal returns for US IPOs. However, the underperformance disappears when either equally-weighted event-time buy-and-hold or cumulative abnormal returns are used instead. The long-run underperformance phenomenon is not exclusive to the US IPOs. Lee et al. (1996) find that Australian IPOs exhibit severe underperformance in the long term, whilst Da Silva Rosa et al. (2003) find no evidence of underperformance in the two years post-IPO in the same country. In the UK, Levis (1993) examined the three-year long-run performance of a sample of 712 UK IPOs issued between 1980 and 1988. His work confirmed Ritter (1991)'s finding of statistically significant underperformance of IPOs in the long term with UK data of a similar magnitude. Espenlaub et al. (2000) re-investigated the long-term performance of 588 UK IPOs issued between 1985 and 1992; they contribute further evidence on the sensitivity of long-term underperformance: evidence is found that using an event-time framework, there are substantial negative abnormal returns after 3 years irrespective of the benchmarks adopted. However, over a 5-year horizon, abnormal returns exhibit less severe underperformance and the conclusion on negative abnormal returns varies if different benchmarks are used. Furthermore, their results indicate that if a calendar-time approach is employed, the statistical significance of underperformance is even less remarkable. In Hong Kong, McGuinness (1993b) reports a significant negative market-adjusted return of -18.26% between the close of the first trading day and the 500th day of listing of Hong Kong IPOs between the period of 1980 and 1990. Paudyal et al. (1998) uncover that initial return and underwriters' reputation are important determinants of long run performance. Jelic et al. (2001) maintain that in Malaysia, IPOs with higher initial return suffer worse underperformance in the long term, but they find no significant relation between underwriter reputation and long run performance; instead, they find that optimistic management earnings forecasts, percentage of shares sold and size of issues are weakly associated with poor performance in the long term. Overall, the international evidence on the IPO long-term performance has been inconclusive.

Moreover, the literature on unit IPOs and their long-term performance has been rather scarce. Schultz (1993b) proposed the Agency Cost hypothesis in explanation of including warrants in IPOs. He stipulates that in the US, firms include warrants in their IPOs to reduce agency costs by binding managers to optimal investment decisions with the staged financing from warrants. In Schultz (1993b) several predictions about the characteristics of unit firms in comparison to share-only IPO firms are tested, and found that unit firms are younger, smaller, and riskier than share-only IPO firms, and also that unit IPOs are typically issued by less reputable underwriters at higher discount (more underpriced). Concerning the post-listing performance of unit firms, Schultz (1993b) predicts that unit IPOs have lower survival rates than share-only IPOs. However, no prediction is made concerning whether unit firms underperform the share-only comparables and the market as a whole in the long-term.

Chemmanur and Fulghieri (1997) bring forth an alternative Signalling explanation for including warrants in IPOs. They argue that younger, smaller, and riskier firms strategically convey information about their firm value to the market through a combination of costly signals, namely, the inclusion of warrants, managerial ownership in their own company's shares, and underpricing of the IPOs. It is predicted that firms sacrifice the cost of signalling, in the hope that they can distinguish themselves from less quality firms in the IPO market (who cannot afford to sacrifice the 'money left on the table') and recoup the costs by issuing seasoned equity offerings later on at more favourable terms. Regardless the competing explanation for including warrants, the long-term performance of unit IPOs is not discussed in Chemmanur and Fulghieri (1997).

Several other academic papers on unit IPOs such as How and Howe (2001), Lee et al. (2003) have focussed on comparing the Agency Cost and Signalling theories as reasons for including warrants in IPOs. None of them however, has examined the two competing hypotheses with a long-term approach. To the best of my knowledge, the only focused study on the long-term performance of unit IPOs is Mazouz et al. (2007b), which investigates a sample of unit IPOs issued in Hong Kong. To test 'the extent to which the Agency Cost and Signalling models explain the reasons for unit IPOs issuance', they provide a comprehensive comparison of long-term performance between unit and share-only IPOs using a variety of methods for measuring long-term stock returns. Their event-time method suggests that both unit and share-only IPOs underperform the market index in the long term. However, the underperformance of unit IPOs is significantly lower than those of share-only IPOs. With an alternative calendar-time approach, the underperformance of unit firms and share-only firms are not significantly different from zero. Overall, evidence from Hong Kong concerning the long-term performance of unit IPOs is not conclusive and therefore unable to support either explanation for including warrants in IPOs.

So far, no research has been carried out in the UK exploring unit IPOs and their price performance post-listing. In this chapter, following Mazouz et al. (2007), I extend both the Agency Cost and the Signalling hypotheses into a longer time-scale and test the two competing theories for including warrants using the long-term price performance approach with a fresh sample of unit IPOs issued in the UK between 1994 and 2006. In testing the Agency Cost hypothesis, if warrants are included in IPOs to reduce agency cost, then unit firms are expected to possess better management performance and therefore, higher long-term returns than share-only IPOs. According to the Signalling hypothesis, the unit firms are riskier than share-only IPO firms. If the firm value signalled by including warrants, insider holdings, and underpricing the IPOs successfully conveyed to the market, unit firms should yield higher long-term returns to compensate investors for bearing the extra risk (Mazouz et al., 2007).

This chapter contributes to the literature concerning the long-term performance of IPOs in several aspects. Firstly, there have been extensive studies on the long-term performance of share-only IPOs, but very few aim to uncover the long-run performance of unit IPOs. In this chapter, I focus on the unit IPOs and compare the long-term performance of them with a portfolio of share-only IPOs matched by market capitalisation and industry. Since the unit IPOs are explained as a form of staged financing by the Agency Cost hypothesis, it is valuable to examine long-term performance following the first stage of financing by IPO proceeds, and the potential second stage of financing by warrant proceeds. It would be interesting to see how the unit firms performed in the long run with unit IPOs claiming to reduce agency costs. Secondly, there has been remarkable previous literature on long-term share price performance of IPOs issued in the UK, such as Levis (1993) and Espenlaub et al. (2000). However, no prior regional research of unit IPOs has been undertaken in the UK. The UK stock market provides a unique opportunity to re-examine the robustness of the findings on the long-run performance of US IPOs within the setting of another 'market-based' financial system, in which stock markets are supposed to play a crucial role in providing company financing. In my paper, a sample of 350 UK IPOs consisting of 92 unit IPOs and 258 share-only IPOs are collected for the study of long-term performance, which contributes to the growing body of international evidence on the long run performance of newly issued shares. Thirdly, the sample firms are selected from both the London Stock Exchange Official Listing (Main Board) and the Alternative Investment Market (AIM), allowing a direct comparison of long-term performance of unit firms listed on different market locations. Additionally, four different market indices from the UK are adopted in my study as benchmarks. The FTSE All Share Index is used as the primary benchmark to adjust for general market movements. Since unit IPO firms tend to be younger and smaller comparing to share-only IPO firms, I also employ the Hoare Govett Smaller Companies (HGSC) Index and FTSE Small Cap Index as benchmark for robustness check. Furthermore, because the listings of unit IPOs in my sample are highly concentrated on the Alternative Investment Market (AIM), I also apply FTSE AIM All Share Index as another benchmark to test the sensitivity of the performance measures. Finally yet importantly, Mazouz et al. (2007) as the only existing study on the long-term performance of unit IPOs focus on the comparison between unit firms and share-only firms; in my research, I extend their research to analyse the long-term performance in relation to the characteristics of unit IPOs and attached warrants. I believe this unique approach can shed light on explaining the role of the warrants in unit IPOs.

The rest of the chapter is organised as follows: Section 5.2 reviews the existing literature on the long-term performance of unit IPOs and the different methodology of measuring long-term IPO returns. Section 5.3 discusses the testable hypotheses of this study and the motivations behind them. Section 5.4 outlines the related methodologies. Section 5.5 reveals tests and results from various long-term returns measures, cross-sectional and regression analysis. Finally, in Section 5.6, the test results are summarised and conclusions drawn on the long-term performance of unit IPOs issued in the UK.

5.2 Literature Review

5.2.1 Long-term performance of Unit IPOs

The only publicised study of the long-term performance of unit initial public offerings is by Mazouz et al. (2007b). They investigate a sample of 137 unit IPOs issued in Hong Kong between 1990 and 2002 and test the extent to which the Agency Cost hypothesis and the Signalling hypothesis construe the reasons why companies attach warrants in unit IPOs with a long-term price performance approach. Schultz (1993b)'s Agency Cost theory proclaims that the inclusion of warrants in unit IPOs serves to bind managers to optimal investment decisions by arranging small proceeds from unit IPOs and staging a second round of financing through the exercise of warrants. Since the warrants will not be exercised if the company's share price stays below the warrant exercise price, accordingly the second round of financing will not occur. Under the incentive to materialise the financing from warrant proceeds, managers in unit firms are expected to invest only in value generating projects. Extending the Agency Cost theory into the post-listing period, Mazouz et al. (2007) predict that unit firms with reduced agency costs after the unit IPOs should have a better long-term performance than that of a share-only IPO firm.

On the other hand, the Signalling hypothesis proposed by Chemmanur and Fulghieri (1997) demonstrates that unit firms, which are high-risk, high-growth firms, choose to include warrants in their IPOs to convey information about firm value. Together with other costly signals such as insider ownership in their own shares and underpricing of the new shares, inclusion of warrants is a strategic arrangement of unit firms to distinguish themselves from lesser quality competitors. With those costly signals, which the bad quality firms cannot afford to imitate, the unit firms can successfully stand out to the public investors and attract post-listing interests. The management of the unit firms plan to recover these signalling costs by issuing additional shares at higher price in the after-market. Mazouz et al. (2007) argue from the Signalling theory that since unit IPO firms are customarily riskier than share-only IPO firms are, after attracting investors' interests, they are expected to yield higher long-term return to compensate investors for bearing the extra risk. As such, despite the different explanation for including warrants in the IPOs, the Signalling hypothesis also predicts that unit firms shall outperform share-only firms in the long term.

Mazouz et al. (2007b) firstly calculate equally-weighted cumulative abnormal returns (CAR) and the results largely depend on the choice of benchmarks. When the market index is employed as benchmark, the equally weighted CARs for unit and share-only IPOs are all significantly negative. When firms matched by firm size are used as benchmark however, the underperformance greatly decreased, and when size-and-book-to-market matched firms are adopted as benchmarks, the underperformance of share-only IPOs disappears completely; whilst the unit firms still significantly underperform the matching firms. The value-weighted CARs are also reported in Mazouz et al. (2007), which provides similar results to the equally-weighted CARs. Regardless of the benchmarks used, the value-weighted CARs indicate significant underperformance for unit IPOs against both the market index and share-only matching firms. However, the negative abnormal returns observed under value-weighted CARs are lower in magnitude than those generated by the equally weighted CARs, suggesting that the equally-weighted CARs are driven by small-firm stocks. A direct comparison of the long-term average CARs between unit and share-only IPOs are also conducted. Indicated by the p-values from non-parametric Mann-Whitney tests, Mazouz et al. (2007) provide evidence that unit IPOs significantly underperform share-only IPOs in the long term. The overall results from the cumulative abnormal returns from Hong Kong contradict both the Agency Cost and the Signalling hypotheses, that unit firms should generate higher long-term returns than share-only IPO firms.

Mazouz et al. (2007) also examine the long-term performance of unit IPOs with a buy-and-hold approach over three years post-listing. The equally-weighted average buy-and-hold abnormal returns (BHAR) indicate the long-term performance is sensitive to the choice of benchmarks. The unit and share-only IPOs both significantly underperform the market index, by -81% and 55% respectively. However, such underperformance shrinks greatly when size-matched firms are used as the benchmark and disappear completely when the long-term returns are compared with the returns of their size-and-book-to-market matched or industry-size-and-market-to-book matched comparables. The value-weighted average BHARs are also calculated. Similarly, to the equally-weighted BHARs, both the unit and share-only firms underperform the market index significantly but with lower magnitude. However, when size and industry-size-and-book-to-market matched firms are employed as benchmarks, none of the underperformance from unit or share-only samples remains significant. The non-parametric Mann-Whitney test again suggests that share-only IPO firms perform better than unit firms do in the long term, which is not consistent with either the Agency Cost or the Signalling explanations of why firms include warrants in their IPOs.

Alternatively, to the event-time approach, Mazouz et al. (2007) reassessed the long-term performance of unit IPOs in Hong Kong with a calendar-time approach, which automatically resolves the potential correlation problem of individual firms in an event-time method. When matched calendar-time regression is conducted, the underperformance of both the unit and share-only IPOs against the market index and matching firms vanish completely. Furthermore, no evidence is found that unit firms significantly outperform share-only firms in the long term. Such results contradict the predictions of both the Agency Cost and the Signalling hypotheses.

Viewed collectively, none of the cumulative abnormal returns or the buy-and-hold abnormal returns, whether weighted equally or by sample firms' market values, under either event-time or calendar-time, indicate that unit IPO firms possess better quality of investments and in turn perform better than share-only IPO firms. The long-term price performance evidence from Hong Kong rejects both the Agency Cost and the Signalling hypotheses in explaining firms' choice of unit IPOs over share-only IPOs.

5.2.2 IPO long-term performance in the UK

To provide a solid grounding for my research in absence of existing studies of UK unit IPOs and to understand the UK IPO market better, I also reviewed several established academic papers, which examine the long-term IPO performance with UK data. Levis (1993) delves into the three-year long-run performance of a sample of 712 UK IPOs issued between 1980 and 1988 using the share-price data from 1980 until the end of 1990. His work also recognises the important issue of the size effect for UK IPO firms and sets forth long-run abnormal returns based on two market indices: the Financial Times Actuaries All Share (FTA) Index as the indicator of general market level and the Hoare Govett Smaller Companies (HGSC) Index, which is composed of listed firms with small market capitalisation. Both of these indices are included in this study of unit IPOs in the UK. The results from Levis (1993) confirm Ritter (1991)'s finding of statistically significant long-term underperformance of US IPOs. However, he remarks that the average underperformance in his UK sample appears to be less severe than in Ritter (1991)'s US sample; they record underperformance for UK IPOs of between -8% and -23% depending on the market benchmark applied, whilst Ritter (1991) documented underperformance of up to -29% for US IPOs.

Espenlaub, Garrett and Mun (1999) investigate the long-term performance of IPOs issued by UK firms between 1992 and 1995 with existing venture capital investors and underwritten by issuing houses that are parents or affiliates of the venture capitalists. The total sample of IPOs comprises 135 venture-backed and 114 un-backed offerings. The long-term abnormal returns are measured relative to the FTSE All Share Index, which is also used as the main benchmark in my research. The market-wide movements are controlled by subtracting the equivalent return on the FTSE All Share Index. They explain that at the time of flotation, venture capital funds generally hold substantial equity positions in the companies they invest in. Consequently, they are in the position to put potential influence in force on the management, have strong motivation to monitor the managerial performance and become involved in the decision-making. Differences in long-term performance between the IPOs backed by existing venture capitalists and other non-venture-backed IPOs are reasonably expected. On one hand, the authors stipulate that venture-backing can be expected to significantly contribute to improvements in IPO firms' long term performances for several reasons: Firstly, as repeated players in the IPO market, venture capitalists are able to credibly commit themselves to the accuracy and completeness of disclosed information. Naturally, it is in their best interest for truthful certification since false certification would only lead to the loss of their valuable reputation, which has been built up over time. Secondly, as long-term players in the IPO market, venture capitalists are able to form lasting relationships with other financial firms that they attract more interest in the offering from large institutional investors and moreover have the advantage to attract reputable underwriters and auditors at lower costs. Furthermore, venture capitalists are also able to screen potential portfolio companies by offering them contracts that only qualified candidates will accept. For the above reasons, venture capital backing has the certification effect that certifies the quality of the offerings and facilitates the issue at an earlier stage in a company's life cycle. On a different note, Espenlaub, Garrett and Mun (1999) also brought forth the clear potential for a conflict of interest between venture capitalist-affiliated sponsors, who are generally involved in the pricing of the new shares and underwriting the issues, and the outside investors taking up the offering. Chances are that the underwriters are likely to have access to private information about the issuing firm and the motivation to exploit this information at the expense of IPO investors. Especially, 'underwriters may set offer prices too high and time share offerings so as to coincide with the market's overvaluation of the issuing firm's equity'. The authors conjecture that such a conflict of interest is likely to manifest itself into poor long-term performance of the IPO firm if the market fails to recognise the adverse effects of the underwriters' self-interest on IPO timing and pricing. Both sides of the argument in Espenlaub, Garrett, and Mun (1999) for long-term under- and over-performance of venture-capital-backed IPOs seem to make sense. Their results indicate that both sub-samples (venture-backed or unbacked IPOs) underperform the FTSE All Share Index over the entire 36-months period post-listing. However, contrary to the conflict of interest argument, IPOs underwritten by venture-capitalist-affiliates exhibit substantially better long-run performance compared with IPOs underwritten by independent issuing houses. While the cumulative abnormal returns (CARs) of the un-backed sample become negative after the sixth post-issue month and continue to be negatives in each month thereafter; the performance of the venture-backed sample is more variable, fluctuating above and below zero. The comparison of the two sub-samples suggests that venture backing is associated with better long-term performance. Additionally, the authors provide evidence that the long-term performance of UK IPOs is positively related to the reputation of the venture capital backers. Therefore, despite the potential conflict of interests, reputable venture capitalists still effectively screen the companies they invest in and certify the quality of their IPOs. The staged financing through attached warrants in unit IPOs serves a similar monitoring role as venture capitalists by binding managers to optimal investment decisions. After receiving intentionally limited proceeds from unit IPOs, managers are motivated to invest only in value generating projects in order to materialise the second round of financing through the exercise of warrants. Inspired by Espenlaub, Garrett and Mun (1999)'s results, I expect that unit IPO firms should perform better in the long-term comparing to share-only IPO firms which do not have the monitoring mechanism to reduce agency costs.

Espenlaub et al. (2000) re-investigated the long-term performance of 588 UK IPOs using a new set of non-financial sample firms issued between 1985 and 1992. They review that the original IPO long-term underperformance findings by Ritter (1991), Loughran and Ritter (1995), and Levis (1993) are dramatic and imply that investing in recent IPOs is a poor investment; however, the subsequent studies by Brav and Gompers (1997) and the critical review of Fama (1998) argue that the underperformance phenomenon is not a consensus. The results are sensitive to performance measures and require further investigations. The UK stock market provides a distinctive opportunity to examine the robustness of the findings on the performance of US IPOs within the setting of another 'market based' financial environment.

The abnormal returns are assessed extensively against several alternative benchmarks under different approaches. The benchmarks employed include: (1) the standard CAPM returns; (2) a size-decile adjusted model; (3) a value-weighted multi-index model extended for size effects, namely the difference between the Financial Time Actuaries All Share (FTA) Index and the Hoare Govett Smaller Companies (HGSC) Index; (4) Fama and French (1996) 3-factor Model and finally (5) Ibbotson (1975) Return Across Securities and Times (RAST) Model. For a particular benchmark, monthly abnormal returns are calculated for up to 60 months (5 years) after the listing but excluding the month of new issue. To avoid any downward bias in returns when average returns are equally-weighted across portfolios, discrete returns are used as opposed to logarithmic returns throughout their study. Furthermore, both the popular event-time approach and the recently favoured calendar-time approach are adopted. In line with Fama (1998)'s findings, Espenlaub et al. (2000) contribute further evidence on the sensitivity of long-term underperformance: They report that using an event-time framework, there are substantial negative abnormal returns after 3 years irrespective of the benchmark used. However, over a 5-year period, abnormal returns exhibit less severe underperformance and the conclusion on negative abnormal returns varies if different benchmarks are used.

There are several critical differences between Levis (1993) and Espenlaub et al. (2000), which both studied the UK IPOs. Firstly, although Levis (1993) identified the importance of size effect for UK firms, he did not explicitly adjust for risk and size effects. Instead, Levis simply used an alternative market index for implicitly smaller firms (the Hoare Govett Smaller Companies Index), which is also adopted in the latter study. To better adjust for firm size, Espenlaub et al. (2000) examined the long-term IPO performance against a wider range of alternative benchmarks and models including the Ibbotson (1975)'s RAST model and the Fama-French (1993) three-factor model, both of which are explicitly designed to adjust for size effects. Secondly, Levis (1993) investigates the long-term share performance of IPOs issued between 1980 and 1990, a period during which small firms outperformed larger firms. By contrast, Espenlaub et al. (2000) assess the long-run IPO performance over the period of 1985-1997, during which there was much greater time-series variation in the size effect as smaller firms over performed during the initial part of the sample period (1985-1988) but underperformed during 1989-1992 period with more reversals during 1992-1997. Last but not the least, Levis (1993) calculated abnormal returns up to three years post listing, whilst Espenlaub et al. (2000) extended the sample period to a longer five years after the IPO.

5.2.3 Literature on long-term price performance measurement

Another segment of the long-term performance research area focuses on the choice of metric to measure firms' abnormal returns. Calculating long-term abnormal returns with a buy-and-hold strategy has been very popular (Ritter, 1991; Barber and Lyon, 1997). In addition, the cumulative abnormal returns serve an alternative measure for long-term performance on a continuous basis. The wealth relatives are also applicable to provide a general indication of long-term performance against benchmarks. Each long-term return measure can be calculated on an equally-weighted or value-weighted basis, which may lead to different inclusions. Furthermore, the long-term abnormal returns computed against different benchmarks can also alter the results of the overall performance of sample firms. Finally yet importantly, different cross-sectional analyses can provide supporting evidence from different research angles. Therefore, the assessment of long-term share price performance is notoriously difficult to estimate with a high degree of accuracy. A number of academic papers have examined and compared different measurements of IPO's long-term performance, each aspect of measuring long term abnormal performance has been questioned and there is no consensus on which is to be preferred.

5.2.3.1 CARs versus BHARs

Beginning with Ritter (1991), the most popular estimator of long term performance is the average buy-and-hold abnormal return (BHAR). Barber and Lyon (1997) also argue that the average BHAR is the appropriate estimate for long-term performance because it is a more precise measure for investor experience. However, the skewness of individual-firm long-term abnormal returns restrained statistical inference in many initial studies, which either avoided formal statistical inference or relied on assumptions that were later on challenged, such as normality assumption of the estimates. Evidence about various alternative methods of measuring abnormal returns is provided such as the cumulative abnormal returns (CARs) and wealth relatives (WRs), but no one method is proven ultimately preferable so far.

Kothari and Warner (1997) state that cumulative abnormal returns are systematically biased upward as a result of bid-ask bounce and the bias is an increasing function of the proportionate bid-ask spread of the sample firms (E.g. Conrad and Kaul, 1993). However, they also claim that the implied bias in a 36-month cumulative abnormal return is very small. The compounded BHARs have been endorsed since they mitigate such bias due to cumulation. They investigate the properties of BHARs and provide simulation evidence that common estimation procedures can produce biased buy-and-hold estimates over a long horizon. Before all else, bias arises from new listings, rebalancing of benchmark portfolios, and skewness of multi-year abnormal returns, can all significantly contaminate the performance results. In addition, test statistics using buy-and-hold returns typically use the cross-sectional standard deviation of sample firms' abnormal returns, which is different from the time-series standard deviation of portfolio returns adopted by cumulative abnormal return measures.

Fama (1998) provides an additional assessment concerning the merits of different methodologies in the literature. He argues against buy-and-hold methodology due to the systematic errors that arise with imperfect expected returns that are compounded with long-horizon returns. Furthermore, as a method that ignores cross-sectional dependence of event-firm abnormal returns that are overlapping in calendar time, event-time buy-and-hold abnormal returns are likely to produce overstated test statistics. Therefore, they elucidate one of the defects of the buy-and-hold strategy; that the BHARs could magnify underperformance, even if it occurs in only a single period, because of compounding single-period returns at a monthly frequency. However, the cumulative abnormal returns (CARs) and time-series regressions, on the other hand, do not involve the compounding effect of a single period's poor performance and are less likely to yield spurious rejections of market efficiency than buy-and-hold returns. Therefore, CARs are considered as a better, less biased method to calculate long-horizon returns comparing to BHARs. Furthermore, distributional properties and test statistics for cumulative abnormal returns are better understood. The choice of CARs or BHARs largely depends upon the implicit trading strategy that is being assumed.

Lyon et al. (1999) argue that buy-and-hold abnormal return is a suitable estimate for long term performance because it 'accurately represents investor experience'. They document that BHARs should be used if the research question is whether or not investors earn abnormal stock returns by holding stocks over a particular time horizon and the CARs method should be applied to answer the question, 'Do sample firms persistently earn abnormal monthly returns?'. The authors are inclined to the more recently favoured approach that calculate average buy-and-hold abnormal returns using carefully constructed benchmarks to avoid known biases and assessing statistical significance of average BHAR.

Mitchell and Stafford (2000) is another critical study on the reliability of long-run abnormal performance estimates subsequent to major corporate events. They reveal surprising evidence that the recently favoured average multi-year buy-and-hold abnormal returns, teamed up with statistical inference conducted via bootstrapping procedure are severely flawed. They claim that although BHARs can capture the investors' experience from buying and holding securities for 3-5 years as Barber and Lyon (1997) and Lyon et al. (1999) argued, there are still several limitations to this method. Firstly, there is only one type of investor experience captured, namely the buy-and-hold experience. Other reasonable trading strategies that apprehend alternative investors' experience, such as periodic portfolio rebalancing, are not reflected in buy-and-hold abnormal returns. Secondly, the buy-and-hold abnormal returns increase with holding period, implicitly due to compounding. Because the length of the holding period is arbitrary, such property hampers the reliability for measuring long term performance. If any abnormal returns existed for only a short period of time after an event, both 3- and 5-year BHARs can be significant and 5-year BHAR will be larger in magnitude than 3-year BHAR. Therefore, it became an important issue to select various holding period intervals to determine how long the abnormal performance persisted after the event, if there was any. Finally, Mitchell and Stafford (2000) provide evidence that there are severe statistical problems with BHARs that cannot be easily corrected.

Gompers and Lerner (2003) sought to assess the performance of IPOs by examining the period before the creation of NASDAQ, hoping to test whether the poor performance is driven by some fundamental behavioural anomaly or just an idiosyncratic feature of the recent sample period that has happened to be the focus of academic research. Using powerful *out-of-sample* tests, they find that IPO firms significantly underperform the market benchmarks using event-time BHARs as a performance measure. However, when CARs are computed, the underperformance disappeared. In conclusion, they claim the difference in the results between CARs and BHARs is due to the large skewness in some individual IPO firm returns and the choice of CARs or BHARs largely rely on the implicit trading strategy that is being assumed. However, the authors did claim that the CAR method tends to misrepresent performance when returns are highly volatile. Therefore, they recommend using buy-and-hold returns and the wealth relative measures to provide further evidence for the long-term performance of IPOs.

Chan, Wang and Wei (2004) claim that there are potential biases from summing up average abnormal returns when calculating the Cumulative Abnormal Returns (CARs) over a long horizon, and they propose to 'focus on the holding period return and the wealth relatives' as the performance measure, also as suggested by Ritter (1991) and Loughran and Ritter (1995). Chi and Padgett (2005) also attempt to satisfy the great interest in Chinese evidence on the long-term performance of IPOs. In choosing between the cumulative returns (CAR) and buy-and-hold returns (BHAR), Chi and Padgett (2005) argue that since in China the majority of investors are individual investors and they trade much more frequently than those in other countries, CARs may give a better estimate of the long-run performance of IPOs in the Chinese Markets. Therefore, although both CARs and BHARs are calculated, CARs are chosen as the dependent variable in the cross-sectional analysis to explain the long-term performance of Chinese IPOs.

Goodacre et al. (2007) compared the results obtained from both cumulative abnormal returns (CARs) and the buy-and-hold return method using 454 Malaysian IPOs. The reported long term over-performance of Malaysian IPOs is much lower when buy-and-hold returns are adopted. Unexpectedly, such an outcome suggests that the buy-and-hold return measure imparts a downward bias in the long horizon, which is not consistent with the arguments from Fama (1998), Mitchell and Stafford (2000) and Gompers and Lerner (2003) that imply the buy-and-hold return measure can magnify under- or over-performance.

A most recent Pan-Asia study by Moshirian et al. (2009) supports Barber and Lyon (1997) and confirms that BHARs should be used as long-run performance measure instead of CARs. They insist that CARs neglect compounding effects whereas BHARs implicitly have the compounding effect to reflect investor experience. Overall, BHARs are recommended in long-term studies because they correspond to an implementable trading strategy that does not make unrealistic assumptions about transaction costs.

Overall, both the buy-and-hold abnormal returns and cumulative abnormal returns have received substantial support and doubting challenges at the same time from various studies with international evidence around the world. To add fresh evidence of unit IPOs' long-term performance from the UK, both the buy-and-hold and cumulative abnormal returns are examined in this chapter.

5.2.3.2 Equally-weighted versus Value-weighted returns

Various studies imply that the long run performance measure could be very sensitive to the weighting scheme chosen to calculate abnormal returns. Barber and Lyon (1997) argue that bid-ask bounce can result in a rebalancing bias when equally-weighted portfolios of securities are examined. This is because each period the portfolio is rebalanced to put more weight on stocks that have declined in price and less weight on stocks that have increased in price. Controversial to the popular findings of IPO long term underperformance 3 to 5 years after listing, Brav and Gompers (1997) argue that value weighting IPO returns significantly reduces the measured underperformance since weighting returns under event-time framework by the number of IPOs may overstate underperformance.

Fama (1998) noted that the choice of weighting scheme should depend on the hypothesis of interest of the researcher. Similarly, Loughran and Ritter (2000) argue 'if one is trying to measure the abnormal returns on the average companies undergoing some event, then each company should be weighted equally; [this] will produce point estimates that are relevant from the point of view of a manager, investor, or researcher attempting to predict the abnormal returns associated with a random event'. Brav et al. (2000) argue that the value-weighted scheme should be employed if the aim of the research is to quantify the average wealth change of investors subsequent to an event.

Gompers and Lerner (2003) confirmed the differences in results between value-weighted and equally-weighted abnormal returns. As the first large-scale *out-of-sample* examination of the IPO long-term performance in the US, they claim that the nominal returns on IPOs are low, and their sample displays some underperformance when value-weighted event-time buy-and-hold abnormal returns are computed as performance measure; however, such underperformance disappears when equally-weighted buy-and-hold abnormal returns are employed as the alternative.

Goodacre et al. (2007) also conduct an in-depth comparison of abnormal returns between equal-weight and value-weight schemes. Results from the equally-weighted CAR indicate that while Malaysian IPOs temporarily outperform their matching firms in the first year (highest CAR 8.20%) of issuing, they generally do not exhibit any abnormal performance over the three-year horizon (the CAR falls to 0.43% by the end of month 36), which is consistent with the results from Jelic et al. (2001). However, when value-weighted abnormal returns are calculated, the CARs reported are much lower, falling to -8.16% by the end of month 36, which indicate that large IPO firms perform less well than smaller IPO firms (since they give more 'weight' to the calculation). To check the robustness of this result, an alternative benchmark was adopted. Consistent with the previous conclusion, equally-weighted CARs are positive and statistically significant but when sample firms are value-weighted, the abnormal the outperformance is decreased and insignificant. To reassess the difference between abnormal returns under different weighting schemes, I calculated both equally-weighted and value-weighted abnormal returns for unit IPOs issued in the UK, in comparison to several market indices and matched share-only IPOs.

5.2.3.3 Selection of benchmarks

There has been substantial evidence that benchmark selection plays a crucial role in the scale of abnormal returns from event studies. The selection of matching firms can be performed with a pure size matching. Ritter (1991) proposed that since many of the firms going public have low market capitalisations, a small firm index might be appropriate to use as a benchmark portfolio. H adopted an equally-weighted index of small non-IPO stocks as represented by the lowest decile of market capitalisation firms trading on the NYSE. This approach however, has the disadvantage of neglecting differences in the level and development of industries and industry risk effects and therefore delivers more coarse results. Barber and Lyon (1997) argue that the adjustment for matching firms appears to be the most adequate benchmark concept. They provide evidence that using matching firms to control for similar size and book-to-market ratios generate well-specified test statistics in virtually all sampling situations since the matching-firm-adjusted procedure mitigates the new listing bias, the rebalancing bias and the skewness bias.

In her long-term study of 142 German IPOs, Sapusek (2000) stressed that 'the selection of index is important' due to different methods of index calculation. The author selected two pricing indices and three performance indices. The study found that underperformance is generally higher for the performance indices than for the price indices. The underperformance is generally higher for the equally-weighted performance indices than for the value-weighted performance indices. Sapusek (2000) also selected a reference portfolio of matching firms as the benchmark according to the nearest neighbour principle. She insists that the matching firms are very similar companies compared with the newly listed IPO sample firms. The matching firm adjustment by size and industry is the best form of benchmark comparison, especially because the matching firms face the same business risks as the IPO firms. Therefore, these firms appear to be the 'most adequate' benchmark for the performance comparison. The results suggests that the IPO cohorts of the whole investigation period, and the 1983-1988 and 1989-1993 sub-periods, all significantly underperform the sample of matching firms, implying that aftermarket performance of IPO firms is worse than that of comparable firms matched by size and industry.

5.2.3.4 Various cross-sectional patterns of IPO long run performance

The cross-sectional patterns of long run IPO performance can provide valuable insights into the driven factors of any abnormal returns. Various cross-sectional analyses from different angles have been conducted by several academic papers. Ibbotson (1975) originally reported a negative relation between initial returns at the IPO and the long-run abnormal returns. Ritter (1991) also records that companies, which have higher mean initial returns exhibit worse long term abnormal returns. In a more recent study on the US market, Purnanandam and Swaminathan (2004), established that the more over-priced the IPO is relative to its comparables, the worse its long-run performance. With international evidence from China, Chi and Padgett (2005) insert that IPOs are underpriced by investment bankers to create the appearance of excess demand. Consistent with Ritter (1991) they believe IPO firms that are more underpriced at the initial public offering will suffer lower subsequent returns in the long run. A negative relationship between the initial returns and the long-term performance was found to be significant at 5% level, proving that the higher the return on the first trading day, the worse the performance will be in the long term.

Loughran and Ritter (1995) reveal that the degree of underperformance by issuing firms differs over time. They find evidence that IPOs issued in years when there is little issuing activity exhibit no significant underperformance comparing to those issued in years during high volume periods that underperform severely. Ritter and Welch (2002) also document that the degree of underperformance of an IPO varies over time. Chi and Padgett (2005) also applied a year-dummy to detect any difference in the long-run performance between IPOs that are listed in different years. The estimation results show that the year1997 dummy is positively significant, suggesting that companies that went public in 1997 perform better.

Brav and Gompers (1997) find that when issuing firms are matched on size and book-to-market ratios, IPOs do not underperform their comparables. In fact, underperformance is a character of small, low book-to-market firms regardless of whether they are IPO firms or not. Such results are also supported by Ritter and Welch (2002), in which they find that IPOs, when matched on size and book-to-market ratios, have only very modest underperformance. Researchers on post-NASDAQ IPOs demonstrate strong patterns of performance when firms are classified based on size and book-to-market: the smallest and lowest book-to-market IPOs tend to have the worst performance; in contrast, larger IPOs have performance that is relatively close to the market and their industries. Gompers and Lerner (2003) explore whether the pre-NASDAQ IPOs display a similar convention and find mixed evidence of a deterioration of underperformance over a longer horizon of five years. The underperformance after three year is smaller (-8.4%) but underperformance after five years is larger (-33%) when IPO returns are adjusted for size and book-to-market benchmark returns, which suggest that the returns of IPO firms initially imitate the poor performance of small, low book-to-market firms, but perform worse in the longer term.

Teoh, Welch, and Wong (1998) provide evidence that IPO underperformance in the long run is positively related to discretionary accruals in the fiscal year of the IPO, i.e. larger accruals in the IPO year are associated with more negative performance. They claim that the levels of discretionary accrual can proxy for earnings management and that the boosted earnings systematically fool investors. Chi and Padgett (2005) also studied the relationship between the long-run performance and the quality of listed firms using earnings per share as the proxy of the profitability of the firm. A positive relationship between the average earnings per share for the last three years before the firm's listing and the three-year market-adjusted returns of IPOs is expected. However, the results are statistically insignificant.

Carter et al. (1998) examined the effect of underwriter reputation on the long-term performance of US IPOs and found that over a three-year period, the underperformance is less severe for IPOs issued by more prestigious underwriters. Espenlaub, Garrett, and Mun (1999) investigated UK IPOs issued by companies with existing venture capital investors and underwritten by issuing houses that are affiliates of the venture capitalists. They report that in the long term, UK IPO performance is positively related to the reputation of the venture capital backers. Jelic et al. (2001) also segregated the long-run performance results of their sample of Malaysian IPOs by underwriter reputation. Portfolios are formed based on the reputation of the underwriter, which is measured by the frequency of engagement in underwriting during the sample period (1980-1995). Evidence is found that IPOs underwritten by more prestigious underwriters provide higher long-term returns than IPOs underwritten by less reputable underwriters. However, the results are not statistically significant. They claim that the lack of support for their hypotheses on the underwriters' role in valuation of IPOs brings forth concerns about the role of Malaysian banks in the primary market, especially given the ongoing reforms in the banking sector in Malay.

Cai and Wei (1997) report that Japanese issuing firms significantly underperform size-matched non-IPO firms in most industries. To provide the Chinese evidence on the long-term performance, Chi and Padgett (2005) examined the industry effect on the IPO long-run returns using a high-tech dummy that measures whether a company has high-tech products. A company is expected to have high growth in the near future if it belongs to a high-tech industry but it will also implicitly face higher risk at the same time, which could be rewarded by better long-run performance. As a result Chi and Padgett predict a positive relationship between a high-tech industry classification and the three-year market-adjusted long term returns of IPOs. The high-tech dummy in the cross-sectional regression appears to be positive at the 1% significance level, suggesting when a company has certain high-tech features investors expect it to present high growth in the future.

Goodacre et al. (2007) analysed the cross-sectional pattern of 454 Malaysian IPOs' long-term performance. While analyses based on size and initial returns has been undertaken in previous studies of Malaysian IPOs (Jelic et al, 2001), analysis of the long-term performance by different boards of listing are presented for the first time. The authors claim that by breaking down the sample in this way, the source of variation in the performance of IPOs due to a company's specific characteristics and broad economic characteristics could be traced.

5.3 Hypotheses

In the unit IPO literature, Mazouz et al. (2007) find evidence that under event-time approach, both the unit IPOs and share-only IPOs issued in Hong Kong significantly underperform the market index and that the unit firms generate significantly lower abnormal returns in the three years after listing than share-only IPOs. Their event study provides contradicting results to both the Agency Cost and the Signalling hypotheses, both theoretically implying that unit firms should perform better than share-only IPO firms in the long term. There is no other existing study on the long-term performance of unit IPOs. However, in the UK, Levis (1993) distinguished significant underperformance of share-only IPOs in the long term with a sample of 712 UK IPOs. Espenlaub et al. (2000) document substantial negative abnormal returns 3 years after listing under an event-time approach for UK IPOs issued between 1985 and 1992, irrespective of the benchmarks adopted. However, over a 5-year horizon, abnormal returns exhibit less severe underperformance and the conclusion on negative abnormal returns varies if different benchmarks are used. Furthermore, they point out that if a calendar-time approach is employed, the statistical significance of underperformance is even less remarkable. Since the unit IPO study is absent in the UK and the IPO underperformance is reported to be sensitive to the methodology applied to measure abnormal returns, I am motivated to reassess the long-term price performance of unit IPOs issued in the UK with different methods of measuring long-term returns. The following Hypotheses 5.1-5.5 are proposed to test the robustness of the long-term underperformance anomaly.

$H_{5.1}$: Unit IPOs underperform the FTA Index in the 3-year period post-listing

$H_{5.2}$: Unit IPOs underperform the FTSE Small Cap Index in the 3-year period post-listing

$H_{5.3}$: Unit IPOs underperform the HGSC Index in the 3-year period post-listing

$H_{5.4}$: Unit IPOs underperform the FTSE AIM All Share Index in the 3-year period post-listing

$H_{5.5}$: Unit IPOs underperform share-only IPOs matched on firm size, year of listing, and industry

Ibbotson (1975) originally reported a negative relation between initial returns at the IPO and the long-run abnormal returns. Ritter (1991) also records that companies, which have higher mean initial returns exhibits worse long term abnormal returns. However, in a more recent study on the US market, Purnanandam and Swaminathan (2004) argue differently, that the more over-priced the IPO is relative to its comparables, the worse its long-run performance. In the unit IPO literature, Schultz (1993b) predicts that unit IPOs are more underpriced than share-only IPOs at the time of listing; in the long-term, firms, which choose to issue unit IPOs have lower survival rate than firms choose to issue shares alone. However, no direct prediction has been made concerning the relation between the initial returns and the long-term performance of unit IPOs. Chemmanur and Fulghieri (1997) explain both the inclusion of warrants in unit IPOs and the underpricing of new shares are costly signals to convey favourable information about firm value and for unit firms to distinguish themselves from bad quality firms in the IPO process. Nonetheless, whether there is any association between initial returns and long-term abnormal returns is not covered in their study. As the first and only existing academic paper on the long-term performance of unit IPOs, Mazouz et al. (2007) did not discuss such potential relations with unit IPOs issued in Hong Kong. One is motivated to initiate the test of association between the short-term underpricing and long-term performance for unit IPOs in the UK. According to the Signalling hypothesis, unit IPOs are strategically underpriced by the issuers with the intention to signal favourable information about firm value. Since the underpricing is viewed as a credible signal in the IPO process, a positive relationship should be expected from a signalling perspective. However, the Agency Cost hypothesis in Schultz (1993b) explains that despite the intention to reduce agency costs, with the restriction from the attached warrants, unit firms (which are more underpriced at the time of listing) are more likely to fail in the absence of positive-NPV projects. Therefore, I propose the null hypothesis in favour of the Agency Cost theory, that unit firms, which are more underpriced at the time of IPO, should suffer worse long-term performance.

$H_{5.6}$: Unit IPOs with higher initial returns exhibit worse long-term performance

The Agency Cost hypothesis reasons that firms choosing unit IPOs attempt to reduce agency costs by arranging staged financing through exercise of warrants. Schultz (1993b) predicts that to create incentive and bind managers to optimal investment decisions, issuers intentionally limit the size of the unit IPOs. The proceeds from the unit IPOs are only enough to start production and test marketing but not enough for managers to waste on any negative-NPV projects. Therefore, managers are encouraged to use the limited proceeds from the first round of financing to invest in value-generating projects so that the unit firms' share prices will increase enough to allow the exercise of warrants and the materialisation of the second round of financing. No academic papers on unit IPOs have made any implications on the potential relation between the size of the unit IPOs and the long-term performance of unit firms. However, in the IPO literature, Ritter (1991) identifies that US IPOs display worse aftermarket long-run underperformance for smaller offers. The possibilities of any association between the size of unit IPOs and the long-term abnormal returns of unit firms are twofold. On one hand, the smaller size of the first round of financing, managers will be more motivated to invest in positive-NPV projects and the unit firms are expected to generate higher long-term returns. On the other hand, as Schultz (1993b) explained, managers of unit firms sometimes will have no positive-NPV projects to invest in and with the small proceeds from the IPOs, unit firms are less likely to survive comparing to share-only IPOs. Therefore, it is possible that unit firms with smaller issue size will underperform the share-only IPO firms and the market as a whole. To examine whether such relation exists, I hypothesise that in the UK, unit IPOs with smaller proceeds at the IPO stage will exhibit worse long-term abnormal returns than those unit IPOs that raise more capital.

$H_{5.7}$: The long-term performance of unit firms is positively related to the size of the unit IPOs

Both the Agency Cost and the Signalling hypotheses predict that unit firms are smaller than share-only firms. The study on the long-term performance of unit IPOs by Mazouz et al. (2007) also confirms that the unit IPOs in Hong Kong display smaller market value of equity than their share-only comparables. However, no implication has been made as whether smaller unit firms suffer worse long-term performance than bigger unit firms. In the share-only IPO literature, on the other hand, Page and Reyneke (1997) recorded that the degree of underperformance is greater among smaller companies in South Africa. Brav and Gompers (1997) in fact, find that underperformance is a character of small, low book-to-market firms regardless of whether they are IPO firms or not. Such argument is also supported by Ritter and Welch (2002), in which find that IPOs, when matched on size and book-to-market ratios, have only very modest underperformance. Since the IPO literatures indicate that the size of the firms have determining power on their long-term performance, I intend to test whether the unit IPO firms' long-term abnormal returns are also affected by their firm size. Therefore, Hypothesis 5.8 predicts that in the UK, smaller unit firms, in terms of market capitalisation at the offer price immediately after the unit IPOs, exhibit worse long-term performance than larger unit firms.

$H_{5.8}$: Unit firms' long-term performance is positively related to the firm size

Mazouz et al. (2007) report significant clustering in the years of listing from unit IPOs in Hong Kong. They illustrate the frequency distribution of both share-only and unit IPOs over the same period and find that in the period from 1990 to 1993, the sample is fairly balanced between share-only IPOs and unit IPOs, but the proportion of unit IPOs relative to the total number of IPOs has decreased sharply since 1994. The decline in the unit issues is not exclusive to the Hong Kong market; Byoun (2004) examines the unit seasoned offerings in the US and also documents the proportion of unit issues relative to the total number of issues has been relatively low since 1995. However, none of the unit IPO studies has examined the cross-sectional long-term performance of unit IPOs in relation to the year of issue. Within the IPO literature, Loughran and Ritter (1995) find evidence that IPOs issued in years when there is little issuing activity exhibit no significant underperformance, but IPOs issued in years during high volume periods underperform severely. Ritter and Welch (2002) also document that the degree of underperformance of IPOs varies over time. They showed that IPOs issued during the year 1990-1994, averaged at a much worse 3-year BHAR of -12.7%, but IPOs issued over the period of 1995-1998 had a positive average BHAR of 11.6%. No such implications are provided in Schultz (1993b) and Chemmanur and Fulghieri (1997). Therefore, one is motivated to analyse the long-term abnormal returns of UK unit IPOs cross-sectionally in relation to the market level of their issuing years.

$H_{5.9}$: Unit IPOs that are issued during years of higher market levels exhibit worse long-term performance

Both the Agency Cost and the Signalling hypotheses predict some degree of industry clustering for unit IPOs. Schultz (1993b) records that unit IPOs issued in the US are more popular with firms from the service sector and mining industry, in which exist higher uncertainty about issuing firms' future growth. Chemmanur and Fulghieri (1997) anticipate that firms from industries with high-technology elements are more likely to choose unit IPOs rather than share-only IPOs because those industries suffer higher degrees of information asymmetry, and have more motivation to signal favourable information about firm value during the IPO process. Mazouz et al. (2007) also display the industry distribution of their sample IPOs and a clear indication of industry clustering in the Hong Kong IPO market has been observed. However, they claim that the industry clustering in their sample does not depend on whether the new issues are unit IPOs or share-only IPOs. However, none of these academic papers have cross-sectionally examined the long-term performance of unit IPOs categorised by their industry sectors. In the IPO literature, Cai and Wei (1997) report that Japanese issuing firms significantly underperform size-matched non-IPO firms in most industries. Chi and Padgett (2005) examined the industry effect on the Chinese IPO long-run returns using a high-tech dummy that measures whether a company has high-tech products. They predict a positive relationship between a high-tech industry classification and the three-year market-adjusted abnormal returns of IPOs. The high-tech dummy in the cross-sectional regression appears to be positive at 1% significance level, suggesting when a company has certain high-tech features investors expect it to present high growth in the future. Unit IPOs are issued when the future cash flows are uncertain, the viability of investment opportunities may vary substantially across industries. In CHAPTER 3, I record that unit IPOs in the UK are popularly distributed across certain industries, such as mining, Internet technology, and biotechnology. A company is expected to have high growth in the near future if it belongs to those industries but it will also implicitly face higher risk at the same time, which could be the source of underperformance. Therefore, I analyse the long-term abnormal returns relative to unit firms' industry classification with Hypothesis 5.10.

$H_{5.10}$: Unit firms from high-risk industries exhibit worse underperformance in the long-term

Both the Agency Cost and the Signalling hypotheses predict that unit firms tend to have less earnings prior to the IPOs than share-only firms. However, no implication has been proposed on whether the profitability of unit firms prior to the IPO has any impact on their long-term stock performance. In the IPO literature, Teoh, Welch, and Wong (1998) provide evidence that IPO underperformance in the long run is positively related to the size of discretionary accruals in the fiscal year of the IPO, i.e. larger accruals in the IPO year are associated with more negative performance. They claim that the levels of discretionary accrual can proxy for earnings management and that the boosted earnings systematically fool investors. However, according to the Agency Cost explanation for including warrants in IPOs to reduce agency costs, unit firms should possess better managerial quality and therefore generate higher abnormal returns in the long term after the agency costs has been reduced by issuing unit IPOs. Whether the earnings of unit firms prior to the IPOs are boosted false attraction or does it indicate higher profitability and asset utilisation has yet to be evaluated in relation to the long-term performance of unit firms. I therefore hypothesise that unit firms that have higher earnings and asset utilisation prior to the IPOs should exhibit higher long-term returns comparing to unit firms with worse earning record.

$H_{5.11}$: The long-term returns of unit firms are positively related to the ratio of EBIT to total assets

Schultz (1993b) predicts that unit IPOs tend to be issued by less reputable underwriters comparing to those who market for share-only IPOs. How and Howe (2001) provide evidence that in Australia underwriters who issue unit IPOs are at least as reputable as those who issue share-only IPOs. The long-term study of unit IPOs by Mazouz et al. (2007) did not discuss any relation between the long-term returns of unit IPOs and the reputation of underwriters who brought the issues to market. In the share-only IPO literature, Espenlaub et al. (1999) investigate UK IPOs issued by companies with existing venture capital investors and underwritten by issuing houses that are affiliates of the venture capitalists. They report that in the long term, UK IPO performance is positively related to the reputation of the venture capital backers. Jelic et al. (2001) also segregated the long-run performance results of their sample of Malaysian IPOs by underwriter reputation. They found that IPOs underwritten by more prestigious underwriters provide higher long-term returns than IPOs underwritten by less reputable underwriters. In the absence of evidence of the long-term performance of unit IPOs in relation to the reputation of the underwriters who market for them, I hypothesise that in the UK unit IPOs underwritten by more prestigious issuing houses will exhibit higher long-term abnormal returns than unit IPOs issued by less reputable underwriters.

$H_{5.12}$: Unit IPOs issued by highly reputable underwriters exhibit better long-term performance

According to the Agency Cost explanation for including warrants in IPOs, to bind managers to optimal investment decisions, Schultz (1993b) predicts that the exercise price of attached warrants are set above the offer price of the IPOs. By doing so managers will be motivated to use the unit IPO proceeds to invest only in value-generating projects so that the share price of unit firms will increase enough to allow the materialisation of warrant proceeds as the second round of financing. Garner and Marshall (2005) stipulate that firms with different risk profiles may choose to issue different types of warrants. In particular, they provide evidence that risky firms tend to issue warrants with longer maturity and lower exercise price to offer price.

Chemmanur and Fulghieri (1997) provide evidence that the firm riskiness of unit firms is positively related to the firm value sold as warrants after controlling for the level of insider holding. However, neither of the above papers on unit IPOs specifies any relations between warrant characteristics and the long-term price performance of unit firms. Mazouz et al. (2007) insert that if the characteristics of warrants attached in unit IPOs reflect the unit firms' riskiness, the long-term abnormal returns of these unit firms may be affected by a warrant's maturity and its exercise price to offer price. However, their regression results do not indicate any significant difference in the monthly abnormal returns of unit firms segregated by warrant maturity and exercise price to offer price ratio. They conclude that the long-term performance of unit IPOs does not depend on the type of warrants issued. Nonetheless, Mazouz et al. (2007) only examined two of many characteristics specified in warrant contracts. Other warrant characteristics, such as the number of warrants included in unit IPOs, and the firm value sold as warrant proceeds have not been examined in relation to the long-term performance of unit firms. Furthermore, according to the Agency Cost hypothesis, warrants are attached in unit IPOs as the potential second round of financing. Whether the warrants will be eventually exercised to materialise additional funding depends on the price performance of the unit firms in the aftermarket. If the share prices of unit firms exceed the warrant exercise price post-listing, the warrant-holders are likely to exercise the warrant contracts for profit and the managers will have materialised the warrant proceeds as the second round of financing to support their companies' growth. Therefore, it is reasonable to expect such unit firms generate higher longer-term returns. To reassess the long-term abnormal returns of unit firms in relations to selected warrant characteristics with a fresh sample of UK unit IPOs, I propose several hypotheses as follows:

$H_{5.13}$: The long-term performance of unit IPOs is positively related to the maturity of warrants

$H_{5.14}$: The long-term performance of unit IPOs is positively related PRATIO

$H_{5.15}$: The long-term performance of unit IPOs is positively related to the numbers of warrants

$H_{5.16}$: The long-term performance of unit firms is positively related to firm value sold as warrants

$H_{5.17}$: Unit firms whose warrants have been exercised exhibit better long-term performance

5.4 Data and Methodology

5.4.1 Selection of unit IPO firms

To be included in the final sample, IPO firms had to meet the following criteria: (1) an offer price of at least GBP£0.01; (2) a fixed offering price, in other words, any tender offers were excluded; (3) the underlying company to be listed on the London Stock Exchange, either on the Official List or on the Alternative Investment Market (AIM); (4) return data available on the DataStream database for up to three years after listing; (5) the listing was not associated with any takeover or merger, or a major restructuring scheme; (6) any investment firms, Trusts, or Closed-End- Funds are disregarded from the sample. The final sample of 350 IPO firms consists of 92 unit IPOs and 258 share-only IPOs.

5.4.2 Selection of matching share-only IPO firms

The matching share-only firms were chosen following Loughran and Ritter (1995). Unit IPOs are individually matched to share-only IPO firms based on size, measured by market capitalisation on offer price, industry group, and the year of issue. Within the share-only sample, all the firms are ranked by their market capitalisation. To select 92 matching firms for the unit IPO firms issued between 1994 and 2006, I firstly split the unit firms into four groups according to prospectus publication dates: 6 unit IPOs with prospectus dates from the years 1993-1995 are matched with share-only IPOs from the year 1994 since there is only one unit IPO issued in 1993; 21 unit firms listed between 1996-1999 are compared with share-only IPOs from 1996; 27 unit IPOs from 2000-2003 are matched with share-only IPOs from the year 2000; 38 unit IPOs from 2004-2007 are compared with 2004 share-only IPOs. Secondly, the share-only firm in the same industry, with the market capitalisation closest to, but higher than, that of a unit firm, was selected as the matching company. Matching firms are only used once and when there are no share-only firms that match the industry for the matching years, another sample firm with the same industry was selected from the closest year.

5.4.3 Selection of market benchmarks

Monthly benchmark-adjusted returns are calculated as the monthly raw return on a stock minus the monthly benchmark return for the corresponding 21-trading-day period. Five different benchmarks are adopted: (1) FTSE All Share (FTA) Index, (2) The Hoare Govett Smaller Companies (HGSC) Index, (3) FTSE Small Cap Index, (4) FTSE Alternative Investment Market (AIM) All Share Index, and (5) Reference portfolio matched by size and industry. Following Ritter (1991), the long-term returns are calculated for both the unit IPO sample and the share-only IPO sample. FTSE ALL Share (FTA) Index is set as the main benchmark. Since unit IPO firms tend to be younger and smaller comparing to share-only IPO firms, I also employ the Hoare Govett Smaller Companies (HGSC) Index and FTSE Small Cap Index as benchmarks for robustness checks. Furthermore, since the listings of unit IPOs in my sample are highly concentrated on the Alternative Investment Market (AIM), I also apply the FTSE AIM All Share Index as another benchmark to test the sensitivity of the performance measures.

5.4.4 The raw monthly returns and market-adjusted monthly returns

The daily share prices of sample firms (excluding dividends) are collected for three years post-listing from DataStream's Equity Return Index datatype (RI). The various market index prices are obtained for the corresponding periods. I calculated the monthly market-adjusted returns for a period of 3 years following the first trading day. Following Ritter (1991), monthly returns are calculated for two intervals: The initial return period (usually 1 day), defined as the listing date to the first closing price listed on London Stock Exchange; and the after-market period, defined as the 3 years after the IPO exclusive of the initial return period. The event month is defined as the successive 21-trading day period relative to the listing date. The initial return period is identified as event month 0, and the aftermarket period includes the following 36 months post-IPO. Assuming the most common case of 1-day initial return period, event month 1 shall consist of event days 2-22, event month 2 will be identified as event days 23-43, and so on. For IPOs in which the initial return period is longer than 1 day, the month 1 period is truncated accordingly, thus the name 'Event-time approach'. For example, if the initial return period lasts 3 days, against odds of a calendar month, event month 1 will be identified as trading day 4-22. According to Kothari and Warner (1997), the issue of how to weight firms that do not survive the period ('drop-outs') can potentially affect the specification of any long-horizon test statistic. In this study, with regards to IPOs that are delisted before their 3-year anniversary, the aftermarket period is truncated and the 3-year buy-and-hold return ends with London Stock Exchange's last listing date (the delisting date).

The monthly raw return for firm i in event month t ($r_{i,t}$) was calculated shown as EQATION 5.1, by comparing the closing price on the last trading day of the month to the closing price of the previous month. Where, $P_{i,t}$ is the last traded total return of the firm i in event month t and $P_{i,t-1}$ is the last traded total return index in event month $t-1$.

$$r_{i,t} = (\frac{P_{i,t}}{P_{i,t-1}}) - 1 \qquad \textbf{EQUATION 5.1}$$

The market-adjusted return for firm i in the t-th month is defined as shown in EQUATION 5.2, where, $r_{i,t}$ is the return for firm i in the t-th trading month and $r_{m,t}$ is the return on the market index during the corresponding time period. The market-adjusted returns for firm i in the t-th month are then used to calculate the average market-adjusted abnormal returns under both the equally-weighted and value-weighted schemes.

$$ar_{i,t} = r_{i,t} - r_{m,t} \qquad \textbf{EQUATION 5.2}$$

5.4.5 Cumulative market-adjusted abnormal returns (CARs)

(A) Equally-weighted CARs

Cumulative average adjusted returns (CARs) are calculated with monthly portfolio rebalancing, where the adjusted returns are computed using several different benchmarks. The average market-adjusted return on a sample of n stocks for the t-th month is calculated as the equally-weighted arithmetic average of the market-adjusted returns, as shown in EQUATION 5.3. The t-statistics for the average adjusted returns are computed for each month as EQUATION 5.4, where n_t is the number of observations in month t, and sd_t is the standard deviation of the adjusted returns for month t.

$$AR_t = \frac{1}{n}\sum_{i=1}^{n} ar_{i,t}$$ **EQUATION 5.3**

$$t_{AR} = AR_t \times \sqrt{n_t} / sd_t$$ **EQUATION 5.4**

The Cumulative market-adjusted long-run return (CAR) from event month q to event month s is the summation of the average monthly market-adjusted returns over various intervals during the 36-month aftermarket period, q to s, as presented in EQUATION 5.5. The statistical significance of abnormal returns is tested by a standard one-sample Student's t-Test. According to Ritter (1991), to test the null hypothesis that the mean abnormal return is equal to zero for a sample of n firms, a conventional t-statistic is calculated as EQUATION 5.6, where csd_t is the standard deviation of cumulative abnormal returns for the sample of n firms, where, n_t is the sample size in the t-th month, *Var* is the average cross-sectional variance over 36 months, and *Cov* is the first-order autocovariance of the AR_t series, which is the product of correlation efficient and cross-sectional variance.

$$CAR_{q,s} = \sum_{t=q}^{s} AR_t$$ **EQUATION 5.5**

$$t_{\mathrm{CAR}} = \frac{CAR_{i,t} \times \sqrt{n_t}}{csd_t} \quad \text{where }, csd_t = [t \cdot Var + 2(t-1) \cdot Cov]^{1/2}$$ **EQUATION 5.6**

When a sample firm is delisted from the London Stock Exchange before its 3-year anniversary, the portfolio return for the next month is an equally-weighted average of the *remaining* firms in the portfolio. The cumulative market-adjusted return for months 1 to 36, $CAR_{1,36}$, therefore implicitly involves monthly rebalancing, with the proceeds of a delisted firm equally allocated among the surviving members of the portfolio in each subsequent month. For the month in which an IPO firm is delisted, the return for both the IPO and the benchmark includes just the days from the start of the month until the delisting date.

(B) Value-Weighted CARs

The value-weighted CARs are the sum of value-weighted market-adjusted returns $AR_{t,}$ as shown in EQUATION 5.7, where w_i is the value weight for firm i. The value weights are calculated as the market capitalisations of firm i at offer price immediately after the listing, divided by the total market capitalisation of the whole unit IPO sample.

$$AR_t = w_i \sum_{i=1}^{n} ar_{i,t}$$
$$CAR_{q,s} = \sum_{t=q}^{s} AR_t$$

EQUATION 5.7-5.8

5.4.6 Buy-and-hold market-adjusted abnormal returns (BHARs)

The use of 'independent' monthly rebalancing introduced by Ritter (1991) may cause a downward bias in CARs over a long period. To assure the robustness of the test results I employ the buy-and-hold market-adjusted abnormal returns (BHAR) under an event-time approach as an alternative measure of long-term performance to reduce the statistical bias in the measurement of cumulative performance. Adopting the calculation used in Loughran and Ritter (1995), the three-year holding period return for firm i is defined as the geometrically compounded return on the stock in event month t minus the geometrically compounded return on the market benchmark over the same period (EQUATION 5.9); where, $r_{i,t}$ is the return for firm i in the t-th event month and $r_{m,t}$ is the return of the FTSE 100 index during the corresponding time period. *Min (36, delist)* is the earlier of the last month of listed trading or the end of the three-year period. The mean three-year market-adjusted buy-and-hold return is computed as the total BHAR of the sample divided by the sample size, shown as EQUATION 5.10. A standard one sample Student's t-test is conducted to test the null hypothesis of zero mean three-year market-adjusted buy-and-hold return, as shown in EQUATION 5.11, where $\sigma(BHAR_i)$ is the standard deviation of the three-year buy-and-hold market-adjusted returns and n is the sample size.

$$BHAR_i = [\prod_{t=1}^{\min(36,delist)} (1+r_{i,t}) - 1] - [\prod_{t=1}^{\min(36,delist)} (1+r_{m,t}) - 1]$$ **EQUATION 5.9**

$$\overline{BHAR} = \frac{1}{n}\sum_{i=1}^{n} BHAR_i$$ **EQUATION 5.10**

$$t_{BHAR} = \frac{\overline{BHAR}}{\sigma(BHAR_i)/\sqrt{n}}$$ **EQUATION 5.11**

5.4.7 Wealth Relative (WR)

Barber and Lyon (1997), Kothari and Warner (1997) argue that there exists potential bias from summing up average benchmark-adjusted returns over the long horizon. Therefore, I change the focus onto the holding period returns. Following Ritter (1991), the three-year total buy-and-hold returns are then converted into wealth relatives to provide an overall indicator of long-term relative performance. By definition, a wealth relative is defined as the ratio of the end-of-period wealth from holding a portfolio of shares to the end-of-period wealth from holding a portfolio of matching companies or market benchmarks. As shown in EQUATION 5.12, a wealth relative is computed as one plus the mean 3-year BHAR of the sample firms, divided by the sum of one plus the mean 3-year BHAR of the benchmarks. A wealth relative of greater than one can be interpreted as meaning that IPOs have outperformed a portfolio of matching firms or market benchmarks. On the other hand, a wealth relative of less than one suggests that IPOs underperform their matching firms or market benchmark.

$$WR = \frac{1 + mean\ 3\ year\ \text{BHAR}\ IPOs}{1 + mean\ 3 year\ \ BHAR\ \ on\ benchmarks}$$ **EQUATION 5.12**

5.5 Tests and results

5.5.1 Cumulative Abnormal Returns (CARs)

TABLE 5.2 demonstrates the average FTSE All Share Index (FTA)-adjusted monthly abnormal returns (*ARt*) and cumulative average FTA-adjusted abnormal returns ($CAR_{1,t}$) for the 36 months following the listing day for 92 unit IPOs issued between 1994-2006. Both the equally-weighted and value-weighted results are presented for comparison reasons. The two-tailed Student's *t*-tests are conducted to test against the hypothesis that the mean abnormal returns are equal to zero; and both the *t*-statistics and *p*-values are presented to indicate the significance level of the results.

When the monthly raw returns are equally weighted across the sample, 27 of the 36 monthly average-adjusted abnormal returns are negative and *all* 36 average CARs are negative. The negative average monthly returns are also mirrored in predominantly declining average CARs, with insignificant periodical reversals. Consistent with Ritter (1991)'s findings regarding US IPOs' long-term performance, in the UK, aftermarket performance of unit firms deteriorate significantly over the long-term. In the first year post-listing, the CARs are negative for all 12 months but in the first three months and event month 5, the underperformance comparing to the market index is not significant. Proceeding into the second year, the underperformance is highly significant at 1% level. The CARs in year 3 remain significantly negative. Overall, measured by equally-weighted cumulative abnormal returns, unit IPOs issued in the UK significantly underperform the FTA Index three years post-listing and the underperformance is both economically and statistically significant. Hypothesis 5.1 is not rejected.

When the monthly abnormal returns are value-weighted by the ratio of the sample firms' market capitalisations at offer price to the total market capitalisation of the whole unit IPO sample, the level of underperformance and the significance are both higher than if weighted equally. Similar to the equally-weighted results, the underperformance in the first five months, although significant, has much less magnitude comparing to the underperformance in the second and third years. The CARs remain significantly negative throughout the second and third year. Overall, the value-weighted cumulative abnormal returns exhibit worse underperformance than the equally-weighted cumulative returns, which strengthens the result that unit IPOs underperform the FTA Index in the three-year period post-listing.

INSERT TABLE 5.2

To test the robustness of the results from FTA-adjusted ARs and CARs, TABLE 5.3 illustrates the equally-weighted average monthly abnormal returns (ARs) and the cumulative abnormal returns (CARs) comparing to the market movements of four different market indices. Sample rebalancing has been carried out every month in case a sample firm is delisted from the London Stock Exchange. The FTSE All Shares (FTA) Index is still selected to be the main market index. Since unit IPO firms tend to be younger and smaller comparing to share-only IPO firms, I also employ the Hoare Govett Smaller Companies (HGSC) Index and FTSE Small Cap Index as alternative benchmarks for robustness check. Furthermore, since the listings of unit IPOs in my sample are highly concentrated on the Alternative Investment Market (AIM), I also apply FTSE AIM All Share Index as another benchmark to test the sensitivity of the performance measures. The market-adjusted average abnormal returns (ARs) are calculated by taking the difference between the raw monthly returns of firm i ($r_{i,t}$) and the monthly returns of respective indexes ($r_{m,t}$) for the corresponding periods. The results in TABLE 5.3 indicate that for the first three event months, all the four benchmark-adjusted ARs or CARs are negative but only the HGSC-adjusted CAR is significant (at 10% level) in event month 3, which is consistent with the previous result and the US evidence from Ritter (1995), that the abnormally high initial returns at the time of listing will persist into the aftermarket for up to five months. In event month 4, the unit IPOs significantly underperform the other three indices, but the underperformance against the SMALL CAP index is not significant. In event month 5, none of the adjusted CARs are significantly negative apart from HGSC-adjusted CAR, which remains significantly negative at 10% level. From event month 6 onwards, the cumulative abnormal returns adjusted for movements from the FTA index, SMALLCAP index and the HGSC index, remain significantly negative throughout all event months. By the end of the third year post-listing, the sample unit IPOs significantly underperform the FTSE All Share index by -35.685% at 1% level, whilst FTSE SMALL CAP-adjusted CARs generate less underperformance of -29.009% and becomes significant at 5% level. The unit IPOs display the most significant underperformance within the HGSC index by -42.276% at 1% level. The market adjustment from the FTSE AIM index provides the least negative CAR of -13.141%, but the AIM-adjusted CARs only stayed significantly negative until event month 20, after which point the underperformance only remains marginally significant. The AIM-adjusted CARs have not been identified as significantly negative since event month 20.

To obtain a visual comparison of the underperformance of unit IPOs against different indices, FIGURE 5.1 plots equally-weighted raw monthly returns of unit IPOs and the market-adjusted monthly returns against the four indices (ARs); FIGURE 5.2 plots the equally-weighted CARs for the unit IPOs and the market-adjusted CARs against the four benchmark indices. Confirming the results from TABLE 5.3, the raw and market-adjusted ARs in FIGURE 5.1 display a general underperformance with several positive reversals, which explains the low significance level of the AR results. However, all five series of CARs in FIGURE 5.2 illustrate both economically and statistically significant underperformance for the three-year period after the initial listing. The underperformance predominantly worsens during the three years after the initial listing.

Although all four market-adjusted CARs display significantly negative post-initial return performance, the quantitative measure of the long-term performance of unit IPOs is sensitive to the benchmark chosen, which is common in event studies over long-term. The HGSC-adjusted CARs extrude the worst long-term performance, whilst AIM-adjusted CARs were favoured with the least severe underperformance. The FTA-adjusted CARs display a milder deterioration from the raw CARs whereas the SMALL CAP-adjusted CARs are almost synchronised with the movement of the raw CARs. For examining long-term performance of IPOs, it is not possible to ascertain which characteristics comprise the ideal benchmark portfolio. The FTA Index contains all the shares listed on the LSE; including firms of various sizes from diverse industries and of very different span of trading history. As a result, I consider the FTA Index as a good candidate for a general benchmark, to outline the overall long-run performance of the unit IPOs comparing to the majority IPOs on the market, but may over-adjust the performance downwards due to inclusion of large established firms that tend to perform well. In consideration of the smaller size of unit IPO firms in general, the FTSE Small Cap (SMALLCAP) index became another natural candidate, which consists of 300 UK companies outside of the FTSE 350 Index (The 350 largest companies in the UK). The very similar patterns that raw CARs and FTSE SMALLCAP-adjusted CARs share confirm the choice of this index as a decent consideration of size effect. In May 2005, FTSE Group enhanced its coverage of the Alternative Investment Market (AIM) by updating the existing index –the new FTSE AIM All Share (AIM) Index[42] segments the market in a new way and is a stock market index consisting of all companies quoted on the Alternative Investment Market which meet the flexible requirements for liquidity and free float. The HGSC Index as another popular index for smaller firms, measures the performance of the lowest 10 per cent by market capitalisation of the main UK equity market.

The different underperformances against the four alternative benchmark indices can also be confirmed by the comparison of the mean, median, and extreme values of the average abnormal returns of the unit IPOs; the results of which are illustrated in TABLE 5.4. Focusing

[42] The index is reviewed quarterly, and the constituent companies may change based on market capitalisation data as at the end of February, May, August and November.

first on the raw returns, the monthly average raw returns range from 6.044% to -5.156% with the median value of -0.711% and average at -8.85%. The results of adjusting for market movements, by subtracting the returns of the market index for the corresponding period, greatly depend on the choice of benchmarks. Even under the same FTSE-index series, the results vary with the different compositions of the listed companies: the FTSE All Share Index-adjusted average abnormal returns (-0.991%) illustrate even worse underperformance than the average raw monthly returns (-0.850%), while the underperformance shown by FTSE Small Cap Index-adjusted abnormal returns (-0.806%) are slightly less severe and FTSE AIM All Shares-Adjusted average return (-0.365%) is much less negative than the raw returns. Interestingly, like the FTSE Small Cap Index, the Hoare Govett Smaller Companies (HGSC) Index also focuses on smaller companies. However, the HGSC–adjusted average abnormal returns (-1.174%) generate the worst performance among all selected benchmarks and HGSC-adjusted ARs suffer worst performance throughout the three-year period (-6.217%).

In conclusion, the unit IPOs in the UK exhibit significant underperformance against the FTSE All Share index, the FTSE SMALL CAP index and the Hoare Govett Smaller Companies Index measured by equally-weighted cumulative abnormal returns. Despite the significant underperformance against the Alternative Investment Market index up to event month 20, the low significance level from event month 21 to 36 weakens the choice of the AIM index as a major benchmark. The difference in the magnitude of CARs comparing to the different indices can be attributed to the variations in performance of the selected indices. In the case of the AIM-adjusted CARs, the low significance in the underperformance can be explained by the more flexible listing requirements from the Alternative Investment Market index, which is likely to result in the inclusion of high risk firms that impair the index returns as a whole. In comparison, the other three indices provide better benchmark adjustments for the abnormal returns over the long-term. With three different market indices confirming significant underperformance over the three-year period post-listing, this chapter provides strong support to the prediction that in the UK, unit IPOs significantly underperform the market in the long-term measured by cumulative abnormal returns.

INSERT TABLE 5.3 HERE

INSERT TABLE 5.4 HERE

INSERT FIGURE 5.1-5.2 HERE

5.5.2 Buy-and-hold abnormal returns (BHARs) and Wealth relatives (WRs)

To avoid the downward statistical bias in long-term CARs caused by the implicit monthly rebalancing, the buy-and-hold market-adjusted abnormal returns (BHARs) and the wealth relatives (WR) are calculated as alternative measurements of long-term performance. Panel A of TABLE 5.5 reports the raw buy-and-hold abnormal returns (BHARs) in comparison to various market index-adjusted BHARs for different holding periods. Overall, all five series of BHARs indicate underperformance with negative holding period returns worsening over the three years after listing. However, the AIM-adjusted BHARs illustrate the lowest significance level comparing to the other four benchmarks, which is similar to the result from cumulative abnormal returns (CARs). Therefore, the analysis of long-term buy-and-hold returns are focused on the FTA, SMALLCAP, HGSC, and matching firm-adjusted BHARs.

In the first year post-listing, the buy-and-hold abnormal returns of unit IPOs are all visibly negative but not all statistically significant. The market-adjusted BHARs are only significantly negative in event month 6, when the unit IPOs significantly underperform the FTA index by -7.555%, the SMALLCAP index by -7.639% and the HGSC index by -15.082%, all at 5% level. In the same event month, the worst underperformance of unit IPOs is against the matching share-only firms, by -31.601% despite the marginal significant *p*-value, which might be caused by limited sample size. By the end of the first year, the BHARs are again all negative but only marginally significant.

By the end of the second year after the listing, the unit IPOs significantly underperform all four market-indices and the matching share-only firms. The FTA-adjusted BHAR in event month 24 is -31.888% with a t-statistic of -3.89 (significant at 1% level); the SMALLCAP-adjusted 24-month-BHAR is -25.472% with a *t*-statistic of -3.2 6 (significant at 1% level); the unit IPOs underperformance against the HGSC index is the worst, at -34.353% and also significant at 1% level; the average 24-month-BHAR compared to the matching firms indicates a slightly lower underperformance of -33.880%, which is significant at 5% level. The AIM index-adjusted 24-month-BHAR provides the mildest underperformance of -13.757% and the result is significant at 10% level.

In Panel A of TABLE 5.5, the buy-and-hold abnormal returns suggest the most consistent underperformance in year three (event month 28-36), when the unit firms constantly underperform the FTA index, SMALLCAP index and the HGSC index throughout all event months; the underperformance against the matching share-only firms are also highly significant with the exception of event month 30, and 34. By the end of the third year post-listing, the market-adjusted BHARs are -31.329% against the FTA index (significant at

1% level), -24.027% against the SMALLCAP index (significant at 5% level); the worst underperformance is again the HGSC-adjusted BHAR of -37.162% (significant at 1% level) and the matching firm adjusted BHAR of -25.212% implies the mildest underperformance (significant at 5% level). Overall, the three-year abnormal returns under a buy-and-hold strategy, whilst confirming the results obtained from cumulative abnormal returns, provides strong support that unit IPOs underperform both the matching share-only firms and the market as a whole.

FIGURE 5.3 visually illustrates the comparison of five series of *n*-year BHARs (*n*=1, 2, and 3): (1) no adjustment (raw returns), (2) FTSE ALL Share Index adjustments (FTA), (3) FTSE Small Cap Index adjustments (SMALL CAP), (4) FTSE AIM All Share Index adjustments (AIM), and (5) Hoare Govett Smaller Companies Index adjustments (HGSC). The BHARs against different benchmarks for different holding periods display slight differences in the magnitude of underperformance: For raw BHARs, FTA-adjusted BHARs and the SMALL CAP-adjusted BHARs, the worst underperformance all occurred in the second year (-23.927%, -31.888%, and -25.472% respectively). The HGSC-adjusted BHARs suffered the worst underperformance by the end of year three (-37.162%). However, even in the second year, the HGSC-adjusted BHAR (-34.353%) is still the most negative comparing to the other benchmark-adjusted BHARs. Similar differences are also observed from the cumulative abnormal returns adjusted from different market indices from previous results and again are contributed to the difference in performance caused by different compositions of listed firms on these indices. However, comparing to the cumulative measurements of long-run performance, the buy-and-hold returns exhibit less severe underperformance. Despite the difference in the magnitude, the negative market-adjusted BHARs are statistically robust. Overall, the results of buy-and-hold returns indicate significant long-term underperformance for UK unit IPO firms against various market indices and matching share-only IPO firms.

Panel B of TABLE 5.5 presents the wealth relatives of unit IPO firms in comparison to four market indices and the matching share-only IPO firms, for years 1, 2 and 3 post-listing. All the wealth relatives display significantly high *t*-statistics from the two-tailed Student's *t*-tests, indicating the results are all highly significant at 1% level. Only the 1-year and 3-year WRs against the AIM index are higher than 1, which suggests that unit IPO firms outperform the AIM index in year one and year three. However, as discussed before, because of the loose listing requirements and the inclusion of large numbers of high-risk firms on the Alternative Investment Market index, the unit firms do not underperform the AIM Index. All the other WRs against the FTA Index, SMALL CAP Index, HGSC Index, and the matching share-only firms are all less than 1 and all significant at 1% level, which suggests that the unit IPOs significantly underperform all four market benchmarks and the matching share-only firms. In conclusion, the wealth relatives indicate statistically significant long-term underperformance from the unit IPO firms comparing to both the share-only firms and the market as a whole. Such results are consistent to both the buy-and-hold abnormal returns and the cumulative abnormal returns.

The long-term performance of unit IPOs is compared to the matching share-only IPOs in TABLE 5.6. The 1-year, 2-year, and 3-year BHARs for both unit firms and share-only firms are ranked respectively by ascending order. The Student's *t*-test and Mann-Whitney test are conducted to indicate significance level in means and medians. In the first year, unit IPOs do not significantly underperform the share-only matching firms, which can be explained by the finding in Ritter (1995) that the abnormally high initial returns at the time of listing will persist into the short-term aftermarket. In the second and third year, the unit firms significantly underperform the matching share-only firms for most of the rank (apart from the extreme outliers in Rank 1 and 5) and the differences in the mean and median BHARs are both significant. In the second year, the unit firms underperform the matching share-only firms by 32.41% on average and the difference in means is significant at 1% level. The difference in median 3-year BHARs is -23.05%. In the third year, the unit firms significantly underperform the matching share-only firms by 21.38% at 1% level in means and 23.27% in medians at 5% level.

In conclusion, results from both cumulative, and buy-and-hold, long-term abnormal returns and the wealth relatives strongly support that unit IPOs in the UK underperform both the market indices and share-only firms matched by size and industry. Despite the adjustments from different indices and the different performance measures, the long-term underperformance of UK unit IPOs is both economically and statistically significant.

INSERT TABLE 5.5 HERE

INSERT TABLE 5.6 HERE

INSERT FIGURE 5.3 HERE

5.5.3 Cross-sectional analysis of long-term performance

The cross-sectional patterns of long run IPO performance have been examined from several dimensions. The mean and median values of three-year buy-and-hold abnormal returns for

UK unit IPOs, the FTSE All Share (FTA) index, and the matching share-only IPOs are categorised by the year of listing, industry sector, firm size, firm riskiness, the gross proceeds of the IPO, the level of underpricing, and the listing location of the firms. The mean and median buy-and-hold returns are compared between both unit IPOs and the FTA index, and between unit IPOs and their matching share-only IPOs. Paired *t*-tests are conducted to examine the significance level of differences in means; whilst the non-parametric Mann-Whitney (MW) tests are conducted to examine the differences in medians. The *p*-values are reported in indication of the significance levels.

5.5.3.1 Long-term performance categorised by year of listing

Panel A of TABLE 5.7 reports the equally-weighted average three-year buy-and-hold returns for the 92 UK unit IPO firms listed over the period of 1994-2006 in comparison to the FTSE All Share index returns, and also the matching share-only IPO firms for the corresponding cohort periods. The cohort periods are determined according to the level of market index returns. Monthly returns on the FTSE All Share Index, the FTSE Small Cap Index and Hoare Govett Smaller Companies (HGSC) Index are calculated and charted in FIGURE 5.4 to decide the ‘hot’ versus ‘cold’ market conditions. As indicated in FIGURE 5.4, the periods of 1994-95, 1999, and 2001-03, are considered the ‘cold’ market periods, when the market suffered severe declines of the index returns (also known as the ‘bear’ market); whereas, the sub-periods of 1996, 2000, and 2004-06 are considered the ‘hot’ market, displaying overall price appreciation on the market index. The cross-sectional long-term buy-and-hold returns illustrated in Panel A of TABLE 5.7 clearly indicates that unit IPOs generate significantly negative long-term abnormal returns if they are issued during years of high market levels when the market indices generally exhibit strong performance (1996, 2000, and 2004-06). On the other hand, unit IPOs issued during cold market periods such as 1994-95, 1997-99, and 2001-23, do not exhibit significant underperformance. Unit IPOs issued in the year 1996 (when the FTA Index procures a steady increase in index prices), display an average 3-year BHAR of 6.473%. Despite the positive long-term returns, the unit IPOs issued in 1996 significantly underperform the market index by -46.499%, which is significant at 10% level. The difference is their median 3-year BHARs is also significant at 10% level. The unit IPOs also underperform the share-only IPOs issued during the same year matched by firm size and industry. However, the difference in means and medians are not significant at a conventional level. During the year 2000, the 'dot-com' bubble is driving the market up. Unit IPOs issued in this year display significantly negative average 3-year buy-and-hold returns. Comparing to the FTA Index, unit IPOs' underperformance is significant in means and medians both at 10% level. The unit IPOs also significantly underperform the matching share-only firms issued in the same year with the difference in means significant at 5% level. However, the difference in medians is not significant. In 2004, when the market level hit its historical high (mainly driven by the bio-tech bubble), both unit IPOs and share-only IPOs significantly underperform the market index, but unit IPOs issued in 2004 significantly outperform the matching share-only IPOs. Considering the hot market condition, which is driven by certain high-risk industries during this period, the underperformance of shares issued in this year is expected regardless of the type of the offer. Unit IPOs issued during another 'hot' market period from 2005 to 2006, consistently and significantly underperform both the market index and their matching share-only IPOs issued in the same year. For both years, the differences in both means and medians are highly significant at 1% level. On the other hand, the long-term returns of unit IPOs issued during cold market conditions, when the index suffers price decreases (1994-95, 1997-99, and 2001-03), do not present any significant underperformance comparing to both the market index and the share-only matching IPOs. Overall, unit IPOs that are issued during years of higher market level exhibit worse long-term performance than unit IPOs that are issued during years with lower market level.

INSERT FIGURE 5.4 HERE

5.5.3.2 Long-term performance categorised by industry sector

In CHAPTER 3 I record that unit IPOs in the UK are popularly distributed across certain high risk industries, such as mining (33.70%), support services (23.91%), IT and hi-tech (13.04%), and bio-technology (9.78%). A company is expected to have high growth in the near future if it belongs to those industry groups but it will also implicitly face greater risk at the same time, which could be the source of long-term underperformance. Panel B of TABLE 4.7 illustrates the equally-weighted average 3-year buy-and-hold returns across industry groups in test of Hypothesis 5.10 proposed in Section 5.3. Results indicate that unit IPOs from mining, support services, and bio-technology industry groups present severe underperformance against the market index and the differences in means and medians are all significant at conventional levels. The worst performing industry in the long term is the biotechnology group, which underperforms the FTA index by 43.994% over the 3-year period post-listing. The original estimate in world markets for genetically engineered products is nearly US$100 billion by the year 2000. The high-tech elements inject high risk into the industry, but the risk was dismissed in favour of the appealing benefits. Investors stayed overoptimistic about the biotech industry up to the year 2004, before substantial doubts of the industry began to concern investors. Investors have been stunned more by the absence of profits in their investments than by medical progress in the sector. The mining industry is another popular patron in unit IPOs. Indicated by results from Panel B of TABLE 5.7, mining unit IPOs significantly underperform the market index by 32.819% on average. The difference in means is significant at 5% level indicated by a paired two-tail *t*-test and the difference in medians is significant at 1% level, suggested by the *p*-value from the non-parametric Mann-Whitney test. For the IT industry, unit IPOs also exhibit significant underperformance against the market index; however, the difference in means is only marginally significant, which can be explained by the limited number of IT unit IPOs in the sample data. Nonetheless, the magnitude of the underperformance still sheds light on the industry clustering argument.

When compared to share-only IPOs matched by firm size and industry, the underperformance becomes insignificant in most industry groups except the support service sector. The support sector unit IPOs significantly underperform the share-only comparables in mean values at 1% level, although the difference in median values is not significant as suggested by the Mann-Whitney test's *p*-value. Such results confirm that there is indeed industry clustering in the long-term performance of unit IPOs. Unit firms from high risk industries including mining, IT, support services and bio-technology exhibit worse underperformance against the market index in the long-term, comparing to unit IPOs from 'other' industry groups.

5.5.3.3 Long-run performance categorised by size of unit firms

To test Hypothesis 5.8 and to ascertain whether the unit IPO firms' long-term abnormal returns are also affected by their firm size, Panel C of TABLE 5.7 segregates the unit IPOs into three size groups by market capitalisation at offer price. The results indicate that the average 3-year BHARs of 'large'-size unit IPOs significantly underperform the market index by the highest 30.081%, but the difference in means is not significant. The average BHAR of 'medium'-sized unit IPOs underperform the market index by 27.711%, with the difference in means significant at 10% level. The 'small'-sized unit firms provide the least underperformance against the market index by 23.101% and the difference in means is significant at 5% level. However, by median values, the 'small' unit IPOs underperform the market index by the highest 69.115% and the difference in medians is highly significant at 1% level suggested by the *p*-value from the Mann-Whitney test. The 'medium' unit IPOs' underperformance against the market index is 59.887% in median values with the non-parametric *p*-value of 0.002 (significant at 1% level). The 'large' unit firms provide the least underperformance of 52.355% in medians and it is significant at 1%. Overall, the results from the differences in means and medians give the opposite indications, and therefore the hypothesis predicting that unit firms' long-term performance is positively related to the firm size is rejected. In the UK, the size of unit firms does not significantly affect their abnormal returns in the long term.

5.5.3.4 Long-run performance categorised by unit firms' riskiness

The standard deviations of the share prices 200 days after the unit IPOs are calculated to indicate firm risk. The unit IPOs are ranked by the riskiness in ascending order and divided into three groups. The 'low' risk group, including the top division of unit firms with lower riskiness, display the least severe underperformance comparing to the market index in both mean (-11.638%) and median (-53.465%), with the differences both statistically significant at 5% level. The 'high' risk unit IPOs, i.e. the last division of the rank with highest firm riskiness, exhibit the most severe underperformance against the market index and both the mean (-59.664%) and the median (-72.136%) are significant at 1% level. The 'medium' risk unit IPOs outperform the 'high' risk group but suffer worse underperformance than unit IPOs from the 'low' risk group. When compared to share-only IPOs matched on firm size and industry, only the high-risk unit IPOs significantly underperform their share-only comparables. The unit IPOs with 'low' and 'medium' risk do not present significant underperformance to the matching portfolio of share-only IPOs. Overall, the long-term buy-and-hold abnormal returns of unit IPOs are negatively related to the firm riskiness. The riskier the unit firms, the worse they perform in the three-year period after the unit IPOs.

5.5.3.5 Long-run performance categorised by the size of the unit offers

In Panel E of TABLE 5.7, the 3-year buy-and-hold returns of unit IPOs are segregated into different groups by the gross proceeds of the unit offers. The results suggest that unit IPOs, which raise more than five million pounds significantly, underperform both the market index and share-only firms matched on firm size and industry. The five-to-ten million group displays the highest underperformance of -60.88% against the FTA Index and -62.056% against the matching share-only IPOs, both of which are significant at 1% level. The unit issues, which raise above ten million pounds underperform the market index by -45.426% in means and -25.863% in median values; the difference in means is significant at 1% level, and the difference in medians is significant at 5% level. Other unit IPOs with a sizes less than five million pounds generally significantly underperform the market, except for issues that raise less than one and half million, in which the underperformance is not significant. However, those smaller issues do not present significant underperformance comparing to their share-only matching firms. Overall, the bigger unit issues exhibit worse underperformance than smaller issues, which is consistent with the Agency Cost theory, that unit firms intentionally limit the size of their offers to bind managers to optimal investment decisions. The smaller the proceeds from unit IPOs, the more managers will rely on materialising the second round of financing through the exercise of warrants and gain higher incentive to invest in value-generating projects. Therefore, Hypothesis 5.7, that the long-term performance of unit firms is positively related to the size of the unit IPOs, is rejected.

5.5.3.6 Long-run performance categorised by level of initial underpricing

In testing whether there is any relation between the initial underpricing on the first trading day and the long-term abnormal returns three years after listing, in Panel F of TABLE 5.7, unit IPOs are divided into three groups with low, medium, and high HGSC-adjusted first-day initial returns (IR_D2) respectively. The results clearly indicate that unit IPOs that generate lower initial returns, i.e. underpriced less, do not significantly underperform either the market index or the matching share-only IPOs. The negative 3-year BHAR against the FTA index is not significant; in fact those unit IPOs appear to outperform the share-only IPOs matched on firm size and industry, although the differences in means and medians are not significant. Unit firms with 'medium' initial returns significantly underperform the market index, but not the matching share-only firms. Contrarily, unit IPOs with 'high' initial returns exhibit severe underperformance against both the market index and the matching share-only IPOs. The differences in means and medians are all statistically significant at conventional levels. Unit IPOs that are highly underpriced on the first trading day suffer the worst underperformance than the other groups. On average, highly underpriced unit IPOs underperform the FTA Index by 55.167%, which is highly significant at 1% level; the underperformance comparing to matching share-only IPOs is 65.302%, which is significant at 5% level. Overall, Hypothesis 5.6, stating that unit IPOs with higher initial underpricing exhibit worse long-term performance is not rejected.

INSERT TABLE 5.7 HERE

5.5.4 Regression analysis of long-term performance

I conduct three linear regressions on the three-year BHARs of unit IPOs with the matching share-only IPOs as a benchmark. The variables included are designed to test the long-term performance of unit IPOs in relations to unit firm-characteristics, unit offering-characteristics, and warrant characteristics, the results of which are illustrated in TABLE 5.8. The first regression includes several firm characteristics as independent variables. As discussed in the cross-sectional analysis previously, evidence was found that smaller, riskier unit firms exhibit worse long-term underperformance. The market capitalisation (MKTCAP) and the firm riskiness (RISK) are included as indicators of firm size and riskiness respectively. In test of Hypothesis 5.11 that the long-term performance of unit IPOs is positively related to the earnings and asset utilisation, the ratio of EBIT to total asset (EBIT/TTLASSET) is also included. Other variables are employed to detect any relation between the long-term returns of unit IPOs and the age, insider holding, and leverage of the firm. The SEO dummy variable is included in extension of previous chapter's findings, that unit IPOs are more likely to issue seasoned equity offerings if they survived the three-year period post-listing. The results from Panel A of TABLE 5.8 indicate that the firm riskiness and the leverage of the unit firms are both significantly and negatively related to the 3-year BHAR of unit firms. The riskier the unit firms, the higher leverage the unit firms have by the time of listing, the worse their long-term performance. On the other hand, the earning and asset utilisation, measured by the ratio of EBIT to total asset (also applied as the 'efficiency ratio' to indicate level of agency costs in CHAPTER 3), is positively related to the long-term BHARs and the relation is highly significant at 1% level. The age, insider holding and the SEO dummy is not significantly related to the long-term performance. The R^2 of 48.7% is not very high, which can be explained by the limited sample size of unit IPOs. The variance inflation factors (VIF) are all slightly higher than 1, which do not indicate collinearity problems. Overall, the regression provides viable results.

$$\begin{aligned}\mathrm{BHAR} = {} & \alpha_0 + \alpha_1 RISK + \alpha_2 MKTCAP + \alpha_3 AGE + \alpha_4 INSIDER + \alpha_5 EBIT / TTLASSET \\ & + \alpha_6 LEVERAGE + \alpha_7 SEO + \xi\end{aligned}$$

EQUATION 5.13

The second regression focuses on the long-term performance of unit firms in relation to several characteristics of the unit offering. As discussed in the cross-sectional analysis, I find evidence that the unit IPOs that are more underpriced and have larger proceeds exhibit worse long-term performance. Therefore, the initial returns on the first trading day (IR_D2) and the proceeds net of expenses (NETPROCEEDS) from the unit IPOs are included in the regression to test the robustness of previous results. In addition, to test whether the trading location has any impact on the long-term abnormal returns, I also include the AIM dummy; which takes the value of 1 if the unit firms are listed on the Alternative Investment Market, 0 if otherwise. Furthermore, in test of Hypothesis 5.12, stating that unit IPOs issued by more reputable underwriters display better long-term performance, I also employ the REPUTATION dummy in the regression. Results in Panel B of TABLE 5.8 provide a clear indication that both the initial returns and the net proceeds of the unit issues are negatively related to the 3-year BHAR of the unit IPOs, both of which are highly significant at 1% level. The AIM dummy and REPUTATION dummy are both positively and significantly related to the long-term abnormal returns of unit IPOs. Overall, the results from Regression 2 sufficiently support the argument that unit IPOs that obtained higher initial returns and raised larger proceeds ultimately suffer worse underperformance in the long-term. On the other hand, unit IPOs that are listed on the Alternative Investment Market and issued by more reputable underwriters accrue better long-term performance, compared to unit IPOs that are listed on the Main Market and issued by less prestigious underwriters.

$$BHAR = \beta_0 + \beta_1 IR_D 2 + \beta_2 GROSSPROCE\ ED + \beta_3 AIM + \beta_4 REPUTATION + \xi$$

EQUATION 5.14

Regression 3 highlights any possible relations between the long-term performance of unit IPOs and several characteristics of attached warrants. As discussed in Section 5.3, the unit IPO literature suggests the characteristics of warrants attached in unit IPOs can potentially affect the long-term performance of unit IPOs. Chemmanur and Fulghieri (1997) provide evidence that the firm value sold as warrants is positively related to firm riskiness. Since previous results in this chapter indicate that riskier unit firms suffer worse long-term performance, the percentage of warrant proceeds as the market capitalisation of the unit firms (VALUE) is included to examine the robustness of the Signalling hypothesis. According to the Agency Cost hypothesis, warrants are attached in unit IPOs as the potential second round of financing. The larger number of warrants attached indicates that more funding could be materialised from the exercise of warrants, which could create higher incentive to reduce agency costs and in turn improve unit firms' performance in the long term. Therefore, the number of warrants (NUMBER) is also included in Regression 3. Mazouz et al. (2007) find no significant difference in the long-term performance segregated by warrant maturity with a sample of unit IPOs issued in Hong Kong. To reassess their findings, I include the LIFE variable measured by the calendar years between the warrant issuance and their expiration date. Furthermore, whether the warrants will be eventually exercised to materialise additional funding depends on the price performance of the unit firms in the aftermarket. If the share prices of unit firms exceed the warrant exercise price post-listing, the warrant-holders are likely to exercise the warrants as the second round of financing to support unit firms' growth. The EXERCISE dummy in Regression 3 takes the value of 1 if attached warrants in the unit IPOs are exercised by the time of this research, 0 if otherwise. Schultz (1993b) also predicts that unit firms set the warrants exercise price above the IPO offer price to create incentives for managers to improve their companies' performance. I adopt the ratio of warrant exercise price to the offer price (PRATIO) in the regression in examination of the Agency Cost hypothesis.

Results of Regression 3 are demonstrated in Panel C of TABLE 5.8. The firm value sold as warrants is positively related to the 3-year BHAR of unit IPOs and the result is highly significant at 1% level. Viewed collectively with the significantly negative relation between firm riskiness and long-term performance of unit IPO in the previous results from Regression 1 and the cross-sectional analysis, the long-term performance evidence of UK unit IPOs does not support the Signalling hypothesis. On the other hand, the number of warrants attached to the unit IPOs is positively related to the long-term performance of unit firms; which is consistent with the Agency Cost hypothesis in that the larger the warrant proceeds, the higher the incentive to bind managers to optimal investment decisions and in turn better the long-term performance. The PRATIO is also positively related to the 3-year BHARs of unit IPOs. The higher the ratio, the higher the incentive for managers to invest only in value-generating projects and in turn materialise the exercise of warrants. Such results strengthen the support of the long-term evidence towards the Agency Cost hypothesis. The maturity of the warrants and the proportion of warrants, which have been exercised, are all positively related to the long-term performance of unit IPOs. However, the coefficients on these two variables are not significant at conventional levels. Nonetheless, results from Regression 3 provide strong evidence that certain characteristics of warrants attached in a unit IPO can indeed affect the long-term performance of the issuing firm.

$$\mathrm{BHAR} = \alpha_0 + \alpha_1 \mathrm{VALUE_i} + \alpha_2 NUMBER_i + \alpha_3 LIFE_i + \alpha_4 EXERCISE_i + \alpha_5 PRATIO_i + \xi_i$$

EQUATION 5.15

5.6 Summary and conclusions

According to both the Agency Cost and the Signalling hypotheses, regardless of whether warrants are included in IPOs to reduce agency cost or to signal favourable information about firm value, unit firms are expected to generate higher long-term returns than share-only IPOs.

In this chapter, both the Agency Cost and the Signalling hypotheses for including warrants are examined with a fresh sample of unit IPOs issued in the UK between 1994 and 2006. The long-term performance of UK unit IPOs are compared to four market indices and share-only firms matched on firm size and industry. Additionally, the long-term performance of unit IPOs are also analysed in relation to the characteristics of unit IPOs and attached warrants.

Firstly, results from the cumulative abnormal returns, the buy-and-hold abnormal returns, and the wealth relatives all provide strong evidence that unit IPOs in the UK significantly underperform both, the market indices and share-only firms matched by size and industry. Comparing to the cumulative measurements, the buy-and-hold abnormal returns exhibit significantly less severe underperformance.

Secondly, cross-sectional patterns of long run IPO performance have been categorised by listing year, industry, firm size, firm riskiness, issue size, and the level of underpricing. Unit IPOs issued during years of high market levels generate significantly worse underperformance compared to unit IPOs issued during years of low market levels. Unit firms from high-risk industries including mining, IT, support services and biotechnology display significantly worse long-term underperformance comparing to unit IPOs from less risky industry groups. However, in the UK, the size of unit firms does not significantly affect their abnormal returns in the long term. In addition, evidence is found that the long-term BHARs of unit IPOs are negatively related to the firm riskiness. The riskier the unit firms, the worse they perform in the three-year period after the unit IPOs. When unit IPOs are segregated by their gross proceeds, bigger unit issues with larger proceeds exhibit worse underperformance than smaller issues. Such a result is consistent with the Agency Cost theory, that unit firms intentionally limit the size of their offers to bind managers to optimal investment decisions. Moreover, less underpriced unit IPOs do not significantly underperform either the market index or the matching share-only IPOs. Contrarily, unit IPOs with high initial returns exhibit severe underperformance against both the market index and the matching share-only IPOs.

Last but not least, the linear regression results indicate that the firm riskiness and the leverage of the unit firms are both significantly and negatively related to the 3-year BHAR of unit firms. The riskier the unit firms and the higher leverage the unit firms have by the time of listing, the worse their long-term performance. On the other hand, the earning and asset utilisation, measured by the ratio of EBIT to total asset is positively related to the long-term BHARs and the relation is highly significant at 1% level. The age, insider holding and the SEO dummy is not significantly related to the long-term performance. The second regression examines relations between the long-term performance of unit firms and several characteristics of the unit offerings. The results confirm the argument that unit IPOs that are more underpriced, and raise larger proceeds, exhibit worse underperformance in the long-term. On the other hand, unit IPOs that are listed on the Alternative Investment Market and issued by more reputable underwriters achieve better long-term performance, compared to unit IPOs that are listed on the Main Market and issued by less prestigious underwriters.

Regression 3 highlights relations between the long-term performance of unit IPOs and several warrant characteristics. The firm value sold as warrants is positively related to the 3-year BHAR of unit IPOs and the result is highly significant at 1% level. Such a result contradicts the Signalling hypothesis' perdition of a positive relation between the firm value sold as warrants and firm riskiness, since previous cross-sectional analyses found that the long-term underperformance increased with firm riskiness. On the other hand, the number of warrants attached to the unit IPOs is positively related to the long-term performance of unit firms, which is consistent with the Agency Cost hypothesis, that the larger the warrant proceeds, the higher the incentive to bind managers to optimal investment decisions and in turn the better the long-term performance. The PRATIO is also positively related to the 3-year BHARs of unit IPOs. The higher the ratio of exercise price to offer price, the higher the incentive for managers to invest only in value-generating projects to increase the unit firms' share prices and in turn materialise the exercise of warrants. Such a result strengthens the support of the long-term evidence towards the Agency Cost hypothesis. Both the maturity of the warrants and the proportion of warrants, which have been exercised present positive coefficients, but these two variables are not significant at conventional level. Nonetheless, it is safe to conclude that certain characteristics of warrants attached in a unit IPO have significant impact on the long-term performance of the issuing firms.

To sum up, unit IPOs issued in the UK present significant underperformance across both the matching share-only IPOs and various market indices, regardless of the methods adopted to calculate abnormal returns (BHARs, CARs, and WRs; equally-weighted and value-weighted). Such results are unable to directly support either the Agency Cost hypothesis or the Signalling hypothesis, both of which imply that unit firms should exhibit better performance in the long term. However, the cross-sectional and regression analyses provide some insight within the unit IPO sample. Certain characteristics of the unit firms, the unit issues, and the attached warrants can significantly affect the long-term performance of unit IPOs.

TABLE 5.1
Definition of included variables

Variables	Definition
IR_D1	Discrete raw initial return calculated using the first closing bid price and offer price at the IPO
IR_D2	HGSC-adjusted first-day initial returns
IR_D3	The continuously compounded first-day initial return is the natural logarithm of (1+ IR_D2)
IR_W1	HGSC Index-adjusted first-week initial returns
IR_W2	The continuously compounded first-week initial return is the natural logarithm of (1+ IR_W1)
AGE	Number of calendar days between firm incorporation and the listing date
MKTCAP	Market capitalisation of the issued share capital following the listing at the placing price
TTLASSET	Total assets of the sample firms by end of the fiscal year prior to the IPO
ASSET	The ratio of total assets divided by the gross proceeds from IPO
MKT2BK	Market-to-book ratio of IPO firms immediately post-listing
INSIDER	Percentage of directors' holdings in their own company immediately after the listing
RISK	Firm riskiness, measured by the residual standard deviations of the discrete share return 200 days following the IPO
TTLREVENUE	Total revenue of the IPO firm by the end of the fiscal year prior to the IPOs
REVENUE	The ratio of total revenue divided by the gross proceeds from IPO
EBIT	Earnings before interest and tax of the IPO firm by the end of the fiscal year prior to the IPOs
NI	Net income after tax by the end of the fiscal year prior to the IPOs
LEVERAGE	Ratio of total debt to total assets by the end of the fiscal year prior to the IPOs
DEBT	The ratio of total debt divided by the gross IPO proceeds
DELAY	Number of calendar days between the registrations of prospectus and commencement of trading
EXPENSE	Percentage total expense to gross proceeds of the IPOs
REPUTATION	Dummy variable that is equal to 1 if the underwriter has a high reputation ranking, 0 if otherwise
PROCEEDS	The expected gross proceeds of the IPOs
Ln(PROCEED)	The natural logarithm of the expected gross proceeds from the IPO
VALUE	Firm value sold as warrants calculated as warrant proceeds as a percentage of firm market capitalisation after IPO
UNIT	Dummy variable that takes the value of 1 if the IPO includes warrants, 0 if otherwise
NUMBER	Number of warrants included in the unit IPOs
LIFE	Number of years before warrant expiration
PRATIO	The ratio of warrant exercise price to the offer price
AIM	Dummy variable that is equal to 1 if the IPO firm is listed on Alternative Investment Market (AIM), 0 if otherwise

TABLE 5.2
FTA Index - Adjusted cumulative abnormal returns (CARs) for Unit IPOs

Equally-weighted and value-weighted average FTSE All Share Index (FTA)-adjusted abnormal returns (AR) and average cumulative abnormal returns (CAR) for the 36 months following the unit IPOs are presented. The calculations are shown in EQUATION 5.3-5.8. Two-tailed Student's *t*-tests are conducted for each month's returns against the zero-mean hypothesis. The *t*-statistics for the average adjusted return is computed for each month following EQUATION 5.4 The *t*-statistic for the cumulative average returns in each month, is calculated according to EQUATION 5.6. The level of significance is indicated by associated *p*-values.

		Equally-Weighted						**Value-Weighted**					
Month	**Sample Firms**	**AR%**	*t-stat*	*p-value*	**CAR%**	*t-stat*	*p-value*	**AR%**	*t-stat*	*p-value*	**CAR%**	*t-stat*	*p-value*
1	92	-0.571	*-0.29*	*0.775*	-0.571	*-0.29*	*0.775*	-5.254	*-2.47*[a]	*0.015*	-5.254	*-2.47*[a]	*0.015*
2	92	-1.374	*-0.70*	*0.486*	-1.945	*-0.69*	*0.508*	-4.794	*-1.35*	*0.182*	-10.048	*-2.17*[b]	*0.033*
3	92	-1.183	*-0.96*	*0.339*	-3.128	*-1.31*	*0.176*	-2.834	*-1.41*	*0.163*	-12.882	*-2.23*[b]	*0.029*
4	92	-1.714	*-1.39*	*0.169*	-4.842	*-1.75*[c]	*0.120*	-2.652	*-1.21*	*0.231*	-15.534	*-2.13*[b]	*0.036*
5	92	-0.039	*-0.02*	*0.987*	-4.881	*-1.16*	*0.249*	-0.016	*-0.01*	*0.996*	-15.550	*-1.84*[c]	*0.069*
6	92	-3.331	*-1.94*[b]	*0.056*	-8.212	*-1.85*[b]	*0.058*	-5.958	*-1.44*[d]	*0.154*	-21.508	*-1.83*[c]	*0.071*
7	92	-2.627	*-1.47*[d]	*0.144*	-10.839	*-2.12*[b]	*0.037*	-8.001	*-1.57*[d]	*0.121*	-29.509	*-1.80*[c]	*0.074*
8	92	-4.226	*-2.18*[b]	*0.032*	-15.065	*-2.89*[a]	*0.010*	-6.433	*-2.80*[a]	*0.006*	-35.942	*-1.99*[b]	*0.050*
9	92	0.040	*0.020*	*0.984*	-15.025	*-2.45*[a]	*0.016*	-5.757	*-1.25*	*0.213*	-41.699	*-1.91*[c]	*0.060*
10	92	3.893	*1.13*	*0.262*	-11.133	*-1.45*[d]	*0.150*	-6.070	*-0.97*	*0.332*	-47.769	*-1.72*[c]	*0.089*
11	92	-5.835	*-3.03*[a]	*0.003*	-16.968	*-2.11*[b]	*0.038*	-2.783	*-0.40*	*0.690*	-50.552	*-2.18*[b]	*0.032*
12	91	-1.367	*-0.54*	*0.594*	-18.334	*-2.13*[b]	*0.036*	-6.654	*-1.65*[c]	*0.101*	-57.205	*-2.26*[b]	*0.026*
13	91	-4.207	*-2.32*[a]	*0.013*	-22.542	*-2.49*[a]	*0.014*	-1.998	*-0.50*	*0.617*	-59.203	*-2.24*[b]	*0.027*
14	91	-2.435	*-1.73*[c]	*0.087*	-24.977	*-2.77*[a]	*0.007*	-6.343	*-1.60*[c]	*0.104*	-65.546	*-2.20*[b]	*0.031*
15	90	-1.304	*-0.59*	*0.560*	-26.281	*-2.73*[a]	*0.008*	-8.422	*-1.63*[c]	*0.103*	-73.968	*-2.15*[b]	*0.034*
16	90	-0.097	*-0.05*	*0.964*	-26.378	*-2.69*[a]	*0.009*	-2.859	*-0.45*	*0.650*	-76.827	*-1.99*[b]	*0.050*
17	90	-2.478	*-0.84*	*0.403*	-28.856	*-2.82*[a]	*0.006*	0.354	*0.11*	*0.913*	-76.473	*-1.95*[b]	*0.054*
18	90	0.950	*0.42*	*0.677*	-27.905	*-2.69*[a]	*0.008*	5.708	*0.66*	*0.508*	-70.765	*-2.19*[b]	*0.031*

(Continued)

Month	**Sample Firms**	**AR%**	*t-stat*	*p-value*	**CAR%**	*t-stat*	*p-value*	**AR%**	*t-stat*	*p-value*	**CAR%**	*t-stat*	*p-value*
19	90	-1.634	*-0.65*	*0.516*	-29.539	*-2.88*[a]	*0.005*	-1.861	*-0.42*	*0.678*	-72.626	*-2.30*[b]	*0.024*
20	90	-1.133	*-0.47*	*0.640*	-30.672	*-2.93*[a]	*0.004*	5.721	*0.65*	*0.515*	-66.904	*-2.55*[a]	*0.012*
21	90	-0.743	*-0.31*	*0.755*	-31.415	*-3.02*[a]	*0.003*	0.891	*0.22*	*0.823*	-66.014	*-2.82*[a]	*0.006*
22	90	0.332	*0.19*	*0.849*	-31.083	*-2.93*[a]	*0.004*	-2.655	*-1.10*	*0.275*	-68.669	*-2.82*[a]	*0.006*
23	90	-1.659	*-0.80*	*0.425*	-32.742	*-3.13*[a]	*0.002*	-0.155	*-0.03*	*0.976*	-68.824	*-3.14*[a]	*0.002*
24	88	-3.070	*-1.36*	*0.177*	-35.812	*-3.43*[a]	*0.001*	-0.114	*-0.04*	*0.965*	-68.938	*-3.22*[a]	*0.002*
25	88	0.453	*0.14*	*0.890*	-35.359	*-2.95*[a]	*0.004*	-5.221	*-1.23*	*0.221*	-74.159	*-3.14*[a]	*0.002*
26	88	-1.010	*-0.39*	*0.698*	-36.370	*-2.95*[a]	*0.004*	0.808	*0.18*	*0.857*	-73.351	*-3.34*[a]	*0.001*
27	87	-1.437	*-0.75*	*0.453*	-37.807	*-3.03*[a]	*0.003*	-0.468	*-0.17*	*0.863*	-73.819	*-3.29*[a]	*0.001*
28	86	-0.930	*-0.44*	*0.660*	-38.737	*-3.09*[a]	*0.003*	-2.049	*-1.22*	*0.226*	-75.868	*-3.26*[a]	*0.002*
29	85	-2.836	*-1.32*	*0.189*	-41.573	*-3.18*[a]	*0.002*	-6.571	*-1.56*[d]	*0.121*	-82.440	*-3.11*[a]	*0.002*
30	84	-1.112	*-0.38*	*0.703*	-42.685	*-3.31*[a]	*0.001*	2.712	*0.49*	*0.626*	-79.728	*-3.05*[a]	*0.003*
31	84	0.278	*0.15*	*0.878*	-42.406	*-3.85*[a]	*0.001*	1.626	*0.44*	*0.660*	-78.102	*-2.98*[a]	*0.004*
32	83	6.094	*1.31*	*0.195*	-36.312	*-2.77*[a]	*0.007*	-2.336	*-0.89*	*0.375*	-80.438	*-2.86*[a]	*0.005*
33	81	0.419	*0.16*	*0.874*	-35.893	*-2.66*[a]	*0.009*	-2.859	*-0.73*	*0.466*	-83.297	*-2.69*[a]	*0.008*
34	81	-0.930	*-0.42*	*0.674*	-36.824	*-2.67*[a]	*0.009*	1.106	*0.26*	*0.797*	-82.191	*-2.74*[a]	*0.007*
35	80	-0.116	*-0.06*	*0.955*	-36.940	*-2.63*[a]	*0.010*	-5.027	*-1.09*	*0.278*	-87.218	*-2.61*[a]	*0.011*
36	78	1.255	*0.40*	*0.692*	-35.685	*-2.55*[a]	*0.012*	-2.565	*-0.64*	*0.522*	-89.782	*-2.75*[a]	*0.007*

[a], one sample t-Test is significant at 1% level
[b], one sample t-Test is significant at 5% level
[c], one sample t-Test is significant at 10% level

TABLE 5.3
Four Market index-adjusted CARs for unit IPOs

Robustness Comparison

Monthly abnormal returns are calculated following EQUATION 5.2 against four different benchmarks: (1) FTSE All Share Index (FTA), (2) FTSE Small Cap Index, (3) FTSE AIM (Alternative Investment Market) All Shares Index, (4) The Hoare Govett Smaller Companies (HGSC) Index. $\mathrm{AR_t} = 1/n_t \cdot \sum_{i=1}^{n_t}(r_{i,t} - r_{m,t})$, where $r_{i,t}$ is the monthly return on unit firm i in event month t, and $r_{m,t}$ is the monthly return of the respective market benchmarks for the corresponding time period[43]. The t-statistics for the average adjusted return (AR) and for the cumulative abnormal returns (CAR) in month t, is calculated according to EQUATION 5.4 and EQUATION 5.6 respectively. The t-statistics are presented in brackets and the subscripts ^{a}, ^{b}, ^{c}, represent the significance levels of 1%, 5%, and 10% respectively, indicated by associated p-values.

	FTA-Adjusted (%)		**SMALL-Adjusted (%)**		**AIM-Adjusted (%)**		**HGSC-Adjusted (%)**	
t	**AR_t**	**CAR_{-FTA}**	**AR_t**	**CAR_{-SMALL}**	**AR_t**	**CAR_{-AIM}**	**AR_t**	**CAR_{-HGSC}**
1	-0.571	-0.571	-0.481	-0.481	-0.849	-0.849	-0.623	-0.623
	(-0.29)	*(-0.29)*	*(-0.25)*	*(-0.25)*	*(-0.48)*	*(-0.48)*	*(-0.32)*	*(-0.32)*
2	-1.374	-1.945	-1.451	-1.933	-0.348	-1.197	-1.677	-2.300
	(-0.70)	*(-0.69)*	*(-0.75)*	*(-0.68)*	*(-0.18)*	*(-0.43)*	*(-0.85)*	*(-0.83)*
3	-1.183	-3.128	-1.410	-3.342	-0.497	-1.694	-1.620	-3.920
	(-0.96)	*(-1.31)*	*(-1.22)*	*(-1.03)*	*(-0.38)*	*(-0.54)*	*(-1.30)*	*(-1.64)^c*
4	-1.714	-4.842	-1.508	-4.850	-1.903	-3.597	-2.089	-6.009
	(-1.39)	*(-1.75)^c*	*(-1.27)*	*(-1.37)*	*(-1.58)^c*	*(-1.06)*	*(-1.67)^c*	*(-2.08)^b*
5	-0.039	-4.881	0.418	-4.432	1.035	-2.562	-6.217	-12.226
	(-0.02)	*(-1.16)*	*(0.19)*	*(-1.06)*	*(0.43)*	*(-0.62)*	*(-0.92)*	*(-1.62)^c*
6	-3.331	-8.212	-3.806	-8.238	-3.088	-5.650	-3.807	-16.032
	(-1.94)^b	*(-1.85)^b*	*(-2.23)^a*	*(-1.84)^c*	*(-1.70)^c*	*(-1.25)*	*(-2.22)^b*	*(-3.42)^a*
7	-2.627	-10.839	-2.321	-10.559	-2.123	-7.773	-2.690	-18.723
	(-1.47)	*(-2.12)^b*	*(-1.36)*	*(-2.09)^a*	*(-1.16)*	*(-1.51)*	*(-1.55)*	*(-3.53)^a*
8	-4.226	-15.065	-3.879	-14.438	-3.335	-11.108	-3.984	-22.707
	(-2.18)^b	*(-2.89)^a*	*(-2.07)^b*	*(-2.57)^a*	*(-1.70)^c*	*(-1.90)^c*	*(-2.08)^b*	*(-4.41)^a*
9	0.040	-15.025	-0.520	-14.958	1.258	-9.850	-0.626	-23.333
	(0.02)	*(-2.45)^a*	*(-0.27)*	*(-2.49)^a*	*(0.64)*	*(-1.58)^c*	*(-0.32)*	*(-3.44)^a*
10	3.893	-11.133	4.667	-10.291	5.462	-4.389	4.594	-18.739
	(1.13)	*(-1.45)*	*(1.35)*	*(-1.47)*	*(1.51)*	*(-0.61)*	*(1.32)*	*(-1.95)^b*
11	-5.835	-16.968	-5.266	-15.556	-4.333	-8.722	-5.097	-23.836
	(-3.03)^a	*(-2.11)^b*	*(-2.74)^a*	*(-2.430)^a*	*(-2.18)^b*	*(-1.32)*	*(-2.67)^a*	*(-4.87)^a*
12	-1.367	-18.334	-1.457	-17.013	-0.729	-9.452	-1.300	-25.136
	(-0.54)	*(-2.13)^b*	*(-0.58)*	*(-2.02)^b*	*(-0.28)*	*(-1.49)*	*(-0.51)*	*(-3.46)^a*
13	-4.207	-22.542	-3.856	-20.869	-3.196	-12.647	-4.090	-29.226
	(-2.32)^a	*(-2.49)^a*	*(-2.20)^a*	*(-2.47)^a*	*(-1.69)^c*	*(-1.46)*	*(-2.28)^b*	*(-4.37)^a*

[43] The FTSE AIM (Alternative Investment Market) All Share Index is only available from 29th December 1995 onwards; therefore, five sample unit firms issued before that date are excluded from the calculation, leaving the sample size to be 87 for the AIM-adjusted CARs.

14	-2.435	-24.977	-2.024	-22.893	-1.441	-14.088	-2.405	-31.631
	(-1.73)[b]	*(-2.77)*[a]	*(-1.40)*	*(-2.68)*[a]	*(-0.97)*	*(-1.58)*[c]	*(-1.64)*[c]	*(-5.98)*[a]
15	-1.304	-26.281	-1.005	-23.898	0.081	-14.007	-1.274	-32.905
	(-0.59)	*(-2.73)*[a]	*(-0.46)*	*(-2.97)*[a]	*(0.04)*	*(-1.64)*[c]	*(-0.58)*	*(-4.38)*[a]
16	-0.097	-26.378	0.134	-23.764	-0.370	-14.378	-0.544	-33.449
	(-0.05)	*(-2.69)*[a]	*(0.064)*	*(-2.68)*[a]	*(-0.17)*	*(-1.56)*[c]	*(-0.26)*	*(-4.18)*[a]
17	-2.478	-28.856	-1.789	-25.553	-1.527	-15.905	-2.210	-35.658
	(-0.84)	*(-2.82)*[a]	*(-0.61)*	*(-2.53)*[a]	*(-0.49)*	*(-1.48)*	*(-0.74)*	*(-3.01)*[a]
18	0.950	-27.905	0.661	-24.893	1.382	-14.523	0.673	-34.985
	(0.42)	*(-2.69)*[a]	*(0.30)*	*(-2.48)*[a]	*(0.59)*	*(-1.58)*[c]	*(0.29)*	*(-3.55)*[a]
19	-1.634	-29.539	-1.689	-26.581	-2.051	-16.574	-2.150	-37.135
	(-0.65)	*(-2.88)*[a]	*(-0.70)*	*(-3.44)*[a]	*(-0.84)*	*(-2.00)*[b]	*(-0.90)*	*(-4.41)*[a]
20	-1.133	-30.672	-0.283	-26.864	0.341	-16.233	-0.582	-37.717
	(-0.47)	*(-2.93)*[a]	*(-0.12)*	*(-3.52)*[a]	*(0.13)*	*(-2.20)*[a]	*(-0.24)*	*(-4.77)*[a]
21	-0.743	-31.415	0.130	-26.734	1.667	-14.566	-0.005	-37.722
	(-0.31)	*(-3.02)*[a]	*(0.06)*	*(-2.59)*[a]	*(0.73)*	*(-1.37)*	*(-0.02)*	*(-3.26)*[a]
22	0.332	-31.083	0.446	-26.287	1.046	-13.520	0.319	-37.403
	(0.19)	*(-2.93)*[a]	*(0.25)*	*(-2.50)*[a]	*(0.58)*	*(-1.24)*	*(0.18)*	*(-4.75)*[a]
23	-1.659	-32.742	-1.603	-27.891	-0.969	-14.488	-1.856	-39.258
	(-0.80)	*(-3.13)*[a]	*(-0.76)*	*(-2.69)*[a]	*(-0.44)*	*(-1.35)*	*(-0.87)*	*(-4.06)*[a]
24	-3.070	-35.812	-2.222	-30.112	-1.500	-15.988	-2.469	-41.728
	(-1.36)	*(-3.43)*[a]	*(-0.99)*	*(-2.90)*[a]	*(-0.62)*	*(-1.49)*	*(-1.09)*	*(-3.77)*[a]
25	0.453	-35.359	0.487	-29.626	0.739	-15.249	0.696	-41.032
	(0.14)	*(-2.95)*[a]	*(0.15)*	*(-2.50)*[a]	*(0.22)*	*(-1.25)*	*(0.21)*	*(-3.01)*[a]
26	-1.010	-36.370	-1.037	-30.663	-0.626	-15.875	-1.239	-42.271
	(-0.39)	*(-2.95)*[a]	*(-0.40)*	*(-2.63)*[a]	*(-0.23)*	*(-1.34)*	*(-0.48)*	*(-3.27)*[a]
27	-1.437	-37.807	-1.765	-32.428	-0.953	-16.828	-1.624	-43.895
	(-0.75)	*(-3.03)*[a]	*(-0.96)*	*(-2.74)*[a]	*(-0.50)*	*(-1.35)*	*(-0.89)*	*(-4.88)*[a]
28	-0.930	-38.737	-0.260	-32.688	0.017	-16.811	-0.111	-44.006
	(-0.44)	*(-3.09)*[a]	*(-0.12)*	*(-2.63)*[a]	*(0.01)*	*(-1.29)*	*(-0.05)*	*(-3.55)*[a]
29	-2.836	-41.573	-2.090	-34.778	-1.208	-18.019	-2.164	-46.170
	(-1.32)	*(-3.18)*[a]	*(-0.98)*	*(-3.62)*[a]	*(-0.51)*	*(-1.59)*	*(-0.99)*	*(-5.49)*[a]
30	-1.112	-42.685	-0.925	-35.703	-0.387	-18.406	-0.868	-47.038
	(-0.38)	*(-3.31)*[a]	*(-0.32)*	*(-2.80)*[a]	*(-0.13)*	*(-1.38)*	*(-0.30)*	*(-3.25)*[a]
31	0.278	-42.406	-0.130	-35.833	0.527	-17.880	-0.097	-47.135
	(0.15)	*(-3.85)*[a]	*(-0.07)*	*(-2.87)*[a]	*(0.29)*	*(-1.37)*	*(-0.05)*	*(-4.11)*[a]
32	6.094	-36.312	5.384	-30.449	5.614	-12.266	5.198	-41.937
	(1.31)	*(-2.77)*[a]	*(1.17)*	*(-2.40)*[a]	*(1.15)*	*(-0.95)*	*(1.11)*	*(-2.94)*[a]
33	0.419	-35.893	0.686	-29.762	0.832	-11.434	0.317	-41.620
	(0.16)	*(-2.66)*[a]	*(0.27)*	*(-2.26)*[b]	*(0.31)*	*(-0.88)*	*(0.12)*	*(-2.89)*[a]
34	-0.930	-36.824	-1.076	-30.839	-1.333	-12.767	-0.920	-42.540
	(-0.42)	*(-2.67)*[a]	*(-0.50)*	*(-2.30)*[b]	*(-0.62)*	*(-0.94)*	*(-0.42)*	*(-2.83)*[a]
35	-0.116	-36.940	1.040	-29.799	-0.484	-13.251	-0.413	-42.953
	(-0.06)	*(-2.63)*[a]	*(0.46)*	*(-2.17)*[b]	*(-0.22)*	*(-0.96)*	*(-0.20)*	*(-3.00)*[a]
36	1.255	-35.685	0.790	-29.009	0.110	-13.141	0.677	-42.276
	(0.40)	*(-2.55)*[a]	*(0.25)*	*(-2.13)*[b]	*(0.03)*	*(-0.95)*	*(0.21)*	*(-2.74)*[a]

TABLE 5.4
Average Abnormal Returns (ARs) of Unit IPOs

The minimum (Min), median, maximum (Max) and mean values of the average abnormal returns of unit IPOs are presented in percentage. Also shown are the standard deviations (St.D) of the monthly returns. The first column is the raw monthly returns of unit IPOs, the next four columns are market-adjusted average monthly abnormal returns against four different indices: FTSE All Share (FTA) Index, FTSE Small Cap Index, the FTSE Alternative Investment Market (AIM) All Share Index, and the Hoare Govett Smaller Companies (HGSC) Index,

	RAW	FTA	SMALL CAP	AIM	HGSC
Min	-5.156%	-5.835%	-5.266%	-4.333%	-6.217%
Median	-0.711%	-1.123%	-1.021%	-0.491%	-1.257%
Max	6.044%	6.094%	5.384%	5.614%	5.198%
Mean	-0.850%	-0.991%	-0.806%	-0.365%	-1.174%
St.D	*0.0204*	*0.0214*	*0.0205*	*0.0202*	*0.0220*

TABLE 5.5

Market-adjusted buy-and-hold abnormal returns (BHARs) and wealth relatives (WRs)

The *n*-year holding period return for firm *i* is defined as the geometrically compounded return presented in EQUATION 5.9. Min (36, delist) is the earlier of the last month of listed trading or the end of the three-year period. The average BHARs is equally rebalanced by the number of actively trading unit firms (N) by the end of each month. One-sample Student's *t*-tests are conducted to test the null hypothesis of zero mean as shown in EQUATION 5.11. In Panel B, wealth relatives (WR) are calculated as the ratio of the end-of-period wealth from holding a portfolio of issuers to the end-of-period wealth from holding a portfolio of matching companies or market benchmarks (EQUATION 5.12). The Student's *t*-tests are conducted to test the difference, the *p*-values of which are presented to indicate the significance level.

Panel A: Market-index adjusted Buy-and-hold abnormal returns (BHARs)

Holding period	N	RAW (%)	FTA (%)	SMALL (%)	HGSC (%)	AIM (%)	MATCH (%)
2 Months	92	-0.248 *(-0.08)*	-1.608 *(-0.74)*	-1.606 *(-0.56)*	-1.892 *(-0.67)*	-0.876 *(-0.31)*	-12.131 *(-1.49)*
6 Months	92	-5.068 *(-1.23)*	-7.555 *(-2.12)*[b]	-7.639 *(-2.13)*[b]	-15.082 *(-2.07)*[b]	-5.119 *(-1.22)*	-31.601 *(-1.27)*
9 Months	92	-5.047 *(-0.57)*	-8.408 *(-1.07)*	-8.351 *(-1.08)*	-15.671 *(-1.57)*	-3.496 *(-0.39)*	-31.300 *(-1.21)*
12 Months (1 Year)	91	-5.181 *(-0.58)*	-9.360 *(-1.08)*	-7.816 *(-1.04)*	-14.684 *(-1.51)*	2.672 *(0.21)*	-23.856 *(-0.79)*
18 Months	90	-6.224 *(-0.45)*	-12.580 *(-1.01)*	-9.202 *(-0.75)*	-17.874 *(-1.26)*	0.275 *(0.02)*	-20.922 *(-1.01)*
20 Months	90	-12.478 *(-1.00)*	-18.834 *(-1.67)*[c]	-14.839 *(-1.35)*	-23.046 *(-1.83)*[c]	-5.882 *(-0.48)*	-23.651 *(-1.25)*
22 Months	90	-15.335 *(-1.40)*	-23.093 *(-2.37)*[a]	-17.658 *(-1.86)*[c]	-26.133 *(-2.34)*[b]	-7.253 *(-0.68)*	-32.173 *(-1.53)*
24 Months (2 Years)	88	-23.927 *(-2.77)*[a]	-31.888 *(-3.89)*[a]	-25.472 *(-3.26)*[a]	-34.353 *(-3.77)*[a]	-13.757 *(-1.67)*[c]	-33.880 *(-1.93)*[b]
28 Months	86	-22.734 *(-2.07)*[b]	-29.060 *(-2.90)*[a]	-22.133 *(-2.25)*[b]	-30.530 *(-2.74)*[a]	-9.946 *(-0.92)*	-25.398 *(-1.62)*[c]
30 Months	84	-24.582 *(-2.03)*[b]	-32.033 *(-2.86)*[a]	-23.976 *(-2.09)*[b]	-33.366 *(-2.71)*[a]	-9.589 *(-0.81)*	-24.036 *(-1.50)*
34 Months	81	-22.973 *(-1.89)*[c]	-31.264 *(-2.86)*[a]	-23.360 *(-2.19)*[b]	-34.849 *(-2.80)*[a]	-9.272 *(-0.85)*	-30.210 *(-1.50)*
36 Months (3 Years)	78	-23.733 *(-1.84)*[c]	-31.329 *(-2.63)*[a]	-24.027 *(-2.05)*[b]	-37.162 *(-2.77)*[a]	-9.141 *(-0.78)*	-25.212 *(-2.30)*[b]

Panel B: Wealth Relatives (WRs)

	N	FTA	SMALLCAP	HGSC	AIM	MATCH
WR- 1 Year	91	0.9102 *(8.46)*[a]	0.8831 *(9.15)*[a]	0.8518 *(9.16)*[a]	1.0410 *(8.40)*[a]	0.8040 *(6.74)*[a]
WR- 2 Year	88	0.7032 *(9.96)*[a]	0.7269 *(9.82)*[a]	0.6817 *(9.80)*[a]	0.9410 *(8.86)*[a]	0．6919 *(4.55)*[a]
WR- 3 Year	78	0.7078 *(8.01)*[a]	0.7187 *(7.73)*[a]	0.6719 *(7.66)*[a]	1.003 *(6.82)*[a]	0.7540 *(3.76)*[a]

TABLE 5.6
Rank distribution of buy-and-hold returns post-listing

In the table, *n*-year buy-and-hold returns (*n*= 1, 2, and 4) are ranked by ascending order for both the unit IPOs and their share-only counterparts matched on firm size and industry. The mean and median values of *n*-year buy-and-hold returns for each sample are calculated and illustrated. The Student's *t*-tests are conducted to test the difference in means and non-parametric Mann-Whitney tests are conducted to test the difference in medians. The *p*-values from both tests are presented to indicate the significance level in the difference of the buy-and-hold returns between the unit sample and the matching share-only sample.

	One-Year Buy-and-hold (%)			Two-Year Buy-and-hold (%)			Three-Year Buy-and-hold (%)		
Rank	**Unit**	**Match**	**Difference**	**Unit**	**Match**	**Difference**	**Unit**	**Match**	**Difference**
1	-92.41	-100.00	7.59	-100.00	-100.00	0.00	-100.00	-100.00	0.00
5	-77.40	-80.98	3.59	-96.06	-96.11	0.05	-100.00	-98.22	-1.78
10	-72.89	-71.47	-1.43	-89.76	-88.64	-1.12	-96.95	-94.32	-2.63
15	-62.15	-63.08	0.93	-87.75	-83.47	-4.28	-95.40	-90.49	-4.91
20	-53.86	-56.02	2.16	-79.67	-74.11	-5.56	-91.09	-85.19	-5.90
25	-51.07	-46.68	-4.39	-69.75	-66.94	-2.81	-85.66	-80.77	-4.89
30	-46.15	-36.62	-9.53	-64.47	-56.60	-7.88	-79.65	-72.19	-7.46
35	-42.99	-25.55	-17.44	-56.85	-44.44	-12.41	-69.12	-61.43	-7.69
40	-40.48	-20.83	-19.64	-53.12	-33.03	-20.09	-64.67	-48.02	-16.65
45	-28.44	-7.69	-20.75	-49.23	-25.00	-24.23	-55.05	-38.37	-16.68
50	-17.52	0.00	-17.52	-42.86	-18.01	-24.84	-50.00	-25.00	-25.00
55	-11.11	0.59	-11.70	-32.85	-4.50	-28.35	-42.86	-18.41	-24.45
60	-4.76	6.63	-11.39	-14.70	-0.06	-14.65	-33.33	-4.47	-28.86
65	7.33	21.87	-14.54	0.00	29.04	-29.04	-14.70	0.00	-14.70
70	14.29	29.07	-14.78	1.85	41.14	-39.29	4.17	22.35	-18.19
75	25.63	38.34	-12.71	16.67	62.51	-45.84	14.72	49.40	-34.67
80	36.29	55.53	-19.24	42.00	96.21	-54.20	79.30	102.72	-23.42
85	68.48	62.49	5.99	92.69	109.82	-17.13	134.06	150.00	-15.94
90	122.86	108.33	14.52	125.00	232.01	-107.01	212.35	413.99	-201.63
91	563.73	233.10	330.63	176.02	249.51	-73.49	407.89	529.63	-121.73
92	900.00	2527.43	-1627.43	493.37	1322.21	-828.84	673.50	653.84	19.66
			***t*-test and MW-test *p*-value**			***t*-test and MW-test *p*-value**			***t*-test and MW-test *p*-value**
Mean	*-2.12*	*21.48*	*0.356*	*-22.89*	*9.52*	*0.000[a]*	*-19.25*	*2.13*	*0.000[a]*
Median	*-27.64*	*-6.85*	*0.1438*	*-47.05*	*-24.00*	*0.097[c]*	*-54.73*	*-31.46*	*0.109[b]*

TABLE 5.7
Cross-sectional analyses of the long-term performance

The mean and median values of three-year buy-and-hold abnormal returns (%) for UK unit IPOs, the FTSE All Share (FTA) index, and the matching share-only IPOs are categorised by the year of listing, industry sector, firm size, firm riskiness, the gross proceeds of IPO, the level of underpricing, and the listing location of the firms. The mean and median buy-and-hold returns are compared between both unit IPOs and FTA index, and between unit IPOs and their matching share-only IPOs. Paired *t*-Tests are conducted to examine the significance level of differences in means; whilst the *p*-value from the Mann-Whitney (MW) tests is reported for the significance level of differences in medians.

Panel A: Long-run performance by Year of listing

Cohort Year		UNIT (%)	FTA (%)	*Paired t-test and MW test*	MATCH (%)	*Paired t-test and MW test*
1994 –1995	*Mean*	0.359	34.059	*0.560*	-30.467	*0.518*
	Median	-0.548	0.321	*0.379*	-39.580	*0.876*
1996	*Mean*	6.473	52.972	*0.092*[c]	55.643	*0.430*
	Median	0.000	52.512	*0.076*[c]	-29.729	*0.948*
1997 –1999	*Mean*	37.635	0.884	*0.601*	15.902	*0.786*
	Median	-39.255	-5.129	*0.162*	11.820	*0.521*
2000	*Mean*	-55.473	-35.669	*0.109*[c]	-19.803	*-0.018*[a]
	Median	-86.579	-35.197	*0.073*[c]	-61.767	*0.366*
2001 –2003	*Mean*	31.321	3.021	*0.520*	76.618	*-0.649*
	Median	-36.778	-3.070	*0.393*	-38.372	*0.743*
2004	*Mean*	1.730	46.811	*0.040*[b]	-45.081	*0.013*[a]
	Median	-19.890	43.875	*0.036*[b]	-54.582	*0.023*[b]
2005	*Mean*	-76.183	6.036	*0.000*[a]	-31.024	*0.012*[a]
	Median	-79.650	1.399	*0.000*[a]	-78.871	*0.167*
2006	*Mean*	-67.937	-21.478	*0.003*[a]	13.107	*0.010*[a]
	Median	-80.834	-20.887	*0.000*[a]	3.561	*0.008*[a]

Panel B: Long-run performance by Industry Sector

Industry		UNIT (%)	FTA (%)	*Paired t-test MW p-value*	MATCH (%)	*Paired t-test MW p-value*
Mining	*Mean*	-14.622	18.197	*0.081*[b]	-10.833	*0.884*
	Median	-45.702	30.442	*0.001*[a]	-23.805	*0.294*
IT & Technology	*Mean*	-18.946	7.582	*0.315*	38.316	*0.293*
	Median	-58.243	-2.390	*0.058*[b]	-40.000	*0.505*
Support Services	*Mean*	-46.283	-5.139	*0.004*[a]	47.959	*0.157*
	Median	-57.823	-18.468	*0.023*[b]	-43.834	*0.630*
Healthcare & Bio-Tech	*Mean*	-51.054	-7.060	*0.019*[a]	-21.659	*0.312*
	Median	-66.764	-12.962	*0.021*[b]	-70.152	*0.427*
Others	*Mean*	-20.792	9.319	*0.282*	12.150	*0.436*
	Median	-42.857	13.479	*0.057*[b]	-8.310	*0.293*

(Continued)

Panel C: Long-run performance by Size of the firms						
Firm Size		**UNIT (%)**	**FTA (%)**	*Paired t-test MW p-value*	**MATCH (%)**	*Paired t-test MW p-value*
Small	*Mean*	-3.391	19.710	*0.026[b]*	11.357	*0.658*
	Median	-42.857	26.258	*0.006[a]*	-32.453	*0.972*
Medium	*Mean*	-25.372	2.399	*0.070[c]*	-8.210	*0.466*
	Median	-64.674	-4.787	*0.002[a]*	-19.000	*0.179*
Large	*Mean*	-29.308	0.773	*0.224*	3.270	*0.376*
	Median	-55.850	-3.495	*0.000[a]*	-51.066	*0.291*

Panel D: Long-run performance by Risk ranking of firms						
Risk		**UNIT (%)**	**FTA (%)**	*Paired t-test MW p-value*	**MATCH (%)**	*Paired t-test MW p-value*
Low	*Mean*	0.596	12.234	0.038[b]	0.965	*0.987*
	Median	-23.077	30.388	0.035[b]	-29.729	*0.612*
Medium	*Mean*	-6.534	10.139	0.199	-10.083	*0.617*
	Median	-56.851	22.960	0.003[a]	-13.804	*0.278*
High	*Mean*	-66.398	-6.734	0.000[a]	15.945	*0.022[b]*
	Median	-80.135	-7.999	0.000[a]	-60.027	*0.045[b]*

Panel E: Long-run performance by Gross Proceeds from the offerings						
Proceeds (£000)		**UNIT (%)**	**FTA (%)**	*Paired t-test MW p-value*	**MATCH (%)**	*Paired t-test MW p-value*
100-999.99	*Mean*	-2.963	24.869	*0.225*	23.436	*0.554*
	Median	-28.083	31.630	*0.094[c]*	-43.834	*0.955*
1,000-1,499.99	*Mean*	21.523	2.620	*0.669*	-8.715	*0.178*
	Median	-43.606	-8.715	*0.186*	-46.943	*0.597*
1,500-2,499.99	*Mean*	-39.355	7.207	*0.030[b]*	-50.544	*0.687*
	Median	-63.268	-6.284	*0.012[a]*	-55.766	*0.713*
2,500-4,999.99	*Mean*	-23.111	5.799	*0.066[c]*	42.847	*0.138*
	Median	-52.799	-2.390	*0.007[a]*	-28.315	*0.292*
5,000-9,999.99	*Mean*	-58.190	2.690	*0.000[a]*	3.866	*0.055[a]*
	Median	-67.598	-3.070	*0.000[a]*	-29.729	*0.074[c]*
Above 10,000	*Mean*	-49.136	-3.720	*0.019[a]*	-9.141	*0.099[c]*
	Median	-49.747	-23.885	*0.036[b]*	-7.984	*0.093[c]*

Panel F: Long-run performance by Level of Initial Underpricing						
Initial Returns		**UNIT (%)**	**FTA (%)**	*Paired t-test MW p-value*	**MATCH (%)**	*Paired t-test MW p-value*
Low	*Mean*	4.312	10.262	*0.758*	-11.341	*0.592*
	Median	-7.873	8.769	*0.062[c]*	-46.477	*0.530*
Medium	*Mean*	-36.130	4.500	*0.004[a]*	-0.886	*0.169*
	Median	-57.547	-2.730	*0.000[a]*	-16.106	*0.154*
High	*Mean*	-48.060	7.107	*0.000[a]*	17.242	*0.038[b]*
	Median	-56.816	-2.146	*0.000[a]*	-39.643	*0.097[c]*

Panel G: Long-run performance by Board of Listing						
Listing Board		**UNIT (%)**	**FTA (%)**	*Paired t-test MW p-value*	**MATCH (%)**	*Paired t-test MW p-value*
Main Board	*Mean*	-50.041	12.533	*0.000[a]*	41.892	*0.012[a]*
	Median	-51.273	19.303	*0.002[a]*	38.562	*0.038[b]*
AIM	*Mean*	-15.494	7.113	*0.067[b]*	-2.723	*0.515*
	Median	-54.948	-1.696	*0.000[a]*	-39.007	*0.366*

TABLE 5.8
Regression Analysis of the long-term performance

Regression 1: Long-term BHAR and unit firm characteristics

$$\text{BHAR} = \alpha_0 + \alpha_1 RISK + \alpha_2 MKTCAP + \alpha_3 AGE + \alpha_4 INSIDER + \alpha_5 EBIT/TTLASSET + \alpha_6 LEVERAGE + \alpha_7 SEO + \xi$$

Independent Variables	Coefficient	*Std. error*	*t-statistic*	*p-value*	*VIF*
Constant	-1.2090	*0.7849*	*-1.54*	*0.127*	
RISK	-16.7890	*8.412*	*-2.00[b]*	*0.049*	*1.03*
MKTCAP	-0.0000	*0.000*	*-0.41*	*0.683*	*1.02*
AGE	0.0030	*0.000*	*1.54*	*0.128*	*1.06*
INSIDER	-0.2880	*0.7279*	*-0.40*	*0.694*	*1.01*
EBIT/TTLASSET	0.1636	*0.0638*	*2.56[a]*	*0.012*	*1.04*
LEVERAGE	-0.2759	*0.1201*	*-2.30[b]*	*0.024*	*1.00*
SEO	-0.4240	*0.3327*	*-1.27*	*0.206*	*1.06*

R^2=48.7% ***F-statistic=3.62[a]*** ***Durbin-Watson statistic=2.15***

Regression 2: Long-term BHAR and IPO characteristics

$$BHAR = \beta_0 + \beta_1 IR_D 2 + \beta_2 GROSSPROCEED + \beta_3 AIM + \beta_4 REPUTATION + \xi$$

Independent Variables	Coefficient	*Std. error*	*t-statistic*	*p-value*	*VIF*
Constant	-1.2065	*0.5848*	*-2.06*	*0.042*	
IR_D2	-0.1758	*0.1106*	*-2.58[a]*	*0.016*	*1.00*
NETPROCEEDS	-0.7856	*0.0000*	*-2.41[a]*	*0.068*	*1.03*
AIM	1.2276	*0.5854*	*2.17[b]*	*0.039*	*1.02*
REPUTATION	2.8005	*0.7459*	*3.54[a]*	*0.001*	*1.00*

R^2=43.6% ***F-statistic=3.41[a]*** ***Durbin-Watson statistic=2.15***

Regression 3: Long-term BHAR and Warrant characteristics

$$\text{BHAR} = \theta_0 + \theta_1 \text{VALUE} + \theta_2 NUMBER + \theta_3 LIFE + \theta_4 EXERCISE + \theta_5 PRATIO + \xi$$

Independent Variables	Coefficient	*Std. error*	*t-statistic*	*p-value*	*VIF*
Constant	-0.0307	*0.4144*	*-2.07*	*0.094*	
VALUE	1.6660	*0.1022*	*2.63[a]*	*0.012*	*1.02*
NUMBER	0.0003	*0.0001*	*4.50[a]*	*0.000*	*1.01*
LIFE	0.0243	*0.0728*	*0.33*	*0.739*	*1.02*
EXERCISE	0.2122	*0.4706*	*0.45*	*0.653*	*1.08*
PRATIO	0.1124	*0.0874*	*2.28[b]*	*0.020*	*1.01*

R^2=42.8% ***F-statistic=4.28[a]*** ***Durbin-Watson statistic=2.12***

TABLE 5.9
Hypotheses and Test results

The hypotheses proposed in Section 5.3 and the test results summarised from Section 5.5 are presented in the table

Hypothesis	Results
$H_{5.1}$: Unit IPOs underperform the FTA Index in the 3-year period post-listing	Not rejected
$H_{5.2}$: Unit IPOs underperform the FTSE Small Cap Index in the 3-year period post-listing	Not rejected
$H_{5.3}$: Unit IPOs underperform the HGSC Index in the 3-year period post-listing	Not rejected
$H_{5.4}$: Unit IPOs underperform the FTSE AIM All Share Index in the 3-year period post-listing	Not rejected
$H_{5.5}$: Unit IPOs underperform share-only firms matched on firm size, year of listing, and industry in the 3-year period post-listing	Not rejected
$H_{5.6}$: Unit IPOs with higher initial returns exhibit worse long-term performance	Not rejected
$H_{5.7}$: The long-term performance of unit firms is positively related to the size of the unit IPOs	Rejected
$H_{5.8}$: Unit firms' long-term performance is positively related to the firm size	Rejected
$H_{5.9}$: Unit IPOs that are issued during years of higher market levels exhibit worse long-term performance	Not rejected
$H_{5.10}$: Unit firms from high risk industries exhibit worse underperformance in the long-term	Not rejected
$H_{5.11}$: The long-term returns of unit firms are positively related to the ratio of EBIT to total assets	Not rejected
$H_{5.12}$: Unit IPOs issued by more reputable underwriters exhibit better long-term performance	Not rejected
$H_{5.13}$: The long-term performance of unit IPOs is positively related to the maturity of warrants	Rejected
$H_{5.14}$: The long-term performance of unit IPOs is positively related to the ratio of warrant exercise price to IPO offer price	Not rejected
$H_{5.15}$: The long-term performance of unit IPOs is positively related to the numbers of warrants attached in the IPOs	Not rejected
$H_{5.16}$: The long-term performance of unit firms is positively related to firm value sold as warrants	Not rejected
$H_{5.17}$: Unit firms whose warrants have been exercised outperform unit firms whose warrants are expired	Rejected

FIGURE 5.1

Equally-weighted monthly abnormal returns (ARs) of the unit IPOs. Five AR series are plotted for the 36 months after the initial offering: (1) no adjustment (raw returns), (2) FTSE ALL Share Index adjustments (FTA), (3) FTSE Small Cap Index adjustments (SMALL CAP), (4) FTSE AIM All Share Index adjustments (AIM), and (5) Hoare Govett Smaller Companies Index adjustments (HGSC).

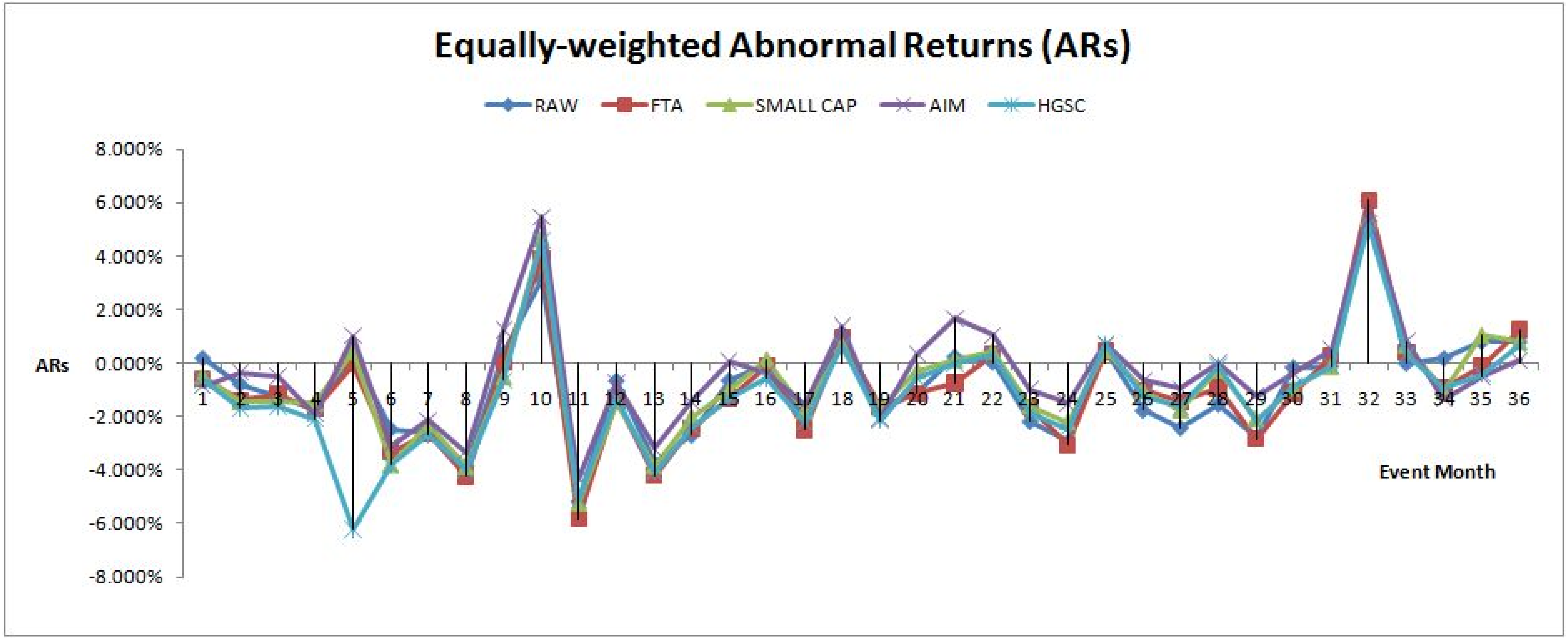


FIGURE 5.2

Equally-weighted cumulative abnormal returns (CARs) of the unit IPOs. Five CAR series are plotted for the 36 months after the initial offering: (1) no adjustment (raw returns), (2) FTSE ALL Share Index adjustments (FTA), (3) FTSE Small Cap Index adjustments (SMALL CAP), (4) FTSE AIM All Share Index adjustments (AIM), and (5) Hoare Govett Smaller Companies Index adjustments (HGSC).

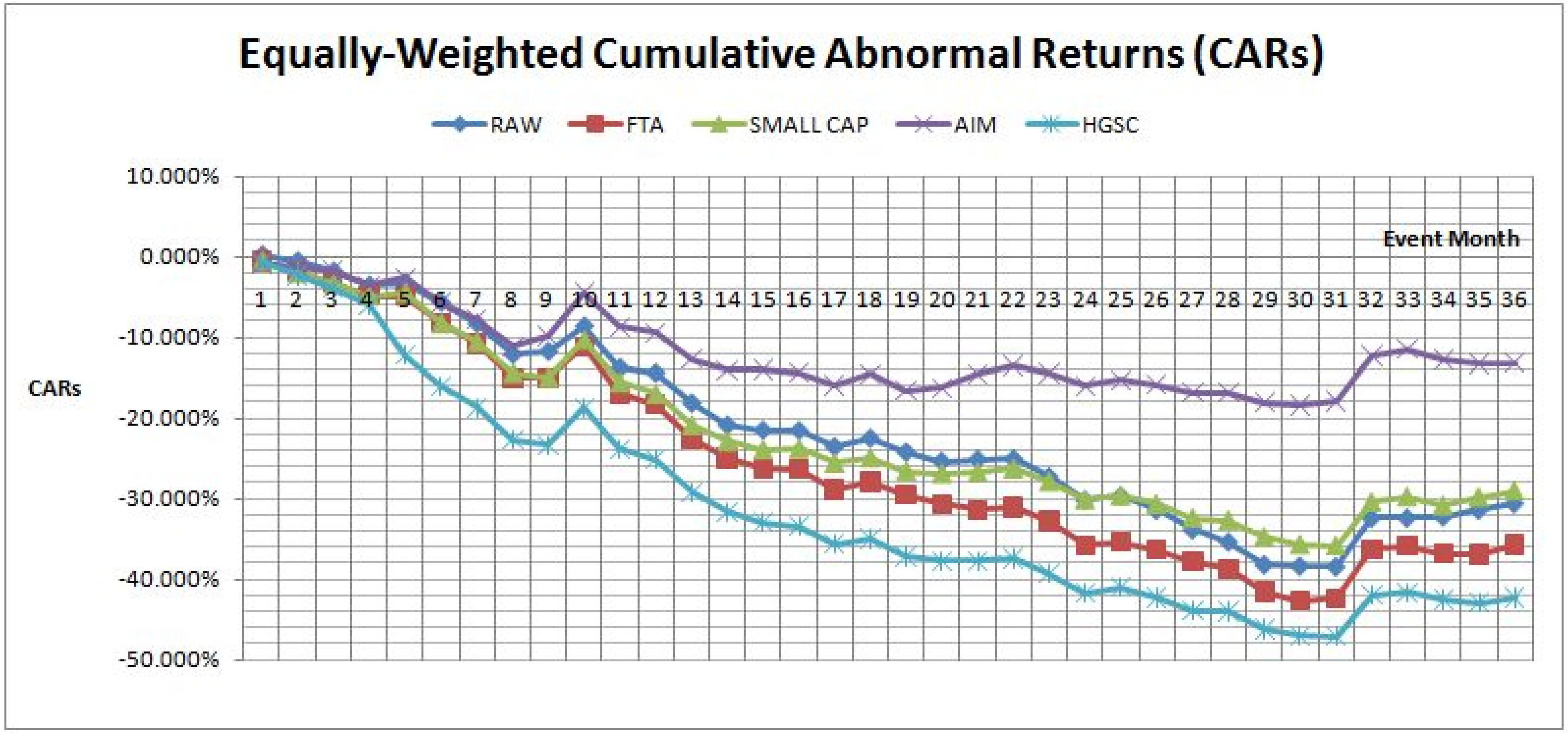
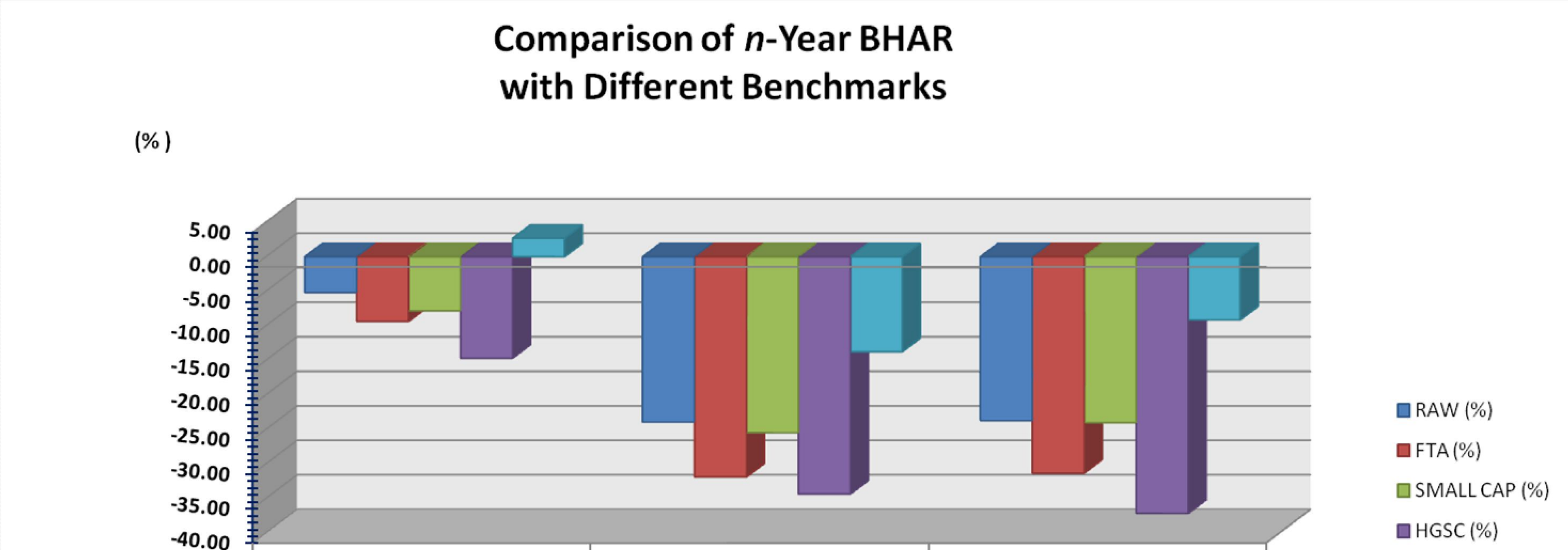


FIGURE 5.3

Equally-weighted *n*-year BHARs with *n*=1, 2, and 3. Five series of BHARs are calculated: (1) No adjustment (raw returns), (2) FTSE ALL Share Index adjustments (FTA), (3) FTSE Small Cap Index adjustments (SMALL CAP), (4) FTSE AIM All Share Index adjustments (AIM), and (5) Hoare Govett Smaller Companies Index adjustments (HGSC).



	1 Year	2 Years	3 Years
RAW (%)	-5.181	-23.927	-23.733
FTA (%)	-9.36	-31.888	-31.329
SMALL CAP (%)	-7.816	-25.472	-24.027
HGSC (%)	-14.684	-34.353	-37.162
AIM (%)	2.672	-13.757	-9.141

CHAPTER 6
CONCLUSIONS

6.1 Main findings

This thesis investigates a sample of unit IPOs issued in the UK between 1994 and 2006 in test of the Agency Cost versus the Signalling hypotheses in explanation of why firms choose to include warrants in their IPOs. My results support both the Agency Cost and the Signalling hypotheses' prediction that unit firms are smaller and riskier than share-only firms. In unique support to the Agency Cost hypothesis, evidence is found that the unit IPOs that are underwritten by less reputable underwriters raise smaller proceeds than that of share-only IPOs. However, contrary to the Agency Cost hypothesis, unit firms are not necessarily younger than share-only firms in the UK and the proportion of insider holding is not significantly different from the unit and share-only samples.

The initial underpricing relative to the IPO offer price in unit IPOs is found to be significantly higher than that of share-only IPOs, on both the first trading day and during the first trading week, which provides strong support to the Agency Cost hypothesis. The short-term after-market performance calculated as BHARn relative to the first trading day, indicate that unit firms significantly outperform share-only firms for up to 21 days in the after market.

In direct test of the Agency Cost hypothesis, the levels of agency costs are measured by the 'efficiency ratios', which are found to be significantly lower than unit firms. The lower the efficiency ratio, the lower the profitability and asset utilisation, and in turn the agency costs are indicated to be higher for unit firms compared to share-only firms. Such results strengthen the short-term evidence obtained in support of the Agency Cost hypothesis. On the other hand, in direct test of the Signalling hypothesis, both the firm riskiness and the delay between announcement of unit IPOs and the first trading day are calculated to proxy for the level of information asymmetry. These measurements suggest that unit firms possess higher levels of information asymmetry than that of share-only firms, which is consistent with the Signalling hypothesis. Both linear and logistic regressions are conducted in examination of the determinants of underpricing and the choice of offer types. Strong support to the Agency Cost hypothesis is obtained from the regression results. The UNIT dummy remains positive and highly significant, implying that the choice to include warrants significantly increases the degree of underpricing on the first trading day.

The survival study of unit firms reports strong evidence that fewer unit firms have survived than share-only firms. Besides the offer type, other characteristics can affect the survival of unit firms as well. Evidence is found that in the first year post-listing, higher insider ownership and the initial returns on the first trading day increase the chance of firms' survival. In the third year post-listing, IPOs issued by more reputable underwriters and with higher insider ownership are more likely to survive. In the fifth year following the IPOs, only underwriter reputation and the offer type remain significant in affecting firms' long-term survival.

I also examine the likelihood of SEO issuance, a much higher 82.09% of survived unit firms are found to have issued seasoned equity offerings comparing to only 50.22% for survived share-only firms. Such percentage results are in line with the Agency Cost hypothesis that despite the lower survival rate, survived unit firms are more likely to receive additional funding through seasoned equity offerings. In addition to the offer type, the size of the IPO issue also has an impact on a firms' decision to issue seasoned equity offerings. Firms that raise less funding in the initial public offerings are more likely to issue a second seasoned offering after their IPOs. An apparent price run-up before the SEO announcements and significant decline in share prices after the announcement are observed for unit firms, which issued additional shares. Seasoned equity offerings are announced when the firm's stock is overvalued and investors revise the firm value downwards due to 'adverse selection'. However, the significant negative relationship found between SEO dummy and initial underpricing implies that more underpriced unit IPOs are less likely to issue additional shares. Such result contradicts the Signalling hypothesis that unit firms use costly signals at the time of listing in the hope that they can recover the signalling cost by issuing seasoned issues after the market verified their quality. Overall, the survival and subsequent financing study for unit firms in the UK provide strong support to the Agency Cost hypothesis but fail to support the Signalling hypothesis for choosing unit IPOs instead of share-only IPOs.

CHAPTER 5 examines the long-term performance of unit IPO firms in comparison of the market indices and the share-only IPO firms matched on firm size and industry. The Agency Cost hypothesis stipulates that small and growing businesses tend to go public via unit IPOs because the attached warrants can form a staged financing strategy to help unit firms reduce agency costs. The Signalling hypothesis interprets the inclusion of warrants in IPOs as one of the costly signals that are strategically adopted for high risk, good quality firms to convey favourable information about firm value and distinguish themselves from bad quality competitors. In the long-term, both hypotheses predict that unit firms are expected to outperform share-only firms, which go public without any warrants attached in the IPOs. However, this thesis provides evidence that unit IPOs issued in the UK present significantly worse underperformance comparing to both the matching share-only IPOs and various market indices, regardless of the methods adopted to calculate abnormal returns (BHARs, CARs, and WRs; equally-weighted and value-weighted). Cross-sectional analyses confirm that unit IPOs issued during years of high market levels, unit IPOs with high initial returns with larger proceeds, and unit firms from high-risk industries exhibit significantly worse long-term underperformance against both the market index and the matching share-only IPOs. Such results are unable to support either the Agency Cost hypothesis or the Signalling hypothesis' prediction that unit firms should be better performers in the long-term.

6.2 Empirical implications of this thesis in the wider context of finance literature

Existing theories for the use of unit IPOs instead of share-only IPOs imply that warrants are valuable to investors or underwriters but are costly to the issuing firm. However, in this thesis, the unique investigation on warrant characteristics in relationship to unit IPOs suggests that certain features of the warrant agreements are not decided randomly. On the contrary, the maturity of warrants, and the choice of warrant exercise price have strategic value to the issuing firm, not just to investors. Exercised or not, warrants attached in unit IPOs represent a conditional option to obtain additional equity financing relatively quickly and cost effectively. The research into the inclusion of warrants in unit IPOs is therefore important especially now that the finance profession has developed an increased interest in the types and characteristics of securities issued by firms. My examination of warrant issues, especially in combination to IPOs in the context of different institutional setting in the UK provide further evidence to the understanding of such corporate financial decisions.

6.2.1 The bonding effect of warrants

Paul Schultz (1993) provides evidence that by issuing units, firms pre-commit to a seasoned offering at the warrant exercise price, which is set in advance. In my UK sample, 54.35% of the unit warrants are issued with their exercise price set equal to the placing price; 33.7% of the warrants are issued out-of-money with their exercise price set above the placing price; only 11.96% of the warrant are issued in-the-money. Evidence was also found that unit firms, which set the warrant exercise price above the IPO offer price are less likely to rely on SEOs for further funding post-listing. Unit IPO issuers obviously did not choose the warrant exercise price randomly. Instead, they intentionally set the warrant exercise price either above or equal to the IPO offer price. The different choices of warrant exercise price reflect different strategies for including warrants. By including out-of-money warrants in unit IPOs, issuers can effectively create incentives for manager to increase the company's share price in order to materialise warrant financing. By issuing warrant at the IPO offer price, unit firms can signal firm value to public investors and bridge the asymmetry information gap. In either case, warrants inclusion is a theoretically positive spell over the unit IPOs.

However, this thesis also find evidence that unit firms are more likely to fail than share-only firms; and survived unit firms are more likely to receive further funding through seasoned equity issues. Unit IPO firms also exhibit significantly worse long-term returns comparing to share-only IPO firms three years post listing. In my UK sample, almost 59% of the unit warrants were left exercised until expiration, only 16% were actually exercised to materialise second round of financing. If the decision to include warrants in unit IPOs can serve to either reduce agency costs or signal firm value or both, why have they not improve unit firms' survival and long-term performance? Schultz (1993b) explains that managers of small business are motivated to take on any (even negative NPV) projects to maintain their jobs, and will do so if given enough free cash flow up front. Unit IPOs in the UK generally raise less proceeds comparing to share-only IPOs. Incorporating warrants in an IPO effectively forms a second round of financing, but the funding can only be materialised when the share prices exceed the warrant exercise price, otherwise the warrants will be left to expire. The bonding effect of warrants will prevent management from wasting the proceeds from the IPO on non-profitable projects. In reality, however, many unit firms will find that there are no positive-NPV projects to ascertain their company's value, resulting in unit warrants left unexercised and expired and the potential second round of funding falls through. By including warrants in unit IPOs, the issuing firm may reduce agency costs by staging the funding but not necessarily be able to improve their chance of survival. The eventual outcome of warrant contracts not only rely on the quality of management, but also depend on the market conditions. The abnormally high degree of underpricing for unit IPOs may attract more aftermarket trading, however, if there are no value-generating projects available for unit firms to invest in, only by efficient management will not be able to materialise the warrant financing. Even with reduced agency problem a unit firm can still go out of business if lack the funding to support their operation.

6.2.2 Manager's strategic intention versus investors' free will

Evidence is found that there is an apparent price run-up before the announcement of the seasoned issues, and that seasoned equity offerings are announced when the firm's stock is overvalued. However, probit regression results project a negative relation between the level of initial underpricing and the likelihood of SEO issuance. As previously reported, unit IPOs are more underpriced than share-only IPO firms at the time of the initial public offering. According to the Signalling hypothesis, the managerial insiders intentionally underprice the initial sale of shares in hope that they can recoup the cost of underpricing through seasoned offerings at a more favourable price. On the contrary, the results suggest that unit IPO firms that achieved high initial returns (highly underpriced) are less likely to conduct a seasoned offer within three years of the initial offering. Therefore, the UK evidence from subsequent financing of unit firms does not support the Signalling hypothesis' prediction. Underpricing exhibited in unit IPOs is not intentionally planned by the management in order to issue seasoned shares in the future at higher price.

On a different note, the level of the price increase before SEO announcements are positively affected by unit firms' insider ownership and debt leverage in the unit firms. Such a positive correlation implies that the higher leverage unit firms possess at time of the initial public offering can significantly influence new investors' expectations in prediction of the announcement of a seasoned issue, and cause higher levels of price increase before the announcement day. Investors also assume that managerial insiders have more information about the expected future cash flows of their companies. Since it is costly for managers to hold a substantial fraction of their own company's shares, managers are motivated to hold large stock positions only if they expect higher future cash flows than the firm's current value. Therefore, rational investors will view managerial holdings as a credible signal of firm quality. A high level of insider holding even at time of the IPO can positively influence the investors' predictions of any seasoned issues in the near future. Overall, the overpriced SEOs are more likely to be a result of investors' reactions towards the information they obtained on firm value, rather than a strategic plan on behalf of the management.

6.2.3 Good intention does not proxy for good performance

Evidence is found in CHAPTER 5 that unit IPOs in the UK significantly underperform both, the market indices and share-only firms matched by size and industry; which contradicts both the Agency Cost and the Signalling hypotheses. Such a result implies that unit firms, being smaller and riskier businesses before they are publicly listed, cannot significantly improve performance by simply attaching warrants, regardless as whether they are used to reduce agency costs or to signal firm value. After all, good intention does not proxy for better performance in the long-term. A much higher percentage of unit IPOs are delisted within three post-listing comparing to share-only IPOs. The finance literature largely focuses on the costs and benefits of public versus private ownership with too little analysis on how these costs and benefits evolve over time. Whether some firms will be better off staying private, whether some firms went public prematurely, what is the optimal timing for public market entry and the possibility and consequences of entry requires further investigation. Going public decisions and IPO failure rates may also be related to conditions in other segments of the capital markets. Favourable credit market conditions may provide either substitute or additional sources of investment capital and in turn affect the survival of IPOs issued during the same periods.

However, the choice to include warrants in IPOs is not in vain. This thesis provides evidence that in the UK, the underperformance of unit firms is negatively related to the degree of initial underpricing and the size of unit issues; while being positively related to the reputation of underwriters employed to market for the issues. In fact, the cross-sectional analyses suggest that unit firms that raise smaller proceeds at lower discount (less underpriced) do not significantly underperform their share-only counterparts or the market as a whole. More importantly, several warrant characteristics are found to influence the long-term performance of unit firms positively. The number of warrants, the firm value sold as warrant proceeds, and the ratio of warrant exercise price to offer price, are all positively and significantly related to the long-term abnormal returns of unit firms.

6.2.4 Underwriters matter

For firms needing outside equity, going public is often the ultimate step in this process. There is considerable debate in the financial economics literature regarding the initial underpricing followed by long-term underperformance for IPOs. Previous studies explain the pricing anomalies with investors' overoptimistic expectation about the earning potential of young growth companies (Ritter, 1991; Loughran and Ritter, 1995) and inefficient earnings management by issuers (Teoh, Welch, and Wong, 1998, etc.). Both lines of research provide some evidence in support of their arguments, however, still fail to explain the pricing puzzle in the IPO process completely. The US evidence indicates that underpricing has become more extreme over time and particularly so during the recent bubble period of 1998-2000. Average first-day IPO returns in the US increased from 7.4% in the 1980s, to 11.2% in the early 1990s, to 18.1% in the mid-1990s and to 65% in the bubble years (Ritter and Welch, 2002). Recent behavioural finance researchers focus on the role of the major players in the IPO process, in particular, reputable underwriters, institutional investors, and venture capitalists. Loughran and Ritter (2004) propose the 'corruption hypothesis' as a rationale for underpricing, which implies a conflict of interest between the issuer and the underwriters (or/and venture capitalists). They found that underwriters creased their traditional certification function and took advantage of exuberant investor sentiment during the bubble years of the late 1990s.

The segmented study of unit IPOs in this thesis add evidence of abnormal underpricing on the first trading day and worse long-term performance from UK and contributes to the existing literature with the examination of unit IPO performance in association with underwriter reputation. The study found that unit IPOs in the UK are issued by less reputable underwriters comparing to share-only IPOs. These unit IPOs tend to be more underpriced initially but will have less chance of surviving the three-year period post-listing. Even the survived unit firms significantly underperform their matching share-only counterparts and the market index in the long-term. Such results suggest inefficiency in the methods used by poor quality underwriters to price IPOs, which shed some light on the institutional characteristics of the going public process as alternative explanation for the IPO puzzle. Multiples valuation methods based on comparable companies are the principal approach adopted to determine IPO offer prices in practice (Kim and Ritter, 1999). However, such method may introduce a survivorship bias into the pricing of new issues and resulting in overestimated survival probabilities of some firms that are masked by the artificial initial underpricing on the first trading day. This valuation inefficiency is especially likely when financial intermediaries are pricing younger riskier firms because comparison firms are difficult to be correctly identified.

Owing to the unsatisfied demand for external financing, policy makers have been taking steps to increase the offer of capital available to young firms. Regulators in the UK also made effort to ease the listing requirements for small capitalisation firms and launched the Alternative Investment Market with less strict listing requirements on the firm size and issue size alike. Within such an encouraging market environment, small business might be overoptimistic about the timing and consequences of entering the public market and less careful in choosing underwriters to bring them public. Low quality screening, pricing and certification functions by underwriters may account for the long-term underperformance and eventually failure of the underlying firms. In the financial crisis of 2008, the stock prices of the clients of Lehman Brothers, Merril Lynch, and Bear Stearns suffered tremendous decline thanks to their troubled underwriters, which provides a live example for the importance of underwriters and at the same time, the vulnerability of the market makers. Therefore, the management of issuing firms should be more cautious when chooses agents to underwriter their new issues. Not only should the IPO firms assess the investment banks' pricing and marketing skills, they should closely evaluate the underwriter's financial health.

6.3 Potential limitations of the thesis and further research

Significant effort has been made in this thesis to investigate a sample of 92 unit IPOs and 258 share-only IPOs issued in the UK between 1994 and 2006. However, I am aware that within the limited time scale, there are several potential limitations and further improvement is proposed for future research interest. Firstly, the sample size of unit IPOs is limited due to the availability of data and implicitly the population of unit IPOs issued during the sample period. At the beginning of this research, after excluding unit IPOs from investment funds and real estate companies only 92 unit firms are finalised in the sample. The limited sample size might have biased the significance level of certain results. Since unit IPOs have become increasingly popular in more recent sample years, I am convinced that a more recent sample incorporating unit IPOs issued between 2007 and 2010 will potentially provide new insight in test of the competing Agency Cost and Signalling hypotheses. Secondly, warrant characteristics discussed in this thesis are collected from the IPO prospectuses. Features such as numbers of warrants included in unit IPOs, the firm value sold as warrants, maturity, and exercise price of warrants are proven to have significant impact on unit firms' performance in both short-term and long-term studies. However, Due to the availability of data on the detailed warrant contracts and information on further amendment after the unit IPOs, this thesis does not discuss the extension of warrant terms and any reduction or step-up arrangement of warrant exercise price after their issuance. Some warrants attached to unit IPOs in my UK sample did contain a provision in the warrant agreement that the issuing firm reserve the right to change the exercise price of the warrants if certain criteria met. Howe and Su (2000) provide evidence that firms lower the exercise price of equity warrants after their issuance are largely young, small firms with poor operating performance at the time of amendment. On the other hand, Garner and Marshall (2004) find that unit firms with higher levels of insider ownership are less likely to lower the exercise price of the warrants after the issuance. They interpret this with the managerial insiders' reluctance to dilute its ownership since the issuing firm faces the potential dilutive effects to its share price should the warrants be exercised. According to Garner and Marshall (2004 and 2005), warrant amendments including life extension, reduction or step-up arrangement of exercise price are rather frequent corporate decisions. By any stretch, there is certainly space for further investigation into any change of warrant contractual features post-IPO in the UK. More detailed data on such warrant characteristics might reveal further evidence as to why companies choose to include warrants in their IPOs and may attract future research interests. In addition, the calculation of survival rate in this thesis simply accounts for firms that are still listed on the London Stock Exchange, the voluntary delisting of IPOs due to either mergers or acquisition are not incorporated into the results. Conditions in the market for mergers and acquisitions may be an important determinant of the long-term survival of IPOs. Higher volume conditions in the merger and acquisition market might be associated with higher unit IPO delisting. Therefore, future research of unit IPO survival is encouraged to take into consideration of any voluntary delisting from the exchange. More sophisticated methods, such as the Kaplan-Meier method, should also be applied to account for data censoring issues in calculation of survival rate. Last but not least, the calendar-time approach for long-term performance is not applied in this thesis due to the limited sample size. I am confident that providing a larger sample of unit IPOs in future research, the calendar-time approach will present better statistical inference on the robustness of tests results.

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APPENDIX I

Robustness Check for TABLE 3.9 using first-week initial return (IR_W1)
Determinants of underpricing and offer types

Panel A illustrates results from the Ordinary Least Square regression (EQUATION 3.7) on the determinants of underpricing examining 258share-only IPOs and 92 unit IPOs issued during the period of 1994-2006.The dependent variable is the HGSC-adjusted first-week initial return IR_W1 relative to the offer price (IR_W1), which is used as the alternative measure of underpricing for robustness check purpose. Due to limited sample size of the unit IPO sample, Panel B exhibits results from the Two-staged Least Square Regressions as robustness check for omitted variable problem (EQUATION 3.8-3.9). The offer type dummy UNIT is selected as the instrumented variable in the first-stage regression. The instruments include: insider holding (INSIDER), firm riskiness (RISK), time lag between Prospectus publication and listing (DELAY), MINING industry dummy, POST2000 listing year dummy, firm AGE, total asset (TTLASSET), total debt (TTLDEBT), and net income (NI) of issuing firms *prior to* the IPOs, all of which are potential factors that might affect a firm's decision to choose unit IPOs instead of share-only IPOs. The instrumented offer-type dummy (Noted as Inst.UNIT) and other motivated factors are then included in the second stage regressions to test for any relationship between the degree of underpricing and the offer type of the IPOs. Numbers in parentheses are the *p*-values of coefficients to indicate significance level. Regression 1 includes ALL variables in discussion, whereas Regression 2 and 3 respectively include variables on the 'profitability' and 'leverage' of the underlying IPO firms prior to listing. Regression 4 highlights the characteristics of the offering at the time of the IPO. Regression 5 summarise variables, which remain significant in all the previous regressions. Definitions of variables refer to TABLE3.1. [a], [b], and [c]: Significantly different from zero at 1%, 5%, and 10% level respectively

Panel A: OLS regressions on determinants of underpricing and offer type (N=350)

$$IR_W1_i = \alpha_0 + \alpha_1 UNIT_i + \alpha_2 (ASSET/PROCEED)_i + \alpha_3 (REV/PROCEED)_i + \alpha_4 (DEBT/PROCEED)_i$$
$$+ \alpha_5 MKT2BK_i + \alpha_6 Ln(PROCEED)_i + \alpha_7 REPUTATION_i + \xi_i$$

N=350	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Intercept	0.5686	0.0976	0.1026	0.5793	0.1025
	(0.075)[c]	(0.002)[a]	(0.001)[a]	(0.069)[c]	(0.005)[a]
UNIT	0.3317	0.3571	0.3679	0.3457	0.3418
	(0.000)[a]	(0.000)[a]	(0.000)[a]	(0.000)[a]	(0.000)[a]
ASSET/PROCEED	-0.0194		-0.0081		-0.0177
	(0.043)[b]		(0.030)[b]		(0.063)[c]
REV/PROCEED	-0.0093	-0.0064			-0.0091
	(0.038)[b]	(0.046)[b]			(0.043)[b]
DEBT/PROCEED	-0.0191		-0.0195		
	(0.409)		(0.424)		
MKT2BK	-0.0002	-0.0002	-0.0002	-0.0003	
	(0.289)	(0.274)	(0.234)	(0.219)	
Ln(PROCEED)	-0.0294			-0.0292	-0.0286
	(0.107)[c]			(0.105)[c]	(0.096)[c]
REPUTATION	-0.0081			-0.0134	-0.0237
	(0.089)[c]			(0.083)[c]	(0.077)[c]
Adjusted R^2	11.42%	10.69%	10.57%	10.74%	12.32%
F-statistic	7.43	14.93	11.32	10.38	9.66
	(0.000)[a]	(0.000)[a]	(0.000)[a]	(0.000)[a]	(0.000)[a]

(Continued)

Panel B: 2SLS regressions on determinants of underpricing and offer type

Stage One:

$$\mathrm{UNIT_i} = \alpha_0 + \alpha_1 INSIDER_i + \alpha_2 RISK_i + \alpha_3 DELAY_i + \alpha_4 \mathrm{Ln}(Age)_i + \alpha_5 TTLASSET_i + \alpha_6 TTLDEBT_i + \alpha_7 NI_i + \alpha_8 \mathrm{MINING_i} + \alpha_9 \mathrm{POST2000}_i + \xi_i$$

Stage Two:

$$IR_W 1_i = \beta_0 + \beta_1 Inst.UNIT_i + \beta_2 (ASSET/PROCEED)_i + \beta_3 (REV/PROCEED)_i + \beta_4 (DEBT/PROCEED)_i + \beta_5 MKT2BK_i + \beta_6 Ln(PROCEED)_i + \beta_7 REPUTATION_i + \xi_i$$

N=350	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Intercept	-0.2951 (0.446)	-0.0228 (0.596)	-0.0137 (0.084)[c]	-0.3316 (0.419)	-0.0542 (0.316)
Inst.UNIT	0.9218 (0.000)[a]	0.9020 (0.000)[a]	0.8992 (0.000)[a]	0.9388 (0.000)[a]	0.9463 (0.000)[a]
ASSET/PROCEED	-0.0213 (0.043)[b]		-0.0137 (0.122)		-0.0222 (0.037)[b]
REV/PROCEED	-0.0062 (0.214)	-0.0029 (0.368)			
DEBT/PROCEED	-0.0215 (0.145)		-0.0206 (0.152)		
MKT2BK	-0.0006 (0.019)[b]	-0.0006 (0.018)[b]	-0.0006 (0.015)[b]	-0.0006 (0.015)[b]	-0.0006 (0.016)[b]
Ln(PROCEED)	-0.0161 (0.106)[c]			-0.0185 (0.108)[c]	-0.0166 (0.092)[c]
REPUTATION	-0.0971 (0.094)[c]			-0.0903 (0.104)[c]	0.1156 (0.106)[c]
Adjusted R^2	*10.16%*	*9.12%*	*10.12%*	*9.36%*	*11.16%*
F-statistic	*7.16* *(0.000)[a]*	*5.68* *(0.000)[a]*	*7.09* *(0.000)[a]*	*5.98* *(0.000)[a]*	*9.15* *(0.000)[a]*

APPENDIX II

Robustness Check for TABLE 3.12 using first-week initial return (IR_W1)
Unit offering underpricing and warrant characteristics

Linear Square Regressions are estimated for a sample 88 unit IPOs after excluding 4 outliers identified by Cook's Distance[44]. Alternative underpricing measure (**IR_W1**), defined as the HGSC-adjusted first-week initial return relative to IPO offer price, is adopted as the dependent variable in each regression as robustness check. Regression 1 include ALL the motivated variables. Regression 2 hightlight warrant characteristic variables. Regression 3 focus on all the dummy variables and Regression 4 confirms all the significant variables from previous regressions. The *p*-values of coefficients are reported in parentheses to demonstrate level of significance. INSIDER is the percentage managerial holding in the issuing firm. RISK of firm is calculated as the residual standard deviations of the share prices 200 days post-listing. EXPENSE is the total cost of IPOs as percentage of expected gross proceeds. LEVERAGE is the ratio of total debt to total asset one year prior to the IPO. PRATIO is the ratio of warrant exercise price to the offer price, PRATIO>1 indicates warrants are issued out-of-money, whereas PRATIO<1 imply that warrants are issued in-the-money. VALUE is the firm value sold as warrants, calculated as the potential warrant proceeds at exercise price as percentage of unit firms' market capitalisation at offer price immediately post-listing. LIFE is computed as the number of years from the issuance of warrants until expiration. CALLABLE takes the value of 1 if the warrants attached in the unit IPO are callable before expiration, 0 if the warrants are still outstanding or lapsed. REPUTATION is set to the value of 1 if unit IPOs are marketed by reputable underwriters, 0 if otherwise. AIM is equal to 1 if unit firms are listed on the Alternative Investment Market (AIM), 0 if otherwise. MINING is set to be 1 if the unit firm is from the mining industry, 0 if otherwise. POST2000 takes the value of 1 if the unit IPO is issued during the sample period 2000-2006, 0 if during the sample period 1996-1999.

N=88 (After excluding 4 outliers)	**Regression 1**	**Regression 2**	**Regression 3**	**Regression 4**
Intercept	0.0861	0.2226	1.0480	0.0625
	(0.089)c	(0.029)[b]	(0.000)[a]	(0.184)
INSIDER	0.7254			0.7084
	(0.054)[b]			(0.055)[b]
RISK	1.1923			1.6052
	(0.059)[c]			(0.039)[b]
LEVERAGE	-0.2013			-0.2201
	(0.171)			(0.126)
PRATIO	0.1700	0.1872		0.1687
	(0.003)[a]	(0.002)[a]		(0.002)[a]
VALUE	-0.3828	-0.4340		
	(0.342)	(0.290)		
LIFE	-0.0100	-0.0050		
	(0.757)	(0.880)		
CALLABLE	0.3992	0.3866	0.3218	0.3509
	(0.017)[b]	(0.029)[b]	(0.064)[c]	(0.026)[b]
REPUTATION	-0.5812		-0.5600	-0.5013
	(0.004)[a]		(0.005)[a]	(0.008)[a]
AIM	-0.3680		-0.4103	-0.4100
	(0.076)[c]		(0.053)[b]	(0.023)[b]
MINING	0.1180		0.1920	
	(0.468)		(0.241)	
POST2000	0.0624		0.2165	
	(0.714)		(0.215)	
F-statistic	*4.75*	*3.56*	*3.76*	*5.74*
	(0.000)[a]	*(0.005)[a]*	*(0.004)[a]*	*(0.000)[a]*
Adjusted R^2	*34.32%*	*13.72%*	*18.12%*	*32.62%*

[a]: Significantly different from zero at 1% level (two-tailed test).
[b]: Significantly different from zero at 5% level (two-tailed test).
[c]: Significantly different from zero at 10% level (two-tailed test).

[44] The same procedure to deal with outliers with Cook's Distance is employed as in TABLE 3.12.