Going Public: Why?... and When?

Evidence from the UK

By

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To

My parents

My husband Edward Yip

Abstract

This thesis empirically investigates the motive for and the timing of initial public offerings (IPOs) in the UK. Due to an apparent lack of research, the two questions as to why firms choose to go public and how they time their IPO are left under-addressed in the existing IPO literature. Answers to these questions are critical to understand IPO activities and the extent to which firms can make efficient use of the stock market

The empirical studies in this thesis were based on a large and unique sample of 183 UK IPOs that floated on the London Stock Exchange during 1998-2003 and a control group of 2135 UK firms that remained private during 1996-2007. All firms considered in the sample were non-financial firms Both cross-sectional and panel data techniques were employed to thoroughly examine the data from various angles

First, a conventional panel probit approach was applied to examine the determinants of the probability of going public, and a panel fixed effects model was used to evaluate the effects of IPO decision on financial performance of firms It was revealed that the likelihood of an IPO increases in capital investment and ownership dispersion whereas decreases in internal cash generation and sales IPO activity increases in a bull market. Independent firms appear to go public to raise capital to fund investment whereas IPOs of subsidiaries seem to be driven by corporate re-structuring and divestment. After IPO, IPO firms continue to increase their sales and firm value is significantly improved

Following this, a recent cross-sectional approach was adopted to analyse the determinants of IPO structure. The determinants of the type and the size of share were examined respectively in a multinomial logit model, and OLS and 2SLS models. The results showed that more established firms with high market valuation are more likely to include secondary shares. Divesting via an IPO is more likely to happen at a higher market return. More highly levered firms with more concentrated managerial shareholdings offer larger size of primary shares whereas firms in a better financial position sell larger size of secondary shares. It appears that the UK stock market enables access to financing for both young and growth firms that are constrained by weak internal cash generation and mature firms that are constrained by debt burden.

The determinants of the size of share and the probability of going public were then

estimated in a simultaneous equations system – a bivariate sample selection model. This new approach developed in this thesis makes it possible to control for potential problems of omitted variable and examine the impact of private information that an IPO firm may possess. In addition, the consequences of IPO were further assessed by computing 'treatment effects'. The findings suggested that the determinants of IPO decision can be incorporated into a unified investment-divestment framework IPO firms appear to possess private information about the value of their growth potential The higher the value, the greater is the capital raised while the lower is the number of shares divested IPO firms also appear to time their offerings at the peak of their growth

In conjunction with the primary focus on an investigation of IPO decision, this thesis also looked into the determinants of IPO underpricing and IPO short-run performance in the context of IPO decision It was found that the IPOs that involve divesting shareholdings are less underpriced, so as to reduce insiders' wealth losses Underpricing is used as a means to discriminate among investors so as to protect original controlling shareholders' control rights.

Overall, the findings of this thesis supported the view that the UK stock market plays a positive role in supporting firm growth, especially for financially constrained smaller growth firms. It was highlighted that the UK IPOs utilise the stock market as a channel for financing more than as a facility for shareholders to sell out. This is an important distinguishing feature as between the UK market and available evidence for continental European markets.

Keywords: IPO decision; IPO motives; IPO timing; IPO underpricing, Primary shares and secondary shares, The UK stock market.

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ABBREVIATIONS

IPO	Initial Public Offering
SEO	Seasoned Equity Offering
PSO	Primary Share Offering
SSO	Secondary Share Offering
CO	Combined Offering
VC	Venture Capital
NPV	Net Present Value
LSE	London Stock Exchange
AIM	Alternative Investment Market
NOMAD	Nominated Adviser
PSM	Professional Securities Market
SFM	Specialist Fund Market
FSA	Financial Services Authority
UKLA	UK Listing Authority
FSMA	Financial Services Markets Act 2000
POS	Public Offer of Securities Regulations 1995
IID	Independent and Identically Distributed
BLUE	Best Linear Unbiased Estimator
OLS	Ordinary Least Squares
GLS	Generalised Least Squares
GEE	Generalised Estimating Equations
SUR	Seemingly Unrelated Regression
IV	Instrumental Variables
2SLS	Two-stage Least Squares
MLE	Maximum Likelihood Estimation
FE	Fixed Effects
RE	Random Effects
MNL	Multinomial Logit
FIML	Full Information Maximum Likelihood
DID	Differences-In-Differences Estimator
RRR	Relative Risk Ratio
AR	Abnormal Return
CAR	Cumulative Abnormal Return
CAAR	Cumulative Average Abnormal Return

1 Introduction

1.1 Motivations of This Thesis

An initial public offering of equity (hereafter referred to as IPO) is the first sale of shares by an unlisted firm to the public Once the stock of the company is listed on a stock exchange and the shares are traded publicly in the stock market, a market price for the company's shares is established and liquidity for the shares is created. Along with the process of going public, the capital structure and the ownership structure of the company are changed There is also evidence that firms' operating performance changes after their IPOs.

The changes that occur from pre-market to post-market distinguish IPO activities from other events in the life of a firm, making the study of IPOs a subject of considerable research interests There has been a huge volume of research on the IPO process and the immediate post-IPO experience concentrating in particular on the underpricing phenomenon (Rock, 1986); this refers to the widely observed anomaly that the offer price tends to be well below the first day's trading price Jenkinson and Ljungqvist (2001), Ritter and Welch (2002) and Ljungqvist (2006) surveyed different aspects of this literature. However, the fundamental and arguably substantially more important question is that why firms choose to go public in the first place and how they time their IPO, and this question has received much less attention The theoretical work in this field is less well-developed and of more recent origin. Moreover, due to a lack of data, the empirical work is even more limited

Going public is not a stage that every firm will go through during its growth. Firms that choose to undertake an IPO vary in age, size, financial characteristics, ownership structure, and industrial attributes, and their IPO decisions can be driven by different motives Existing theoretical models mainly focus on one of the two most important reasons[1] for going public first, to raise fresh equity capital in order to fund current or

[1] Röell (1996) provides an overview of other benefits of being a public company the public shares created with a market price can be used as acquisition currency or for an employee remuneration scheme, the firm's reputation and investor recognition are enhanced following the IPO, and its industrial competitiveness may be improved

future investment and expansion, or to repay debt, or second, to enable some existing shareholders to divest and cash in their shareholdings and to maximise their proceeds from selling the ownership, or to facilitate owners to complete an eventual transfer of control.

Closely connected with the 'why' question, is the 'when' question It seems clear that motive and timing are closely related to one another and cannot easily be separated (Ritter and Welch, 2002) The timing element of a decision to go public includes two dimensions: at what stage in the life of a firm and in what kind of market conditions will it choose to go public?

The timing of raising capital is irrelevant in an efficient market where security prices reveal all information However, due to the presence of asymmetric information problems, private information may not be observed or inferred in the same way by all market participants, who may consequently place different valuations on the same security at different times Therefore, firms can time their public equity offerings to exploit cheaper fresh equity capital (Chemmanur and Fulghieri (1999), Subrahmanyam and Titman (1999), Clementi (2002), Pastor and Veronesi (2005) and Benninga, Helmantel and Sarig (2005)).

The timing of divestment and change of control is associated with agency problems, idiosyncratic risks and adverse selection costs For early start-ups, concentrated ownership and internal control are generally preferred, as the few insider block-shareholders (such as entrepreneurs, private equity or venture capital) typically have expertise and are actively involved in monitoring activities, which helps to improve firm value. As firms grow more mature, agency conflicts between managers and shareholders and firm specific risks may increase significantly. Transfer of ownership or control rights via going public may become a better choice at this point of time, as continuously quoted stock prices help to enhance managerial incentives and improve the efficiency with which outsiders can evaluate firms' growth prospects. At the same time, informative stock prices help to reduce the adverse selection problems between buyers and sellers which occur in a direct sale. This enables the original owner to consider exiting in a two-stage process in which, at the second stage, proceeds from

the sale are determined in a more efficient market thus maximising the process for the selling shareholders (Zingales (1995), Mello and Parsons (1998), Ellingsen and Rydqvist (1997), Wagner (2002))

In the theoretical literature there are two main gaps. First, although the two types of motive can jointly drive an IPO decision, none of the existing theoretical models incorporate both in a unified framework. Second, in the various theoretical models the timing of IPO decisions are analysed separately for the two types of IPO motives, but in the real world they are not necessarily mutually exclusive. To understand fully the decision to go public, it is important that the two types of motive and the related timing pattern are examined in a unified framework in empirical research.

There are only few empirical papers that address the question of the motive and timing of going public The best known empirical paper is by Pagano, Panetta and Zingales (1998), who analysed the determinants of the IPO decision for a large sample of Italian firms They compared public and private firms and found that the likelihood of going public is positively related to firm size and industry market-to-book ratio The Italian firms in their sample were likely to use the IPO to rebalance their financial structure and to facilitate future borrowings rather than to finance an immediate investment

Instead of studying a dataset including both public and private firms, an alternative approach is to examine the IPO structure of existing public firms. An IPO may consist of primary shares, secondary shares, or a mixture of both Primary shares are newly created and therefore raise new money for the company, whereas secondary shares are those already existing that are sold by current shareholders and, prima facie, permit these shareholders an exit route. In an interesting recent contribution, Huyghebaert and Van Hulle (2006) studied the determinants of the size of primary and secondary portions in a sample Belgian IPOs and they concluded that the type of shares offered in these IPOs directly reveals information about the motivation for the IPO.

However, neither Pagano *et al* (1998) nor Huyghebaert and Van Hulle (2006) fully answered the question 'why' and 'when'. In addition, Italy and Belgium are both French civil law countries French civil law countries, among the four legal systems – French

civil law, German civil law, Scandinavian law and English common law countries, have the weakest protection for investors[2] Weak protection by law for outside investors is associated with strong expropriation by managers Consequently, investors will find it difficult to share firm's profit Without a large number of confident outside investors, it will be hard for firms to raise equity externally from the stock market La Porta, Lopez-de-Silanes, Shleifer and Vishny (2002) found that better protection of minority shareholders increases the valuation of firms. La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997) also showed that countries that protect shareholders have more valuable stock markets and a higher rate of IPO activities. Therefore, although the evidence found in Italy and Belgium suggested that the reasons for firms to resort to public equity market tend to be related to shareholder exit, it is necessary to re-examine the decision to go public in a market that has a different legal origin.

The motivation and timing for firms to go public is vital in revealing a complete picture of IPO activities and elucidating the extent to which firms can make efficient use of the stock market. It may also shed light on the causes of underpricing and other characteristics of post-IPO performance Considering the lack of empirical research that systemically examine the two types of IPO motives and the related timing pattern, in this thesis I investigate the IPO motive and timing in a unified framework I choose to focus on the UK market This is because it is one of the most important IPO markets, and for this market, there is a surprising lack of empirical research on the determinants of IPOs In contrast to Italy and Belgium, the UK legal system is based on common law, which is generally agreed to provide the best available protection for shareholders (La Porta *et al* (1997, 1999)). It would be interesting to find out whether or not IPO firms in the UK perform similarly to those in French civil law countries, and more generally the role of the stock market in the UK

[2] La Porta, Lopez-de-Silanes, Shleifer and Vishny (1996) examined protection of shareholders and creditors by legal rules, the origin of the legal rules, and the quality of the law enforcement in 49 countries The legal protection of shareholders was measured by anti-director rights index and one-share one-vote, and the legal protection of creditors was measured by creditor rights index The quality of law enforcement was measured by efficiency of the judiciary system, rule of law, degree of corruption, risk of forced nationalisation by the government, likelihood of contract repudiation by the government, and quality of accounting standards It was found that French civil law countries generally have the weakest, and common law countries the strongest, legal protections of investors, with German and Scandinavian civil law countries located in the middle

1.2 Objectives

In this thesis, it is my intention to fully examine the determining factors of an IPO decision including both the motives and timing, and thus answer the question of both 'why' and 'when' I will base my empirical analysis in the UK context using recent data. Given the complexity of a decision to go public, I will examine the data from various angles using different methodologies This involves applying both cross-sectional and panel data techniques. As there is no theoretical model that incorporates both the investment and divestment motives in one framework, I will empirically test the hypothesis that the investment and divestment motives are not mutually exclusive but can jointly shape an IPO decision Finally, I will examine the determinants of underpricing in the context of the IPO decision, to connect the reasons for going public to the observed differences in the degree of underpricing across firms over time

1.3 Methodology

One popular methodology that many empirical researchers have used to study the decision to go public is to compare IPO firms against private firms, conventionally using a probit or logit model to study the likelihood of going public, followed by a fixed effects model to examine the consequences of the IPOs. Examples include Pagano *et al* (1998), Fischer (2000), Chemmanur, He and Handy (2007), Rosen, Smart and Zutter (2005). A drawback of this method is that the data of private firms are quite difficult to collect, both cross-sectionally and over any meaningful time horizon. In this thesis, I collect a panel dataset from various sources (some are downloaded from databases while some others are hand-collected from documents and websites). I first apply the conventional panel approach by answering the more general question· why does a firm choose to go public rather than stay private?

An alternative to the panel approach is to examine the determinants of the sizes of primary and secondary shares using a cross-sectional data of IPO firms at the offering (Huyghebaert and Van Hulle, 2006). This approach requires less data, and can also generate interesting results from a different perspective. Using this approach, it is possible both to decompose the investment and divestment motives and look at the

determining factors of an IPO. Therefore, after the panel approach, I apply this more recent cross-sectional approach to investigate the determinants of investment-driven and divestment-driven IPOs

In addition to the existing methodologies, I examine the decision to go public in a bivariate sample selection model that estimates the determinants of the size of primary (secondary) share and the determinants of IPO choice (against staying private) in a simultaneous equations system. As far as I am aware, this is the first study that applies the sample selection model to analyse the decision to go public, although selection models have found a wide range of applications in other fields of corporate finance. Using this approach, it is possible to test the hypothesis that the investment and the divestment motives jointly drive an IPO By including an extra equation (the IPO choice) to the equations of the sizes of primary and secondary shares, additional information is added, thus providing extra results

Finally, I investigate the underpricing of the sample IPOs using event study methodology, and examine the determinants of the degree of underpricing using OLS regression. Short-run performance of the sample IPOs is compared across firms with different IPO, ownership and control structures. The relationship between underpricing and the IPO and ownership and control structures is analysed.

1.4 Contributions

This thesis contributes to the literature mainly in four ways. First, it provides new empirical evidence. It systematically examines the determinants of an IPO decision, gives answers to the important questions of why and when firms go public It offers new evidence from the UK market, which is distinguished from other markets documented in the IPO decision literature. This makes it possible to compare IPO decisions across markets with different institutional features and legal foundations. The data used in the thesis are recent, which makes the empirical results up to date

Second, various methodologies (old and new) are applied, and thus the IPO decision is fully examined from various perspectives to make certain that results from different

methodologies are consistent. In particular, the application of the bivariate sample selection model is new to the empirical literature of IPO decision

Third, the test of the hypothesis that investment-related and divestment-related motives jointly drive an IPO decision may have implications for new theoretical model

Fourth, it links the underpricing phenomenon to the IPO decision, which helps to interpret the underpricing anomaly from a fundamental point of view

1.5 Outline

The research is organised into four empirical chapters The chapters are interconnected but each one addresses a different aspect of the decision to go public using a different methodology The rest of the thesis is structured in the following manner Chapter 2 reviews theoretical and empirical work on the IPO decision Chapter 3 introduces the institutional characteristics of the UK stock market and its primary equity market, and reviews existing empirical studies about UK IPOs Chapter 4 describes data and sources. Chapters 5 to 8 consist of four empirical studies. In Chapter 5, I apply a panel probit approach to examine the *ex ante* determinants of the decision to go public, and a fixed effects model to examine the *ex post* consequences of the IPO decision. In Chapter 6, I use cross-sectional techniques to investigate the motivation and timing of the IPO decision by analysing the determinants of the IPO structure. In Chapter 7, I employ a bivariate sample selection approach to examine the determinants of a complete IPO decision while emphasising the role of private information in shaping the IPO structure, and use a treatment effects approach to discover the function of the stock market in helping firms to grow and enhance firm value. In Chapter 8, I investigate the relation between IPO structure, ownership and control and IPO underpricing, and study the determinants of the underpricing of the sample UK IPOs. Chapter 9 concludes

2 Financing, Exit, Ownership and Control, and the Decision to Go Public

A Review of the Theory and Evidence on IPO Motivation and Timing

Theories of the decision to go public do not fall easily into neat compartments, but they are often organised into one of two broad strands of literature. life cycle theory and market timing theory (Ritter and Welch, 2002). Within these different strands of literature it is common to distinguish two types of motive: first, to raise equity capital for investment, second, to allow original shareholders to divest or to exit. Life cycle theory is built upon these two alternative motives for going public, it stresses that the optimal time for an IPO is determined by the asymmetric information and agency problems that firms face at different stages in their life cycle (Zingales, 1995, Ellingsen and Rydqvist, 1997; Mello and Parsons, 1998; Pagano and Roell, 1998, Maug, 2001; Wagner, 2002; Chemmanur and Fulghieri, 1999, Maksimovic and Pichler, 2001) Market timing theory on the other hand focuses mainly on the motive of raising equity capital for investment; and it emphasises that the optimal time for an IPO is determined by the potential market valuation of the company (Subrahmanyam and Titman, 1999, Clementi, 2002; Pastor and Veronesi, 2005; Benninga *et al*, 2005). However, the classical theory of capital structure also has implication for the determinants of going public, thus the seminal Jensen-Meckling capital structure paper (Jensen and Meckling, 1976) and the asymmetric information based capital structure theory (Myers, 1984; Myers and Majluf, 1984) can equally well be interpreted as an analysis of IPOs.

2.1 Theory of Capital Structure

The theory of capital structure concerns the question of what determines the mix of debt and equity for a firm It is essentially built within the framework of raising finance for investment According to different assumptions about market efficiency, it can be divided into two branches – trade-off theory and pecking order theory While the trade-off theory assumes that the capital market is efficient and there exists an optimal capital structure as a result of tax considerations (Miller, 1977) or agency conflicts (Jensen and Meckling, 1976), the pecking order theory emphasises the asymmetric information problem which results in a 'pecking order' of financing (Myers, 1984;

Myers and Majluf, 1984) Although not directly linked to decision to go public, its arguments about the impact of agency conflicts and information asymmetries on capital structure offer a very good starting point to uncover the reasons for going public – after all, public equity financing via an IPO forms an important resource of equity capital for many firms

2.1.1 Agency Conflicts

Jensen and Meckling (1976) and Jensen (1986) based their explanations about optimal capital structure on agency conflicts, and they argued that an optimal capital structure is determined by a trade-off between the benefit of debt against the agency cost of debt The benefit arises from the conflict between managers and shareholders. Managers have an incentive to make less effort in managing the company while expropriating firm resources for their private benefit Shareholders on the other hand need to bear the resulting loss of firm value. Creditors in highly levered firms will monitor management more closely to avoid risks of bankruptcy Therefore, a larger fraction of debt can motivate managers to work harder to pay off the debt, which will consequently mitigate the inefficiency that arises from the manager-shareholder conflict However, this comes with an agency cost of debt The cost arises from the conflict between bondholders and shareholders. Bondholders would have to bear the failure if the firm goes bankrupt whereas shareholders would obtain the gains if the investment yields larger returns than the value of the debt. Therefore, shareholders may benefit from investing in a very risky project even if it is a poor investment. Bondholders can anticipate the shareholders' incentive to invest in a value-decreasing project, and thereby increase the cost of debt. Jensen and Meckling argued that there should be an optimal mix of debt and equity that minimises the total agency costs incurred by the firm in financing its investment.

An interesting prediction from Jensen and Meckling's theories is that leverage is positively related both to cash inflows from operations and to firm (or industry) age, but negatively related to firm (or industry) risks and growth opportunities. This implies that older firms and firms with higher cash inflows may prefer debt to equity – for example, they may have lower incentive to raise public equity. On the other hand, riskier firms and firms with higher growth opportunities may prefer equity to debt – for example,

they may be more likely to seek public equity However, Jensen and Meckling did not distinguish between private and public equity In addition, their argument about the conflict between managers and shareholders has its limitations because the extent to which such a conflict is likely to be a problem for a firm depends on the firm's own corporate governance – for example, this may be a negligible problem to a firm which is largely owned by its managers

2.1.2 Information Asymmetries

While the assumption that the market is efficient is too strong, the pecking order theory drops this assumption. It is based on the argument that there are asymmetric information problems associated with external financing This leads to the conclusion that there is no optimal mix of debt and equity, although a firm's capital structure is designed to improve efficiency in making investment decisions

Myers (1984) and Myers and Majluf (1984) assumed that there are information asymmetries between managers and investors. Managers are better informed about firm value than investors, suggesting that managers would have to discount the price of a firm's security to compensate for the risk that investors believe that they will be taking. The 'asymmetric information discount' of issuing risky security indicates that internally-generated cash are a better source of funds than external financing The information discount can be so severe – it may exceed the NPV of the project – that it creates a possibility that a firm will pass up a positive-NPV investment when internal funds are insufficient. The other possibility is that the firm chooses to raise external financing to fund the positive-NPV project In this case, safer securities will be issued before riskier ones. Debt is safer than equity. Both have information discount, but the discount is larger on equity. Therefore, debt will be preferred to equity financing. Accordingly, a firm's financing activities follow a 'pecking order' first internal funds are used, then external debt financing, and external equity financing as a last resort.

Although debt has lower information discount than equity, there are limitations of debt financing. First, there is a moral hazard problem of managers. Mangers who borrow substantially have an increased incentive to take risks that lead to default. This may give

rise to credit rationing That is, the borrowers cannot obtain a loan even if they are willing to pay a high interest rate (Stiglitz and Weiss, 1981) Second, a large debt burden may result in a debt overhang problem. Firms with a high level of debt may find it difficult to negotiate with previous lenders or new creditors so as to fund an investment with positive NPV. This is because the proceeds generated by the new investment must be used to repay the old debt first, and therefore may be unavailable to repay the new claimants (Myers, 1977) The above financial constraints may prevent private firms from realising all their investment opportunities and therefore reduce firm value. In this case, the firm can benefit from external equity, such as a wider source of public equity, which can help it to avoid potential financial constraints In addition, going public may also improve access to debt markets by mitigating asymmetric information problems Therefore, it seems possible to infer that the firms with higher leverage are more likely to seek equity capital, for example from the public equity market.

Yet, like the trade-off theory, the pecking order theory does not offer a direct answer to the question as to why public equity would be preferred to private equity. This issue is addressed more specifically by life cycle theory and market timing theory

2.2 Life Cycle Theory

At a certain stage of a firm's life cycle, it can become more beneficial for a firm to go public rather than to stay private The forces that drive the IPO decision may arise from various constraints associated with being private. These could include increasing firm risks (which may result in over-investment or may reduce the funds that the firm can raise), a lack of information to evaluate the performance of the firm and its growth prospects, managerial incentive problems, or over-monitoring by the external large shareholders on the controlling shareholders. These various problems can affect the investment decision of the firm, curb its growth and reduce firm value. When these constraints can be overcome by going public at acceptable costs, an IPO decision will be made Going public at an optimal time during the firm's life cycle can help the firm to maximise the amount of equity financing raised for its investment, improve its ownership and control structure, and help it to create a market price which can facilitate

the original owners or the venture capital (VC)'s exit plan (i.e. divestment).

2.2.1 Raising Funds for Investment

Diversification versus information costs

Chemmanur and Fulghieri (1999) focused on the investment motive They argued that raising financing from public investors creates liquidity for the firm's equity and will enable block shareholders to diversify their portfolios; the firm will also enjoy stronger bargaining power against a large numbers of outside risk neutral[3] public investors Conversely, risk averse private equity suppliers will require a high risk premium for providing the firm a large portion of their private funds, and the firm will be weak at bargaining against a limited number of funds suppliers.

Alongside the benefit of public equity in reducing the risk premium required by outside suppliers of funds, there is a cost imposed by the asymmetric information problem. The issuer may be better informed about a firm value; outside investors on the other hand, can reduce their informational disadvantage at a cost, by evaluating the firm as a bad or good one. If public investors can evaluate the IPO firm at some cost; overall, there will be sizeable duplication of the costs of information production, and ultimately it is the firm that needs to pay for the total costs incurred (most likely in a form of underpricing). If the duplication costs are too high, it will make the public equity financing process extremely expensive The information costs are decreasing in the available information about the firm that has been accumulated in the public domain, and increasing in the difficulty of evaluation. For example, older and mature firms are likely to be less costly to evaluate because they have accumulated a history in the market and are less complex to evaluate. By contrast, the small number of private equity suppliers typically have specialised expertise and incur lower information costs[4] Therefore, the equilibrium

[3] Chemmanur and Fulghieri (1999) argued that the crucial difference between the VC and the public investors is that VC is less diversified and have greater bargaining power against the entrepreneur compared to the IPO investors The differences between the VC and the IPO investors in their attitude toward risk do not affect the results of their model Therefore, there is no significant loss of generality (but keeping analytical simplicity) from assuming that the IPO investors are risk neutral

[4] The costs of information production associated with the informational asymmetries in the market can be equally well interpreted by adverse selection theory (Rock, 1986) Some investors are less informed than the other investors about the value of IPO firms, this creates a standard 'lemons' problem, suggesting that bad IPOs are likely to drive

timing of an IPO involves a trade-off between the risk premium demanded by private equity for a lack of diversification against the duplication costs in information production by public investors.

According to Chemmanur and Fulghieri (1999), there are four key factors determining the optimal time to go public for firms First, firm age Older and mature firms have fewer uncertainties and are easier to evaluate, and thus incur lower information costs. On the other hand, private equity tends to demand a high risk premium for a lack of liquidity. Therefore, older and mature firms are more likely to go public.

Second, capital investment. The greater the capital investment, the more expensive it will be for a firm to resort to private equity, suppliers of which will require a greater expected rate of return for investing a larger fraction of their wealth in the firm. In addition, private equity will have better bargaining power against the entrepreneur. As a result, the price of each share sold will be lesser, and the total number of shares issued must be increased for any given amount of capital raised On the other hand, when more external equity is needed to finance greater capital investment, it is more expensive for a poor firm to pretend to be a good one and thus it is less likely that distorted information about the true value of the firm will be included in the offer price. This greatly reduces information costs for public investors. Therefore, firms with greater capital investment are likely to go public at an earlier stage

Third, firm risks Riskier firms (e.g high-tech firms) have high uncertainties, and thus a greater risk premium will be demanded by private equity. Therefore, they are more likely to go public at an earlier stage, in order to obtain a better bargaining position against investors.

Fourth, difficulties in firm evaluation The more expensive it is for public equity to evaluate a firm, the less attractive it will be So if certain information about the firm is important for evaluation but is hard and costly to obtain by the public, going public will

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good ones out of the public market To avoid a failure in its offering, the firm may underprice its IPO to signal its quality Young and small firms have little track record and hence the adverse selection costs (underpricing costs) will be especially high for them

be less likely. Therefore, a firm operating in an industry which is characterised by low evaluation costs and less asymmetry of information is more likely to go public For similar reasons, it will be easier for a firm to go public if it is from an industry for which there has already been a substantial number of firms listed on the market, as the information spillover can help it to reduce the costs of going public.

From the perspective of the market as a whole, the higher the efficiency of a market in revealing information about firms (e g. a market with many active financial intermediaries who play an important role in information production), the lower the costs of information production for outside investors Therefore, the average age of public firms is expected to be younger in more efficient and developed markets. In addition, an unanticipated increase in the profitability of a given industry can lead to a decrease in the threshold of evaluation costs of going public for other unlisted firms in the same industry, which can make their IPOs easier Consequently, firms from the same industry tend to go public almost simultaneously, resulting in a 'hot issue' The unanticipated increase in the industrial profitability will be reflected in an unexpected increase in market returns of the already listed firms from the same industry Therefore, a 'hot issue' is expected to happen when the market returns of an industry become abnormally high

Technological innovation

Maksimovic and Pichler (2001) emphasised the impact of technology factors on the decision to go public, and differentiated two types of risks that arise from intense technology innovation. They argued that firms in an industry that is experiencing rapid technological change have advantages in new product markets but face two major risks: (a) technology risk – the risk of a failure in the new technology, (b) new entry risk – the risk of losing confidentiality because of revealing information about their financial and investment decisions to potential entrants.

For an industry in which the cost of the first stage investment[5] is higher than that of the

[5] The first stage investment includes investment in research and in developing new technology It is a sunk cost for the pioneer firms in the industry, whereas is an initial cost for potential entrants

later stages, technology risk decreases in the relative cost of the first stage investment for both public equity and private equity, whereas new entry risk increases in the relative cost of the first stage investment and is higher for public equity as compared to private equity. Meanwhile, feedback from financial markets to production market which is unique to public equity has a function of revealing the value of serendipitous information provided by investors, and such feedback can reduce adverse selection problems.

Maksimovic and Pichler (2001) argued that if the public perception[6] of an industry is that the cost of the first stage investment is higher than that of later stages, the greater relative cost of the first stage investment reduces technology risk. At the same time, the feedback effect will induce a greater reduction in the returns required by public equity in comparison to private equity. Therefore, public equity will be preferred at an early stage. On the other hand, if the public perception of an industry is that the cost of later stage development is high and that technology risk is high, private equity will be preferred in early stage financing

In addition, for a new and emerging industry, if technology risk is more significant than new entry risk, there will be only a small number of IPOs in this industry until technology risk has been eliminated Conversely, if new entry risk is more significant than technology risk, there will be a herding phenomenon of IPOs, i.e the first IPO in the industry will be rapidly followed by a large number of the other similar IPOs.

2.2.2 Exit, Divestment and Transfer of Control

Idiosyncratic risks and adverse selection costs

Ellingsen and Rydqvist (1997) assumed that firms may be over-invested at a later stage and thus idiosyncratic risks of firms increase with firm age. Large block holders (e g entrepreneurs, venture capital) may want to cash out from the firm at a certain time in order to reduce their exposure to risks, obtain liquidity, or to undertake new and

[6] Public perception includes the perception that whether or not the industry is viable, the probability that a superior technology will appear, and the initial costs on R&D that need to be paid by new entrants

profitable activities. Going public is the first stage of a longer term divestment plan and exit strategy. Selling out via the stock market is superior to direct sale, because an informative stock price established in the after-market for the firm can reduce adverse selection problems between buyers and sellers, thus reducing the asymmetric information discount and maximizing total proceeds from the sales in subsequent seasoned equity offerings (SEOs)

Due to the existence of asymmetric information problems between issuers and investors and moral hazard problems of issuers, shareholders' exit might be perceived as a bad signal by public investors· they might ascribe the exit to poor entrepreneurial performance or to decreasing investment value for venture capital. This implies high adverse selection costs for IPOs of bad firms Ellingsen and Rydqvist (1997)'s model predicted that it is more likely for good firms to go public and to utilise the market device for their shareholders' exit, and that firms that go public should be old as there will be a lesser adverse selection problem.

Wagner (2002) made the rather different assumption that an entrepreneur has a motivation to divest at the very beginning of a firm's life. Two possibilities exist First, if investors cannot anticipate the entrepreneur's intention to exit, the benefit of going public will always decrease with firm age, because the entrepreneur's own valuation is increasing with firm age. Then the entrepreneur will either choose to go public immediately after the business is set up, if the initial gains from the IPO exceed the costs of going public, or will never go public at all. But second, if rational investors can anticipate the entrepreneur's moral hazard (i e. the divestment plan), the valuation of investors in the firm will increase with firm age. However, the entrepreneur's own valuation will also increase with firm age (since his discount factor of the valuation will decrease with firm age). Therefore, there is an optimal time for the divestment. The entrepreneur will postpone the divestment until the outside investors' valuation exceeds the entrepreneur's. At this optimal time for divestment, public investors will be preferred to private investors, because the latter is less diversified and will ask for a risk premium to compensate for firm-specific risk and illiquidity However, at an earlier stage, private investors will be preferred because they can help the firm to reduce the discount factors, e g. by providing expertise

Wagner (2002)'s model does not conflict with Ellingsen and Rydqvist (1997) and it also embedded the influence of the firm risks on the choice between private and public equity. However the assumption that the divestment motive exists since the beginning of the firm's life leads to a different emphasis on the decision to go public: if the decision to divest by an IPO is made, the ultimate goal will be a transfer of control. He argued that young and small firms and firms neither affiliated with a mature parent nor backed by venture capital are less likely to go public. The reason is that if the firm is not sold immediately after the IPO, there is always the possibility of underperformance in the aftermarket due to reduced managerial effort, and the entrepreneur will have to bear the resulting loss The only way to avoid such a constraint is to change control. But for these firms, the change of control will mean a loss of entrepreneurial human capital, which is not what the entrepreneur wishes to see. In this aspect (the view about an eventual change of control), Wagner (2002)'s model also shares some similarity with the following group of models

Excessive owner-manager conflicts and the value of control rights

Like Wagner (2002) and Ellingsen and Rydqvist (1997), Zingales (1995) and Mello and Parsons (1998) focus on the divestment motive. However in this group of theories, the exit plan is driven by excess owner-manager conflict, it is stressed that the IPO is only the first step of a two-stage exit strategy, for which the ultimate aim is a transfer of control (the idea of transfer of control is similar to Wagner, 2002)

Zingales (1995) assumed that the higher proportion of cash flow rights to total shares are sold, the more private benefit of control is transferred to the buyer. A large shareholder's valuation of a firm essentially comes from the private benefit of control Directly selling out the firm and bargaining with potential buyers can maximise the proceeds from a sale of control rights, whereas going public and selling the firm to dispersed public shareholders can maximise the proceeds from the sale of cash flow rights.

When management extracts private benefits from the controlling shareholders, first selling a portion of the firm's stock to dispersed shareholders can indirectly strengthen

the existing owners' control status. In addition, publicly observable stock price can reduce the information asymmetries between the seller and potential buyers, which will enhance the seller's bargaining power for the subsequent sale of controlling blocks Therefore, an optimal combination of majority control and dispersed ownership in the IPO can maximise the entrepreneur's total revenue from the eventual sale of control; or alternatively, maximise the venture capital's total proceeds from their exit.

In contrast to Zingales (1995), Mello and Parsons (1998) proposed that a large shareholder's valuation of a firm comes from its expected cash flow and they stressed that the efficiency of share allocation increases with the efficiency of the information revealing process Due to the asymmetric information problem, there are uncertainties about both the demand of small investors and the value added by large and active investors First selling shares to small and dispersed investors in the IPO can help the seller to acquire valuable information for setting favourable terms for subsequent sales to value-adding large investors, so that large investors will be attracted to participate in the extended sales As a result, the efficiency of allocating shares is improved. And at the same time, the large and active shareholders can provide monitoring and management activities, which can improve the efficiency of corporate control and add value to the firm These will maximise the total proceeds gained from the extended sales and exit process

Apart from the explanation of the process by which the total selling proceeds can be maximised, there is another key difference between the two models, which is the issuer's attitude towards the large and active investors In one case, large investors are discriminated against in the selling process so as to favour small investors and to protect the seller's controlling status (Zingales, 1995). In the other, they are encouraged to join in the firm in the extended sales for the monitoring that they can provide (Mello and Parsons, 1998). These two accounts clearly assign diametrically opposite roles to the large investors, and a more accurate interpretation may depend on the particular market environment.

Zingales (1995)' model implies that there are three possibilities for an optimal way to transfer control First, if the private benefit of control rights is important and the value

of cash flow rights is more sensitive to the fluctuations in the firm's share price than in the value of private benefits, going public to eventually sell out will be preferred. Second, if the potential buyer's private benefit of control is zero, spin-off[7] will be optimal. Third, if the potential buyer is likely to reduce the value of cash flow rights, selling the subsidiary directly to a third party would be the best choice

Besides the implications of each model, there are two common predictions by theories that focus on the divestment motive. First, the operating performance of an IPO firm is expected to decrease after going public due to the divestment plan, which may reduce the owner's incentives and increase the moral hazard problem Second, the IPOs are expected to be followed by seasoned equity offerings (SEOs), as the IPO is only the 1st stage for its original owner to cash out. In this case, the probability of SEOs should be positively related to the increase in the firm's share price after the IPO.

2.2.3 Optimising Ownership Structure

In addition to the investment and the divestment based models, there are several other theoretical papers on the decision to go public They built their model neither within the investment nor the divestment settings, but instead highlight the intention of the IPO firms to achieve an optimal dispersion of ownership structure via the process of going public While it is not certain whether the intention of optimising ownership structure is the ultimate reason for going public, it is certainly a very important consideration both for firms that go public to raise new funds and for those who are mainly divesting existing shares. Therefore, in this section I review theories that are concerned with how an IPO decision may affect and improve the ownership structure of the company.

According to this group of theories, going public is for the purpose of optimising ownership structure, to improve the efficiency with which the firm's growth prospects can be evaluated. Informative stock prices offer valuable market-specific information for the firm, reducing poor managerial incentive problems. An optimal dispersion of ownership can overcome excessive monitoring of controlling shareholders by external large shareholders on the one hand, and under-monitoring of management on the other,

[7] Spin-off means a parent firm distributes equity claims in its subsidiary directly to shareholders of parent firms

thus solving the agency conflicts.

Market monitoring

One function of the stock market is the monitoring of a firm's managerial performance, as stock prices can reveal additional information about a firm's performance which may not be reflected in its accounting data Thus market monitoring creates a mechanism to enhance managerial incentives (Holmstrom and Tirole, 1993)[8] Tradable shares bring in either explicit compensation contracts (e g stock option schemes for management) or implicit contracts (e.g. the potential threat of management losing their jobs from a takeover) Continuously quoted share prices can provide incentives to management and curb managerial misbehaviour, especially because a poorly performing firm in the market will face the threat of takeover (and the manager will be fired if a takeover succeeds)

The ability of stock prices to reveal such additional information and the efficiency of managerial incentive contracts increase with the liquidity of the firm's shares in the stock market. A stock with high liquidity is covered by a large number of liquidity traders. Subsequently, a large number of informed speculators with private information will be attracted to the trading of the stock, as it will be easy for them to find a liquidity trader to take a position and to make money from the market This makes the stock prices informative and thereby increases the efficiency of its managerial incentive contracts.

The achievable market liquidity of the firm's stock is influenced by the firm's ownership structure. A firm cannot directly contract with speculators on the amount of information that they obtain However, increases in ownership dispersion indicate increases in the number of shares that will be traded in the market, and hence increase liquidity of the stock. Subsequently, the efficiency of the managerial incentives contract will be improved

[8] It does not belong to the formal literature of IPO decision, however its argument about the function of the market monitoring made contribution to the life cycle theory

Yet, to benefit from market monitoring – i e. to list on the stock exchange and to trade in the market – is costly. In the market, speculators produce the additional information and get compensation for their information from the losses of liquidity traders and other owners of shares, while the liquidity traders are compensated by the underpricing of the IPO shares

Therefore, the efficiency of monitoring by speculators increases with the marginal value of their information that will be revealed In equilibrium, there is a trade-off between the value of managerial incentive and the cost of market monitoring which is ultimately in the form of underpricing.

With respect to the monitoring function of the stock, Maug (2001) offered a further explanation from the information perspective The information consists of firm-specific information and market-specific information. Firm-specific information is better collected by insiders – entrepreneur, VC or the parent firm, whereas market-specific information is better collected by informed investors in the market Going public can assist a firm to gather valuable market-specific information about its investment projects from informed public investors. Market-specific information helps a firm to decide whether or not to carry out an investment project and help it to reduce the monitoring cost of its block insider-shareholders, so that the efficiency in evaluating its growth prospects can be improved. The monitoring costs of public investors are compensated by underpricing Therefore, an IPO decision is a trade-off between the values of market-specific information against the cost of underpricing

In the early stage of a firm's life cycle, or when a firm plans to restructure, firm-specific information is more valuable. Insiders have advantages in gathering this kind of information and would not wish to disclose it to the public. Therefore, staying private is a better choice. For this reason, a young firm is less likely to go public In the later stage however, when market-specific information becomes more valuable and insiders lose advantage in collecting such information, going public will become a preferred choice.

Over-monitoring and under-monitoring problems

Pagano and Röell (1998) suggested that ownership structure should be designed to optimally allocate control to entrepreneur, and going public is one way to achieve this A firm may choose either private equity financing or public equity financing. Each of these two is associated with different ownership and control structure, and consequently different monitoring problems Private equity financing is commonly associated with concentrated ownership structure A firm may sell only a minority of shares in order to make sure that its control and concentrated ownership base will not be affected. Concentrated ownership structure can avoid a problem of poor managerial incentives (i e under-monitoring), but it may give rise to an over-monitoring problem from large external shareholders (e.g. VC). Large external shareholders may destroy entrepreneur's private benefit and they do not take into account the rent that they should pay for acquiring control from entrepreneur. Therefore, entrepreneur may prefer dispersed ownership as it avoids excessive monitoring by large external shareholders Going public at a certain stage in the life cycle of a firm can help it to optimise the dispersion of its ownership structure, provide a solutions to the above agency problem and improve its firm value.

If a firm chooses public equity financing, it can choose either to keep concentrated ownership structure or to achieve disperse ownership structure. If it intends to keep concentrated ownership structure, an over-monitoring problem will be the main concern An over-monitoring problem arises from the conflict between controlling shareholders (typically the founders or their descendants) and minority block public shareholders Controlling shareholders often siphon off corporate earnings or take advantage of corporate assets in support of its other investments. On the other hand, minority block shareholders often actively monitor the firm, which in return weakens controlling shareholders' private benefits of control They also have incentives to get involved in takeover activities if a firm is badly managed, so as to benefit from capital appreciation on their shareholdings from takeover premium These will put controlling shareholders' controlling status in danger. Such over-monitoring costs can be very high to controlling shareholders

If a firm that chooses public equity financing intends to achieve dispersed ownership structure, a problem of poor managerial incentives (i e. under-monitoring problem) is the main issue that it needs to tackle Dispersed shareholders have low incentive to monitor hired manager, and hired manager who actually runs the firm will tend to put his personal interests above those of the shareholders, thus reducing firm value.

For public equity financing, in addition to the above agency costs related to ownership structure, there are also direct costs of listing and indirect costs of underpricing. Therefore, the decision to go public in Pagano and Roell (1998) is a trade-off between the benefits of overcoming the agency problems and the costs of creating liquidity for sold shares, the goal of which is to maximise firm value subject to optimal ownership dispersion However, the consideration of investment or divestment is irrelevant to their model.

Pagano and Röell (1998) provided many interesting implications for a firm's IPO decision First, it was predicted that going public is attractive to a firm that has high capital investment because, when the firm is in need of a large amount of equity capital, a higher ratio of external funds to firm value increases the likelihood of over-monitoring, resulting in a stronger incentive to go public.

Second, it was predicted that the incentive to go public decreases with the value of monitoring added by internal block shareholders (e g their expertise and management skills), but increases with external dispersed shareholders' ability to monitor the firm and increases with the value of the founders' private benefits of control. In addition, if controlling shareholders can pay off internal block shareholders to induce them to monitor less, the over-monitoring problem will be reduced and going public will become less attractive.

Third, for the market as a whole, going public is more attractive when the rules of disclosure are strict and the accounting standards for public firms are transparent, because this means that the market can offer more effective monitoring of managers and hence a lesser problem of poor managerial incentive coming from dispersed public ownership structure. Similarly, the incentive to go public increases with the degree of

legal protection for small shareholders, because under weak legal protection it is more likely that managers bribe large shareholders to monitor less, which will reduce firm value and damage small investors' benefits.

2.3 Market Timing Theory

In contrast to life cycle theory, the role of share prices is at the centre of market timing theory and its models are built within the setting of firm investment. One branch of this theory is established on the assumption that the market is rational Fluctuations in stock prices can convey valuable information about the expected payoff to the firms' growth opportunities, risks, expected profitability and expected cash flow (Clementi, 2002; Pastor and Veronesi, 2005; Benninga *et al*, 2005) Timing an IPO to coincide with a high market price (i e. potentially high market valuation) can facilitate a firm's investment decision, overcome borrowing constraints, and diversify away idiosyncratic risks Therefore, the likelihood to go public increases when market valuation is high, whereas the likelihood for a publicly listed firm to return to being private increases when market valuation is low

Another branch of market timing theory proposed an alternative explanation based on misbehaviour of market participants Investors in the market can be irrational and a firm may time its IPO to utilise the fads in the market (i e to take advantage of windows of opportunity from market mispricing when stock pricing is irrationally high). In another case, irrationally high prices can be purposely made by managers, for example using earnings manipulation, to induce investors.

2.3.1 Rational Market

Serendipitous information versus costly information

Subrahmanyam and Titman (1999) assumed that entrepreneur is less informed and bases his pricing of the firm on existing assets excluding growth opportunities. There are two types of investors public investors and private financiers (private financiers are

well diversified[9]). Entrepreneur can acquire imperfect information about the expected payoff on the firm's growth opportunities, either from private financier or from public investors. This additional information obtained from investors determines the amount of capital that will be invested Therefore, the firm's investment decision is related to the type of investors. And the precision and the cost of the additional information determine the firm's efficiency in allocating capital and the maximum expected returns on future investments.

In Subrahmanyam and Titman (1999)'s framework, the evaluation of the additional information is followed by investment decision, this distinguishes the model from Chemmanur and Fulghieri (1999) (a life cycle theory), in which the opposite order is used – investment decision is followed by the evaluation of information costs However, as investment is a continuous process in practice, such a discrepancy in theoretical models may be less important.

Subrahmanyam and Titman (1999) proposed that information consists of costly information (such as information about production efficiency, organisation and management etc.) and costless information (i.e. serendipitous information, such as information about total demand for the firm's product etc) Costly information is mostly generated by financial intermediaries (such as underwriters, analysts and auditors), whereas serendipitous information is generated by public investors. Serendipitous information can provide valuable signals The importance and the precision of serendipitous information vary according to the nature of a firm. Its importance increases with the uncertainties of product demand, and its precision increases with the diversification of serendipitous information When some of the diversified serendipitous information is widely agreed across investors (as signalled by increased market prices), going public becomes more likely However, such an argument can hardly be empirically tested, because the market value of a firm before its IPO does not exist in practice.

Yet, there are some implications of this model. When serendipitous information (e g

[9] There are no non-diversification costs, and this is different from Chemmanur *et al* (1999) The suitability of these two assumptions may depend on the firm in question

uncertainties on the demand for a new product or on an expansion of production) is valuable for resource allocation and when costly information is diverse and cheap to acquire for a firm, the market valuation tends to be high, indicating a preferential time to go public. For the market as a whole, the benefit of going public increases with market size (i.e. the number of listed firms) and with the capitalisation ability of a market

Interaction between production market and stock market

Clementi (2002) argued that the value of going public is determined by the book value of an entrepreneur's accumulated wealth, and that the market timing of an IPO is determined by the stochastic process governing the dynamics of productivity, which can be viewed as exercising an option. If the total factor productivity of a firm is low, the entrepreneur will only be able to raise a limited amount of money by going public and will hardly carry out seasoned equity offerings Therefore he will not exercise the option. A firm will go public if the expected value of the growth of productivity as reflected in the aftermarket price is high enough to offset the fixed costs of its IPO (the underpricing cost is not specified explicitly in this model). After the IPO, liabilities, capital expenditure and sales are expected to increase whereas profitability is expected to decrease.

Pastor and Veronesi (2005) focused on firms that own patented inventions and need funds for production, these firms either did not start production or only started at limited level. They argued that, for these firms, IPO financing other than debt or private equity is a natural result because public equity can diversify and hedge away the idiosyncratic risks The market timing of these IPOs depends on the market valuation of the firms. When the expected aggregate profitability or the prior uncertainty rises, or the expected market return declines, the market valuation is expected to reach its maximum, and thus reaches the optimal time to go public. Pastor and Veronesi (2005)'s model predicted that going public after large-scale production is not optimal because the entrepreneur is exposed to idiosyncratic risks which can no longer be hedged away in the public market. This theory may help to explain why some young high-tech firms choose to go public at an early stage

2.3.2 Behavioural Explanations

Investors in the market can be irrational and the fluctuation of market valuation can be driven by investor sentiment It seems that there exists a fads phenomenon in the market, in which irrational investors (and analysts) tend to become over-optimistic about IPO firms' future growth prospects It is possible that investors' over-optimism is inherent in the market and that issuers can successfully time their IPOs to coincide with the occurrence of the temporary irrational fads and grab relatively low cost of capital (Ljungqvist, Nanda and Singh, 2006). The literature about long-run performance of IPOs also found evidence that the long-run returns of IPOs tend to be negative (e g Ritter, 1991), which is consistent with this argument

Following this theory, it is expected that if the decision to go public is driven by investment motive, an IPO firm should be very keen to take advantage of window of opportunity (if this exists) for its IPO On the other hand, if divestment is the plan, an IPO firm should be less likely to float in a hot market, because the value of the retained shares will decrease subsequently as the fever in the market fades away[10], which will reduce the total proceeds from selling controlling blocks later on.

Teoh, Wang and Rao (1998) found that going public enables CEOs (who hold company shares) to exploit their private benefits from increased firm value after the IPO Managers dress up the performance of firms in order to create investor over-optimism about firms' future performance. Before going public, they overestimate the expected future cash flows by 'massaging' earnings, or simply cheat investors by overstating earnings After the IPO, they purchase analysts' research coverage with an intention to boost firms' share prices However, this explanation is not entirely convincing theoretically or empirically. In certain circumstances, such manager manipulation may exist, but this is not likely to be the main reason for going public Overall, behavioural explanations of IPO decision have provided interesting alternatives to the conventional approach, but they are still not well developed and remain controversial.

[10] Market-to-book ratio can be used as a proxy to measure non-systemic risks and invests' sentiment

2.4 Empirical Evidence on IPO Motivation and Timing

The empirical research on the decision to go public is still quite limited. Different studies have found mixed evidence from different markets using various samples and methodologies.

2.4.1 Raising Funds for Investment and the Related Timing

Chemmanur, He and Nandy (2007) studied a sample of US manufacturing firms, and claimed that firms facing less information asymmetry and having projects that are cheaper for outsiders to evaluate are more likely to go public They found that the probability of going public increases with firm size, capital investment and industry risks of cash flow, but decreases with information asymmetry[11]; the sales and capital expenditures of the IPO firms increase both before and after the IPO. These findings are consistent with the predictions of Chemmanur and Fulghieri (1999) and Clementi (2002)

Based on a sample of 877 US IPOs, Jain and Kini (1999) examined the determinants of transition to one of the three post-IPO states – survival, failure, or being acquired They documented that higher pre-IPO operating performance increases the probability of survival whereas higher firm risks increase the likelihood of failure. Firms may go public at various stage of their life cycle. Riskier firms are expected to go public to raise finance at an earlier stage since otherwise a high risk premium would be demanded by private equity (Chemmanur and Fulghieri, 1999) However, if these firms have poor pre-IPO operating performance, they will not be able to raise sufficient funds from their IPOs and the subsequent SEOs In another words, exercising the option of going public will be too costly (Clementi, 2002). Consequently, it is more likely that the IPOs will fail in the aftermarket. Although Jain and Kini's study did not directly address the question as to why and when firms go public, it emphasised the importance of timing to the success of an IPO. This sheds light on the determinants of an IPO decision.

[11] Capital investment was measured by capital stock over total employment, industry risk was measured by the industry median of the five years coefficient of variation on firm sales at 3 digit SIC level, information asymmetry was measured by the average standard deviation of analyst forecasts and analyst forecast errors for listed firms in the same industry, and the ease of evaluating a firm was measured by the number of public firms from a same industry listed in CRSP

Fischer (2000) focused on a sample of growth and technology firms floated in the Germany Neuer Market and reached similar conclusions in terms of the impact of the investment, risks and the stage of life cycle on IPO decision. In addition, he highlighted the influence of technology factors (Maksimovic and Pichler, 2001) and market timing. He showed that the probability of IPOs is positively related to the risks of the firms' projects and the investment intensity of the firms[12]. Firms that grow and invest a lot and have high proportion of intangible assets and R&D intensity are more likely to go public. They go public when they are in good economic and financial conditions. He also pointed out that IPO is more attractive to firms that are already active in a new industry and are introducing new products and planning expansions For this type of firm, there are considerable uncertainties about product demand due to the widening customer base, therefore serendipitous information is extremely valuable (consistent with Subrahmanyam and Titman, 1999). Moreover, stock prices can provide valuable information about investors' risk preferences and the ability of the market to capitalise future cash flows, which is important for firms' investment decisions Schultz and Zaman (2001) also emphasised high-tech factors and found that internet firms go public at an earlier stage than firms from other industries, and they rush to IPO market In addition, Fischer also found that controlling shareholders keep control and even consolidate their control after IPOs, which provided supportive evidence for Zingales (1995).

Boehmer and Ljungqvist (2004) and Burgstaller (2005) also found supportive evidence for Subrahmanyam and Titman (1999), from the German and the Austrian markets respectively: firms are more likely to go public when the market and the economic conditions[13] improve, so that they can get higher valuation for their IPO shares and promote their investment. Lerner (1994) found similar evidence from venture-backed biotechnology firms these firms tend to go public when market valuation peaks, whereas they choose private venture capital financing when market valuation is low.

On the other hand, Houge and Loughran (1999) found different results from the

[12] The ratio of intangible assets over total long-term assets is used as a proxy for the risk of a firm's project, R&D intensity is used as a proxy for investment intensity for the high-tech firms

[13] GDP, gross investment, gross corporate profits, credits provided to private firms, share price index are used to measure the economic conditions

banking industry in the US: rather than raising funds for investment, banking IPOs are likely to be driven by the need to meet regulatory capital requirements and the intention to sell overvalued stock. Furthermore, banking IPOs are followed by poor performance due to loan growth and increased loan losses Since the banking industry is distinguished by a unique capital structure (e g high leverage) and a distinctive regulatory environment, these might differentiate the banking IPOs from the IPOs in other industries.

From the Italian market, Pagano, Panetta and Zingales (1998) revealed that for the Italian firms the likelihood of going public is positively related to firm size and industry market-to-book ratio, the reason for going public is to raise funds to reduce leverage, overcome financial constraints and to facilitate future borrowings, rather than to fund immediate investment.

2.4.2 Exit, Divestment and Transfer of Control and the Related Timing

Rosen, Smart and Zutter (2005) studied a sample of US IPOs of banking and bank holding firms and found that the equity-to-asset ratio of IPO banks increases to a level similar to that of private bank and that the IPO banks are more likely to be acquired This offers support to the proposition that an IPO may be only the first step of an eventual sell out. Ang and Brau (2003) added further evidence in this aspect. They claimed that the number of owner's shares actually sold in an IPO is greater than disclosed in the original prospectus, and that the issuer tends to conceal its intentions on the sale and insider selling They also found that if the information acquired from road shows and other marketing activities results in an increased offer price, the number of the owner's shares actually sold will increase

In addition, Pagano *et al* (1998) found that the Italian IPOs are related to divestment by controlling shareholders Huyghebaert and Van Hulle (2006) found that in Belgium the IPOs of established firms tend to be related to divestment motives and that adverse selection costs play an important role However, the timing issue for the divestment related IPOs has largely been overlooked in empirical studies

2.4.3 Optimising Ownership Structure

Helwege and Packer (2003) examined 178 US large and highly leveraged non-financial firms and found that firms with inside ownership (i e solely held by management, or solely held by family members, or a mix of the two) seldom make IPO decision, whereas firms with significant shareholdings held by outsiders (VC and private equity investors) are more likely to go public, which might be due to their exit plan. However, there is no evidence supporting the argument that the decision to go public arises from the original owners' preference to reduce over-monitoring problems As discussed earlier, although the consideration of optimal dispersion of ownership and structure is important for both investment and divestment driven IPOs, it is less likely to be the primary driving force of going public.

2.4.4 Irrational Investors and Market Mispricing

There is some interesting but mixed empirical evidence for the proposition that IPO firms exploit windows of opportunity Loughran and Ritter (1995) found that stock returns are significantly lower in a hot market, indicating that issuers are likely to time the fads for their IPOs Besides, Rajan and Servaes (1997) found that the IPOs with low analyst forecasts in the aftermarket actually outperform those with high analyst forecasts. However, Helwege and Liang (1996) found that there is no difference in the performance of stocks issued in hot markets and those issued in cold markets

2.5 Summary

The decision to go public is a choice rather than a natural stage in the growth of a firm Some firms may choose to go public at a certain point, whereas some others may never make an IPO decision While some IPOs take place at a later stage, others may be carried out at a fairly early stage in the firms' life cycle.

Going public may involve the activity of raising new funds for the IPO firm (by

offering primary shares[14]) or selling existing shares by the original shareholders (by offering secondary shares[15]) or a combined of both. Various theoretical models from different perspectives explain the reasons why at a certain time public equity financing may be preferred to debt or private equity financing (the investment motives), and why selling out via an IPO may be superior to other forms of exit (the divestment motives)

Firms face the need to fund their growth from time to time during their life. Agency conflicts (manger-shareholder conflicts and bondholder-shareholder conflicts) and information asymmetries associated with external financing affect firms' choices between debt and equity capital (Jensen and Meckling, 1976; Myers and Majluf, 1984; Stiglitz and Weiss, 1981, Myers, 1977). For early start-ups, using debt financing, bank lending is typically more attractive to creditors than bonds because of efficient renegotiation and a closer relationship with the borrowers. As firms mature, the information monopoly of banks increases the costs of borrowing, while increasing bondholder-shareholder conflicts can also make debt financing very expensive The existence of moral hazard in management, bondholder-shareholder conflicts and the asymmetric information problem between lenders and borrowers may leave the firms facing potential threats of financial constraints. Financial constraints may arise for various reasons. limited cash generation, credit rationing, debt overhang, or inability to issue private equity. Firms that are financially constrained may prefer external equity financing to debt financing, in which case, public equity is one alternative.

Between private and public equity financing, private equity is typically preferable to public equity at an early stage because of the high information disclosure costs and the high adverse selection costs for public equity. An IPO at an early stage of a firm's life involves the disclosure of information about financial and operational conditions, which may make the firm lose commercial confidentiality and weaken its competitiveness (Maksimovic and Pichler, 1999) Moreover, early start-ups have little track record and therefore high adverse selection costs. Private equity suppliers typically have specialised expertise and therefore incur lower information costs. As firms grow, private equity is likely to become increasingly unattractive because of the high risk premium

[14] Primary shares refer to the shares newly created in an offering, by offering primary shares, the IPO firm can raise fresh capital

[15] Secondary shares refer to the shares that already exist and sold by the original shareholders, the proceeds from selling secondary shares in an offering will go to the selling shareholders

demanded for a lack of diversification and liquidity, limited size of funds available consistent with retaining insider control Public equity may become a cheaper source of equity capital compared to private equity. Public firms can benefit from a competitive investor market with greater information gathering and diversified opinions about prospective payoffs, all of which will enhance their bargaining power, improve their resource allocation and lower the financing costs (Chemmanur and Fulghieri, 1999, Subrahmanyam and Titman, 1999) On the other hand, as firms become more mature, substantial firm-specific information is accumulated in the public domain, so that the costs of information production (the underpricing costs of the IPOs to signal their quality in the adverse selection theory) are substantially reduced for raising public equity. Nevertheless, although public equity is normally beneficial for more mature firms, greater capital investment, higher risk profile and technology innovation may push firms to go public at an earlier stage for relatively cheaper capital (Chemmanur and Fulghieri, 1999, Maksimovic and Pichler, 2001).

A further important aspect of public equity is that it provides the firms with opportunities to raise money progressively through later SEOs, even if they did not raise sufficient capital in their IPOs. In particular, as more information about the IPO firms becomes publicly available in the after-market, the costs of information production and adverse selection can be reduced and consequently SEOs can attract better offer prices.

Apart from the investment motives, divestment motive can be another determinant of the decision to go public. As a firm grows, some original shareholders may wish to cash in their shareholdings and exit from the firm to avoid the exposure to increasing idiosyncratic firm risks (Ellingsen and Rydqvist, 1997, Wagner 2002) and excessive owner-manager conflicts (Zingales, 1995; Mello and Parsons, 1998) A special case is that many private firms are backed by private equity (VC, buyout firms or business angles). These private investors will typically wish to exit at some stage to cash in their investment An IPO is one obvious route for an exit However, the disposal of the existing shareholdings is likely to be viewed as a bad signal, thereby selling out via an IPO is more possible for good firms at a later stage of development but less likely for small and young independent firms In the later stage of the firms' growth,

market-specific information from informed investors becomes more valuable and insiders lose their advantages in gathering such information Likewise, information duplication costs for public investors become lower as firm-specific information comes into the public domain, and this would make the exit easier and more profitable.

More generally, it can be argued that selling out by a two-stage process starting with an IPO can maximise the total proceeds from the eventual sale of controlling blocks through subsequent SEOs In the first stage of the IPO, the selling shareholders only sell a minor proportion of their holdings, and progressively divest their controlling blocks in the second-stage sales at SEOs. The established stock prices help to reduces asymmetric information problems between buyers and sellers (Zingales, 1995). The information revealed from dispersed small investors during the IPO can also help to improve the efficiency of allocating shares to larger shareholders during the SEOs (Mello and Parsons, 1998). Consequently, the improved offer prices and efficiency of allocating shares in SEOs help to increase the proceeds cashed in from selling the controlling blocks. However, a discrepancy exists with regard to the role of large and active investors in SEOs it still remains an important question as to whether they are discriminated against to protect the controlling shareholders' control, or alternatively are favoured to join the firm to improve monitoring. The answer to this question may depend on the corporate governance of each individual firm and the nature of a particular financial system

No matter what motivation lies behind an IPO decision (whether it is investment or divestment related or a combination of both), the potential impact of going public on the ownership and control structure has to be taken into account. On the investment side, raising equity capital potentially affects the firm's ownership and control structure and is associated with various agency problems between external financiers, managers and entrepreneurs Solving the agency problems involves the efficient use of corporate resource, and direct or indirect monitoring of management. For firms with concentrated ownership structure, when they raise equity from dispersed public investors, minority-controlling shareholder conflict is the main problem Monitoring from a number of minority block shareholders may put too much pressure on controlling shareholders. Multiple block shareholders may result in costly duplication of effort and

cause an over-monitoring problem. Minority block shareholders also have an incentive to get involved in takeover activities, which jeopardises the controlling shareholders' control status (Pagano and Roell, 1998). On the other hand, for firms with dispersed ownership structure, manager-shareholder conflict is the main concern when the firm accesses public equity Unlike a concentrated ownership structure, in which the controlling shareholder actively monitors the managers, a dispersed ownership structure provides less effective monitoring. However, continuously quoted stock prices can reveal valuable information about managerial performance and a firm's growth prospects (Holmstrom and Tirole, 1993). This helps to create a managerial incentive mechanism, curb managerial misbehaviour, and enhance firm value

On the divestment side, when management extracts private benefits from shareholders, diffusion of ownership in the first-stage sale would be beneficial Selling minority stakes of the firm's stock to dispersed public investors can help the original controlling shareholders to retain and strengthen control This indirectly enhances the selling shareholders' bargaining power for the subsequent sale of controlling blocks, and helps to maximise the proceeds from the two-stage selling process (Zingales, 1995). Overall, going public makes it possible in principle to design the dispersion of ownership structure and to optimally allocate control rights to the entrepreneurs, thus improving corporate governance (Pagano and Roell, 1998)

Timing the market is another important component of IPO decisions The costs of public equity financing can be affected by market conditions. During periods when the stock market is over-optimistic, firms' stocks can be overvalued. Firms may exploit such windows of opportunity and take advantage of mispriced public equity (Ritter, 1991) From a different point of view, rational theory argues that firms time their offering at the peak of market valuation (Subrahmanyam and Titman, 1999; Clementi, 2002; Pastor and Veronesi, 2005). Fluctuation in stock prices can reveal valuable information about the expected payoff on firms' growth opportunities Timing an IPO to coincide with a high stock price can facilitate the firm's investment decision a higher stock price (i e higher market valuation) indicates more investment opportunities, signalling that the firm should revise its investment upwards However, Ritter and Welch (2002) argue that the investment and financing decisions of entrepreneurs are

largely driven by firm-specific information rather than stock market share prices It takes time for entrepreneurs to adjust their private valuation towards market valuation.

Theories about market timing are based on the investment motive, existing theoretical models have not considered how market timing affects IPO decisions associated with the divestment motive. Intuitively, the selling shareholders would seek to dispose their holdings at a high market valuation. In a buoyant market, there are more active public investors and they may assess shareholders' exit more optimistically when influenced by optimistic market sentiment This may reduce the adverse selection problem and allow the selling shareholders to divest their shareholders more easily. However, following the two-stage sales theory, divestment should be a continuous process, and it is less obvious how the divesting shareholders should plan the whole exit process (at the IPO), timing the market for their later sales and riding the cycle of the performance of the stock market so as to maximise the total proceeds. Answers to this question await more convincing theoretical explanations.

Another gap in the theoretical literature is that it lacks a unified dynamic framework to incorporate both investment and divestment motives. This leaves several questions under-addressed Why do some firms issue only primary shares, some issue only secondary shares, while some others issue a combination of both? Why does IPO structure vary across firms? What are the reasons behind the observed cross-country difference in IPO structure? As the investment and divestment motives may not necessarily be mutually exclusive, it is important that the two types of motive and the related timing pattern are examined in a unifying framework in empirical research

A summary of the theories and their implications for IPO decision is shown in Table 2.1

The existing empirical research about the decision to go public is still quite limited Most of them focused mainly on particular firms or industries, and either concentrated on the investment motives or the divestment motives but not both. The available evidence shows that IPO decisions in the US tend to be related to raising financing to fund firm growth In contrast, continental European markets exhibit more diverse

motive In the Italian market, it was found that firms were likely to use IPOs to rebalance their financial structure and to facilitate future borrowings rather than to finance an immediate investment (Pagano et al., 1998) For other continental European markets, the reasons for going public tend to be relatively closer either to the US case or to the Italian case For example, German technology firms seemed to float on the Neuer Market to fund rapid growth (Fischer, 2000), whereas Belgium IPOs seemed to be more related to the exit motives than the financing motives (Huyghebaert and Van Hulle, 2006).

The various evidences revealed quite different roles and functions of the stock markets across countries and financial systems. To further discover the function of the stock market, it is essential to examine systemically the decision to go public in other markets, while addressing both the 'why' and the 'when' questions

A summary of the empirical evidence is provided in Table 2 2.

Table 2.1 Theory on IPO Motivation and Timing

Reasons for IPOs			Author(s)	Implications	Theory Grouping
Investment	Overcoming financial constraints		Jensen and Meckling (1976), Myers (1977), Stiglitz and Weiss (1981), Myers and Majluf (1984)	Financially constrained firms are more likely to go public	Theory of Capital Structure
	Minimal information costs, while avoiding the risk premium demanded by private equity for a lack of diversification		Chemmanur and Fulghieri (1999)	Older and mature firms are more likely to go public, the firms with greater capital investment, riskier firms, will go public at an earlier stage, the average age of IPO firms will be younger for a more efficient and developed market, an abnormally high market return will be followed by hot issue	Life Cycle Theory
	Market feedback and serendipitous information reduce adverse selection problems for firms that invest heavily in R&D and new technology		Maksimovic and Pichler (2001)	The likelihood of going public increases in the relative costs of the first stage investment in R&D and in developing new technologies	
	Serendipitous information is valuable for the resource allocation of firms		Subrahmanyam and Titman (1999)	The likelihood of going public increases in market returns, the benefit of going public increases in market size and in the capitalisation ability of the market	Market Timing Theory
	High market valuation promotes the production of firms and increases firm value		Clementi (2002), Pastor and Veronesi (2005)	The likelihood of going public increases in market valuation, when the expected aggregate profitability or the prior uncertainties rise, it will be the optimal time to go public, after the IPOs, the liabilities, capital expenditure and sales will increase whereas profitability will decrease	
	Exploiting windows of opportunity		Ljungqvist, Nanda and Singh (2004)	Going public is likely when market returns are abnormally high	
	Market monitoring	Divestment	Maug (2001)	Young firms are less likely to go public	Life Cycle Theory
	Solving over-monitoring and under-monitoring problems		Pagano and Roell (1998)	IPO is more likely for firms with high capital investment, the likelihood of IPO increases in the founders' private benefit of control, the effectiveness of market monitoring and the degree of legal protection on small shareholders	
	Reducing exposure to idiosyncratic risks, low adverse selection costs		Ellingsen and Rydqvist (1997), Wagner (2002)	Exit via IPO is more likely for good firms, selling firms should be old, selling out via IPO is less likely for small and young independent firms	
	Avoiding excessive owner-manager conflicts, protecting controlling status, maximizing sales		Zingales (1995), Mello and Parsons (1998)	Selling out via IPO is likely if private benefit of control rights is important, operating performance decreases after the IPOs, IPOs are followed by SEOs	

Table 2.2 Empirical Evidence on IPO Motivation and Timing

Author(s)	Market and Sample	Evidence	Relevant Theories
Investment motives and the timing			
Chemmanur, He and Nandy (2007)	US manufacturing IPOs	The likelihood of going public increases in firm size, capital investment and industry risks of cash flow, whereas decreases in information asymmetry, the sales and capital expenditure of the IPO firms increase both before and after the IPOs	Chemmanur and Fulghieri (1999) and Clementi (2002)
Fischer (2000)	Germany Neuer Market high-tech IPOs	The likelihood of going public increases in investment intensity, intangibility and R&D intensity, controlling shareholders keep (and consolidate) their control after IPOs	Maksimovic and Pichler (2001), Zingales (1995)
Boehmer and Ljungqvist (2004), Burgstaller (2005)	German IPOs, Austrian IPOs	The likelihood of going public increases when market and economic conditions improve	Subrahmanyam and Titman (1999)
Houge and Loughran (1999)	US banking IPOs	Banking IPOs are likely to be driven by the need to meet regulatory capital requirement and the intention to sell overvalued stocks	Ljungqvist, Nanda and Singh (2004), Ritter (1991)
Pagano, Panetta and Zingales (1998)	Italian IPOs	The likelihood of going public is positively related to firm size and industry market-to-book ratio, the reason to go public is to raise funds to re-pay debt and to facilitate future borrowings	Financial constraints
Huyghebaert and Van Hulle (2006)	Belgian IPOs	Small growth firms tend to be driven by financing motives, they are more likely to issue SEOs	Chemmanur and Fulghieri (1999)
Divestment motives and the timing			
Rosen, Smart and Zutter (2005)	US IPOs of banks and bank holding firms	The IPO banks are more likely to be acquired	Zingales (1995), Mello and Parsons (1998)
Ang and Brau (2003)	US IPOs	Issuers tend to conceal information about insider selling, aiming for insider-wealth maximization	Zingales (1995), Mello and Parsons (1998)
Helwege and Packer (2003)	US large and highly leverage non-financial IPOs	Firms with significant shareholdings by outsiders are more likely to go public, firms with insider ownership seldom make IPO decisions	Zingales (1995), Mello and Parsons (1998)
Pagano, Panetta and Zingales (1998)	Italian IPOs	IPOs are related to sales by controlling shareholders, divestment is one motive of going public	Zingales (1995), Mello and Parsons (1998)
Huyghebaert and Van Hulle (2006)	Belgian IPOs	The IPOs of established firms tend to be related to divestment motives, adverse selection costs matter	Ellingsen and Rydqvist (1997)

The UK market is one of the most important IPO markets but, surprisingly, there has been a lack of research on the IPO decision *per se*. In contrast to Italy and Belgium, both of which are French civil law countries, the UK legal system is based on common law La Porta, Lopez-de-Silanes, Shleifer and Vishny (2000) argued that legal origin shapes the legal rules of a country This consequently influences how well legal rules protect outside investors. French, German and Scandinavian laws are made by legislation and courts normally do not intervene in investor expropriation providing that the transaction has a reasonable business purpose. In contrast, legal rules in English common laws are made by judges who have the power to make new rules on new situations by applying general principles Therefore, unfair investor expropriation can be limited by the expansion of legal rules. In addition to strong judicial power, greater protection of private property rights against government intervention in economic activity also makes English common law systems provide the best investor protection

Strong legal protection for outside investors in the UK boosts investor confidence and promotes a well-developed and liquid capital market, where institutional investors play an active and important role. Considering the substantial differences in the legal and financial systems between UK and other continental European markets, it seems essential to examine the decision to go public for UK firms, compare whether or not IPO firms in the UK perform the same as elsewhere and discover the functions of the stock market in the UK.

3 The Primary Equity Markets in the UK

This chapter describes the institutional characteristics of the UK stock market and its primary equity markets, looks at the regulatory and documentation requirements of the UK primary equity markets for IPOs and its IPO offering and pricing techniques, reviews existing empirical research about UK IPOs and sets out the research focus in this study.

3.1 The UK Stock Market

The UK stock market is an Anglo-Saxon market and is one of the largest in the world by market capitalisation. The UK financial system is market-oriented. In contrast to the bank-based system of continental Europe, in the UK the proportion of companies listed on the stock exchange is large And this capital market is known for its high liquidity – investors are able to sell their securities quickly and easily in the market place

The UK legal system is based on common law, i.e. a case-based system It is generally agreed that the legal system and its origin strongly affect the corporate governance rules of a country and the development of an external capital market La Porta *et al* (1997, 1999) attributed this to differences in investor protection which is greater in common law systems. The stock market is one important source for companies to raise additional capital and one useful channel for some original shareholders to exit by selling shares to the public There is, however, a problem with this separation of ownership and control. Public investors who provide funds wish to profit from having ownership while managers who control the firm are willing to exploit their private benefit of control at the cost of the investors A good legal environment can protect public investors (the minority shareholders) from expropriation by managers. In addition, transparent accounting standards, strict disclosure rules and informative stock prices enhance market monitoring of management. These encourage investors to provide money in exchange for ownership and boost the development of stock market. An English origin (common law system) provides the best protection for shareholders and creditors, generally promoting a developed stock market. French civil law countries provide the

least investor protection, whereas German and Scandinavian civil law countries lie in the middle.

In this liquid and well-developed market financial intermediaries play an active and important role in producing information, and the efficiency in revealing information about firms is generally high. These all serve to reduce the costs of information production for public investors. Lower information costs and high efficiency of market-specific information may encourage firms to go public at an earlier stage in their growth (Chemmanur and Fulghieri, 1999, Subrahmanyam and Titman, 1999)

The London Stock Exchange is the market place for stock flotation and security trading. A wide range of securities trade in the market, including UK and international equities, debt, covered warrants, exchange traded funds (ETFs), exchange traded commodities (ETCs), REITs, fixed interest, contracts for difference (CFDs), depositary receipts and derivatives The LSE hosts four primary markets: the Main Market, the Alternative Investment Market (AIM), the Professional Securities Market (PSM) and the Specialist Fund Market (SFM) The Main Market and AIM are the primary markets for equity new issues; PSM is the market for listed debt and depository receipt securities, SFM is the market for specialised investment entities such as large hedge funds, private equity funds etc. The primary equity markets (the Main Market and AIM) have some unique institutional features which distinguish them from other developed stock markets

3.2 The Main Market and AIM

The LSE enables both domestic and international companies to list on one of the two primary equity markets There are currently more than 2,800 companies[16] listed on the markets, ranging from small young firms to established large companies, with a market value over 3,500 billion pounds.

The Main Market is also referred to as the Official List and is mainly targeted at established large companies. It hosts some of the largest corporations such as BP, HSBC

[16] The statistics in this section all come from the London Stock Exchange

Holdings, Vodafone Group and GlaxoSmithKline Each of them has a market capitalisation as of December 2008 of over 60 billion pounds. In total, the Official List has around 1,800 companies with a combined market capitalisation of around 3,500 billion pounds (as of June 2008) Within the Main Market, there are two specialist segments for certain industry sectors techMARK® which was launched in 1999 and created for innovative technology companies, and techMARK mediscience® which was launched in 2001 and focused on innovative healthcare companies.

AIM was established in 1995 and designed for smaller growth firms. On average, the companies listed on AIM are much smaller in comparison with the Official List For instance, three of the largest companies listed on AIM – Lancashire Holdings, Playtech and Sibir Energy all have a market capitalisation of below 900 million pounds (as of December 2008). AIM currently has more than 1,060 companies with a total market capitalisation of 37 billion pounds (as of June 2008).

The listing requirement on AIM is less strict than the Official List[17], and even less strict than AMEX and NASDAQ in the US market Since its establishment, AIM has attracted 65% of all IPOs in Western Europe, and many foreign companies have chosen to cross-list on the AIM segment As of June 2008, there have been 1739 IPO deals on AIM which raised a total of 29 billion pounds. This includes 312 IPOs of foreign companies from 25 countries including USA, Canada, Australia, Netherland etc. These cross-listings raised 8 5 billion pounds altogether, which accounts for nearly a third of the total money raised from the AIM segment. However, the cross-listings on AIM are rather small as compared to the ones on the Main Market. For example, from January 1998 through June 2008, there were 791 IPO deals on the Main Market which raised more than 116 billion pounds. 168 of them are foreign firms (from 48 countries around the world). In total, they raised nearly 54 billion pounds, which accounts for nearly half of the total money raised from the Main Market during this period. Nevertheless, as one of the most successful growth markets in the world, AIM offers valuable access to capital for those companies that cannot float on the Official List and it has started to become a truly international exchange.

[17] Please see section 3 3 for details

The LSE provides two levels of admission IPOs and introductions. This allows the separation of firm listing and issuing equity. The common concept of IPO refers to listing and selling shares (primary shares, secondary shares, or a combined of both) simultaneously. In an IPO, the nominated broker(s) (together with the directors) takes the responsibility of the pricing and the marketing of the IPO shares In contrast, an 'introduction' refers to a new listing on the stock exchange. In an introduction, no primary or secondary shares are issued. Introductions typically result from the following cases a company which move its listing from the AIM to the Official List; a foreign company which lists on the LSE but does not raise funds.

In the introduction stage, an introduction prospectus is required However, if a firm has already gone through the introduction stage (i.e. it is already listed), the incremental requirements for an offering are minimal. After the introduction, when the firm wishes to issue equities, the introduction prospectus then needs to be updated and filed with the terms of the offering Derrien and Kecskés (2007) argued that such two-stage offerings reduce the uncertainties on the IPO pricing and allow the firms to time the market more efficiently.

The IPO volume of the LSE exhibits great volatility as market conditions go up and down. This is a common feature of almost all IPO markets around the world Yet, among all the European IPO markets, the LSE generally has the largest IPO volume. Loughran, Ritter and Rydqvist (1994, updated 2006[18]) compared IPO volume cross countries For example, there were 93 IPOs in Belgium during the period 1984-2004, 181 IPOs in Italy during 1985-2001, 332 IPOs in Sweden during 1980-1998, 545 IPOs in Germany during 1978-2001, whereas 3,122 IPOs in the UK during 1959-2001 The legal system in the UK offers better protection for minority shareholders, which may have encouraged investment in the IPOs.

The LSE is home to both young, small and mature IPO issuers. However, as compared with other European markets, the IPO issuers of the UK market are much younger and smaller. For instance, Ellul and Pagano (2006) reported an average firm age[19] of 7.12

[18] http //bear cba ufl edu/ritter/InternationalTable2006%20(2) pdf
[19] Firm age was defined as the number of years between the firm's initial incorporation and the time of the IPO

and firm size[20] of 51.22 million pounds for 337 IPOs carried out between June 1998 and December 2000 on the LSE In contrast, Pagano *et al* (1998) documented a much older average firm age of 33.43 and much larger average firm size of 257.20 billion lire (roughly 117 million pounds) for 68 IPOs listed on the Milan stock exchange between 1982 and 1992. Similarly, Huyghebaert and Van Hulle (2006) documented an average firm age of 39 44 and firm size of 281 60 million Euros (about 247 32 million pounds) for 95 IPOs floated on the three main exchanges of Belgium between 1984 and 2000. Issuers at different growth stage may go public for different reasons Young issuers at an earlier growth phase are expected to raise capital from the market to fund investments, whereas mature issuers are likely to go public for reasons other than to finance growth The differences in IPO volume and IPO firm age and size of the UK market suggest that the factors that affect an IPO decision in the UK may differ from other European markets

3.3 The Regulatory and Documentary Requirements

3.3.1 For the Main Market

The companies that intend to list on the Main Market are subject to regulation by two regulatory bodies[21] the UK Listing Authority (UKLA) which is part of the Financial Services Authority (FSA), and the London Stock Exchange (LSE) which has its own rules and regulation regarding a company's suitability for listing. The FSA has overriding authority over the LSE. Firms that wish to float on the Official List must first apply to the UKLA for its securities to be 'admitted to the Official List' and then to the LSE for its securities to be 'admitted to trading'

The laws governing new issues include the *Financial Services and Markets Act 2000 (FSMA)*, the *Public Offers of Securities Regulations 1995 (POS Regulations)* and the *Companies Act 1989*. The section 'Official Listing' in the *FSMA* clearly defines the competent authority of new issues of securities; rules on listing and delisting securities, listing particulars, prospectuses and disclosure, sponsors, advertising and other general

[20] Firm size was defined as the sales during the year preceding the IPO
[21] Before 2001, the LSE acts as the sole regulator of new issues

provisions The *POS Regulations* set out the definition of a public placement which requires prospectuses and full disclosure, and the definition of a private placement which does not require statutory disclosure

In addition to the three main governing laws, the publicly listed companies also have to comply with the *Listing Rules* (current version May 2007 at the time of writing), the *Prospectus Rules* and the *Disclosure and Transparency Rules*, which are issued by the UKLA, and the *London Stock Exchange Admission and Disclosure Standards* (current version November 2007) which are issued by the LSE

The *Listing Rules* was traditionally issued by the LSE, but is now published by the FSA, and is part of the *FSA Handbook.* It dictates minimum requirements for the admission of securities to listing, the contents, approval and publication of listing particulars; listing principles, sponsors; and the ongoing obligations of issuers after admission (such as the disclosure of price sensitive information, communications on new share offers, rights issues, potential or actual takeover bids for the company etc). The *London Stock Exchange Admission and Disclosure Standards* sets out the rules and responsibilities in relation to a company's admission to trading and the ongoing disclosure obligations

According to the *Listing Rules*, all companies incorporated in the UK and listed on the Main Market are required to state in their annual reports on how they have applied the main principles of the *Combined Code on Corporate Governance*[22]; whereas overseas companies listed on the Main Market are required to disclose any significant way in which their corporate governance practices differ from those set out in the Code.

The main document that is required by the UKLA before an IPO takes place is the prospectus The preparation of a prospectus is the most important stage in a listing process; and a prospectus must contain all the necessary information for potential investors to assess the company's shares and for the UKLA to assess the suitability of the company to be admitted to the Main Market A UK prospectus must include

[22] The *Combined Code on Corporate Governance* (current version June 2008 at the time of writing) sets out standards of good practices in relation to issues such as board composition and development, remuneration, relations with shareholders, accountability and audit The listed companies need to either confirm that they have complied with the Code's provisions or, where they have not, to provide an explanation

information about the persons responsible for the document, placing statistics, company background and business, accountants' reports on the issuer's prior three years' financial results, description of share capital and any changes in the prior three years, management and block shareholders (have more than 3% shareholdings), and the recent development and prospects of the issuer. The placing statistics include information on the book price and placing price of the IPO shares, number of new shares being placed by company, number of existing shares being placed by vendors and number of shares outstanding before and after the IPO. In circumstances where a prospectus is not required (e g. a company is seeking admission of new securities to the Official List but no public offering is made), listing particulars are required by the UKLA. Listing particulars contain detailed information about the securities and the issuer

The following key eligibility criteria must be met for an admission to the Official List:

- *Compliance with the Exchange's Admission and Disclosure Standards,*
- *Appointment of a sponsor,*
- *Compliance with the Listing Principles,*
- *Prospectus approved by the UKLA,*
- *Minimum market capitalisation of £700k,*
- *Free transferability of securities,*
- *A minimum of 25% of shares in public hands,*
- *Having at least three years' audited historical financial information,*
- *At least 75% of the entity's business must be supported by a revenue earning track record for the three year period,*
- *Control over the majority of the entity's assets for the three year period,*
- *Clear working capital statement (sufficient working capital for at least 12 months from the date of the prospectus)*

3.3.2 For AIM

AIM is an exchange-regulated market. The companies that intend to list on AIM are not bound by the *Listing Rules* of the UKLA but must abide by AIM's own set of rules, the *AIM Rules*. The admission requirements for AIM and the ongoing obligations after admission are less stringent than those for the Main Market; and the *Combined Code on*

Corporate Governance is not mandatory for AIM companies. Nevertheless, companies seeking an AIM listing must comply with relevant legislation such as the *POS Regulations*, in addition to the *AIM Rules*.

There are no restrictions on the type of company that can apply to be admitted to AIM. The companies can be start-ups or established firms However, this does not mean that all small firms are able to be admitted, considering the substantial costs involved in a successful AIM flotation. The costs can vary significantly from around £300k to £1,000k in adviser's fees In addition, there are also broker fees of between 2% and 5% of all money raised. On average the total cost of floating on AIM was £480k, according to the statistics in 2002.

Unlike the shares traded on the Main Market, the shares traded on AIM are unquoted for tax purposes As a result, there are certain tax incentives making investments in AIM companies attractive to both individual and institutional investors However, as AIM-listed companies typically have high risk profiles, AIM's investor base is largely composed of sophisticated institutional investors who maintain close relations with companies (Mendoza, 2008).

The admission criteria for the AIM are relatively less strict

- *No minimum size of company,*
- *No minimum proportion of shares to be in public hands,*
- *No trading record requirement,*
- *No prior shareholder approval for the majority of transactions,*
- *No restrictions on the transferability of the company's shares,*
- *No requirement to be incorporated in the UK*

The following criteria must be met for an admission to the AIM:

- *An applicant must appoint a nominated adviser (NOMAD) and an AIM company must retain a nominated adviser at all times,*
- *An applicant must provide the Exchange, at least ten business days before the expected date of admission to AIM, with the required information,*

- *An applicant must produce an admission document disclosing the required information This document must be available publicly, free of charge, for at least one month from the admission of the applicant's securities to AIM,*
- *At least three business days before the expected date of admission, an applicant must pay the AIM fee and submit to the Exchange a completed application form and an electronic version of its admission document These must be accompanied by the nominated adviser's declaration,*
- *Where an applicant's main activity is a business which has not been independent and earning revenue for at least two years, it must ensure that all related parties and applicable employees as at the date of admission agree not to dispose of any interest in its securities for one year from the admission of its securities,*
- *Where the applicant is an investing company, a condition of its admission is that it raises a minimum of £3 million in cash via an equity fundraising on, or immediately before admission,*
- *The Exchange may make the admission of an applicant subject to special conditions,*
- *The AIM company must also meet requirements of principles of disclosure, disclosure of price sensitive information, disclosure of corporate transactions, disclosure of miscellaneous information, half-yearly reports, annual accounts and other ongoing obligation as specified in the AIM Rules*

In essence, AIM's regulatory model has arisen from a trade-off between compliance costs and investor protection; it is based on a comply-or-explain option and the NOMADs play a key role as gatekeepers, advisers and regulators of the AIM companies. On one hand, these enable smaller firms with growth potential to access a large pool of capital at relatively low costs as compared to the Official List On the other hand, AIM listed companies inevitably face potential constraints of weak corporate governance and poor standards of disclosure. It has been argued that as more foreign companies choose to cross-list on the AIM and more retail investors are attracted to the market, to develop the AIM segment to a deeper and more liquid market it is necessary to tighten its rules accordingly – for instance, on the regulation of NOMADs and on disclosure rules (Mendoza, 2008).

3.4 The IPO Offering and Pricing Techniques

There are generally two offering techniques by which a UK or a foreign company can float on the Official List or AIM: public offers and placings

In public offers, shares are sold directly to the public. Public offers consist of two types Offer for Sale, in which old shares are sold by the existing shareholders, and Offer for Subscription, in which new shares are created and sold by the issuing company. Public offers generally use fixed pricing techniques. In the fixed price method, the offer price is set before taking purchase orders and is normally set through negotiation between brokers and issuers Therefore, the offer is priced without knowing actual investors' valuation and demands.

Such an offering and pricing process is associated with a Winner's Curse problem (Rock, 1986) There are better informed and less informed investors competing with each other in the market Less informed investors incur higher risks if the offer price is less than the expected value of the IPO stock, better informed investors will obtain most of the shares offered, whereas if the IPO stock is over-priced, less informed investors will get all the shares they request To attract less informed investors and compensate for the risks that they take, the issuer who is uncertain about the market demand would have to underprice the IPO stock

Another offering technique is placings. In placings, shares are sold to specific investors through brokers or other intermediaries rather than directly to the public. The investors are often institutional investors. However, on smaller issues, shares are sometime sold to retail investors as well. Before the 1990s, most placings used fixed pricing technique However, since the 1990s, bookbuilding has become the predominant pricing method In a bookbuilding process, the leading underwriter or sponsor is responsible for road shows and other marketing activities to decide the target investors And potential investors have to place an order through a stock broker who is participating in the offering. As a result, the underwriter is able to discover potential investors' valuations prior to setting the offer price and allocating IPO shares, and adjust offering terms in favour of the offering This enables the underwriter to discriminate among investors and

allocate IPO shares to investors who report higher values.

Biais and Faugeron-Crouzet (2002) argued that the offer price set by the bookbuilding method is more informative and better reflects the true value of the IPO. Consequently, the less informed investors are less likely to receive overpriced IPO stocks. This eliminates the winner's curse problem caused by the fixed pricing method and reduces underpricing By allocating larger amounts of IPO shares to investors who set higher prices, the issuer also receive increased proceeds from the offering.

Apart from the flexibility to adjust the offer price, the bookbuilding method allows the issuer to adjust the number of shares offered. Benveniste and Busaba (1997) pointed out that when investor demand is strong, issuing more shares reduces underpricing required for each share. Benveniste and Spindt (1989) suggested that repeat dealings between the underwriters and institution investors over different IPOs give the underwriter the power to exclude certain investors (e g those who provide low pricing while demanding high underpricing) from future hot IPOs. This enables the underwriter to demand lower underpricing for the current IPO Sherman (2001) argued that such a threat also applies to regular retail investors and this can further reduce underpricing.

Since 1996, placings and bookbuilding have become the preferred IPO method in the UK, and underwriters have been playing an important role in IPO allocation as intermediaries Consequently, the winner's curse problem that arose from the pro-rata allocation may have been alleviated and the factors that affect underpricing may have changed

3.5 Empirical Research on IPO Activities in the UK

Earlier studies of UK IPOs focused on the IPO underpricing issue For example, Levis (1993) found that the winner's curse hypothesis can only partly explain the degree of underpricing of UK IPOs. This suggested that testing other underpricing hypotheses is necessary In addition, Levis's study was based on early years from 1980 to 1988 when the offer for sale (a public offer method) and fixed pricing were the preferred IPO

methods However, since the late 1990s, placing and bookbuilding pricing has become the predominant IPO technique In addition, since the establishment of the AIM segment in 1995 many smaller and growth companies have been encouraged to join in the stock market. The new AIM regulatory model and the different risk profile of these new issuers may also have affected IPO activities in the UK. The changed IPO subscription and allocation method, alongside the different market participants and the changing market constraints and institutional features make it essential to re-examine the UK IPO activities in recent periods

Another interesting study also based on an early sample from 1986 to 1989 is that of Brennan and Franks (1997). They studied the underpricing and the separation of corporate control and ownership of UK IPOs. They found that in the seven years after the IPOs, non-director shareholders were reduced substantially. However, there were few changes of director shareholdings. In the ten years after the IPOs, although the acquisition activities of the IPO firms were frequent, there were very few hostile takeovers Furthermore, the degree of underpricing was negatively related to the post-IPO size of block shareholders They therefore suggested that IPO activities facilitated the separation of corporate control and ownership and optimised ownership dispersion, while protecting the private benefit of control of insiders Underpricing was used as a means to induce oversubscription, to ration share allocation and to favour dispersed outside-investors so as to retain effective control of managers. However, critics argued that protecting the private benefits of control may not be the only reason why dispersed outside ownership is favoured – underpricing may also be used to encourage monitoring and minimise agency costs (Stoughton and Zechner, 1998). Hence the ownership and control based arguments need to be justified in the UK context

Reber, Berry and Toms (2005) studied the impact of shareholding structure, money raised, advisers' reputation, and managerial experience on the market value of a sample of 172 UK IPOs floated during 1992-1996 However they included only IPOs on the Official List. They found that the extent to which existing owners keep their stakes positively affected the value of the IPOs in the aftermarket A larger amount of money raised could be viewed as an indicator of growth opportunities and was associated with

high market value The experience of the board had significant impact on the IPO performance whereas advisers' reputation appeared to be irrelevant.

However, there is an apparent lack of research on the motivation and the related timing for going public of UK firms This amounts to an important gap in the empirical literature In this thesis, I address this basic question. why and when do the UK firms choose to go public? I focus on the recent period and take the AIM segment into account I also examine IPO underpricing in relation to the reasons for going public, and investigate the post-IPO performance (including both financial performance and performance of stock prices in the aftermarket in the short-run). These will help to draw a more complete view of the IPO activities and the function of the stock market in the UK.

4 Data

To implement the analyses, I need a panel of accounting and ownership data for the IPO firms before, at and after listing, and those of the control group of firms that stayed private over the matching periods. In addition, I need a cross-sectional dataset of the IPO structure[23], data for market conditions[24] over the sample periods, and descriptive data including firm age, whether or not the IPO was a carve-out[25], the industry group[26]of the firm, and the market segment where an IPO was listed. Finally, to investigate underpricing in relation to IPO decision, I need the offer price of the sample IPOs and their daily closing prices in the aftermarket over the IPO windows.

I collected the data from four main sources: Thomson Financial's SDC Platinum Global New Issues[27] database, Bureau van Dijk's FAME[28]database, IPO prospectuses obtained from Companies House (the national registrar for UK companies) and Thomson Financial's Datastream.

In SDC Platinum Global New Issues, I searched for UK non-financial firms listed on the London Stock Exchange (including both Official List and AIM segments) from Jan 1998 through Dec 2003. The SDC Global New Issues database reported 835 IPOs over these six years I excluded financial firms, non-UK registered firms and firms with a foreign parent company, leaving 406 non-financial UK IPOs[29]. Of these, 223 firms were excluded because the necessary accounting data were incomplete This leaves 183 non-financial UK firms which held IPOs during 1998-2003. The list of the IPOs was

[23] These include the number of primary shares and secondary shares offered in the IPOs, and the number of total shares outstanding immediately following the IPOs

[24] These include market return (in relation to the theories), IPO volume (measured by the number of IPOs) for each sample year (for description only), and a year dummy

[25] A carve-out is a sale of the subsidiary's stock in an IPO, which consist of either secondary shares owned by the parent, primary shares in the subsidiary or both

[26] Maksimovic and Pichler (2001) suggested that technology risks have a distinct impact on an IPO decision Therefore, an industry dummy was added, it equals one if the IPO firm belongs to ICT industry

[27] The SDC Platinum Global New Issues database provides detailed information of all new issues in the global markets

[28] The FAME database provides data of companies' financial statements, ownership structure etc for the largest 2 6 million UK and Irish companies

[29] The 406 non-financial IPOs of the UK registered firms (excluding firms with a foreign parent company) consist of 319 primary share offerings (i e only primary shares are offered in an IPO), 84 combined offerings (i e both primary and secondary shares are offered in an IPO), and 3 secondary share offerings (only secondary shares are offered in an IPO)

also cross-checked with a list drawn from the LSE website[30]

A list of private firms was drawn from FAME The control group of private firms included firms staying private from 1996 to 2007, from all industries (except financial industry) that had IPOs during 1998-2003. Each private firm should have at least one financial year between 1998 and 2003 in which total assets exceeded £500,000. If not, it would be unlikely to be able to afford an IPO. Private firms with foreign parent companies, or with account type 'partial/full exemption' or 'dormant' or 'small company' or with substantial missing data were all excluded. This yielded 2315 non-financial private firms

The accounting and ownership data of the IPO and non-IPO firms were obtained from FAME and the IPO prospectuses. Data in FAME can be traced back to 1996, so the sample period was limited to 1996-2007. All listed companies must publicly disclose their financial statements in a timely manner, so all accounting data for the post-IPO periods were collected from FAME. For the pre-IPO periods, a substantial number of IPO firms did not have data in FAME. In these cases, I collected pre-IPO data directly from accountants' reports in their IPO prospectuses.

To describe ownership concentration, block shareholders were defined as those with at least a 3% shareholding Block holders were split into those who were directors and those who were not, so as to distinguish between managerial and non-managerial ownership. Firm age at the time of IPO was drawn from IPO prospectuses Two types of age were defined: first, the age since the firm started its business ('firm age'); second, the time between incorporation and the IPO ('incorporation age') Often, firms do not incorporate when they start up, but wait until their business grows more mature. Because at this point in time, they need to set out clearly the legal benefits for the owners, to protect personal assets and to facilitate potential future transactions (such as sale of stock, transfer of ownership) In some cases, incorporation takes place as the immediate (and necessary!) precursor to the planned IPO. Thus, the incorporation age does not measure the real age of firms.

[30] The LSE website provides complete statistics of new issues from Jan 1995 for AIM whereas from Jan 1998 for the Official List

FTSE indices were obtained from Datastream and used to calculate the market returns. Together with IPO volume, these were used to describe market conditions. During the sample period, the UK market experienced something like an IPO cycle with generally rising volume until late 2000, followed by a quieter period. It would also appear that there was a broadly positive relationship between share prices and IPO volumes in this period (Figures 4.1 and 4.2).

Figure 4.1 FTSE Indices 04/1996-03/2006

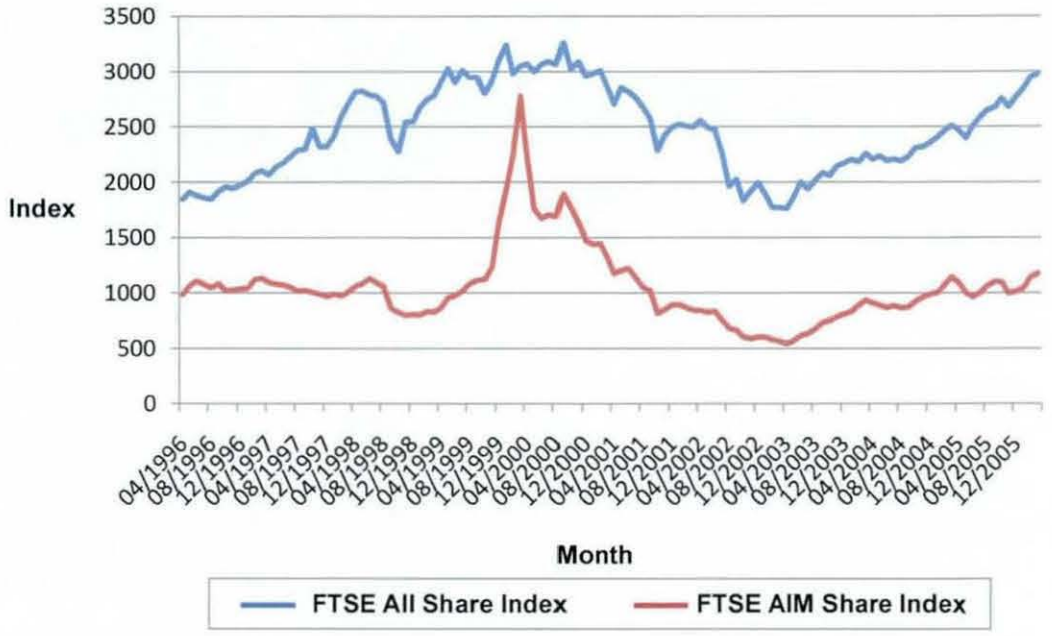
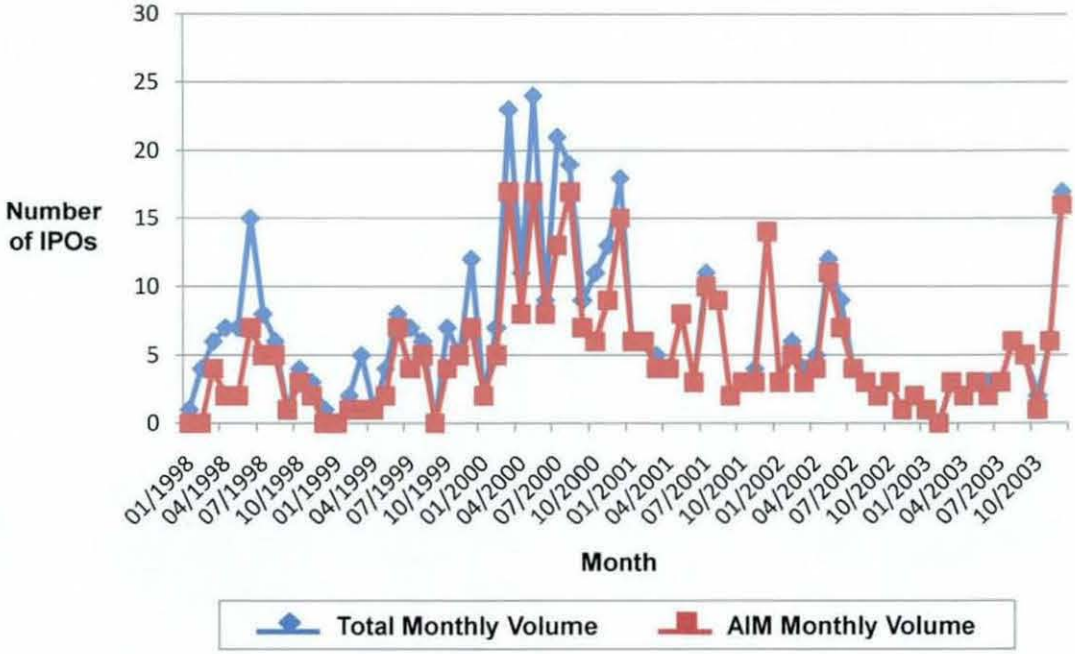


Figure 4.2 IPO Volume 01/1998-12/2003



The data on IPO structure were obtained from SDC Platinum Global New Issues There were cross-checked with the information disclosed in IPO prospectus. I also collected information about SEO firms and deals, offer prices and the type and number of shares offered in the SEOs from SDC. After-market trading prices were downloaded from Datastream. All other descriptive data were collected from FAME and SDC.

The characteristics of the different datasets are described in more details in the respective empirical chapters (chapter 5 to chapter 8).

5 Staying Private or Going Public?

An Empirical Analysis of the IPOs Listed on the Main Market and AIM

5.1 Introduction

In this first empirical chapter, I address the general question as to why firms choose to go public rather than stay private. I apply a panel probit approach to examine the *ex ante* determinants of the decision to go public, and apply a fixed effects model to look into the *ex post* consequences of the IPOs. Pagano *et al* (1998) argued that if IPO decision makers have rational expectations, the *ex ante* and the *ex post* analyses should provide consistent results. Therefore, I investigate both *ex ante* and *ex post* firm characteristics

In the sample of Italian firms, Pagano *et al* (1998) found that the likelihood of going public was positively related to firm size and industry market-to-book ratio and that, after the IPOs, profitability, investment, leverage and the costs of bank credit were reduced. It thus appeared that Italian firms were likely to use IPOs to rebalance their financial structure and to facilitate future borrowings rather than to finance an immediate investment. They also found that some firms utilised the IPO as a channel to gradually sell out of the companies

The UK stock market is distinct from Italy by its high liquidity and market efficiency, active institutional investors and strong legal protection for smaller investors. Where market efficiency and legal protection are high, the costs of information production are reduced As a result, firms should be encouraged to go public at an earlier stage (Chemmanur and Fulghieri, 1999) In addition, the high capitalisation ability of a stock market generally increases the value and precision of the serendipitous information generated by public investors. This would encourage more firms to raise capital from the stock market. Furthermore, in a market where legal protection for shareholders is strong, minority-controlling shareholder conflicts are relatively less of a concern. On the other hand, manager-shareholder conflict might be better resolved by market monitoring (Holmstrom and Tirole (1993), Maug (2001)). Because of all these

characteristics of the UK stock market, it is expected to see a different picture for IPO activities in the UK

The analyses in this chapter are based on a panel data of 183 non-financial UK firms that listed on the London Stock Exchange during 1998-2003 and 2315 non-financial firms that stayed private over the period 1996-2007. The sample includes both IPOs listed on the Main Market and those floated on AIM. AIM is often criticised for its loose regulation and high risks To distinguish the role of AIM from the Official List, I investigate the *ex post* consequences of the IPOs separately for those on the Official List and those on AIM.

I analyse both the *ex ante* determinants and the *ex post* consequences of the IPOs respectively in the whole sample, and in subsamples of independent firms and carve-outs. Pagano *et al* (1998) found that carve-outs seemed to go public for different reasons from independent firms. Independent firms were likely to raise finance from the stock market to reduce leverage whereas carve-outs were likely to utilise windows of opportunity to maximise the proceeds from selling shares Carve-outs also seemed to divest a greater percentage of shareholdings. Therefore, it is necessary to examine the behaviour of the independent firms and the carve-outs separately

The rest of the chapter is organised as follows: section 5 2 constructs the hypotheses and describes the sample, section 5.3 analyses the determinants of the IPO decision; section 5 4 compares post-IPO and pre-IPO operating performance, section 5.5 provides concluding remarks.

5.2 Hypotheses and Sample

5.2.1 Hypotheses

Financial Constraints

Firms need to fund their investments so as to grow When internal capital is insufficient,

they will have to seek external finance, either debt or equity In debt market, there are asymmetric information problems between borrowers and creditors. the borrower has private information about the firm whereas creditors cannot fully observe the risks of the firm's investment and managerial effort; creditors face potential risks that the borrower may misbehave and pursue its private benefit The existence of such moral hazard problems for debt financing may give rise to credit rationing (Stiglitz and Weiss, 1981) and a debt overhang problem (Myers, 1977), which may prevent firms from realising their investment opportunities. Weak profitability implies that internally generated cash is likely to be insufficient to support intensive investments. Firms with large investments, weak profitability and high leverage are more likely to suffer from borrowing constraints In this case, equity financing such as public equity can be an attractive alternative to debt financing

Hypothesis 1 The likelihood of an IPO is positively correlated with leverage and investment and negatively correlated with profitability[31]

Cheaper Capital

The choice between private and public equity in part, depends on a trade-off between risk premiums for a lack of diversification and costs of information production (Chemmanur and Fulghieri, 1999) Raising capital from a large number of public investors enhances the firm's bargaining power, and liquidity created for the firm's equity allows its shareholders to diversify their portfolios. These reduce risk premiums that would otherwise be required by private equity investors However, each public investor needs to evaluate the IPO firm at a cost. Overall, there are sizeable duplications of the costs on information production and ultimately it is the firm that needs to pay for the total costs incurred. When sufficient information about the firms has accumulated in the public domain and there is less uncertainty, informational costs are greatly reduced and hence public equity can be cheaper than private equity. Therefore, in general, firms go public after start-up stage. For firms with great capital investment, private equity investors tend to increase the expected rate of return for investing a larger fraction of their wealth in a given firm. On the other hand, when raising large amounts of capital for investment from public investors, it is more expensive for a bad firm to pretend to

[31] Profit is the principal long-term source of internal capital for firms The ability of firms to generate cash internally is often measured by profitability

be a good one, and hence it is less likely that distorted information about the true value of the firm is included in offer price Therefore, public equity can be cheaper than private equity for young firms with great capital investment

Hypothesis 2 Firms with greater capital investment are likely to go public at an earlier stage

The relative costs of public equity can also be affected by market conditions. During periods when the stock market is over-optimistic, firms' stocks can be overvalued Firms may exploit such windows of opportunity and take advantage of mispriced public equity (Ritter, 1991) From a different point of view, Subrahmanyam and Titman (1999), Clementi (2002) and Pastor and Veronesi (2005) argued that firms time their offering to coincide with the peak of market valuation Fluctuation in stock prices can reveal valuable information about the expected payoff on firms' growth opportunities Timing an IPO to coincide with a high stock price can facilitate the firm's investment decision

Hypothesis 3 The likelihood of an IPO is higher in a bull market

Shareholder Exit and Maximizing the Selling Proceeds

Rather than going public to raise finance, some firms may utilise IPO as a channel for their shareholders to cash out Ellingsen and Rydqvist (1997) argued that divestment may arise from the original shareholders' willingness to diversify personal portfolios and reduce exposure to risks Divesting via an IPO is superior to a direct sale, because informative stock prices established in the after-market can reduce the information discount demanded in a direct sale, and increase total proceeds from the subsequent SEOs. However, the exit might be perceived as a bad signal by public investors. Outsider-investors might ascribe the sale to poor entrepreneurial performance or to decreasing investment value, which may lead to a failure of the IPO. Firms at a late stage of life cycle and firms with sound financials have lesser adverse selection problems. Therefore, they are more likely to utilise the market device to sell out.

Hypothesis 4 The likelihood of an IPO is positively correlated with firm age and firm size and the financial conditions of firms

Raising equity capital potentially affects a firm's ownership and control structure For firms with concentrated ownership structure, when they raise equity from dispersed public investors, minority-controlling shareholder conflict is the main problem. Costly duplication of monitoring from minority block shareholders may cause an over-monitoring problem Minority block shareholders also have an incentive to engage in takeover activities, which jeopardises controlling shareholders' controlling status (Pagano and Roell, 1998). On the other hand, for firms with dispersed ownership structure, manager-shareholder conflict is the main concern when a firm accesses public equity A dispersed ownership structure provides less effective monitoring However, continuously quoted stock prices can reveal valuable information about managerial performance and a firm's growth prospects (Holmström and Tirole, 1993). This helps to create a managerial incentive mechanism and to curb managerial misbehaviours, and enhancing firm value. In this aspect, firms with a more dispersed ownership structure are more likely to benefit from monitoring capital in the stock market.

It is possible that some existing shareholders utilise an IPO to divest their shareholdings. If this is the case, when management extracts private benefits from shareholders, diffusion of ownership in the first-stage sale (i e an IPO) can be beneficial (Zingales, 1995). Selling minority stakes of a firm's stock to dispersed public investors can help its original controlling shareholders to retain and strengthen control, indirectly enhancing selling shareholders' bargaining power for the subsequent sale of controlling blocks and maximising the proceeds cashed in from a two-stage selling process.

Overall, whether an IPO is investment or divestment driven (or is driven by both), it is expected that:

Hypothesis 5 The likelihood of an IPO decreases in ownership concentration

5.2.2 Sample and Summary Statistics

The analyses are based on a panel data of 183 non-financial UK firms that listed on the Main Market or AIM during 1998-2003 and 2315 non-financial UK firms that stayed

private over the period 1996-2007 For the IPO firms, there are at least two years' data for the pre-IPO window and at least three years for the post-IPO window For the non-IPO firms, the year coverage is adjusted to match that of the IPO firms Each non-IPO firm has at least one financial year between 1998 and 2003 in which total assets exceeded £500k According to the statistics of the LSE in 2002, the average total direct cost of listing on AIM was £480k. To float on the Official List, it is generally even more costly The direct listing costs include underwriting fees, registration fees and many other on-going administrative expenses and fees such as auditing fees, stock exchange fees etc. These substantial fixed costs suggest that small firms are not likely to carry out a costly flotation (Pagano *et al*, 1998) Therefore, the sample of non-IPO firms was limited to these medium and large firms

Firms registered outside the UK or those with a foreign parent company were excluded, so as to concentrate on UK firms listed on the domestic market without considering cross-listings. Cross-listings can be driven by institutional factors such as lower listing costs and better legal protection, which are beyond the hypotheses tested in this chapter. Financial firms were excluded because they are subject to different regulations from non-financial firms and hence may be driven to go public by the need to meet regulatory requirements. The details of the data sources and sample selection criterion were reported in chapter 4

Table 5.1 contains some descriptive statistics for my sample Panel A-1 shows the industrial distribution[32] of the IPO and private firms. The largest number of IPOs is found in real estate, renting and business activities and manufacturing industry, which also have a large number of medium and large private firms. On the other hand, there were only few IPO deals in the construction industry and the wholesale and retail trades, although these industries too have a large number of medium and large private firms On average, IPO firms constitute 8 0% of the private firms in my sample. Dividing the sample according to whether a firm is independent or held by a UK parent firm (Panel A-2), it can be seen that the percentage of independent firms that went public is more than three times as high as the number of the firms with a British parent, suggesting much greater interests of independent firms in an IPO

[32] For the industry classification, I follow the UK SIC standard (2003)

Among the IPOs floated on the LSE during 1998-2003 (Panel B-1), there were 319 primary-only issues, 97 of which are included in my sample, 84 combined issues, all of which are included, and only 3 secondary-only issues, 2 of which are included This is quite different from e g. the Belgian IPOs in Huyghebaert and Van Hulle (2006), where secondary-only issues account for over a third of all the IPOs whereas primary-only issues make up only around a fourth. It appears that in comparison with Belgium, IPO activities in the UK are more related to financing than to transfer of ownership Panel B-2 reports the distribution of the sample IPOs over time, which shows that the sample coverage of the IPOs can reasonably reflect the IPO clusters over time.

Table 5.1 Sample Descriptive Statistics

Panel A-1. Industrial Distribution

Industry	Number of IPO Firms	Number of Private Firms
Mining and Quarrying	7	20
Manufacturing	37	262
Construction	4	477
Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and Household Goods	16	396
Hotels and Restaurants	9	101
Transport, Storage and Communication	11	95
Financial Intermediation	-	-
Real Estate, Renting and Business Activities	74	842
Education	3	12
Health and Social Work	3	23
Other Community, Social and Personal Service Activities	19	87
Total	183	2315

Panel A-2. Distribution of Ownership Status

Ownership Status	Number of IPO Firms	Number of Private Firms
Independent	143	1229
British Ultimate HLDS	40	1086

Panel B-1. Number of IPOs by Type of IPO Structure

IPO Structure	Primary-only Issues	Secondary-only Issues	Combined Issues
Number of IPOs in Sample	97	2	84
	(319)	(3)	(84)

Panel B-2. Number of IPOs by Year

Year of Listing	1998	1999	2000	2001	2002	2003
Number of IPOs in Sample	24	19	70	34	19	17
	(58)	(30)	(184)	(71)	(48)	(47)

Panel A-1 reports the number of sample IPO firms and private firms across different industries Panel A-2 reports the number of sample IPO firms and private firms across the two types of ownership status independent companies and British ultimate holding companies Panel B-1 reports the number of sample IPO firms divided according to the three types of IPO structure, the number of all IPOs that took place is presented in brackets beneath Panel B-2 reports the number of sample IPO firms across each sample year, the number of all IPOs that took place over the sample period is presented in brackets

The sample contains 17,360 firm-years. The mean of total assets and sales for the entire sample are respectively £9.03m and £9 18m Compared to private firms, the IPO firms

on average are slightly smaller but have particularly higher growth rate; they also have a lower return on assets. Weaker profitability yet higher growth suggests that the IPO firms are likely to be experiencing faster expansion, and that they are more likely to confront financial constraints than the private firms and hence are in greater need of external financing Compared to the Italian IPO firms (Pagano *et al*, 1998) and the Belgian IPO firms (Huyghebaert and Van Hulle, 2006), the UK IPO firms on average are much smaller, less levered and have weaker internal cash generation, i e are in an earlier stage of the life cycle

There are few differences between independent private firms and private firms with a British parent. By contrast, for the IPO subsample, the independent firms are on average smaller, with weaker internal cash generation (ROA) and much higher growth rates This implies that the independent IPOs may be in an earlier stage of growth and are more likely to be financially constrained than carve-outs[33] We may also expect that their motives for going public might differ.

Finally, IPOs listed on AIM are evidently smaller than those listed on the Main Market, with weaker internal cash generation, lower net worth but higher growth rate AIM was designed for younger growth firms. The different profile in profitability, growth rate and net worth confirm that the firms that choose to float on AIM are indeed at an earlier stage of life cycle and require external finance to grow business.

[33] A carve-out refers to a sale of the subsidiary's stock in an IPO

Table 5 2 Sample Summary Statistics

Variables	Mean	Std Dev	Min	Max	Obs	Mean	Std Dev	Min	Max	Obs	Mean	Std Dev	Min	Max	Obs
Panel A The Whole Sample															
	Whole Sample					Independent Firms					Firms with British Ultimate HLDS				
Total Assets	9 03	1 53	0 00	16 65	17342	8 94	1 41	0 00	15 20	10397	9 17	1 68	0 00	16 65	6945
Sales	9 18	2 31	0 00	15 78	16515	8 91	2 63	0 00	14 54	10248	9 63	1 58	0 00	15 78	6267
Leverage	0 29	0 52	0 00	23 04	15049	0 25	0 34	0 00	9 03	9685	0 34	0 74	0 00	23 04	5364
ROA	0 04	0 60	-22 35	27 26	17062	0 01	0 52	-22 35	2 78	10344	0 08	0 70	-12 34	27 26	6718
CAPEX	-0 05	0 12	-3 14	3 41	15201	-0 04	0 11	-1 13	3 41	10093	-0 05	0 14	-3 14	3 21	5108
Inventory	0 16	0 19	0 00	0 98	14276	0 17	0 19	0 00	0 97	9445	0 15	0 20	0 00	0 98	4831
Cash in Hand	0 12	0 16	0 00	1 00	16154	0 12	0 17	0 00	1 00	10037	0 12	0 15	0 00	1 00	6117
Acquisition	-0 01	0 13	-5 17	9 52	17360	-0 01	0 13	-4 23	9 52	10396	-0 01	0 13	-5 17	3 07	6964
Growth_Asset	0 28	1 69	-1 00	58 71	14811	0 31	1 81	-1 00	58 08	9016	0 23	1 48	-1 00	58 71	5795
Growth_Sales	0 31	1 98	-1 00	64 50	13299	0 34	2 31	-1 00	64 50	8231	0 25	1 26	-1 00	55 86	5068
Net Worth	7 23	2 66	0 00	15 65	17347	7 36	2 37	0 00	13 75	10396	7 03	3 04	0 00	15 65	6951
Panel B The Private Firms															
	Entire Private Firms Subsample					Independent Private Firms					Private Firms with British Ultimate HLDS				
Total Assets	9 05	1 49	0 00	16 65	15713	8 97	1 32	0 00	15 20	9092	9 15	1 68	0 00	16 65	6621
Sales	9 28	2 22	0 00	15 78	14886	9 03	2 57	0 00	14 37	8943	9 65	1 48	0 00	15 78	5943
Leverage	0 29	0 52	0 00	23 04	13422	0 26	0 29	0 00	9 03	8381	0 34	0 76	0 00	23 04	5041
ROA	0 07	0 49	-12 34	27 26	15435	0 05	0 23	-9 40	1 49	9041	0 08	0 72	-12 34	27 26	6394
CAPEX	-0 04	0 11	-3 14	3 21	13575	-0 04	0 10	-0 95	1 45	8790	-0 05	0 14	-3 14	3 21	4785
Inventory	0 17	0 19	0 00	0 98	12648	0 18	0 19	0 00	0 97	8141	0 16	0 20	0 00	0 98	4507
Cash in Hand	0 11	0 15	0 00	1 00	14526	0 11	0 15	0 00	1 00	8733	0 12	0 15	0 00	1 00	5793
Acquisition	-0 01	0 09	-5 17	3 07	15733	0 00	0 06	-1 30	1 26	9093	-0 01	0 11	-5 17	3 07	6640
Growth_Asset	0 19	1 21	-1 00	58 71	13369	0 17	0 98	-1 00	48 46	7857	0 22	1 48	-1 00	58 71	5512
Growth_Sales	0 22	1 45	-1 00	61 97	11944	0 21	1 59	-1 00	61 97	7143	0 23	1 22	-1 00	55 86	4801
Net Worth	7 22	2 60	0 00	15 65	15718	7 36	2 24	0 00	13 75	9091	7 02	3 02	0 00	15 65	6627
Panel C The IPO Firms															
	Entire IPO Firms Subsample					Independent IPO Firms					Carve-Out Firms				
Total Assets	8 88	1 88	0 00	14 68	1629	8 72	1 91	0 00	14 68	1305	9 53	1 60	4 08	13 10	324
Sales	8 30	2 88	0 00	14 54	1629	8 07	2 86	0 00	14 54	1305	9 22	2 76	0 00	13 97	324
Leverage	0 23	0 55	0 00	8 55	1627	0 22	0 59	0 00	8 55	1304	0 29	0 39	0 00	3 70	323
ROA	-0 24	1 16	-22 35	2 78	1627	-0 31	1 28	-22 35	2 78	1303	0 01	0 33	-2 52	0 73	324
CAPEX	-0 06	0 17	-2 18	3 41	1626	-0 06	0 17	-1 13	3 41	1303	-0 07	0 16	-2 18	0 29	323
Inventory	0 05	0 11	0 00	0 91	1628	0 05	0 12	0 00	0 91	1304	0 06	0 08	0 00	0 40	324
Cash in Hand	0 21	0 24	0 00	1 00	1628	0 23	0 25	0 00	1 00	1304	0 11	0 15	0 00	0 80	324
Acquisition	-0 03	0 32	-4 43	9 52	1627	-0 02	0 32	-4 23	9 52	1303	-0 07	0 30	-4 43	0 52	324
Growth_Asset	1 13	3 86	-1 00	58 08	1442	1 27	4 24	-0 98	58 08	1159	0 55	1 37	-1 00	11 51	283
Growth_Sales	1 07	4 38	-1 00	64 50	1355	1 19	4 80	-1 00	64 50	1088	0 57	1 80	-0 99	24 35	267
Net Worth	7 35	3 19	0 00	13 74	1629	7 34	3 11	0 00	13 74	1305	7 36	3 49	0 00	12 33	324
						IPOs Listed on AIM					IPOs listed on the Main Market				
				Total Assets		8 35	1 73	0 00	13 11	1151	10 16	1 58	3 66	14 68	478
				Sales		7 65	2 80	0 00	14 54	1151	9 85	2 43	0 00	13 97	478
				Leverage		0 23	0 58	0 00	8 55	1150	0 23	0 48	0 00	5 50	477
				ROA		-0 33	1 34	-22 35	2 78	1149	-0 03	0 47	-5 33	0 72	478
				CAPEX		-0 06	0 19	-2 18	3 41	1148	-0 07	0 12	-1 13	0 47	478
				Inventory		0 05	0 12	0 00	0 91	1150	0 06	0 10	0 00	0 41	478
				Cash in Hand		0 22	0 26	0 00	1 00	1150	0 17	0 18	0 00	0 93	478
				Acquisition		-0 02	0 32	-1 59	9 52	1149	-0 06	0 31	-4 43	0 52	478
				Growth_Assets		1 24	3 92	-0 98	46 42	1016	0 87	3 70	-1 00	58 08	426
				Growth_Sales		1 23	4 72	-1 00	64 50	944	0 71	3 45	-0 99	52 25	411
				Net Worth		6 93	2 99	0 00	12 84	1151	8 35	3 42	0 00	13 74	478

Panel A reports summary statistics for the full sample over the period 1996-2007 Panel B reports summary statistics for the UK non-financial firms that remained private between 1996 and 2007 Panel C reports summary statistics for UK non-financial firms that went public in the domestic market between 1998 and 2003 The private firm subsample includes all industries (except financial industries) that had IPOs during 1998-2003 having at least one financial year between 1998 and 2003 in which their total assets was over £500,000 Private firms with account type 'partial/full exemption' or 'dormant' or 'small company' and with missing data are excluded Another five observations are deleted due to outlier The 'independent' subsample refers to firms without a parent company The 'British Ultimate HLDS' subsample refers to firms with a British ultimate holding company Total Assets is the log value of total assets Sales is the log value of turnover Leverage is total debt over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets Inventory is stock and work in progress over total assets Cash in Hand is cash and cash equivalent over total assets Acquisition is the net cash flow from acquisition and disposal over total assets Growth_Assets is the rate of growth of total assets Growth_Sales is the rate of growth of turnover Net Worth is the log value of shareholders' funds, and values below zero are truncated at zero

5.3 *Ex ante* Determinants of Going Public

5.3.1 The Model

To test the theoretical predictions on IPO decisions, I estimate a panel probit model of the probability of going public, following Pagano *et al* (1998). The likelihood to go public for firm i in year t is given by.

$$\Pr[y_{it} = 1] = F(x_{it}'\beta + w_t'\theta + u_i) \tag{5.1}$$

The dependent variable y_{it} for firm i in year t is equal to unity if firm i is listed in year t, otherwise if firm i stayed private it equals zero. $F(\cdot)$ is a standard normal cumulative distribution function (cdf) x_{it}' is a set of firm and industry characteristics (for firm i in year t) that affect the IPO decision. w_t' is a set of calendar year dummy variables u_i is the firm-specific effects In any year t, the sample includes all the private firms that satisfy the listing requirements in that year. After a firm goes public, it was dropped from the sample

x_{it}' include leverage (LEV), capital investment (CAPEX), profitability (ROA), firm size (SIZE) and ownership concentration (OWCON). Leverage is measured by total interest bearing debt over total assets As a broader definition of leverage, this measurement has been extensively used in the empirical capital structure literature Profitability is measured by internal cash generation – earnings before interest, taxes, depreciation and amortization (EBITDA) over total assets. Profitability together with leverage indicates the financial conditions of a firm Capital investment is measured by net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument scaled by total assets As a proxy for intensity of capital investment, a negative CAPEX indicates capital outflow whereas a positive one indicates capital inflow Therefore, the lower the value of CAPEX, the larger the capital investment Firm size is measured by the log value of turnover Because the data of firm age are unavailable for private firms, I use firm size as a proxy for the stage of a firm's growth. Ownership concentration is measured by an indicator variable It equals 0 if none of the shareholders has more than 25% shareholdings, equals 0 25 if one or more

shareholders have more than 25% but less than 50% shareholdings, equals 0 5 if one shareholder has a total of more than 50% shareholdings (i e indirectly holds more than 50% ownership), and equals 1 if one shareholder has a direct ownership of over 50% Market conditions is measured by calendar year dummy variables w_t' (YEAR)

Pagano *et al* (1998) argued that there might be a negative correlation between the R&D intensity of an industry and the probability of an IPO. Public firms are subject to compulsory disclosure of highly sensitive R&D information and exposed to close scrutiny from tax authorities These create an expensive cost of loss of confidentiality for an industry with high R&D intensity, making an IPO less attractive. However, this variable was not included in Pagano *et al* (1998)'s study due to a lack of data They also argued that firms facing higher interest rates and more concentrated credit sources are more likely to go public, to gain greater bargaining power with banks However, their results showed that bank rate and concentration of borrowing were not significant Due to a lack of R&D data, bank rate and concentration of borrowing of firms, these variables cannot be tested in this study

Pagano *et al* (1998) also included the median ratio of the market-to-book value of equity of public firms in the same industry This variable was used as a proxy for future investment opportunity. On the other hand, they argued that this variable may also reflect overvaluation by irrational investors when the market is too over-optimistic. It appears that these two explanations can hardly be disentangled from this single variable. For this reason, this variable was not included in this study. But instead, I use CAPEX to measure current investment while using year dummies to capture seasonal market conditions.

Therefore, the model of the probability of going public is written as.

$$\Pr[IPO_{it} = 1] = F(\beta_1 LEV_{it} + \beta_2 CAPEX_{it} + \beta_3 ROA_{it} + \beta_4 SIZE_{it} + \beta_5 OWCON_{it} + \gamma_t YEAR_t) \quad (5\ 2)$$

Table 5.3 Definitions of Explanatory Variables

Variable	Theory	Sign	Abbr	Definition
Leverage	Financial constraints	+	LEV	(total debt)/(total assets)
Capital investment	Financial constraints, Cheaper capital	–	CAPEX	(net cash flow from capital expenditure, sale of plant and equipment and returns of equity instrument)/(total assets)
Profitability	Financial constraints	–	ROA	EBITDA/(total assets)
Firm size	Cheaper capital	–	SIZE	ln(sales)
	Shareholder exit	+		
Ownership concentration	Corporate governance	–	OWCON	=0 if any single shareholding<25%, =0 25 if at least one shareholding≥25% (<50%) =0 5 if at least one indirect shareholding≥50% =1 if at least one direct shareholding≥50%

5.3.2 Methodology

Firms' IPO decision may in part depend on some unobservable which may need to be added to a standard panel probit model. The unobservable can be assumed to be time-invariant firm effects (u_i) and it reflects the heterogeneities that are specific to firm i and stay constant over time t. If u_i is treated as a random variable with $u_i \sim \text{IID}(0, \sigma_u^2)$ and ***independent*** of the time varying regressors x_{it}' and the year dummy regressors w_t', random effects estimator is appropriate A random effects probit model can be estimated by maximum likelihood estimation[34] (MLE) and computed using the Gaussian quadrature procedure (Butler and Moffitt 1982). Alternative to random effects probit model, one can also use a logit specification, in which case $F(\cdot)$ is the logistic cdf. However, in empirical studies probit specification appears to be more popular for random effects binary model.

If the unobservable time-invariant firm effects are assumed to be fixed parameters to be estimated, fixed effects estimator should be used. Here u_i is a dummy variable that

[34] The random effects MLE of β, θ and σ_u^2 maximises the log-likelihood $\sum_{i=1}^{N} lnf\,(Y_i|X_i, W, \beta, \theta, \sigma_u^2)$, where $f(Y_i|X_i, W, \beta, \theta, \sigma_u^2) = \int f(Y_i|X_i, W, \sigma_u^2, \beta, \theta)\frac{1}{\sqrt{2\pi\sigma_u^2}} exp(\frac{-u_i}{2\sigma_u^2})^2 du_i$

equals 1 if an observation belongs to firm i, equals 0 otherwise. For fixed effects binary model, there is an incidental parameters problem (Neyman and Scott, 1948, Lancaster, 2000) The standard MLE of the incidental parameters u_i is inconsistent as $N \to \infty$, because only T observations are used to estimate each parameter u_i. The inconsistency of the MLE of u_i is then transmitted into the inconsistency of the MLE of β and θ. The incidental parameters problem however, is not present in linear panel models, since β and θ are estimated consistently by first eliminating u_i using the within transformation and the MLE of β and θ and u_i are asymptotically independent (Hsiao, 2003). Chamberlain (1980) and Hsiao (2003) demonstrated this incidental parameters problem Greene (2004) also showed that the fixed effects MLE is biased. For the fixed effects probit model, there is no solution to the incidental parameters problem Therefore, unlike the random effects binary models, fixed effects estimation is only possible for the logit specification Chamberlain (1980) suggested using the conditional MLE for the fixed effects logit model Explanations of the conditional MLE can also be found in Baltagi (2005)

To detect whether fixed effects are present, one can conduct a Hausman test based on the difference between the conditional MLE and the standard logit MLE ignoring the firm effects The null hypothesis and the alternative hypothesis are set as follows.

H_0: There are no firm effects

H_1. There are fixed firm effects.

Under the null hypothesis, the conditional MLE is consistent but inefficient, whereas the standard logit MLE is consistent and efficient. Under the alternative hypothesis, the conditional MLE is consistent, whereas the standard logit MLE is inconsistent

Therefore, both the standard logit model and the fixed effects logit model need to be estimated, and their common marginal effects estimates[35] need to be compared in the Hausman test statistics[36] ($H \sim \chi^2$). If the marginal effects estimates of the standard logit MLE are significantly different from their conditional MLE counterparts, the null hypothesis is rejected while the alternative hypothesis is accepted In this case, the fixed effects logit model should be used

[35] In linear models, comparison is based on the common coefficient estimates

[36] H_0 Difference in coefficients is not systematic

If no fixed effects are detected, one can then use either a random effects binary model or a pooled binary model[37] (logit or probit) For a pooled binary model, random effects are averaged out. A pooled binary model can be estimated by quasi-maximum likelihood estimation via a Generalised Estimating Equations (GEE) approach (Liang and Zeger, 1986)

For equation 5.2, I first conducted a Hausman test to check fixed effects As no fixed effects were detected – a Hausman test cannot reject the null hypothesis that there are no firm effects (Prob>χ^2=0.2312), a random effects probit specification was adopted. In addition to random effects estimates, I also computed pooled GEE estimates. The results for both are reported

5.3.3 The Results

Table 5 4 and Table 5 5 respectively report the results from the random effects probit model and the pooled probit model Both models were estimated separately for the entire sample, the independent-firm subsample, and for the carve-outs subsample. The results from the two models are quite similar both qualitatively and quantitatively. For the random effects model, a likelihood-ratio test of the null hypothesis ρ=0 cannot be rejected for both the entire sample and the subsamples. ρ is the fraction of the total variance due to the variance of the random firm effects u_i. As the inexistence of the random firm effects cannot be rejected, the pooled probit model is more appropriate. Therefore, I focus my analysis on the results from the pooled probit model

Consistent with the 'cheaper capital' hypothesis (Hypothesis 2), it is found that the smaller the firm (SIZE) and the larger the capital investment (CAPEX), the higher probability of an IPO. Return on assets (ROA) is significantly and negatively signed, indicating that the IPO firms are more constrained by limited internal cash generation than the firms that choose to stay private Leverage (LEV) is positively signed but not statistically significant Overall, this suggests that the UK firms that choose to go public are likely to be the smaller ones in needs of external capital to support their capital investment and to promote growth. This is quite different from the result for Italy,

[37] For this case, the pooled binary models would have the specification that is $\Pr[y_{it} = 1] = F(x_{it}'\beta + w_t'\theta)$

where IPO firms seem to be the mature firms with higher internal cash generation (seeking public equity to re-balance their financial structure after a period of expansion). Such results support the view that, as an Anglo-Saxon model, the well-developed and informative stock market in the UK reduces the informational costs of public equity capital, especially for small, capital intensive, growth firms. Therefore, relatively cheaper public equity becomes an attractive alternative to debt financing and private equity for financially constrained firms

More dispersed ownership (OWCON) significantly increases the likelihood of going public, implying that to utilise the monitoring function of the stock market may be another reason behind the decision to go public (this supports Hypothesis 5) Dispersed ownership is generally associated manager-shareholder conflicts and under-monitoring problem. However, the changes in stock prices reveal information about managerial performance, which in a way serve to reward or punish management (e g via manager remuneration scheme) In this aspect, an informative stock price is more effective than financial indicators which might be subject to managerial manipulation Therefore, firms with dispersed ownership structure can benefit from monitoring by the market

In addition, a hotter market is correlated with increased IPO activity (reflected by the year dummies Year 1998, Year 1999 and Year 2000) On the other hand, as the stock market reversed from the end of year 2000, especially during 2003 when the market stayed cold, the probability of going public was significantly reduced (as reflected by the year dummy Year 2003). The year dummy Year 2002 is negatively signed yet not significant, reflecting a lagged response of IPO activities to a market that went down This is because that the stock market tends to be very responsive to positive information whereas slow to negative information. Overall, the results of the year dummies are consistent with Hypothesis 3 and with the evidence on clusters in IPOs found in most markets.

However, Hypothesis 4 is not supported, indicating that the divestment motive is not the dominant reason for going public for the UK firms.

Now I turn to the results for the subsamples. The results for independent firms are similar to those for the entire sample. However, it is shown a different picture for the carve-outs in that sales, return on assets and capital expenditure are not statistically significant, on the other hand, leverage significantly increases the likelihood of carve-outs This implies that, unlike the IPOs of the independent firms, cheaper public capital is not a major concern for the carve-outs. This is because subsidiaries in general can benefit from the reputation capital of their parents and hence have fewer informational problems. It seems that the parent firms tend to carve-out those subsidiaries which are highly indebted and over which they have less control. By doing this, the parent firms (the ultimate decision maker of the subsidiaries) can improve their financing position while utilising the market monitoring function to create more effective managerial compensation contracts for the carve-outs.

The earlier statistics showed that the independent firms are more involved in IPO activities than the firms with a British parent. This, combined with the results from the panel probit model, suggests that the dominant motive to go public in the UK is raising cheaper capital to fund investment rather than corporate restructuring

Table 5.4 Determinants of the IPO Decision (Random Effects Probit Model)

Variables	All Sample IPOs	Independent IPOs	Carve-Outs
Intercept	-0 8449***	-1 1707***	1 2218*
	(0 1390)	(0.1569)	(0 4811)
LEV	0 0589	0 0302	0.1123
	(0 0479)	(0 0794)	(0 0716)
CAPEX	-0.7124***	-1.5793***	-0 2165
	(0 1551)	(0 2673)	(0 3551)
ROA	-0 1967**	-0 2380***	0 1145
	(0 0599)	(0 0670)	(0 2793)
SIZE	-0 0840***	-0 0770***	-0 0525
	(0 0113)	(0 0124)	(0 0439)
OWCON	-1 2097***	-0 8509***	-4 1216***
	(0 0999)	(0 1151)	(0 3405)
Year 1998	0 6618***	0 5655***	1 0198***
	(0.1091)	(0 1264)	(0 2909)
Year 1999	0 5040***	0.5548***	0 3968
	(0.1145)	(0 1271)	(0 3555)
Year 2000	0.5831***	0 5527***	0 9313**
	(0 1106)	(0 1254)	(0 3099)
Year 2002	-0 0700	-0 0051	-0 7492
	(0 1498)	(0 1591)	(0 1271)
Year 2003	-0 4636*	-0 5424*	0 0647
	(0.2081)	(0 2433)	(0 5905)
Number of Observations	9487	5840	3647
Number of Firms	2498	1372	1126
Wald test all coefficients=0 (Chi-sq)	317.35***	214 59***	160 87***
Log likelihood	-707 6095	-538 8367	-110.1320
LR test ρ=0 (Prob≥Chibar-sq)	0 497	0 497	0 499

The effects of the variables listed above on the probability of going public are estimated by a random effects probit model $Pr[y_{it} = 1] = F(x_{it}'\beta + w_t'\theta + u_i)$. The dependent variable for firm i in year t equals 1 if firm i is listed in year t, otherwise it equals 0. The observations for the IPO firms in the post-IPO period are dropped from the sample The observations for private firms are restricted to the period 1996-2003 The estimation method is MLE. Standard errors are reported in parentheses The probit model is estimated separately using the entire sample, with independent firms only, and with British ultimate holding firms only LEV is total debt over total assets CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets SIZE is the log value of turnover OWCON is an indicator variable it equals 0 if none of the shareholders has more than 25% shareholdings, equals 0 25 if one or more shareholders have more than 25% but less than 50% shareholdings, equals 0 5 if one shareholder has a <u>total</u> of more than 50% shareholdings (i e. indirectly holds more than 50% ownership), and equals 1 if one shareholder has a <u>direct</u> ownership of over 50% Year 1998, Year 1999, Year 2000, Year 2002 and Year 2003 are year dummies; the year dummy Year 2001 is dropped # p<0 1, * p<0 05; ** p<0 01, *** p<0 001

Table 5.5 Determinants of the IPO Decision (Pooled Probit Model)

Variables	All Sample IPOs	Independent IPOs	Carve-Outs
Intercept	-0 8487***	-1 1772***	1 2171***
	(0 1262)	(0 1394)	(0 3464)
LEV	0 0592	0 0307	0 1072*
	(0 0406)	(0 1033)	(0 0434)
CAPEX	-0 7154 #	-1 5906***	-0 2181
	(0 4124)	(0 2713)	(0 1759)
ROA	-0 1980*	-0 2398*	0 1133
	(0 0818)	(0 1035)	(0 3775)
SIZE	-0 0842***	-0 0771***	-0 0564
	(0 0094)	(0 0094)	(0 0444)
OWCON	-1 2073***	-0 8491***	-4 0580***
	(0 0866)	(0 0966)	(0 4346)
Year 1998	0 6646***	0 5691***	1 0083*
	(0 1147)	(0 1343)	(0 4434)
Year 1999	0 5060***	0 5580***	0 3935
	(0 1179)	(0 1314)	(0 4520)
Year 2000	0 5841***	0 5541***	0 9162*
	(0 1133)	(0 1278)	(0 4496)
Year 2002	-0 0734	-0 0091	-0 5263
	(0 1563)	(0 1638)	(0 3921)
Year 2003	-0 4717*	-0 5555*	0 0486
	(0 2025)	(0 2363)	(0 5100)
Number of Observations	9487	5840	3647
Number of Firms	2498	1372	1126
Diagnostics			
Wald test all coefficients=0 (Chi-sq)	348 27***	260 51***	496 37***

The effects of the variables listed above on the probability of going public are estimated by a pooled probit model: $Pr[y_{it} = 1] = F(x_{it}'\beta + w_t'\theta)$ The dependent variable for firm i in year t equals 1 if firm i is listed in year t; otherwise it equals 0 The observations for IPO firms in the post-IPO period are dropped from the sample The observations for private firms are restricted to the period 1996-2003 The estimation method is GEE approach Semi-robust standard errors are reported in parentheses The probit model is estimated separately using the entire sample, with independent firms only, and with British ultimate holding firms only. LEV is total debt over total assets CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets SIZE is the log value of turnover OWCON is an indicator variable it equals 0 if none of the shareholders has more than 25% shareholdings, equals 0 25 if one or more shareholders have more than 25% but less than 50% shareholdings, equals 0 5 if one shareholder has a total of more than 50% shareholdings (i e indirectly holds more than 50% ownership), and equals 1 if one shareholder has a direct ownership of over 50%. Year 1998, Year 1999, Year 2000, Year 2002 and Year 2003 are year dummies, the year dummy Year 2001 is dropped # p<0 1; * p<0 05; ** p<0 01, *** p<0 001.

5.4 *Ex Post* Consequences of Going Public

5.4.1 The Model

Together with investigating the determinants of an IPO, it is necessary to examine the consequences of going public to further clarify the reasons of the IPO decision One way of doing this is to compare the IPO firms' operating performance between the pre-IPO and post-IPO period, because seeking equity capital for investment or divesting shareholdings by original shareholders should be reflected in the changes of operating performance over the IPO windows. I look into such changes in a linear panel-data fixed effects model·

$$y_{it} = \alpha + \beta_1 BeforeIPO_{it} + \beta_2 AfterIPO_{it} + \gamma_1 u_i + \gamma_2 v_t + \varepsilon_{it} \qquad (5\ 3)$$

$BeforeIPO_{it}$ is a dummy that equals 1 if an observation for IPO firm i in year t is before the IPO. $AfterIPO_{it}$ is a dummy that equals 1 if an observation for IPO firm i in year t is after the IPO[38] Therefore, I use each IPO firm's performance in the IPO year as a control for itself before and after the IPO u_i and v_t are respectively firm-specific and year-specific effects. The regressand y_{it} includes eleven performance variables that measure the changes in firm size, leverage, internal cash generation, investment-related cash flow and current assets, growth rate and firm value All the performance variables use the same model specification

Firm size is proxied by SIZE and TA. SIZE is the log value of turnover, and TA is the log value of total assets. The log value of turnover is used as the main measure of firm size Leverage (LEV) is measured by total debt over total assets. Internal cash generation (ROA) is measure by EBITDA over total assets. Investment-related cash flow is measured by capital investment (CAPEX) and acquisition intensity (ACQ). CAPEX is net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument scaled by total assets ACQ is net cash flow from acquisition and disposal scaled by total assets Investment-related current assets are measured by inventory (INVEN) and cash in hand (CASH). INVEN is stock and

[38] These do not include the IPO year

work in progress scaled by total assets. CASH is cash and cash equivalent scaled by total assets Growth rate is measured by growth in sales (GSIZE) and growth in total assets (GTA) GSIZE is the rate of growth of turnover, GTA is the rate of growth of total assets. Firm value is measured by net worth of firms (NWTH) which is the log value of shareholders' funds

Table 5.6 Definitions of Performance Variables

Performance Variable		Abbr	Definition
Firm size		SIZE	ln(sales)
		TA	ln(total assets)
Leverage		LEV	(total debt)/(total assets)
Profitability		ROA	EBITDA/(total assets)
Investment-related cash flow	Capital investment	CAPEX	(net cash flow from capital expenditure, sale of plant and equipment and returns of equity instrument)/(total assets)
	Acquisition intensity	ACQ	(net cash flow from acquisition and disposal)/(total assets)
Investment-related current assets	Inventory	INVEN	(stock and work in progress)/(total assets)
	Cash in hand	CASH	(cash and cash equivalent)/(total assets)
Growth rate	Growth in sales	GSIZE	$(sales_t\text{-}sales_{t-1})/sales_{t-1}$
	Growth in total assets	GTA	$(totalassets_t\text{-}totalassets_{t-1})/totalassets_{t-1}$
Net worth of firms		NWTH	ln(shareholders' funds)

5.4.2 Methodology

I used a two-way error component fixed effects model to evaluate the post-IPO operating and financial performance The two-way error component disturbances can be written as

$$\delta_{it} = \gamma_1 u_i + \gamma_2 v_t + \varepsilon_{it} \tag{5.4}$$

where u_i and v_t capture the unobservable heterogeneities that affect the performance variables in question (i.e. the regressend) More explicitly, u_i is a dummy variable that equals 1 if an observation belongs to firm i, equals 0 otherwise. It reflects the

heterogeneities that are specific to firm i and stay constant over time t, i e the unobservable time-invariant firm effects. v_t is a dummy variable that equals 1 if an observation belongs to year t, equals 0 otherwise. It reflects the heterogeneities that are specific to year t and stay constant across firm i, i.e. the unobservable firm-invariant calendar year effects (a set of year dummies in this model). ε_{it} is the stochastic disturbance with $\varepsilon_{it} \sim \text{IID}(0, \sigma_\varepsilon^2)$ The regressors were assumed independent of the random variable ε_{it}.

The two-way error component fixed effects model was chosen based on the following diagnostics: (1) whether or not the firm effects u_i and/or the time effects v_t are/is significant, and (2) whether or not u_i and/or v_t are/is correlated with the regressors.

Testing (1) is to test:
(1.1) the joint significance of the time-invariant firm effects u_i, i e the joint test that all the coefficients of u_i are zero (F-statistics), and
(1 2) the joint significance of the firm-invariant calendar year effects v_t, i e the joint test that all the coefficients of the year dummies are zero (F-statistics)

If (1 1) is rejected, there is variation of the regressors across firms within each year, and hence a pooled model would be inappropriate If (1 2) is rejected, there is variation of the regressors over calendar years within each firm, and therefore a one-way error component fixed effects model ignoring the time effects would suffer from omitted variable bias.

Testing (2) is to examine the appropriateness of the random effects model[39] This can be done using a Hausman test based on the difference between the fixed effects estimator (FE) and the random effects estimator (RE). The null hypothesis and the alternative hypothesis are set as follows
H_0 There are no fixed effects (i e. the orthogonality assumption of the RE – the

[39] If a two-way error component random effects model is used to evaluate the post-IPO operating and financial performance, the two-way error component disturbances would be written as
$\delta_{it} = u_i + v_t + \varepsilon_{it}$,
where u_i, v_t and ε_{it} are all assumed to be random variables $u_i \sim \text{IID}(0, \sigma_u^2)$, $v_t \sim \text{IID}(0, \sigma_v^2)$ and $\varepsilon_{it} \sim \text{IID}(0, \sigma_\varepsilon^2)$ are assumed to be independent of each other The regressors are assumed to be independent of the random variables u_i, v_t and ε_{it} for all i and t (Baltagi, 2005)

regressors are independent of u_i, v_t and ε_{it}– is valid).

H_1: There are fixed firm effects.

Under the null hypothesis, the FE is consistent but inefficient, whereas the RE is consistent and efficient. Under the alternative hypothesis, the FE is consistent, whereas the RE is inconsistent

Therefore, both the FE and the RE need to be estimated, and the common coefficient estimates need to be compared in the Hausman test statistics ($H \sim \chi^2$). If both the FE and the RE generate consistent coefficient estimates, they will not differ significantly, and the RE estimator can be used. However, if the orthogonality assumption of the RE is violated, the estimates of the RE will be significantly different from their FE counterparts, implying that the null hypothesis should be rejected In this case, the FE estimator should be used.

Rather than statistical tests, applied researchers in practice tend to use the nature of the data as a guideline to choose between the FE and the RE. Baltagi (2005) argued that if the data exhaustively represent the population under investigation, FE is preferred to RE, on the other hand, if the sample is drawn randomly from a large population, RE is preferred

If the linear random effects model is appropriate, statistic inference can be based on pooled OLS estimator, although feasible GLS estimators are more efficient (Baltagi, 2005)

If the linear fixed effects model is the true model, it can be estimated by the within estimator (Baltagi, 2005). In the presence of the fixed effects, the within estimator is consistent Alternatively, the fixed effects model can also be consistently estimated by the first differences estimator. However, the first differences estimator is less efficient than the within estimator for $T > 2$. In contrast, the pooled OLS estimator is inconsistent, and suffers from omission bias since the firm effects and the time effects are ignored The between estimator, which only uses the cross-sectional variation while ignoring the individual-specific variation, is also inconsistent.

The limitation of the fixed effects estimators is that the within transformation eliminates the time-invariant and the firm-invariant regressors Consequently, the coefficients of these two types of regressors cannot be identified

5.4.3 The Results

Table 5.7, 5.8, 5.9, 5 10 and 5.11 present the estimates of the fixed effects model respectively for the entire sample, the independent IPO subsample, the carve-outs subsample, the IPOs listed on AIM and those listed on the Main Market In each table, the *F*-statistics test the significance of the fixed effects (including the joint significance of the firm effects and the joint significance of the time effects) and the Hausman test examines the appropriateness of a random effects model. When an RE model cannot be rejected, only the estimates of an FE model are reported, as the FE estimates would still be consistent (though inefficient)

For the independent IPOs (Table 5 7), the firms become larger immediately after their IPOs (in terms of both total assets and sales) In particular, their sales during the following years after the IPOs appear to be significantly larger in comparison with the pre-IPO and the at-IPO level. CAPEX after IPO is negatively signed, indicating that capital investment tends to increase after an IPO. These results suggest that independent IPO firms benefit from the new equity capital raised from the stock market which promotes their investment in business and growth CASH before IPO is significant and negative whereas CASH after IPO is positively signed (insignificant), confirming that cash injection from IPO financing indeed helps firms relieve financial constraints. LEV is negative but not significant If we consider this result together with the results of CASH and CAPEX, they appear to tell a consistent story That is, the capital raised from the IPOs was used to alleviate borrowing constraints and fund investment rather than merely for deleverage.

Profitability (ROA) and the rate of growth of total assets (GTA) however, both exhibit a significant decrease after IPO. Degeorge and Zeckhauser (1993) argued that firms may time their IPOs to coincide with unusually high profitability. Clementi (2002) also predicted that firms are expected to go public at the peak of their growth as the value of

exercising the option of IPO is at the highest. After the IPO, profitability is expected to decrease The negative ROA and GTA may be a reflection of these views Overall, the *ex post* results are consistent with the earlier conclusion from the *ex ante* analysis.

Table 5.7 Effects of the IPO Decision for the Independent IPO Subsample

Variables	Before IPO	After IPO	*F*-test: all coefficients=0	Firm Effects (*F*-stats)	Time Effects (*F*-stats)	FE vs RE (*Hausman* test)	Obs	Firms
SIZE	-0 4899* (0 2013)	0 4994** (0 1898)	0 0000	0 0000	0 0002	0 0000	1305	143
TA	-0 9151*** (0 1133)	0 1521 (0 1072)	0 0000	0 0000	0 0000	0 0000	1305	143
LEV	0 1566 (0 1058)	-0 0313 (0 0467)	0 0193	0 0000	0.2816	1 0000	1304	143
ROA	-0.0316 (0 0997)	-0 5916* (0 2536)	0 3467	0 0207	0 3038	0 0000	1305	143
CAPEX	-0 0687# (0.0393)	-0 0260 (0 0246)	0 0000	0 0000	0 0003	0 0002	1303	143
ACQ	0 0138 (0 0192)	0 0443 (0 0410)	0 2294	0 4229	0 1898	0 9800	1303	143
INVEN	0 0053 (0 0060)	-0 0027 (0 0109)	0 0059	0 0000	0 0180	0 2186	1304	143
CASH	-0 1192*** (0 0298)	0 0017 (0 0258)	0 0008	0 0000	0 0083	0 0120	1304	143
GSIZE	-0.3925 (0 6796)	0 1435 (0 5961)	0 0405	0 0000	0 0735	0 0015	1099	141
GTA	-3 4855*** (0 6875)	-3 3353*** (0 8036)	0 0000	0 0137	0 0001	0 0063	1159	143
NWTH	-2 0291*** (0 3298)	0 0624 (0 2631)	0 0000	0 0000	0 0012	0 7570	1305	143

The effects of the decision to go public on the variables listed above are estimated by a fixed effects model $y_{it} = \alpha_i + \beta_1 BeforeIPO_{it} + \beta_2 AfterIPO_{it} + u_i + v_t + \varepsilon_{it}$ u_i and v_t are respectively firm-specific and year-specific effects $BeforeIPO_{it}$ is a dummy equals 1 if an observation for IPO firm i in year t is before the IPO. $AfterIPO_{it}$ is a dummy equals 1 if an observation for IPO firm i in year t is after the IPO. Therefore I use each firm in the IPO year as a control for itself before and after the IPO Heteroskedasticity robust standard errors are reported in parentheses The fixed effects model is estimated using the independent IPOs subsample SIZE is the log value of turnover, which is used as the main measure of firm size TA is the log value of total assets LEV is total debt over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets. CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ACQ is the net cash flow from acquisition and disposal over total assets INVEN is stock and work in progress over total assets CASH is cash and cash equivalent over total assets GSIZE is the rate of growth of turnover GTA is the rate of growth of total assets NWTH is the log value of shareholders' funds, and values below zero are truncated at zero # p<0 1, * p<0 05; ** p<0 01, *** p<0 001

The carve-outs also increase their total assets and sales after an IPO (Table 5.8) However, there seems to be no change in capital investment, acquisition or inventory On the other hand, leverage appears to be reduced after an IPO These results further support the view that carve-outs are not mainly driven by financing for investment, rather that their parent firms are likely to divest highly indebted subsidiaries via IPOs and to rebalance the financial structure of the carve-outs. Evidently, after the IPO the firm value of a carve-out is significantly improved and profitability is increased. This

might come from market monitoring which act to enhance the corporate governance of the carve-outs. In addition, the increased publicity may also have helped to create reputation capital for the carve-outs.

Table 5.8 Effects of the IPO Decision for the Carve-out Subsample

Variables	Before IPO	After IPO	*F*-test: all coefficients=0	Firm Effects (*F*-stats)	Time Effects (*F*-stats)	FE vs RE (*Hausman* test)	Obs	Firms
SIZE	-0 6374* (0 2543)	0 5253* (0 2455)	0 0000	0 0000	0 0310	0 3675	324	40
TA	-0 3671# (0 2110)	0 4920* (0 1950)	0.0000	0 0000	0 0000	0 0140	324	40
LEV	0 0440 (0 0882)	-0 0796 (0 0497)	0 0073	0 0000	0 0110	0 3478	323	40
ROA	0 0089 (0 0462)	0 0581 (0 0417)	0 0416	0 0000	0 0249	0 0952	324	40
CAPEX	1.1288 (1 1698)	0 8792 (0 8840)	0 9408	0 7859	0 8982	0 9995	324	40
ACQ	0 0223 (0 0542)	0 0323 (0 0565)	0 3707	0 2299	0 3104	0 8734	324	40
INVEN	0 0103 (0 0215)	-0 0002 (0 0077)	0 5212	0 0000	0 4078	1 0000	324	40
CASH	-0 0955* (0 0380)	-0 0099 (0 0430)	0 0449	0 0000	0 0399	1 0000	324	40
GSIZE	-0 5772 (0 7919)	-0 4234 (0 6001)	0 0009	0 3492	0 0065	0 0649	272	39
GTA	-0 8222* (0.3374)	-0 6608 (0 5129)	0 0001	0 2933	0 0001	0 0334	283	40
NWTH	-0 6212 (0 9526)	1.7415** (0 4665)	0 0001	0 0000	0 3653	0 9801	324	40

The effects of the decision to go public on the variables listed above are estimated by a fixed effects model: $y_{it} = \alpha_i + \beta_1 BeforeIPO_{it} + \beta_2 AfterIPO_{it} + u_i + v_t + \varepsilon_{it}$. u_i and v_i are respectively firm-specific and year-specific effects $BeforeIPO_{it}$ is a dummy equals 1 if an observation for IPO firm i in year t is before the IPO $AfterIPO_{it}$ is a dummy equals 1 if an observation for IPO firm i in year t is after the IPO. Therefore I use each firm in the IPO year as a control for itself before and after the IPO Heteroskedasticity robust standard errors are reported in parentheses. The fixed effects model is estimated using the carve-out subsample. SIZE is the log value of turnover, which is used as the main measure of firm size TA is the log value of total assets LEV is total debt over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ACQ is the net cash flow from acquisition and disposal over total assets. INVEN is stock and work in progress over total assets. CASH is cash and cash equivalent over total assets GSIZE is the rate of growth of turnover. GTA is the rate of growth of total assets NWTH is the log value of shareholders' funds, and values below zero are truncated at zero # p<0.1; * p<0 05, ** p<0 01, *** p<0 001

I do not find that AIM plays a negative role in supporting the firms' growth. Comparing the performance of AIM-listed companies to that of the Main-Market-listed companies (Table 5.9 and Table 5.10), the latter shows a significant and greater increase in firm value (net worth) However, the sales of AIM companies appear to grow better Otherwise, there is no other significant difference in performance

Table 5.9 Effects of the IPO Decision for the IPOs Listed on AIM

Variables	Before IPO	After IPO	*F*-test all coefficients=0	Firm Effects (*F*-stats)	Time Effects (*F*-stats)	FE vs RE (*Hausman* test)	Obs	Firms
SIZE	-0 5620* (0 2190)	0 5407* (0 2136)	0 0000	0 0000	0 0137	0 8209	1151	132
TA	-0 9337*** (0 1177)	0 1361 (0 1061)	0 0000	0 0000	0 0000	0 6727	1151	132
LEV	0 1841# (0.1076)	-0.0138 (0 0324)	0 0046	0 0000	0 0907	1 0000	1150	132
ROA	-0 0154 (0 1098)	-0 6458* (0 3114)	0 5469	0 0794	0 4262	0 0000	1151	132
CAPEX	0 3980 (0 4792)	0 2445 (0 2716)	0 0042	0 8226	0 0594	1 0000	1149	132
ACQ	0 0441# (0 0235)	0 0707 (0 0528)	0 5252	0 7563	0 8147	0 9726	1149	132
INVEN	0 0061 (0 0066)	0 0012 (0 0122)	0 0379	0 0000	0 0587	0 0000	1150	132
CASH	-0 1392*** (0 0315)	0 0104 (0 0265)	0 0000	0 0000	0 0010	0 0175	1150	132
GSIZE	-0 6485 (0 6309)	0 3598 (0 6419)	0 0054	0 0001	0 0255	0 0000	958	130
GTA	-3 2274*** (0 6567)	-2 9598*** (0 6653)	0 0000	0 0199	0 0006	0 9598	1016	132
NWTH	-1 9965*** (0 3473)	0 3114 (0 2313)	0 0000	0 0000	0 0024	0 2208	1151	132

The effects of the decision to go public on the variables listed above are estimated by a fixed effects model. $y_{it} = \alpha_i + \beta_1 BeforeIPO_{it} + \beta_2 AfterIPO_{it} + u_i + v_t + \varepsilon_{it}$ u_i and v_t are respectively firm-specific and year-specific effects $BeforeIPO_{it}$ is a dummy equals 1 if an observation for IPO firm i in year t is before the IPO. $AfterIPO_{it}$ is a dummy equals 1 if an observation for IPO firm i in year t is after the IPO Therefore I use each firm in the IPO year as a control for itself before and after the IPO Heteroskedasticity robust standard errors are reported in parentheses The fixed effects model is estimated using the subsample of the IPOs that listed on AIM SIZE is the log value of turnover, which is used as the main measure of firm size TA is the log value of total assets. LEV is total debt over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets. CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ACQ is the net cash flow from acquisition and disposal over total assets INVEN is stock and work in progress over total assets. CASH is cash and cash equivalent over total assets GSIZE is the rate of growth of turnover GTA is the rate of growth of total assets NWTH is the log value of shareholders' funds, and values below zero are truncated at zero # p<0 1, * p<0 05, ** p<0 01, *** p<0 001.

Table 5.10 Effects of the IPO Decision for the IPOs Listed on the Official List

Variables	Before IPO	After IPO	*F*-test: all coefficients=0	Firm Effects (*F*-stats)	Time Effects (*F*-stats)	FE vs RE (*Hausman* test)	Obs	Firms
SIZE	-0 3393 (0 2223)	0 4763* (0 2008)	0 0000	0 0000	0 0000	0 9999	478	51
TA	-0 5262* (0.2344)	0 4553* (0 1851)	0 0000	0 0000	0 0000	0 9555	478	51
LEV	0 0378 (0 0937)	-0 1371 (0 0895)	0 0342	0 0000	0 2759	1 0000	477	51
ROA	-0 1201# (0 0688)	-0 0988 (0 0760)	0 0456	0 0000	0 0452	0 9449	478	51
CAPEX	-0 0050 (0 0144)	-0 0092 (0 0144)	0 0000	0 0000	0 0001	0 0861	478	51
ACQ	-0 0456 (0 0335)	-0 0177 (0 0242)	0 1214	0.0486	0 1009	1 0000	478	51
INVEN	0 0130 (0 0165)	-0 0162 (0 0101)	0 0259	0 0000	0 2565	0 4604	478	51
CASH	-0 0596 (0 0365)	0 0106 (0 0424)	0 1007	0 0000	0 2069	0 0548	478	51
GSIZE	0 2481 (1.1864)	-0 6351 (0 6624)	0 0189	0 0559	0 0135	0 0003	413	50
GTA	-2 1715* (1 0121)	-2 3938 (1 7193)	0 0131	0.1034	0 0093	0 2748	426	51
NWTH	-1 6571* (0 6764)	1 1097* (0 5536)	0 0000	0 0000	0 0055	1 0000	478	51

The effects of the decision to go public on the variables listed above are estimated by a fixed effects model $y_{it} = \alpha_i + \beta_1 BeforeIPO_{it} + \beta_2 AfterIPO_{it} + u_i + v_t + \varepsilon_{it}$ u_i and v_i are respectively firm-specific and year-specific effects. $BeforeIPO_{it}$ is a dummy equals 1 if an observation for IPO firm i in year t is before the IPO $AfterIPO_{it}$ is a dummy equals 1 if an observation for IPO firm i in year t is after the IPO Therefore I use each firm in the IPO year as a control for itself before and after the IPO Heteroskedasticity robust standard errors are reported in parentheses The fixed effects model is estimated using the subsample of IPOs that listed on the Official List SIZE is the log value of turnover, which is used as the main measure of firm size TA is the log value of total assets LEV is total debt over total assets. ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ACQ is the net cash flow from acquisition and disposal over total assets INVEN is stock and work in progress over total assets CASH is cash and cash equivalent over total assets GSIZE is the rate of growth of turnover GTA is the rate of growth of total assets NWTH is the log value of shareholders' funds, and values below zero are truncated at zero # p<0 1, * p<0 05; ** p<0 01; *** p<0 001

Overall (Table 5 11), after the offerings the IPO firms significantly grow larger, total shareholder value is significantly increased (firm value is enhanced)

Table 5.11 Effects of the IPO Decision for the Entire Sample IPOs

Variables	Before IPO	After IPO	*F*-test all coefficients=0	Firm Effects (*F*-stats)	Time Effects (*F*-stats)	FE vs RE (*Hausman* test)	Obs	Firms
SIZE	-0 5423** (0 1691)	0 5414** (0 1564)	0 0000	0 0000	0 0046	0 0000	1629	183
TA	-0 8264*** (0 1013)	0 2203* (0 0934)	0 0000	0 0000	0 0000	0 0000	1629	183
LEV	0 1367 (0 0847)	-0 0483 (0 0361)	0 0002	0 0000	0 0592	1 0000	1627	183
ROA	-0 0280 (0 0777)	-0 4471* (0 1976)	0 3105	0.0076	0 2289	0 0138	1629	183
CAPEX	0 2421 (0 3044)	0 1722 (0 1935)	0 0000	0 8027	0 0001	0 9999	1627	183
ACQ	0 0208 (0 0184)	0 0426 (0 0342)	0 2229	0 3109	0 3144	0 9863	1627	183
INVEN	0 0071 (0 0067)	-0 0021 (0 0086)	0 0046	0 0000	0 0094	0 0340	1628	183
CASH	-0 1156*** (0 0246)	0 0015 (0 0223)	0 0001	0 0000	0 0019	0 0016	1628	183
GSIZE	-0 3997 (0 5531)	0 0117 (0 4847)	0 0133	0.0000	0.0205	0 0002	1371	180
GTA	-2 8553*** (0 5397)	-2 8324*** (0 6478)	0 0000	0 0068	0 0000	0 0011	1442	183
NWTH	-1 7797*** (0 3275)	0.4558* (0 2339)	0 0000	0 0000	0 0002	0 0208	1629	183

The effects of the decision to go public on the variables listed above are estimated by a fixed effects model: $y_{it} = \alpha_i + \beta_1 BeforeIPO_{it} + \beta_2 AfterIPO_{it} + u_i + v_t + \varepsilon_{it}$. u_i and v_t are respectively firm-specific and year-specific effects $BeforeIPO_{it}$ is a dummy equals 1 if an observation for IPO firm i in year t is before the IPO $AfterIPO_{it}$ is a dummy equals 1 if an observation for IPO firm i in year t is after the IPO Therefore I use each firm in the IPO year as a control for itself before and after the IPO Heteroskedasticity robust standard errors are reported in parentheses The fixed effects model is estimated using the entire sample of IPOs SIZE is the log value of turnover, which is used as the main measure of firm size TA is the log value of total assets LEV is total debt over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ACQ is the net cash flow from acquisition and disposal over total assets INVEN is stock and work in progress over total assets CASH is cash and cash equivalent over total assets GSIZE is the rate of growth of turnover. GTA is the rate of growth of total assets NWTH is the log value of shareholders' funds, and values below zero are truncated at zero # p<0 1, * p<0 05; ** p<0 01; *** p<0 001

5.5 Concluding Remarks

In this chapter, I have used panel data for 183 UK IPO firms and 2315 UK private firms over twelve years from 1996 to 2007, to investigate the reasons for going public in the UK. I focused on UK registered non-financial private firms (the parent firms, if they exist, also need to be registered in the UK) and non-financial IPOs listed on the domestic market I studied the determinants of the likelihood of going public and compared the pre- and post- IPO operating performance of the IPO firms.

The findings provide support for many theoretical arguments. Financial constraints, cheaper costs of public equity, consideration of enhancing corporate governance are all important factors driving an IPO decision in the UK.

For this UK sample, the IPOs of independent firms are mainly driven by the need for capital to fund investment due to their limited ability to generate internal cash These firms appear to be smaller, have a more dispersed ownership structure and be in an earlier stage of growth. These are quite different from the evidence from Italy (Pagano *et al*, 1998), where it was found that larger and mature firms are more likely to go public with a main purpose of reducing high level of leverage and re-balancing financial structure

In contrast to independent firms, the IPO decision of the subsidiaries in the UK is mainly driven by corporate re-structuring and divestment motives. The parent firms tend to divest highly indebted and less controlled subsidiaries via IPO This is consistent with the results from the Italian firms.

Overall, for the UK market, smaller and growth firms are more likely to go public, and raising funds for investment is the dominant motive. The informative stock market reduces financing costs, and provides an access to a large pool of funds especially for young firms in need of capital for investment and expansion. This is quite different from the available evidence from other continental European markets, where mature firms are more likely to raise funds from the stock market, whereas young and growth firms are less keen to seek public equity due to high information costs.

In addition, it is found that corporate governance is an important consideration behind the IPO decision. Firms with more dispersed ownership structure show greater interests in an IPO This can be explained by the legal foundations and efficiency of the UK market. Stronger investor protection and informative stock prices may have induced these firms' preference for a market monitoring mechanism.

The UK stock market, including both the Official List and the AIM segment, seems to perform a quite positive role in supporting firm development, especially for financially constrained smaller growth firms. IPO firms continue to increase their sales after floatation, and firm value is significantly improved.

6 Going Public: Why? ... and When?

Evidence from How Companies Structure the IPOs in the UK

6.1 Introduction

The decision to go public includes two components one is the motive that is why firms go public; the other one is the timing that is when firms go public The timing element includes two dimensions: at what stage in the life of a firm and in what kind of market conditions will it choose to go public? The motive and the timing elements are closely connected (Ritter and Welch, 2002) and should be paid equal attention in empirical research.

There has been a huge volume of research on the IPO process and the immediate post-IPO experience, concentrating in particular on the underpricing phenomenon (Rock, 1986) Jenkinson and Ljungqvist (2001), Ritter and Welch (2002), Ljungqvist (2006) surveyed different aspects of this literature, but as these reviewers explain, much less research has been reported on the IPO decision *per se*, either on the 'why' or the 'when'

Most of the empirical studies on IPO decision use datasets including public and private firms. An alternative approach is to examine the IPOs of existing public firms An IPO may consist of primary shares, secondary shares, or a mixture of both. Primary shares are newly created and therefore raise new money for the company, whereas secondary shares are those already existing that are sold by current shareholders and, *prima facie*, permit these shareholders an exit route In an interesting recent contribution, Huyghebaert and Van Hulle (2006) studied the determinants of the size of the primary and secondary portions in a sample of 95 Belgian IPOs and they concluded that the type of shares offered in these IPOs directly reveals information about the motivation for the IPO. This suggests that it may be useful to investigate the determinants of the primary and secondary portions of IPOs in other markets to test more fully the validity of this hypothesis

In this chapter, I investigate cross-sectional data from a sample of 204[40] UK IPOs floated on the LSE over the six years 1998 to 2003. For these companies, I study the determinants of the structure of their IPOs and investigate the determining factors from the point of view of both the motives and the timing: 'why' and 'when' I first examine the determining factors of the choice of IPO structure – primary share offering, secondary share offering or combined offering, and then examine the determinants of the size of the primary and secondary portions

The rest of this chapter is organised as follows section 6 2 presents the theoretical predictions, section 6.3 describes the sample, section 6 4 examines the determinants of the choice of IPO structure; section 6.5 analyses the determinants of the size of the primary and secondary portions; section 6 6 provides some concluding remarks.

6.2 Theoretical Predictions

In the theoretical literature it is common to distinguish two types of motive – to raise equity capital for investment or, for original shareholders to divest or to exit. The two types of IPO motive and the related timing patterns can be tested by examining the determinants of IPO structure, since the type(s) of shares and their issue size(s) convey information about the decision to go public. Primary shares are the shares newly created at the IPO and hence the issue size of primary share[41] is mainly driven by the demand for fresh capital (e g. initial financing, reinvestment, expansions). Secondary shares are the existing shares divested at IPO and hence the issue size of secondary share[42] is driven by the motive of divesting and exit. In the following, I derive the theoretical predictions on the factors (including both the motives and the timing elements) that determine the issue size of primary share and secondary share, and attempt the question why some IPO firms only issue primary shares in their initial offerings while some others also include secondary shares A summary of the theoretical predictions is presented in Table 6.1.

[40] Further to the 183 IPO firms used in chapter 5, I was able to add another 21 IPO firms that registered in the UK yet have a foreign parent company for the cross-sectional dataset

[41] It is measured by the ratio of the number of primary shares to the number of total shares outstanding following the IPO

[42] It is measured by the ratio of the number of secondary shares to the number of total shares outstanding following the IPO

6.2.1 Investment Financing in Relation to Primary Shares

Financial Constraints

Financial constraints may arise for various reasons, such as debt overhang, limited cash generation and credit constraints. Highly levered firms may have fully used their borrowing capacity and the debt overhang problem is more likely to occur Regular debt interest payments can be a burden for firms that generate uneven cash inflows – the lower the interest coverage (EBIT over interest), the larger is the debt burden and the greater is the bankruptcy risk. Firms that rely heavily on bank borrowing may also be rationed, suggesting the need to seek wider sources of financing. These financial constraints may prevent private firms from realising all their investment opportunities and hence reduce firm value. In this case, the firm can benefit from a wider source of public equity by offering primary shares In line with this implication, the pecking order theory of Myers and Majluf (1984) suggested that firms use external equity as 'last resort' financing

Higher level of leverage, heavier debt burden and more reliance on bank borrowings indicate more severe financial constraint problems, and hence are expected to be correlated with a larger number of primary shares that need to be raised On the other hand, the weaker the internal cash generation, the larger the number of primary shares Leverage is often measured by total debt over total assets (LEV). Debt burden can be measured by the inverse of interest coverage, which is interest expense over EBIT (INCOV). Reliance on bank borrowing can be measured by bank loan over total debt (DTMIX). Internal cash generation is often measured by EBITDA over total assets (ROA). Therefore, the size of the primary share is expected to be positively related to LEV, INCOV and DTMIX, whereas negatively related to ROA

Corporate Governance and Market Monitoring

When firms access external capital – whether debt or equity financing, this typically gives rise to agency problems between financiers and managers (entrepreneurs) Solving the agency problems involves the efficient use of corporate resources, and

direct or indirect monitoring of management. Costs of control and monitoring depend less on whether the firm is privately or publicly owned, and more on the actual governance of each firm.

For firms financed by public equity, there are two main types of agency conflict One is the conflict between insider manager-shareholders and outsider large public investors Outsider block shareholders may put too much pressure on management (e g hostile takeover) and the presence of multiple outsider block shareholders may result in costly duplication of monitoring (causing the over-monitoring problem). The other is the conflict between non-shareholder managers' private benefits and dispersed public investors' interests. However, the stock market has the important function of revealing valuable information about firms' managerial performance and growth prospects via continuously quoted stock prices (Holmström and Tirole, 1993). This works as an important managerial incentive mechanism, alleviating the under-monitoring problem.

It is therefore expected that management would wish to keep (or even strengthen) their control by allocating shares to dispersed public investors. The larger the shareholdings of management before the IPO, the less likely it is that the managerial control is subsequently diluted, and hence a larger number of primary shares can be offered to the public. The degree of managerial concentration can be measured by the percentage of stock that directors own at IPO (DH). Therefore, the size of the primary share is likely to be positively correlated with DH

Timing – The Stage in Life Cycle of Firms

Diversification, bargaining power vs costs of information production, adverse selection

Raising financing from public investors creates liquidity for the firm, allowing its shareholders to diversify their portfolios and enhancing the entrepreneur's bargaining power against a large numbers of outside public investors. However, the advantage of avoiding an excessive risk premium for public equity comes with a cost imposed by asymmetric information problems. Each public investor needs to evaluate an IPO firm at a cost, implying sizeable duplications of the costs of information production that ultimately the firm must pay (in the form of underpricing) Information costs decrease

with the available information about the firm accumulated in the public domain, but increase with difficulties in evaluation (Chemmanur and Fulghieri, 1999). Therefore, there exists a negative relation between information costs and firm age and size.

The costs of information production associated with the informational asymmetries in the market can equally well be interpreted by adverse selection theory. Some investors are less informed about the value of the IPO firm, this creates a standard 'lemons' problem. To avoid a failure in its offering, the firm may underprice the IPO to signal its quality. Young and small firms have little track record and therefore especially high adverse selection costs and possible high underpricing costs

However, the correlation between the size of the primary share offered and firm age and size is uncertain On the one hand, higher costs of information production and adverse selection for younger and smaller firms are likely to induce a smaller size of primary share, and firms at an earlier stage may delay its profitable investment until a seasoned equity offering (when asymmetric information problems are reduced). On the other hand, if the costs of forgoing investment opportunities are substantially high (in particular if this will cause increasing costs of seasoned equity offerings), these firms may still issue a large number of primary shares in their IPO. An accurate measurement for firm age is the log value of time from starting business until IPO year (AGE) Firm size can be measured either by the log value of sales (SIZE), or the log value of total assets (TA).

Timing – Market Timing and Windows Opportunities

Subrahmanyam and Titman (1999) distinguished between firm-specific information which is generated from day-to-day operations and better collected by the insiders (managers, financial intermediaries), and market-specific information which is better collected by outside informed public investors and conveyed by stock prices Fluctuations in stock prices can reveal valuable information about the expected payoff from growth opportunities, risks, expected profitability and expected cash flow (Clementi, 2002, Pastor and Veronesi, 2005; Benninga *et al* , 2005) Timing an IPO to coincide with a high market price (i e potentially high market valuation) can facilitate

the firm's investment decision, overcome borrowing constraints and diversify away idiosyncratic risks. A higher market price indicates more investment opportunities, allowing the firm to revise its investment upwards From this point of view, a larger size of primary shares is expected to be offered when market price is high. In addition, when market price is high, the intrinsic value of a project becomes larger relative to the potential adverse selection costs. This is also likely to induce a larger size of primary shares so as to take advantage of windows of opportunity.

Market price at IPO can be measured by annual market return in the 12 month preceding the IPO (MKTRT) Following the rational theory of market timing, MKTRT is expected to be positively related to the size of primary share

However, Ritter and Welch (2002) pointed out that the investment and financing decisions of entrepreneurs are more driven by firm-specific information rather than by the stock market It takes time for entrepreneurs to adjust their private valuation towards the market valuation. Given this semi-rational theory, the relation between MKTRT and the size of primary share is not obvious.

6.2.2 Divestment and Exit in Relation to Secondary Shares

Excessive Owner-Manager Conflicts and Value of Control Rights

As firms grow, conflicts between managers and some block holders (if the block holders are outside management) can become increasingly acute, driving the block holders to exit from the firm (Zingales, 1995; Mello and Parsons, 1998). Directly selling the firm out and bargaining with potential buyers can maximise the proceeds from the sale of control rights However, going public and selling out to dispersed shareholders can maximise the revenue from the sale of cash flow rights, as publicly observable stock prices reduce information asymmetries and enhance monitoring of management. This is especially beneficial for the selling shareholders if management extracts private benefits from shareholders As a consequence, first selling a small portion of shares to dispersed shareholders indirectly strengthens the owner's bargaining power for a subsequent sale of the controlling block (Zingales, 1995)

Zingales' model (1995) implies that the greater proportion of cash flow rights to total shares sold, the more private benefit of control is transferred to buyers This may prevent the manager-shareholders from extracting their private benefits. As such a threat to the managers increases in managerial concentration, managerial concentration at IPO (DH) is expected to be negatively related to the size of secondary share offered

Timing – The Stage in Life Cycle of Firms

Idiosyncratic risks and adverse selection costs

Ellingsen and Rydqvist (1997) argued that firms may be over-invested and that idiosyncratic risks increase with firm age. Some large block holders (e.g. entrepreneurs, venture capital) may want to cash out from the firm by a certain time in order to avoid potential over-investment and increasing idiosyncratic risks, and to undertake new and profitable activities.

Due to asymmetric information and moral hazard problems, the exit of shareholders might be perceived as a bad signal by public investors, who might ascribe the exit to poor entrepreneurial performance or decreasing investment value for venture capital This implies high adverse selection costs of IPOs for bad firms For this reason, it is likely that only the shareholders of good firms are able to exit via going public. The better the signal a firm can send to the market, the larger the shareholdings that original shareholders can divest via the IPO. Firms at a later stage suffer less from adverse selection problems, and thus shareholders may be able to sell more at IPO

Therefore, the size of the secondary share offered in an IPO is expected to be positively correlated with the firm's operational performance and financial conditions – positively correlated with ROA whereas negatively correlated with LEV, DTMIX and INCOV The size of the secondary share may also be positively correlated with firm age (AGE) and firm size (SIZE and TA)

Timing – Market Timing and Windows of Opportunity

As far as I am aware, there is no formal theory that models the impact of windows of

opportunity on a firm's divestment or exit strategy However, during a period of high market return, public investors may assess shareholders' exit more optimistically because they are affected by optimistic market sentiment. This may allow selling shareholders to sell secondary shares more easily, owing to lower adverse selection costs

6.2.3 Investment and Divestment in a Unified Framework

The existing theoretical literature about the decision to go public is built either on an investment assumption or a divestment assumption. Due to the complexity of IPO decision, there is no single theoretical model that incorporates both motives within a unified and dynamic framework. This leaves one important question under-addressed why some firms issue only primary shares, while others also add secondary shares in their IPOs

Tirole (2005) distinguishes two types of corporate monitoring mechanism: first, active monitoring by equity holders such as venture capital or other large shareholders, or by debt holders such as banks; or second, passive monitoring by changes in stock prices. Active monitors make use of their formal control (voting rights) or real control (influence on the board with respect to a given policy) and provide strategic information about firm structure, competition strategy and personnel decisions, so as to increase the value of assets in place. By contrast, while passive monitoring performed by stock prices does not have value, a liquid and well-developed stock market has the function of rewarding or punishing management via changing stock prices, thus improving managerial performance and indirectly increasing firm value.

During its life, a firm may resort to the stock market to raise funds for its reinvestment and expansion, because at a certain time financing from the stock market is associated with lower adverse selection and information production costs, better bargaining power and lower required risk premiums, value indirectly added by market monitoring and favourable market valuation. On the other hand, during the cycle of financing and investment, some active monitors (large shareholders) may wish to sell some of their shares to diversify their portfolios or to exit from the firm to move on to other projects.

These active monitors are able to exit from their investment before a final outcome is realised – the monitoring capital in the market provides the active monitors with an exit mechanism, because their performance can be evaluated by the market. However, this does not mean that active monitors can exit at any time they want The exit mechanism functions well for them only if there are sufficient reinvestment opportunities with high intrinsic value for the firm, there is substantial favourable information about the firm accumulated in the public domain, and there are adequate potential public investors (i.e the passive monitoring providers)

In relation to this argument, firms who add secondary shares in their IPOs are expected to be more mature (older and larger), in better financial shape and have better growth prospects than those who only offer primary shares. In addition, IPOs that include secondary shares are expected to conduct the offerings at higher stock prices, because there is more monitoring capital (public investors) in a more optimistic market.

A summary of the theoretical predictions is presented in table 6.1

Table 6.1 Summary of the Theoretical Predictions

Theories *Investment and Expansion*		Size of Primary Shares *Sign*	*Variables*
Financial constraints	Jensen and Meckling (1976), Myers (1977), Stiglitz and Weiss (1981), Myers and Majluf (1984)	+	Leverage (LEV)
		+	Bank borrowing (DTMIX)
		+	Debt burden (INCOV)
		−	Internal cash generation (ROA)
Diversification and bargaining power vs costs of information production and adverse selection	Chemmanur and Fulghieri (1999)	?	Firm age (AGE)
		?	Firm size (SIZE, TA)
Agency problems vs market monitoring	Jensen and Meckling (1976), Jensen (1986), Holmstrom and Tirole (1993), Pagano and Roell (1998)	+	Managerial concentration (DH)
Market timing and window of opportunity	Subrahmanyam and Titman (1999), Clementi (2002), Pastor and Veronesi (2005), Benninga *et al* (2005)	+	Market return (MKTRT)
	Ritter and Welch (2002)	?	Market return (MKTRT)

Theories *Divestment and Exit*		Size of Secondary Shares *Sign*	*Variables*
Idiosyncratic risks and adverse selection costs	Ellingsen and Rydqvist (1997)	−	Leverage (LEV)
		−	Bank borrowing (DTMIX)
		−	Debt burden (INCOV)
		+	Internal cash generation (ROA)
		+	Firm age (AGE)
		+	Firm size (SIZE, TA)
Excessive owner-manager conflicts and value of control rights	Zingales (1995), Mello and Parsons (1998)	−	Managerial concentration (DH)
Market timing and window of opportunity	N/A	?	Market return (MKTRT)

Size of Primary (Secondary) Shares is measured by the ratio of the number of primary shares (secondary shares) to the number of total shares outstanding after IPO LEV is total debt over total assets DTMIX is bank loan over total debt INCOV is interest expense over EBIT (earnings before interest and tax), and values below zero are truncated at zero ROA is EBITDA (earnings before interest, tax, depreciation and amortization) over total assets AGE is the log value of firm age which is the age since the firms started business until the IPO year Two measurements for firm size are (1) SIZE which is log value of sales, and (2) TA which is log value of total assets DH is the percentage of shareholdings that directors (with ownership exceeding 3%) own at IPO MKTRT is the annual market return in the 12 months preceding the IPO, calculated using the FTSE All Share Index

6.3 Sample and Summary Statistics

The analyses are based on 204 non-financial UK IPOs listed on the LSE during 1998 through 2003. I use a cross-sectional dataset of these IPOs at the time of their offering. The sources of the data were introduced in chapter 4

Table 6 2 reports summary statistics on the IPO structure, financial characteristics, ownership structure and the growth opportunities of the whole sample of IPO firms at the time of their flotation The mean (median) size of primary shares issued relative to the post-IPO shares outstanding is 27 73% (23 78%), whereas the proportion of secondary shares is much smaller at 5 46% (0%). In sharp contrast, Huyghebaert and Van Hulle (2006) reported that for the Belgian IPOs, the sizes of primary and secondary shares are nearly equal on average. *Prima facie* it may seem that, in comparison with the Belgian firms, IPO activities in the UK are more related to financing than to transfer of ownership. Furthermore, primary and secondary shares combined average 33 21% of total shares outstanding after the offering for the UK IPOs, suggesting that the original owners retain control immediately after the IPO.

The average firm age at IPO is 13.24 years, much greater than the mean incorporation age (2.74 years) suggesting that indeed many firms incorporate for the purpose of a flotation The key financial indicators vary quite widely across firms, reflecting differences in size, operating performance and financial structure at the IPO Compared with some other European IPOs (Pagano *et al* 1998, Huyghebaert and Van Hulle, 2006), UK firms at IPO are younger, smaller, and rely much less on debt financing (especially less on bank borrowing)

Ownership is relatively concentrated both before and after IPO, although total blockholders' shareholdings fall from 72 8% to 55.12% after IPO However, ownership is much less concentrated on average in the UK than in other European IPOs. For example, in the UK, 4.78 blockholders own 55 12% of the shares on average after IPO, whereas in Belgium 1.99 blockholders own 64.94% of the shares after IPO (Huyghebaert and Van Hulle, 2006) Directors own a large portion of blockholders' total shareholdings and, although the number and stake of directors are reduced after IPO,

their holdings relative to the blockholders' total are nearly unchanged This pattern is consistent with a 'managerial ownership and control' structure for the UK IPO firms in general.

Table 6.2 IPO Structure, Financial and Ownership Characteristics at the IPOs (n=204)

Variable	Mean	Median	Std Dev.	Min	Max
		IPO STRUCTURE			
Primary Funds (£'000)	11791 75	4700	23074 58	0	168750
Secondary Funds (£'000)	6188 08	0	21898 06	0	225000
IPO Funds (£'000)	17985 34	5183 10	41285 37	200	393750
Primary Size	0 2773	0 2378	0.1888	0	1 0000
Secondary Size	0 0546	0	0.1020	0	0 8165
IPO Size	0 3321	0 2954	0 1902	0 0183	1 0000
Primary Proportion	0 8423	1	0 2390	0	1
		FINANCIAL CHARACTERISTICS			
Firm Age	13 24	7	27.14	0 08	264
Incorporation Age	2 74	0 67	4 17	0	19 67
Total Assets (£'000)	11865 16	2779	27149.48	12 51	205763
Total Sales (£'000)	13607 06	2868	32154 92	0	229635
ROA	-0 2480	0 0530	1 2495	-14 1970	1 2653
LEV	0 3623	0.1497	0 8305	0	9 2381
DTMIX	0 3638	0 2330	0 3849	0	1
DTMIX_ST	0 2229	0 0303	0 3167	0	1
DTMIX_LT	0.1541	0	0 3203	0	2 9098
INCOV	0.2292	0	0 6550	0	6.9677
		OWNERSHIP STRUCTURE			
Blockholders Before IPO	4 21	4	3 04	0	14
Blockholders After IPO	4.78	5	2.77	0	13
Directors Before IPO	2 38	2	1 53	0	7
Directors After IPO	2.16	2	1.35	0	7
CONC1 (%)	0 7280	0 8200	0 2805	0	1
CONC2 (%)	0 5512	0 5780	0 2274	0	1
DH1 (%)	0 5063	0 5331	0 3131	0	1
DH2 (%)	0.3417	0 3374	0.2267	0	0 9615
		GROWTH OPPOTUNITIES			
PVRE	9 7955	9 7964	1 7162	0	14 9975

Primary (Secondary) Funds is the filing offer price times the number of primary (secondary) shares IPO Funds is the filing offer price times the number of total IPO shares Primary Size (Secondary Size) is the ratio of the number of primary shares (secondary shares) to the number of total shares outstanding after IPO IPO Size is the ratio of the number of total IPO shares to the number of total shares outstanding after IPO Primary Proportion is the ratio of the number of primary shares to the number of total IPO shares Firm Age is the age since the firm started business Incorporation Age is the age since the firm incorporated ROA is EBITDA (earnings before interest, tax, depreciation and amortization) over total assets LEV is total debt over total assets DTMIX is bank debt over total debt DTMIX_ST (DTMIX_LT) is short-term (long-term) bank loan over total debt INCOV is interest expense over EBIT (earnings before interest and tax), and values below zero are truncated at zero Blockholders (Directors) Before (After) IPO is the number of blockholders (directors) whose ownership exceeds 3% before (after) IPO CONC1 (CONC2) is the percentage of shareholdings that blockholders own before (after) IPO DH1 (DH2) is the percentage of shareholdings that directors (with ownership exceeding 3%) own before (after) IPO PVRE is the log present value of expected residual earnings, calculated as log value of the difference between the market value of equity and the book value of equity, where values below zero are truncated at zero

The theories imply that offering primary shares is likely to be associated with financial constraints, firms who add secondary shares in their IPOs are likely to be more mature, in a better financial shape and have higher growth opportunities than those who only offer primary shares. To draw a distinction among firms that only issue primary shares, those that only issue secondary shares and those that issue a combination, I further divide the sample IPOs into three sub-samples according to the type of shares offered, and compare the profile of the IPO firms Table 6.3 reports the means and *p*-values of the Wilcoxon rank sum test for the pair-wise sub-samples.

As shown in Table 6.3, more than half of the sample firms issued primary shares only, just 2 firms issued secondary shares only while the remaining 88 firms issued a mixture of primary and secondary shares[43]. In contrast, in Belgium from 1984 to 2000 (Huyghebaert and Van Hulle, 2006), primary share offerings[44] make up only one quarter of all IPOs, whereas secondary share offerings account for over a third. Together with the differences in the size of primary share and secondary share offered, the popularity of primary share offerings (financing related) in UK as opposed to secondary share offerings (transfer of ownership) may reflect differences in the institutional and legal environment between UK and the continental European countries, as argued by La Porta *et al* (1997).

Funds collected are not significantly different between combined offerings and secondary share offerings, although combined offerings collect both larger primary funds and total funds than primary share offerings. This may suggest that firms conducting primary share offerings have less ability to utilise the market device. Interestingly, total shares offered relative to total shares outstanding after the IPO do not differ significantly across groups. This may indicate an 'optimal IPO size' for IPO firms, due to an optimal dispersion of ownership base

Evidently, firms that issue primary shares only are significantly younger and smaller

[43] There were 438 non-financial UK IPOs listed on the LSE from 01/01/1998 to 01/01/2004, consisting of 337 primary share offerings, 96 combined offerings, and 5 secondary share offerings

[44] Primary share offering refers to an issue in which only primary shares (i e new shares) are offered Secondary share offering refers to an issue in which only secondary shares (i e existing shares) are offered Combined offering refers to an issue in which both primary and secondary shares are offered

than the other two groups while firms that conduct combined offerings have significantly higher growth opportunities (PVRE) than firms offering primary shares only In addition, as compared to the combined offerings, primary share offerings have weaker profitability (ROA) yet better ability to meet interest payments on outstanding debt (INCOV) This may suggest different causes of financial constraints for the two groups – weaker internal cash generation for younger and smaller firms in contrast to the need to alleviate debt interest payments for older and larger firms. Secondary share offerings show much higher profitability and much less leverage, compared with the other two groups[45]. The very low leverage level implies that raising finance is not the reason of floatation for the firms that only sell existing shares in their IPOs On the other hand, divesting and exit by the existing shareholders can be the real motives These firms are in late stage of their life cycle and are likely to have established business Selling out by the insiders (i e the existing shareholders) can be a bad news However, strong profitability may be interpreted by the market as a positive signal, which may promote the sales This is also consistent with the hypothesis that offering primary shares is associated with financial constraints.

[45] The insignificant *p*-value might be caused by small sample size for the secondary-share-offering group (n=2) This limitation can hardly be avoided as in total there are only five secondary share offerings during the sample period

Table 6.3 Summary Statistics for the Sub-samples Sorted according to the Choice of IPO Structure

Variable	Primary Share Offering (PSO) n=114			Combined Offering (CO) n=88		Secondary Share Offering (SSO) n=2
	Mean	Wilcoxon RST (PSO–CO)	Wilcoxon RST (PSO–SSO)	Mean	Wilcoxon RST (CO–SSO)	Mean
IPO STRUCTURE						
Primary Funds (£'000)	6318 15	0 0000	0 0156	19150 55	0 0160	0
Secondary Funds (£'000)	0	0 0000	0 0000	14186 37	0 8054	6983 41
IPO Funds (£'000)	6318 15	0 0000	0 5385	33349 71	0 1469	6983 41
Primary Size	0 3219	0 0004	0 0156	0 2258	0 0160	0
Secondary Size	0	0 0000	0 0000	0 1181	0 0248	0 3683
IPO Size	0 3219	0.1500	0.3845	0 3445	0 3961	0 3683
FINANCIAL CHARACTERISTICS						
Firm Age	9 02	0 0001	0 0387	17.01	0.0705	81 5
Incorporation Age	2 01	0 0055	0 3496	3 55	0 4933	8 63
Total Assets (£'000)	3920 01	0 0000	0 0200	21587 91	0 3757	17963 5
Total Sales (£'000)	4183 35	0 0000	0 0664	24608 10	0 4548	43942
ROA	-0 4411	0 0000	0 1654	-0 0186	0 5432	0 2033
LEV	0 4040	0 5155	0.1629	0 3186	0 0883	0 0111
DTMIX	0 3759	0 8371	0 7977	0 3490	0 8223	0 3561
DTMIX_ST	0 2474	0 7131	0 7953	0.1893	0 7621	0 3561
DTMIX_LT	0 1285	0 1374	0 3821	0 1894	0 2716	0
INCOV	0 1767	0 0000	0 8376	0 3004	0 2506	0 0048
OWNERSHIP STRUCTURE						
Blockholders before IPO	3 99	0 1356	0.3702	4 54	0 2150	2
Blockholders after IPO	4 95	0 7225	0 9915	4 56	0 9777	4 5
Directors before IPO	2 27	0 1975	0 4821	2 51	0 5849	3
Directors after IPO	2 18	0.9425	0 5915	2 14	0 6310	1 5
CONC1 (%)	0 7422	0 3151	0 7436	0 7107	1 0000	0 7011
CONC2 (%)	0.5723	0.1051	0 6844	0.5219	0 6030	0 6475
DH1 (%)	0 5164	0 6794	0 4547	0 4977	0 4193	0 3315
DH2 (%)	0 3464	0 8708	0 7644	0 3367	0 8159	0 2917
GROWTH OPPORTUNITIES						
PVRE	9 2076	0 0000	0 5310	10 6370	0 0742	4 9311

Primary (Secondary) Funds is the filing offer price times the number of primary (secondary) shares IPO Funds is the filing offer price times the number of total IPO shares Primary Size (Secondary Size) is the ratio of the number of primary shares (secondary shares) to the number of total shares outstanding after IPO IPO Size is the ratio of the number of total IPO shares to the number of total shares outstanding after IPO Primary Proportion is the ratio of the number of primary shares to the number of total IPO shares Firm Age is the age since the firm started business Incorporation Age is the age since the firm incorporated ROA is EBITDA (earnings before interest, tax, depreciation and amortization) over total assets LEV is total debt over total assets DTMIX is bank debt over total debt DTMIX_ST (DTMIX_LT) is short-term (long-term) bank loan over total debt INCOV is interest expense over EBIT (earnings before interest and tax), and values below zero are truncated at zero Blockholders (Directors) Before (After) IPO is the number of blockholders (directors) whose ownership exceeds 3% before (after) IPO CONC1 (CONC2) is the percentage of shareholdings that blockholders own before (after) IPO DH1 (DH2) is the percentage of shareholdings that directors (with ownership exceeding 3%) own before (after) IPO PVRE is the log present value of expected residual earnings, calculated as log value of the difference between the market value of equity and the book value of equity, where values below zero are truncated at zero For the primary share offering subsample, following the mean, they are the p-values of the Wilcoxon rank sum tests for (1) the primary share offering and the combined offering subsamples, and (2) the primary share offering and the secondary share offering subsamples For the combined offering subsample, following the mean, they are the p-values of the Wilcoxon rank sum tests for the combined offering and the secondary share offering subsamples

6.4 Determinants of the Choice of IPO Structure

6.4.1 The Model and Methodology

When an IPO decision is made, the issuer first chooses the type of share to be offered, and then decide the size of the different types of share. Therefore, I first investigate the determining factors that drive a firm's choice of IPO structure. On the basis of the discussion in section 6 2 3, it is expected that older and larger firms, with higher growth opportunities and in better financial shape, are more likely to add secondary shares to their offerings in order to meet the liquidation needs of some shareholders, and that the offerings are likely to be conducted at a higher market return I now test the validity of these predictions

The choice of IPO structure is among three options: primary share offering, secondary share offering and combined offering The three options are not ordered from 'less' to 'more', but are disjoint and cover all possible choices In this case, the MNL model – multinomial logit model (Luce 1959) offers an ideal approach to accessing the determinants of the choice of IPO structure

The utility function for firm i to choose IPO structure j (j=1, 2, 3) is given by:

$$U_{ij} = x_i' \beta_j + \varepsilon_{ij} \qquad (6\ 1)$$

Firm i will choose IPO structure j only if it offers the highest level of utility of all the three types of IPO structure. Let $Choice_i$ represent a random variable whose value indicates the choice of firm i, the probability that firm i will choose IPO structure m (m=1, 2, 3) is given by.

$$\Pr(Choice_i = m) = \Pr(U_{im} > U_{ij}) \text{ , for } j=1, 2, 3 \text{ and } j \neq m \qquad (6\ 2)$$

Therefore,

$$\Pr(Choice_i = m) = \Pr(\varepsilon_{ij} - \varepsilon_{im} < U_{im} - U_{ij}) \text{ , for } j=1, 2, 3 \text{ and } j \neq m \qquad (6\ 3)$$

According to McFadden (1973), if the error terms ε_{ij} are assumed to be $i.i.d$ with Weibull distribution[46] $F(\varepsilon_{ij}) = \exp[\exp(-\varepsilon_{ij})]$, then

$$\Pr[Choice_i = m] = \frac{\exp(x_i'\beta_m)}{\sum_{j=1}^{3}\exp(x_i'\beta_j)} \quad (6\,4)$$

Here, $Choice_i = m$ (m=1, 2, 3) for each IPO firm i (i=1, .. , 204) is defined as $Choice_i = 1$ if firm i chooses a primary share offering, $Choice_i = 2$ if firm i chooses a secondary share offering, and $Choice_i = 3$ if firm i chooses a combined offering I use combined offering as the control group and normalise $Choice_i = 3$ to have a zero coefficient. Thus I measure the ***relative*** influence of a set of regressors X on primary share offerings or secondary share offerings with respect to a common base group of combined offerings.

Therefore, the probability for the choice m of the firm i in the MNL model is given by.

$$\Pr[Choice_i = m] = \frac{\exp(x_i'\beta_m)}{1+\sum_{j=1}^{2}\exp(x_i'\beta_j)}, \text{ for } m=1, 2 \quad (6\,5)$$

and

$$\Pr[Choice_i = m] = \frac{1}{1+\sum_{j=1}^{2}\exp(x_i'\beta_j)}, \text{ for } m=3 \quad (6\,6)$$

Consequently, the logarithm of the ratio of the probability of $Choice_i = 1$ or $Choice_i = 2$ to that of the base outcome $Choice_i = 3$ is:

$$\ln\left(\frac{\Pr(Choice_i=m)}{\Pr(Choice_i=3)}\right) = x_i'\beta_m = \sum_{r=1}^{N}\beta_{mr}x_{ir}, \; m=1, 2 \quad (6\,7)$$

where N denotes the number of explanatory variables. The coefficients β_r estimate the effects of the explanatory variables x_r on the ***log-ratio*** of the probability being in the target group m (m=1, 2) relative to the base group m=3 A positive (negative) coefficient implies an increase of the probability ratio as x increases (decreases).

[46] Yellott (1977) demonstrated that for any number of alternatives which satisfy Luce's (1959) choice rule, Weibull distribution is the only distribution that yields logistic form

I include ten explanatory variables (N=10): AGE (x_1) and TA (x_2) measure the stage in the life cycle, LEV (x_3) and ROA (x_4) measure financial conditions, DH1 (x_5) and DH2 (x_6) measure managerial control, PVRE (x_7) measures growth opportunities, and MKTRT (x_8) captures market timing effects. In addition, two dummies are added: INDM (x_9) captures industry difference (impact of technology) and ACQDM (x_{10}) distinguishes acquisition financing from general financing purposes.

Table 6.4 Definitions of Explanatory Variables

Explanatory Variable	**Abbr**	**Definition**
Firm age	AGE	ln(age since the firm started business until IPO)
Total assets (firm size)	TA	ln(total assets)
Leverage	LEV	(total debt)/(total assets)
Profitability	ROA	EBITDA/(total assets)
Managerial control before IPO	DH1	percentage of shareholdings that directors own (ownership>3%) before IPO
Managerial control after IPO	DH2	percentage of shareholdings that directors own (ownership>3%) immediately after IPO
Growth opportunities	PVRE	ln(present value of expected residual earnings)
Market return	MKTRT	the annual market return in 12 months preceding the IPO
Industry dummy	INDM	equals 1 if the IPO firm belongs to ICT industry, equals 0 otherwise
Acquisition dummy	ACQDM	Equals 1 if the IPO is related to acquisition financing, equals 0 otherwise

The MNL model is usually estimated by maximum likelihood. Greene (2000) suggested several measures for the goodness-of-fit of the model. The basic criterion is the maximised value of the log-likelihood function Subsequently, the statistical test on the hypothesis that all the slopes in the model are zero (i.e. comparing the full model with an intercept only model) should be reported (χ^2) Veall and Zimmerman (1996) surveyed pseudo-R^2 measures, and argued that McFadden (1973)[47]'s measure is worthwhile The higher the pseudo-R^2value, the better is the fit of the model (Greene,

[47] pseudo $-R^2 = \frac{1-lnL_{fit}}{ln L_0}$ (McFadden, 1973), where L_{fit} denotes the maximised log-likelihood value for the fitted model, L_0 denotes the maximised log-likelihood value for the intercept-only model

2000). In general, it is necessary to report both diagnostics – χ^2 and pseudo-R^2.

For convenience of interpretation, the relative risk ratios (RRRs) are usually computed in addition to the estimated coefficients. RRRs are the exponentiated coefficients obtained by taking exponential of equation 6.7. The RRR of explanatory variable x_r measures the change of the probability of being in group m (m =1, 2) relative to the probability of being in the base group for a one unit change in the determining variables x_r, given that the other variables are held constant The calculation of the RRR of x_r for a one unit change from value a to value $(a+1)$ is shown as follows:

$$RRR_{mr} = \frac{\Pr(Choice_i=m|x_r=a+1)/\Pr(Choice_i=3|x_r=a+1)}{\Pr(Choice_i=m|x_r=a)/\Pr(Choice_i=3|x_r=a)}, m=1, 2 \quad (6.8)$$

Because the RRRs are the exponential transformation of the estimated coefficients, the RRR is equal to unity if the coefficient equals zero, greater than unity if the coefficient is positive and less than unity if the coefficient is negative. The RRR indicates the direction of the change in the probability ratio as the x change, and gives a direct estimate of the sensitivity of the probability ratio to the change in the x the closer to one the RRR, the less sensitive is the probability ratio to the change.

The marginal effects on the probabilities of the different outcomes of a unit change in the value of the explanatory variables are not straightforward in the MNL model. They cannot be inferred either from the signs of the β_r or from the RRRs This is because, in the MNL model, a change in the value of an explanatory variable for firm i affects the firm's probability of every possible choice (m =1, 2, 3) and whether $\Pr(Choice_i = m)$ increases or decreases depends on what happens to the probabilities of the other choices Thus, the marginal effect can change sign depending on where the explanatory variable is being evaluated. An alternative strategy is to compare the predicted probabilities before and after a unit change in one explanatory variable with the values of the other variables being unchanged[48]. This method is especially useful for evaluating the impact

[48] One way to keep the value of the other variables unchanged while changes to the value of a variable are being analysed is to set the values of the other variables to their mean values

of a change in a dummy variable on the probability of the choices

6.4.2 The Results

The estimated coefficients and RRR of the MNL model are reported in Table 6.5 Panel A. Inside the parentheses under the parameters are the robust standard errors of the estimated coefficients and RRRs. The marginal effects are also computed for the MNL and reported in Panel B The results are generally very satisfactory The estimates show that the stage of a firms' life cycle (AGE, TA), Leverage (LEV), growth opportunities (PVRE), market timing (MKTRT), ICT industry (INDM), and acquisition financing (ACQDM) all have distinctive effects on the choice of IPO structure.

In response to a *ceteris paribus* increase in firm age or firm size, the probability ratio of a primary share offering decreases whereas that of a secondary share offering increases. The estimated RRRs of AGE and TA confirm that the probability ratio of a primary share offering and that of a secondary share offering are sensitive to a change in AGE or TA. A small increase in the value of AGE (TA) is related to 11 68% (9 91%) decrease in the probability of a primary share offering whereas 11.68% (9.91%) increase in the probability of a combined offering for the 'average firm' (i e. a firm with average values for all the other variables). Overall, these relations suggest that much younger and smaller IPO firms are likely to issue primary shares only whereas the oldest and largest firms tend to issue secondary shares only rather than combined shares.

PVRE and MKTRT are both negatively signed for primary share offering, significant at 0.1% level for MKTRT yet at only 10% level for PVRE. These suggest that higher growth prospects would increase the probability that firms will include secondary shares, and that a combined offering is likely to be conducted at a relatively higher market return The marginal effect on the probability of a primary share offering (a combined offering) of a smaller change in MKTRT is as high as -132.18% (132 18%) The RRRs of MKTRT are far from 1. There results suggest that market return has a very strong impact on the choice of IPO structure. The combined results of PVRE and MKTRT indicate that, compared to growth prospects, market return is much more critical for firms when they decide their IPO structure

Overall, these results suggest that firms with higher growth prospects are more likely to utilise IPO as an exit device In particular, the selling shareholders tend to time the offering at a higher market return in order to maximise the proceeds from divestment.

LEV is also correctly signed but is only significant at 10% for primary share offerings In short, the results provide supportive evidence for the predictions Older and larger firms with better growth prospects are more likely to exploit exit opportunities in their IPOs (by adding secondary shares), especially when market returns are higher. This is because these firms have substantial reinvestment opportunities with high intrinsic value. They also have informational advantages, since more firm-specific information becomes publicly available as firms grow mature This in return reduces information production costs and alleviates adverse selection problems These advantages warrant sufficient monitoring capital in the stock market. The monitoring capital (passive monitors) provides the selling shareholders (active monitors) with an exit mechanism

The two dummy variables, INDM and ACQDM are both significant but show different signs of coefficients for primary share offering and secondary share offering The RRRs of the two indicators are far from 1, implying that the probability ratios are sensitive to both dummy variables The marginal effects of the two are quantitatively similar The results of INDM indicate that shareholders of ICT firms are more likely to exploit exit opportunities during their IPO. This may also reflect the market conditions over the sample period when the ICT industry was in favour with investors, implying that more monitoring capital available in the market for the ICT sector. Conversely, the ACQDM exerts a positive effect on the probability ratio of primary share offering but a negative influence on that of secondary share offering, suggesting that the shareholders of the firms involved in acquisition financing are less likely to exit from the firms in the IPOs

It is also noticeable that the coefficients have large values for secondary share offering[49]. This is caused by the small sample size of secondary share offerings – there were only a total of five secondary share offerings during the sample period and two of these were included in the sample Estimating the choice of IPO structure taken together the combined offerings and secondary share offerings in a binary logit model, the conclusions hold (shown in Table 6.6)

[49] When the RRR for secondary share offering is extremely large, the value is not reported

Table 6.5 Determinants of the Choice of IPO Structure (MNL Model, n=204)

Panel A: The parameter estimates & relative risk ratios for the multinomial logit model (MNL)

Variable	PSO – Primary Share Offering (n=114)		SSO–Secondary Share Offering (n=2)	
	Parameter Estimate	RRR	Parameter Estimate	RRR
Intercept	11 6247**		-54 1762***	
	(3 6350)		(6 3930)	
AGE	-0 4832*	0 6168*	18 0412***	***
	(0 1912)	(0 1179)	(0 5664)	
TA	-0 4098*	0 6638*	11 7508***	***
	(0 1601)	(0 1063)	(0 4691)	
LEV	0 5794#	1 7851#	-567 6869***	0 0000***
	(0 3441)	(0 6142)	(14 4627)	(0 0000)
ROA	-0 2359	0 7898	0 2181	1 2438
	(0 2954)	(0 2333)	(2 4207)	(3 0107)
DH1	-2 1909	0 1118	-72 5885***	0 0000***
	(1 3972)	(0 1562)	(2 2223)	(0 0000)
DH2	2 7908	16 2933	91 2785***	***
	(1 8807)	(30 6425)	(3 2942)	
PVRE	-0 7606#	0 4674#	-12 1947***	0 0000***
	(0 4073)	(0 1904)	(0 5236)	(0 0000)
MKTRT	-5 4691***	0 0042***	-154 2656***	0 0000***
	(1 4270)	(0 0060)	(5 9775)	(0 0000)
INDM	-0 9792*	0 3756*	3 8639*	47 6522*
	(0 4275)	(0 1606)	(1 5755)	(75 0757)
ACQDM	1 2090**	3 3502**	-61 4982***	0 0000***
	(0 4140)	(1 3869)	(1 7284)	(0 0000)
Wald Chi-sq	9680 12		Prob> Chi-sq	0 0000
Pseudo R-sq	42 31%		Log Pseudo-likelihood	-83 0682

Panel B: Marginal effects after the MNL

Variable	*y=Pr(PSO)=0 5912* dy/dx	*y=Pr(CO)=0 4088* dy/dx	*y=Pr(SSO)*=0 0000 dy/dx	X
AGE	-0 1168*	0 1168*	0 0000	1 8617
	(0 0455)	(0 0455)	(0)	
TA	-0 0991*	0 0991*	0 0000	8 0799
	(0 0396)	(0 0396)	(0)	
LEV	0 1400#	-0 1400#	0	0 3656
	(0 0829)	(0 0829)	(0)	
ROA	-0 0570	0 0570	0 0000	-0 2449
	(0 0709)	(0 0709)	(0)	
DH1	-0 5295	0 5295	0	0 5078
	(0 3324)	(0 3324)	(0)	
DH2	0 6745	-0 6745	0 0000	0 3431
	(0 4484)	(0 4484)	(0)	
PVRE	-0 1838#	0 1838#	0	9 8065
	(0 0968)	(0 0968)	(0)	
MKTRT	-1 3218***	1 3218***	0	0 0204
	(0 3457)	(0 3457)	(0)	
INDM	-0 2388*	0 2388*	0 0000	0 2769
	(0 1015)	(0 1015)	(0)	
ACQDM	0 2878**	-0 2878**	0 0000	0 5641
	(0 0941)	(0 0941)	(0)	

CO – combined offering (n=88) is the base outcome Robust standard errors are reported in the parentheses In Panel A, when the RRR is extremely large, the value is not reported The last column of Panel B (X) reports the mean values of the variables All variables use the value at the time of IPO AGE is the log value of firm age that is the age since the firms started business until the IPO year TA is the log value of total assets LEV is total debt over total assets ROA is EBITDA (earnings before interest, tax, depreciation and amortization) over total assets DH1 (DH2) is the percentage of shareholdings that directors (with ownership exceeding 3%) own before (after) IPO PVRE is the log present value of expected residual earnings, calculated as the log value of the difference between the market value of equity and the book value of equity, where values below zero are truncated at zero MKTRT is the annual market return in 12 months preceding the IPO, calculated using the FTSE All Share Index INDM equals 1 if the IPO firm belongs to ICT industry ACQDM equals 1 if the IPO is related to acquisition financing # p<0 1, * p<0 05, ** p<0 01, *** p<0 001

Table 6.6 Determinants of the Choice of IPO Structure (Binary Logit Model, n=204)

Variable	Primary Share Offering (n=114)		Marginal Effects after the Logit *y=Pr(Primary Share Offering) =0 5748*	
	Parameter Estimate	Odds Ratio	dy/dx	X
Intercept	9 2962**			
	(2 7416)			
AGE	-0 5891**	0 5548**	-0.1440**	1 8617
	(0 2168)	(0 1203)	(0 0525)	
TA	-0 4614**	0 6304**	-0 1128**	8 0799
	(0 1639)	(0 1034)	(0 0406)	
LEV	0 6689*	1.9522*	0 1635*	0 3656
	(0 3413)	(0 6663)	(0 0835)	
ROA	-0 1342	0 8744	-0 0328	-0 2449
	(0 2574)	(0.2251)	(0 0628)	
DH1	-1.3840	0 2506	-0 3383	0 5078
	(1 3419)	(0 3362)	(0 3263)	
DH2	2 1518	8 6002	0 5259	0 3431
	(1.7843)	(15 3449)	(0 4340)	
PVRE	-0 4849	0 6158	-0 1185	9 8065
	(0 3131)	(0 1928)	(0 0760)	
MKTRT	-5 833***	0 0029***	-1 4256***	0 0204
	(1 5381)	(0.0045)	(0 3804)	
INDM	-1.0017*	0 3673*	-0 2450*	0 2769
	(0 4282)	(0.1572)	(0 1012)	
ACQDM	1.1859**	3 2738**	0 2848**	0 5641
	(0 3955)	(1 2946)	(0 0906)	
Wald Chi-sq	43 93		Prob> Chi-sq	0 0000
Pseudo R-sq	34 96%		Log Pseudo-likelihood	-87 4340

Robust standard errors are reported in the parentheses The last column (X) reports the mean values of the variables All variables use the value at the time of IPO AGE is the log value of firm age that is the age since the firms started business until the IPO year TA is the log value of total assets LEV is total debt over total assets ROA is EBITDA (earnings before interest, tax, depreciation and amortization) over total assets DH1 (DH2) is the percentage of shareholdings that directors (with ownership exceeding 3%) own before (after) IPO PVRE is the log present value of expected residual earnings, calculated as the log value of the difference between the market value of equity and the book value of equity, where values below zero are truncated at zero MKTRT is the annual market return in 12 months preceding the IPO, calculated using the FTSE All Share Index INDM equals 1 if the IPO firm belongs to ICT industry ACQDM equals 1 if the IPO is related to acquisition financing # p<0 1, * p<0 05, ** p<0 01, *** p<0 001

6.5 Determinants of Primary Size, Secondary Size, and Proportion

In this section, I conduct regression analyses to examine the determinants of the size of the respective issues: primary shares (Primary Size), secondary shares (Secondary Size), and the proportion of primary shares included in an IPO (Proportion). First, I estimate

OLS models to identify the determinants of these sizes. The sizes of primary and secondary shares might be simultaneously determined Therefore, I then estimate 2SLS models for the Primary Size and Secondary Size, controlling for this simultaneity.

Table 6.7 Definitions of the 'Sizes'

Dependent Variable	Definition
Primary Size	The ratio of the number of primary shares to the number of total shares outstanding after IPO
Secondary Size	The ratio of the number of secondary shares to the number of total shares outstanding after IPO.
Proportion	The ratio of the number of primary shares to the number of total IPO shares.

6.5.1 The OLS Models and the Results

6.5.1.1 The Models

Primary Size

On the basis of the discussion in section 6.2 1, it is expected a positive relation between Primary Size and LEV, DTMIX, INCOV, DH, MKTRT but a negative relation between Primary Size and ROA and possibly AGE and SIZE. To further indentify the impact of the concentration of managerial ownership and control on the size of primary share, I add a director dummy (DHDM) that equals 1 if the directors' shareholdings are above 50% immediately before the IPO takes place. An AIM dummy (AIM) is added to distinguish the IPOs listed on the AIM from those listed on the Main Market AGE, DTMIX and INCOV were dropped due to insignificance (Wald, F, and t- tests were used to eliminate insignificant variables) Thus, the model of the size of primary share is given by:

Model 1:

$$Primary\_Size = f(\beta_1 SIZE + \beta_2 LEV + \beta_3 ROA + \beta_4 DH1 + \beta_5 DH2 + \beta_6 DHDM + \beta_7 MKTRT + \beta_8 AIM) \quad (6.9)$$

Secondary Size

I turn next to the determinants of Secondary Size On the basis of the discussion in section 6.2.2, it is expected a negative relation between Secondary Size and LEV, DTMIX, INCOV, DH, MKTRT but a positive relation between Secondary Size and ROA, AGE and SIZE. However, DTMIX was insignificant, but DTMIX_LT (long-term bank loan over total assets) showed significant. An AIM dummy (AIM) is added to distinguish the IPOs listed on the AIM from those listed on the Main Market. Thus, the model of the size of secondary share is given by:

Model 2

$$Secondary\_Size = f(\beta_1 AGE + \beta_2 SIZE + \beta_3 LEV + \beta_4 ROA + \beta_5 DTMIX\_LT + \beta_6 INCOV + \beta_7 DH1 + \beta_8 DH2 + \beta_9 MKTRT + \beta_{10} AIM) \quad (6.10)$$

Proportion

To further identify the determinants of a trade-off between primary and secondary shares, a Proportion equation is estimated

Model 3:

$$Proportion = f(\beta_1 AGE + \beta_2 SIZE + \beta_3 LEV + \beta_4 DTMIX + \beta_5 INCOV + \beta_6 DH1 + \beta_7 DH2 + \beta_8 MKTRT + \beta_9 INDM + \beta_{10} ACQDM + \beta_{11} AIM) \quad (6.11)$$

Estimation for these models can use the OLS estimator. Under the assumption of IID errors, the OLS estimator is the Best Linear Unbiased Estimator (BLUE) However, a typical feature of the cross-sectional dataset at firm level is that the error term is likely to be heteroskedastic (i e. non-IID errors) To detect heteroskedasticity, one can use the White test, the Breusch-Pagan test (BP test) and the Cameron & Trivedi's decomposition of IM test. In the presence of heteroskedasticity problems, the statistical inference should be based on heteroskedastic robust standard errors. White correction for the standard errors is a popular way to control for heteroskedasticity

6.5.1.2 The Results

The results for Primary Size, Secondary Size, and Proportion are respectively presented in Table 6.8, 6 9 and 6.10. The standard errors reported are heteroskedasticity-consistent, using White's correction.

Primary Size

In general, the results confirm the earlier predictions Financial constraints are an important force driving the size of primary share. More highly leveraged firms issue more primary shares (as indicated by the significant and positively signed coefficient for leverage (LEV)), profitability (ROA) is also negatively signed, as expected, although it is not statistically significant. Dependence on bank borrowings (DTMIX) and ability to meet interest payment on outstanding debt (INCOV) do not explain Primary Size, suggesting that it is the total borrowing capacity rather than constraints on bank borrowing that matters. Firm age and size also appear to have little impact, indicating that adverse selection costs play little role in shaping the size of primary share.

Corporate governance (managerial ownership and control)[50] is also an important determinant of Primary Size Higher director shareholdings (DH1) and director shareholdings greater than 50% before the IPO (DHDM) are associated with a larger size of primary shares, reflecting management's willingness to retain control. Firms with more concentrated managerial shareholdings are able to issue more primary shares because the control of management is less likely to be diluted after IPO, even though the ownership becomes more diverse (as indicated by negatively signed DH2)

Market return (MKTRT) has a negative sign, suggesting that a larger increase in market prices is correlated with a smaller size of primary shares. When I estimate equation 6.5 using (i) the primary offering subsample and (ii) the subsample of the offerings that include secondary shares, MKTRT is statistically non-significant in the first regression

[50] Ownership concentration as measured by the percentage of shareholdings that blockholders own before (after) IPO (CONC1, CONC2) is not statistically significant

but significant and negatively signed in the second regression

This raises the question as to why MKTRT is negatively signed, especially for IPOs that include secondary shares Perhaps when the market return is relatively high the costs of raising financing are also higher On the other hand, the increased stock prices enable the firm to offer a smaller number of shares for the same amount of funds. As a result, it is observed as a negative correlation between market return and the size of primary shares for the entire sample and for the subsample of the offerings that include secondary shares. Firms that offer only primary shares tend to be smaller and riskier, and consequently their stock prices are less responsive to increases in market prices. Therefore they might have to offer a similar number of shares even when the market price is high For this reason, MKTRT is not significant for the subsample of primary share offerings.

In addition, firms listed on the AIM market seem to make larger primary share issues (AIM dummy), indicating stronger financing needs for smaller growth firms

Table 6.8 Determinants of Primary Size (Model 1)

Variable	The Entire Sample (n=204)	Primary Share Offerings (n=114)	The Offerings that Include Secondary Shares (n=90)
Intercept	0 2386***	0 2676***	0 2022***
	(0 0368)	(0 0526)	(0 0489)
SIZE	-0 0009	0 0020	-0 0001
	(0 0034)	(0 0047)	(0 0048)
LEV	0.0509**	0.0342***	0 1144***
	(0 0164)	(0 0094)	(0 0278)
ROA	-0 0047	-0 0042	-0 0075
	(0 0050)	(0 0056)	(0 0176)
DH1	0 4643***	0 4912***	0 2765*
	(0.0823)	(0 1011)	(0.1095)
DH2	-0 8816***	-0 9570***	-0 5293***
	(0 0921)	(0 0973)	(0 1454)
DHDM	0 0850**	0 1012*	0 0515
	(0 0318)	(0 0470)	(0 0405)
MKTRT	-0.1541*	-0 0441	-0 2801*
	(0 0764)	(0 1196)	(0 1188)
AIM	0.0613**	0 0463	0 0330
	(0 0230)	(0 0378)	(0 0294)
F-test: all coefficients=0	0 0000	0 0000	0 0000
Adjusted R-sq	0.5261	0 5986	0 4126
Root MSE	0 1271	0 1298	0.1087

Robust standard errors are reported in the parentheses All variables use the value at the time of IPO Primary Size is the ratio of the number of primary shares (secondary shares) to the number of total shares outstanding after IPO SIZE is the log value of total sales LEV is total debt over total assets ROA is EBITDA (earnings before interest, tax, depreciation and amortization) over total assets DH1 (DH2) is the percentage of shareholdings that directors (with ownership exceeding 3%) own before (after) IPO DHDM equals 1 if DH1 is above 50% MKTRT is the annual market return in 12 months preceding the IPO, calculated using the FTSE All Share Index. AIM equals 1 if the IPO firm lists on the AIM market. The equation of Primary Size is estimated separately using the entire sample, the subsample of IPOs that include only primary shares, and the subsample of IPOs that include also secondary shares. # p<0.1, * p<0 05, ** p<0 01, *** p<0 001

Secondary Size

All the variables associated with financial constraints (LEV, DTMIX_LT, INCOV) are significant and negatively correlated with Secondary Size, which confirms that firms in a better financial position sell more old shares hold by original shareholders In addition, firm age and size are both significant and positively signed. These all lend support to the hypothesis that adverse selection costs are important in determining the size of shares divested in IPOs. Thus adverse selection problems are reduced when

firm-specific information accumulated in the public domain favours IPO firms, enabling the selling shareholders to divest more by utilising the market ROA is positively signed, as expected, but not statistically significant.

Managerial control[51] also has some influence on Secondary Size, but it is not as significant as in the Primary Size equation Smaller (larger) director shareholdings immediately before (after) the IPO are related to larger size of secondary shares sold. This provides evidence in support of Zingales (1995). For a firm with higher managerial concentration there is a potential risk that the director-shareholders' private benefit of control is affected by the transfer of a large number of shares to public investors, so they may limit the number of shares sold. On the other hand, for firms less controlled by management, non-manager shareholders are able to sell a larger proportion of their holdings. However, by making the share allocation contingent on public investors, management can gain a higher proportion of ownership and control rights after IPO. So in both cases, management can ensure that their control will not be jeopardised and may even be enhanced after IPO, which can increase the proceeds from the eventual sale of the control rights of the firm.

In contrast to the Primary Size equation, MKTRT is significant and positively signed. However, when I drop IPOs that offered primary shares only, MKTRT is not significant This seems to suggest that IPOs which include secondary shares are offered at a higher market return than for primary share offerings. However, there is no significant relation between MKTRT and Secondary Size for firms that issue secondary shares

Furthermore, the results show that firms floated on AIM offer fewer secondary shares This is not surprising, as smaller and riskier firms are less able to divest shares at an IPO.

[51] Ownership concentration as measured by the percentage of shareholdings that blockholders own before (after) IPO (CONC1, CONC2) is not statistically significant

Table 6.9 Determinants of Secondary Size (Model 2)

Variable	The Entire Sample (n=204)	The Offerings that Include Secondary Shares (n=90)
Intercept	0 0521*	0 0517
	(0 0225)	(0 0352)
AGE	0 0137**	0 0250*
	(0 0049)	(0 0113)
SIZE	0 0069***	0 0102**
	(0 0019)	(0 0029)
LEV	-0 0100#	-0 0225
	(0 0059)	(0 0144)
ROA	0 0001	0 0129
	(0 0024)	(0 0114)
DTMIX_LT	-0 0477**	-0 0595**
	(0 0144)	(0 0174)
INCOV	-0 0156***	-0 0387**
	(0 0042)	(0 0134)
DH1	-0 0388#	-0 1290*
	(0 0202)	(0 0540)
DH2	0 0210	0 1133
	(0.0311)	(0 0874)
MKTRT	0 1184*	0 0499
	(0 0498)	(0 0958)
AIM	-0.0684***	-0 0476*
	(0 0155)	(0 0182)
F-test. all coefficients=0	0 0000	0 0000
Adjusted R-sq	0 3787	0 3786
Root MSE	0.0696	0 0783

Robust standard errors are reported in the parentheses All variables use the value at the time of IPO. Secondary Size is the ratio of the number of secondary shares to the number of total shares outstanding after IPO AGE is the log value of firm age that is the age since the firms started business until the IPO year. SIZE is the log value of total sales LEV is total debt over total assets ROA is EBITDA (earnings before interest, tax, depreciation and amortization) over total assets DTMIX_LT is long-term bank loan over total debt. INCOV is interest expense over EBIT (earnings before interest and tax), and values below zero are truncated at zero DH1 (DH2) is the percentage of shareholdings that directors (with ownership exceeding 3%) own before (after) IPO MKTRT is the annual market return in 12 months preceding the IPO, calculated using the FTSE All Share Index AIM equals 1 if the IPO firm lists on the AIM market. The equation of Secondary Size is estimated separately using the entire sample, the subsample of IPOs that include only primary shares, and the subsample of IPOs that include also secondary shares. # p<0 1, * p<0 05, ** p<0 01, *** p<0.001

Proportion

The results for Proportion suggest that smaller, younger firms and firms which are more dependent on bank borrowing and less able to meet interest payments, include a larger

proportion of primary shares in their IPOs. This is not surprising These firms are more financial constrained, and hence the issued shares consist of a larger proportion of newly created shares.

MKTRT is negatively related to the proportion of primary shares. This is consistent with the earlier results The IPO firms reduce the number of primary shares when the market returns are higher as the public equity becomes more costly at a hotter market on the one hand, and on the other hand higher stock prices reduce the number of shares required for the same amount of proceeds While the number of new shares created is reduced, the number of old shares sold is increased Because when the market returns are higher, it is also the time when the public investors are more optimistic. This ensures that a larger proportion of old shares can be divested by the selling shareholders.

INDM is negatively signed, significant at 10% level Non-ICT firms have lower technology risks, lower uncertainties and lower information discount As a result, public equity is less costly for them than for ICT firms. Therefore, they raise a larger proportion of new shares. In addition, acquisition activity related IPOs and AIM IPOs also include a larger proportion of primary shares

Table 6.10 Determinants of Proportion (Model 3)

Variable	Proportion (n=204)
Intercept	0 8525***
	(0 0570)
AGE	-0 0385**
	(0 0130)
SIZE	-0 0172**
	(0 0053)
LEV	0 0394
	(0 0250)
DTMIX	0 0765*
	(0 0367)
INCOV	0 0504***
	(0 0136)
DH1	0 0911#
	(0 0514)
DH2	-0 0918
	(0 0789)
MKTRT	-0.3996**
	(0 1345)
INDM	-0 0460#
	(0 0277)
ACQDM	0 0559*
	(0 0276)
AIM	0 1450**
	(0 0409)
F-test all coefficients=0	0 0000
Adjusted R-sq	0 4162
Root MSE	0.1799

Robust standard errors are reported in the parentheses. All variables use the value at the time of IPO Proportion is the ratio of the number of primary shares to the number of total IPO shares. AGE is the log value of firm age that is the age since the firms started business until the IPO year. SIZE is the log value of total sales LEV is total debt over total assets DTMIX is bank loan over total debt. INCOV is interest expense over EBIT (earnings before interest and tax), and values below zero are truncated at zero. DH1 (DH2) is the percentage of shareholdings that directors (with ownership exceeding 3%) own before (after) IPO MKTRT is the annual market return in 12 months preceding the IPO, calculated using the FTSE All Share Index INDM is a dummy equals 1 if the IPO firm belongs to ICT industry ACQDM is a dummy equals 1 if the IPO is related to acquisition activities AIM equals 1 if the IPO firm lists on the AIM market. # p<0 1, * p<0 05, ** p<0 01; *** p<0 001.

6.5.2 The 2SLS Models and the Results

In the OLS model, the regressors may be correlated with the error term, i.e. the endogeneity problem This can lead to inconsistency of the OLS estimator. There are several possible causes for such a problem, including simultaneity (when the regressant and the regressors are simultaneously determined), sample selection bias, omitted variables, or measurement errors for the regressors. An Instrument Variables (IV)

estimator is a common solution In cross-sectional analysis, the 2SLS estimator (with inference based on heteroskedastic robust standard errors) is often used for its simplicity in computation

At the time of structuring an IPO, there might exist a trade-off between primary and secondary shares, and hence the sizes of the primary shares and the secondary shares might be simultaneously decided. To incorporate this simultaneity, Secondary Size (Primary Size) can be added to the equation for Primary Size (Secondary Size). However, this would also bring in a potential endogeneity problem It is clear that Secondary Size would be an endogenous regressor in the Primary Size equation; Primary Size would be an endogenous regressor in the Secondary Size equation This simultaneity problem can be dealt with using 2SLS regressions, where Secondary Size (Primary Size) is used as the instrumented variable for the equation for Primary Size (Secondary Size).

For each equation at least one parameter restriction is needed For the new Primary Size equation the instruments AGE, DTMIX, INCOV are dropped in the second stage regression, as these variables are not correlated with Primary Size according the results in section 6.5 1. For the new Secondary Size equation the instruments DH1, DH2, DHDM are dropped in the second stage regression because of their weak relation to Secondary Size I also run a test of over-identifying restrictions (Sargan, 1958; Basmann, 1960) for each of the two equations The null hypothesis, that all instruments are uncorrelated with the error term, cannot be rejected for either of the two equations, confirming the suitability of the instrument sets for both equations.

It can be seen from the results of the 2SLS models (Table 6 11) that Secondary Size is not significant in the Primary Size equation, implying that Primary Size is not determined by Secondary Size Similarly, Primary Size is not significant in the Secondary Size equation, implying that Secondary Size is not determined by Primary Size either Therefore, the results seem to suggest that Primary Size and Secondary Size do not influence each other at the same time. Overall, the conclusions from the OLS models hold

Table 6.11 Determinants of Primary Size and Secondary Size (2SLS Regression, n=204)

Variable	The Primary Size Equation		The Secondary Size Equation	
	1st stage regressions *Secondary Size*	IV (2SLS) regressions *Primary Size*	1st stage regressions *Primary Size*	IV (2SLS) regressions *Secondary Size*
Intercept	0 0517*	0 2621***	0 2408***	0 0507**
	(0 0215)	(0 0411)	(0 0364)	(0 0186)
Primary Size				-0 0373
				(0 0304)
Secondary Size		-0 4516		
		(0 3904)		
AGE	0 0137**		-0 0092	0 0126**
	(0 0049)		(0 0099)	(0 0046)
SIZE	0 0068***	0 0027	0 0003	0 0070***
	(0 0019)	(0 0043)	(0 0036)	(0 0018)
LEV	-0 0100#	0 0464**	0 0516**	-0 0062
	(0 0060)	(0 0147)	(0 0174)	(0 0049)
ROA	0 0001	-0 0045	-0 0042	-0 0002
	(0 0024)	(0 0052)	(0 0051)	(0 0022)
DTMIX	-0 0475**		0 0054	-0 0491***
	(0 0145)		(0 0221)	(0 0138)
INCOV	-0 0156***		0 0117	-0 0154***
	(0.0043)		(0 0112)	(0 0040)
DH1	-0 0347	0 4521***	0 4653***	
	(0 0363)	(0 0797)	(0 0807)	
DH2	0 0215	-0 8706***	-0 8766***	
	(0 0302)	(0 0891)	(0 0914)	
DHDM	-0 0033	0 0810**	0 0843**	
	(0 0207)	(0 0293)	(0 0317)	
MKTRT	0 1193*	-0 1009	-0 1558*	0 1070*
	(0 0516)	(0 0828)	(0 0776)	(0 0467)
AIM	-0 0683***	0 0333	0 0628*	-0 0699***
	(0 0154)	(0 0315)	(0 0241)	(0 0158)
Test all coefficients=0	0 0000 (*F*-test)	0 0000 (Wald test)	0 0000 (*F*-test)	0 0000 (Wald test)
Adjusted R-sq	0 3754	0.5566 (R-sq)	0 5227	0.4143 (R-sq)
Root MSE	0 0698	0.1228	0 1278	0 0674
Test of over-identifying restrictions (Chi-sq)		Score Chi-sq(2) = 0 9880 (*p*-value=0 6102)		Score Chi-sq(2) = 2 5927 (*p*-value=0 2735)

Robust standard errors are reported in the parentheses All variables use the value at the time of IPO Primary Size is the ratio of the number of primary shares (secondary shares) to the number of total shares outstanding after IPO Secondary Size is the ratio of the number of secondary shares to the number of total shares outstanding after IPO AGE is the log value of firm age that is the age since the firms started business until the IPO year SIZE is the log value of total sales LEV is total debt over total assets ROA is EBITDA (earnings before interest, tax, depreciation and amortization) over total assets DTMIX is bank loan over total debt INCOV is interest expense over EBIT (earnings before interest and tax), and values below zero are truncated at zero DH1 (DH2) is the percentage of shareholdings that directors (with ownership exceeding 3%) own before (after) IPO DHDM equals 1 if DH1 is above 50% MKTRT is the annual market return in 12 months preceding the IPO, calculated using the FTSE All Share Index AIM equals 1 if the IPO firm lists on the AIM market # p<0 1, * p<0 05, ** p<0 01, *** p<0 001

6.6 Concluding Remarks

In this chapter, I have used cross-sectional data of 204 UK IPOs to examine the motive and timing of the decision to go public. I studied the determinants of IPO structure and found results supporting that the IPO structure can indeed reveal important information about IPO decisions, in terms of both motive and timing.

A key conclusion from a basic examination of the data is that the financial profile, ownership structure and IPO structure of the UK IPOs appear to differ markedly from those of continental European countries. On average, UK firms are younger and smaller than other European IPO firms, and rely much less heavily on debt, especially bank lending. They also have a less concentrated ownership structure, which typically involves 'managerial ownership and control'. A substantial proportion of UK firms incorporate for the apparent purpose of flotation; and the subsequent IPO is more related to financing for growth, rather than transfer of ownership (as in Belgium) or restructuring from previous expansion (as in Italy)

Many theoretical implications about IPO motives and the related timing pattern are supported by the results in the UK context The UK IPO firms were driven by the motive(s) of raising funds for investment and/or divesting shares by existing shareholders The IPO firms raise public equity at different stages of life cycle and for different reasons. Young and growth firms are constrained by weak internal cash generation whereas mature firms are constrained by debt burden due to a long period of investment and expansion The stock market provides accessible financing for firms at both of the two stages. In contrast, divesting via an IPO is likely to happen at a later stage of a firm's development There is also evidence of market timing for the divestment motive. But no clear evidence of market timing for the investment motive is found

Relating to the investment motives, financing need is an important force that drives firms to issue additional equity capital. Firms that are more highly levered, and therefore threatened by debt overhang, offer a larger size of primary share Corporate governance is another important consideration behind their IPO decisions. More highly

concentrated managerial shareholdings enable a larger size of primary shares, as the control of management is less likely to be diluted, although the ownership base does becomes more diverse after the IPO. I find no evidence that these firms raise more primary shares at a higher market price and revise their investment plan upwards so as to facilitate their investment decision This seems to support the semi-rational theory of Ritter and Welch (2002). The idea that asymmetric information and adverse selection problems influence on the size of primary share is not supported by the data

As firms grow more mature (older and larger), substantial firm-specific information accumulates in the public domain, reducing information asymmetry. In particular, firms in good financial positions and with a number of valuable re-investment opportunities, potentially have a large amount of monitoring capital (passive monitors) available in the market Therefore, in addition to obtaining financing for their investment from the public market, the passive monitors in the market enable the original shareholders (active monitors) an exit route. For the secondary shares divested, adverse selection costs matter (the shareholders of older and larger firms can divest more) Furthermore, for firms in better financial positions and less controlled by management, the non-manager shareholders can sell more shares through IPO These IPOs in which shareholders sell out tend to time the market, by offering when market returns are higher, because in a more buoyant market investors tend to assess shareholders' exit more optimistically

Finally, established mature firms may go public purely to sell existing shareholdings, although this seems to be relatively rare in the UK.

Overall, I have found evidence that the UK stock market plays a positive role in supporting the growth of UK firms UK IPOs utilise the stock market as a channel for financing more than as a facility for shareholders to sell out, and this is an important feature that distinguishes the UK market from continental European markets

7 Private Information, Stock Market and the IPO Decision

A Bivariate Sample Selection and a Treatment Effects Approach

7.1 Introduction

In chapters 5 and 6, I examined the determinants of an IPO decision in two separate settings: (i) the determinants of the decision to go public against the decision to stay private (chapter 5), (ii) the determinants of the sizes of primary and secondary shares (issuing primary shares is related to investment, whereas issuing secondary shares is related to divestment) (chapter 6). One question is worth further investigation – why does an IPO firm that goes public for financing purpose add secondary shares Similarly, why does an IPO firm that goes public for divestment add primary shares? One may ask the same question from a different angle – is the investment motive or the divestment motive the ultimate reason that drives a firm to go public rather than to stay private?

There are two possible answers to this question. The first is that going public is either related to investment or divestment Thus, it could be argued that a firm chooses to go public ultimately for investment, and that secondary shares are added purely for increasing the overall offer size and hence increasing liquidity of the stock in the aftermarket. Investment-based theoretical models of the IPO decision provided an explanation for the first half of this argument by showing that going public to raise capital for investment is cheaper at a certain stage and in a certain market conditions Huyghebaert and Van Hulle (2006) provided empirical evidence from Belgian IPOs for the second half of this argument by demonstrating that the size of the secondary share is determined by the size of the primary share and that increasing IPO funds[52] significantly increases stock liquidity. On the other hand, it could also be argued that a firm chooses to go public ultimately for divestment, and primary shares are added to increase liquidity of aftermarket stock trading Divestment-based theoretical models of the IPO decision suggested that complete exit is the ultimate goal for a firm going public, and gradually selling out can maximise the selling shareholders' total proceeds. This helps to justify the first half of this argument. However, there is as yet no empirical

[52] IPO funds is measured by log of the number of IPO shares times the offer price

evidence for this If only one of the two arguments can be true, the determinants of a decision to go public or stay private are expected to depend on whether an IPO is investment or divestment driven

The second possible answer is that going public is related to both investment and divestment, i e. investment and divestment are not mutually exclusive Investment from new public investors and divestment by existing shareholders jointly determine the optimal value of a firm To achieve the optimal firm value, the best way is to go public. Investing in a firm is a continuous process, although at a certain point some existing shareholders may choose to exit from their investment and bring in other more effective investors monitors. The reason why it is optimal to raise capital and/or transfer ownership by going public at a certain stage in a certain market conditions is that the stock market provides cheaper capital and promotes an optimal monitoring mechanism, maximising firm value.

In fact my results of the 2SLS on the sizes of primary and secondary shares (in chapter 6) suggest that the size of primary (secondary) share is not determined by the size of secondary (primary) share This seems to support the hypothesis (i e. the second answer) that going public is related to both investment and divestment, and that the numbers of new shares to raise and old shares to divest are determined by the achievable optimal firm value In this chapter, I further test this hypothesis

To find out which one of the two answers applies in the UK context, it is essential to examine the determinants of an IPO (against staying private) and the determinants of the sizes of primary and secondary shares in a simultaneous equations system To achieve this, I employ a bivariate sample selection model.

A firm's choice to be publicly listed or to stay private incorporates the decision about how to structure the IPO. Therefore, the equation of the determinants of an IPO (against staying private) may offer extra information for the equation of the determinants of the sizes of primary and secondary shares. It is possible that the extra information includes some unobservable factor that affects the way an IPO is structured. By employing a selection model, the potential problem of omitted variables (i e. the unobservable) can

be avoided An additional advantage of a selection model is that, if such an unobservable factor does exist, it should reflect the impact of a firm's private information on its IPO decision

In addition, to further verify whether or not the stock market helps the IPO firms enhance firm value, I examine the 'treatment[53] effects' of going public. More explicitly, this is to compare the changes in performance of IPO and non-IPO firms The performance of IPO firms after being publicly listed is observable. However, the counter-factual performance of IPO firms assuming that they had not been listed cannot be observed. Following the treatment effects approach, I use the performance of non-IPO firms (in the same year as IPO firms) to compute the potential performance of IPO firms presuming that they did not go public Therefore, the differences between the performance of IPO and non-IPO firms – the treatment effects – give the average causal effects of going public, i e. the extent to which a firm can benefit from the stock market. A potential problem of the treatment effects approach is selection bias. I match non-IPO firms (the control group) and IPO firms by similar firm size and industry characteristics, to control for selection bias.

This chapter uses the same panel dataset as in chapter 5 The chapter is organised as follows: section 7.2 presents the empirical econometric models, section 7 3 investigates the determinants of a complete IPO decision, analysing the determinants of the IPO structure while incorporating the firms' choice of going public; section 7 4 examines the treatment effects of going public; section 7.5 provides concluding remarks.

[53] 'Treatment' here refers to being publicly listed

7.2 Empirical Models

7.2.1 A Bivariate Sample Selection Model

Let y_{it}^* denote the net value of going public for firm i at time t, if this is positive, it is observed that firm i chooses to go public at time t, i e $y_{it} = 1$[54] Otherwise, it is observed that it stays private, i e.$y_{it} = 0$. Such a choice mechanism is presented in a selection equation

$$y_{it} = \begin{cases} 1 & if\ y_{it}^* > 0 \\ 0 & if\ y_{it}^* \leq 0 \end{cases} \tag{7.1}$$

Consequently, if the choice is IPO, it is also observed that at time t firm i issues primary and/or secondary shares Otherwise, it is observed nothing The size of primary share is indicated by d_{1it}^* in an outcome equation

$$d_{1it} = \begin{cases} d_{1it}^* & if\ y_{it}^* > 0 \\ - & if\ y_{it}^* \leq 0 \end{cases} \tag{7.2}$$

The size of secondary share is indicated by d_{2it}^* in an outcome equation

$$d_{2it} = \begin{cases} d_{2it}^* & if\ y_{it}^* > 0 \\ - & if\ y_{it}^* \leq 0 \end{cases} \tag{7.3}$$

More specifically, y_{it}^* is an unobserved latent variable measuring the net value of the IPO, observed as binary outcomes Based on the discussions and results in chapter 5, y_{it}^* can be determined by firm size, leverage, internal cash generation, capital investment, ownership concentration and market conditions In addition, y_{it}^* may be determined by some unobservable factor, such as managers' private information about the growth potential of the firm. Thus, the equation of the latent variable y_{it}^* is given by

$$y_{it}^* = \alpha_i + x_{it}'\beta + w_t'\theta + \varepsilon_{it} \tag{7 4}$$

[54] After a firm goes public, its post-IPO observations are subsequently dropped from the sample

Here α_i are firm effects[55], x_{it}' are a set of firm and time variant regressors; w_t' are a set of year dummy variables[56], ε_{it} is the error term. Variables in x_{it}' include LEV, CAPEX, ROA, SIZE, OWCON, following equation 5 2 in section 5.3.1.

Table 7.1 Definitions of Explanatory Variables in the Selection Equation (Eq. 7.4)

Variable	Theory	Sign	Abbr	Definition
Leverage	Financial constraints	+	LEV	(total debt)/(total assets)
Capital investment	Financial constraints, Cheaper capital	–	CAPEX	(net cash flow from capital expenditure, sale of plant and equipment and returns of equity instrument)/(total assets)
Profitability	Financial constraints	–	ROA	EBITDA/(total assets)
Firm size	Cheaper capital	–	SIZE	ln(sales)
	Shareholder exit	+		
Ownership concentration	Corporate governance	–	OWCON	=0 if any single shareholding<25%, =0.25 if at least one shareholding≥25% (<50%) =0.5 if at least one indirect shareholding≥50% =1 if at least one direct shareholding≥50%

The above variables, except CAPEX, are also likely to influence the size of primary share offered. Thus the outcome equation for primary shares is given by

$$d_{1it}^{*} = \delta_i + z_{it}'\gamma + w_t'\theta + v_{it} \qquad (7\ 5)$$

Here d_{1it}^{*} is Primary Size for firm i at time t, measured by the ratio of the number of primary shares to the number of total shares outstanding following the IPO, δ_i are firm effects. Variables in z_{it}' include LEV, ROA, SIZE, OWCON w_t' include year dummy variables and v_{it} is the error term.

For the outcome equation for secondary shares, d_{2it}^{*} is Secondary Size for firm i at

[55] The fixed effects estimator is inconsistent in short panel For random effects, ML estimation involving a bivariate integral is suggested (Hausman and Wise, 1979), which allows correlation between α_i and δ_i, and between ε_{it} and v_{it}

[56] Market return is not significant for panel data Therefore, a set of year dummies were used to capture market conditions

time t, measured by the ratio of the number of secondary shares to the number of total shares outstanding following the IPO. Year dummy variables are excluded Thus the outcome equation for secondary shares is given by

$$d_{2it}^{*} = \delta_i + z_{it}^{'}\gamma + v_{it} \qquad (7\ 6)$$

As firms' decision to go public and the decision on the sizes of primary and secondary shares to be offered are correlated, the error term ε_{it} in equation 7 4 may contain information of some unobservable that could be correlated with the error terms v_{it} in equation 7 5 and 7.6. Ignoring such information and estimating equation 7.5 and 7.6 through OLS or GLS may give rise to an omitted variables problem. This can be illustrated as follows, in the context of Heckman two-step estimators

For the primary share outcome equation:

$$E(d_{1it}^{*}|y_{it} = 1) = z_{it}^{'}\gamma + w_t^{'}\theta + \rho\sigma E(\varepsilon_{it}|x_{it}^{'}\beta + w_t^{'}\theta + \varepsilon_{it} > 0) \qquad (7\ 7)$$

$$E(d_{1it}^{*}|y_{it}) = z_{it}^{'}\gamma + w_t^{'}\theta + \rho\sigma\lambda(x_{it}^{'}\beta,\ w_t^{'}\theta) \qquad (7.8)$$

Similarly, for the secondary share outcome equation

$$E(d_{2it}^{*}|y_{it} = 1) = z_{it}^{'}\gamma + \rho\sigma E(\varepsilon_{it}|x_{it}^{'}\beta + w_t^{'}\theta + \varepsilon_{it} > 0) \qquad (7\ 9)$$

$$E(d_{2it}^{*}|y_{it}) = z_{it}^{'}\gamma + \rho\sigma\lambda(x_{it}^{'}\beta,\ w_t^{'}\theta) \qquad (7.10)$$

Here ρ is the correlation between the two error terms v_{it} and ε_{it}, σ^2 is the variance of v_{it}, and $\lambda(.)$ is the conditional expectation of ε_{it} given firms' choice of IPO or staying private ($E(\varepsilon_{it}|y_{it}) = \lambda(.)$) The ex-ante expectation of ε_{it} should be zero Ex-post after firm i chooses to go public or stay private, the expectation of ε_{it} is updated. And $E(\varepsilon_{it}|y_{it})$ is the revised expectation, which is an updated estimate of the firm's private information. If $\rho \neq 0$, OLS or GLS estimates will not consistently estimate γ and θ. Such a self-selection represents an omitted variable problem. In this case, $\lambda(\ )$ can be viewed as firms' private information about the net value (total benefits net total costs) of going public

Such a potential omitted variable problem is dealt with in the sample selection model In the sample selection model, the correlated error terms v_{it} and ε_{it} are assumed to be jointly normally distributed, i e bivariate normal[57]. The equations system 7 1, 7.2, 7.4, 7.5, and the equations system 7 1, 7.3, 7.4, 7 6 can be estimated either by the Heckman two-stage technique (Heckman, 1979) or by the full information maximum likelihood method (FIML estimates). Overall, FIML provides consistent estimates that are more efficient than the two-stage Heckman method (Nawata, (1993, 1994)).

The models are based on panel data The observations for each firm may be correlated over the time horizon Therefore, the standard errors need to be adjusted to take into account the intra-firm correlation This can be done via the Huber-White estimator of variance (Huber (1967), White (1980))

7.2.2 Treatment Effects of Going Public

I examine the consequences of going public from the perspective of the role of the stock market. More explicitly, this involves comparing the performance of IPO firms before and after going public to the performance of a control group of non-IPO firms over the same period I employ differences-in-differences estimators (DID) to evaluate such treatment effects, following Blundell and MaCurdy (2000)

Let's consider two periods in period 1, both IPO and non-IPO firms are private, in period 2, IPO firms go public and non-IPO firms stay private I first evaluate the treatment effects of going public without controlling for differences in performance in period 1

For period 2, let D_{it} equal one if firm i is publicly listed in year t but equal zero otherwise One then has a fixed effects model for y_{it} (the variables of the operating performance under investigation):

$$y_{it} = \theta D_{it} + u_i + d_t + \varepsilon_{it} \tag{7.11}$$

[57] Klaauw and Koning (2003) demonstrated that in the sample selection model, the parameter estimates are not very sensitive to the distributional assumptions of the error terms Even when the error terms are non-normal, the maximum likelihood estimates under the assumption of normal distribution are close to the true value

Here u_i and d_t are respectively the firm-specific and year-specific effects By first differencing, u_i are eliminated. Therefore,

$$\Delta y_{it} = \theta \Delta D_{it} + (d_t - d_{t-1}) + \Delta \varepsilon_{it} \tag{7.12}$$

Dropping the subscript t, D_i equals one for the IPO firms and zero for the non-IPO firms. Thus, equation 7 12 can be re-written as

$$\Delta y_i = \theta D_i + d + \varepsilon_i \tag{7 13}$$

Equation 7.13 can then be consistently estimated by a pooled OLS regression of Δy_i on the binary treatment variable D_i and the year dummies d Subsequently, one can compute the predicted average value of Δy_i in period 2 for both the IPO firm subsample ($\Delta \bar{y}_2^{public}$) and for the non-IPO firm subsample ($\Delta \bar{y}_2^{private}$) So the differences-in-differences estimator for period 2 (DID2) is given by

$$\widehat{\theta_2} \equiv DID2 = \Delta \bar{y}_2^{public} - \Delta \bar{y}_2^{private} \tag{7.14}$$

In the same way, one can also obtain the DID estimator for period 1. This gives estimates of the differences in the performance between the IPO-firms and the non-IPO firms in the pre-IPO period (DID1)·

$$\widehat{\theta_1} \equiv DID1 = \Delta \bar{y}_1^{public} - \Delta \bar{y}_1^{private} \tag{7.15}$$

Therefore, the treatment effects of going public are given by·

$$\hat{\theta} = \widehat{\theta_2} - \widehat{\theta_1} = \left(\Delta \bar{y}_2^{public} - \Delta \bar{y}_1^{public}\right) - \left(\Delta \bar{y}_2^{private} - \Delta \bar{y}_1^{private}\right) \tag{7.16}$$

In this way, the performance of the non-IPO firms is used as a control for that of the IPO firms over the IPO windows Such treatment effects can reflect the gains or losses from being a public company, the function of the stock market.

I examine treatment effects for the same set of eleven performance variables studied in chapter 5 section 5 4. The variables measure changes in firm size, leverage, internal

cash generation, investment-related cash flow and current assets, growth rate and firm value

Table 7.2 Definitions of Performance Variables

Performance Variable		Abbr	Definition
Firm size		SIZE	ln(sales)
		TA	ln(total assets)
Leverage		LEV	(total debt)/(total assets)
Profitability		ROA	EBITDA/(total assets)
Investment-related cash flow	Capital investment	CAPEX	(net cash flow from capital expenditure, sale of plant and equipment and returns of equity instrument)/(total assets)
	Acquisition intensity	ACQ	(net cash flow from acquisition and disposal)/(total assets)
Investment-related current assets	Inventory	INVEN	(stock and work in progress)/(total assets)
	Cash in hand	CASH	(cash and cash equivalent)/(total assets)
Growth rate	Growth in sales	GSIZE	$(sales_t\text{-}sales_{t-1})/sales_{t-1}$
	Growth in total assets	GTA	$(totalassets_t\text{-}totalassets_{t-1})/totalassets_{t-1}$
Net worth of firms		NWTH	ln(shareholders' funds)

7.3 Determinants of the IPO Decision

Tables 7.3 and 7.4 respectively present the results of the bivariate sample selection models for the size of primary share and the size of secondary share, while controlling for the firms' choice of going public

For the independent IPOs, more financially constrained smaller firms issue more primary shares (Table 7.3), as indicated by the negatively signed SIZE and ROA, and the positively signed LEV in the outcome equation LEV is statistically significant, suggesting the existence of an optimal capital structure. Although the independent IPO firms may not be necessarily more highly levered than the independent private firms (as suggested by the selection equation), the weaker internal cash generating ability of these firms indicates the needs to raise relatively larger amounts of new equity capital to

avoid potential debt overhang problems and to fund growth

Higher ownership dispersion increases the amount of new public equity raised. In chapter 6, I also found that higher managerial ownership is correlated with larger size of primary shares. This combined evidence suggests that in the UK, firms with more dispersed ownership prefer public equity, so as to take advantage of the monitoring function of the stock market. At the same time, controlling management also tends to avoid dilution of their controlling status, although in the presence of financial difficulties they may have to surrender part of their ownership to outside public investors in exchange for capital to fund growth.

In addition, the size of primary share increases during a bull market. Therefore, it appears that taking into account of underpricing costs, firms tend to exploit windows of opportunity in a buoyant market.

Importantly, the correlation (ρ) between v_{it} and ε_{it} is as high as 0.9795, and a Wald test of the hypothesis that $\rho = 0$ is rejected This suggests that estimating the 'stand-alone' equation of the size of primary share will produce inconsistent estimates $\lambda(.)$ is positive λ reflects the firms' private information about going public. Therefore, it seems that raising fresh public equity capital is related to positive information possessed privately by the firm, e g private information about growth potential. The higher the growth potential, the greater amount of public equity is raised.

At the same time (Table 7 4), larger firms include larger size of secondary shares (i.e. smaller firms sell less existing shareholdings), confirming that adverse selection costs matter for firms whose original shareholders plan an exit – larger (more mature) firms have fewer uncertainties and hence lower adverse selection costs. In the secondary share equation, LEV and ROA show opposite signs to those in the primary share equation, although these variables are not statistically significant

Independent firms with more dispersed ownership sell larger size of secondary share, reflecting their preference to bring in the monitoring capital in the market (to alleviate manager-shareholder conflicts) On the other hand, independent firms with more

concentrated ownership sell smaller size of secondary share, suggesting that controlling shareholders wish to retain control undiluted $\lambda(.)$ is negative, although the hypothesis that $\rho = 0$ cannot be rejected

The selection equation of primary share and the one of secondary share show similar results both qualitatively and quantitatively. This confirms the hypothesis that the investment and divestment motives are not mutually exclusive and are both correlated with the net value of going public

The combined results of the primary share and the secondary share equations for independent firms imply that raising fresh capital to support growth is the dominant reason for these firms to go public in the UK. The stronger the growth potential, the more new shares are created. For larger firms, existing shareholders may also use the market device to cash in their shareholdings, transferring wealth and ownership between new and existing shareholders

I now turn to the results for the carve-outs. The hypothesis that $\rho = 0$ is rejected for both primary share and secondary share equations. $\lambda(\ )$ is positive in the primary share equation but negative in the secondary share equation These suggest that for carve-outs raising fresh capital is related to positive private information whereas selling old shares is related to negative private information If the firms' private information indicates a higher growth potential by being public, less old shares are divested and more new shares are created by the subsidiaries In particular, it is shown that carve-outs with more concentrated ownership sell more secondary shares (whereas the opposite is true for independent IPOs) These results, combined with the results of the choice on a carve-out, suggest that exit motive is the dominant reason for a carve-out

Subsidiaries commonly have concentrated ownership and control structures, where parent companies are the ultimate controllers. A parent company might want to divest a highly indebted and less controlled subsidiary, and one way of carrying out such corporate restructuring is IPO A direct sale can maximise proceeds from selling the control rights but, for a subsidiary less controlled by its parent, selling out via IPO can maximise total proceeds for the parent firm. This is a two-stage selling process, because

improved monitoring of management can help to increase firm value of the carve-out in the after-market and hence improve revenue from second stage sales (Zingales, 1995) Thus, for a subsidiary in a better shape financially (larger size, lower leverage) and comparatively more controlled by its parent firm, larger size of secondary shares can be sold in the first stage (because lower adverse selection costs and less dilution on the control of the parent are associated with the sale in the IPO) In addition, with higher growth potential (private information indicated by λ), more fresh capital can be raised, while fewer old shares are divested in the first stage (i e. the IPO)

Overall, the results are consistent with the earlier conclusion in chapter 5 and 6. In particular, it is confirmed that the investment and divestment motives are not necessarily mutually exclusive and can be explained in a unified framework. IPO firms appear to possess private information about the value of being publicly listed. If a firm has a higher growth prospect, more public equity will be raised to finance the growth to increase firm value. If a firm has a lower growth prospect, fewer funds are raised while some existing shareholders may transfer ownership to public investors – market information may evaluate the firm more optimistically and market monitoring may improve firm value

Table 7.3 Determinants of Primary Size (Selection Model FIML Estimates)

Variables	All Sample IPOs	Independent IPOs	Carve-Outs
	The Outcome Equation		
Intercept	-0 1120	-0 1030	0 6788***
	(0 0721)	(0 0768)	(0 1715)
LEV	0 0818***	0 0807**	0 0680
	(0 0158)	(0 0241)	(0 0551)
ROA	-0 0485 #	-0 0481	
	(0 0281)	(0.0298)	
SIZE	-0 0372***	-0 0323***	-0 0277
	(0 0049)	(0 0050)	(0 0204)
OWCON	-0 4191***	-0 2558***	-0 9809
	(0 0598)	(0 0581)	(0 6867)
Year 1998	0 1487**	0 0716	
	(0 0491)	(0 0474)	
Year 1999	0.1475**	0 1104*	
	(0 0503)	(0 0498)	
Year 2000	0.1477**	0 0991*	
	(0 0483)	(0 0477)	
Year 2002	0 0438	0 0600	
	(0 0675)	(0 0637)	
Year 2003	-0.1831*	-0 2321**	
	(0 0901)	(0 0894)	
	The Selection Equation		
Intercept	-0 8162***	-1 0910***	1 5157
	(0.1254)	(0 1373)	(1 1019)
LEV	0 0676 #	0 0515	0 1059
	(0 0383)	(0 0718)	(0 0649)
CAPEX	-0 5346***	-0 9472***	0 1263
	(0.1392)	(0.1878)	(0 9760)
ROA	-0 1766*	-0 2315**	
	(0 0692)	(0 0817)	
SIZE	-0 0829***	-0 0770***	-0 0440
	(0 0098)	(0 0098)	(0 0451)
OWCON	-1 2170***	-0 8628***	-4 0533***
	(0 0888)	(0 0987)	(0 4280)
Year 1998	0 6280***	0 5376***	0 5106
	(0.1119)	(0.1279)	(1 9499)
Year 1999	0 4871***	0 5257***	0 0129
	(0 1158)	(0 1274)	(0 9750)
Year 2000	0 5667***	0 5323***	0 5044
	(0.1119)	(0.1239)	(1 4805)
Year 2002	-0 0926	-0 0385	-7 2298***
	(0 1525)	(0 1575)	(1 2391)
Year 2003	-0.4709*	-0 5657**	-1 2969
	(0.1986)	(0.2163)	(3 1929)
Number of Observations	9487	5840	3647
Censored Observations	9304	5697	3607
Uncensored Observations	183	143	40
Diagnostics			
Wald test all coefficients=0 (Chi-sq)	107 37***	58 81***	52 24***
Log pseudo-likelihood	-605 5236	-458 0255	-88 6612
Wald test· independent eqs (ρ=0)	36 48***	17 43***	13.20**
ρ	0 9895	0 9795	0 9807
λ	0 3658	0 3121	0 2651

Notes for Table 7.3:

The effects of the variables listed above on the decision to go public are estimated by a bivariate sample selection model 1) the selection equation $y_{it} = \begin{cases} 1 & if\ y_{it}^{*} > 0 \\ 0 & if\ y_{it}^{*} \leq 0 \end{cases}$; 2) the outcome equation $d_{1it} = \begin{cases} d_{1it}^{*} & if\ y_{it}^{*} > 0 \\ - & if\ y_{it}^{*} \leq 0 \end{cases}$, where $y_{it}^{*} = \alpha_i + x_{it}'\beta + w_t'\theta + \varepsilon_{it}$, $d_{1it}^{*} = \delta_i + z_{it}'\gamma + w_t'\theta + v_{it}$ The dependent variable in the selection equation equals 1 if firm i is listed in year t, otherwise it equals 0 The dependent variable in the outcome equation (Primary Size) equals d_{it}^{*} if firm i is listed in year t, otherwise nothing is observed The observations for IPO firms in the post-IPO period are dropped from the sample The observations for private firms are restricted to the period 1996-2003 Primary Size is the ratio of the number of primary shares to the number of total shares outstanding following the IPO The estimation method is FIML (full information maximum likelihood) The standard errors are corrected for heteroskedasticity and clustering in firms (i e allowing for intra-firm correlation) Robust standard errors are reported in parentheses The selection model is estimated separately using the entire sample, independent firms only, and British ultimate holding firms only LEV is total debt over total assets CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets SIZE is the log value of turnover, which is used as the main measure of firm size OWCON is an indicator variable it equals 0 if none of the shareholders has more than 25% shareholdings, equals 0 25 if one or more shareholders have more than 25% but less than 50% shareholdings, equals 0 5 if one shareholder has a total of more than 50% shareholdings (i e indirectly holds more than 50% ownership), and equals 1 if one shareholder has a direct ownership of over 50% Year 1998, Year 1999, Year 2000, Year 2002 and Year 2003 are year dummies, the year dummy Year 2001 is dropped # p<0 1, * p<0 05, ** p<0 01, *** p<0 001

Table 7.4 Determinants of Secondary Size (Selection Model FIML Estimates)

Variables	All Sample IPOs	Independent IPOs	Carve-Outs
	The Outcome Equation		
Intercept	0 0003	0 0072	-0 1827***
	(0 0210)	(0 0201)	(0 0510)
LEV	-0 0055	-0 0017	-0 0309 #
	(0 0056)	(0 0053)	(0 0167)
ROA	0 0069	0 0090	
	(0 0057)	(0 0060)	
SIZE	0 0169***	0 0124***	0 0303***
	(0 0028)	(0 0025)	(0 0066)
OWCON	-0 0191	-0.0451*	0 2567**
	(0 0235)	(0 0220)	(0 0930)
	The Selection Equation		
Intercept	-0 8507***	-1.1717***	1 0967**
	(0.1281)	(0.1433)	(0 3533)
LEV	0 0591	0 0308	0 1083*
	(0 0414)	(0 0858)	(0 0540)
CAPEX	-0 6986**	-1 5730***	-0 1751
	(0.2534)	(0 2683)	(0 2220)
ROA	-0 1972**	-0 2379**	
	(0 0716)	(0 0856)	
SIZE	-0 0834***	-0 0769***	-0 0422
	(0 0100)	(0 0102)	(0 0443)
OWCON	-1 2119***	-0 8513***	-4 1023***
	(0 0886)	(0 0993)	(0 4073)
Year 1998	0 6857***	0 5686***	1 1511**
	(0 1127)	(0 1319)	(0 3442)
Year 1999	0 5072***	0 5581***	0 3316
	(0 1152)	(0 1296)	(0 3743)
Year 2000	0 5688***	0 5494***	0 8101*
	(0 1133)	(0 1267)	(0 4029)
Year 2002	-0 0668	-0 0059	-6 6493***
	(0.1513)	(0 1601)	(0 3376)
Year 2003	-0 4683*	-0 5473*	0 0344
	(0.1927)	(0 2259)	(0 4168)
Number of Observations	9487	5840	3647
Censored Observations	9304	5697	3607
Uncensored Observations	183	143	40
Diagnostics·			
Wald test· all coefficients=0 (Chi-sq)	45 39***	27 52***	22 94***
Log pseudo-likelihood	-499 3004	-364 9288	-68 1360
Wald test. independent eqs (ρ=0)	1 84	0 22	6 17*
ρ	-0 3301	-0 1150	-0 7929
λ	-0 0269	-0 0083	-0 0947

Notes for Table 7.4:

The effects of the variables listed above on the decision to go public are estimated by a bivariate sample selection model 1) the selection equation $y_{it} = \begin{cases} 1 & if\ y_{it}^{*} > 0 \\ 0 & if\ y_{it}^{*} \le 0 \end{cases}$, 2) the outcome equation $d_{2it} = \begin{cases} d_{2it}^{*} & if\ y_{it}^{*} > 0 \\ - & if\ y_{it}^{*} \le 0 \end{cases}$, where $y_{it}^{*} = \alpha_i + x_{it}'\beta + w_t'\theta + \varepsilon_{it}$, $d_{2it}^{*} = \delta_i + z_{it}'\gamma + w_t'\theta + v_{it}$ The dependent variable in the selection equation equals 1 if firm i is listed in year t, otherwise it equals 0 The dependent variable in the outcome equation (Secondary Size) equals d_{it}^{*} if firm i is listed in year t, otherwise nothing is observed The observations for IPO firms in post-IPO period are dropped from the sample The observations for private firms are restricted to the period 1996-2003 Secondary Size is the ratio of the number of secondary shares to the number of total shares outstanding following the IPO The estimation method is FIML (full information maximum likelihood) Standard errors are corrected for heteroskedasticity and clustering in firms (i e allowing for intra-firm correlation) Robust standard errors are reported in parentheses The selection model is estimated separately using the entire sample, only the independent firms, and using only the British ultimate holding firms LEV is total debt over total assets CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets SIZE is the log value of turnover, which is used as the main measure of firm size OWCON is an indicator variable it equals 0 if none of the shareholders has more than 25% shareholdings, equals 0 25 if one or more shareholders have more than 25% but less than 50% shareholdings, equals 0 5 if one shareholder has a total of more than 50% shareholdings (i e indirectly holds more than 50% ownership), and equals 1 if one shareholder has a direct ownership of over 50% Year 1998, Year 1999, Year 2000, Year 2002 and Year 2003 are year dummies, the year dummy Year 2001 is dropped # p<0 1, * p<0 05, ** p<0 01, *** p<0 001

7.4 Consequences of the IPO Decision

The treatment effects estimated by the differences-in-differences estimators (DID) are presented in Table 7.5 (for the entire sample IPOs), Table 7 6 (for the independent IPOs) and Table 7.7 (for the carve-out subsample) Controlling for the performance of private firms, it can been seen that the performance of IPO firms actually declined after IPO – firm size (total assets, sales), profitability (return on assets), growth rate (in total assets and in sales) and net worth all decreased, as indicated by DID in the last column in the three tables. Therefore, although firms show significant growth and increase their firm value after IPO compared to themselves in the pre-IPO period (results in chapter 5), such growth actually does not beat their performance before the IPOs when I used the performance of the private firms as a control The market timing theory argues that the stock market has a function of revealing information about firms' value and that it is optimal for firms to go public at the peak of their growth when their market valuation reaches a maximum. These results perhaps provide evidence for the market timing theory

The decreases in growth rate and net worth seem to be lower for the carve-outs (Table 7.7) than for the independent IPOs (Table 7 6). A possible reason might be that the carve-outs have benefited from the improved publicity and the reputation capital of their parent firms.

However, one may argue that with an assumption that the stock market helps the IPO firms to enhance firm value, a positive treatment effect on firms' net worth would be expected. It is possible that the results estimated by the treatment effects approach suffer an omitted variable bias At this stage, only firm size and industry characteristics are controlled for the IPO firms and the non-IPO firms However there are uncontrolled observed and unobserved differences between the two groups. A treatment effects with sample selection approach might provide more accurate results. In this aspect, further research is required

Table 7.5 Treatment Effects of the IPO Decision for the Entire Sample IPOs (Differences-in-Differences Estimates)

Variables	Theta	Wald test all coefficients=0 Prob>Chi-sq	DID2	Obs	Firms	Theta	Wald test all coefficients=0 Prob>Chi-sq	DID1	Obs	Firms	DID
	For the Post-IPO Period					For the Pre-IPO Period					
SIZE	0 3585***	0 0000	0 3837	14602	2495	0 5785***	0 0000	0 7153	6978	2074	-0 3316
	(0 0357)					(0 1271)					
TA	0 2301***	0 0000	0 2300	14602	2495	0 2662***	0 0000	0 3289	6978	2074	-0 0990
	(0 0190)					(0 0527)					
LEV	-0 0096	0 0000	0 0017	14602	2495	0 0183	0 2443	0 0377	6978	2074	-0 0360
	(0 0103)					(0 0251)					
ROA	-0 0131*	0 0000	-0 0053	14602	2495	0 0138	0 0091	0 0568	6978	2074	-0 0622
	(0 0067)					(0 0454)					
CAPEX	0 0087	0 0000	0 0123	14602	2495	0 0097	0 0258	0 0086	6978	2074	0 0037
	(0 0066)					(0 0100)					
ACQ	0 0124	0 0241	0 0184	14602	2495	0 0149	0 4370	0 0387	6978	2074	-0 0203
	(0 0096)					(0 0104)					
INVEN	-0 0022	0 0000	-0 0012	14602	2495	0 0027	0 1865	0 0027	6978	2074	-0 0039
	(0 0017)					(0 0042)					
CASH	0 0032	0 0010	0 0050	14602	2495	-0 0130	0 4869	-0 0015	6978	2074	0 0065
	(0 0041)					(0 0125)					
GSIZE	-0 0517*	0 0000	-0 0505	14602	2495	0 4330*	0 0000	0 5229	6978	2074	-0 5734
	(0 0261)					(0 1417)					
GTA	-0 0389	0 0000	-0 0605	14602	2495	0 5066***	0 0000	0 6156	6978	2074	-0 6760
	(0 0259)					(0 1120)					
NWTH	0 3701***	0 0000	0 3717	14602	2495	0 2169#	0 0060	0 4078	6978	2074	-0 0360
	(0 0421)					(0 1317)					

The 'treatment effects' of the decision to go public on the variables listed above are estimated by differences-in-differences estimators $\Delta y_{it} = \theta \Delta D_{it} + (d_t - d_{t-1}) + \Delta \varepsilon_{it}$ D_{it} is a dummy that equals 1 if a firm i is publicly listed in year t d_t is the year dummy $DID2 = \Delta \bar{y}_2^{public} - \Delta \bar{y}_2^{private}$ for the post-IPO period (including the IPO year), $DID1 = \Delta \bar{y}_1^{public} - \Delta \bar{y}_1^{private}$ for the pre-IPO period, *DID=DID2-DID1*, giving the 'treatment effects' (the effects of going public) I use the performance of non-IPO firms as a control for the performance of IPO firms Standard errors are adjusted for clustering on firms Semi-robust standard errors are reported in parentheses The 'treatment effects' are estimated using the entire sample SIZE is the log value of turnover, which is used as the main measure of firm size TA is the log value of total assets LEV is total debt over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ACQ is the net cash flow from acquisition and disposal over total assets INVEN is stock and work in progress over total assets CASH is cash and cash equivalent over total assets GSIZE is the rate of growth of turnover GTA is the rate of growth of total assets NWTH is the log value of shareholders' funds, values below zero are truncated at zero # p<0 1, * p<0 05, ** p<0 01, *** p<0 001

Table 7.6 Treatment Effects of the IPO Decision for the Independent IPO Subsample (Differences-in-Differences Estimates)

Variables	Theta	Wald test all coefficients=0 Prob>Chi-sq	DID2	Obs	Firms	Theta	Wald test all coefficients=0 Prob>Chi-sq	DID1	Obs	Firms	DID
	For the Post-IPO Period					For the Pre-IPO Period					
SIZE	0 2403***	0 0000	0 2427	8819	1371	0 4932***	0 0000	0 6594	4458	1208	-0 4167
	(0 0307)					(0 1365)					
TA	0 2259***	0 0000	0 2199	8819	1371	0 2975***	0 0000	0 3665	4458	1208	-0 1465
	(0 0190)					(0 0627)					
LEV	-0 0080	0 0053	-0 0004	8819	1371	0 0240	0 7328	0 0475	4458	1208	-0 0480
	(0 0105)					(0 0302)					
ROA	-0 0087	0 0002	0 0029	8819	1371	0 0103	0 0648	0 0655	4458	1208	-0 0626
	(0 0086)					(0 0554)					
CAPEX	0 0103	0 1199	0 0134	8819	1371	0 0108	0 0010	0 0130	4458	1208	0 0004
	(0 0072)					(0 0118)					
ACQ	0 0088	0 0429	0 0163	8819	1371	0 0128	0 0676	0 0413	4458	1208	-0 0250
	(0 0091)					(0 0112)					
INVEN	-0 0055**	0 0436	-0 0045	8819	1371	0 0027	0 3385	0 0031	4458	1208	-0 0076
	(0 0020)					(0 0051)					
CASH	0 0053	0 0276	0 0073	8819	1371	-0 0118	0 7864	0 0022	4458	1208	0 0050
	(0 0059)					(0 0150)					
GSIZE	-0 0384	0 0004	-0 0472	8819	1371	0 4983**	0 0052	0 6113	4458	1208	-0 6585
	(0 0267)					(0 1770)					
GTA	-0 0484#	0 0000	-0 0708	8819	1371	0 5976***	0 0000	0 7242	4458	1208	-0 7950
	(0 0261)					(0 1412)					
NWTH	0 4045***	0 0000	0 4028	8819	1371	0 3409*	0 0004	0 5554	4458	1208	-0 1526
	(0 0418)					(0 1502)					

The 'treatment effects' of the decision to go public on the variables listed above are estimated by differences-in-differences estimators $\Delta y_{it} = \theta \Delta D_{it} + (d_t - d_{t-1}) + \Delta \varepsilon_{it}$ D_{it} is a dummy that equals 1 if a firm i is publicly listed in year t d_t is the year dummy $DID2 = \Delta \bar{y}_2^{public} - \Delta \bar{y}_2^{private}$ for the post-IPO period (including the IPO year), $DID1 = \Delta \bar{y}_1^{public} - \Delta \bar{y}_1^{private}$ for the pre-IPO period, *DID=DID2-DID1*, giving the 'treatment effects' (the effects of going public) I use the performance of non-IPO firms as a control for the performance of IPO firms Standard errors are adjusted for clustering on firms Semi-robust standard errors are reported in parentheses The 'treatment effects' are estimated using the independent IPO subsample SIZE is the log value of turnover TA is the log value of total assets LEV is total debt over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ACQ is the net cash flow from acquisition and disposal over total assets INVEN is stock and work in progress over total assets CASH is cash and cash equivalent over total assets GSIZE is the rate of growth of turnover GTA is the rate of growth of total assets NWTH is the log value of shareholders' funds, and values below zero are truncated at zero # p<0 1, * p<0 05, ** p<0 01, *** p<0 001

Table 7.7 Treatment Effects of the IPO Decision for the Carve-out Subsample (Differences-in-Differences Estimates)

Variables	Theta	Wald test all coefficients=0 Prob>Chi-sq	DID2	Obs	Firms	Theta	Wald test all coefficients=0 Prob>Chi-sq	DID1	Obs	Firms	DID
	For the Post-IPO Period					For the Pre-IPO Period					
SIZE	0 2653*	0 0000	0 4942	5783	1124	1 0091**	0 0000	1 0100	2520	866	-0 5157
	(0 1246)					(0 3574)					
TA	0 1593**	0 0000	0 2140	5783	1124	0 1811*	0 0000	0 2499	2520	866	-0 0358
	(0 0546)					(0 0883)					
LEV	-0 0118	0 0000	0 0304	5783	1124	-0 0102	0 1553	0 0425	2520	866	-0 0121
	(0 0371)					(0 0384)					
ROA	-0 0370**	0 0012	-0 0502	5783	1124	0 0289	0 0108	0 0487	2520	866	-0 0989
	(0 0127)					(0 0647)					
CAPEX	-0 0013	0 0000	0 0051	5783	1124	0 0033	0 0470	0 0001	2520	866	0 0049
	(0 0081)					(0 0139)					
ACQ	0 0327	0 0001	0 0235	5783	1124	0 0500	0 2110	0 0414	2520	866	-0 0179
	(0 0296)					(0 0305)					
INVEN	0 0045*	0 0000	0 0019	5783	1124	0 0038	0 7889	0 0053	2520	866	-0 0034
	(0 0021)					(0 0060)					
CASH	-0 0005	0 0003	0 0029	5783	1124	-0 0139	0 4879	-0 0041	2520	866	0 0070
	(0 0055)					(0 0194)					
GSIZE	-0 0629**	0 0000	0 0171	5783	1124	0 2445*	0 0000	0 2712	2520	866	-0 2542
	(0 0239)					(0 1159)					
GTA	-0 0450	0 0000	0 0107	5783	1124	0 1924*	0 0000	0 3209	2520	866	-0 3102
	(0 0277)					(0 0881)					
NWTH	0 2355#	0 0002	0 0803	5783	1124	-0 1621	0 3088	0 0879	2520	866	-0 0075
	(0 1333)					(0 2345)					

The 'treatment effects' of the decision to go public on the variables listed above are estimated by differences-in-differences estimators $\Delta y_{it} = \theta \Delta D_{it} + (d_t - d_{t-1}) + \Delta \varepsilon_{it}$ D_{it} is a dummy that equals 1 if a firm i is publicly listed in year t d_t is the year dummy $DID2 = \Delta \bar{y}_2^{public} - \Delta \bar{y}_2^{private}$ for the post-IPO period (including the IPO year), $DID1 = \Delta \bar{y}_1^{public} - \Delta \bar{y}_1^{private}$ for the pre-IPO period, *DID=DID2-DID1*, giving the 'treatment effects' (the effects of going public) I use the performance of non-IPO firms as a control for the performance of IPO firms Standard errors are adjusted for clustering on firms Semi-robust standard errors are reported in parentheses The 'treatment effects' are estimated using the carve-out subsample SIZE is the log value of turnover TA is the log value of total assets LEV is total debt over total assets ROA is EBITDA (earnings before interest, taxes, depreciation and amortization) over total assets CAPEX is the net cash flow from capital expenditure, sale of plant and equipment and returns (including sale) of equity instrument over total assets ACQ is the net cash flow from acquisition and disposal over total assets INVEN is stock and work in progress over total assets CASH is cash and cash equivalent over total assets GSIZE is the rate of growth of turnover GTA is the rate of growth of total assets NWTH is the log value of shareholders' funds, and values below zero are truncated at zero # p<0 1, * p<0 05, ** p<0 01, *** p<0 001

7.5 Concluding Remarks

In this chapter, I have used panel data of 183 UK IPO firms and 2315 UK private firms over twelve years from 1996 to 2007, to investigate the determinants of the choice to go public and the determinants of structuring an IPO in a unified framework. Bivariate sample selection models are used, which has allowed me to examine a complete IPO decision while controlling for omitted variable problems (and examining the impact of an IPO firm's private information). I have also compared the performance of IPO firms between pre- and post- IPO periods by investigating the treatment effects of going public

It is confirmed that the sizes of primary and secondary shares are jointly determined. IPO firms appear to possess private information about the value of being publicly listed. If the private information indicates a higher growth prospect by going public, more public equity will be raised to finance the growth to increase firm value while less shares being divested This is different from Huyghebaert and Van Hulle (2006), which argued that the size of secondary shares is determined by the size of primary shares and that the purpose to add secondary shares is to increase aftermarket liquidity for the stock

Earlier results about IPO motives and timing in chapter 5 and 6 are further confirmed. For the UK sample, the IPOs of independent firms are mainly driven by financing needs, due to their limited ability to generate internal cash They also seem to take advantage of windows of opportunity in bull markets to raise more equity capital Larger independent firms are able to include secondary shares in their IPOs and to enable their original shareholders (most likely the non-director shareholders) to divest their shareholdings, as there is less adverse selection cost associated with the divestment for them. However, this is not the dominant reason for these independent IPOs.

In contrast, the IPO decision of subsidiaries is mainly driven by corporate restructuring and divestment Parent firms tend to divest highly indebted and less controlled subsidiaries via IPO The lower the value of their private information about growth potential, the more the shares divested and the fewer the new shares raised in the IPOs

In this way, improved cash flows after the IPOs (from investment and improved monitoring of management) and increased firm value of the subsidiaries generate maximum total proceeds from a two-stage selling process

Smaller firms tend to go public purely to raise new capital Firms whose existing shareholders sell out in IPOs tend to offer in rising markets while avoiding hot issue markets, so as to maximise the total proceeds from the two-stage selling process

The results of the treatment effects approach seem to suggest that firms time their IPOs at the peak of their growth. This seems to provide supportive evidence for the market timing theory However, it will be necessary to check the robustness of these results. A treatment effects with sample selection approach is suggested for future research.

8 Structuring the IPO, Ownership and Control and the IPO Underpricing

An Event Study of the IPOs in the UK

8.1 Introduction

Underpricing of IPOs is a well documented phenomenon in almost every stock market: it is widely observed that the offer price tends to be well below the first day's trading price. Numerous theoretical models and empirical researches have been developed to explain this anomaly, which appears to violate the efficient markets hypothesis.

On the theoretical front, Jenkinson and Ljungqvist (2001), Ritter and Welch and Ljungqvist (2006) reviewed various theoretical explanations and concluded that although the various theories[58] are not necessarily mutually exclusive, there is no single one that can completely resolve the underpricing anomaly. Empirically, different theories find supporting evidence in different markets. However, depending on the examined market and the chosen sample period, the empirical results vary. For example, supportive evidence has been found for the winner's curse hypothesis (an information based model) for the US (Barry and Jennings, 1993), Latin America (Aggarwal, Leal and Hernandez, 1993) and Taiwan (Huang, 1999), but the hypothesis was rejected in Singapore (Lim, 1999)

Given the complexity of the underpricing anomaly, and its vital role in the development of the IPO market, research in this area is likely to continue to receive great interest. In particular, the question as to what accounts for variation in the extent of underpricing over time and across countries is both critical and unresolved

In this chapter, I empirically examine underpricing in the sample of 183 UK IPOs (used in chapter 5 and 7) for the recent years 1998-2003. Earlier work on UK IPOs found that the winner's curse hypothesis can only partly explain the degree of underpricing of UK IPOs (Levis, 1993) Therefore, it is necessary to test other underpricing hypotheses. In

[58] The theories of IPO underpricing are generally divided into four groups information based models, the institutional explanations, the ownership and control models and the behavioural explanations

addition, Levis's study was based on early years (1980-1988) when 'offer for sale' (a fixed pricing method) was the preferred IPO method. However, since the late 90s, 'placing' (a bookbuilding pricing method) has become the predominant IPO method. In the current bookbuilding process, the underwriter plays an important role in IPO allocation as intermediary. Consequently, the old winner's curse problem between issuers and investors that arises from pro-rata allocation rules (Rock, 1986) may no longer apply Moreover, since the establishment of AIM in 1995, many smaller and growth companies have been encouraged to join the stock market. The different risk profile of these new issuers may also have affected IPO underpricing in the UK Changes in the IPO subscription and allocation method, together with these different market participants, make it necessary to re-examine UK IPO underpricing for the recent period

In another interesting example (although also based on an early sample period 1986-1989), Brennan and Franks (1997) suggested that the underpricing of UK IPOs is used as a mean to induce oversubscription and avoid outside block shareholders, so as to retain effective control by managers However, critics argued that protecting private benefits of control may not be the only reason why dispersed outside ownership is favoured – underpricing may also be used to encourage monitoring and minimise agency costs (Stoughton and Zechner, 1998). Hence, explanations based on an ownership and control hypothesis also need to be justified in the UK context.

In this chapter, I test a relatively new underpricing theory – Entrepreneurial Wealth Losses theory (Habib and Ljungqvist, 2001) in conjunction with Ownership and Control explanations There are several reasons why I focus on these two theories First, the entrepreneurial wealth losses model takes into consideration the role of underwriters and is also applicable in a bookbuilding environment, thereby better reflecting the current fashion of the IPO market. Second, this model embraces the reasons why a firm goes public – whether to sell old shares or to raise new money – and links this to IPO underpricing Although it is not complete, the various IPO scenarios are reasonablely incorporated in this model, allowing it to be distinguished from other asymmetric information models. Third, this model emphasises that the degree of underpricing is affected by insider selling and the dilution of the original shareholdings caused by the

creation of new shares. This provides a link to the ownership and control theories and makes it possible to test these and the entrepreneurial wealth losses theory at the same time Fourth, ownership and structure is a very important consideration when a firm makes decision to go public, with evidence in the previous chapters also showing that primary and secondary share offerings are differentially affected As this issue directly affects entrepreneurial wealth losses in IPOs, integrating the ownership and control models and the entrepreneurial wealth losses model should provide a more complete view of IPO underpricing. At last but not least, recent developments in law and corporate finance have found that ownership and control structure is strongly influenced by legal systems and institutional features. Therefore, understanding the relationship between ownership and control structure, IPO structure and IPO underpricing may in part help to explain the cross-country differences in IPO underpricing in an institutional framework. In short, focusing on these two theories should help to link together underpricing and the motivation for going public, extending the understanding of IPO underpricing and offering a more fundamental explanation.

The variables I test, apart from ownership and control structure, include the IPO structure, which is for the first time embraced and emphasised in an empirical study of IPO underpricing The IPO structure directly reveals information about the motivation for going public and also serves as an ideal testable variable for the entrepreneurial wealth losses model

A different methodology – event study – is adopted in this chapter Event study has the advantage in an underpricing study, of showing how stock prices react in the move from primary to secondary markets and how new stocks perform in the secondary market after flotation, reflecting valuable information However various problems arise from applying the event study procedure to the study of IPO underpricing These are discussed and carefully controlled. Two sets of event-estimation windows are tested. Abnormal returns are calculated using both a market-adjusted approach and the market model. For the parameters of the market model, I perform both OLS and SUR regressions to control for the correlations of the error terms across IPOs. Testing for statistical significance of ARs and CAARs is based on both Patell and Boehmer tests.

Using the event study methodology, I examine the underpricing and short-run performance of UK IPOs and make a comparison between firms with different control and IPO structures. This is followed by cross-sectional regressions to test the relationship between underpricing and IPO structure, and ownership and control structure, while controlling for market conditions

The rest of the chapter is organised as follows section 8.2 discusses the theoretical background and generates testable implications; section 8 3 introduces the methodology; section 8 4 analyses results and section 8.5 concludes.

8.2 Entrepreneurial Wealth Losses, Ownership and Control, and Underpricing

8.2.1 IPO Structure, Entrepreneurial Wealth Losses and Underpricing

Going public is costly because of market imperfections Information friction among IPO participants such as issuers, investors and investment banks gives rise to underpricing costs, which are used to compensate the less informed party in order to promote IPO success.

Rock (1986)'s winner's curse model is one of the best known asymmetric information models for explaining the underpricing puzzle In Rock's model, the presence of better informed investors gives rise to adverse selection problem. Issuers have to underprice their IPOs to induce less informed investors to participate.

Habib and Ljungqvist (2001) introduced the role of promotion costs and extended Rock's model to recognise that the proportions of better informed and less informed investors are determined by the issuer They argue that issuers can reduce underpricing costs by promoting the IPOs so as to reduce information asymmetries, e g hiring reputable underwriters and auditors to attract a greater number of uninformed investors However, such promotion is costly and, like underpricing costs, it causes entrepreneurial wealth losses Hence, promotion costs and underpricing costs are substitutes, and the trade-off between the two is determined by the minimisation of

entrepreneurial wealth losses.

In an IPO, the issuer either offers new shares (i e. primary shares) or/and sells existing shares (i.e. secondary shares). The larger the number of primary shares offered, the higher the promotion costs incurred in attracting larger numbers of less informed investors. This would also be true for offering secondary shares As the promotion costs increase, underpricing costs would decrease. Therefore, the larger the number of primary shares (or secondary shares) offered, the lower the underpricing costs. Between primary share offerings and secondary share offerings, the issuers' wealth suffers more from underpricing for the latter group, creating a net benefit of reduced underpricing costs for secondary share offerings (reduced wealth losses).

Therefore, in equilibrium, wealth losses are invariant to promotion costs, but instead are determined by uncertainty and by the number of primary and secondary shares offered The extent to which the issuers would want to reduce underpricing costs through promotion depends on the type of shares offered Hence, a key implication that can be drawn from this entrepreneurial wealth losses model is that insider selling is related to lower underpricing in general:

Hypothesis 1 Primary share offerings are more underpriced than offerings that include secondary shares

The entrepreneurial wealth losses model makes a very interesting point not only is minimisation of the wealth losses of the issuer (the entrepreneur) vital to the issuing firm but also such wealth losses to the issuer are affected differently by flotations that include the sale of existing shares and those that do not. This is not hard to understand intuitively, the selling shareholders would want to maximise the selling price and would favour as low as possible underpricing. On the other hand, to reduce the promotion costs borne by themselves (so that their own wealth losses can be minimised) they can choose to sell their shares in an IPO at a later stage of the firm's growth, when information costs (promotion costs) are reduced By contrast, for an IPO that does not include sales of existing shares, trade-off between promotion costs and underpricing costs is irrelevant to the firm Whether to incur higher promotion costs (i.e. to leave money to the underwriters), or to incur higher underpricing costs (i e. to leave money to

the investors), the total expense of the issuer will be unaffected. In this case, the question only concerns the extent to which underwriters and other intermediates can share the benefits of the flotation.

8.2.2 Ownership and Control Structure and Underpricing

The wealth losses model is incomplete and cannot fully answer the IPO underpricing question First, for a primary share offering, the issuer retains the existing shareholdings after the IPO. If the share price increases in the aftermarket, firm value will improve consequently So the wealth losses incurred at the IPO can be compensated by the increased firm value. In contrast, for a secondary share offering, the realised losses for the selling shareholders cannot be compensated by an increase in the share price in the aftermarket. Therefore, it remains unexplained that why the existing shareholders would want to sell their shares in the IPO and bear the losses Second, IPO changes the original ownership structure, and in most cases dilutes the original shareholdings. Whether such a change has an impact on underpricing remains unanswered.

To answer these questions and to determine whether or not insiders are ultimately better off, I need to return to ownership and control theories I start by answering the second question One reason why the ownership and control problems (or agency problems) exist is that the separation of ownership and control is incomplete Managers have an incentive to grab firm resources for their private benefits, while non-managing shareholders bear the resulting loss of firm value through the threat of bankruptcy (Jensen and Meckling, 1976, Jensen, 1986). Apart from this manager-shareholder problem (an under-monitoring problem), going public will bring in minority outside shareholders, creating minority-controlling shareholder conflicts. If outside shareholders consist of block shareholders, it may create an over-monitoring problem since outside block shareholders may have incentive to involve in take over activities, jeopardising controlling shareholders' controlling status (Pagano and Roell, 1998)

The issuers can solve ownership and control problems by underpricing their IPOs However, there is a debate Brennan and Franks (1997) suggested that underpricing and the consequent over-subscription are used to restrict large investors with an aim to

avoid the over-monitoring problem. On the other hand, Stoughton and Zechner (1998) argued that underpricing and over-subscription are used to restrict small investors for the purpose of solving the under-monitoring problem

There may be truth in both explanations, however, for a specific market it is important to identify whether the over-monitoring or the under-monitoring problem is the dominant issue. If conflicts between outside block shareholders and original controlling shareholders are dominant, a higher ownership concentration should increase the tendency for controlling shareholders to favour small investors against large ones. Hence, following the argument of Brennan and Franks (1997), it is expected that:

Hypothesis 2 Underpricing increases in ownership concentration before IPO but decreases in ownership concentration after IPO

On the other hand, if manger-shareholder conflicts are dominant, higher ownership dispersion increases the incentive of issuers to ration out small investors in favour of larger investors. So following the argument of Stoughton and Zechner (1998), it is expected that:

Hypothesis 3 Underpricing decreases in ownership concentration before IPO but increases in ownership concentration after IPO

In this sense, underpricing not only matters for wealth losses at IPO but also potentially affects 'wealth losses' during an extended period after IPO. Underpricing may induce optimal ownership structure and serve to increase firm value, boosting insiders' wealth

Now I address the first question as to why the original shareholders sell at IPO. Zingales (1995) argued that the selling shareholders sell out in two stages. In the first stage (at the IPO), they sell only a small portion of their shareholdings to dispersed outsider-shareholders. The diffusion of the ownership structure can help to enhance the controlling shareholders' controlling status (the controlling shareholders are assumed to be the eventual sellers). At the same time, informative stock prices can improve managerial incentive, which helps to increase the value of the cash flow rights for the remaining block shareholdings. This improves the bargaining power of the selling shareholders Subsequently, the proceeds from selling the controlling blocks in the

second stage (some time after the IPO) are maximised As a result, the total proceeds for the selling shareholders are maximised from the two-stage selling process

8.2.3 Extension of the Entrepreneurial Wealth Losses Theory

Habib and Ljungqvist (2001) stress that testing underpricing theory should be conditional on the issuers' incentives to incur costs in order to reduce their losses In addition to the type of shares offered at an IPO and the effect of the ownership and control structure, I extend the incentives by bringing in the impact of market conditions.

In booming market conditions, there are many investors, especially uninformed investors, who actively deal in the market. As the market is optimistic and the market return is high, the price of an IPO is likely to increase substantially in the aftermarket (by behavioural explanations, over-pricing is likely). Therefore, there is little incentive to incur costs in promoting the IPO to uninformed investors. This would consequently be observed as a higher degree of underpricing. On the other hand, in pessimistic markets, it is more difficult to attract uninformed investors, and therefore higher promotion costs will be incurred and underpricing will be lower. This provides an alternative 'rational' explanation to 'irrational' explanations based on investor sentiment So the following hypothesis arises·

Hypothesis 4 Underpricing increases as market returns increase

8.3 Methodology

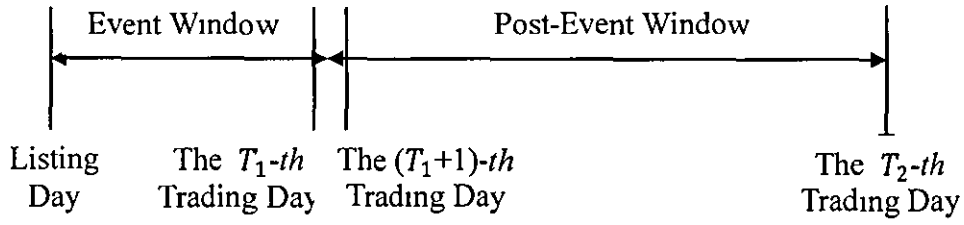
Event study methodology[59] is employed in this chapter In the first stage, using the event study method, I compute the degree of underpricing, abnormal returns (ARs) and cumulative average abnormal returns (CAARs), over two different post-event windows. Then I test the statistical significant of ARs and cumulative abnormal returns (CARs), and also compare them across the firms with different ownership and IPO structures In the second stage, I carry out cross-sectional regression to examine the relationship between IPO underpricing, IPO structure and ownership structure and market returns

[59] MacKinlay (1997) provided a very good survey on event studies in Economics and Finance

8.3.1 Computation of ARs and CAARs

I. Event window

(Event window and post event window)



According to the Efficient Markets Hypothesis, aftermarket trading should quickly bring the price of an IPO to its equilibrium price – that is, abnormal returns should disappear in a day or two after the listing Therefore, I assume that a 5-day event window (five consecutive trading days, equivalent to about one week in calendar days) is long enough to reflect the performance of the IPOs in the short-run I also test a longer period – a 60-day event window – for a further confirmation and for extra information. The downside of this is that too long an event window may adversely affect the power of the statistical tests of the significance of abnormal returns. So, $T_1 = 5, 60$ for the two event windows. T_2 is set to be the 260th trading day after an IPO, giving a 255-day post-event window (i e. the estimation window for the market model) for the 5-day event window and a 200-day post-event window for the 60-day event window.

II. Daily abnormal returns (ARs)

The daily stock returns[60] for IPO i at day t are calculated both for arithmetic returns·

$$R_{it} = {(P_{it} - P_{i,(t-1)})}/{P_{i,(t-1)}}$$

and for logarithmic returns·

[60] Daily returns perform best for event studies as compared to weekly or monthly returns (MacKinlay, 1997)

$R_{it} = \ln P_{it} - \ln P_{i,(t-1)} = \ln(1 + R_{it})$

P_{it} is the daily closing price for stock i on day t, adjusted for dividends and stock splits It is commonly agreed that log returns are more likely to be normally distributed but make it more difficult to take a cross-sectional average, for which reason log returns are often used in long-run studies whereas arithmetic returns are frequently used in short-run studies In this study, I calculate and examine both

For ARs, two models are used market-adjusted ARs and market model adjusted ARs. The advantage of the market model adjusted ARs over the market-adjusted ARs is that the former model allows the ARs to be adjusted for the beta risk of each stock.

For the market-adjusted ARs:

$$AR_{it} = R_{it} - E(R_{it}) \qquad (8\ 1)$$

where I respectively use FTSE All Share Index and FTSE Industrial Indices for the normal performance $E(R_{it})$ The second benchmark takes into account different stock performances across industries $(t = 1,2, \ldots T_1)$

For the market model adjusted ARs, I first compute $E(R_{it})$ using the Market Model

$$R_{it} = \alpha_i + \beta_i R_{m_i t} + \varepsilon_{it} \qquad (8\ 2)$$

Because there are no observable trading prices before listing, the post-event window (from day (T_1+1) to day T_2 , $T_2 = 260$) is used as the estimation window for computing alpha and beta parameters in the market model. The expected daily returns (normal returns) over the event window are defined as:

$$E(R_{it}|X_{it}) = \alpha_i + \beta_i R_{m_i t} \qquad (8.3)$$

Here X_t is the conditioning information for the market model on day t, α_i is the constant term for stock i, measuring the part of the normal return which is independent of market performance, β_i is the systemic risk for stock i and $R_{m_i t}$ is the market

return on day t, calculated from the FTSE All Share Index $(t = T_1 + 1, T_1 + 2, \ .T_2)$ The market model is estimated by both OLS regression and SUR regression (seemingly unrelated regression, Zeller 1962).

Estimating the market model by SUR is simultaneously estimating the following linear regression equations system,

$$R_{1t} = \alpha_1 + \beta_1 R_{m_1 t} + \varepsilon_{1t}$$

$$R_{2t} = \alpha_2 + \beta_2 R_{m_2 t} + \varepsilon_{2t}$$

$$\vdots$$

$$R_{Nt} = \alpha_N + \beta_N R_{m_N t} + \varepsilon_{Nt}, (N = 183) \qquad (8\ 4)$$

SUR controls for the correlations of the error terms (ε_{Nt}) across stocks When the residuals of the stock equations are highly correlated, there will be efficiency gains from SUR estimation

Daily abnormal returns over the event window $(t = 1,2, \ldots T_1)$ are defined as

$$AR_{it} = R_{it} - E(R_{it}|X_{it}) \qquad (8.5)$$

III. Daily cumulative abnormal returns (CARs)

The ARs are then aggregated for each stock i from day 1 until day t $(t = 1,2, \ldots T_1)$. The cumulative abnormal returns (CARs) for stock i over period $(1,t)$ are defined as

$$CAR_i(1,t) = AR_{i1} + \cdots + AR_{it} \qquad (t = 1,2, \ldots T_1) \qquad (8\ 6)$$

IV. Daily cumulative average abnormal returns (CAARs)

The cross-sectional average of CARs for the event window over period $(1,t)$ is defined by the CAAR

$$CAAR(1,t) = \frac{1}{183}\sum_{i=1}^{183} CAR_i(1,t) \qquad (t = 1,2,\ldots T_1) \tag{8.7}$$

V. Testing for statistical significance of ARs and CARs

[61]I perform Patell tests (Patell, 1976) and Boehmer tests (Boehmer, Musumeci and Poulsen, 1991) to test for the significance of ARs; and perform Patell tests, corrected Patell tests (Mikkelson and Partch, 1988) and Boehmer tests to test for the significance of CARs. The advantage of the Patell tests over simple *t*-tests is that the former are based on standardised abnormal returns (the abnormal returns are adjusted by the variance of the total standardised prediction errors), which allows for the heteroskedasticity of ARs and CARs For the CARs, the corrected Patell test further accounts for the problem that the ARs of each stock may be serially correlated over the event window Serial correlation arises for CARs because the ARs of each stock over the event window are computed by the same market model with the same slope estimator. However, such a problem may be trivial in a short event window of less than 60 days In addition to a serial correlation problem, the IPO event is likely to induce variation in abnormal performance across firms The Boehmer tests are more reliable in this aspect, as the ARs and CARs are adjusted for the cross-sectional variance. The test statistics are respectively given in what follows

The tests for ARs:

1) Patell tests: H_0: AR_{it} has zero mean, $(t = 1,2,\ldots T_1)$

$$\sigma^2_{AR_{it}} = \sigma^2_{AR_i}\left[1 + \frac{1}{L_1} + \frac{(R_{mt} - \overline{R_m})^2}{\sum_{\tau=T_1+1}^{T_2}(R_{m\tau} - \overline{R_m})^2}\right] \tag{8 8}$$

$$\sigma^2_{AR_i} = \frac{\sum_{\tau=T_1+1}^{T_2} AR^2_{i\tau}}{L_1 - 2} \tag{8.9}$$

Here L_1 denotes the number of observations in the estimation window – 255 for the 5-day event window and 200 for the 60-day event window R_m is the average market return over the estimation window.

And,

[61] Alternative tests include non-parametric tests – Rank and Sign tests Brown and Warner (1980) found that the T-tests perform well, Rank tests the second well, but Sign tests are not good Therefore, I perform T-tests

$$SAR_{it} = \frac{AR_{it}}{\sigma_{AR_{it}}} \tag{8 10}$$

Under H_0, SAR_{it} follows a student-t distribution with (L_1-2) degrees of freedom, where its mean is given by $\frac{1}{N}\sum_{i=1}^{N} SAR_{it}$, and its variance is given by $\frac{L_1-2}{L_1-4}$ (N denotes the sample size, and $N = 183$)

Therefore, under H_0,

$$z_t = \frac{\frac{1}{N}\sum_{i=1}^{N} SAR_{it} - 0}{\sqrt{\frac{L_1-2}{L_1-4}}/\sqrt{N}} \sim \mathrm{N}(0, 1) \tag{8.11}$$

2) Boehmer tests: H_0: AR_{it} has zero mean

Under H_0,

$$z_t = \frac{\frac{1}{N}\sum_{i=1}^{N} SAR_{it} - 0}{\sigma_{SAR_{it}}/\sqrt{N}} \sim \mathrm{N}(0, 1) \tag{8.12}$$

$$\sigma^2_{SAR_{it}} = \frac{1}{N-1}\sum_{i=1}^{N}\left(SAR_{it} - \frac{1}{N}\sum_{i=1}^{N} SAR_{it}\right)^2 \tag{8 13}$$

The tests for CARs:

1) Patell tests H_0: $CAAR(1,t)$ has zero mean, $(t = 1,2,\ldots T_1)$

Under H_0,

$$z_{1,t} = \frac{1}{\sqrt{N}}\sum_{i=1}^{N} \frac{\sum_{\tau=1}^{t} SAR_{i\tau}}{\sqrt{(t-1+1)\frac{L_1-2}{L_1-4}}} \sim \mathrm{N}(0, 1) \tag{8.14}$$

2) Corrected Patell tests: H_0. $CAAR(1,t)$ has zero mean, $(t = 1,2,..\ T_1)$

Under H_0,

$$z_{1,t} = \frac{1}{\sqrt{N}}\sum_{i=1}^{N} \frac{CAR_i(1,t)}{\sigma_{CAR_i}} \sim \mathrm{N}(0, 1) \tag{8.15}$$

$$\sigma^2_{CAR_i} = \sigma^2_{AR_i}\left[T + \frac{T^2}{L_1} + \frac{\left(\sum_{\tau=1}^{t} R_{m\tau} - T(\overline{R_m})\right)^2}{\sum_{k=T_1+1}^{T_2}(R_{mk} - \overline{R_m})^2}\right] \tag{8 16}$$

where $T = t - 1 + 1$, which is the length of event window

3) Boehmer tests: H_0 $CAAR(1,t)$ has zero mean, $(t = 1,2,\ldots T_1)$

Under H_0,

$$z_{1,t} = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \frac{SCAR_i(1,t)}{\sigma_{SCAR_i}} \sim N(0, 1) \quad (8\ 17)$$

$$SCAR_i(1,t) = \frac{CAR_i(1,t)}{\sigma_{CAR_i}} \quad (8.18)$$

$$\sigma^2_{SCAR_i} = \frac{1}{N-1} \sum_{i=1}^{N} (SCAR_i(1,t) - \frac{1}{N} \sum_{i=1}^{N} SCAR_i(1,t))^2 \quad (8\ 19)$$

8.3.2 Cross-sectional Relation between Underpricing, IPO Structure, Ownership Structure and Market Return

Based on the discussion in Section 2, I estimate the following model:

$$Underpricing = f(\beta_1 Market\_Return + \beta_2 CONC1 + \beta_3 CONC2 + \gamma_1 Carveout + \gamma_2 Portion\_Dummy + \delta_1(CONC1 * Carveout) + \delta_2(CONC1 * Portion\_Dummy) + \delta_3(Market\_Return * Carveout) + \delta_4(Market\_Return * Portion\_Dummy)) \quad (8.20)$$

Underpricing is frequently measured by the first day return of an IPO. The arithmetic return is the ratio of the difference between the closing price of the first trading day and the offer price relative to the offer price. The logarithmic return is the difference between the log value of the closing price of the first trading day and the log value of the offer price. In addition to this measurement, I also measure underpricing by the AR of the first trading day, where AR is calculated by both the market-adjusted model (two benchmarks are applied: the FTSE All Share Index and the FTSE Industrial Indices) and the market model. Two sets of event-post_event windows are applied: 5-255 and 60-200. These are estimated by two methods: OLS and SUR. For each measurement of underpricing, both the logarithmic and the arithmetic returns are calculated.

Market_Return is the annual market return in the 12 months preceding the IPO, calculated using the FTSE All Share Index. By Hypothesis 4, it is expected to be positively related to Underpricing.

CONC1, CONC2 are correspondingly the percentage of shareholdings owned by blockholders (with ownership exceeding 3%) before and after the IPO. By hypothesis 2, it is expected that CONC1 (CONC2) is positively (negatively) related to Underpricing.

In contrast, by hypothesis 3, it is expected that CONC1 (CONC2) is negatively (positively) related to Underpricing

Portion_Dummy is a dummy equals 1 if the IPO includes primary shares only and equals 0 if the IPO includes secondary shares. By Hypothesis 1, it is expected to be positively related to Underpricing

Caveout is a dummy equals 1 if the IPO is a carve-out, which is the case when the holding parent company of the IPO firm is selling its shareholdings of the firm in the IPO; it equals 0 otherwise, indicating that the IPO firm is an independent firm. While it is argued that carve-out firms go public for different reasons (Pagano et al 1998), this variable captures the effect on IPO underpricing of this particular type of ownership and control structure.

CONC1*Carveout, CONC1*Portion_Dummy, Market_Return*Portion_Dummy and Market_Return*Carveout control for interaction effects between the indicator variables and the quantitative factors

8.4 Results[62]

8.4.1 The Degree of Underpricing

Table 8.1 reports summary statistics of the degree of underpricing computed by different methods The mean of the raw first day return is slightly lower than those adjusted by various benchmarks. Underpricing adjusted by the market model is on average a little higher than that adjusted by the FTSE indices, possibly caused by underperformance of the IPOs in the aftermarket – because the expected returns in the market model are computed using post-event data. Market models estimated by OLS and SUR give quite close results for the degree of underpricing.

The logarithmic returns are on average about 6% lower than the corresponding

[62] The results based on logarithmic returns are reported in this section The results based on arithmetic returns are reported in the Appendices as references

arithmetic returns The reason can be explained as follows if let R denote the arithmetic return, and LR denote the logarithmic return, it is known that the relation between the two is given by $R \approx LR + R^2/2$. This may underestimate the difference in the underpricing as compared to what were reported by earlier studies (using arithmetic return)

The average degree of underpricing (15.38%) for the period 1998-2003 in this study appears to be more than 10% higher than that reported in earlier studies on UK IPOs – 9.42% for 1986-1989 in Brenna and Franks (1997), 11 5% for 1980-1988 in Levis (1993), both using arithmetic raw returns in the first trading day as the measure of underpricing After the establishment of the AIM market, many smaller and/or growth firms with higher uncertainties and susceptibility to risk joined the London Stock Exchange, which may have led to the increase in the underpricing.

Table 8.1 Summary Statistics of the IPO Underpricing for the Entire Sample (Log)

Variable	Model	Obs	Mean	Std Dev.	Min	Max
Underpricing1	Market-adjusted. FTSE all share index	183	0 1543	0 2544	-0 2917	1 4752
Underpricing2	Market-adjusted FTSE industrial indices	183	0 1550	0 2547	-0 3118	1 4706
Underpricing5	Market model. 200-day estimation window – OLS	183	0 1562	0 2540	-0 2866	1 4759
Underpricing6	Market model 255-day estimation window – OLS	183	0.1560	0 2542	-0 2860	1 4808
Underpricing9	Market model· 200-day estimation window – SUR	183	0 1561	0 2539	-0 2865	1 4747
Underpricing10	Market model 255-day estimation window – SUR	183	0 1560	0 2543	-0 2856	1 4807
Underpricing13	Raw return	183	0.1538	0 2544	-0 2957	1 4663

Underpricing is calculated using adjusted stock prices – the offer price and daily closing prices are all adjusted for dividends and stock splits

8.4.2 ARs and CARs over the Event Windows

Summary statistics for abnormal returns over 60 days and 5 days (for the market model using 5-255 windows) are reported in Table 8.2 These can be better visualised in Figures 8.1 to 8 4 for the corresponding cumulative average abnormal returns For the market model adjusted ARs and CARs, only the OLS results are reported at this stage – the SUR estimates will be discussed later.

Table 8.2 Summary Statistics for ARs over 60-Day/5-Day Event Windows (Log Return)

Day	Obs	Mean	Std Dev	Min	Max
Panel A Market-adjusted abnormal returns – using the FTSE all share index as a benchmark					
1	183	0.1543	0 2544	-0.2917	1.4752
2	183	0 0035	0 0659	-0.1858	0.3052
3	183	0 0037	0 0662	-0 3348	0 5688
4	183	0 0047	0 0573	-0 2726	0 3876
5	183	0 0006	0.0510	-0 2847	0 2917
6	183	-0 0031	0 0360	-0 1756	0 2341
7	183	-0 0031	0 0408	-0 2423	0 1769
8	183	0 0016	0 0406	-0 2028	0 2033
9	183	-0 0064	0 0288	-0 1618	0 0882
10	183	-0 0037	0 0309	-0 2055	0 1256
11	183	-0 0005	0.0418	-0 1398	0 3718
12	183	-0 0049	0 0368	-0 2092	0 1981
13	183	-0 0041	0 0347	-0.1593	0 1224
14	183	0 0012	0 0423	-0 2895	0 1684
15	183	0 0032	0 0441	-0 0789	0 3350
16	183	-0 0007	0 0278	-0 1502	0 0827
17	183	-0 0007	0 0295	-0 1545	0 1844
18	183	-0 0066	0 0307	-0 2072	0 0820
19	183	-0 0012	0 0267	-0 1082	0.1518
20	183	0 0000	0.0284	-0 0917	0 2015
21	183	0 0009	0.0279	-0 1190	0 1576
22	183	-0 0045	0 0313	-0 1875	0 1644
23	183	-0 0010	0 0249	-0.1064	0 1609
24	183	-0 0026	0 0322	-0 2037	0.1742
25	183	-0 0018	0 0257	-0 1065	0 1173
26	183	0 0019	0 0305	-0 1584	0 1136
27	183	-0 0008	0 0358	-0 2100	0 1596
28	183	0 0040	0 0347	-0 0720	0 3186

Day	Obs	Mean	Std Dev	Min	Max
29	183	0 0025	0 0250	-0 0522	0.1822
30	183	-0 0009	0 0262	-0 0899	0 1500
31	183	-0 0015	0 0259	-0 1188	0 1183
32	183	0 0013	0 0311	-0 1288	0 1262
33	183	-0 0010	0 0273	-0 1137	0 1168
34	183	0.0030	0 0351	-0 1232	0 1849
35	183	0 0002	0 0255	-0 1065	0 1251
36	183	0 0030	0 0284	-0 0700	0 1464
37	183	-0 0002	0 0248	-0.1454	0 1178
38	183	-0 0014	0 0264	-0 1344	0 0889
39	183	-0 0006	0 0236	-0 1016	0 1210
40	183	0 0036	0 0504	-0 1200	0 5833
41	183	0 0003	0 0314	-0 2280	0 1534
42	183	0 0012	0 0281	-0 1322	0 1741
43	183	-0 0049	0 0363	-0 2295	0.1197
44	183	-0 0009	0 0338	-0 1501	0.1672
45	183	0 0012	0 0315	-0 1514	0 1503
46	183	-0 0014	0 0234	-0 1086	0.1152
47	183	-0 0036	0 0254	-0 1428	0 0871
48	183	-0 0003	0 0361	-0 0947	0 2906
49	183	-0 0032	0.0301	-0 1353	0 1974
50	183	-0 0030	0 0340	-0 1378	0 2263
51	183	-0 0052	0 0290	-0 1402	0.1788
52	183	0 0008	0 0324	-0 0754	0 2676
53	183	-0 0019	0 0290	-0 1812	0 1072
54	183	-0 0002	0 0307	-0 1194	0 2140
55	183	0 0004	0 0382	-0 3285	0.1605
56	183	-0 0001	0 0429	-0 2182	0 2898
57	183	-0 0025	0 0309	-0 1321	0 1486
58	183	0 0005	0 0392	-0 1309	0 2830
59	183	-0 0022	0 0275	-0 1051	0.1256
60	183	0.0009	0 0289	-0 1202	0 1788

Panel B Market-adjusted abnormal returns – using the FTSE industrial indices as a benchmark

1	183	0 1550	0 2547	-0 3118	1.4706
2	183	0 0044	0 0650	-0 1828	0 3009
3	183	0 0031	0 0682	-0 3507	0 5611
4	183	0 0063	0 0592	-0 2719	0 3920
5	183	0 0014	0 0528	-0 2943	0 2920
6	183	-0 0027	0 0383	-0 1949	0 2181
7	183	-0 0028	0 0443	-0 2439	0 1646
8	183	0 0017	0 0414	-0 2233	0 1991
9	183	-0 0045	0 0331	-0 1640	0 0877
10	183	-0 0031	0 0333	-0 1898	0.1102

Day	Obs	Mean	Std Dev.	Min	Max
11	183	-0 0003	0 0436	-0.1229	0 3662
12	183	-0 0042	0 0387	-0 2136	0 1990
13	183	-0 0033	0 0365	-0 1511	0 1306
14	183	0.0018	0 0456	-0 2867	0.1757
15	183	0.0043	0 0477	-0 0912	0.3321
16	183	-0 0001	0 0315	-0 1329	0 1138
17	183	0 0010	0 0301	-0 1504	0 1573
18	183	-0 0064	0 0333	-0 2105	0.1317
19	183	0 0012	0 0318	-0 1193	0 1442
20	183	-0 0009	0 0313	-0 1030	0.1629
21	183	0 0032	0 0285	-0 0842	0 1546
22	183	-0 0041	0 0354	-0 2175	0 1639
23	183	0 0013	0 0285	-0 0931	0 1478
24	183	-0.0030	0 0348	-0 2145	0 1309
25	183	-0 0027	0 0301	-0 0906	0 1420
26	183	0 0011	0 0323	-0 1400	0.1149
27	183	-0 0019	0 0387	-0 2163	0 1541
28	183	0 0052	0 0378	-0 0810	0 3050
29	183	0.0027	0 0290	-0 0877	0 1869
30	183	-0 0017	0 0297	-0 1050	0 1502
31	183	-0 0014	0 0292	-0.1406	0 1227
32	183	0 0001	0 0309	-0 1113	0 1193
33	183	0 0021	0 0285	-0 1138	0 0930
34	183	0 0032	0 0377	-0 1190	0 1950
35	183	0 0017	0 0296	-0 1110	0 1230
36	183	0 0035	0 0303	-0 0908	0 1559
37	183	0 0006	0 0256	-0.1146	0 1427
38	183	-0 0001	0 0290	-0 1288	0 1165
39	183	0 0007	0 0265	-0 1039	0 1213
40	183	0 0039	0 0536	-0 1684	0 5950
41	183	0 0002	0 0356	-0 2331	0 1583
42	183	0 0006	0 0313	-0 1540	0 1557
43	183	-0 0061	0 0380	-0 2368	0 0988
44	183	-0 0005	0 0361	-0 1533	0 1511
45	183	0 0020	0 0351	-0 1513	0 2290
46	183	-0 0014	0 0283	-0 1143	0 1280
47	183	-0 0027	0 0318	-0 0831	0 2181
48	183	0 0002	0 0403	-0 1250	0 3160
49	183	-0 0017	0 0322	-0 1454	0 2057
50	183	-0 0030	0 0382	-0 1447	0 2296
51	183	-0 0031	0 0333	-0.1675	0 1798
52	183	0 0037	0 0354	-0 0754	0 3101
53	183	-0 0002	0 0285	-0 1517	0 0859
54	183	0 0021	0 0342	-0 1037	0 2222

Day	Obs	Mean	Std Dev	Min	Max
55	183	-0 0001	0 0402	-0 3285	0 1501
56	183	0 0002	0 0423	-0 2171	0 2898
57	183	-0 0037	0 0326	-0 1303	0 0960
58	183	-0 0012	0 0425	-0.1268	0 2848
59	183	-0 0008	0 0328	-0.1443	0 1602
60	183	0 0026	0 0304	-0 1250	0 1791
Panel C Market model – using the 60-200 event-post_event windows (estimated by OLS)					
1	183	0.1562	0 2540	-0 2866	1 4759
2	183	0 0067	0 0645	-0.1784	0 3063
3	183	0 0055	0 0652	-0 3279	0 5639
4	183	0 0055	0 0563	-0 2705	0 3938
5	183	0 0022	0 0510	-0 2813	0 2920
6	183	-0.0001	0 0345	-0.1706	0 2331
7	183	-0 0008	0 0397	-0 2457	0 1774
8	183	0 0031	0 0409	-0 2122	0 2079
9	183	-0 0045	0 0279	-0 1633	0 0838
10	183	-0 0019	0 0292	-0 1919	0 1256
11	183	0 0007	0 0418	-0 1349	0 3727
12	183	-0 0035	0 0365	-0 2061	0 2085
13	183	-0 0023	0 0350	-0 1626	0 1218
14	183	0 0032	0 0392	-0.2622	0 1718
15	183	0 0058	0 0431	-0 0733	0 3344
16	183	0 0007	0 0273	-0 1502	0 1005
17	183	0 0000	0 0284	-0 1575	0 1834
18	183	-0 0049	0 0298	-0 2145	0 0752
19	183	-0.0002	0 0253	-0 1142	0 1372
20	183	0 0009	0 0259	-0 0765	0 1723
21	183	0 0019	0 0279	-0 1279	0 1606
22	183	-0 0023	0 0309	-0 1717	0 1645
23	183	0 0012	0 0232	-0 0924	0 1643
24	183	-0 0003	0 0309	-0 1881	0 1843
25	183	-0 0001	0 0247	-0 1197	0 1279
26	183	0 0029	0 0312	-0 1904	0 1158
27	183	0 0015	0 0355	-0 2111	0 1628
28	183	0 0053	0 0336	-0 0703	0 3136
29	183	0.0034	0 0249	-0 0618	0 1837
30	183	0 0016	0 0266	-0.1057	0 1632
31	183	0 0007	0 0259	-0.1227	0 1287
32	183	0 0023	0 0296	-0 1066	0 1343
33	183	0 0006	0 0257	-0 1154	0 1024
34	183	0 0045	0 0331	-0 1129	0.1755
35	183	0 0024	0 0231	-0 0964	0 1337

Day	Obs	Mean	Std Dev.	Min	Max
36	183	0 0038	0 0265	-0 0560	0 1435
37	183	0 0008	0 0228	-0 1336	0 1184
38	183	-0 0012	0 0249	-0 1311	0 0868
39	183	0 0020	0 0226	-0 0959	0 1364
40	183	0 0052	0 0504	-0 1087	0 5995
41	183	0 0024	0 0292	-0 2194	0 1551
42	183	0 0033	0 0274	-0 1270	0 1806
43	183	-0 0028	0 0371	-0 2273	0 1229
44	183	0 0012	0 0327	-0 1558	0 1664
45	183	0 0027	0 0293	-0 1460	0 1573
46	183	0 0005	0 0224	-0 1067	0 1402
47	183	-0.0020	0 0241	-0 1488	0 0871
48	183	0 0006	0 0347	-0 0911	0 2916
49	183	-0 0029	0 0290	-0 1384	0 1979
50	183	-0 0012	0 0322	-0 1329	0 2244
51	183	-0 0036	0 0274	-0 1328	0 1790
52	183	0 0027	0 0297	-0 0700	0 2432
53	183	-0 0006	0 0277	-0 1781	0 1120
54	183	0 0030	0 0308	-0 1505	0 2288
55	183	0 0007	0 0382	-0 3415	0 1577
56	183	0 0018	0 0429	-0 2236	0 2802
57	183	-0 0007	0 0304	-0 1247	0 1482
58	183	0 0017	0 0380	-0 1332	0 2803
59	183	-0.0003	0 0257	-0 1061	0 1260
60	183	0 0028	0 0277	-0 1210	0 1762
Panel D Market model – using the 5-255 event-post_event windows (estimated by OLS)					
1	183	0 1560	0 2542	-0.2860	1 4808
2	183	0 0065	0 0641	-0 1755	0 3045
3	183	0 0053	0 0652	-0 3284	0.5611
4	183	0 0054	0 0562	-0 2694	0 3947
5	183	0 0019	0 0505	-0 2813	0 2910

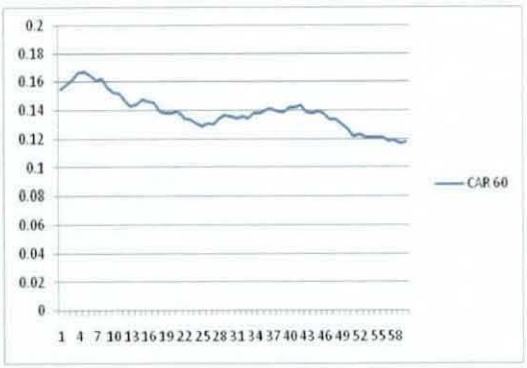
As reflected in Figures 8.1 to 8 4 (logarithmic returns) and Appendix III (arithmetic returns), logarithmic returns and arithmetic returns provide different profiles of CAAR over the 60 days after the IPOs, whereas such differences do not present over the 5-day period This suggests that while the results are sensitive to the choice between logarithmic and arithmetic return for longer periods (over a month), this is not the case for very short periods

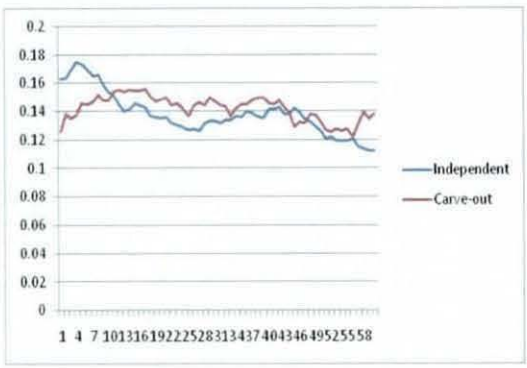
Overall, it seems that the IPOs of independent firms have higher CAARs in comparison to the IPO of carve-out firms, although the change in CAARs seems to be similar in the two groups Carve-outs are commonly backed by established parent companies and thus have informational advantages, and hence fewer asymmetric information problems than independent firms This may have reduced the degree of underpricing and hence CAARs for carve-outs

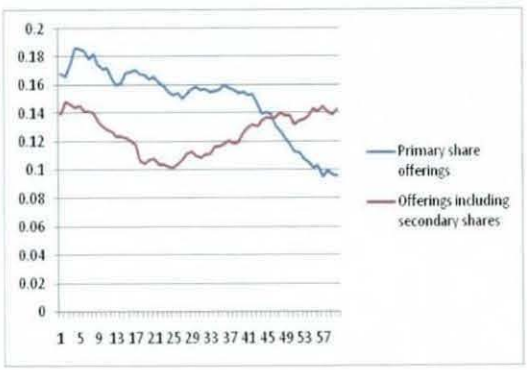
IPOs that offer primary shares only appear to have a higher degree of underpricing than IPOs that also offer secondary shares, which seems to support Hypothesis 1. However, the CAARs of the first group decrease over time while those of the second group are increasing. The increasing CAARs of IPOs that include secondary shares provide supporting evidence for the two-stage selling theory of Zingales (1995) As the CARs are continually building, the selling environment keeps improving for the shareholders who hold controlling blocks (the insiders), so that the selling shareholders are able to cash in on the improved conditions for second stage sales.

Figure 8.1 Cumulative Average Abnormal Returns – CAARs (Logarithmic Return) Market-adjusted – using the FTSE all share index as a benchmark

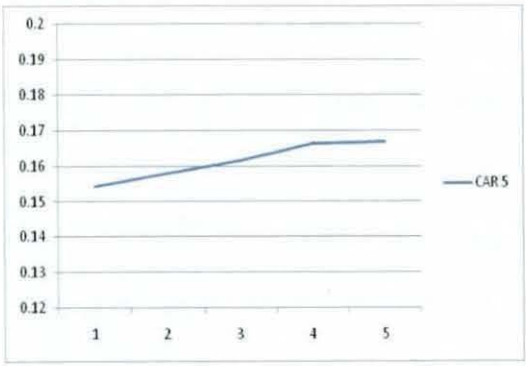
A. Over 60 days after IPO

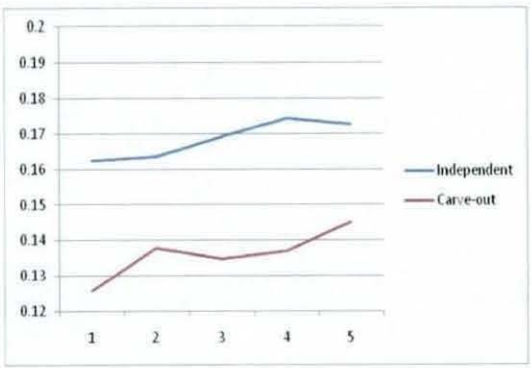






B. Over 5 days after IPO





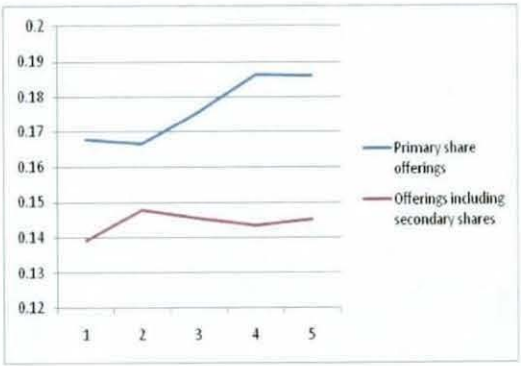
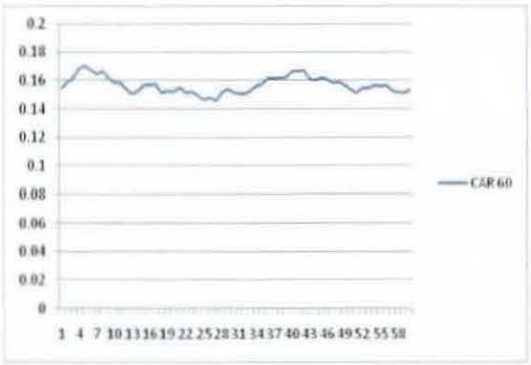
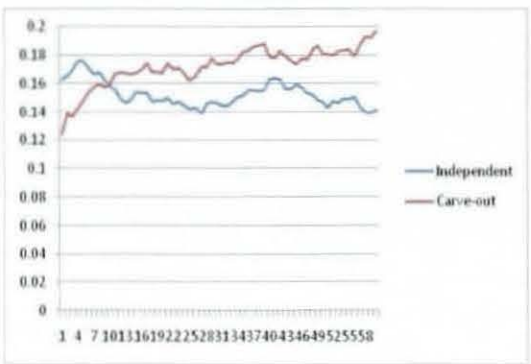
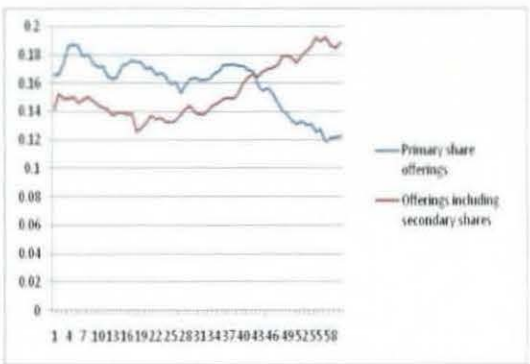


Figure 8.2 Cumulative Average Abnormal Returns– CAARs (Logarithmic Return) Market-adjusted – using the FTSE industrial indices as a benchmark

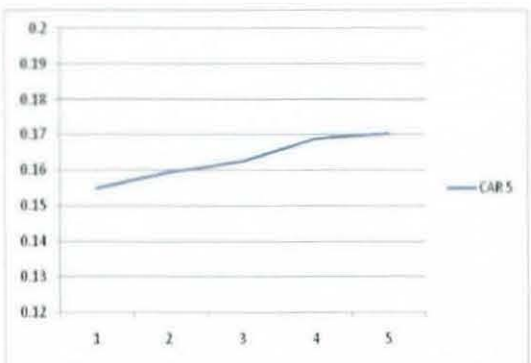
A. Over 60 days after IPO

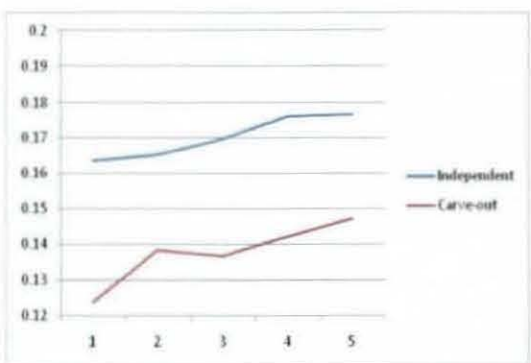






B. Over 5 days after IPO





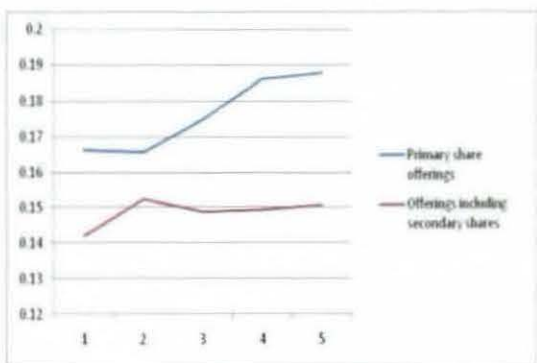
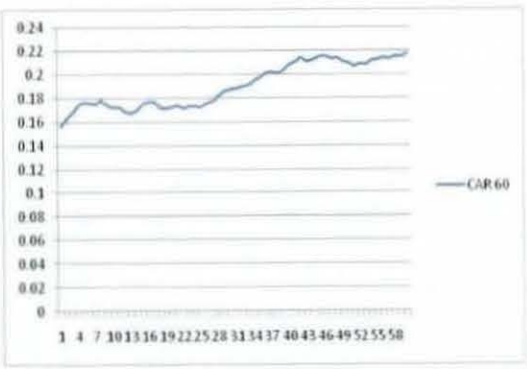
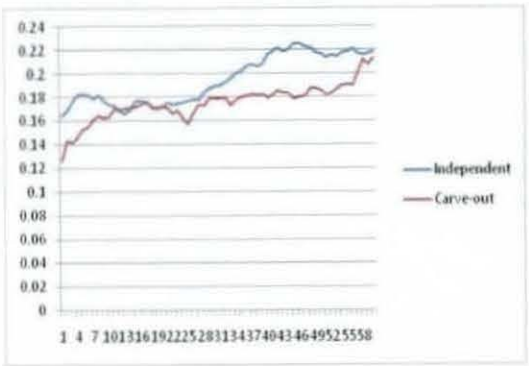
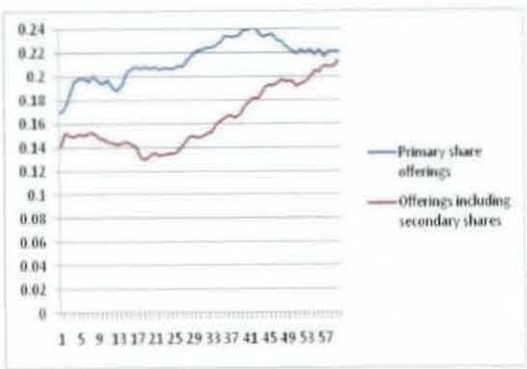


Figure 8.3 Cumulative Average Abnormal Returns – CAARs (Logarithmic Return) Market model (OLS) – using the 60-200 windows

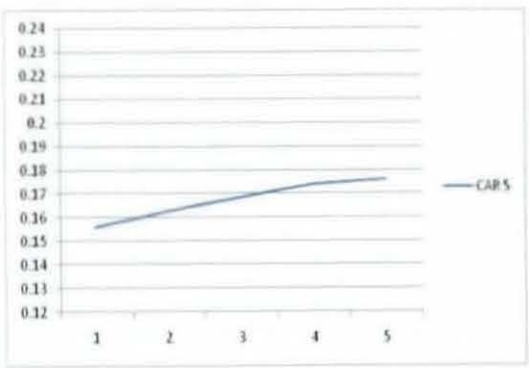
A. Over the 60-day event window after IPO

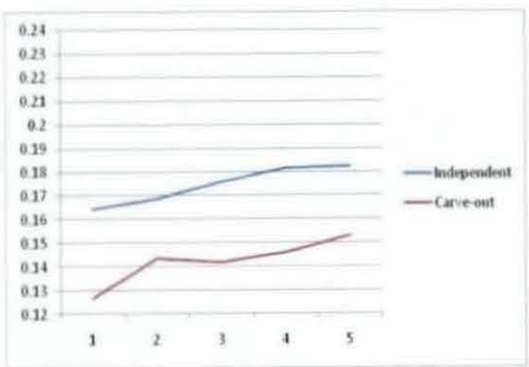






B. Over 5 days after IPO





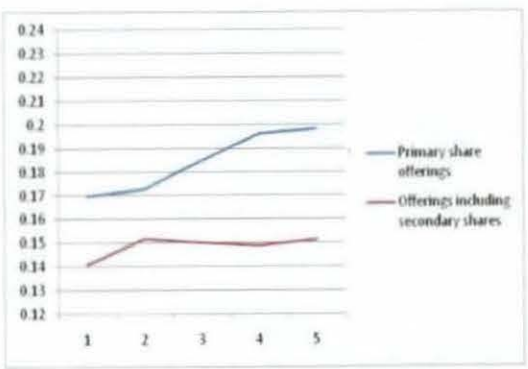
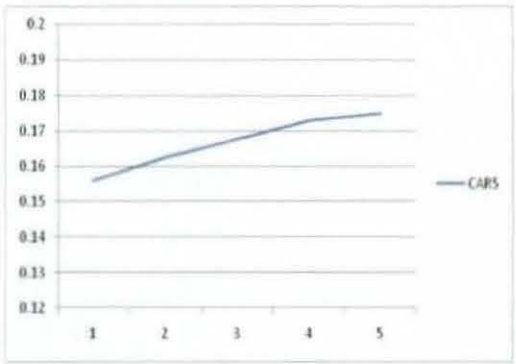
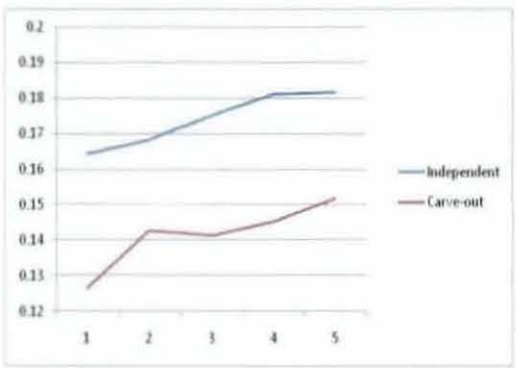
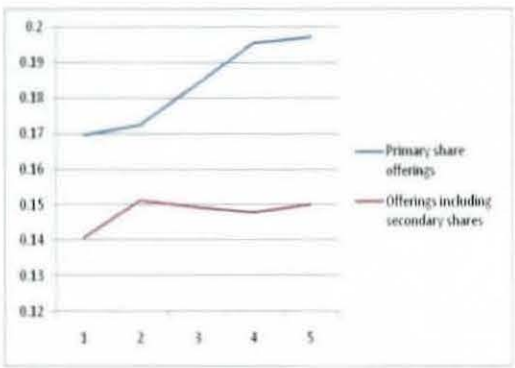


Figure 8.4 Cumulative Average Abnormal Returns – CAARs (Logarithmic Return) Market model (OLS) – using the 5-255 windows

Over the 5-day event window after IPO







I now turn to the results of testing the statistical significance of the ARs and CARs over the event windows. The results based on the market model estimated by OLS are presented in Tables 8.3 and 8.4, while those estimated by SUR are presented in Tables 8.6 and 8.7. The Patell test and the corrected Patell test give similar results for CARs, suggesting that serial correlation problems are not important for the short-run performance of the IPOs. However, for the tests on ARs, the Patell test suggests significant ARs for the first 3 days and day 8, 15, 28, 29 and 40, whereas the Boehmer test only highlights the first day and days 28 and 29. The difference in results comes from the variation in the market response to each different IPO, i.e. the event-induced variation. The different reasons for going public and the different risk profiles of the IPO firms might be the factors which have caused such a variation. For this reason, I believe that the variance-corrected Boehmer test is more robust. This test suggests that the abnormal return disappears immediately after the first day's trading, which is

consistent with the Efficient Markets Hypothesis. For a longer period, the significant ARs that occurred in days 28 and 29 might have arisen from other events, for example, the expiration of lock-up period. For example, Ofek and Richardson (2000), Field and Hanka (2001) found significant negative abnormal returns around the time of expiry of the lock-up period from the US IPOs. However, the regulation on lock-up period in the UK is very different from the one in the US. In the US, there is a standard lock-up period of 180 days for majority IPO firms (Bradley, Jordan, Roten and Yi, 2000). In contrast, Espenlaub, Goergen and Khurshed (2001) found that in the UK, there is a great variability in the lock-up period and often there are different lock-up periods for directors and other shareholders. The question as to whether the abnormal returns in day 28 and 29 are indeed caused by the expiration of lock-up period or related to other company events requires further study.

The difference in the statistical significance tests for the OLS and SUR results is very small for the entire sample (Table 8 3 – OLS, Table 8.6 – SUR), but larger for the sub-sample tests (Table 8.4 – OLS; Table 8.7 – SUR) I focus on the results from the Boehmer test for both ARs and CARs (Tables 8.4 and 8.7) The difference is reflected in the tests for the primary share offering sub-sample (Sub_b1), where the non-zero ARs hypothesis seems to be over rejected for the OLS results. The Breusch-Pagan tests of independence for SUR (Table 8 8) clearly indicate a strong correlation among the residuals of the equations for each IPO stock, suggesting that the SUR estimators should be more efficient than the OLS estimators It seems that the efficiency gain is especially important for the subsample of primary share offerings. It also seems that the risk factors are highly correlated among these sub-groups of IPOs rather than correlated with the market return

As seen in Table 8.7, overall, apart from the first day AR, there is no AR for the primary share offerings and secondary share offerings sub-groups for the first two months of trading in calendar time (around 40 trading days). After 40 trading days, there are only ARs detected for the secondary share offerings, which may be related to insider trading Again, this provides evidence for the entrepreneurial wealth losses theory and the two-stage selling process

On average, the primary share offering IPOs consistently earn CARs until the 52nd trading day (Table 8.7) (for the secondary share offering IPOs, the CARs last until the 30th trading day), due to the higher first day AR (Table 8.5). The CARs last for the shortest period for the carve-out sub-sample, because these firms have the lowest underpricing level.

Table 8.3 Testing for Statistical Significance of ARs and CARs over 60 (5) Days in the Entire Sample (n=183) – OLS Estimated Market Model (Log Return)

Day	AR		CAR		
	Patell test	Boehmer test	Patell test	Corrected Patell test	Boehmer test
Panel A Market model –using the 60- 200 event-post_event windows					
1	**74.4676**	**9.5576**	74 4676	74 8466	9 5577
2	**3.0508**	1 3687	54 8138	55 0742	8 6620
3	**2.0550**	1 2294	45 9417	46 1614	8 0786
4	1 0551	0 6515	40 3143	40 5004	7 6651
5	0 4062	0 1998	36 2398	36 4104	7 1057
6	0 2734	0 1884	33 1939	33 3615	6 5059
7	1 0249	0 7517	31 1190	31 2858	6 1798
8	**1.9891**	1 2050	29 8124	29 9757	5 9328
9	-1 8694	-2 2760	27 4842	27 6325	5 5049
10	-1 1741	-1 1998	25 7025	25 8375	5 1807
11	-0 2267	-0 2164	24 4381	24 5602	4 9713
12	-1 5891	-1 3506	22 9389	23 0525	4 7018
13	-1 2235	-1 0155	21 6997	21 7968	4 4217
14	0 5219	0 3705	21 0498	21 1392	4 2727
15	**1.9624**	1 5015	20 8427	20 9358	4 2375
16	0 2412	0 2592	20 2412	20 3323	4 0981
17	-0 0554	-0 0658	19 6234	19 7096	3 9736
18	-2 0199	-2 0188	18 5944	18 6839	3 7555
19	-0 0839	-0 0948	18 0792	18 1638	3 6624
20	0 4294	0 5377	17 7175	17 7993	3 5884
21	0 5603	0 5719	17 4128	17 4842	3 5372
22	-1 3312	-1 4981	16 7286	16 7973	3 3894
23	0 3477	0 4953	16 4334	16 4994	3 3358
24	0 2551	0 2718	16 1395	16 1981	3 2819
25	-0 1056	-0 1606	15 7923	15 8516	3 2097
26	1 2140	1 1580	15 7237	15 7805	3 1971
27	0 7888	0 6309	15 5816	15 6396	3 1746
28	**2.1927**	**2.1776**	15 7152	15 7734	3 2079
29	**1.9834**	**2.0995**	15 8101	15 8705	3 2348
30	0 4057	0 4785	15 6185	15 6833	3 1872
31	0 3396	0 4463	15 4255	15 4915	3 1486
32	0 5099	0 5826	15 2727	15 3368	3 1179
33	0 3195	0 3943	15 0951	15 1597	3 0815
34	1 7610	1 6441	15 1735	15 2420	3 1070
35	1 4901	1 7824	15 2070	15 2733	3 1114
36	1 6247	1 4715	15 2651	15 3320	3 1295
37	0 8534	1 1113	15 1977	15 2635	3 1197
38	-0 3544	-0 3939	14 9389	15 0033	3 0686
39	0 5066	0 6632	14 8273	14 8897	3 0483
40	**2.9194**	1 8228	15 1024	15 1665	3 1184

Day	AR		CAR		
	Patell test	Boehmer test	Patell test	Corrected Patell test	Boehmer test
41	1 1597	1 4703	15 0982	15 1587	3 1222
42	1 2549	1 3201	15 1110	15 1729	3 1278
43	-2 5054	-1 4911	14 5522	14 6064	2 9814
44	1 1576	1 2050	14 5604	14 6135	2 9886
45	1 3368	1 4960	14 5970	14 6489	2 9985
46	0 3922	0 5301	14 4953	14 5470	2 9763
47	-0 8080	-1 0914	14 2224	14 2770	2 9143
48	0 6150	0 5593	14 1622	14 2124	2 8938
49	-1 0437	-1 1801	13 8679	13 9161	2 8199
50	-1 0079	-1 1305	13 5859	13 6328	2 7494
51	-1 5711	-1 9430	13 2321	13 2745	2 6671
52	0 8148	0 9704	13 2172	13 2639	2 6652
53	0 1019	0 1028	13 1060	13 1522	2 6375
54	0 8058	0 8528	13 0937	13 1404	2 6362
55	0 0756	0 0578	12 9843	13 0285	2 6044
56	1 3036	0 9667	13 0421	13 0871	2 6182
57	-0 7483	-0 6636	12 8280	12 8734	2 5688
58	1 5409	0 8314	12 9193	12 9653	2 5826
59	-0 1603	-0 1651	12 7885	12 8329	2 5555
60	1 9139	1 6994	12 9286	12 9724	2 5920
Panel B Market model –using the 5-255 event-post_event windows					
1	**71.9428**	**10.0092**	71 9428	72 2289	10 0092
2	**2.7655**	1 3824	52 8268	53 0158	9 4166
3	1 8806	1 1835	44 2186	44 3788	9 1667
4	1 1701	0 7436	38 8795	39 0166	9 1314
5	-0 2683	-0 1361	34 6549	34 6219	8 9227

Table 8.4 Testing for Statistical Significance of ARs and CARs over 60 (5) Days after IPO in the Sub-samples – OLS Estimated Market Model (Log Return)

Day	AR								CAR											
	Patell test				Boehmer test				Patell test				Corrected Patell test				Boehmer test			
	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)
Panel A Market model – using the 60-200 event-post_event windows																				
1	**64 5671**	**37.1993**	**49 6321**	**55 9178**	**7.8912**	**5.9299**	**6 5620**	**6 9440**	64 5671	37 1993	49 6321	55 9178	64 8957	37 3886	49 8847	56 2024	7 8912	5 9300	6 5620	6 9438
2	**1 9774**	**2 7864**	0 6617	**3.7475**	0 8688	1 3502	0 7950	1 3437	47 0541	28 2742	35 5631	42 1897	47 2710	28 4210	35 7331	42 3890	7 1100	5 4760	6 2129	6 0704
3	**2 3299**	-0 0098	1 7622	1 1262	1 3538	-0 0066	1 8718	0 7270	39 7647	23 0801	30 0545	35 0980	39 9542	23 1918	30 1892	35 2755	6 7453	4 7267	5 7393	5 6791
4	0 7738	0 7937	**1 9145**	-0 4941	0 4416	0 7722	**2 2362**	-0 3051	34 8241	20 3848	26 9852	30 1487	34 9750	20 4977	27 0788	30 3208	6 4103	4 4303	5 3762	5 4137
5	-0 3249	1 4832	-0 5125	1 1369	-0 1442	1 7113	-0 4575	0 5858	31 0024	18 8960	23 9071	27 4742	31 1371	19 0062	23 9914	27 6336	5 8648	4 3162	4 8179	5 1783
6	-0 0621	0 7023	0 7774	-0 4268	-0 0407	0 6082	0 8480	-0 4062	28 2758	17 5363	22 1415	24 9062	28 4132	17 6349	22 2463	25 0393	5 3621	3 9487	4 4038	4 7413
7	0 5110	1 2259	0 5454	0 9159	0 3391	**1 9717**	0 6760	0 7881	26 3715	16 6989	20 7052	23 4048	26 5145	16 7851	20 8236	23 5223	5 0648	3 8222	4 1253	4 5648
8	**2 0220**	0 4313	**3.0036**	-0 2883	1 1551	0 3464	**3 2654**	-0 1878	25 3831	15 7728	20 4298	21 7913	25 5221	15 8594	20 5499	21 9019	4 8817	3 6264	4 0285	4 3034
9	-1 8503	-0 5002	-0 9504	-1 7177	-2 0718	-1 0217	-2 3027	-1 9805	23 3147	14 7041	18 9446	19 9725	23 4397	14 7847	19 0504	20 0764	4 5289	3 3436	3 7886	3 9293
10	-1 1741	-0 2914	-0 2468	-1 4507	-1 1731	-0 3218	-0 4905	-1 4372	21 7470	13 8573	17 8944	18 4888	21 8609	13 9305	17 9935	18 5804	4 2612	3 1350	3 6383	3 6141
11	-0 8765	1 1723	0 1971	-0 5400	-0 8301	1 1693	0 3438	-0 5356	20 4707	13 5659	17 1211	17 4656	20 5723	13 6350	17 2102	17 5491	4 0563	3 0719	3 5700	3 3856
12	-1 7278	-0 1322	-2 4072	0 2384	-1 3238	-0 2664	-3 1205	0 3301	19 1004	12 9502	15 6973	16 7908	19 1936	13 0169	15 7798	16 8689	3 8266	2 9097	3 3391	3 2439
13	-1 5105	0 2390	-1 0683	-0 6502	-1 1364	0 4234	-1 5397	-0 6030	17 9321	12 5085	14 7852	15 9518	18 0102	12 5686	14 8515	16 0231	3 5753	2 7818	3 1493	3 0434
14	1 2071	-1 1660	1 1652	-0 4762	0 9611	-0 6273	1 6675	-0 3166	17 6024	11 7419	14 5588	15 2442	17 6753	11 7952	14 6222	15 3073	3 5071	2 5612	3 1029	2 8824
15	**2 1595**	0 1143	**2.5052**	0 2020	1 4685	0 4152	**3.0540**	0 2117	17 5632	11 3732	14 7120	14 7795	17 6412	11 4247	14 7805	14 8424	3 5092	2 4700	3 1485	2 7888
16	0 0286	0 4618	1 2635	-0 9900	0 0276	1 2366	**2 6131**	-1 0557	17 0126	11 1275	14 5607	14 0627	17 0897	11 1766	14 6306	14 1213	3 3824	2 4150	3 1196	2 6270
17	-0 1136	0 0963	0 2104	-0 3042	-0 1277	0 1483	0 4127	-0 4476	16 4771	10 8186	14 1770	13 5690	16 5486	10 8678	14 2445	13 6230	3 2776	2 3441	3 0482	2 5267
18	-1 7123	-1 0828	-0 0411	-2 9029	-1 5579	-2 0738	-0 0974	-2 4769	15 6093	10 2586	13 7678	12 5025	15 6873	10 3024	13 8399	12 5565	3 1039	2 1964	2 9815	2 2997
19	-0 2939	0 3761	0 1384	-0 2695	-0 3331	0 4160	0 2957	-0 3030	15 1255	10 0713	13 4324	12 1072	15 2005	10 1104	13 5009	12 1578	3 0230	2 1448	2 9350	2 2220
20	0 1973	0 5455	-0 4483	1 1025	0 2610	0 5774	-1 2811	1 1913	14 7866	9 9382	12 9920	12 0472	14 8573	9 9797	13 0579	12 0965	2 9586	2 1048	2 8364	2 2132
21	0 6821	-0 0912	0 0171	0 7993	0 6399	-0 1569	0 0295	0 9556	14 5791	9 6788	12 6826	11 9313	14 6397	9 7172	12 7355	11 9793	2 9312	2 0398	2 7896	2 1912

Day	AR								CAR											
	Patell test				Boehmer test				Patell test				Corrected Patell test				Boehmer test			
	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)
22	-0 8461	-1 2477	-0 9130	-0 9723	-0 9486	-1 4164	-2 1780	-0 9817	14 0636	9 1903	12 1964	11 4496	14 1236	9 2237	12 2494	11 4935	2 8284	1 9097	2 6815	2 0936
23	0 1047	0 5458	0 3898	0 0932	0 1502	0 7526	1 1184	0 1241	13 7763	9 1021	12 0096	11 2174	13 8332	9 1355	12 0638	11 2561	2 7793	1 8859	2 6481	2 0525
24	0 9212	-1 1961	-0 0881	0 4657	0 9605	-1 4232	-0 2246	0 4143	13 6742	8 6663	11 7388	11 0763	13 7238	8 6980	11 7849	11 1128	2 7720	1 7767	2 5861	2 0348
25	0 2719	-0 7399	-0 0942	-0 0539	0 4167	-1 1025	-0 3536	-0 0675	13 4524	8 3432	11 4827	10 8417	13 5039	8 3727	11 5319	10 8761	2 7305	1 6979	2 5295	1 9898
26	0 1253	**2 3597**	0 7419	0 9831	0 1142	**2 9632**	**2 1417**	0 7193	13 2157	8 6440	11 4052	10 8240	13 2648	8 6726	11 4530	10 8561	2 6764	1 7790	2 5254	1 9801
27	-0 2349	**2.1314**	0 2339	0 9023	-0 1952	1 5371	0 2891	1 0767	12 9234	8 8926	11 2370	10 7953	12 9725	8 9239	11 2856	10 8284	2 6215	1 8383	2 4945	1 9784
28	**2 3335**	0 2779	1 1142	**2.0152**	**2.3253**	0 2716	**2.7079**	1 6558	13 1316	8 7848	11 2451	10 9816	13 1812	8 8155	11 2953	11 0132	2 6749	1 8034	2 5067	2 0134
29	1 3536	1 6830	**2 0339**	0 7332	1 5346	1 4685	**3 6437**	0 9140	13 1545	8 9446	11 4272	10 9268	13 2036	8 9807	11 4789	10 9599	2 6836	1 8464	2 5631	2 0010
30	0 3850	0 1397	0 8782	-0 3409	0 4221	0 2451	**1.9912**	-0 3950	13 0037	8 8198	11 3955	10 6809	13 0574	8 8569	11 4517	10 7158	2 6469	1 8131	2 5456	1 9522
31	0 3255	0 1110	0 1584	0 3272	0 3979	0 2154	0 3695	0 4640	12 8507	8 6963	11 2386	10 5659	12 9042	8 7363	11 2970	10 6002	2 6187	1 7823	2 5089	1 9330
32	0 5134	0 1198	0 5717	0 1367	0 5465	0 1998	1 2957	0 1480	12 7391	8 5805	11 1627	10 4237	12 7902	8 6210	11 2200	10 4563	2 5965	1 7580	2 4910	1 9076
33	0 8736	-0 9683	0 0504	0 4126	1 0380	-1 4514	0 1048	0 6013	12 6967	8 2809	11 0011	10 3364	12 7487	8 3208	11 0581	10 3700	2 5951	1 6783	2 4564	1 8908
34	1 0453	1 7902	0 2655	**2 2869**	1 0615	1 3371	0 6317	1 7452	12 6878	8 4653	10 8836	10 5754	12 7451	8 5035	10 9446	10 6106	2 5993	1 7266	2 4334	1 9443
35	1 2971	0 7347	1 3014	0 7915	1 5154	0 9533	**2 5408**	1 1993	12 7245	8 4676	10 9470	10 5570	12 7791	8 5061	11 0057	10 5913	2 6041	1 7271	2 4412	1 9419
36	1 2935	1 0294	1 5520	0 7218	1 1941	0 8655	**2.5747**	0 6762	12 7621	8 5208	11 0525	10 5297	12 8173	8 5595	11 1127	10 5634	2 6187	1 7375	2 4754	1 9365
37	0 7481	0 4109	0 3949	0 8255	0 8900	0 9703	0 8897	1 2098	12 7115	8 4724	10 9671	10 5221	12 7656	8 5106	11 0271	10 5543	2 6130	1 7266	2 4584	1 9384
38	-0 1781	-0 4213	0 1982	-0 7276	-0 1910	-0 5395	0 3674	-0 9789	12 5142	8 2918	10 8540	10 2647	12 5701	8 3240	10 9118	10 2972	2 5769	1 6848	2 4443	1 8858
39	0 6681	-0 1796	0 5201	0 1866	0 9959	-0 1729	1 1782	0 2746	12 4597	8 1561	10 7972	10 1622	12 5133	8 1882	10 8539	10 1929	2 5718	1 6493	2 4370	1 8662
40	**3 6306**	-0 6203	1 5528	**2 6095**	**2 0363**	-1 2026	1 5179	**2.3279**	12 8770	7 9554	10 9069	10 4469	12 9312	7 9902	10 9626	10 4813	2 6751	1 6025	2 4729	1 9273
41	0 9764	0 6344	0 3077	1 3650	1 1722	1 0336	0 7122	1 8066	12 8715	7 9568	10 8211	10 5319	12 9234	7 9882	10 8749	10 5631	2 6790	1 6032	2 4549	1 9478
42	0 9294	0 9269	0 8214	0 9582	0 8860	2 0391	1 4524	1 1953	12 8608	8 0046	10 8182	10 5536	12 9137	8 0370	10 8725	10 5863	2 6779	1 6175	2 4565	1 9538
43	-2 2904	-1 0281	-2 2476	-1 2677	-1 3782	-0 5824	-3 3030	-0 6208	12 3610	7 7542	10 3490	10 2369	12 4112	7 7753	10 3944	10 2676	2 5464	1 5534	2 3302	1 8744
44	1 1586	0 2854	-0 2865	**1 9928**	1 1184	0 4529	-0 4861	**2 7089**	12 3944	7 7086	10 1875	10 4203	12 4422	7 7317	10 2305	10 4521	2 5600	1 5430	2 2907	1 9176

Day	AR								CAR											
	Patell test				Boehmer test				Patell test				Corrected Patell test				Boehmer test			
	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)
45	**2.2410**	-1 3779	0 6504	1 2593	**2.4189**	-2 0099	1 4166	1 3614	12 5900	7 4170	10 1706	10 4916	12 6368	7 4397	10 2126	10 5227	2 6091	1 4718	2 2885	1 9326
46	0 1697	0 5180	0 2972	0 2565	0 2092	1 3231	0 7335	0 3595	12 4774	7 4123	10 1033	10 4147	12 5237	7 4357	10 1444	10 4466	2 5841	1 4713	2 2739	1 9166
47	-1 0441	0 2460	-1 1438	0 0362	-1 3548	0 3978	-2 6861	0 0549	12 1917	7 3689	9 8284	10 3086	12 2418	7 3910	9 8699	10 3442	2 5194	1 4611	2 2015	1 8980
48	-0 1857	1 6667	0 0992	0 7918	-0 1742	1 3888	0 1865	0 6589	12 0372	7 5323	9 7398	10 3150	12 0832	7 5528	9 7794	10 3462	2 4770	1 4970	2 1762	1 8938
49	-1 1180	-0 1184	-1 0547	-0 4024	-1 1953	-0 1747	-2 7980	-0 3839	11 7540	7 4382	9 4892	10 1517	11 7988	7 4568	9 5292	10 1796	2 4075	1 4702	2 1117	1 8539
50	-0 6715	-0 8860	-1 3901	0 0061	-0 7238	-1 1743	-3 0330	0 0066	11 5409	7 2381	9 1973	10 0505	11 5835	7 2578	9 2343	10 0795	2 3529	1 4228	2 0341	1 8296
51	-1 3318	-0 8424	-0 4804	-1 7817	-1 5654	-1 3070	-1 3827	-1 8765	11 2407	7 0488	9 0394	9 7020	11 2792	7 0669	9 0753	9 7257	2 2843	1 3765	1 9974	1 7543
52	0 7968	0 2364	0 5808	0 5718	0 8639	0 5377	1 2750	0 6977	11 2426	7 0135	9 0326	9 6876	11 2855	7 0323	9 0712	9 7146	2 2866	1 3681	1 9989	1 7509
53	-0 1497	0 5009	-0 7204	0 9137	-0 1359	1 2322	-1 7219	0 7774	11 1155	7 0158	8 8480	9 7213	11 1593	7 0321	8 8860	9 7484	2 2541	1 3705	1 9544	1 7542
54	0 6217	0 5480	-0 2672	1 4592	0 5906	1 5213	-0 6315	1 3489	11 0967	7 0251	8 7293	9 8294	11 1400	7 0432	8 7662	9 8585	2 2508	1 3740	1 9233	1 7794
55	-0 0397	0 2367	-1 2441	1 4316	-0 0278	0 3178	-2 0680	0 9752	10 9900	6 9929	8 4819	9 9327	11 0306	7 0107	8 5164	9 9605	2 2192	1 3659	1 8593	1 7946
56	1 2419	0 4402	1 0300	0 8078	0 8769	0 4047	1 5530	0 5552	11 0574	6 9890	8 5434	9 9515	11 0976	7 0095	8 5773	9 9813	2 2358	1 3641	1 8756	1 7986
57	-1 8229	1 8463	-2 4928	1 5560	-1 6927	1 4818	-3 9912	1 5173	10 7185	7 1720	8 1380	10 0699	10 7581	7 1942	8 1701	10 1020	2 1586	1 4043	1 7729	1 8247
58	-0 7654	4 7431	2 1376	-0 0223	-0 8427	1 3417	1 7899	-0 0178	10 5252	7 7327	8 3482	9 9798	10 5645	7 7568	8 3818	10 0113	2 1135	1 5201	1 8161	1 8039
59	0 3323	-0 9712	-0 3873	0 1775	0 3241	-1 3138	-0 9508	0 1529	10 4789	7 5404	8 2267	9 9180	10 5179	7 5616	8 2621	9 9452	2 1073	1 4720	1 7891	1 7921
60	1 5730	1 1197	0 5523	2 2054	1 3600	1 0940	0 9213	1 9753	10 5943	7 6219	8 2292	10 1197	10 6323	7 6438	8 2642	10 1464	2 1372	1 4934	1 7926	1 8375
Panel B Market model –using the 5-255 event-post event windows																				
1	61 7024	37 2155	47 4548	54 5471	8 3429	5 7757	7 0119	7 1450	61 7024	37 2155	47 4548	54 5471	61 9477	37 3634	47 6434	54 7640	8 3429	5 7757	7 0119	7 1563
2	1 6159	2 8599	0 2825	3 7340	0 8181	1 3653	0 1982	1 4999	63 3183	40 0753	47 7373	58 2812	44 9287	28 4471	33 8730	41 3618	7 5531	5 3649	6 5372	6 4521
3	2 2414	-0 2155	1 7259	0 9103	1 3922	-0 1420	0 9899	0 6486	65 5596	39 8598	49 4632	59 1915	37 9883	23 0958	28 6512	34 3084	7 1102	4 6005	5 9618	6 0009
4	0 9363	0 7325	1 8513	-0 2593	0 5540	0 6815	1 1116	-0 1770	66 4959	40 5923	51 3145	58 9322	33 3586	20 3803	25 7233	29 5960	6 6757	4 2981	5 5305	5 6622
5	-1 0319	1 3772	-1 0543	0 7283	-0 4735	1 5720	-0 4838	0 4248	65 4640	41 9695	50 2602	59 6605	29 2015	18 8405	22 4360	26 6765	6 0291	4 1898	4 9045	5 3802

Sub_a1 stands for the sub-sample that includes the IPOs of independent firms only, Sub_a2 stands for the sub-sample that includes carve-out IPOs only, Sub_b1 stands for the sub-sample of IPOs that offer primary shares only, Sub_b2 stands for the sub-sample of IPOs that include secondary shares

Table 8.5 Summary Statistics for ARs over the 60-Day Event Window after IPO (Log Return, Estimated by SUR)

Day	Mean	Std Dev.	Mean	Std Dev	Mean	Std Dev.	Mean	Std Dev	Mean	Std Dev
	The entire sample		Sub_a1		Sub_a2		Sub_b1		Sub_b2	
1	0 1561	0 2539	0 1643	0 2787	0 1267	0 1296	0 1696	0 2911	0 1408	0 2046
2	0 0067	0 0646	0 0040	0 0632	0 0166	0 0695	0 0030	0 0591	0 0110	0 0705
3	0 0054	0 0653	0 0073	0 0717	-0 0013	0 0336	0 0118	0 0825	-0 0018	0 0366
4	0 0055	0 0563	0 0059	0 0611	0 0040	0 0347	0 0113	0 0651	-0 0011	0 0438
5	0 0022	0 0510	0 0008	0 0564	0 0071	0 0233	0 0020	0 0510	0 0024	0 0513
6	-0 0002	0 0345	-0 0007	0 0359	0 0019	0 0292	0 0008	0 0405	-0 0013	0 0265
7	-0 0007	0 0397	-0 0026	0 0440	0 0063	0 0148	-0 0031	0 0484	0 0020	0 0267
8	0 0032	0 0408	0 0032	0 0440	0 0033	0 0269	0 0054	0 0433	0 0007	0 0380
9	-0 0045	0 0280	-0 0053	0 0309	-0 0018	0 0129	-0 0048	0 0312	-0 0042	0 0241
10	-0 0020	0 0292	-0 0029	0 0311	0 0013	0 0214	-0 0025	0 0328	-0 0014	0 0248
11	0 0007	0 0418	-0 0009	0 0440	0 0067	0 0329	0 0034	0 0507	-0 0022	0 0287
12	-0 0035	0 0365	-0 0042	0 0403	-0 0008	0 0174	-0 0059	0 0458	-0 0007	0 0219
13	-0 0023	0 0350	-0 0030	0 0389	0 0002	0 0149	-0 0026	0 0399	-0 0020	0 0288
14	0 0032	0 0395	0 0038	0 0436	0 0010	0 0187	0 0043	0 0491	0 0019	0 0248
15	0 0058	0 0431	0 0071	0 0485	0 0012	0 0074	0 0105	0 0539	0 0005	0 0252
16	0 0006	0 0273	0 0002	0 0304	0 0022	0 0104	0 0035	0 0290	-0 0026	0 0249
17	0 0000	0 0284	-0 0003	0 0305	0 0012	0 0198	0 0011	0 0347	-0 0012	0 0192
18	-0 0048	0 0298	-0 0049	0 0327	-0 0047	0 0161	-0 0009	0 0235	-0 0093	0 0352
19	-0 0002	0 0254	-0 0001	0 0265	-0 0007	0 0211	0 0014	0 0271	-0 0020	0 0233
20	0 0010	0 0260	0 0008	0 0271	0 0015	0 0218	-0 0015	0 0269	0 0037	0 0248
21	0 0019	0 0279	0 0026	0 0308	-0 0008	0 0132	0 0015	0 0297	0 0023	0 0258
22	-0 0022	0 0310	-0 0013	0 0329	-0 0054	0 0232	-0 0023	0 0280	-0 0022	0 0343
23	0 0012	0 0233	0 0006	0 0235	0 0032	0 0227	0 0015	0 0262	0 0008	0 0196
24	-0 0004	0 0310	0 0014	0 0329	-0 0065	0 0224	-0 0009	0 0321	0 0002	0 0300
25	-0 0002	0 0246	0 0013	0 0254	-0 0055	0 0210	-0 0003	0 0236	0 0000	0 0258
26	0 0029	0 0312	0 0009	0 0333	0 0098	0 0207	0 0029	0 0252	0 0029	0 0370
27	0 0015	0 0355	0 0000	0 0384	0 0068	0 0217	-0 0008	0 0389	0 0041	0 0314
28	0 0053	0 0335	0 0070	0 0365	-0 0006	0 0188	0 0049	0 0278	0 0058	0 0392
29	0 0034	0 0248	0 0026	0 0243	0 0064	0 0269	0 0043	0 0231	0 0024	0 0268
30	0 0016	0 0266	0 0022	0 0288	-0 0007	0 0160	0 0041	0 0276	-0 0012	0 0252
31	0 0007	0 0259	0 0009	0 0285	-0 0001	0 0135	0 0007	0 0272	0 0007	0 0245
32	0 0023	0 0295	0 0028	0 0321	0 0008	0 0180	0 0023	0 0290	0 0024	0 0303
33	0 0006	0 0256	0 0025	0 0260	-0 0063	0 0233	-0 0005	0 0294	0 0018	0 0206
34	0 0044	0 0330	0 0043	0 0324	0 0048	0 0358	0 0024	0 0332	0 0067	0 0329
35	0 0023	0 0231	0 0024	0 0236	0 0021	0 0218	0 0025	0 0255	0 0021	0 0203
36	0 0038	0 0265	0 0046	0 0271	0 0009	0 0242	0 0049	0 0292	0 0026	0 0232
37	0 0008	0 0229	0 0005	0 0248	0 0018	0 0141	-0 0008	0 0251	0 0026	0 0201
38	-0 0012	0 0249	-0 0012	0 0257	-0 0012	0 0218	0 0000	0 0267	-0 0025	0 0226
39	0 0019	0 0225	0 0023	0 0200	0 0007	0 0300	0 0015	0 0257	0 0024	0 0184
40	0 0053	0 0503	0 0076	0 0558	-0 0030	0 0193	0 0044	0 0663	0 0063	0 0213
41	0 0023	0 0292	0 0022	0 0321	0 0028	0 0152	-0 0001	0 0321	0 0051	0 0255
42	0 0033	0 0273	0 0032	0 0302	0 0038	0 0131	0 0036	0 0313	0 0030	0 0223
43	-0 0029	0 0371	-0 0030	0 0376	-0 0027	0 0357	-0 0053	0 0322	-0 0003	0 0420
44	0 0013	0 0327	0 0016	0 0363	0 0002	0 0139	-0 0035	0 0389	0 0067	0 0228
45	0 0027	0 0293	0 0049	0 0311	-0 0051	0 0202	0 0015	0 0281	0 0041	0 0306
46	0 0006	0 0224	0 0002	0 0248	0 0020	0 0101	0 0004	0 0246	0 0008	0 0198
47	-0 0021	0 0242	-0 0029	0 0261	0 0006	0 0154	-0 0049	0 0297	0 0010	0 0154
48	0 0005	0 0347	-0 0010	0 0368	0 0062	0 0255	-0 0019	0 0303	0 0033	0 0391

Day	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
	The entire sample		Sub_a1		Sub_a2		Sub_b1		Sub_b2	
49	-0 0029	0 0291	-0 0037	0 0318	0 0001	0 0156	-0 0042	0 0239	-0 0013	0 0341
50	-0 0012	0 0322	-0 0010	0 0342	-0 0018	0 0242	-0 0026	0 0318	0 0004	0 0328
51	-0 0036	0 0275	-0 0036	0 0298	-0 0039	0 0169	-0 0025	0 0256	-0 0049	0 0295
52	0 0027	0 0294	0 0031	0 0327	0 0014	0 0121	0 0027	0 0325	0 0028	0 0258
53	-0 0006	0 0278	-0 0018	0 0307	0 0039	0 0122	-0 0022	0 0235	0 0012	0 0320
54	0 0030	0 0309	0 0031	0 0344	0 0028	0 0113	0 0022	0 0332	0 0040	0 0282
55	0 0007	0 0383	0 0006	0 0419	0 0014	0 0210	-0 0036	0 0421	0 0056	0 0330
56	0 0019	0 0429	0 0025	0 0458	-0 0004	0 0308	0 0038	0 0493	-0 0004	0 0345
57	-0 0007	0 0304	-0 0038	0 0292	0 0102	0 0324	-0 0057	0 0315	0 0049	0 0282
58	0 0016	0 0381	-0 0010	0 0322	0 0110	0 0535	0 0038	0 0377	-0 0008	0 0385
59	-0 0003	0 0257	0 0007	0 0271	-0 0038	0 0194	0 0001	0 0238	-0 0007	0 0277
60	0 0029	0 0276	0 0024	0 0283	0 0047	0 0253	0 0006	0 0259	0 0054	0 0295

Sub_a1 stands for the sub-sample that includes the IPOs of independent firms only, Sub_a2 stands for the sub-sample that includes carve-out IPOs only, Sub_b1 stands for the sub-sample of IPOs that offer primary shares only, Sub_b2 stands for the sub-sample of IPOs that include secondary shares

Table 8.6 Testing for Statistical Significance of ARs and CARs over 60 Days in the Entire Sample (n=183) – SUR Estimated Market Model (Log Return)

Day	AR		CAR		
	Patell test	Boehmer test	Patell test	Corrected Patell test	Boehmer test
1	**74.4389**	**9.5553**	74 4676	74 8177	9 5553
2	**3.0494**	1 3680	54 8138	55 0528	8 6578
3	**2.0453**	1 2233	45 9417	46 1383	8 0732
4	1 0694	0 6603	40 3143	40 4877	7 6628
5	0 4295	0 2112	36 2398	36 4094	7 1077
6	0 2603	0 1794	33 1939	33 3551	6 5067
7	1 0841	0 7954	31 1190	31 3023	6 1861
8	**2.0143**	1 2204	29 8124	30 0000	5 9406
9	-1 8614	-2 2631	27 4842	27 6582	5 5133
10	-1 2034	-1 2278	25 7025	25 8525	5 1864
11	-0 2313	-0 2205	24 4381	24 5731	4 9765
12	-1 5869	-1 3492	22 9389	23 0656	4 7073
13	-1 2181	-1 0090	21 6997	21 8109	4 4268
14	0 5046	0 3571	21 0498	21 1480	4 2766
15	**1.9633**	1 5020	20 8427	20 9445	4 2413
16	0 2435	0 2615	20 2412	20 3413	4 1020
17	-0 0579	-0 0688	19 6234	19 7177	3 9773
18	-2 0048	-1 9986	18 5944	18 6954	3 7597
19	-0 1129	-0 1272	18 0792	18 1683	3 6648
20	0 4443	0 5554	17 7175	17 8070	3 5919
21	0 5711	0 5832	17 4128	17 4940	3 5413
22	-1 3036	-1 4625	16 7286	16 8128	3 3948
23	0 3475	0 4930	16 4334	16 5145	3 3408
24	0 2228	0 2370	16 1395	16 2062	3 2851
25	-0 1231	-0 1883	15 7923	15 8560	3 2120
26	1 2259	1 1703	15 7237	15 7870	3 1999
27	0 7896	0 6311	15 5816	15 6462	3 1774
28	**2.1884**	**2.1780**	15 7152	15 7791	3 2106
29	**2.0148**	**2.1308**	15 8101	15 8819	3 2389
30	0 4260	0 5042	15 6185	15 6982	3 1922
31	0 3504	0 4603	15 4255	15 5080	3 1540
32	0 5444	0 6237	15 2727	15 3592	3 1248
33	0 3240	0 4005	15 0951	15 1827	3 0883
34	1 7435	1 6304	15 1735	15 2616	3 1132
35	1 4635	1 7500	15 2070	15 2879	3 1164
36	1 6200	1 4649	15 2651	15 3457	3 1343
37	0 8195	1 0639	15 1977	15 2714	3 1230
38	-0 3485	-0 3877	14 9389	15 0122	3 0722
39	0 4845	0 6364	14 8273	14 8949	3 0509
40	**2.9458**	1 8410	15 1024	15 1758	3 1221

Day	AR		CAR		
	Patell test	Boehmer test	Patell test	Corrected Patell test	Boehmer test
41	1 1552	1 4666	15 0982	15 1672	3 1256
42	1 2474	1 3144	15 1110	15 1802	3 1310
43	-2 5516	-1 5175	14 5522	14 6064	2 9828
44	1 1874	1 2372	14 5604	14 6181	2 9912
45	1.3364	1 4934	14 5970	14 6534	3 0010
46	0 4288	0 5797	14 4953	14 5569	2 9801
47	-0 8589	-1 1595	14 2224	14 2793	2 9163
48	0 5942	0 5401	14 1622	14 2117	2 8950
49	-1 0384	-1 1731	13 8679	13 9161	2 8211
50	-1 0189	-1 1432	13 5859	13 6312	2 7502
51	-1 5868	-1 9573	13 2321	13 2707	2 6674
52	0 8300	0 9946	13 2172	13 2623	2 6660
53	0 0965	0 0970	13 1060	13 1499	2 6381
54	0 8170	0 8646	13 0937	13 1397	2 6372
55	0 1043	0 0797	12 9843	13 0316	2 6063
56	1 3003	0 9642	13 0421	13 0898	2 6200
57	-0 7510	-0 6655	12 8280	12 8757	2 5706
58	1 5151	0 8171	12 9193	12 9643	2 5836
59	-0 1548	-0 1596	12 7885	12 8325	2 5567
60	1 9258	1 7108	12 9286	12 9735	2 5935

Table 8.7 Testing for Statistical Significance of ARs and CARs over 60 Days after IPO in the Sub-samples – SUR Estimated Market Model (Log Return)

Day	AR								CAR											
	Patell test				Boehmer test				Patell test				Corrected Patell test				Boehmer test			
	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)
1	**64 5369**	**37 1950**	**49.6144**	**55.8946**	**7 8890**	**5 9287**	**6 5625**	**6.9400**	64 5369	37 1950	49 6144	55 8946	64 8653	37 3843	49 8669	56 1791	7 8890	5 9288	6 5625	6 9400
2	**1.9652**	**2 8068**	0 6568	**3.7508**	0 8636	1 3580	0 4167	1 3454	47 0241	28 2855	35 5471	42 1757	47 2409	28 4322	35 7169	42 3750	7 1099	5 4793	6 2106	6 0806
3	**2 3205**	-0 0128	1 7500	1 1250	**1** 3484	-0 0085	0 9832	0 7253	39 7347	23 0877	30 0344	35 0859	39 9242	23 1991	30 1690	35 2633	6 7435	4 7304	5 7346	5 7007
4	0 8058	0 7638	**1 9423**	-0 5028	0 4598	0 7438	1 1981	-0 3110	34 8142	20 3764	26 9817	30 1338	34 9651	20 4891	27 0754	30 3059	6 4132	4 4293	5 3761	5 4461
5	-0 3114	1 5074	-0 4918	1 1487	-0 1382	**1** 7362	-0 2322	0 5917	30 9995	18 8994	23 9133	27 4663	31 1342	19 0095	23 9975	27 6256	5 8705	4 3191	4 8210	5 2193
6	-0 0680	0 6854	0 7784	-0 4469	-0 0446	0 5950	0 4488	-0 4254	28 2707	17 5325	22 1475	24 8907	28 4080	17 6310	22 2521	25 0238	5 3669	3 9490	4 4069	4 7812
7	0 5571	1 2654	0 5639	0 9825	0 3698	**2 0316**	0 3697	0 8461	26 3842	16 7102	20 7177	23 4156	26 5271	16 7967	20 8360	23 5333	5 0734	3 8275	4 1296	4 6142
8	**2 0603**	0 4128	**3.0176**	-0 2665	1 1765	0 3330	1 7393	-0 1730	25 4086	15 7769	20 4465	21 8091	25 5474	15 8636	20 5663	21 9200	4 8927	3 6292	4 0337	4 3547
9	-1 8422	-0 4981	-0 9299	-1 7277	-2 0595	-1 0192	-1 1887	-1 9913	23 3413	14 7086	18 9672	19 9859	23 4663	14 7894	19 0729	20 0900	4 5403	3 3463	3 7955	3 9775
10	-1 2055	-0 2948	-0 2712	-1 4674	-1 2009	-0 3272	-0 2846	-1 4517	21 7623	13 8606	17 9081	18 4963	21 8762	13 9339	18 0070	18 5880	4 2695	3 1377	3 6431	3 6583
11	-0 8842	1 1771	0 2110	-0 5615	-0 8356	1 1744	0 1942	-0 5561	20 4830	13 5705	17 1383	17 4662	20 5844	13 6397	17 2273	17 5498	4 0639	3 0746	3 5757	3 4260
12	-1 7368	-0 1104	-2 4007	0 2347	-1 3314	-0 2219	-1 6461	0 3251	19 1096	12 9609	15 7157	16 7904	19 2026	13 0279	15 7982	16 8684	3 8337	2 9141	3 3457	3 2827
13	-1 5210	0 2705	-1 0497	-0 6620	-1 1424	0 4761	-0 7996	-0 6112	17 9380	12 5274	14 8080	15 9480	18 0160	12 5878	14 8743	16 0193	3 5808	2 7883	3 1565	3 0787
14	1 2073	-1 2035	1 1614	-0 4973	0 9592	-0 6450	0 8764	-0 3297	17 6082	11 7501	14 5797	15 2350	17 6808	11 8037	14 6431	15 2979	3 5127	2 5640	3 1097	2 9145
15	**2 1688**	0 0985	**2 5151**	0 1928	1 4748	0 3553	1 6208	0 2022	17 5711	11 3771	14 7348	14 7682	17 6489	11 4288	14 8033	14 8310	3 5152	2 4717	3 1559	2 8194
16	0 0254	0 4727	1 2614	-0 9845	0 0246	1 2595	1 3787	-1 0488	17 0195	11 1340	14 5822	14 0531	17 0964	11 1833	14 6521	14 1116	3 3881	2 4176	3 1267	2 6563
17	-0 1060	0 0765	0 2208	-0 3190	-0 1192	0 1176	0 2290	-0 4682	16 4857	10 8201	14 2004	13 5562	16 5569	10 8695	14 2680	13 6100	3 2836	2 3453	3 0558	2 5541
18	-1 6931	-1 0868	-0 0304	-2 8922	-1 5364	-2 0811	-0 0380	-2 4595	15 6221	10 2591	13 7931	12 4925	15 7000	10 3030	13 8652	12 5463	3 1105	2 1971	2 9896	2 3250
19	-0 3209	0 3652	0 1376	-0 3107	-0 3621	0 4058	0 1549	-0 3487	15 1318	10 0693	13 4568	12 0880	15 2066	10 1085	13 5253	12 1384	3 0280	2 1448	2 9430	2 2441
20	0 2221	0 5303	-0 4329	1 1078	0 2933	0 5606	-0 6521	1 1959	14 7984	9 9329	13 0193	12 0297	14 8688	9 9745	13 0852	12 0788	2 9651	2 1040	2 8453	2 2361
21	0 6897	-0 0825	0 0030	0 8299	0 6476	-0 1413	0 0027	0 9938	14 5922	9 6755	12 7062	11 9209	14 6525	9 7140	12 7591	11 9687	2 9381	2 0396	2 7976	2 2150

Day	AR								CAR											
	Patell test				Boehmer test				Patell test				Corrected Patell test				Boehmer test			
	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)
22	-0 8097	-1 2573	-0 8882	-0 9583	-0 9046	-1 4273	-1 1164	-0 9650	14 0841	9 1850	12 2247	11 4425	14 1438	9 2186	12 2776	11 4862	2 8368	1 9091	2 6905	2 1175
23	0 0917	0 5699	0 3679	0 1162	0 1310	0 7842	0 5587	0 1534	13 7936	9 1019	12 0327	11 2152	13 8503	9 1355	12 0868	11 2537	2 7867	1 8865	2 6557	2 0770
24	0 9030	-1 2307	-0 0935	0 4244	0 9392	-1 4697	-0 1254	0 3777	13 6875	8 6591	11 7602	11 0657	13 7367	8 6908	11 8063	11 1018	2 7784	1 7753	2 5932	2 0574
25	0 2567	-0 7488	-0 0899	-0 0841	0 3962	-1 1151	-0 1788	-0 1060	13 4623	8 3344	11 5046	10 8253	13 5135	8 3638	11 5537	10 8592	2 7361	1 6961	2 5366	2 0108
26	0 1379	**2.3613**	0 7469	0 9950	0 1258	**2.9531**	1 1437	0 7282	13 2279	8 6356	11 4277	10 8102	13 2766	8 6642	11 4754	10 8419	2 6824	1 7773	2 5326	2 0015
27	-0 2440	**2.1504**	0 2451	0 8916	-0 2027	1 5491	0 1602	1 0617	12 9337	8 8880	11 2613	10 7797	12 9824	8 9194	11 3098	10 8124	2 6269	1 8376	2 5023	1 9993
28	**2 3171**	0 2998	1 0950	**2.0294**	**2 3150**	0 2930	1 4078	1 6725	13 1385	8 7845	11 2653	10 9690	13 1878	8 8152	11 3154	11 0002	2 6797	1 8039	2 5134	2 0355
29	1 3924	1 6767	**2 0679**	0 7428	1 5808	1 4540	1 9571	0 9254	13 1686	8 9431	11 4533	10 9162	13 2174	8 9793	11 5050	10 9489	2 6902	1 8464	2 5714	2 0234
30	0 4168	0 1231	0 8946	-0 3286	0 4588	0 2156	1 0746	-0 3827	13 0233	8 8153	11 4242	10 6727	13 0766	8 8524	11 4803	10 7072	2 6549	1 8123	2 5544	1 9747
31	0 3300	0 1256	0 1609	0 3403	0 4031	0 2445	0 1982	0 4829	12 8708	8 6945	11 2673	10 5602	12 9238	8 7345	11 3255	10 5941	2 6268	1 7821	2 5177	1 9559
32	0 5556	0 1138	0 5921	0 1653	0 5933	0 1894	0 7101	0 1798	12 7663	8 5777	11 1945	10 4232	12 8170	8 6181	11 2516	10 4554	2 6064	1 7575	2 5009	1 9313
33	0 8664	-0 9453	0 0460	0 4237	1 0316	-1 4168	0 0506	0 6200	12 7223	8 2822	11 0316	10 3378	12 7741	8 3220	11 0886	10 3711	2 6045	1 6789	2 4659	1 9147
34	1 0380	1 7666	0 2707	**2 2558**	1 0533	1 3275	0 3400	1 7263	12 7118	8 4624	10 9146	10 5715	12 7688	8 5006	10 9755	10 6064	2 6084	1 7262	2 4430	1 9679
35	1 2834	0 7037	1 3008	0 7534	1 5014	0 9061	1 3434	1 1395	12 7458	8 4596	10 9774	10 5467	12 8000	8 4979	11 0359	10 5806	2 6125	1 7254	2 4507	1 9640
36	1 3011	1 0050	1 5434	0 7240	1 1986	0 8450	1 3516	0 6774	12 7844	8 5088	11 0811	10 5199	12 8392	8 5474	11 1411	10 5532	2 6274	1 7348	2 4845	1 9587
37	0 7211	0 3894	0 3668	0 8058	0 8556	0 9114	0 4357	1 1771	12 7290	8 4570	10 9906	10 5092	12 7828	8 4951	11 0505	10 5410	2 6205	1 7231	2 4660	1 9600
38	-0 1733	-0 4177	0 1874	-0 7074	-0 1860	-0 5366	0 1837	-0 9547	12 5323	8 2773	10 8754	10 2552	12 5878	8 3092	10 9331	10 2875	2 5845	1 6815	2 4515	1 9076
39	0 6435	-0 1803	0 4908	0 1855	0 9637	-0 1737	0 5882	0 2752	12 4736	8 1416	10 8137	10 1526	12 5269	8 1735	10 8703	10 1831	2 5783	1 6460	2 4429	1 8877
40	**3 6461**	-0 5929	1 5924	**2 6061**	**2.0467**	-1 1481	0 8240	**2 3250**	12 8932	7 9454	10 9295	10 4370	12 9471	7 9801	10 9851	10 4711	2 6824	1 6004	2 4805	1 9495
41	0 9653	0 6458	0 3149	1 3507	1 1600	1 0560	0 3855	1 7920	12 8857	7 9488	10 8445	10 5198	12 9373	7 9800	10 8982	10 5507	2 6858	1 6016	2 4627	1 9698
42	0 9236	0 9217	0 8265	0 9418	0 8816	**2 0477**	0 7732	1 1794	12 8739	7 9958	10 8422	10 5392	12 9266	8 0281	10 8963	10 5716	2 6845	1 6157	2 4644	1 9754
43	-2 3099	-1 0902	-2 2828	-1 2978	-1 3918	-0 6130	-1 7630	-0 6366	12 3711	7 7360	10 3672	10 2180	12 4210	7 7569	10 4125	10 2485	2 5521	1 5493	2 3363	1 8940
44	1 1863	0 2968	-0 2678	**2 0165**	1 1467	0 4693	-0 2406	**2.7413**	12 4085	7 6924	10 2084	10 4052	12 4562	7 7153	10 2512	10 4368	2 5667	1 5393	2 2976	1 9386

Day	AR								CAR											
	Patell test				Boehmer test				Patell test				Corrected Patell test				Boehmer test			
	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)	Sub_a1 (n=143)	Sub_a2 (n=40)	Sub_b1 (n=97)	Sub_b2 (n=86)
45	**2.2562**	-1 4075	0 6497	1 2594	**2 4336**	-2 0485	0 7489	1 3565	12 6062	7 3966	10 1912	10 4767	12 6528	7 4190	10 2331	10 5075	2 6165	1 4672	2 2952	1 9539
46	0 2095	0 5211	0 2988	0 3083	0 2582	1 3344	0 3895	0 4327	12 4993	7 3926	10 1238	10 4077	12 5455	7 4156	10 1649	10 4393	2 5928	1 4669	2 2805	1 9395
47	-1 0774	0 1999	-1 1701	-0 0102	-1 3976	0 3222	-1 4489	-0 0155	12 2085	7 3427	9 8449	10 2948	12 2585	7 3644	9 8863	10 3302	2 5267	1 4551	2 2069	1 9192
48	-0 2000	1 6491	0 0795	0 7824	-0 1874	1 3732	0 0790	0 6510	12 0518	7 5038	9 7533	10 3000	12 0976	7 5239	9 7927	10 3309	2 4837	1 4904	2 1808	1 9146
49	-1 1309	-0 0827	-1 0739	-0 3742	-1 2087	-0 1215	-1 5009	-0 3573	11 7666	7 4150	9 4998	10 1409	11 8112	7 4334	9 5396	10 1686	2 4135	1 4650	2 1154	1 8749
50	-0 6863	-0 8816	-1 3794	-0 0213	-0 7395	-1 1727	-1 5908	-0 0232	11 5513	7 2158	9 2093	10 0359	11 5936	7 2353	9 2462	10 0646	2 3583	1 4179	2 0382	1 8494
51	-1 3438	-0 8534	-0 4873	-1 7972	-1 5765	-1 3142	-0 7396	-1 8882	11 2493	7 0252	9 0503	9 6854	11 2875	7 0430	9 0861	9 7087	2 2891	1 3713	2 0010	1 7726
52	0 8205	0 2240	0 5878	0 5866	0 8947	0 5171	0 6870	0 7195	11 2544	6 9884	9 0444	9 6732	11 2970	7 0070	9 0829	9 6998	2 2923	1 3625	2 0027	1 7697
53	-0 1601	0 5090	-0 7231	0 9087	-0 1450	1 2427	-0 9116	0 7706	11 1257	6 9921	8 8593	9 7063	11 1693	7 0081	8 8972	9 7331	2 2593	1 3653	1 9581	1 7728
54	0 6181	0 5788	-0 2755	1 4844	0 5871	1 6002	-0 3438	1 3738	11 1063	7 0058	8 7394	9 8180	11 1495	7 0238	8 7761	9 8468	2 2559	1 3698	1 9266	1 7993
55	-0 0219	0 2644	-1 2561	1 4861	-0 0153	0 3523	-1 1015	1 0124	11 0020	6 9775	8 4902	9 9287	11 0424	6 9951	8 5247	9 9563	2 2247	1 3628	1 8622	1 8161
56	1 2204	0 4737	1 0164	0 8173	0 8619	0 4346	0 8092	0 5624	11 0664	6 9782	8 5499	9 9489	11 1063	6 9986	8 5837	9 9784	2 2406	1 3619	1 8779	1 8204
57	-1 8105	1 8170	-2 4946	1 5539	-1 6790	1 4570	-2 1099	1 5143	10 7291	7 1574	8 1441	10 0671	10 7684	7 1795	8 1762	10 0989	2 1639	1 4013	1 7752	1 8469
58	-0 7866	**4.7280**	**2.1447**	-0 0676	-0 8648	1 3371	0 9492	-0 0540	10 5329	7 7163	8 3552	9 9710	10 5721	7 7402	8 3887	10 0023	2 1180	1 5167	1 8187	1 8245
59	0 3498	-0 9925	-0 3777	0 1753	0 3413	-1 3540	-0 4902	0 1513	10 4888	7 5214	8 2349	9 9090	10 5276	7 5424	8 2703	9 9359	2 1123	1 4680	1 7920	1 8125
60	1 5812	1 1295	0 5566	**2 2181**	1 3679	1 1039	0 4911	**1.9883**	10 6051	7 6042	8 2379	10 1124	10 6430	7 6260	8 2728	10 1389	2 1425	1 4898	1 7956	1 8590

Sub_a1 stands for the sub-sample that includes the IPOs of independent firms only, Sub_a2 stands for the sub-sample that includes carve-out IPOs only, Sub_b1 stands for the sub-sample of IPOs that offer primary shares only, Sub_b2 stands for the sub-sample of IPOs that include secondary shares

Evidently, systemic risk, as reflected by the beta coefficient in the market model, is significantly lower for the primary share offerings sub-group than for the secondary share offerings subgroup (Table 8 9) Together with the earlier conclusion on the correlation of the residuals, this implies that the risks of the primary-share-offering IPOs are more highly correlated and relatively less affected by overall market performance, compared to the secondary-share-offering IPOs

Table 8.8 SUR Regression Diagnostics for the Market Model (Log Return)

Variable	Obs	Mean	Std Dev	Min	Max	Mean	Std Dev	Min	Max
		200-day estimation window				255-day estimation window			
Panel A The entire sample									
Alpha	183	-0 0020	0 0035	-0 0117	0 0095	-0 0019	0 0031	-0 0116	0 0071
Beta	183	0 2679	0 4573	-0 8521	2 2616	0 2831	0 4450	-0 5294	2 3577
rmse	183	0 0317	0 0160	0 0023	0 0973	0 0312	0 0148	0 0021	0 0882
R-sq	183	0 0210	0 0348	-0 0013	0 2353	0 0191	0 0318	-0 0054	0 2117
Chi-sq	183	55 838	92 814	0 0200	654 05	19 290	32 096	0 0000	223 79
p-value	183	0 0876	0 1850	0 0000	0 8910	0 1466	0 2602	0 0000	0 9974
Panel B (Sub_a1) The IPOs of independent firms									
Alpha	143	-0 0022	0 0036	-0 0117	0 0095	-0 0020	0 0032	-0 0116	0 0071
Beta	143	0 2725	0 4830	-0 8521	2 2616	0 2961	0 4702	-0 5294	2 3577
rmse	143	0 0329	0 0166	0 0023	0 0973	0 0327	0 0155	0 0021	0 0882
R-sq	143	0 0208	0 0363	-0 0013	0 2353	0 0192	0 0330	-0 0036	0 2117
Chi-sq	143	53 000	90 216	0 0200	654 05	19 277	33 246	0 0000	223 79
p-value	143	0 0883	0 1834	0 0000	0 8910	0 1496	0 2658	0 0000	0 9778
Panel C (Sub_a2) The IPOs of carve-out firms									
Alpha	40	-0 0015	0 0033	-0 0085	0 0061	-0 0013	0 0029	-0 0077	0 0043
Beta	40	0 2515	0 3551	-0 2853	1 5589	0 2365	0 3408	-0 3226	1 4237
rmse	40	0 0271	0 0127	0 0055	0 0663	0 0262	0 0111	0 0062	0 0594
R-sq	40	0 0221	0 0296	-0 0009	0 1245	0 0188	0 0271	-0 0054	0 1162
Chi-sq	40	65 984	102 13	0 0600	478 38	19 339	27 979	0 0000	131 56
p-value	40	0 0851	0 1931	0 0000	0 8117	0 1362	0 2418	0 0000	0 9974
Panel D (Sub_b1) The primary share offerings									
Alpha	97	-0 0025	0 0035	-0 0117	0 0058	-0 0024	0 0030	-0 0116	0 0049
Beta	97	0 1842	0 4436	-0 8521	2 1961	0 2063	0 4476	-0 5294	2 3577
rmse	97	0 0341	0 0176	0 0023	0 0973	0 0337	0 0164	0 0021	0 0882
R-sq	97	0 0148	0 0290	-0 0005	0 2353	0 0137	0 0297	-0 0054	0 2117
Chi-sq	97	40 124	81 069	0 0600	654 05	13 284	29 074	0 0000	223 79
p-value	97	0 1085	0 1994	0 0000	0 8117	0 1786	0 2808	0 0000	0 9778
Panel E (Sub_b2) The offerings including secondary shares									
Alpha	86	-0 0015	0 0036	-0 0103	0 0095	-0 0013	0 0033	-0 0093	0 0071
Beta	86	0 3623	0 4566	-0 3821	2 2616	0 3698	0 4282	-0 2282	2 0815
rmse	86	0 0289	0 0135	0 0055	0 0888	0 0285	0 0124	0 0062	0 0791
R-sq	86	0 0280	0 0394	-0 0013	0 1869	0 0251	0 0331	-0 0013	0 1544
Chi-sq	86	73 563	102 09	0 0200	478 38	26 064	34 109	0 0000	148 91
p-value	86	0 0641	0 1653	0 0000	0 8910	0 1106	0 2310	0 0000	0 9974

Breusch-Pagan test of independence for SUR

200-day estimation window (Logarithmic return) Chi2(16653) = 17137 511, Pr = 0 0042

255-day estimation window (Logarithmic return) Chi2(16653) = 17340 310, Pr = 0 0001

Table 8.9 Equality Tests (Mean and Median) on the Alpha and the Beta of the Sub-samples (Estimated by SUR, Log Return)

Sub-samples	Tests	200-day estimation window		255-day estimation window	
		Alpha	Beta	Alpha	Beta
Sub_a1 vs Sub_a2	Wilcoxon rank-sum test	0 267	0 962	0 194	0 589
	Median test	0 451	0 499	0 266	0 080
	Continuity corrected median test	0 565	0 619	0 351	0 116
Sub_b1 vs Sub_b2	Wilcoxon rank-sum test	0.134	**0.002**	**0.026**	**0.000**
	Median test	0 210	**0.006**	0 210	**0.015**
	Continuity corrected median test	0 269	**0.010**	0 269	**0.022**

Sub_a1 stands for the sub-sample that includes the IPOs of independent firms only, Sub_a2 stands for the sub-sample that includes carve-out IPOs only, Sub_b1 stands for the sub-sample of IPOs that offer primary shares only, Sub_b2 stands for the sub-sample of IPOs that include secondary shares This table reports the *p*-value of the non-parametric Wilcoxon rank-sum test (testing equality of mean) and the Median test (testing equality of median) between the two sub-samples (carve-outs versus independent firms, primary share IPOs versus secondary share IPOs) For the Median test, the Pearson chi-squared test statistic is computed both with and without a continuity correction

8.4.3 The Relationship between Underpricing, Ownership Structure, and IPO Structure

Table 8.10 presents the results of the cross-sectional OLS regressions of underpricing on market performance (Market_Return), ownership concentration (CONC1, CONC2) and control (Carve-out), and IPO structure (Portion_Dummy). Fourteen different types of underpricing calculated by various methods are analysed. As shown by the table, the results do not vary much.

For several reasons, I favour Underpricing10, which is computed using 5-255 event-post_event windows based on logarithmic returns estimated by the market model using SUR. First, given the fact that the daily abnormal returns disappeared shortly after trading began (zero ARs from the second trading day), a 5-day event window is long enough to capture underpricing while avoiding contamination by other events Second, log returns are preferred as they are more likely to be normally distributed, therefore providing better accuracy for estimation by the market model. Third, the market model is superior to the market-adjusted model and raw returns in that it deals with the possibility that a change in a stock price may come from co-movement with market performance Fourth, SUR estimation adjusts for correlation between the residuals of different equations

Evidently, Market_Return is an important determinant of the degree of underpricing, while underpricing increases in market performance, which confirms Hypothesis 4. For variables related to ownership and control structure, CONC1 is significant and positive whereas CONC2 is negative but not significant (CONC1 and CONC2 are jointly significant), while Carve-out is significant and positive. Therefore Hypothesis 2 is confirmed whereas Hypothesis 3 is rejected. The dominant concern for the UK IPO firms seems to be to avoid dilution on the owners' control status. The higher is ownership concentration (in another words, the more highly controlled of the IPO firm by the owners), the less likely it is that under-monitoring will be a problem On the other hand, the control rights of the owners will be more valuable This implies that issuers would prefer to underprice in order to induce a larger number investors (more intense rationing) to minimise the potential threat to their control rights and to keep out non-value-maximizing monitoring from outside block shareholders

Portion_Dummy is significant and positive, suggesting that when other factors are kept constant (controlling for both market conditions and ownership concentration and control), underpricing varies with IPO structure. IPOs that offer primary shares only are more highly underpriced than those in which the original shareholders are selling out. This result supports Hypothesis 1 and confirms that the degree of underpricing is significantly influenced by the entrepreneurial wealth losses effect

When I examine the interaction effects between the carve-out dummy, portion dummy and ownership concentration at IPO (CONC1), it is found that ownership concentration actually reduces underpricing for the carve-outs that offer primary shares only ($0.3466 - 0.3294 - 0\ 2663 = -0.2491$). An explanation for this is that there may be a threshold for the impact of ownership concentration on underpricing when the issue company is so firmly controlled by a single shareholder (e g. with over 50% shareholding), dilution of control rights is less likely to be a problem for an issuer that goes public purely for raising new finance.

Comparing between the independent firms that offer primary shares only and the ones that include secondary shares, the change in underpricing is much more sensitive to the degree of ownership concentration for the latter group. Here a one-unit increase in ownership concentration at the time of the IPO will produce an increase of 34 66% for the independent secondary-share-offering IPOs but only 8 03% ($= 0.3466 - 0.2663$) for the independent primary-share-offering IPOs. This implies that for independent firms, when the IPO involves insider selling, the change in underpricing is much more sensitive to the degree of ownership concentration than when it does not. This provides further supporting evidence for Hypothesis 2. To retain their original control is a very important consideration for the owners of IPO firms, especially for owners planning an insider exit, and underpricing is used as a means to discriminate among investors so as to protect the insiders' controlling status.

There is also an interaction effect between the carve-out dummy, portion dummy and market performance (Market_Return), significant at 10% level While underpricing increases in market return for both the IPOs of independent firms and carve-outs, the former group shows a higher sensitivity of the performance to market movement. In

addition, the performance of the carve-outs that offer primary shares only is more sensitive to market movement ($0\ 6299 + 0.0843 - 0\ 3980 = 0\ 3162$), as compared to the carve-outs that include secondary shares ($0\ 6299 - 0\ 3980 = 0.2319$)

Table 8.10 Determinants of Underpricing (n=183) – Log Return

	Panel A Market-adjusted abnormal return on day 1				*Panel B Market model estimated abnormal return on day 1 (OLS regression)*			
	Underpricing1 (FTSE all share index)		Underpricing2 (FTSE industrial indices)		Underpricing5 (Market model (200))		Underpricing6 (Market model (255))	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Intercept	-0 0584	-0 0643	-0 0476	-0 0566	-0 0601	-0 0665	-0 0606	-0 0669
	(0 0917)	(0 0875)	(0 0936)	(0 0889)	(0 0917)	(0 0877)	(0 0916)	(0 0876)
Market_Return	0 6380**	0 6805**	0 6054**	0 6706**	0 6272**	0 6739**	0 6303**	0 6758**
	(0 2235)	(0 2061)	(0 2249)	(0 2076)	(0 2233)	(0 2060)	(0 2228)	(0 2059)
CONC1	0 3391**	0 3449**	0 3332**	0 3421**	0 3460**	0 3524**	0 3464**	0 3527**
	(0 1201)	(0 1201)	(0 1220)	(0 1213)	(0 1200)	(0 1200)	(0 1201)	(0 1201)
CONC2	-0 1471	-0 1498	-0 1459	-0 1501	-0 1484	-0 1514	-0 1488	-0 1517
	(0 1116)	(0 1150)	(0 1112)	(0 1147)	(0 1114)	(0 1147)	(0 1115)	(0 1148)
Carve-out	0 2156*	0 2212*	0 1936*	0 2022*	0 2160*	0 2223*	0 2165*	0 2225*
	(0 0931)	(0 0902)	(0 0961)	(0 0926)	(0 0926)	(0 0897)	(0 0924)	(0 0895)
Portion_Dummy	0 2790*	0 2838*	0 2766*	0 2838*	0 2859*	0 2911*	0 2864*	0 2915*
	(0 1146)	(0 1179)	(0 1155)	(0 1184)	(0 1146)	(0 1180)	(0 1145)	(0 1180)
CONC1*Carve-out	-0 3262**	-0 3318**	-0 3040*	-0 3126**	-0 3293**	-0 3355**	-0 3296**	-0 3356**
	(0 1176)	(0 1158)	(0 1200)	(0 1175)	(0 1167)	(0 1148)	(0 1166)	(0 1147)
CONC1*Portion_Dummy	-0 2567#	-0 2597#	-0 2636#	-0 2682#	-0 2657#	-0 2690#	-0 2659#	-0 2692#
	(0 1388)	(0 1383)	(0 1394)	(0 1386)	(0 1385)	(0 1381)	(0 1384)	(0 1381)
Market_Return*Carve-out	-0 4103#	-0 4261#	-0 3873	-0 4116#	-0 3948#	-0 4123#	-0 3980#	-0 4150#
	(0 2397)	(0 2437)	(0 2416)	(0 2445)	(0 2365)	(0 2409)	(0 2367)	(0 2412)
Market_Return*Portion_Dummy	0 0769		0 1178		0 0844		0 0823	
	(0 3088)		(0 3104)		(0 3080)		(0 3080)	
Prob>F	0 0155	0 0111	0 0278	0 0174	0 0131	0 0088	0 0129	0 0088
R-sq	0 1426	0 1422	0 1386	0 1378	0 1438	0 1434	0 1441	0 1437

	Panel C Market model estimated abnormal return on day 1 (SUR regression)				*Panel D Raw return on day 1*	
	Underpricing9 (Market model (200))		**Underpricing10 (Market model (255))**		Underpricing13 (Raw return)	
	Model 1	Model 2	**Model 1**	**Model 2**	Model 1	Model 2
Intercept	-0 0600	-0 0665	**-0 0605**	**-0 0669**	-0 0630	-0 0691
	(0 0917)	(0 0877)	**(0 0917)**	**(0.0877)**	(0 0919)	(0 0879)
Market_Return	0 6267**	0 6741**	**0.6299****	**0 6765****	0 6309**	0 6751**
	(0 2233)	(0 2058)	**(0.2229)**	**(0.2059)**	(0 2233)	(0 2062)
CONC1	0 3459**	0 3524**	**0.3466****	**0 3530****	0 3461**	0 3521**
	(0 1201)	(0 1200)	**(0.1201)**	**(0 1201)**	(0 1203)	(0 1202)
CONC2	-0 1486	-0 1516	**-0 1490**	**-0 1520**	-0 1488	-0 1517
	(0 1113)	(0 1146)	**(0.1115)**	**(0.1148)**	(0 1113)	(0 1146)
Carve-out	0 2161*	0 2224*	**0 2162***	**0.2224***	0 2189*	0 2248*
	(0 0926)	(0 0897)	**(0 0925)**	**(0 0896)**	(0 0928)	(0 0899)
Portion_Dummy	0 2860*	0 2912*	**0.2865***	**0 2917***	0 2847*	0 2896*
	(0 1146)	(0 1180)	**(0 1145)**	**(0 1180)**	(0 1147)	(0 1181)
CONC1*Carve-out	-0 3294**	-0 3356**	**-0 3294****	**-0 3355****	-0 3312**	-0 3371**
	(0 1167)	(0 1147)	**(0 1167)**	**(0 1148)**	(0 1172)	(0 1153)
CONC1*Portion_Dummy	-0 2658#	-0 2692#	**-0.2663#**	**-0 2696#**	-0 2631*	-0 2662#
	(0 1385)	(0 1381)	**(0 1385)**	**(0 1381)**	(0 1389)	(0 1385)
Market_Return*Carve-out	-0 3942#	-0 4119#	**-0.3980#**	**-0 4154#**	-0 3945#	-0 4110#
	(0 2364)	(0 2407)	**(0 2367)**	**(0 2411)**	(0 237)	(0 2416)
Market_Return*Portion_Dummy	0 0857		**0.0843**		0 0799	
	(0 3078)		**(0 3079)**		(0 3086)	
Prob>F	0 0129	0 0085	**0.0128**	**0 0087**	0 0125	0 0085
R-sq	0 1440	0 1435	**0 1443**	**0.1438**	0 1437	0 1433

Market_Return is the annual market return in the 12 months preceding the IPO, calculated using the FTSE All Share Index CONC1 (CONC2) is the percentage of shareholdings that block holders own before (after) the IPO Carve-out is a dummy equals 1 if the IPO firm is a carve-out Portion_Dummy equals 1 if the IPO includes primary shares only # p<0 1, * p<0 05, ** p<0 1, *** p<0 001

8.5 Concluding Remarks

In this chapter, using a sample of 183 IPOs floated on the London Stock Exchange from 1998 to 2003, I have examined both the performance of IPOs in the short-run and the determinants of underpricing. Event study methodology has been employed, with various approaches used and compared. Of these, the market model using 5-255 event-post_event windows and log returns and estimated by SUR is preferred.

The average degree of underpricing in the UK for the studied period is greater than in earlier periods This may have been caused by increased risks of firms floated in the market, following the establishment of AIM for smaller and/or growth firms

The entrepreneurial wealth losses model and the theory of retaining control are examined and supportive evidence is found. Firms that go public purely for financing reasons have higher uncertainties but less systemic risk and hence are more highly underpriced. On the other hand, firms that go public also for the purpose of divesting shares are relatively less underpriced, probably so as to reduce insiders' wealth losses from the continuous sales. At the same time, underpricing is used as a means for the original controlling shareholders to discriminate among investors so as to protect their control rights.

9 Conclusions

In this thesis, I have used a sample of 204 UK IPO firms and 2315 UK private firms to systematically investigate the decision to go public in the UK I have examined the determinants of the likelihood of an IPO, IPO structure and IPO underpricing so as to attempt an answer to the question 'why and when do firms go public in the UK?'

UK IPO activities indeed show different characteristics from continental European IPOs Over the sample period from 1998 through 2003, UK IPOs utilise the stock market as a channel for financing rather than as a facility for shareholders to sell out. The UK market provides access to a large pool of equity capital for firms at different stages of growth – not only for mature firms, but (more importantly) also for young growth firms These are two important features distinguishing the UK market from continental European markets. The different roles played by the UK stock market can be explained by its high market efficiency, informative stock prices and strong investor protection. A deep market with high efficiency in revealing firm value reduces asymmetric information problems in the market, hence reducing information costs and improving evaluation accuracy. In addition, strong investor protection enhances the confidence of dispersed public investors, hence encouraging investment in firms at an earlier stage of their life cycle These features serve to lower the barrier to stock market entries for younger firms and enable them to seek public equity to fund growth. In contrast, continental European markets have relatively weaker market efficiency and weaker investor protection, which gives rise to more significant problems of adverse selection and increases the risks of investing in young firms. Consequently, firms tend to go public at a later stage, and use the market as a channel to raise funds to reduce leverage or as a facility for shareholders to divest

Why and When Do Firms Go Public in the UK?

Overall for the UK IPOs, their reasons for resorting to the stock market appear to be different over the life cycle of firms For firms at a relatively earlier stage of growth, limited cash generation ability drives these growth firms to seek additional equity

capital from the stock market to overcome financial constraints As firms grow more mature (older and larger), a high leverage level drives these firms to seek fresh equity in order to avoid the potential threat of debt overhang. Meanwhile, the accumulation in the public domain of substantial firm-specific information about the mature firms reduces both information asymmetries and potential adverse selection costs Firms in good financial health and with a number of valuable re-investment opportunities, potentially have a large amount of monitoring capital (passive monitors) available in the market. Therefore, in addition to obtaining investment financing from the public market, passive monitoring in the market enables the original shareholders (active monitors) an exit route. Established mature firms may go public purely to sell existing shareholdings, although this seems to be very rare in the UK.

The market timing patterns also appear to be different across the firms with different reasons of going public. IPOs which involve selling-out by shareholders tend to be timed so as to offer in rising markets but avoiding the market peak so as to maximise the total proceeds from a two-stage selling process These IPOs tend to be timed at a higher market return in comparison to IPOs purely for investment financing On the other hand, at the peak of the market (a hot issue market), more firms float on the market purely for financing, probably to take advantage of the buoyant market conditions and window of opportunity.

Independent firms and subsidiaries appear to go public for different reasons. The IPOs of independent firms are mainly driven by the need for capital to fund investment, due to limited internal cash generation ability These firms appear to be smaller, have a more dispersed ownership structure and in an earlier stage of growth In contrast, the IPO decision of subsidiaries is mainly driven by corporate restructuring and divestment. Parent firms tend to divest highly indebted and less controlled subsidiaries via IPO. This result of carve-outs is consistent with the results from the Italian market.

For all the UK IPO firms, corporate governance is an important consideration when firms make their IPO decisions More highly concentrated managerial shareholdings enable a firm to give away more new shares to public investors, as managerial control is less likely to be diluted by dispersed public investors. For the firms less controlled by

management, the non-manager shareholders divest more at IPOs. Ownership dispersion increases the amount of fresh capital offered (bringing in monitoring capital) but decreases the number of shares divested (maximizing the proceeds from two-stage selling).

A Unified Investment-Divestment Framework for IPO Decision

Although in the UK an IPO decision is related to various factors, these can be incorporated into a unified investment-divestment framework. IPO firms appear to possess private information about the value of their growth potential. The higher the value, the greater is the amount of fresh capital raised to finance investment while the lower is the number of shares divested by existing shareholders. In this way, firm value can be enhanced, benefiting from new investment. On the other hand, the lower the value of growth potential (evaluated by the IPO firms), the greater amount of divestment In this way, ownership is transferred to public investors who may possess superior market information and evaluate firms more optimistically. The changing ownership and control structure may also improve monitoring efficiency for these firms and enhance firm value

The Relation between IPO Decision and IPO Underpricing

The 'entrepreneurial wealth losses' and the 'ownership and control' theories are found to provide more fundamental explanations for the underpricing of UK IPOs. Firms that go public purely for financing have higher uncertainty and higher risk profiles, and hence are more underpriced On the other hand, firms that go public also to divest shares are relatively less underpriced, so as to reduce insiders' wealth losses from continuous sales At the same time, underpricing is also used as means for the original controlling shareholders to discriminate among investors so as to protect their control rights

Further Research

Whether going public for investment or for divestment, this is a continuous process A firm that raises capital from an IPO may continue to raise funds from SEOs Reduced information asymmetries may improve the offer price and increase funds raised. On the other hand, divesting via an IPO is expected to follow a two-stage selling process, in which the firm only sells a minority portion in the first stage and sells the controlling block later on in its SEOs. To verify the hypothesis of this two-stage process, it would be helpful to track changes in ownership structure over the post-IPO period and to examine the seasoned equity offerings (SEOs) of IPO firms

In the appendix, some statistics of the SEOs of the sampled IPO firms are shown. These statistics seem to suggest that financing is the dominant reason for UK IPOs, as a majority of the subsequent SEOs raised new capital at much improved offer prices There is also evidence for two-stage selling, since SEOs which involve shareholder selling show much increased offer size (indicating possible sales of controlling block) and price. However, to confirm the conclusions, further studies on SEOs would be beneficial

This thesis has focused only on non-financial firms. To draw more robust conclusions, further studies on financial firms are suggested. As financial firms are subject to different regulation from non-financial firms, whether or not they go public for the same reasons remains to be seen

Finally, the analysis based on the treatment effects model may suffer a selection bias problem. A treatment effects model with sample selection is suggested for further research

Appendix I Summary Statistics of the IPO Underpricing for the Entire Sample (Arithmetic Return)

Variable	Model	Obs	Mean	Std. Dev	Min	Max
Underpricing3	Market-adjusted FTSE all share index	183	0 2148	0 4541	-0 2520	3 3421
Underpricing4	Market-adjusted FTSE industrial indices	183	0 2149	0 4542	-0 2850	3 3313
Underpricing7	Market model 200-day estimation window – OLS	183	0 2161	0 4536	-0 2476	3 3418
Underpricing8	Market model 255-day estimation window – OLS	183	0 2160	0 4537	-0 2470	3 3461
Underpricing11	Market model 200-day estimation window – SUR	183	0 2161	0 4536	-0 2476	3 3411
Underpricing12	Market model· 255-day estimation window – SUR	183	0 2160	0 4538	-0 2466	3 3460
Underpricing14	Raw return	183	0 2144	0 4539	-0 2560	3 3333

Underpricing is calculated using adjusted stock prices – the offer price and daily closing prices are all adjusted for dividends and stock splits

Appendix II Summary Statistics for ARs over 60-Day and 5-Day Event Windows (Arithmetic Return)

Day	Obs	Mean	Std Dev	Min	Max
Panel A Market-adjusted abnormal returns – using the FTSE all share index as a benchmark					
1	183	0 2148	0 4541	-0 2520	3 3421
2	183	0 0057	0 0705	-0.1700	0 3646
3	183	0 0061	0 0781	-0 2833	0 7743
4	183	0 0063	0 0615	-0 2387	0 4741
5	183	0 0018	0 0522	-0 2487	0 3396
6	183	-0 0025	0 0368	-0 1605	0 2624
7	183	-0 0023	0 0398	-0.2147	0 1928
8	183	0 0024	0 0418	-0 1866	0 2238
9	183	-0 0060	0 0279	-0 1486	0 0930
10	183	-0 0033	0 0301	-0.1829	0 1344
11	183	0 0004	0 0459	-0.1301	0 4513
12	183	-0 0043	0 0357	-0 1879	0 2191
13	183	-0 0036	0 0340	-0 1461	0 1306
14	183	0 0019	0 0422	-0 2582	0 1827
15	183	0 0041	0 0488	-0 0756	0 3965
16	183	-0 0004	0 0273	-0.1391	0 0875
17	183	-0 0004	0 0296	-0 1421	0 2016
18	183	-0 0062	0 0295	-0.1857	0 0836
19	183	-0 0009	0 0272	-0 1015	0 1666
20	183	0 0003	0 0294	-0 0848	0 2283
21	183	0 0012	0 0283	-0 1113	0 1710
22	183	-0.0040	0 0311	-0 1724	0 1788
23	183	-0 0008	0 0251	-0 0988	0 1734
24	183	-0 0021	0 0319	-0.1784	0 1936
25	183	-0 0016	0 0259	-0 1024	0 1251
26	183	0.0024	0 0302	-0 1418	0 1205
27	183	-0 0002	0 0355	-0.1888	0 1729
28	183	0 0045	0 0379	-0 0692	0 3711
29	183	0 0027	0 0261	-0 0505	0.1992
30	183	-0 0006	0.0267	-0 0845	0 1646
31	183	-0 0013	0 0259	-0 1109	0 1255
32	183	0 0016	0 0312	-0 1228	0 1339
33	183	-0 0007	0 0272	-0.1097	0 1203
34	183	0 0036	0 0364	-0.1154	0 2010
35	183	0 0004	0 0255	-0 1000	0 1340
36	183	0 0033	0 0291	-0 0680	0 1567
37	183	0 0000	0 0246	-0 1375	0 1251
38	183	-0 0012	0 0261	-0 1257	0 0927
39	183	-0 0005	0 0238	-0 0967	0 1273
40	183	0 0050	0 0649	-0.1141	0 8035

Day	Obs	Mean	Std Dev.	Min	Max
41	183	0 0006	0 0311	-0 2048	0 1661
42	183	0 0016	0 0288	-0 1233	0 1903
43	183	-0 0043	0 0351	-0 2047	0.1271
44	183	-0 0005	0 0339	-0 1371	0.1811
45	183	0 0016	0 0321	-0 1424	0 1622
46	183	-0 0012	0 0234	-0 1037	0 1252
47	183	-0 0034	0 0248	-0 1321	0 0906
48	183	0 0002	0 0382	-0 0908	0 3350
49	183	-0 0029	0 0302	-0 1262	0 2164
50	183	-0 0026	0 0349	-0 1284	0 2498
51	183	-0 0049	0 0293	-0 1313	0 1959
52	183	0 0012	0 0343	-0 0722	0 3002
53	183	-0 0015	0 0284	-0 1662	0 1142
54	183	0 0002	0 0318	-0 1100	0 2408
55	183	0 0010	0 0360	-0 2754	0 1734
56	183	0 0008	0 0439	-0 1951	0 3320
57	183	-0 0021	0 0308	-0 1244	0 1597
58	183	0 0012	0 0416	-0 1244	0.3244
59	183	-0 0019	0 0275	-0 0998	0 1369
60	183	0 0012	0 0297	-0 1118	0 1953
Panel B Market-adjusted abnormal returns – using the FTSE industrial indices as a benchmark					
1	183	0 2149	0 4542	-0 2850	3 3313
2	183	0 0065	0 0692	-0 1715	0 3601
3	183	0 0054	0 0797	-0 2992	0.7664
4	183	0 0078	0 0632	-0 2381	0 4785
5	183	0 0026	0 0538	-0 2584	0 3399
6	183	-0 0022	0 0389	-0 1801	0 2464
7	183	-0 0022	0 0433	-0 2163	0 1805
8	183	0 0023	0 0425	-0 2078	0 2223
9	183	-0 0042	0 0322	-0 1508	0 0925
10	183	-0 0029	0 0325	-0 1676	0 1189
11	183	0 0005	0 0475	-0.1143	0 4457
12	183	-0 0037	0 0377	-0 1923	0 2200
13	183	-0 0028	0 0358	-0 1394	0 1336
14	183	0 0024	0 0456	-0 2554	0.1899
15	183	0 0051	0 0521	-0 0955	0 3936
16	183	0 0001	0 0312	-0 1219	0.1138
17	183	0 0013	0 0301	-0.1379	0 1742
18	183	-0 0061	0 0321	-0 1889	0 1311
19	183	0 0014	0 0321	-0 1191	0 1589
20	183	-0 0007	0 0321	-0.1072	0 1881
21	183	0 0034	0 0290	-0 0829	0.1680
22	183	-0 0038	0 0353	-0 2031	0 1783
23	183	0 0013	0 0286	-0 0873	0 1603

Day	Obs	Mean	Std. Dev	Mın	Max
24	183	-0 0026	0 0341	-0 1889	0 1485
25	183	-0.0027	0 0302	-0 0905	0 1397
26	183	0.0014	0 0324	-0.1371	0 1218
27	183	-0 0015	0 0385	-0.1951	0 1674
28	183	0 0056	0 0406	-0 0850	0 3575
29	183	0 0029	0 0300	-0 0878	0 2039
30	183	-0 0015	0 0300	-0.1013	0 1648
31	183	-0 0013	0 0291	-0 1327	0 1299
32	183	0 0004	0 0311	-0 1090	0 1270
33	183	0 0022	0 0283	-0 1074	0 0969
34	183	0 0036	0 0388	-0.1112	0 2110
35	183	0 0018	0 0295	-0 1031	0 1320
36	183	0 0037	0 0309	-0 0910	0 1661
37	183	0 0007	0 0254	-0 1067	0 1497
38	183	0.0001	0 0288	-0 1200	0 1197
39	183	0 0008	0 0266	-0 0991	0 1276
40	183	0 0052	0 0677	-0 1641	0 8154
41	183	0.0004	0 0353	-0 2100	0 1709
42	183	0.0008	0 0318	-0 1453	0 1717
43	183	-0 0056	0 0369	-0 2121	0 1060
44	183	-0 0002	0 0364	-0.1402	0 1650
45	183	0 0023	0 0355	-0 1423	0 2317
46	183	-0 0013	0 0282	-0 1090	0 1382
47	183	-0 0027	0 0306	-0 0786	0 1962
48	183	0 0007	0 0423	-0 1219	0 3599
49	183	-0 0014	0 0322	-0 1363	0 2246
50	183	-0 0026	0 0392	-0 1475	0.2531
51	183	-0 0029	0 0334	-0 1590	0 1968
52	183	0 0040	0 0372	-0 0750	0 3409
53	183	0 0000	0 0282	-0 1370	0 0899
54	183	0 0024	0 0352	-0 0948	0 2491
55	183	0 0004	0 0383	-0 2754	0 1631
56	183	0 0010	0 0434	-0 1940	0 3320
57	183	-0 0034	0 0325	-0 1226	0 1059
58	183	-0 0007	0 0451	-0 1202	0 3262
59	183	-0 0007	0 0331	-0 1520	0 1717
60	183	0 0028	0 0311	-0 1166	0 1956
Panel C Market model – using the 60-200 event-post_event windows (estimated by OLS)					
1	183	0 2162	0 4536	-0 2476	3 3418
2	183	0 0084	0 0692	-0 1641	0 3546
3	183	0 0073	0 0770	-0 2776	0 7690
4	183	0 0066	0 0604	-0 2379	0 4791
5	183	0 0028	0 0523	-0 2454	0.3397
6	183	-0 0001	0 0352	-0 1563	0 2612

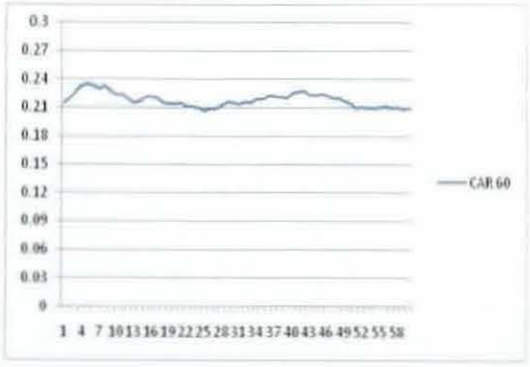
Day	Obs	Mean	Std Dev	Min	Max
7	183	-0 0007	0 0388	-0 2194	0 1932
8	183	0.0033	0 0420	-0 1949	0 2306
9	183	-0 0047	0 0269	-0 1513	0 0862
10	183	-0 0021	0 0284	-0.1758	0 1323
11	183	0 0010	0 0458	-0 1264	0 4500
12	183	-0 0034	0 0355	-0 1863	0 2269
13	183	-0 0023	0 0342	-0.1503	0 1294
14	183	0 0034	0 0392	-0 2311	0 1846
15	183	0 0062	0 0478	-0 0712	0 3948
16	183	0 0004	0 0268	-0 1394	0 1052
17	183	-0 0002	0 0285	-0 1455	0 1999
18	183	-0 0051	0 0286	-0 1935	0 0782
19	183	-0.0005	0 0257	-0.1085	0 1463
20	183	0 0007	0 0270	-0 0776	0 1980
21	183	0 0017	0 0282	-0 1208	0 1737
22	183	-0.0025	0 0306	-0.1577	0 1778
23	183	0.0008	0 0236	-0 0889	0 1755
24	183	-0 0004	0 0306	-0 1632	0 2034
25	183	-0 0005	0 0248	-0 1176	0 1326
26	183	0 0027	0 0309	-0 1742	0 1208
27	183	0 0015	0 0352	-0 1908	0 1753
28	183	0 0053	0 0367	-0 0683	0 3648
29	183	0 0031	0 0260	-0 0606	0 1998
30	183	0 0013	0 0270	-0 1007	0.1776
31	183	0 0003	0 0260	-0.1160	0 1334
32	183	0 0020	0 0298	-0 1039	0 1406
33	183	0 0003	0 0256	-0.1097	0 1076
34	183	0 0044	0 0342	-0 1072	0 1869
35	183	0 0020	0 0234	-0 0915	0 1426
36	183	0 0035	0 0273	-0 0557	0 1536
37	183	0 0005	0 0227	-0 1270	0 1256
38	183	-0 0014	0 0245	-0 1232	0 0904
39	183	0 0016	0 0227	-0 0921	0 1414
40	183	0 0061	0 0652	-0.1039	0 8193
41	183	0 0022	0 0290	-0 1978	0 1659
42	183	0 0031	0 0281	-0 1187	0 1959
43	183	-0 0028	0 0357	-0 2026	0.1294
44	183	0 0011	0.0327	-0.1441	0 1798
45	183	0.0024	0 0300	-0 1386	0 1683
46	183	0 0001	0 0224	-0 1019	0 1500
47	183	-0 0024	0 0234	-0 1388	0 0901
48	183	0 0006	0 0369	-0 0879	0 3355
49	183	-0 0031	0 0291	-0 1305	0 2165
50	183	-0 0013	0 0331	-0.1241	0 2476
51	183	-0 0038	0 0276	-0 1247	0 1954

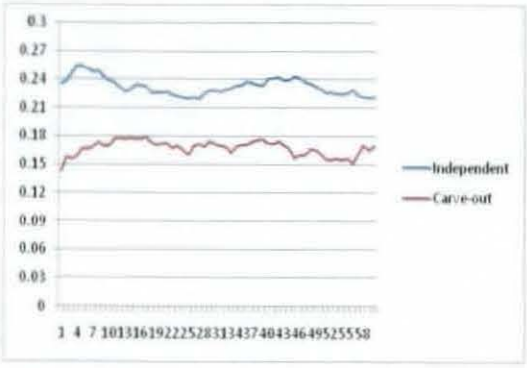
Day	Obs	Mean	Std Dev	Min	Max
52	183	0 0026	0 0316	-0 0680	0 2762
53	183	-0 0007	0 0271	-0.1635	0 1189
54	183	0 0029	0 0319	-0.1415	0 2540
55	183	0 0007	0 0358	-0 2896	0 1705
56	183	0 0021	0 0436	-0 2019	0 3214
57	183	-0 0010	0 0303	-0 1175	0 1588
58	183	0 0018	0 0405	-0 1248	0 3215
59	183	-0 0006	0 0257	-0 1011	0 1362
60	183	0 0026	0 0286	-0 1131	0 1926
Panel D Market model – using the 5-255 event-post_event windows (estimated by OLS)					
1	183	0 2160	0 4537	-0 2470	3 3461
2	183	0 0082	0 0687	-0.1615	0 3531
3	183	0 0071	0 0769	-0 2781	0 7649
4	183	0 0065	0 0603	-0 2366	0 4801
5	183	0 0026	0 0518	-0 2454	0 3386

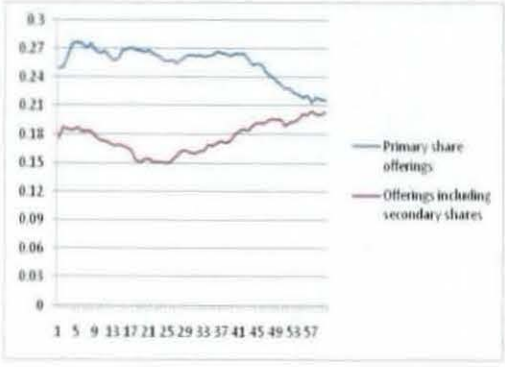
Appendix III Arithmetic Returns

III-1 Cumulative Average Abnormal Returns – CAARs
Market-adjusted – using the FTSE all share index as a benchmark

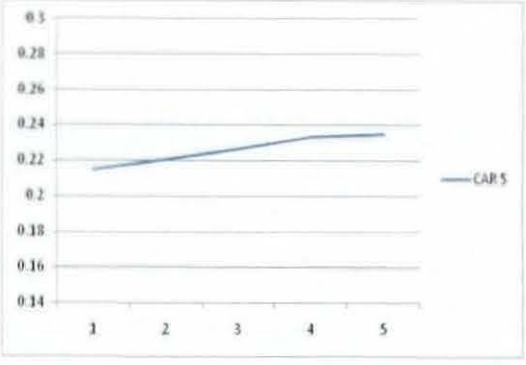
A. Over 60 days after IPO

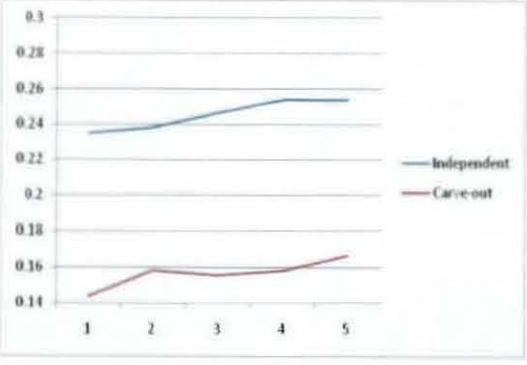


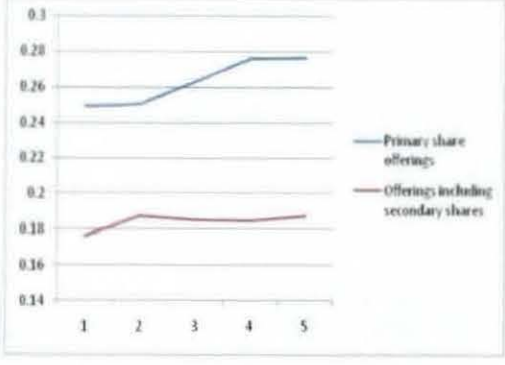




B. Over 5 days after IPO

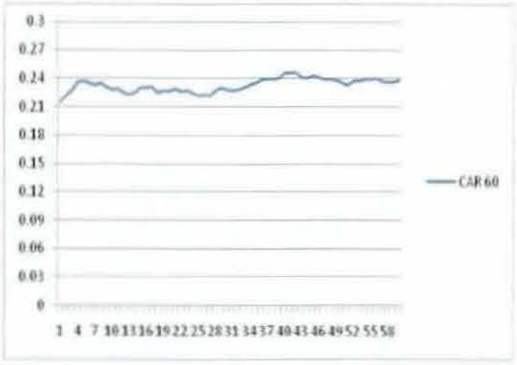


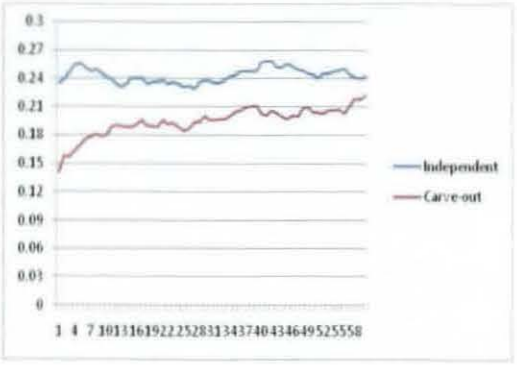


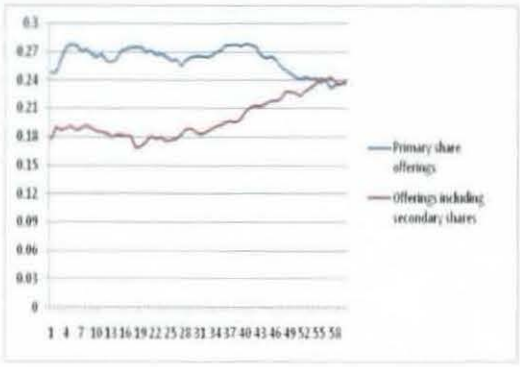


III-2 Cumulative Average Abnormal Returns– CAARs
Market-adjusted – using the FTSE industrial indices as a benchmark

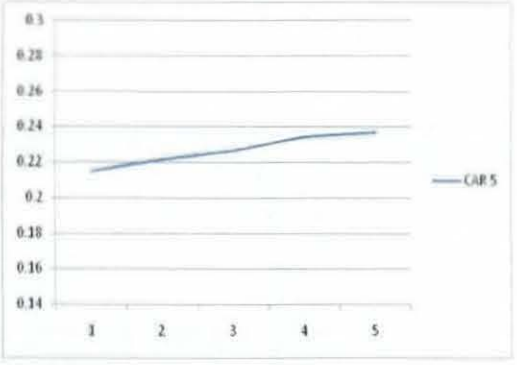
A. Over 60 days after IPO

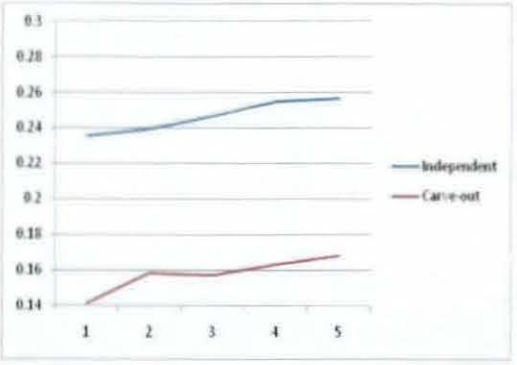


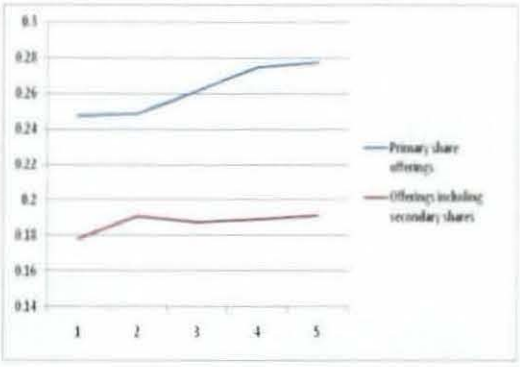




B. Over 5 days after IPO

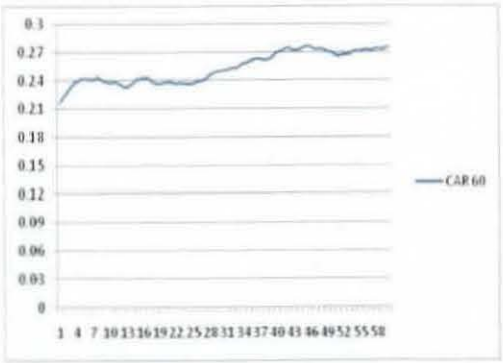


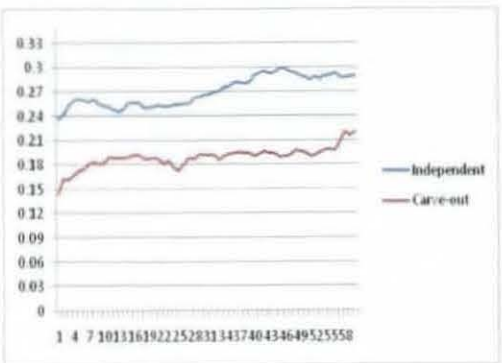


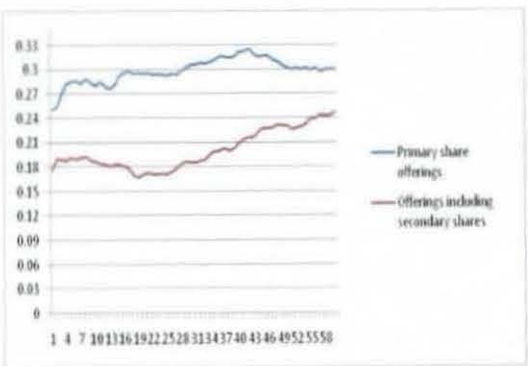


III-3 Cumulative Average Abnormal Returns – CAARs
Market model (OLS) – using the 60-200 windows

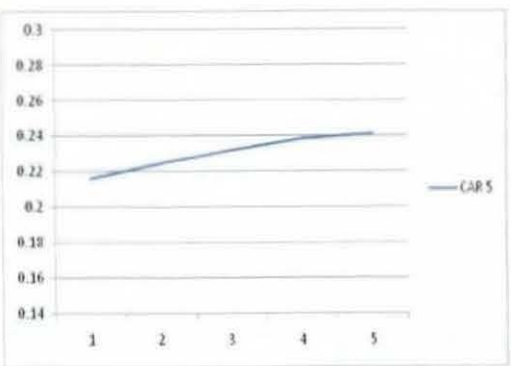
A. Over the 60-day event window after IPO

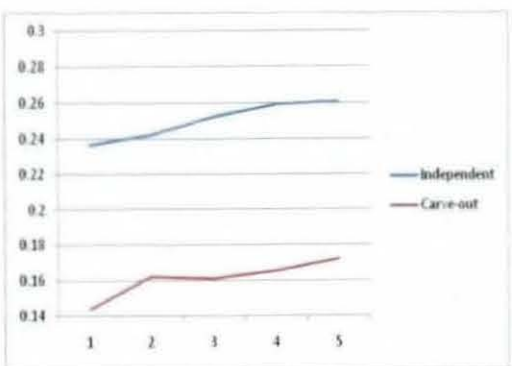


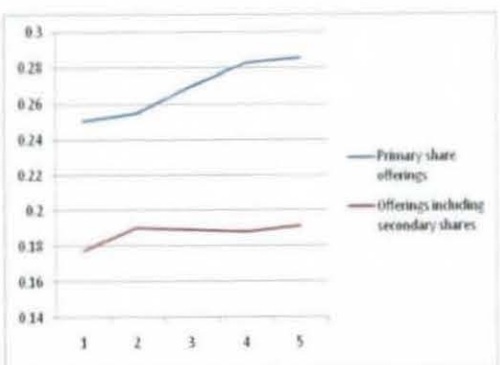




B. Over 5 days after IPO

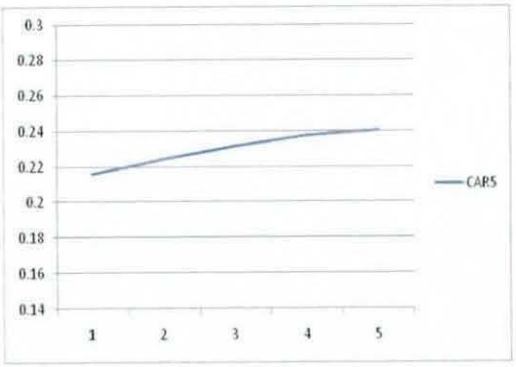


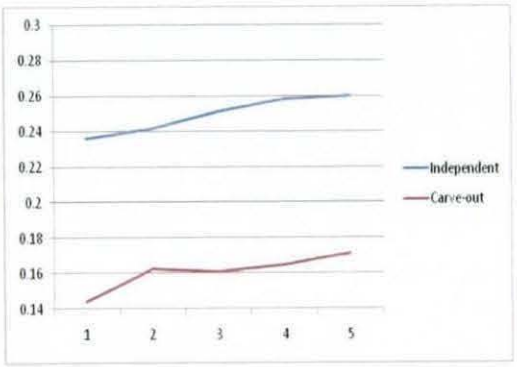


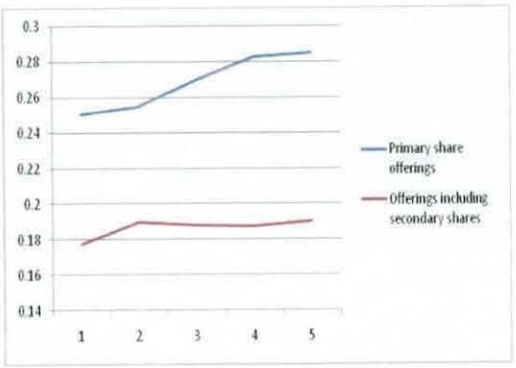


III-4 Cumulative Average Abnormal Returns – CAARs
Market model (OLS) – using the 5-255 windows

Over the 5-day event window after IPO







Appendix IV Testing for Statistical Significance of ARs and CARs over 60 (5) Days after IPO in the Entire Sample (n=183) – OLS Estimated Market Model (Arithmetic Return)

Day	AR		CAR		
	Patell test	Boehmer test	Patell test	Corrected Patell test	Boehmer test
Panel A Market model –using the 60- 200 event-post_event windows					
1	**96.5948**	**8.2264**	96 5948	97 0864	8 2265
2	**3.8144**	1 6083	71 0001	71 3405	7 7852
3	**2.4282**	1.3958	59 3732	59 6578	7 3813
4	1 5872	0 9422	52 2123	52 4515	7 0781
5	1 0810	0 5297	47 1835	47 4038	6 7181
6	0 4851	0 3088	43 2705	43 4895	6 2442
7	1 3258	0 9297	40 5618	40 7829	5 9801
8	**2.3728**	1 3635	38 7810	38 9906	5 7632
9	-1 8518	-2 3349	35 9459	36 1387	5 4109
10	-1 1558	-1 1975	33 7357	33 9144	5 1284
11	-0 2035	-0 1913	32 1044	32 2698	4 9357
12	-1 5723	-1 3839	30 2838	30 4387	4 7041
13	-1 1291	-0 9535	28 7825	28 9180	4 4713
14	0 6373	0 4578	27 9059	28 0337	4 3365
15	**2.1381**	1 5176	27 5117	27 6428	4 2885
16	0 3068	0 3282	26 7148	26 8420	4 1593
17	-0 0970	-0 1166	25 8936	26 0146	4 0381
18	-2 0582	-2 1562	24 6790	24 8029	3 8445
19	-0 1136	-0 1244	23 9947	24 1119	3 7501
20	0 4043	0 4873	23 4775	23 5904	3 6700
21	0 6160	0 6081	23 0461	23 1462	3 6167
22	-1 3241	-1 5086	22 2340	22 3323	3 4846
23	0 2844	0 3936	21 8046	21 8996	3 4219
24	0 3460	0 3697	21 4161	21 5010	3 3686
25	-0 1887	-0 2859	20 9457	21 0318	3 2948
26	1 2540	1 2149	20 7848	20 8680	3 2743
27	0 8836	0 6907	20 5664	20 6527	3 2496
28	**2.2692**	**2.0945**	20 6246	20 7112	3 2650
29	**1.9958**	**2.0230**	20 6365	20 7244	3 2739
30	0 4367	0 4989	20 3694	20 4620	3 2245
31	0 2816	0 3637	20 0887	20 1830	3 1802
32	0 4625	0 5230	19 8541	19 9458	3 1418
33	0 2904	0 3597	19 6015	19 6939	3 1014
34	1 7567	1 5962	19 6124	19 7077	3 1085
35	1 4796	1 6692	19 5803	19 6732	3 0992
36	1 6246	1 4293	19 5772	19 6706	3 1030
37	0 7822	1 0021	19 4394	19 5312	3 0836
38	-0 3753	-0 4152	19 1210	19 2107	3 0347
39	0 4784	0 6173	18 9509	19 0384	3 0091
40	**3.3474**	1 6523	19 2418	19 3302	3 0674

Day	AR		CAR		
	Patell test	Boehmer test	Patell test	Corrected Patell test	Boehmer test
41	1 1617	1 4487	19 1871	19 2708	3 0619
42	1 2544	1 2863	19 1509	19 2371	3 0591
43	-2 4046	-1 5031	18 5602	18 6390	2 9434
44	1 1545	1 1860	18 5221	18 5994	2 9411
45	1 3414	1 4690	18 5151	18 5902	2 9415
46	0 3043	0 4101	18 3576	18 4319	2 9151
47	-0 8786	-1 2044	18 0331	18 1112	2 8591
48	0 6958	0 5930	17 9447	18 0175	2 8388
49	-1 0437	-1 1697	17 6116	17 6825	2 7754
50	-1 0027	-1 1123	17 2928	17 3615	2 7141
51	-1 6227	-1 9736	16 8952	16 9594	2 6434
52	0 7891	0 9177	16 8413	16 9107	2 6354
53	0 1291	0 1332	16 6994	16 7686	2 6108
54	0 8372	0 8622	16 6580	16 7273	2 6053
55	0 2447	0 1939	16 5389	16 6051	2 5799
56	1 4182	1 0374	16 5800	16 6470	2 5890
57	-0 7853	-0 6925	16 3300	16 3975	2 5450
58	1 8931	0 8866	16 4371	16 5051	2 5597
59	-0 1662	-0 1671	16 2756	16 3420	2 5335
60	1 9456	1 6698	16 3906	16 4564	2 5581
Panel B Market model –using the 5-255 event-post_event windows					
1	**92.2695**	**8.5928**	92 2695	92 6364	8 5928
2	**3.4072**	1 5943	67 6537	67 8979	8 3643
3	**2 2259**	1 3419	56 5241	56 7284	8 2110
4	1 6500	0 9972	49 7763	49 9493	8 2112
5	0 2802	0 1484	44 6466	44 5966	8 2002

Appendix V Testing for Statistical Significance of ARs and CARs over 60 Days after IPO in the Entire Sample (n=183) – SUR Estimated Market Model (Arithmetic Return)

Day	AR		CAR		
	Patell test	Boehmer test	Patell test	Corrected Patell test	Boehmer test
1	**96.5513**	**8.2248**	96 5948	97 0426	8 2249
2	**3.8109**	1 6071	71 0001	71 3070	7 7823
3	**2.4241**	1 3937	59 3732	59 6279	7 3782
4	1 5986	0 9493	52 2123	52 4317	7 0766
5	1 0890	0 5337	47 1835	47 3895	6 7182
6	0 4752	0 3025	43 2705	43 4723	6 2437
7	1 3824	0 9698	40 5618	40 7885	5 9836
8	**2.3875**	1 3724	38 7810	39 0010	5 7671
9	-1 8509	-2 3325	35 9459	36 1488	5 4148
10	-1 1858	-1 2279	33 7357	33 9145	5 1305
11	-0 2065	-0 1940	32 1044	32 2689	4 9379
12	-1 5662	-1 3783	30 2838	30 4397	4 7068
13	-1 1233	-0 9472	28 7825	28 9205	4 4738
14	0 6320	0 4527	27 9059	28 0346	4 3388
15	**2.1376**	1 5176	27 5117	27 6435	4 2907
16	0 2974	0 3184	26 7148	26 8404	4 1612
17	-0 1025	-0 1231	25 8936	26 0116	4 0397
18	-2 0427	-2 1372	24 6790	24 8038	3 8466
19	-0 1335	-0 1458	23 9947	24 1081	3 7512
20	0 4244	0 5098	23 4775	23 5913	3 6721
21	0 6269	0 6193	23 0461	23 1493	3 6193
22	-1 2908	-1 4651	22 2340	22 3425	3 4884
23	0 2807	0 3872	21 8046	21 9088	3 4254
24	0 3215	0 3431	21 4161	21 5048	3 3711
25	-0 2095	-0 3195	20 9457	21 0314	3 2964
26	1 2675	1 2284	20 7848	20 8701	3 2764
27	0 8901	0 6954	20 5664	20 6561	3 2518
28	**2.2636**	**2.0941**	20 6246	20 7136	3 2672
29	**2.0289**	**2.0529**	20 6365	20 7328	3 2772
30	0 4584	0 5244	20 3694	20 4742	3 2284
31	0 3048	0 3939	20 0887	20 1992	3 1849
32	0 4892	0 5554	19 8541	19 9665	3 1473
33	0 2907	0 3605	19 6015	19 7145	3 1068
34	1 7333	1 5800	19 6124	19 7239	3 1131
35	1 4530	1 6389	19 5803	19 6845	3 1030
36	1 6329	1 4353	19 5772	19 6832	3 1070
37	0 7544	0 9641	19 4394	19 5390	3 0867
38	-0 3664	-0 4059	19 1210	19 2199	3.0380
39	0 4489	0 5810	18 9509	19 0428	3 0115
40	**3.3746**	1 6673	19 2418	19 3388	3 0707

Day	AR		CAR		
	Patell test	Boehmer test	Patell test	Corrected Patell test	Boehmer test
41	1 1630	1 4539	19 1871	19 2796	3 0652
42	1 2455	1 2794	19 1509	19 2444	3 0621
43	-2 4470	-1 5291	18 5602	18 6397	2 9451
44	1 1605	1 1926	18 5221	18 6010	2 9430
45	1 3478	1 4748	18 5151	18 5927	2 9436
46	0 3383	0 4562	18 3576	18 4395	2 9181
47	-0 9253	-1 2676	18 0331	18 1118	2 8608
48	0 6696	0 5709	17 9447	18 0142	2 8398
49	-1 0174	-1 1396	17 6116	17 6831	2 7770
50	-1 0166	-1 1286	17 2928	17 3601	2 7153
51	-1 6328	-1 9799	16 8952	16 9566	2 6442
52	0 7958	0 9300	16 8413	16 9089	2 6365
53	0 1249	0 1286	16 6994	16 7661	2 6118
54	0 8508	0 8769	16 6580	16 7268	2 6066
55	0 2575	0 2039	16 5389	16 6063	2 5815
56	1 4116	1 0332	16 5800	16 6474	2 5905
57	-0 7823	-0 6895	16 3300	16 3982	2 5466
58	1 8743	0 8776	16 4371	16 5034	2 5608
59	-0 1721	-0 1732	16 2756	16 3396	2 5344
60	1 9576	1 6811	16 3906	16 4555	2 5593

Appendix V SUR Regression Diagnostics for the Market Model (Arithmetic Return)

Variable	Obs	Mean	Std Dev	Min	Max	Mean	Std Dev	Min	Max
		200-day estimation window				255-day estimation window			
Panel A The entire sample									
Alpha	183	-0 0014	0 0033	-0 0104	0 0103	-0 0013	0 0030	-0 0105	0 0077
Beta	183	0 2659	0 4486	-0 8463	2 3028	0 2792	0 4366	-0 4871	2 3342
rmse	183	0 0311	0 0159	0 0024	0 1179	0 0309	0 0150	0 0021	0 1063
R-sq	183	0 0207	0 0343	-0 0015	0 2325	0 0186	0 0312	-0 0042	0 2090
Chi-sq	183	55 749	92 211	0 0000	619 10	18 454	30 725	0 0000	207 27
p-value	183	0 0911	0 2197	0 0000	0 9901	0 1362	0 2364	0 0000	0 9561
Panel B (Sub_a1) The IPOs of independent firms									
Alpha	143	-0 0015	0 0034	-0 0104	0 0103	-0 0014	0 0030	-0 0105	0 0077
Beta	143	0 2696	0 4741	-0 8463	2 3028	0 2922	0 4627	-0 4871	2 3342
rmse	143	0 0323	0 0165	0 0024	0 1179	0 0323	0 0157	0 0021	0 1063
R-sq	143	0 0205	0 0358	-0 0015	0 2325	0 0187	0 0326	-0 0034	0 2090
Chi-sq	143	53 969	91 303	0 0000	619 10	18 543	31 943	0 0100	207 27
p-value	143	0 0862	0 2085	0 0000	0 9649	0 1370	0 2420	0 0000	0 9300
Panel C (Sub_a2) The IPOs of carve-out firms									
Alpha	40	-0 0011	0 0031	-0 0083	0 0064	-0 0009	0 0027	-0 0069	0 0045
Beta	40	0 2529	0 3471	-0 2604	1 5255	0 2328	0 3350	-0 3336	1 3973
rmse	40	0 0268	0 0128	0 0054	0 0713	0 0260	0 0112	0 0061	0 0638
R-sq	40	0 0212	0 0287	-0 0005	0 1201	0 0181	0 0263	-0 0042	0 1123
Chi-sq	40	62 111	96 303	0 0000	453 73	18 135	26 731	0 0000	125 70
p-value	40	0 1087	0 2580	0 0000	0 9901	0 1334	0 2214	0 0000	0 9561
Panel D (Sub_b1) The primary share offerings									
Alpha	97	-0 0017	0 0033	-0 0104	0 0065	-0 0017	0 0028	-0 0105	0 0054
Beta	97	0 1793	0 4274	-0 8463	2 1691	0 2010	0 4359	-0 4871	2 3342
rmse	97	0 0337	0 0182	0 0024	0 1179	0 0335	0 0172	0 0021	0 1063
R-sq	97	0 0145	0 0283	-0 0002	0 2325	0 0133	0 0292	-0 0042	0 2090
Chi-sq	97	39 199	76 861	0 0000	619 10	12 381	27 254	0 0100	207 27
p-value	97	0 1127	0 2365	0 0000	0 9901	0 1684	0 2595	0 0000	0 9300
Panel E (Sub_b2) The offerings including secondary shares									
Alpha	86	-0 0010	0 0034	-0 0091	0 0103	-0 0008	0 0031	-0 0084	0 0077
Beta	86	0 3637	0 4542	-0 3546	2 3028	0 3674	0 4254	-0 2234	2 1126
rmse	86	0 0282	0 0121	0 0054	0 0604	0 0280	0 0114	0 0061	0 0575
R-sq	86	0 0277	0 0390	-0 0015	0 1846	0 0246	0 0326	-0 0017	0 1497
Chi-sq	86	74 416	104 25	0 0000	523 37	25 303	33 226	0 0000	144 38
p-value	86	0 0667	0 1976	0 0000	0 9649	0 0998	0 2043	0 0000	0 9561

Breusch-Pagan test of independence for SUR

200-day estimation window (Logarithmic return) Chi2(16653) = 17137 511, Pr = 0 0042

255-day estimation window (Logarithmic return) Chi2(16653) = 17340 310, Pr = 0 0001

Appendix VI Equality Tests (Mean and Median) on the Alpha and the Beta (Estimated by SUR) of the Sub-samples (Arithmetic Return)

Sub-samples	Tests	200-day estimation window		255-day estimation window	
		Alpha	Beta	Alpha	Beta
Sub_a1 vs Sub_a2	Wilcoxon rank-sum test	0.460	0 957	0.391	0 526
	Median test	0 691	0 301	0 451	0 164
	Continuity corrected median test	0 827	0 392	0.565	0 225
Sub_b1 vs Sub_b2	Wilcoxon rank-sum test	0 262	**0.001**	**0.088**	**0.000**
	Median test	0.338	**0.006**	0 121	**0.015**
	Continuity corrected median test	0 418	**0.010**	0 161	**0.022**

Sub_a1 stands for the sub-sample that includes the IPOs of independent firms only, Sub_a2 stands for the sub-sample that includes carve-out IPOs only, Sub_b1 stands for the sub-sample of IPOs that offer primary shares only, Sub_b2 stands for the sub-sample of IPOs that include secondary shares This table reports the *p*-value of the non-parametric Wilcoxon rank-sum test (testing equality of mean) and the Median test (testing equality of median) between the two sub-samples (carve-outs versus independent firms, primary share IPOs versus secondary share IPOs) For the Median test, the Pearson chi-squared test statistic is computed both with and without a continuity correction

Appendix VII Determinants of Underpricing (n=183) – Arithmetic Return

Panel A Market-adjusted abnormal return on day 1

	Underpricing3 (FTSE all share index)		Underpricing4 (FTSE industrial indices)	
	Model 1	Model 2	Model 1	Model 2
Intercept	-0 0484	-0 0815	-0 0404	-0 0759
	(0 1316)	(0 1221)	(0 1326)	(0 1228)
Market Return	0 9601**	1 1991**	0 9380**	1 1946**
	(0 3519)	(0 4021)	(0 3524)	(0 4035)
CONC1	0 4886**	0 5214**	0 4836**	0 5189**
	(0 1760)	(0 1837)	(0 1771)	(0 1841)
CONC2	-0 3016	-0 3169	-0 3003	-0 3168
	(0 2257)	(0 2358)	(0 2253)	(0 2355)
Carve-out	0 2474*	0 2792*	0 2275#	0 2617*
	(0 1231)	(0 1165)	(0 1253)	(0 1183)
Portion Dummy	0 4289*	0 4555*	0 4287*	0 4573*
	(0 1939)	(0 2097)	(0 1941)	(0 2098)
CONC1*Carve-out	-0 4288**	-0 4604**	-0 4080*	-0 4419**
	(0 1603)	(0 1580)	(0 1618)	(0 1590)
CONC1*Portion_Dummy	-0 3529	-0 3698#	-0 3608	-0 3789#
	(0 2210)	(0 2247)	(0 2210)	(0 2245)
Market_Return*Carve-out	-0 8155*	-0 9047*	-0 7993*	-0 8951*
	(0 3967)	(0 4288)	(0 3983)	(0 4300)
Market_Return*Portion_Dummy	0 4323		0 4642	
	(0 5838)		(0 5851)	
Prob>F	0 0631	0 0470	0 0803	0 0559
R-sq	0 1418	0 1382	0 1408	0 1367

Panel B Market model estimated abnormal return on day 1 (OLS regression)

	Underpricing7 (Market model (200))		Underpricing8 (Market model (255))	
	Model 1	Model 2	Model 1	Model 2
Intercept	-0 0507	-0 0844	-0 0511	-0 0846
	(0 1317)	(0 1223)	(0 1316)	(0 1222)
Market Return	0 9493**	1 1930**	0 9521**	1 1944**
	(0 3517)	(0 4018)	(0 3513)	(0 4017)
CONC1	0 4954**	0 5289**	0 4958**	0 5290**
	(0 1761)	(0 1836)	(0 1761)	(0 1837)
CONC2	-0 3027	-0 3183	-0 3031	-0 3187
	(0 2254)	(0 2355)	(0 2255)	(0 2356)
Carve-out	0 2478*	0 2803*	0 2482*	0 2805*
	(0 1228)	(0 1161)	(0 1227)	(0 1161)
Portion Dummy	0 4355*	0 4627*	0 4360*	0 4630*
	(0 1939)	(0 2098)	(0 1938)	(0 2098)
CONC1*Carve-out	-0 4317**	-0 4639**	-0 4320**	-0 4640**
	(0 1596)	(0 1571)	(0 1595)	(0 1571)
CONC1*Portion_Dummy	-0 3618	-0 3790#	-0 3621	-0 3792#
	(0 2206)	(0 2245)	(0 2206)	(0 2245)
Market_Return*Carve-out	-0 8004*	-0 8914*	-0 8031*	-0 8935*
	(0 3942)	(0 4270)	(0 3943)	(0 4272)
Market_Return*Portion_Dummy	0 4409		0 4382	
	(0 5831)		(0 5829)	
Prob>F	0 0590	0 0417	0 0583	0 0419
R-sq	0 1425	0 1387	0 1426	0 1389

	Panel C Market model estimated abnormal return on day 1 (SUR regression)				*Panel D Raw return on day 1*	
	Underpricing11 (Market model (200))		Underpricing12 (Market model (255))		Underpricing14 (Raw return)	
	Model 1	Model 2	Model 1	Model 1	Model 1	Model 2
Intercept	-0 0506	-0 0844	-0 0509	-0 0846	-0 0531	-0 0864
	(0 1317)	(0 1223)	(0 1317)	(0 1223)	(0 1318)	(0 1225)
Market Return	0 9489**	1 1932**	0 9516**	1 1950**	0 9531**	1 1936**
	(0 3518)	(0 4017)	(0 3513)	(0 4016)	(0 3518)	(0 4019)
CONC1	0 4953**	0 5288**	0 4958**	0 5293**	0 4955**	0 5286**
	(0 1761)	(0 1837)	(0 1761)	(0 1838)	(0 1762)	(0 1837)
CONC2	-0 3029	-0 3186	-0 3033	-0 3189	-0 3033	-0 3187
	(0 2254)	(0 2355)	(0 2256)	(0 2356)	(0 2253)	(0 2353)
Carve-out	0 2479*	0 2804*	0 2479*	0 2803*	0 2506*	0 2827*
	(0 1228)	(0 1162)	(0 1228)	(0 1161)	(0 1230)	(0 1164)
Portion Dummy	0 4356*	0 4628*	0 4361*	0 4632*	0 4346*	0 4614*
	(0 1939)	(0 2098)	(0 1939)	(0 2098)	(0 1940)	(0 2098)
CONC1*Carve-out	-0 4318**	-0 4641**	-0 4317**	-0 4639**	-0 4338**	-0 4656**
	(0 1596)	(0 1572)	(0 1595)	(0 1572)	(0 1600)	(0 1577)
CONC1*Portion_Dummy	-0 3619	-0 3791#	-0 3624	-0 3796#	-0 3594	-0 3763#
	(0 2207)	(0 2245)	(0 2206)	(0 2245)	(0 2210)	(0 2248)
Market_Return*Carve-out	-0 8000*	-0 8911*	-0 8030*	-0 8938*	-0 8001*	-0 8899*
	(0 3942)	(0 4269)	(0 3943)	(0 4271)	(0 3948)	(0 4276)
Market_Return*Portion_Dummy	0 4419		0 4403		0 4352	
	(0 5829)		(0 5829)		(0 5835)	
Prob>F	0 0587	0 0413	0 0584	0 0416	0 0577	0 0413
R-sq	0 1425	0 1388	0 1427	0 1389	0 1423	0 1387

Market_Return is the annual market return in the 12 months preceding the IPO, calculated using the FTSE All Share Index CONC1 (CONC2) is the percentage of shareholdings that block holders own before (after) the IPO Carve-out is a dummy equals 1 if the IPO firm is a carve-out Portion_Dummy equals 1 if the IPO includes primary shares only # p<0 1, * p<0 05, ** p<0 1, *** p<0 001

Appendix VIII SEOs

VIII-1 Summary: the number of firms that conducted SEOs within 3 years after their IPO

	Offered only Primary Shares in SEO(s)	Offered only Secondary Shares in SEO(s)	Offered Primary and Secondary Shares in SEO(s)	No SEOs in 3 Years after IPO
Primary Share Offering in IPO (114 firms)	38	0	4	72
Combined offering in IPO (88 firms)	22	9	6	51
Secondary Share Offering in IPO (2 firms)	0	0	0	2
Total (204 firms)	60	9	10	123

VIII-2 Summary statistics: the percentage changes in offer prices and numbers of shares offered from the IPOs to their SEOs

(within 3 years after the IPOs, 79 IPO firms conducted SEOs with 188 deals in total)

Variable	Offer Price of SEO/Offer Price of IPO*			Total Shares Offered in SEO/Total Shares Offered in IPO		
	Total	Primary Share Offering in IPO	Combined offering in IPO	Total	Primary Share Offering in IPO	Combined offering in IPO
Obs	188	102	86	188	102	86
Mean	140 74%	115 08%	171 16%	260 03%	239 31%	284 61%
Std Dev	1 9105	2 0013	1 7602	9.1780	5.9942	11 9379
Min	0 24%	0 24%	0 83%	0 28%	0 28%	0 40%
Max	1900 00%	1900 00%	1307 02%	8682 48%	4880 00%	8682 48%

*The ratio of the offer price of SEO to that of IPO is significantly higher for combined share IPOs than for primary share IPOs

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CERTIFICATE OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this thesis, that the original work is my own except as specified in acknowledgments or in footnotes, and that neither the thesis nor the original work contained therein has been submitted to this or any other institution for a degree

..... (Signed)

6 Oct 2009 (Date)