UNDERPRICING AND THE LONG-RUN PERFORMANCE OF INITIAL PUBLIC OFFERINGS (IPOs) IN THE U.K.

A thesis submitted for the degree of Doctor of Philosophy

by

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ABSTRACT

The underpricing and long–run underperformance of initial public offerings (IPOs) of common stock are well documented anomalies. The aim of this thesis is to examine why these two anomalies occur. For this purpose we employ a sample of 653 U.K. IPOs listed in the Main Market (official list) and the Unlisted Securities Market (USM) during the period 1984–1992. The thesis has been primarily motivated by the fact that there are not many comprehensive studies examining these anomalies for IPOs in the U.K., particularly with regards to IPOs obtaining a quotation on the official list.

We begin the thesis by examining the initial and aftermarket performance of IPOs. In line with previous studies, we find that the IPOs in our sample are underpriced on average by 10.42%. To assess long–run performance after the initial offering we employ the cumulative return and the buy and hold return measures. We compute IPO abnormal returns relative to two market indexes by using three different models: (1) the market–adjusted model, (2) Ibbotson's (1975) RATS model and (3) the Fama and French (1993) three factor asset pricing model. We find that new offerings perform poorly in the long–run. A one pound investment in IPOs is worth less than 90 pence after three years.

The thesis continuous by investigating the causes of underpricing. We examine the underpricing anomaly from several angles. First, we test the hypothesis that IPOs produce positive short–run returns because of the *ex ante* uncertainty surrounding their post–issue value. Employing OLS regression analysis, we find the influence of *ex ante* uncertainty on the level of initial returns to be rather weak. Second, we examine whether issuers intentionally underprice their IPOs in order to signal firm quality. The empirical findings, however, obtained through logit and OLS regression analysis, provide limited evidence in support of this signalling hypothesis. Third, we investigate whether new issues are deliberately underpriced in the IPO premarket. For this purpose we employ the stochastic frontier model pioneered by Aigner *et al.* (1977). Although we find that IPOs are deliberately underpriced in the premarket, we fail to establish a significant relation between premarket and initial underpricing. Lastly, we evaluate the underwriter price support hypothesis, which posits that the high IPO initial returns are the result of aftermarket inefficiencies. We find, however, on the basis of statistical analysis and Tobit analysis, that this hypothesis cannot explain away positive first day returns.

Overall, the results presented in the current thesis point to the conclusion that newly listed firms generate positive returns in the short–run and negative returns in the long–run because they are initially overvalued by optimistic investors.

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INTRODUCTION

Each year many firms in different countries approach the capital market to make an initial public offering (henceforth:IPO). The process of going public is associated with several anomalies the most well known of which is the underpricing phenomenon: in the primary market firms sell their shares below the prices investors appear willing to pay when the stocks start trading in the secondary market. The level of underpricing varies substantially from one market to another with IPOs in industrialised markets being more fully priced than IPOs in emerging capital markets [Ibbotson and Ritter (1995)]. In recent years, academic researchers focused their attention on the long-run performance of newly listed firms. The evidence which has emerged from several studies is that during the first few years of their public listing IPOs significantly and economically underperform comparable benchmarks [Loughran *et al.* (1994)]. Finally, there is evidence that there are cycles in both the number of companies going public and the magnitude of underpricing [Ibbotson *et al.* (1988, 1994)].

The underpricing and long-run underperformance of newly listed firms are of great interest because both anomalies have several implications on all those involved in IPOs. First, to issuing firms. Underpricing increases the costs of making an IPO because, in addition to the direct costs incurred in going public, issuers raise less capital than is warranted by the true value of their assets. Moreover, if IPOs underperform in the long-run, issuers suffer an opportunity cost of low returns on the shares they retain. Second, to primary market investors. If new offerings are offered at a discount, investors fortunate enough to buy shares at the offering price will be able to earn significant abnormal returns by selling them once trading begins in the secondary market. In addition, the tendency of IPOs to perform poorly in the long–run will discourage primary market investors from holding shares beyond the first days of trading. Third, to secondary market investors. If new offerings systematically and consistently underperform in the long–run, investors who were not able to buy shares at subscription will not be keen to invest in IPOs but would rather seek alternative investments. Fourth, to underwriters. If underwriters price IPOs above their true market values, subscribers might reject an offering because they would receive an inferior return. Subscribers, moreover, will not be willing to invest in IPOs priced by underwriters having a record of overpriced issues. If, on the other hand, underwriters price new offerings too low, thereby depriving issuers the full advantage of their ability to raise external equity capital, potential issuers may not be keen to go public. Finally, to academics. The ability of investors to earn significant abnormal returns, as well as the tendency of new offerings to produce nonzero returns in the long–run, raise questions as to the informational efficiency of the market for IPOs.

Within the finance and economics literature several theories have been put forward to explain the underpricing puzzle but none taken alone has been so far sufficient to account for this anomaly. Most of these theories imply that underpricing is undertaken deliberately, for one reason or another, by the issuers or the underwriters involved in IPOs. More specifically, Baron (1982) suggests that IPOs are intentionally underpriced by underwriters who want to ensure that the whole issue is sold. Rock (1986) argues that issuers offer their shares at a discount in order to attract uninformed investors in the IPO market. Tinic (1988) and Hughes and Thakor (1992) note that underpricing is viewed by issuers and underwriters as a form of insurance against legal suits. Benveniste and Spindt (1989) suggest that underwriters deliberately set the offer price too low in order to compensate investors who truthfully reveal to them information regarding the level of demand for an issue. Allen and Faulhaber (1989), Grinblatt and Hwang (1989) and Welch (1989) argue that issuers use underpricing as a signal of firm value. Booth and Chua (1996) and Brennan and Franks (1997) suggest that IPOs are deliberately offered at a discount by the issuers because they want to develop a broad ownership dispersion and a liquid secondary market for their shares. In contrast, other academic researchers suggest that new offerings are correctly priced, but because of aftermarket inefficiencies caused by underwriters, positive returns are generated once trading begins [Schultz and Zaman (1993), Ruud (1993) and Hanley *et al.* (1993)]. Finally, underpricing may be the result of the *ex ante* uncertainty surrounding the true value of new issues [Beatty and Ritter (1986)] or, as Mauer and Senbet (1992) note, it may be the result of the market for IPOs being partially segmented.

As with the underpricing anomaly, although a few explanations have been advanced to account for the poor performance of IPO firms in the long–run, no sufficient reason for this anomaly has yet emerged. Some of these explanations are based on methodological and statistical challenges, such as the choice of methodology [Conrad and Kaul (1993) and Barber and Lyon (1997)], the choice of benchmark [Dimson and Marsh (1986)] and the adjustment for time–varying systematic risk [Clarkson and Thompson (1990)]. Other academic researchers argue that newly listed firms generate low returns in the long–run because the market for IPOs is subject to mean reverting fads: new offerings are initially overvalued by optimistic investors who subsequently revise their expectations and as a result secondary market prices decline [Miller (1977) and Daniel *et al.* (1998)]. Ritter (1991) and Loughran and Ritter (1995) claim that IPOs perform poorly in the aftermarket because issuing firms time their flotation and choose to go public when investors are willing to overpay for their equity. Lastly, Brav and Gompers (1997) show that IPO firms which are venture capital backed do not underperform in the long–term.

The U.K. new issues market is one of the largest in the world. Over the last twenty years several studies have presented evidence that IPOs in the U.K. are not efficiently priced in the primary market, and that the level of underpricing tends to vary between 10% and 15% [Davis and Yeomans (1976), Buckland *et al.* (1981), Jenkinson and Espenlaub (1991) and Espenlaub and Tonks (1998)]. Despite these findings, however, and inspite of the magnitude of the U.K. IPO market, the empirical research undertaken by academics aiming to explain the underpricing puzzle in this country is relatively limited. Moreover, although in many countries the long–run performance of newly listed firms has received enormous attention by academic researchers, the price behaviour of British initial offerings in the long–term, to the best of our knowledge, has only been evaluated twice [Levis (1993) and Espenlaub *et al.* (1998)]. This thesis sets out to contribute additional evidence regarding the aftermarket performance of IPO firms in the U.K., and aims to provide sufficient explanations as to why new issues generate positive returns in the short–run and negative returns in the long–run. For these purposes, we employ a sample of 653 U.K. IPOs, offers for sale at a fixed price and placements, listed in the Main Market and the Unlisted Securities Market (henceforth:USM) from 1984 to 1992.

The thesis is organised as follows:

In chapter 1, we first present a review of the international evidence on short–run underpricing and long–run underperformance. The review includes markets in North and South America, Europe, the Middle East, Africa and the Asia Pacific region. A brief discussion on the possible reasons which may account for the two anomalies concludes the chapter.

Chapter 2 examines the initial and long–run performance of IPOs. Consistent with previous studies, we find a mean underpricing, measured as the percentage increase from the offer price to the closing price on the first trading day, of 10.42%. To analyze long–run performance after an IPO we employ the cumulative return and the buy and hold return measures. We compute IPO abnormal returns using three different models: (1) the market–adjusted model, (2) the RATS (Returns Across Time and Securities) model pioneered by Ibbotson (1975) and (3) the Fama and French (1993) three factor model. We find that IPO firms are poor long–run investments. Three years after the IPO, and exclusive of the initial return, newly listed firms significantly and economically underperform two benchmarks. The extent of underperformance varies between 12% and 34% depending on the choice of measure, benchmark and the model employed in calculating abnormal returns. We conclude the chapter by examining whether there is a direct relation between the individual characteristics of IPOs and long–run performance. We find that new issues listed in the Main Market or via an offer for sale at a fixed price perform better in the aftermarket than IPOs floated in the USM or through a placing. More importantly, however, we find that IPOs with the highest initial returns tend to be among the worse long–run performers.

Having identified the magnitude of initial returns, the thesis then focuses in explaining why this anomaly occurs. Two hypotheses regarding the underpricing phenomenon are examined in chapter 3. First, following Beatty and Ritter (1986), we examine whether underpricing is the result of the *ex ante* uncertainty surrounding the post–issue value of IPOs. Because *ex ante* uncertainty cannot be measured directly, we use eight proxies, the proportion of equity retained in the firm, post–flotation, by pre–offering shareholders, the size of issue, the market of flotation, the method of flotation, a firm's annual sales revenue in the most recent 12–month period before going public, a firm's variation of earnings three years immediately prior to flotation, the quality of the auditor involved with the issue and the quality of the underwriter involved with the issue, as measures for *ex ante* uncertainty. We test for a relation between these proxies and underpricing by using statistical, correlation and OLS regression analysis respectively. We find, however, that only two of the selected proxies significantly reduce the level of initial returns, and therefore conclude that the effect of this hypothesis on the short–run performance of IPOs is rather weak. Second, following Allen and Faulhaber (1989), Grinblatt and Hwang (1989) and Welch (1989), we examine whether issuers deliberately underprice their IPOs in order to signal firm value. Although some of our empirical results, estimated through logit and OLS regression analysis, are in line with the predictions of the signalling models, when our findings are viewed in their entirety, the support for the signalling by underpricing hypothesis is not overly strong.

In chapter 4, we examine whether, and by how much, IPOs are deliberately underpriced in the premarket, prior to an IPO being floated, and whether such underpricing is related in any way to the actual level of initial returns. Testing for deliberate underpricing in the IPO premarket is achieved by employing the stochastic frontier model developed by Aigner *et al.* (1977), whereas the proportion by which IPOs are deliberately underpriced is computed using the methodology advanced by Jondrow *et al.* (1982). Although we find that IPOs are deliberately underpriced in the premarket, sometimes by as much as 8%, we find that such underpricing cannot explain away the abnormalities in aftermarket returns.

In chapter 5, we test the price stabilisation hypothesis advanced by Schultz and Zaman (1993), Ruud (1993) and Hanley *et al.* (1993), which posits that IPOs generate positive returns in the short–run because underwriters intervene and support aftermarket prices. We examine the effect of price stabilisation on the magnitude of initial returns by utilizing statistical, migration and Tobit analysis respectively. Our findings, however, show that underwriter price support has, at best, a minor impact on the level of first day returns.

Finally, chapter 6 summarizes and concludes the thesis, and offers suggestions for further research.

Having investigated the above issues, the thesis contributes to the financial research literature on several areas. First, it provides indirect evidence that new issues may be initially overvalued by optimistic investors. This result casts doubts on the conventional wisdom that IPOs are, in fact, underpriced, and calls into question the explanatory power of theories which suggest that newly listed firms are deliberately offered at a discount by the issuers or the underwriters involved with IPOs.

The second main contribution of the thesis deals with the *ex ante* uncertainty hypothesis. Unlike previous studies, we examine whether the market of introduction influences the effectiveness of the proxies used as measures for *ex ante* uncertainty.

Two conclusions emerge: (1) the evidence in support of this hypothesis is essentially weak across both listing markets and (2) the auditors involved with new offerings can reduce the level of *ex ante* uncertainty (underpricing) for IPOs listed in the USM, but not for IPOs obtaining a full listing. Moreover, this thesis employs for the first time for U.K. IPOs, to the best of our knowledge, the market and method of flotation as proxies for *ex ante* uncertainty. We show that offers for sale at a fixed price are significantly associated with lower levels of underpricing than placements, and this is true for the entire sample of IPOs and for new offerings listed in the Main Market and the USM separately.

Third, the thesis contributes additional evidence regarding the aftermarket performance of IPOs. Unlike most prior studies, which compute abnormal returns by adopting a simple zero–one model, we evaluate long–run performance by considering several factors which may have a role in explaining the cross–section of expected returns. We find, however, that the magnitude of underperformance becomes even worse when abnormal returns are calculated after taking into account factors such as firm size and book–to–market equity.

Fourth, although the stochastic frontier model of Aigner *et al.* (1977) has been frequently employed by academic researchers examining the efficiency of Banking institutions [Ferrier and Lovell (1990), Mester (1993) and Berger and DeYoung (1996)], it has only been applied once for IPOs [Hunt–McCool *et al.* (1996)]. This thesis applies the stochastic frontier methodology on new issues for only the second time, and for the first time for IPOs in the U.K. (to the best of our knowledge). The main empirical result to emerge from the application of the stochastic frontier model on newly listed firms, is that the market for IPOs is not only dominated by high levels of initial returns, but also by high levels of deliberate premarket underpricing.

Lastly, the thesis examines for the first time for British initial offerings, to the best of our knowledge, whether underwriter price support has any significant impact on the level of short–run returns. Contrary to U.S. findings, however, the price stabilisation hypothesis cannot explain away positive initial returns for U.K. IPOs.

CHAPTER 1

"UNDERPRICING AND THE LONG-RUN PERFORMANCE OF IPOs: AN OVERVIEW."

1.1. Introduction.

Each year many firms approach the capital market to issue equity for the first time. Despite the fact that the motivations for going public vary from one firm to another, and despite the possible drawbacks associated with a Stock Exchange quotation[1], the issuing process represents one of the most important events in the life of independent companies. Quotation of equity on the Stock Exchange is necessary for several reasons. First, firms obtain the ability to raise additional capital from external sources easier, cheaper and more successful. Institutions will be more willing to subscribe to new equity because they know they can, if they wish, dispose of it on the market. Once quotation has been achieved, further issues can be made at a fraction of the costs of the initial flotation. The issue of fixed interest stock becomes a practicable alternative to equity or other borrowing and it may be possible to negotiate finer terms on bank loans. Second, realisation of wealth. Going public is a route which offers existing shareholders the opportunity to sell some or all of their holdings, which otherwise would be locked up in the equity of the company, thus turning their assets into cash which can be used to diversify their wealth. Third, marketability. The orderly trading provided by the Exchange's markets ensures that a fair price is struck for the shares to become more attractive to investors. Its increased marketability ensures that the multiples applied to the earnings of a public company are often higher than those of a similar private company, resulting in a higher valuation. Fourth, visibility and

[1] There are several disadvantages associated with the decision to go public. First, Stock Exchange quotation requires the disclosure of information about the firm. The quantity of information and the frequency of reporting is increased and this imposes additional costs to the issuing firm in the form of information collection and auditing. Second, the firm is vulnerable to the threat of takeover. Third, investor pressure may result in company policies being altered and as a result managers may find themselves with less room for manoeuvre, in terms of investment policy, than is the case in a private company.

status. The initial flotation of a firm and the ongoing Stock Exchange requirements for the publication of information necessarily mean that a firm becomes more visible to the public. The attention drawn to the company may increase awareness of its attractions as a business. Furthermore, a public company is generally regarded by its customers, creditors and suppliers as having a higher standing than a private company.

The pricing of newly listed firms is a difficult task mainly because most of these firms have little or no operating history. A large body of empirical literature has developed in recent years showing that the market has a great deal of difficulty in valuing IPOs appropriately. More specifically, IPOs are mainly associated with two anomalies: (1) they are systematically priced at a discount to their subsequent trading price and (2) in the long–run they tend to underperform comparable benchmarks. It is the objective of this chapter to provide a review of the international evidence on the post–listing price behaviour of IPOs.

The chapter is organised as follows. In section 1.2 we present the results of research on short–run underpricing and long–run performance. Possible explanations as to why both anomalies occur are evaluated in sections 1.3 and 1.4. Concluding remarks are presented in section 1.5.

1.2. The international evidence on IPOs.

Table 1.1 presents a summary of previous research on the initial and aftermarket performance of newly listed firms. The empirical evidence on IPOs accumulated during the last twenty five years reveals a consistent pattern of underpricing across different markets and time periods. Underpricing, measured by the initial return on the stock between the offer date and the first period of trading, varies considerably from one market to another with IPOs in emerging financial markets being more heavily underpriced than IPOs in industrialised markets. For example, the average abnormal initial return for new issues in Britain and the U.S. tends to be around 15% [Levis (1993) and Ibbotson *et al.* (1994)], whereas in Malaysia and China IPOs are underpriced on average by an extraordinary 166.60% and 948.59% respectively [Dawson (1987) and Su and Fleisher (1997)]. Institutional and regulatory constraints and the differences in the characteristics of IPOs are possible explanations as to the variation of underpricing across different markets [Loughran *et al.* (1994)].

Regarding the performance of IPOs in the aftermarket, although some academic researchers find that new issues generate positive abnormal returns in the long–run [McDonald and Jacquillat (1974), Dawson (1987) and Kiymaz (1997)], most studies show that IPOs significantly underperform in the first few years of their public listing[2]. As with underpricing, the magnitude of underperformance varies substantially from one

[2] Several academic researchers show that long–run underperformance is not a unique characteristic of IPOs of equity, but is a pervasive feature found in all common stock offerings. For example, Weiss (1989) finds that 64 U.S. IPOs of closed–end funds that went public from 1985 to 1987 significantly underperform a sample of other IPOs matched by size by 15.05% by the end of the first six months of seasoning. Spiess and Affleck–Graves (1995) report a three year cumulative adjusted return of –23.15% for 1247 U.S. seasoned offerings made between 1975–1989. Loughran and Ritter (1995) report similar results for seasoned equity offerings issued from 1970 to 1990.

market to another. This, however, may be partly attributed to the fact that the aftermarket performance of IPOs in different markets is evaluated for different time periods ranging from a few months to a few years. As shown in table 1.1, U.S. IPO firms tend to perform worse in the long–run than initial offerings in most emerging capital markets. Loughran (1993) and Loughran and Ritter (1995), for example, find that IPOs issued between 1967 and 1990 underperform comparable benchmarks in the long–run by more than 50%. Severe aftermarket underperformance is also reported for IPOs in Austria, South Africa, Brazil and Australia [Aussenegg (1997), Page and Reyneke (1997), Aggarwal *et al.* (1993) and Lee *et al.* (1996)].

Most of the studies examining the long–run performance of IPO firms suffer from two drawbacks. First, as Loughran *et al.* (1994) note, they are based on very small sample sizes. Second, they estimate aftermarket abnormal returns without explicitly adjusting for systematic risk. In the next chapter of the thesis, we examine the performance of U.K. IPOs in the long–run using a large dataset comprising of 653 new issues. Moreover, unlike most prior studies, we compute long–run abnormal returns after adjusting for systematic risk, as well as for other factors which may account for the cross–section of expected returns such as size and book–to–market equity.

Table 1.1: summary of previous studies on the initial and long-run performance of IPOs.

Country	Study	Sample period	Sample size	Initial return (%)	Long-run return (%)
U.S.A.	McDonald & Fisher (1972)	1969	142	28.50	−18.50
U.S.A.	Bear & Curley (1975)	1969	140	12.90	−25.30
U.S.A.	Block & Stanley (1980)	1974–78	102	5.96	−3.06
U.S.A.	Aggarwal & Rivoli (1990)	1977–87	1598	10.67	−13.73
U.S.A.	Ritter (1991)	1975–84	1526	14.32	−29.13
U.S.A.	Loughran (1993)	1967–87	3656	———	−58.94
U.S.A.	Ibbotson *et al.* (1994)	1960–92	10626	15.26	———
U.S.A.	Loughran & Ritter (1995)	1970–90	4753	———	−50.70
U.S.A.	Affleck–Graves *et al.* (1996)	1975–91	2096	9.96	−7.56
U.S.A.	Carter *et al.* (1998)	1979–91	2292	8.08	−19.92
Canada	Jog & Riding (1987)	1971–83	100	11.00	———
Brazil	Aggarwal *et al.* (1993)	1980–90	62	78.50	−47.00
Mexico	Aggarwal *et al.* (1993)	1987–90	44	2.80	−19.60
Chile	Aggarwal *et al.* (1993)	1982–90	36	16.30	−23.70
U.K.	Davis & Yeomans (1976)	1965–71	275	10.60	———
U.K.	Buckland *et al.* (1981)	1965–75	297	9.70	———
U.K.	Jenkinson & Trundle (1990)	1985–89	227	11.90	———
U.K.	Jenkinson & Espenlaub (1991)	1985–89	357	15.04	———
U.K.	Levis (1993)	1980–88	712	14.30	−11.38
U.K.	Espenlaub *et al.* (1998)	1985–92	588	———	−16.02
U.k.	Espenlaub & Tonks (1998)	1986–91	428	12.20	———
France	McDonald & Jacquillat (1974)	1968–71	31	3.03	15.60
France	Jacquillat *et al.* (1978)	1966–74	60	4.09	10.69
France	Husson & Jacquillat (1989)	1983–86	131	4.00	———
France	Leleux & Paliard (1996)	1983–91	108	14.30	−9.42
Germany	Uhlir (1989)	1977–87	97	21.50	−7.41
Germany	Wasserfallen & Whittleder (1994)	1961–87	92	17.58	———
Germany	Schuster (1996)	1988–92	88	9.73	−14.13

Table 1.1 continued.

Country	Study	Sample period	Sample size	Initial return (%)	Long-run return (%)
Germany	Ljungqvist (1997)	1970–93	189	10.57	–12.10
Germany	Steib & Mohan (1997)	1988–95	103	6.81	–9.50
Switzerland	Kunz & Aggarwal (1994)	1983–89	42	35.80	–6.10
Austria	Aussenegg (1997)	1984–96	67	6.50	–73.90
Finland	Keloharju (1993)	1984–89	80	8.70	–26.40
Netherlands	Wessels (1989)	1982–87	46	5.10	———
Greece	Papachristou (1995)	1990–92	42	57.49	———
Greece	Kazantzis & Levis (1995)	1987–91	79	53.32	–8.50
Greece	Kazantzis & Thomas (1996)	1987–94	129	51.73	———
Turkey	Kiymaz (1997)	1990–95	138	13.60	44.10
Turkey	Ozer (1997)	1989–94	89	12.24	———
Sweden	Bergstrom *et al.* (1995)	1970–91	160	33.57	———
Sweden	Rydqvist (1997)	1980–94	249	34.13	———
Israel	Kundel *et al.* (1997)	1993–94	28	4.50	———
South Africa	Page & Reyneke (1997)	1980–91	118	32.70	–63.45
Nigeria	Ikoku (1998)	1989–93	63	19.10	–14.60
Australia	Finn & Higham (1988)	1966–78	93	29.20	–6.52
Australia	How & Low (1993)	1979–89	523	16.10	———
Australia	Lee *et al.* (1996)	1976–89	266	16.41	–51.25
Korea	Kim *et al.* (1993)	1980–90	177	57.54	———
Japan	Dawson & Hiraki (1985)	1979–84	114	51.90	———
Japan	Jenkinson (1990)	1986–88	48	54.70	———
Japan	Packer (1996)	1989–91	158	13.90	———
Thailand	Wethyavivorn & Koo–Smith (1991)	1988–89	32	68.69	–3.02
Singapore	Dawson (1987)	1978–83	39	39.40	–2.70
Singapore	Saunders & Lim (1990)	1987–88	17	45.40	———
Singapore	Hameed & Lim (1998)	1993–95	53	25.94	———
Hong–Kong	Dawson (1987)	1978–83	21	13.80	–9.30
Hong–Kong	McGuinness (1993)	1980–90	92	16.59	–4.60

Table 1.1 continued.

Country	Study	Sample period	Sample size	Initial return (%)	Long-run return (%)
China	Su & Fleisher (1997)	1986–96	308	948.59	———
Malaysia	Dawson (1987)	1978–83	21	166.60	18.20
Malaysia	Ariff *et al.* (1995)	1968–93	111	97.11	———

1.3. Explanations as to the underpricing of IPOs.

1.3.1. The investment banker's monopoly power hypothesis.

A possible reason for underpricing might be the monopoly power the investment banker enjoys over the issuing firm. What this hypothesis assumes, is that there is a lack of competition among investment bankers, and this fact alone gives them a strong position to negotiate with the issuer who has to depend on them. Given that investment bankers have contacts with their clients, and since they have more experience than the issuing firm, they can impose unfavourable conditions for the issuer. A monopolistic investment banker can use his power to increase both, the degree to which the offer price is set below its intrinsic value, as well as the spread between the offer price and the bid price (the underwriters' spread). Investment bankers with monopoly power may have the incentive to underprice since by doing so they can minimize their underwriting risk, by increasing the probability of selling the entire issue to outside investors, while at the same time earning a high investment banking spread on the issue.

A different monopoly power based argument is given by Baron (1982). Baron presents a model in which underpricing is the result of imperfect information between the IPO participants. Since information regarding the issuing firm's value and potential demand for the issue is not evenly distributed among the issuing firm, investors and the underwriter, and assuming that the underwriter is more informed, Baron suggests that investment bankers have an incentive to save resources on distribution and search by underpricing enough to ensure that the whole issue is sold. In sharp contrast to the predictions of Baron's model, however, Muscarela and Vetsuypens (1989) and Cheung and Krinsky (1994) find that when investment banking firms go public, their IPOs are underpriced by as much as other offerings[3].

An implication of the monopoly power hypothesis advanced by Baron is that issuing firms could learn that they are being exploited and, assuming that competition exists, could switch to other underwriters. Beatty and Ritter (1986) examine this monopoly power effect, that is, they test whether underwriters who underprice heavily in one period lose business from IPO firms in the next period. To test this hypothesis, Beatty and Ritter examine the changes in the market shares of 49 U.S. underwriters from one time period, 1977–1981, to the subsequent time period, 1981–1982. They find that the more an underwriter underpriced in one period, the greater his loss of business in the next, a result which implies that monopoly power, at best, is temporary.

1.3.2. The winner's curse model and the *ex ante* uncertainty hypothesis.

Rock (1986) presents a model in which underpricing is directly related to the level of information asymmetries in the IPO market and to the costs of collecting information. In Rock's model there are two types of investors, informed and uninformed, and two types of IPOs, good and bad. Informed investors collect information about all issues and hence know in advance whether an offering is good or bad. On the other hand, uninformed investors have no idea whatsoever about the quality of an issue. Within this context, an informed investor will only bid for those issues that he knows are good,

[3] Within Baron's framework, Tonks (1996) develops a model in which underpricing results from a sequential equilibrium in the bargaining game between the issuer and the underwriter over the type of contract under which the IPO is sold. One implication of this model is that new issues are more heavily underpriced during boom periods, that is, in periods during which the underwriter minimises the amount of marketing effort exerted in the IPO. Tonks tests this proposition using data on 936 U.K. IPOs issued during 1980–1993 and presents results which are in line with it.

whereas an uninformed investor will bid randomly across all issues, good and bad. Given that a good issue attracts both informed and uninformed bidders, it is likely that the issue will be oversubscribed and as a result all bidders will receive fewer shares than they bid for. When the issue is bad, however, the only bidding will come from the uninformed investors. Given that informed investors do not bid, the issue is not likely to be oversubscribed and as a result the uninformed investor will most likely receive his full allotment. This means that the uninformed investor suffers from the problem of the winner's curse: he receives a small proportion of shares for good IPOs and a large proportion of shares for bad IPOs. Rock suggests that because of the winner's curse, newly listed firms must be underpriced on average so as to produce an expected return for the uninformed bidder that is high enough to attract investment in IPOs irrespective of whether the issue is good or bad[4].

Koh and Walter (1989) examine Rock's model using a sample of 66 IPOs that went public in Singapore over the period 1973–1987. They find that 90% of the new issues in Singapore are oversubscribed and that rationing is applied far more stringently in underpriced than in overpriced issues. Koh and Walter interpret their results as being consistent with Rock's theory. Levis (1990) examines whether the underpricing of U.K. IPOs can be explained away by the combined effect of the winner's curse problem and

[4] Keasy and Short (1992) suggest that Rock's model might be inappropriate for explaining the underpricing phenomenon because of its reliance on a number of unclear assumptions, and because it produces propositions which are largely untestable. For example, while Rock assumes that informed and uninformed investors exist, he does not specify how to distinguish the one set of investors from the other. Furthermore, the most important test of Rock's model involves examining the degree to which shares are rationed. However, the institutional arrangements in most countries prevent such information from being publicly disclosed. Arguments against Rock's winner's curse model are also presented by Ruud (1993). She notes that underpricing to attract uninformed investors is not necessary, given that several studies have reported extensive oversubscription [Ibbotson and Jaffe (1975) and Benveniste and Spindt (1989)]. She also notes, however, that oversubscription might have occurred because uninformed investors have been attracted.

the specific settlement mechanism of the London Stock Exchange which imposes an additional cost, interest rate charge, on both informed and uninformed investors[5]. Using a sample of 123 IPOs (offers for sale at a fixed price) issued from 1985 to 1988, Levis finds that the resulting interest rate cost is increasing exponentially with the degree of oversubscription of an issue. Although Levis concludes that the combination of winner's curse and interest rate cost can, except in small and large issues, explain away a great part of underpricing, these factors cannot account for the positive initial returns in placements which, as shown by several academic researchers [Jenkinson (1990), Levis (1993) and Espenlaub (1996)], are much more heavily underpriced than offers for sale at a fixed price. Placements are normally offered to a large group of institutional (informed) investors and there can be no winner's curse like allocational bias.

Within the framework of Rock's winner's curse theory, Beatty and Ritter (1986) suggest that the greater the uncertainty surrounding the post–issue value of IPO shares, the greater the advantage to becoming an informed investor, and therefore the higher the level of initial returns required to attract uninformed investors into the market. This implies that as *ex ante* uncertainty increases, the winner's curse problem becomes more intense. Based on this argument, Beatty and Ritter propose that "the greater is the *ex ante* uncertainty about the value of an issue, the greater is the expected underpricing."

[5] The London Stock Exchange requires, upon application, a payment for the full amount subscribed rather than for the shares actually received. If an issue is oversubscribed, an investor is more likely to receive fewer shares than he applied for. As a result, an applicant has paid a considerable amount of money for shares that he failed to acquire. Any difference between the value of the application and the amount of shares actually received is settled through a cheque, which is normally posted to investors a day prior to the flotation of the shares. In order to finance his application, however, an investor may borrow money, in which case interest rate costs are incurred, or he may use excess cash, in which case interest rate earned in a deposit account is lost.

Several studies examine whether the hypothesis put forward by Beatty and Ritter can account for the observed magnitude of initial returns. Because *ex ante* uncertainty cannot be measured directly, academic researchers use several proxies as substitutes. Although a multitude of variables have been employed to test this hypothesis, a growing body of literature shows that the level of *ex ante* uncertainty (underpricing) is significantly lower for offerings in which: (1) high quality underwriters are appointed to market the firm's securities [Neuberger and LaChapelle (1983), Johnson and Miller (1988), Chishty *et al.* (1996) and Carter *et al.* (1998)], (2) high quality auditors are appointed to provide an auditor's opinion in the registration documents [Balvers *et al.* (1988), Beatty (1989) and Michaely and Shaw (1995)] and (3) venture capitalists back the IPO [Barry *et al.* (1990) and Megginson and Weiss (1991)].

For U.K. IPOs, to the best of our knowledge, the *ex ante* uncertainty hypothesis has only been evaluated twice [Keasy and Short (1991) and Holland and Horton (1993)]. Both of these studies are based on a similar dataset, USM offerings issued via a placing between 1984–1988 and 1986–1989 respectively, and find weak evidence in support of the proposition of Beatty and Ritter. It is possible, however, that the failure of both studies to establish a positive relation between *ex ante* uncertainty and underpricing may be due to the fact that inappropriate proxies have been chosen to test this hypothesis, and as a result other more important variables have been omitted. In chapter 3 of the thesis, we re–examine this hypothesis using a different dataset, which comprises of IPOs issued on both the Main Market and the USM, as well as a few different proxies as measures for *ex ante* uncertainty. Moreover, unlike any other prior study, we examine whether the market of introduction can influence the effectiveness of the proxies used.

1.3.3. The lawsuit avoidance hypothesis.

Another reason why underwriters might underprice IPOs is the fear of potential legal problems stemming from overpriced issues. Company directors and underwriters have to exercise due diligence to ensure that there are no misleading information in the prospectus they offer to investors. Investors who end up holding IPOs which have failed to produce positive initial returns might have the incentive to sue, either the underwriter or the company directors, on the grounds that they have deliberately published inaccurate or incomplete information in the prospectus. Ibbotson (1975) suggests that even if errors or misstatements appear in the prospectus, they are not likely to lead to legal claims if the issue is underpriced. In this sense, underpricing is seen by underwriters and issuing corporations as a form of insurance against legal suits[6].

Tinic (1988) is the first to develop a theory as to the relation between underpricing and the lawsuit avoidance hypothesis. Central to Tinic's theory is the Securities Act of 1933 which imposed stringent civil liability provisions. Tinic argues that the very high risks and costs of litigation associated with the Securities Act of 1933 are what have created incentives for underwriters and/or issuers to underprice their offerings. Under this hypothesis, U.S. IPOs issued prior to 1933 should have been priced more fully than IPOs issued after 1933. Tinic investigates this hypothesis and presents evidence which

[6] This hypothesis cannot explain the underpricing phenomenon in the U.K. This is because the Companies Act of 1985 protects to an extraordinary level all those involved in an IPO. Specifically, the defences which may be used against claims for damages, as stated by the Companies Act of 1985, are:"(1) the defendant was unaware of any matter not disclosed; (2) the defendant honestly and mistakenly failed to comply with or contravened the disclosure requirements; or (3) the failure to comply or the contravention was in regard to an immaterial matter or aught, in the opinion of the court, reasonably to be excused."

is consistent with it. Hughes and Thakor (1992) present a model in which IPOs are underpriced because two types of underwriters, myopic and non–myopic, exist. Given that the new issues market is dominated by information asymmetries, myopic underwriters, who are only concerned about short–term profits, use their superior information to price IPOs above their true market value. On the other hand, non–myopic underwriters are concerned about both, short–term profits and the long–run litigation costs which may arise. Given that myopic underwriters deliberately overprice their IPOs, non–myopic underwriters are forced to underprice some of their offerings. Hughes and Thakor note that the IPOs most likely to be underpriced are those offerings with high risk (high variance). Less risky IPOs are not underpriced, given that for low risk stocks there is less uncertainty and the risk of future lawsuits is smaller. This behaviour of underwriters will result in IPOs being on average below their fundamental values[7].

Drake and Vetsuypens (1993) examine 93 U.S. IPOs which were sued for alleged misstatements in the offering prospectus over the period 1969–1990, and find that these IPOs were underpriced by as much as other offerings which did not subsequently get sued. They conclude that legal action is not triggered by a poor first day price performance, but rather by news of the deterioration of a firm's financial condition in the secondary market long after the IPO. The findings of Drake and Vetsuypens, as well as the fact that IPOs are underpriced in countries where securities lawsuits are unknown, suggest that this legal liability hypothesis is, at best, a minor reason for the underpricing anomaly.

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[7] Within the framework of the lawsuit avoidance hypothesis, a model is also presented by Hensler (1995). The Hensler model simply assumes that the offering price is set by the issuer, and if the IPO is overpriced the entrepreneur is subject to litigation costs.

1.3.4. The signalling hypothesis.

Welch (1989), Grinblatt and Hwang (1989) and Allen and Faulhaber (1989) develop several models in which insiders of high quality firms use underpricing as a signal of firm value. Insiders view underpricing as a cost to be borne for attracting outside investors. The higher the quality of a firm, good issue, the more it will be underpriced relative to a bad issue and as a result the larger the implied loss in gross proceeds per share. Once, however, high quality firms have attracted outside investors, through their underpricing policy, investors will collect information about the firm and, in the secondary market, establish its true value above its offer price. Insiders can benefit from this strategy because once the quality of the firm is revealed in the aftermarket, they can approach the market for a Seasoned Equity Offering (henceforth:SEO) at the higher market price. Thus, the costs or losses of underpricing their IPO are offset by the benefits of cashing in on the secondary offerings. Consequently, owners of high quality firms retain a larger proportion of firm shares at the IPO which can be sold later at a higher price that more closely reflects the firm's true value as signalled by underpricing. On the other hand, a low quality firm, bad issue, will want to price its IPO as close to its true market value as possible, given that once investors discover the quality of the firm in the secondary market, its stock's price will decline. Hence, insiders of low quality firms cannot deliberately underprice their offerings because they will not be able to recoup their losses with subsequent offerings.

Although the empirical studies examining the signalling theory report mixed results, the evidence in support of this hypothesis is not overly strong. For the U.S., Jegadeesh *et al.* (1993) test several implications of the signalling models for 1985 IPOs issued from 1980 through 1986. Although some of their results are in line with the predictions of these models, they find, contrary to the signalling theory, that IPO firms are more likely to make a SEO and reissue equity sooner and in larger amounts the higher their aftermarket return. Slovin *et al.* (1994) analyze the relation between underpricing and the market reaction to a seasoned offering announcement for 175 firms that had an IPO during 1973–1988. Consistent with the predictions of the signalling theory, they find that underpricing mitigates the negative share price response at the SEO[8]. On the contrary, Garfinkel (1993), Michaely and Shaw (1994) and Spiess and Pettway (1997) find that the signalling hypothesis is not an important determinant of IPO underpricing. For the U.K., Jenkinson (1990) examines the relation between initial returns and the probability of a seasoned offering for 197 new issues that went public from 1985 to 1989. He finds, however, that very few of the sample firms, 9%, reissue equity by the end of 1989. Using a sample of 713 IPOs listed during 1980–1988, Levis (1995) investigates several predictions of the signalling theory. In support of IPO signalling, he finds that heavily underpriced firms approach the market for a SEO sooner than IPOs which have been priced more fully. On balance, however, Levis' empirical findings provide limited support for the signalling hypothesis.

Levis' rejection of the signalling theory for U.K. IPOs, however, may be attributed to the fact that his sample of seasoned offerings significantly understates the volume of post–IPO reissuance activity. This is because Levis' sample includes firms which have

[8] The negative effect of a SEO announcement on the stock price of a firm is well documented [Masulis and Korwar (1986), Asquith and Mullins (1986) and Eckbo and Masulis (1992)]. Myers and Majluf (1984) suggest that the negative announcement effect, at least for shares sold to new investors, may be the result of an adverse selection effect under which relatively uninformed investors consider share issues a negative signal of insider information about the issuing firm. Choe *et al.* (1993) show that this adverse selection effect is time dependent; it decreases when promising economic conditions for new investments exist, and increases when the uncertainty surrounding the value of firm assets in place becomes larger.

reissued equity only through a rights issue. As Espenlaub and Tonks (1998) show, however, although rights issues are more frequent than any other reissue method, they account for less than 40% of the first SEOs made from IPO firms during 1986–1994. In chapter 3 of the thesis, we re–examine some of the most important implications of the signalling models. Unlike Levis, however, our sample of seasoned offerings includes, apart from rights issues, other issues of equity such as open offers, placements, issues for cash and vendor placements.

1.3.5. The partial adjustment hypothesis.

In the U.S., when a firm goes public it is required to issue a preliminary prospectus in which a likely range for the price of the stock is set. Ibbotson *et al.* (1988) suggest that underpricing may be the result of changes in the offer price between the filing of the preliminary prospectus and the final prospectus. They argue that when an underwriter revises the offer price, he only partially adjusts the price upwards instead of raising the final offer price to its true market value. Benveniste and Spindt (1989) present a model which explains why underwriters only partially adjust prices. They suggest that underpricing is directly related to the level of presales, the level of interest in the premarket and to the *ex ante* value of investors' information. In order for an underwriter to price an IPO at its intrinsic value, he must collect information from investors, those who are actively involved on an ongoing basis in purchasing shares of IPOs, as to the level of demand for the issue. If there is a high demand for an offering, the underwriter will adjust the price upwards, which in turn will reduce the level of underpricing. A limited demand for an issue will imply that the IPO has been overpriced. In such cases, an underwriter will adjust the price downwards, and as a result no returns will be generated once trading begins. Investors, however, will not want to disclose such information because they can benefit by buying an IPO at a low price and then sell it at the full information price in the secondary market. In order to motivate investors to truthfully reveal the level of demand for an issue, underwriters offer investors a pricing and allocation schedule that maximizes their total expected profits. Profits are generated by a trade off between increased allocation and underpricing. If, for example, there is a strong demand for an IPO, and this information is truthfully revealed by investors to an underwriter, then the underwriter will not fully adjust the share price upwards but rather partially adjust it so as to compensate investors for revealing this information. In such cases, where underpricing is low because of the strong demand, investors receive a higher proportion of shares. Alternatively, when the level of initial returns is higher, investors receive a smaller proportion of shares. Evidence that underpricing is related to the partial adjustment hypothesis is presented by Hanley (1993) and Hanley and Wilhelm (1995), who find that issues that have positive revisions in the offer price are more underpriced than those IPOs for which the offer price is revised downwards[9].

1.3.6. The cascades hypothesis.

Welch (1992) presents a model in which underwriters approach interested investors sequentially. Investors who are approached at a later stage will decide whether to buy or not, not only on the basis of their own private information, but also on the level of demand shown for the issue by investors who are approached first. If early investors

[9] This hypothesis cannot account for the observed magnitude of underpricing of British IPOs because in the U.K. there is no requirement to set a preliminary offer price range.

show a great demand for an issue, then subsequent investors will want to buy too, because they will believe that early investors have favourable information about the offering. Similarly, low demand for an issue will discourage subsequent investing. This implies that a few investors who are approached at an early stage can decide the future of an offering. If they believe that an IPO will produce positive initial returns, they can create a huge demand for the offering. If, on the other hand, they believe that an IPO will be overpriced, they can lead the offering to failure. Therefore, in order to prevent this from happening, issuers underprice their IPOs in order to encourage early investors to buy, thus initiating a cascade in which subsequent investors will want to buy, irrespective of whether they have favourable or unfavourable information about the offering.

1.3.7. The ownership dispersion hypothesis.

Booth and Chua (1996) develop a model in which IPOs are deliberately offered at a discount by the issuers because they want to create excess demand for their issue. By promoting oversubscription the shares in the IPO are allocated to many investors. This ownership dispersion will in turn increase the liquidity of the secondary market for the stock and will also make it difficult for outsiders to challenge management[10].

1.3.8. The underwriter warrants hypothesis.

In many cases, the underwriter involved with an IPO receives warrants as part of the compensation for his services. These warrants entitle the underwriter to purchase an

[10] Brennan and Franks (1997) present similar arguments.

amount, sometimes very large, of the issuer's common stock. Logue (1973) suggests that underwriter warrants create incentives for underwriters to deliberately set the offer price below its true market value. Given that an underwriter can purchase the issuer's common stock either at the offer price or at a price slightly higher, greater profits will be generated to him by underpricing the issue. In line with this hypothesis, Barry *et al.* (1991) and Dunbar (1995) find that underwriter warrants are significantly associated with greater underpricing.

With the exception of the *ex ante* uncertainty hypothesis, all of the above explanations suggest that underpricing is undertaken deliberately by the issuers or the underwriters involved with IPOs. Many of these explanations, however, yield largely untestable implications. Hunt–McCool *et al.* (1996) show that one way to test the prediction that newly listed firms are intentionally priced below their fundamental values in the IPO premarket is to use the stochastic frontier model developed by Aigner *et al.*(1977). In chapter 4 of the thesis, we apply this model on U.K. IPOs for the first time, to the best of our knowledge, to test for deliberate premarket underpricing. The application of the stochastic frontier methodology within the framework of the new issues market has its drawbacks and its advantages. If, for example, we find that IPOs are intentionally offered at a discount, the specific reason for this anomaly is not apparent. If, on the other hand, we find no deliberate premarket underpricing, then the tendency of IPOs to generate positive initial returns should be viewed as an aftermarket phenomenon.

1.3.9. The underwriter price support hypothesis.

More recently, some academic researchers have suggested that IPOs are correctly priced, but because underwriters intervene and actively support aftermarket prices, positive returns are generated once trading begins. Underwriter price support, or price stabilisation, is an attempt by an underwriter to avoid short–run price declines by holding up aftermarket prices which would have declined without intervention. In an IPO the maximum support price is the offer price. This means that underwriters can support offerings which trade at or below their offer price, that is, issues with zero and negative returns. There is no price intervention for issues trading above their offer price. It is implied that offerings which would have produced negative returns are propped up, most likely to zero, whereas slightly positive returns may be generated by IPOs which would have produced zero returns without intervention.

A question which arises, however, is why should underwriters be engaged in price stabilisation activities given the high risk of repurchasing shares in poorly received offerings? It may be argued that underwriters intervene to support aftermarket prices for the same reasons for originally pricing an IPO below its true value. An alternative explanation is given in Chowdhry and Vanda (1996). They note, in contrast to Rock's (1986) arguments, that deliberate underpricing to compensate uninformed investors is too expensive because such a strategy rewards informed investors as well. They suggest that a more efficient way of providing uninformed bidders a compensation for the adverse selection problem they face is through aftermarket support. Price stabilisation offers investors a put option to sell back shares at the offering price. This put option, however, is valuable only to uninformed investors, given that informed investors only bid for those offerings which are already underpriced. Benveniste *et al.* (1996) note that aftermarket support acts as a bonding mechanism between underwriters and investors.

Recent empirical research from the U.S. provides some evidence in support of this hypothesis. Schultz and Zaman (1993) study 72 new issues that were offered to the public in 1992. Using trade and quote–change data from every market maker for the first three days of trading, they find that when IPOs trade at or below their offer price underwriters are quoting the higher bid prices than any other market maker. They conclude, however, that price stabilisation alone cannot explain away positive initial returns. Ruud (1993) examines the distribution of initial returns over a four week period for 463 IPOs issued during 1982–1983. She finds that the distribution of first day returns is leptokurtic and positively skewed, but as the time period for measuring returns increases the distribution becomes mesokurtic and symmetrical. Ruud concludes that this is because of the delays in observing negative initial returns caused by aftermarket support. Hanley *et al.* (1993) develop and test a model in which quoted spreads must be narrower for offerings undergoing stabilisation. Using a sample of 1523 IPOs that went public between 1982–1987, and after adjusting for factors which may influence the bid–ask spread such as volatility, volume, price and number of market makers, Hanley *et al.* find, in line with their predictions, that offerings which trade at or 3% below their offer price have narrower spreads.

Despite the fact that the empirical evidence from the U.S. shows that the price stabilisation hypothesis significantly influences the observed magnitude of first day returns, and although the practice of aftermarket support on the London Stock Exchange is legal [chapter 3, part 10, of the Securities and Investment Board rules and regulations], the effect of this hypothesis on the initial performance of U.K. IPOs, to the best of our knowledge, has never been evaluated. In chapter 5 of the thesis, we examine for the first time for British initial offerings whether price stabilisation has any significant impact on the level of abnormal short–run returns. As with U.S. IPOs, a short–coming of our empirical tests is that the effect of this hypothesis can only be inferred indirectly, given the discretionary nature of the price support activities in the U.K.

1.3.10. The market incompleteness hypothesis.

Mauer and Senbet (1992) present a model in which there is a partial segmentation between the primary market for IPOs and the broader capital market (secondary market). The two markets are partially segmented because in the primary market only primary investors can participate in newly listed firms, whereas the secondary market is accessible to all market participants. They argue that this market incompleteness results in IPOs being underpriced so that investors can be compensated for bearing diversifiable risk. Although Mauer and Senbet present results which are consistent with the model, their findings are also in line with alternative explanations.

1.3.11. The institutional lag hypothesis.

Ritter (1984a) suggests that underpricing might be attributed to rising Stock markets between the fixing of the offer price and the first trading day. In many countries the period between setting an offer price and initial trading may vary between a few days and a few weeks. If underwriters set the offer price several weeks prior to initial trading, abnormal returns may be generated if the market rises over that period. Ritter examines this hypothesis but finds that it cannot explain away positive initial returns. Results inconsistent with this institutional lag hypothesis are also reported by Kunz and

Aggarwal (1994) for the Swiss IPO market.

1.3.12. The lack of experience hypothesis.

It might be said that in some markets, especially emerging markets, underpricing might be caused by the inexperience of the parties involved in an initial offering. Because of their lack of experience and their will to sell the entire issue, they set the offer price below its true market value. Thus, once trading begins in the secondary market, abnormally high returns are produced. Mild evidence in support of this learning effect hypothesis is provided by Uhlir (1989) for the German IPO market and by Kunz and Aggarwal for the Swiss IPO market.

In addition to the theories discussed above, a few other explanations, mostly involving irrational strategies by investors, have also been advanced to explain the underpricing anomaly. These theories are discussed in the next section which evaluates possible reasons for the underperformance of IPO firms in the long–run.

1.4. Explanations as to the long-run underperformance of IPOs.

1.4.1. The fads hypothesis.

The long–run underperformance of IPOs may be the result of investors being overly optimistic or faddish. If a firm's true value is reflected in long–run prices, rather than on the initial trading price, it is possible that IPOs are not initially underpriced, but rather being overvalued by optimistic investors who base their decisions on sentiment or rumours instead on rational analysis of fundamentals. Miller (1977) notes that aftermarket prices are set by faddish investors. As firms season, however, and more information about the true value of a firm become available, the forecasts of both optimistic and pessimistic investors converge, and as a result secondary market prices decline. Similar arguments are presented by Daniel *et al.* (1998), who develop a model in which investors are overconfident about their ability to evaluate securities. Under this model, long–run underperformance cannot be explained away without relying on the hypothesis that excessively optimistic investors affect prices. Evidence that investors are systematically overoptimistic is presented by Jain and Kini (1994), who find that investors initially value IPOs at high multiples[11].

1.4.2. The windows of opportunity (timing) hypothesis.

Ritter (1991) and Loughran and Ritter (1995) suggest that the IPO market is subject to mean reverting fads, and argue that issuing firms have the ability to spot such fads and time their offering to take advantage of them. Under this windows of opportunity

[11] A possible reason for this overoptimism is presented by Teoh *et al.* (1998), who find that investors are guided by earnings to make their valuations, and issuing firms manipulate upwards their earnings before the initial offering by adopting discretionary accounting accruals adjustments.

hypothesis, if issuing firms can successfully time their flotation to coincide with periods in which investors are willing to overpay for their equity, then these IPOs will subsequently produce low long–run returns. Evidence that firms succeed in timing their offerings is presented by Loughran *et al.* (1994), who find a negative relation between the level of IPO volume and the following year's market return in ten of the 14 countries they analyze. Results in line with this hypothesis are also presented by Lerner (1994). He examines 350 privately held venture capital backed biotechnology firms between 1978 and 1992, and finds that venture capitalists take firms public when equity values are high and rely on private financing when valuations are lower. On the contrary, Ljungqvist (1996) finds that the timing hypothesis cannot explain long–run underperformance for German IPOs.

1.4.3. The impresario hypothesis.

Shiller (1990) suggests that underwriters act as impresarios (entertainment managers) and underprice IPOs in an attempt to produce excess demand for new issues in order to create even greater demand for subsequent underwriting. If the market for newly listed firms is subject to such fads, then, under Shiller's impresario hypothesis, heavily underpriced IPOs should have the lowest subsequent long–run returns. Evidence of this relation is presented by Ritter (1991) and Levis (1993).

1.4.4. The underwriter price support hypothesis.

Apart from explaining part of the high IPO initial returns, the underwriter price support hypothesis may partly explain the long–run underperformance anomaly as well. If the prices of some IPOs in early secondary market trading are kept artificially high by the effect of price stabilisation, early secondary market prices may not be the appropriate starting point for evaluating long–run performance. This implies that offerings which are supported in the aftermarket should have negative returns in the long–run when long–run returns are computed from the beginning of initial trading, but not so when long–run performance is assessed once underwriter support is withdrawn. Conversely, the long–run performance of IPOs not supported in the secondary market should be neutral, irrespective of whether long–run performance is evaluated from the beginning of trading or after price stabilisation is terminated.

1.4.5. The risk mismeasurement hypothesis.

Most IPO studies estimate long–run returns on the assumption of unit, time–invariant beta systematic risk. Betas, however, may not be stationary in the secondary market. Evidence that aftermarket betas vary is presented by Clarkson and Thompson (1990), who find that cross–sectional betas are on average higher than one and decline as firms season. If betas are assumed to be stationary but actual betas are initially greater than one and decline over time, a falling (rising) market implies observing under (over) performance, and vice versa if actual betas are less than unity and increase over time. Several studies, however, show that risk mismeasurement alone cannot explain away long–run losses.

1.4.6. The choice of methodology hypothesis.

When computing long–run returns, academic researchers usually employ either the cumulative abnormal return measure or a buy and hold return strategy. Roll (1983) argues that the use of cumulative returns may be a misleading measure of long–term performance because cumulative returns represent the returns on a portfolio which is reweighed every month, and this reweighing may induce spurious abnormal returns where, in reality, none are attainable. Conrad and Kaul (1993) suggest that the best measure of abnormal performance is a buy and hold return strategy because the use of cumulative returns with monthly rebalancing may bias downwards long–run returns. Similar arguments are presented by Barber and Lyon (1997). They too note that buy and hold returns should be used in preference to cumulative returns, although they find that buy and hold returns are severely skewed to the right[12]. On the contrary, Fama (1998) suggests that buy and hold returns are problematic, not only because their distribution is skewed, but also because the use of compounding may exaggerate small initial differences. Despite these arguments, however, the choice of methodology cannot account for the underperformance of IPOs. Keloharju (1993) and Espenlaub *et al.* (1998), among others, present evidence that IPOs generate negative returns in the long–run irrespective of whether cumulative or buy and hold return measures are used in assessing aftermarket performance.

1.4.7. The choice of benchmark hypothesis.

Ideally, the most appropriate benchmark to evaluate long–run performance would be a sample of comparable firms matched by size. Given the problems in constructing such a benchmark, most IPO studies evaluate long–run performance relative to some

[12] Evidence that buy and hold returns are significantly positively skewed is also presented by Kothari and Warner (1997).

market index. Dimson and Marsh (1986) argue that long–run performance can appear significantly positive or negative depending on the choice of index. Several academic researchers [Levis (1993) and Loughran and Ritter (1995)] show, however, that although the magnitude of underperformance depends on the benchmark used in computing abnormal returns, the central finding of inferior aftermarket performance is not sensitive to the choice of benchmark.

1.5. Conclusions.

A large body of empirical evidence accumulated during the last twenty five years shows that the companies going public in many countries are associated with two anomalies: (1) new issue underpricing and (2) long–run underperformance.

Within the finance and economics literature several explanations have been proposed as to why IPOs are on average underpriced. Despite a multitude of models, no consensus has yet emerged as to why this anomaly occurs. In addition, most theories vary in importance from one country to another and no single model appears to claim superiority. Moreover, the possibility that initial prices may be kept artificially high by underwriter price support, casts doubts on the conventional wisdom that newly listed firms are, in fact, underpriced.

As with the underpricing anomaly, although a few explanations have been put forward to account for the long–term underperformance of IPOs, no truly compelling reason for this phenomenon has yet been found. The evidence which has recently emerged suggests that investors are systematically overoptimistic about the growth prospects of IPOs, and issuing firms are able to spot such fads and time their flotation to take advantage of them. Although the evidence in support of the timing hypothesis is indirect, it explains away many of the price patterns that are observed.

CHAPTER 2

"THE POST-LISTING PERFORMANCE OF IPOs IN THE U.K."

2.1. Introduction.

This chapter examines the initial and long–run price behaviour of 653 IPOs listed on the London Stock Exchange over the period 1984–1992. Despite the fact that we examine the initial performance in some detail, the focus of investigation is concentrated on the long–run performance.

Previous IPO studies have shown that once newly listed firms start trading in the aftermarket, there are two possible outcomes for IPO market price trends. First, secondary market prices will not give rise to significant abnormal returns. The secondary market will immediately establish a price for the IPOs, and as a result secondary market investors will not be able to develop profitable trading strategies. If, however, the secondary market is subject to speculative movements, the efficiency hypothesis will be rejected. As a result, prices in early aftermarket trading will give rise to significant positive abnormal returns, but once investors revise their expectations, the rising trend in returns will be reversed. Second, following the initial underpricing, secondary market prices will continue to increase. The rationale behind this possibility is explained by Reilly (1973), who notes that the difference between the offering price and early aftermarket prices may not fully reflect the actual level of underpricing.

As was noted in chapter 1, section 1.4, the aftermarket performance of IPOs might be sensitive to a number of methodological and statistical challenges. Therefore, apart from evaluating the post–listing performance of newly listed firms, this chapter also examines whether the long–run price behaviour of IPOs is robust to a number of possible refinements, such as the choice of methodology, the choice of benchmark and the adjustment for time–varying systematic risk.

The chapter is organised in the following manner. In section 2.2 we present the data and the empirical methods to be employed. In addition, section 2.2 describes the institutional arrangements for IPOs in the U.K. The cross–sectional and time–series findings regarding the initial and long–run performance of IPOs are presented in sections 2.3 and 2.4 respectively. Section 2.5 concludes.

2.2. Data and methodology.

Until the end of 1994, flotation on the London Stock Exchange was mainly achieved on either the Main Market (full listing) or the USM[1]. The differences between the listing requirements for entry in the Main Market and the USM are presented in detail in table 2.1. As table 2.1 reveals, there is a wide variation in the listing requirements among the two different markets. The proportion of equity that has to be held in public hands is notably higher for full listing, 25%, than for USM quotation, 10%. A trading record of three years is required for IPOs seeking flotation in the Main Market, whereas for USM quotation the trading record is lower at two years. Thus, the USM gives firms the opportunity to raise external equity capital much sooner in their life cycle than would otherwise be the case. Most importantly, however, USM flotation involves much less advertising and compliance costs than the official list.

Flotation on the Main Market or the USM can be achieved via an offer for sale at a fixed price, an offer for sale by tender, a placing or an introduction. In an offer for sale at a fixed price investors are invited to specify the amount of shares to which they want to subscribe. The price of the offering is normally set by an issuing house, which acts on behalf of the issuing company, about two weeks before the shares start

[1] During the late 1970s, the advantages associated with a market for a company's shares were met mainly by the Stock Exchange Listed Securities Market and to a very limited extend by the Over the Counter (OTC) market. The high costs and regulations associated with entry to the Main Market led to a market decline in the number of companies coming to the market. Together with the fact that the OTC market alone could not meet the requirements of smaller companies to raise new capital, a lot of concern was caused. Concerns of this nature were raised by many of those who gave evidence to the Wilson Committee (a committee to review the functioning of financial institutions; progress report of the financing of Industry and Trade, H.M. Stationery Office, final report, H.M. Stationery Office, 1980) in 1978. A number of witnesses drew the committee's attention to the absence of a market in the securities of companies which, while not ready for a full listing, might still benefit from a degree of marketability. This led the Stock Exchange Commission to review the structure of the U.K. securities market and as a result the USM was inaugurated in November 1980.

trading. Once the offer price is set, it can neither be changed nor can it be withdrawn. In an offer for sale by tender a minimum price is set, striking price, by a broker and investors are invited to bid for the shares either at the striking or at a higher price. In a placing shares are not offered to the public but instead they are offered to institutional or individual clients of the issuing house which underwrites the issue. The offering price is set on impact day, which is about five business days before the shares start trading, and the placing of the shares is usually completed within that day. To offer investors the opportunity to participate in as many IPOs as possible, Stock Exchange rules require issuers who raise more than £ 2 million by this method to offer to the public at least 25%, either directly or by using a second distributor. Finally, a company may also obtain quotation for its existing shares without issuing new shares. This is known as an introduction and it has been particularly popular with firms transferring from a junior to a senior market[2].

Figures 2.1 and 2.2 show the methods by which IPOs have been made between 1984 and 1992 for the two different markets separately. The most striking trend in the methods of making IPOs in the Main Market has been the increasing use of placements. This change was facilitated by the relaxation of the placing rules[3] at the time of Big Bang[4]. Most USM companies also prefer to use the placing method

[2] Investment trusts often use an offer for sale by subscription. Under this method, the shares are offered to the public directly by the issuing firm.

[3] Before October 1986, placements were normally limited to companies raising less than £3 million. On the date of the Big Bang, the London Stock Exchange changed its rules to allow placements to be used for larger issues – up to £15 million in the Main Market and up to £5 million in the USM. In January 1991, the limit for placements in the USM became £15 million.

[4] During the mid 1980s, London's reputation as a financial centre was on the decline. London's role as an equity market had been steadily declining mainly because of certain regulations which made the London Stock Exchange to be both uncompetitive and expensive. London realized the inefficiencies of its capital markets and, on October 27, 1986, launched a dramatic deregulation effort. This became known as

because for small issues placements are more economical, as well as faster, than offers for sale. Over the 9 year sample period 61% of the IPOs were made through the placing method, 19% were made through an offer for sale at a fixed price, 13% were made through an introduction, 5% were made through an offer for sale by subscription and 2% were made through an offer for sale by tender. An important feature of figures 2.1 and 2.2 is the huge decline of companies entering the market. The USM was particularly hard hit with less than 15 companies being admitted in 1991 and 1992 combined[5]. Despite this decrease, however, by international standards the number of companies going public in the U.K. was phenomenally high [Jenkinson and Espenlaub (1991)].

The sample to be used in this study is comprised of 653 IPOs. Only placements and offers for sale at a fixed price (henceforth: offers for sale) listed in the Main and the Unlisted Securities Markets during 1984–1992 were considered. Offers for sale by tender and introductions were excluded from the sample. Investment trusts, and hence offers for sale by subscription, were also excluded. Table 2.2 shows the distribution of the total population of new issues, offers for sale and placements, and the equivalent distribution of the sample of 653 IPOs used in this study by year, in terms of the gross proceeds, estimated by multiplying the number of shares sold to the public by the offering price and adjusted for inflation using the U.K. GDP price deflator, and the number of offers. As table 2.2 reveals, a total of almost £ 55 billion of new equity

the Big Bang because it transformed the nature of the British financial markets and the range of products traded there in.

[5] In December 1992, the London Stock Exchange announced the closure of the USM by the end of 1995 restricting the admission of companies after June 1993. However, in 1993 the London Stock Exchange decided to delay the closure of the USM by 12 months, until the end of 1996, allowing the admission of companies until the end of 1994.

capital was raised by newly listed firms during the period under investigation, 77% of which was raised by the privatised utilities. Table 2.2 also shows that the number of IPOs was not evenly distributed over the sample period. Only 136 of the 653 sample offers, 21%, occurred during the second half of the period. The sample of 653 IPOs covers 82.70% of the total number of new issues and 92.80% of the total amount of new equity capital raised.

Offer prices for each IPO as well as details about individual characteristics of new issues were obtained from the KPMG Peat Marwick New Issues Statistics. Prices at the end of the first day of trading were taken from DATASTREAM[6]. In some cases DATASTREAM was also used to identify the offer price of an issue because some offer prices were not available from the KPMG New Issues Statistics. Monthly returns for each offering were obtained from the London Share Price Database (LSPD). They include dividend payments and are adjusted, where applicable, for rights and script issues.

For each new offering, returns are calculated for two intervals: the initial return period, day 1, and the aftermarket period, 3 years after the IPO exclusive of the initial return. We define month 0 as the initial return period, whereas the post–listing period includes the following 36 months. As was noted in chapter 1, section 1.4, evaluation of the long–run performance on the basis of early aftermarket prices may be a wrong starting point because initial prices may be kept artificially high by underwriter price support. We therefore use as a starting point end–of–month prices. Within this context, month

[6] DATASTREAM is an extensive on line system of data bases covering, inter alia, domestic (United Kingdom) and international company accounts.

1 is defined as the time period between the last trading day of the first trading month and the last trading day of the next month. Months 2 to 36 are defined in the same way. If an IPO started trading during the last days of a month then the closing price at the end of the next month was chosen as a starting point.

The abnormal initial return for issue i in time period t is calculated as:

$$r_{it}=\frac{P_1-P_0}{P_0} \tag{2.1}$$

where P_1 is the closing price on the first day of trading and P_0 is the offering price.

To assess the aftermarket performance of newly listed firms, we first employ the Cumulative Abnormal Return measure (henceforth:CAR) defined as:

$$CAR_{1,q}=\sum_{t=1}^{q} AR_t \tag{2.2}$$

where

$$AR_t=\frac{1}{N}\sum_{i=1}^{N} AR_{it} \tag{2.3}$$

Abnormal returns are calculated using three different models: (1) the market–adjusted model, (2) the RATS (Returns Across Time and Securities) model developed by

Ibbotson (1975) and the Fama–French (1993) three factor model. Under the market–adjusted model, abnormal returns are calculated as:

$$AR_{it}=R_{it}-R_{mt} \tag{2.4}$$

where R_{it} is the monthly return of security i in month t and R_{mt} is the benchmark return for the same period. Two different benchmarks are used. The first is the Financial Times Actuaries All Share Index (henceforth:FTA). It is considered to be the best indicator of the London equity market embracing more than 90% of the U.K. Stock market by value. Dimson and Marsh (1986) show that long–term performance measurement is very sensitive to the choice of benchmark, especially when the size composition of the benchmark differs from that of the securities under investigation. As shown in table 2.5, many of the IPOs in our sample have low market capitalizations and are therefore smaller than those securities tracked by the FTA. Although the median gross proceeds raised are £ 4.4 million, the median market capitalization of IPOs at the date of flotation is only £ 17.2 million. Therefore, in order to account for the impact of the size effect on the aftermarket performance of IPOs, we also use as a benchmark the Hoare Govett Smaller Companies Index (henceforth:HGSC). This is an index which monitors the performance of the lowest tenth, by market value, of the U.K. equity market.

The estimation of monthly abnormal returns using the market–adjusted model is based on the assumption of unit, time–invariant beta systematic risk for all IPOs. Betas, however, may not be stationary in the aftermarket. Abnormal returns therefore need to be re–estimated while allowing for systematic risk to vary over time. For this purpose we use the RATS model pioneered by Ibbotson (1975). This model measures excess performance, in excess of the risk–free asset, and systematic risk for newly listed firms with a constant amount of seasoning. The model is expressed as:

$$R_{i,n}-R_{f,n}=\alpha_n+\beta_n(R_{m,n}-R_{f,n})+e_{i,n} \tag{2.5}$$

where n denotes the month of seasoning and is held constant in each regression, $R_{i,n}$ is the return on security i during the nth month of seasoning, $R_{m,n}$ is the return on the market proxied by both the FTA and the HGSC and $R_{f,n}$ is the return on the riskless asset proxied by the one month interbank rate. α_n will serve as a measure of mean abnormal performance and β_n will serve as a measure of mean systematic risk. By running 36 such regressions (n=1, 2, 3,....,n=36) we obtain estimates of α_n and β_n for all IPOs for each of the first 36 months of seasoning[7].

Fama and French (1993) argue that the cross–section of expected returns can be explained by an expanded form of the Capital Asset Pricing Model which takes into consideration size and book–to–market factors. Under the Fama–French three factor model, the mean abnormal return for all IPOs for each month of seasoning, α_n, is estimated as follows:

[7] A possible problem which may arise by pooling the returns of different firms within the same month of seasoning is that the measures of abnormal performance and systematic risk might be difficult to interpret. If, however, the independent variable $(R_{m,n}-R_{f,n})$ and the error term are uncorrelated, and assuming that the different values of systematic risk are drawn from distributions with the same mean, then α_n and β_n are unbiased estimators of mean performance and systematic risk respectively.

$$R_{i,n}-R_{f,n}=\alpha_n+\beta_n(R_{m,n}-R_{f,n})+sSMB_n+hHML_n+e_{i,n} \tag{2.6}$$

where SMB is the difference in returns between a portfolio of small firms and a portfolio of large firms (Small Minus Big), and HML is the difference in returns between a portfolio of high book–to–market firms and a portfolio of low book–to–market firms (High Minus Low[8]).

The statistical significance of CARs is assessed using the crude dependence adjustment test of Brown and Warner (1980), so that the lack of independence of the AR series is taken into account. The t–test statistic is computed as:

$$t\text{-}test=\frac{CAR_T}{\sqrt{T*[\sum_{t=1}^{36}(AR_t-\frac{1}{36}\sum_{t=1}^{36}AR_t)^2]/35}} \tag{2.7}$$

where T is the event month.

When an IPO in the portfolio is delisted from the data, the portfolio return for the next month is an equally weighted average of the remaining firms in the portfolio. Thus, the

[8] To form the SMB and HML portfolios the following procedure was employed: each year all stocks for which both market capitalization and book–to–market figures were available were allocated to two groups. Stocks whose market capitalization was above the median market capitalization of all stocks were designated B (for big), whereas the remaining stocks were designated S (for small). Stocks were then allocated to three book–to–market groups. Stocks whose book–to–market figure was in the top 30% of book–to–market values of all stocks were designated H (for high), those in the middle 40% were designated M (for medium), and those in the bottom 30% were designated L (for low). Six value weighted portfolios, BH, BM, BL, SH, SM and SL were then formed. From these portfolio returns we calculated the SMB portfolio returns, which were defined to be $r_{SMB}=(r_{SH}+r_{SM}+r_{SL}-r_{BH}-r_{BM}-r_{BL})/3$, and the HML portfolio returns, which were defined to be $r_{HML}=(r_{BH}+r_{SH}-r_{BL}-r_{SL})/2$.

estimation of CARs for months 1 to 36 involves monthly rebalancing. Returns for the month in which an IPO is delisted are not included[9].

As was noted in chapter 1, section 1.4, several academic researchers argue that the CAR measure may bias downwards long–run returns. Therefore, as an alternative to the use of CARs, we also compute holding period returns. For each IPO the holding period return is defined as:

$$R_i=\prod_{t=1}^{q}[(1+r_{it})]-1 \tag{2.8}$$

where r_{it}, the raw (unadjusted) return on firm i in event month t, measures the return from a buy and hold strategy where a stock is purchased at the closing market price of the first trading month after going public and held until the earlier of either its third year anniversary or its delisting.

The IPO portfolio holding period return is calculated as:

$$R_T=\frac{1}{N}\sum_{i=1}^{N}R_i \tag{2.9}$$

The performance of IPO firms relative to the market is assessed by the wealth relative,

[9] Acquisitions was one of the main reasons for firms being delisted. Firms which started trading in the USM and then moved to the Main Market during the 3 years after their offering date were also delisted.

originally employed by Ritter (1991), computed as:

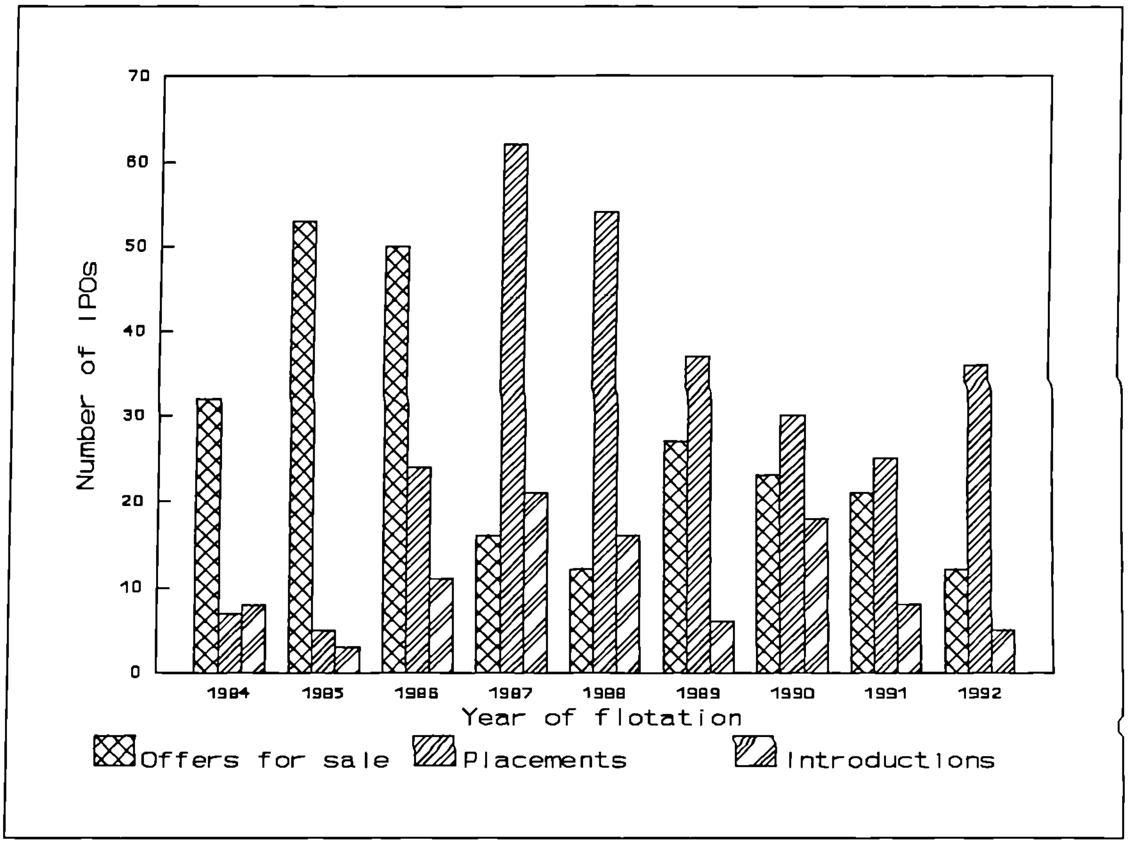
$$WR = \frac{(1+R_T)}{(1+R_M)} \tag{2.10}$$

A wealth relative above one implies IPO overperformance, and vice versa.

Table 2.1: entry requirements for full listing and USM quotation.

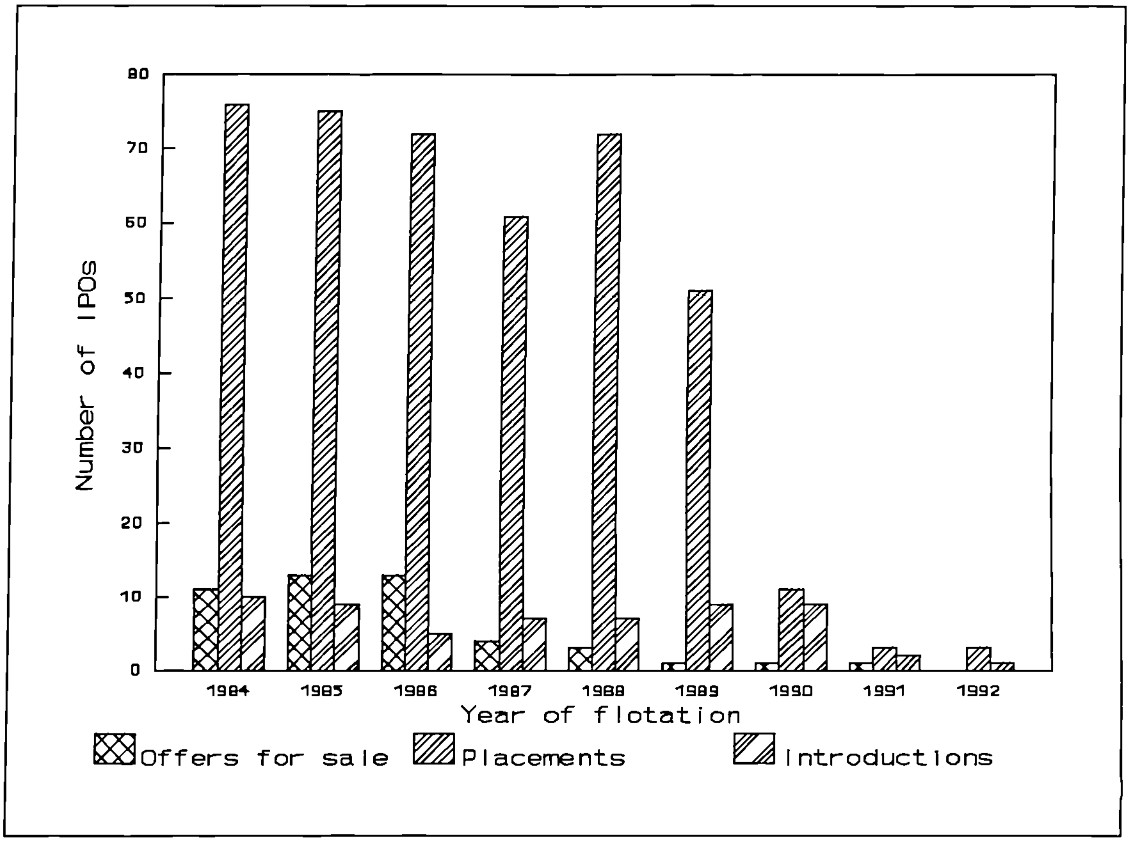
Listing requirements	Full listing (MM)	USM
Trading record	3 years	2 years
Minimum market capitalization	£500–700,000	No lower minimum
Percentage of shares in public hands	At least 25%	At least 10%
Annual fees	Approx. £3,500	£1,500
Entry fees	Approx. £15,000	Nil
Minimum advertising cost Placing Offer for sale Introduction	£50–100,000 £30–50,000 £70–100,000 £4,000	Approx. £5,000 £4,000 £20–60,000 £4,000
Minimum total cost	£250,000	Approx. £150,000
Company details (in practise) Yearly pre–tax profits Yearly turnover Size of issue	 £1,000,000 £10,000,000 £2,000,000	 £200–500,000 No lower minimum £1,000,000
Advertising in national press Placing & Introduction Offer for sale	 Advert & prospectus 2 full prospectuses	 Box advert More
Information to shareholders on substantial capital changes	Where 15% or more of assets profits or equity involved	Where 25% or more of assets profits or equity involved
Latest audit prior to flotation	6 months	9 months
Accountants report	Mandatory	Required only for offers for sale

Figure 2.1: entry methods to the Main Market, 1984-1992.



Note: offers for sale include offers for sale at a fixed price, offers for sale by tender and offers for sale by subscription.

Figure 2.2: entry methods to the USM, 1984-1992.



Note: offers for sale include offers for sale at a fixed price, offers for sale by tender and offers for sale by subscription.

Table 2.2: distribution of IPOs by issue size and year of flotation.

	Total of 789 IPOs			653 IPOs in sample			Total included (%)		
		Gross proceeds (£ m)			Gross proceeds (£ m)			Gross proceeds (£ m)	
Year	N	Total	Adjusted[a]	N	Total	Adjusted[a]	N	Total	Adjusted[a]
1984	106	6929.7	951.7	81	6829.4	851.4	76.4	98.5	89.4
1985	121	1703.7	1703.7	95	1377.1	1377.1	78.5	80.8	80.8
1986	142	11715.9	1773.0	125	11513.7	1506.3	88.0	98.2	84.9
1987	127	6710.6	1991.0	105	6538.8	1819.2	82.6	97.4	91.3
1988	127	4856.6	1711.9	111	4219.8	1075.2	87.4	86.8	62.8
1989	77	7857.5	1701.0	62	6374.5	1627.9	80.5	81.1	95.7
1990	33	5947.6	273.0	26	5072.7	107.1	78.7	85.2	39.2
1991	22	7567.5	821.8	18	7519.6	783.1	81.8	99.3	95.2
1992	34	1413.6	1413.6	30	1324.4	1324.4	88.2	93.7	93.7
Total	789	54702.7	12340.7	653	50770.0	10471.7	82.7	92.8	84.8

Notes: [a] after adjusting for the effect of government privatisations where funds of over £1 billion were raised (British Gas, BT, BSC, TSB, BA, Rolls Royce, BAA, and the water and electricity privatisations). N denotes the number of IPOs. Gross proceeds are measured in pounds of 1992 purchasing power.

2.3. The direct costs of going public and the initial performance of IPOs.

Table 2.3 shows the direct costs of going public by issue size for the entire sample of IPOs and for the two different markets separately[10]. Given that most of the direct costs of making an IPO are fixed, irrespective of the size of issue, it is not surprising that significant economies of scale exist: while the average costs increase as the size of issue increases, the average costs as a percentage of the funds raised decrease[11]. For very small issues the direct costs of flotation account for 18.41% of the gross proceeds raised. This figure drops to 10.97% for IPOs listed in the Main Market and increases to 19.63% for IPOs floated in the USM. For medium sized issues the average direct costs vary between 6% and 12% for all IPOs, between 4% and 9% for IPOs obtaining a full listing and between 7% and 13% for IPOs listed in the USM. For very large offerings, especially of those IPOs listed in the Main Market, the average direct costs are very low. This is because the costs borne by the privatised utilities are very small as a proportion of the issue.

Table 2.4 shows the direct costs by method and year of flotation. For the entire sample of IPOs the mean costs as a proportion of the gross proceeds raised fell from 10.37% in 1985 to 9.03% in 1988 before rising again to 10.37% in the rather subdued conditions of 1989. From 1989 onwards, however, the average costs fell considerably to 6.55% in 1992. For placements the average direct costs remained stable from 1984

[10] The costs incurred in going public are revealed by the issuing firm in the offering prospectus and are mainly comprised of legal, printing and auditing fees, underwriter commissions, issuing house and brokers' fees, advertising fees and Stock Exchange fees.

[11] Ritter (1987) and Lee *et al.* (1996) provide evidence of this effect in the U.S.

to 1988 before increasing to 12.42% in 1989 and then steadily decreasing to 6.87% in 1992. Offers for sale, however, have followed a different pattern. After an increase from 6.65% in 1984 to 8.56% in 1985, the average costs have been steadily falling to 1.69% in 1990 before increasing to 4.94% in 1992. The different trends, however, between offers for sale and placements must be interpreted with caution, given the considerable changes in the size composition of IPOs over the sample period.

Table 2.5 shows some descriptive statistics for the sample of 653 IPOs. Consistent with previous studies on IPOs in the U.K., we report positive mean and median abnormal returns of 10.42% and 6.66% respectively. The t–statistic of 14.47 is statistically significant at the 1% level[12]. These findings indicate that in the primary market IPOs are not efficiently priced and as a result the total costs of going public are increased. The average offering size of IPOs, £ 77.7 million, exceeds that reported in other IPO studies. This is because of the huge amounts raised by the privatised utilities. When adjusting for the effect of government privatisations, the mean offering size drops to £ 16.8 million, which is comparable with prior studies. On average, pre–offering shareholders retain 66.30% of a firm's shares on flotation (median=72%), indicating that most firms in the sample have a very high concentrated ownership structure at the IPO. Also consistent with prior research, the initial return distribution exhibits positive skewness and has excess kurtosis. A Bera and Jarque (1982) test for

[12] The t–statistic is calculated as:

$$\frac{r_{it}}{SD/\sqrt{n}}$$

where r_{it} is the mean initial return estimated as in equation 2.1, SD is the standard deviation of the mean initial return and n denotes the number of observations. The t–statistic assumes normality and independence and is therefore biased and must be interpreted with caution.

normality rejects the joint hypothesis that skewness equals zero and kurtosis equals three at high levels of significance[13].

In table 2.6 initial returns are reported on a year–by–year basis. Such a classification enables us to examine the pattern of returns over time and to investigate whether hot issue markets exist[14]. As table 2.6 reveals, despite the fact that there is a variation in initial returns measured on a yearly basis, underpricing is a consistent phenomenon. The higher mean initial returns are obtained in 1987 and 1984 where the level of underpricing reached 22.20% and 12.81% respectively. The lower level of initial returns is reported in 1986 and 1988 where underpricing fell to 5.00% and 5.83% respectively. Despite these differences, however, in the degree of initial performance, there is no evidence to suggest that there exists a relation between the annual volume of issues and initial returns. Consistent with prior U.K. evidence, our sample period includes a hot issue market, 1987, where the average level of underpricing is almost 10% above the returns obtained for the year showing the next highest return[15]. It has to be said,

[13] The test for normality is estimated as:

$$BJ=[\frac{T}{6}SK^2+\frac{T}{24}(K-3)^2]$$

where SK is the skewness statistic, K is the Kurtosis statistic and T denotes the number of observations.

[14] Hot issue markets are certain periods of time during which underpricing appears to be significantly higher than in any other period [Ibbotson and Jaffe (1975)]. This phenomenon has been documented by Ritter (1984a) and Ibbotson *et al.* (1988, 1994) for the U.S. market, and by Jenkinson and Espenlaub (1991), Levis (1993) and Espenlaub and Tonks (1998) for the U.K. market.

[15] Unlike the underpricing anomaly, very few explanations have been put forward to account for the hot issue market phenomenon. The Bank of England (1990) suggests that the hot issue market during 1987 was the result of the 50% rise in equity prices between December 1986 and July 1987. Ibbotson *et al.* (1994) present two explanations as to why hot issue markets exist. First, on the presumption that riskier IPOs produce higher initial returns, it might be the case that in some periods the firms going public are riskier than in other times. Second, some investors may follow a positive feedback strategy on the grounds that a positive autocorrelation exists in the level of initial returns. Such investors may bid up the price of an IPO in the secondary market, if other IPOs have increased in price, and if a similar strategy is employed by other investors, large positive returns are produced. Rees and Byrne (1996) examine the occurrence of hot issue markets using a sample of 680 U.K. IPOs offered to the public between 1984–1991. They find that the

however, that the magnitude of underpricing during 1987 is not as excessive as that reported for U.S. offerings, where the level of initial returns in some periods was well over 50%.

variation in the characteristics of IPOs, such as issue size, issue method and market of flotation, can account for at least a small portion of the observed hot issue markets. They conclude that the hot issue market anomaly, to some extent, is susceptible to economic explanation.

Table 2.3: direct costs of going public by issue size and market of flotation.

Panel A: all IPOs

Gross proceeds (£000)	Number of IPOs	Average direct costs (£000)	Average direct costs as a % of gross proceeds
1 – 1,767	82	207.06	18.41
1,768 – 2,600	83	263.50	12.00
2,601 – 3,720	81	310.97	9.91
3,721 – 4,535	84	342.94	8.33
4,536 – 6,460	80	458.54	8.32
6,461 – 10,760	83	670.22	7.95
10,761 – 26,000	80	987.79	6.17
26,001 +	80	8934.95	3.18
All	653	1500.87	9.31

Panel B: Main Market

Gross proceeds (£000)	Number of IPOs	Average direct costs (£000)	Average direct costs as a % of gross proceeds
1 – 5,120	47	393.30	10.97
5,121 – 8,220	49	583.60	9.03
8,221 – 11,850	48	733.46	7.37
11,851 – 18,900	49	963.71	6.35
18,901 – 80,000	47	1747.82	4.91
80,001 +	46	14108.98	2.25
All	286	3009.34	6.84

Note: gross proceeds and the costs of flotation are measured in pounds of 1992 purchasing power.

Table 2.3 continued.

Panel C: Unlisted Securities Market

Gross proceeds (£000)	Number of IPOs	Average direct costs (£000)	Average direct costs as a % of gross proceeds
1 – 1,555	61	197.28	19.63
1,556 – 2,265	61	243.58	12.74
2,266 – 2,981	61	281.77	10.97
2,982 – 3,825	61	313.38	9.28
3,826 – 4,940	61	231.19	7.74
4,941 +	62	562.99	7.14
All	367	322.36	11.24

Note: gross proceeds and the costs of flotation are measured in pounds of 1992 purchasing power.

Table 2.4: direct costs of going public by method and year of flotation.

	Offers for sale			Placements			All IPOs		
Year	N[a]	Adc[b]	Adc(%)[c]	N[a]	Adc[b]	Adc(%)[c]	N[a]	Adc[b]	Adc(%)[c]
1984	20	1378.70	6.65	61	223.37	11.09	81	508.64	9.99
1985	33	1408.86	8.56	62	274.78	11.34	95	669.97	10.37
1986	42	5072.48	7.52	83	341.19	10.48	125	1930.91	9.43
1987	17	7954.78	7.30	88	432.80	10.04	105	1650.64	9.59
1988	12	4054.50	5.36	99	457.16	9.47	111	846.66	9.03
1989	15	5894.94	3.94	47	382.90	12.42	62	1716.46	10.37
1990	12	5548.55	1.69	14	394.68	9.66	26	2773.40	5.98
1991	9	10100.58	2.18	9	1323.85	8.21	18	5712.21	5.19
1992	5	2620.00	4.94	25	2813.84	6.87	30	2781.53	6.55
All	165	4424.28	6.32	488	509.12	10.32	653	1500.87	9.31

Notes: a denotes the number of IPOs, b denotes the average total costs of going public (£000) and c denotes the average total costs of going public as a percentage of the gross proceeds raised on flotation. Gross proceeds and the costs of flotation are measured in pounds of 1992 purchasing power.

Table 2.5: descriptive statistics.

Mean (%)	10.42
Minimum (%)	–45.71
Median (%)	6.66
Maximum (%)	158.20
Standard deviation	18.40
t–statistic	14.47**
% of IPOs with positive initial returns	71.82
Mean equity retained (%)	66.30
Median equity retained (%)	72.00
Mean gross proceeds (£000)	77797.1
Adjusted[a] mean gross proceeds (£000)	16808.5
Median gross proceeds (£000)	4491.2
Mean market value on flotation (£000)	115000.0
Median market value on flotation (£000)	17210.9
Skewness	1.75
Kurtosis	12.70
B–J statistic ~ x^2 (2)	2893.3**

Notes: [a]after adjusting for the effect of government privatisations. Mean initial returns are computed using equation 2.1. Two asterisks denote statistical significance at the 1% level. Gross proceeds and the market value of IPOs on flotation are measured in pounds of 1992 purchasing power.

Table 2.6: Initial returns by year of flotation.

Year	Number of IPOs	Mean (%)	Median (%)	Standard Deviation	t-statistic
1984	81	12.81	5.94	23.16	4.97**
1985	95	7.75	2.94	14.26	5.29**
1986	125	5.00	4.22	13.65	4.09**
1987	105	22.20	20.80	24.37	9.33**
1988	111	5.83	5.92	11.19	5.48**
1989	62	12.29	12.00	16.27	5.94**
1990	26	11.89	3.97	11.89	5.09**
1991	18	7.45	4.71	14.97	2.11*
1992	30	7.38	5.22	13.03	3.10**

Notes: mean initial returns are computed using equation 2.1. One and two asterisks denote statistical significance at the 5% and 1% levels respectively.

2.4. Aftermarket Performance.

Table 2.7 reports the CARs when abnormal returns are calculated using the market–adjusted model. Consistent with U.S. and U.K. evidence, IPOs significantly and economically underperform in the long–run. The magnitude of underperformance, however, depends on the benchmark used for estimating abnormal returns. Examining first the CARs when abnormal returns are computed relative to the FTA, it can be observed that during the first few months of seasoning monthly returns are slightly positive but insignificant. After month 11, however, the CARs decline monotonically to –16.60% (t–statistic=–5.52) by the end of month 36. When the aftermarket performance of IPOs is assessed relative to the HGSC, the CARs are negative from month 1 through month 36. By the end of this period, new issues underperform the HGSC by 21.30% (t–statistic=–11.57).

The estimation of abnormal returns using the market–adjusted model is based on the assumption of a beta coefficient equal to one. Betas, however, may not be stationary in the secondary market. In order to examine whether the negative returns could potentially be the result of time–varying systematic risk, we re–estimated the abnormal returns while allowing for systematic risk to vary over time. The results, estimated with Ibbotson's (1975) RATS model, are presented in table 2.8. Our empirical findings remain virtually unchanged. By the end of month 36, IPOs significantly and economically underperform the FTA by 14.27% (t–statistic=–4.75), and the HGSC by 19.71% (t–statistic=–12.38). Thus, the introduction of a specific risk variable explains away only a very small portion of the extent of underperformance. When the RATS model is estimated using the FTA as the market benchmark, the mean cross–sectional betas for post–issue months 1–12 are lower than one (0.954), decline to 0.888 between months 13–24 and then slightly increase to 0.906 between months 25–36. When the HGSC is used as the market benchmark, the average cross–sectional betas follow a similar pattern, the only exception being that during the first year of seasoning IPOs are riskier than the market (beta=1.020). These results indicate that risk mismeasurement alone cannot account for the long–run underperformance of IPOs.

Further evidence as to the poor aftermarket performance of new issues is presented in table 2.9 which reports the CARs when abnormal returns are computed under the Fama and French (1993) three factor model. Not only is the null hypothesis of no abnormal returns strongly rejected, but the extent of underperformance is even more dramatic. By month 24, IPOs significantly and economically underperform the FTA by 13.08% (t–statistic=–3.69), and the HGSC by 21.43% (t–statistic=–8.27). From month 25 onwards, the decline in monthly returns is even greater, and by month 36 IPOs underperform both market indexes a further 13%. These results are in line with the evidence presented by Espenlaub *et al.* (1998), who find that U.K. IPOs underperform in the long–run by almost 30% when the Fama and French three factor model is employed as a measure of abnormal performance. They note, however, that the application of a U.S. model which takes into account book–to–market figures to U.K. data may produce misleading results because balance sheet items in the U.K. are treated differently compared to the U.S. Given the magnitude of underperformance, as well as the concerns raised by Espenlaub *et al.*, the results obtained using the three factor asset pricing model should be interpreted with caution.

In figure 2.3 we have plotted the six CAR series for the 36 months following the IPO where the initial return is also included. The three year underperformance of new issues exceeds the initial return and, subsequently, investors who were able to purchase shares in the primary market and held onto the shares also underperform in the long–run. This result is in sharp contrast to prior U.K. evidence presented by Levis (1993), who finds that the CARs for IPOs issued between 1980 and 1988 remain positive by the end of month 36 when the level of initial returns is included in the long–run performance analysis.

Further evidence regarding the post–listing price behaviour of new issues is presented in table 2.10 which reports the distribution of long–run returns for the sample of IPOs and the two benchmarks. Consistent with our previous findings, IPOs underperform both market indexes in the secondary market. On average, the three year holding period returns are 22.27% for the entire sample of IPOs, 33.62% for the FTA and 41.09% for the HGSC. As shown in table 2.10, the distribution of returns is widely dispersed. To reduce the influence of outlier observations, the sample is truncated by removing the five IPOs with the highest and lowest long–run returns. When the effect of outliers is taken into account, the extent of underperformance is only slightly increased. The mean return for the truncated sample falls to 19.84%, whereas for the two benchmarks it remains almost unchanged at 33.13% and 40.06% respectively[16].

Kothari and Warner (1997) and Barber and Lyon (1997) suggest that significant biases

[16] As revealed in table 2.10, the median return for the sample of IPOs and for the two market benchmarks is lower than the mean, indicating that the distribution of three year holding period returns is positively skewed. Given that the distribution of returns is non–normal, it might be said that the median return gives a more accurate picture of the long–run performance of newly listed firms. For the sample of IPOs, the median return is 5.98%. The comparison of this figure to the 29.60% reported for the FTA and the 35.86% reported for the HGSC shows that the magnitude of underperformance becomes even worse.

can arise in testing for long–run abnormal stock returns, and that the null hypothesis of no positive abnormal performance is significantly over–rejected. The simulation results of Kothari and Warner show that when the CAR measure is employed to assess long–run performance, the null hypothesis of no positive abnormal returns is significantly over–rejected in 26% to 35.2% of the samples over a 36 month period. In contrast, the null hypothesis of no negative abnormal performance is significantly over–rejected in only 2.4% to 8.4% of the samples. When a buy and hold return strategy is used to evaluate long–run performance, Kothari and Warner find that over a three year period positive abnormal returns are reported in 26.4% to 91.2% of the samples, whereas negative abnormal performance is observed in only 0.0% to 1.6% of the samples. Although the simulation results of Kothari and Warner raise questions as to the significance of positive long–term abnormal returns, the main conclusion to emerge from our empirical results, obtained using either the CAR or a buy and hold return strategy, is that newly listed firms significantly underperform in the long–run. Given this finding, it appears that the magnitude of the results cannot be accounted for by specification errors.

Table 2.7: cumulative abnormal returns for IPOs, exclusive of the initial return, estimated using the market-adjusted model.

Month	Number of IPOs	FTA–CARs (%)	t–stat	HGSC–CARs (%)	t–stat
1	653	0.12	0.23	−0.26	−0.84
2	653	−0.32	−0.45	−0.95	−2.19[a]
3	653	−0.15	−0.17	−1.53	−2.88[b]
4	649	0.81	0.80	−1.36	−2.21[a]
5	648	0.55	0.49	−1.74	−2.53[a]
6	646	0.19	0.15	−2.33	−3.10[b]
7	643	0.06	0.04	−3.03	−3.73[b]
8	640	−0.33	−0.23	−3.72	−4.28[b]
9	638	0.29	0.19	−3.92	−4.26[b]
10	633	0.58	0.36	−4.18	−4.31[b]
11	629	−0.06	−0.03	−4.72	−4.64[b]
12	627	−0.54	−0.31	−5.17	−4.86[b]
13	621	−0.90	−0.49	−5.69	−5.14[b]
14	616	−1.19	−0.63	−6.12	−5.33[b]
15	610	−2.02	−1.04	−7.31	−6.15[b]
16	605	−2.66	−1.32	−8.12	−6.62[b]
17	601	−3.07	−1.48	−8.51	−6.73[b]
18	597	−3.69	−1.73	−9.03	−6.94[b]
19	590	−4.77	−2.18[a]	−9.96	−7.45[b]
20	585	−5.21	−2.32[a]	−10.47	−7.63[b]
21	580	−5.43	−2.36[a]	−11.15	−7.93[b]
22	572	−5.89	−2.50[a]	−11.99	−8.33[b]
23	560	−6.34	−2.63[b]	−12.18	−8.28[b]
24	551	−7.75	−3.15[b]	−13.32	−8.86[b]
25	544	−8.37	−3.34[b]	−13.80	−9.00[b]
26	539	−9.55	−3.73[b]	−14.53	−9.29[b]
27	534	−10.04	−3.85[b]	−15.63	−9.81[b]
28	529	−10.85	−4.09[b]	−16.15	−9.95[b]
29	518	−11.64	−4.31[b]	−16.55	−10.02[b]
30	511	−12.72	−4.63[b]	−17.24	−10.26[b]
31	503	−13.94	−4.99[b]	−17.73	−10.38[b]
32	496	−14.78	−5.21[b]	−18.75	−10.81[b]
33	489	−15.10	−5.24[b]	−19.55	−11.10[b]
34	483	−15.24	−5.21[b]	−19.81	−11.08[b]
35	474	−15.46	−5.21[b]	−20.12	−11.09[b]
36	468	−16.60	−5.52[b]	−21.30	−11.57[b]

Notes: cumulative abnormal returns are computed using equation 2.2. a and b denote statistical significance at the 5% and 1% levels respectively.

Table 2.8: cumulative abnormal returns for IPOs, exclusive of the initial return, estimated using Ibbotson's (1975) RATS model.

Month	Number of IPOs	FTA–CARs (%)	t-stat	Beta	HGSC–CARs (%)	t-stat	Beta
1	653	0.12	0.24	0.989^{b}	–0.31	–1.16	1.091^{b}
2	653	–0.26	–0.36	0.876^{b}	–0.93	–2.47^{a}	0.938^{b}
3	653	–0.09	–0.10	0.921^{b}	–1.48	–3.22^{b}	0.971^{b}
4	649	0.86	0.86	1.051^{b}	–1.41	–2.65^{b}	1.119^{b}
5	648	0.65	0.58	0.968^{b}	–1.90	–3.20^{b}	1.063^{b}
6	646	0.24	0.19	1.040^{b}	–2.66	–4.09^{b}	1.097^{b}
7	643	0.21	0.15	0.903^{b}	–3.32	–4.72^{b}	0.982^{b}
8	640	–0.14	–0.09	0.967^{b}	–3.98	–5.30^{b}	0.994^{b}
9	638	0.67	0.44	0.894^{b}	–4.09	–5.13^{b}	0.965^{b}
10	633	0.97	0.61	0.981^{b}	–4.38	–5.22^{b}	1.029^{b}
11	629	0.34	0.20	0.962^{b}	–4.91	–5.57^{b}	1.011^{b}
12	627	0.02	0.01	0.901^{b}	–5.33	–5.79^{b}	0.981^{b}
13	621	–0.20	–0.11	0.886^{b}	–5.72	–5.97^{b}	0.924^{b}
14	616	–0.46	–0.24	0.920^{b}	–6.08	–6.12^{b}	0.936^{b}
15	610	–1.25	–0.64	0.979^{b}	–7.21	–7.01^{b}	1.041^{b}
16	605	–1.87	–0.93	0.986^{b}	–8.02	–7.55^{b}	1.033^{b}
17	601	–1.94	–0.94	0.807^{b}	–8.16	–7.45^{b}	0.860^{b}
18	597	–2.46	–1.15	0.832^{b}	–8.61	–7.64^{b}	0.882^{b}
19	590	–3.49	–1.60	0.852^{b}	–9.53	–8.24^{b}	0.993^{b}
20	585	–3.93	–1.75	0.895^{b}	–10.02	–8.44^{b}	0.934^{b}
21	580	–3.95	–1.72	0.884^{b}	–10.61	–8.72^{b}	0.974^{b}
22	572	–4.25	–1.81	0.904^{b}	–11.40	–9.16^{b}	0.989^{b}
23	560	–4.78	–1.99^{a}	0.937^{b}	–11.63	–9.13^{b}	1.049^{b}
24	551	–6.03	–2.46^{a}	0.783^{b}	–12.62	–9.70^{b}	0.832^{b}
25	544	–6.69	–2.67^{b}	0.876^{b}	–13.11	–9.88^{b}	0.966^{b}
26	539	–7.84	–3.07^{b}	0.913^{b}	–13.78	–10.18^{b}	0.954^{b}
27	534	–8.25	–3.17^{b}	0.798^{b}	–14.71	–10.66^{b}	0.825^{b}
28	529	–8.98	–3.39^{b}	1.027^{b}	–15.20	–10.82^{b}	1.130^{b}
29	518	–9.80	–3.63^{b}	0.940^{b}	–15.59	–10.91^{b}	1.005^{b}
30	511	–11.08	–4.04^{b}	0.835^{b}	–16.42	–11.29^{b}	0.965^{b}
31	503	–12.24	–4.39^{b}	0.906^{b}	–16.89	–11.43^{b}	0.929^{b}
32	496	–12.65	–4.47^{b}	0.872^{b}	–17.47	–11.63^{b}	0.898^{b}
33	489	–12.97	–4.51^{b}	0.960^{b}	–18.26	–11.98^{b}	1.020^{b}
34	483	–13.28	–4.55^{b}	1.015^{b}	–18.58	–12.00^{b}	0.976^{b}
35	474	–13.45	–4.54^{b}	0.866^{b}	–18.88	–12.02^{b}	0.932^{b}
36	468	–14.27	–4.75^{b}	0.870^{b}	–19.71	–12.38^{b}	0.890^{b}

Notes: cumulative abnormal returns are computed using equation 2.2. a and b denote statistical significance at the 5% and 1% levels respectively.

Table 2.9: cumulative abnormal returns for IPOs, exclusive of the initial return, estimated using the Fama and French (1993) three factor model.

Month	Number of IPOs	FTA–CARs (%)	t–stat	HGSC–CARs (%)	t–stat
1	653	0.23	0.31	−0.21	−0.39
2	653	−0.04	−0.03	−1.14	−1.52
3	653	0.25	0.19	−1.62	−1.77
4	649	1.00	0.69	−1.47	−1.39
5	648	0.88	0.54	−1.92	−1.62
6	646	0.41	0.23	−2.81	−2.17[a]
7	643	0.14	0.07	−3.53	−2.52[a]
8	640	−0.47	−0.23	−4.63	−3.09[b]
9	638	−0.28	−0.12	−5.06	−3.19[b]
10	633	−0.10	−0.04	−5.51	−3.29[b]
11	629	−1.04	−0.43	−6.90	−3.93[b]
12	627	−1.61	−0.64	−7.62	−4.16[b]
13	621	−2.07	−0.79	−8.35	−4.38[b]
14	616	−2.10	−0.77	−8.97	−4.53[b]
15	610	−3.99	−1.42	−11.12	−5.43[b]
16	605	−5.46	−1.89	−12.64	−5.98[b]
17	601	−6.31	−2.11[a]	−13.45	−6.17[b]
18	597	−7.24	−2.36[a]	−14.42	−6.43[b]
19	590	−8.46	−2.68[b]	−15.82	−6.86[b]
20	585	−9.00	−2.78[b]	−16.67	−7.05[b]
21	580	−9.68	−2.92[b]	−17.50	−7.22[b]
22	572	−10.35	−3.05[b]	−18.61	−7.50[b]
23	560	−10.54	−3.04[b]	−19.02	−7.50[b]
24	551	−13.08	−3.69[b]	−21.43	−8.27[b]
25	544	−13.89	−3.84[b]	−22.18	−8.39[b]
26	539	−14.85	−4.03[b]	−23.44	−8.69[b]
27	534	−16.09	−4.28[b]	−24.92	−9.07[b]
28	529	−17.26	−4.51[b]	−25.92	−9.27[b]
29	518	−18.42	−4.73[b]	−26.98	−9.48[b]
30	511	−20.02	−5.06[b]	−28.21	−9.74[b]
31	503	−21.78	−5.41[b]	−29.43	−10.00[b]
32	496	−23.41	−5.73[b]	−31.02	−10.37[b]
33	489	−23.79	−5.73[b]	−31.90	−10.50[b]
34	483	−23.89	−5.65[b]	−32.06	−10.40[b]
35	474	−24.48	−5.73[b]	−32.64	−10.44[b]
36	468	−26.29	−6.06[b]	−34.15	−10.77[b]

Notes: cumulative abnormal returns are computed using equation 2.2. a and b denote statistical significance at the 5% and 1% levels respectively.

Figure 2.3: cumulative abnormal returns for IPOs, inclusive of the initial return.

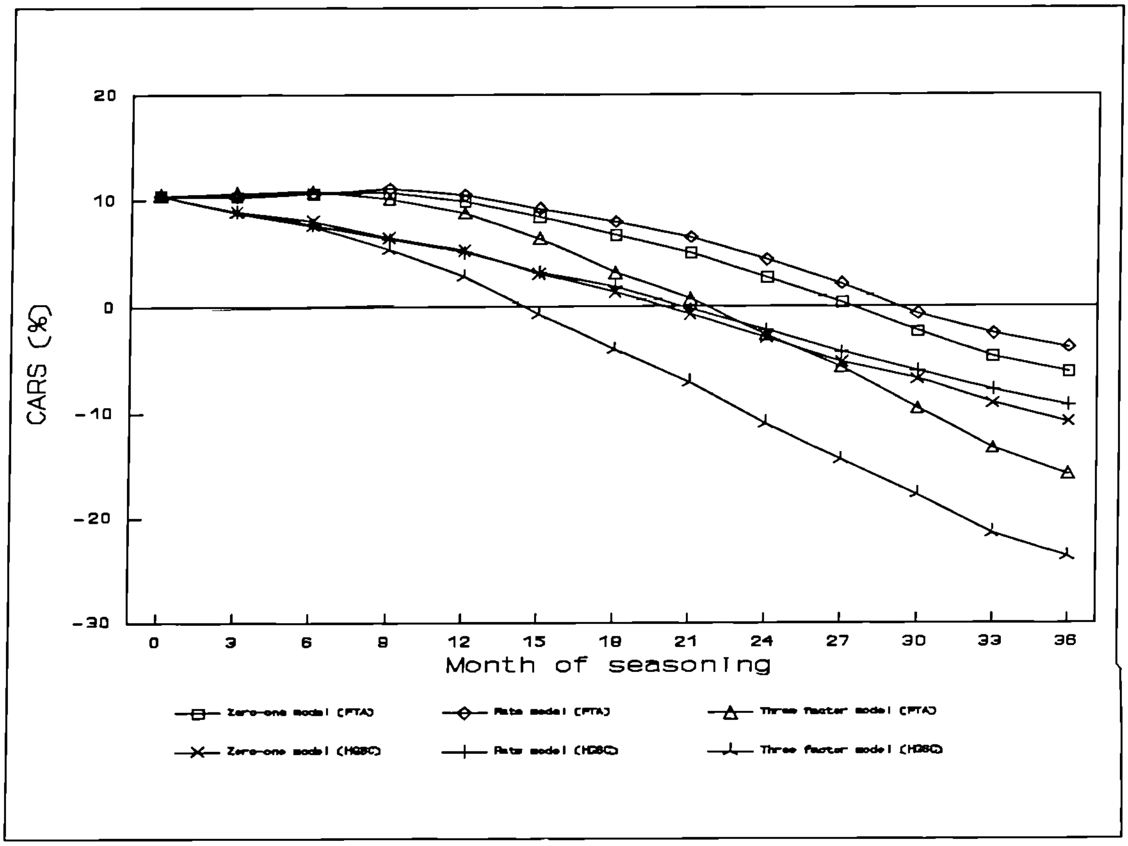


Table 2.10: distribution of three year holding period returns, exclusive of the initial return, for 653 IPOs and the market.

Rank	IPOs (%)	FTA (%)	HGSC (%)
1 (lowest)	–214.87	–27.42	–31.69
66	–81.09	1.92	–9.89
131	–57.59	11.86	–3.47
196	–36.58	19.38	3.16
261	–16.55	26.28	14.12
326 (median)	5.98	29.60	35.86
391	27.07	34.01	57.94
456	57.27	39.65	83.43
521	92.09	46.12	95.45
586	144.33	62.95	115.98
653 (highest)	588.02	153.16	265.42
Mean	22.27	33.62	41.09

Notes: three year holding period returns are computed using equation 2.8.

2.4.1. Aftermarket performance by issue size and market of flotation.

Table 2.11 examines the relation between issue size (gross proceeds) and long–run performance. Panel A reports results for the entire sample of IPOs. As indicated by the wealth relatives, there is no cross–sectional variation in the aftermarket performance of new issues among the various gross proceeds categories. Superior performance is only reported by large offerings, those raising more than £ 14.3 million. For all other size groups the wealth relatives are well below one across both market benchmarks.

Panels B and C report results for IPOs listed in the Main Market and the USM separately. In line with prior U.K. evidence, new issues obtaining a quotation on the official list perform better in the long–run than their USM counterparts. The mean wealth relative for USM IPOs across both indexes is much lower than that reported for offerings listed in the Main Market. When new issues are segmented by size and market of flotation, size appears to be an important determinant of aftermarket performance. For IPOs quoted in the Main Market a positive relation is observed between gross proceeds and long–run returns. For USM offerings, however, the reverse pattern occurs. The 73 largest issues severely underperform in the long–run reporting average wealth relatives of 0.635 and 0.626 respectively.

Table 2.11 also examines the relation between initial and aftermarket performance for all gross proceeds categories. Given that most size groups underperform in the long–run, no conclusive evidence can be drawn as to whether the aftermarket performance of IPOs is directly linked to the initial underpricing anomaly. However, by examining the results obtained for the two markets separately, it can be observed that an inverse relation exists between initial and aftermarket performance; USM offerings are associated with higher levels of underpricing and lower wealth relatives, whereas for IPOs listed in the Main Market the reverse pattern emerges.

Table 2.11: aftermarket performance by issue size and market of flotation, exclusive of the initial return.

Panel A: all issues

Gross proceeds (£000)	Number of IPOs	UP (%)	R_T (%)	WR_{FTA}	WR_{HGSC}
1 – 2,294	131	13.04	22.24	0.896	0.822
2,295 – 3,850	131	11.92	27.70	0.930	0.871
3,851 – 6,100	132	8.95	–3.82	0.742	0.737
6,101 – 14,300	130	10.33	17.66	0.905	0.864
14,301 +	129	7.82	47.95	1.097	1.030
All issues	653	10.42	22.27	0.915	0.866

Panel B: Main Market

Gross proceeds (£000)	Number of IPOs	UP (%)	R_T (%)	WR_{FTA}	WR_{HGSC}
1 – 5,580	57	11.17	4.90	0.839	0.842
5,581 – 9,700	57	7.99	40.11	1.098	1.080
9,701 – 15,300	57	12.06	13.85	0.870	0.835
15,301 – 47,000	57	4.33	29.98	0.974	0.924
47,001 +	58	11.88	68.78	1.248	1.186
All issues	286	9.49	31.65	1.002	0.970

Notes: UP, the level of underpricing, is computed using equation 2.1. R_T denotes the mean three year holding period return and is computed using equation 2.9. WR denotes the wealth relative and is computed using equation 2.10. Gross proceeds are measured in pounds of 1992 purchasing power.

Table 2.11 continued.

Panel C: Unlisted Securities Market

Gross proceeds (£000)	Number of IPOs	UP (%)	R_T (%)	WR_{FTA}	WR_{HGSC}
1 – 1,700	73	11.38	25.68	0.877	0.785
1,701 – 2,480	73	14.82	19.12	0.924	0.897
2,481 – 3,445	74	11.25	32.55	0.939	0.849
3,446 – 4,500	74	7.95	14.09	0.858	0.793
4,501 +	73	10.34	–16.87	0.635	0.626
All issues	367	11.14	14.96	0.849	0.819

Notes: UP, the level of underpricing, is computed using equation 2.1. R_T denotes the mean three year holding period return and is computed using equation 2.9. WR denotes the wealth relative and is computed using equation 2.10. Gross proceeds are measured in pounds of 1992 purchasing power.

2.4.2. Aftermarket performance by fraction of equity retained.

Based on agency theory, which states that additional risk is created when there is a perceived separation of ownership and control, it could be argued that IPOs might perform better in the long–run when pre–offering shareholders retain a large proportion of equity capital in the IPO rather than when insiders appear to be bailing out when the firm goes public. Evidence as to the relation between the fraction of equity retained and long–term performance is presented in table 2.12. The results are at odds with what was anticipated. Regardless of market index used, the average wealth relatives decrease with the proportion of equity retained. The fact that retained equity and long–run performance are negatively related might be an indication that the market takes a sceptical view of those offerings whose owners have remained the dominant shareholders after the offering.

The inverse relation between the fraction of equity retained and aftermarket performance provides evidence against *the timing hypothesis* of Ritter (1991). If issuing firms could successfully time their IPOs to coincide with periods of excessive optimism, it would be logical to expect insiders to overcharge investors when retaining smaller fractions of equity capital, as this strategy would maximise their initial gains and minimise their long–run losses on the shares they retain. As a result, when optimistic investors revise their expectations and the pattern in returns is reversed, offerings whose insiders disposed most of their equity capital in the IPO should experience severe underperformance. Our findings, however, point in the exact opposite direction.

Table 2.12: aftermarket performance by fraction of equity retained, exclusive of the initial return.

Equity retained (%)	Number of IPOs	UP (%)	R_T (%)	WR_{FTA}	WR_{HGSC}
0 – 54.99	127	7.99	40.22	1.040	0.983
55 – 63.99	133	8.82	26.27	0.951	0.910
64 – 69.99	131	10.87	19.47	0.905	0.853
70 – 74.99	138	9.76	5.32	0.811	0.779
75 +	124	14.88	21.42	0.871	0.810
All issues	653	10.42	22.27	0.915	0.866

Notes: UP, the level of underpricing, is computed using equation 2.1. R_T denotes the mean three year holding period return and is computed using equation 2.9. WR denotes the wealth relative and is computed using equation 2.10.

2.4.3. Aftermarket performance by issue size and method of flotation.

In panels A and B of table 2.13 we report long–run performance measures for placements and offers for sale separately. Initial returns are also reported. In contrast to prior U.K. evidence, the vehicle of flotation appears to be an important determinant of long–run performance. Regardless of benchmark used, the average wealth relatives for offers for sale are much higher than those observed for placements. When new issues are segmented by size and method of introduction, gross proceeds exhibit a positive relation with long–term returns, but only for IPOs listed through an offer for sale. For newly listed firms taken to the market via a placing, issue size is not a major determinant of aftermarket performance.

Table 2.13: aftermarket performance by issue size and method of flotation, exclusive of the initial return.

Panel A: offers for sale

Gross proceeds (£000)	Number of IPOs	UP (%)	R_T (%)	WR_{FTA}	WR_{HGSC}
1 – 7,900	32	11.12	53.42	1.044	0.846
7,901 – 13,200	33	7.10	34.02	0.897	0.697
13,201 – 28,200	33	3.08	41.19	0.968	0.825
28,201 – 256,000	31	4.33	29.74	1.034	1.008
256,001 +	36	16.84	93.69	1.402	1.333
All issues	165	8.67	51.43	1.072	0.925

Panel B: placements

Gross proceeds (£000)	Number of IPOs	UP (%)	R_T (%)	WR_{FTA}	WR_{HGSC}
1 – 1,960	97	12.06	26.79	0.910	0.812
1,961 – 3,020	98	14.41	17.45	0.891	0.876
3,021 – 4,230	97	8.64	20.71	0.893	0.831
4,231 – 6,290	98	9.18	−10.10	0.706	0.733
6,291 +	98	10.70	7.45	0.881	0.978
All issues	488	11.01	12.41	0.857	0.842

Notes: UP, the level of underpricing, is computed using equation 2.1. R_T denotes the mean three year holding period return and is computed using equation 2.9. WR denotes the wealth relative and is computed using equation 2.10. Gross proceeds are measured in pounds of 1992 purchasing power.

2.4.4. Aftermarket performance by initial returns.

Table 2.14 examines the long–term performance of IPOs for six first day return categories. Such an investigation enables us to identify whether the market for new issues overreacts. DeBondt and Thaler (1985, 1987) present evidence of market overreaction. They suggest that extreme movements in stock prices are followed by subsequent movements in the opposite direction, implying a negative relation between past and subsequent abnormal returns on individual securities, and that the more extreme the initial price movement, the greater is the subsequent adjustment.

As shown in table 2.14, IPOs rising 22% or more above their offer price by the of the first trading day, the highest initial return category, have the second worse aftermarket performance relative to the FTA and the third worse performance relative to the HGSC. The worse performing group in the long–run differs across the two market indexes. Relative to the FTA, the lowest mean wealth relative, 0.850, is reported by overpriced IPOs, whereas relative to the HGSC, the lowest average wealth relative, 0.786, is reported by offerings with a mean initial return between 0% and 1.38%. Only IPOs earning on average moderate initial returns, between 1.39% and 5.99%, display long–run overperformance, but only against the FTA. Overall, our results are broadly consistent with prior U.K. and U.S. findings, and provide some evidence in support of the notion that the new issues market overreacts.

2.4.5. Aftermarket performance by industrial sector.

Table 2.15 reports long–run performance measures for IPOs broken down by industrial

Table 2.14: aftermarket performance by initial returns, exclusive of the initial return.

Initial return categories (%)	Number of IPOs	R_T (%)	WR_{FTA}	WR_{HGSC}
−45.71 – −0.01	101	16.06	0.850	0.803
0 – 1.38	104	24.75	0.885	0.786
1.39 – 5.99	106	37.42	1.011	0.957
6.00 – 11.99	109	18.39	0.883	0.869
12.00 – 21.99	119	29.42	0.985	0.950
22.00 +	114	7.68	0.865	0.830
All Issues	653	22.27	0.915	0.866

Notes: Initial returns are computed using equation 2.1. R_T denotes the mean three year holding period return and is computed using equation 2.9. WR denotes the wealth relative and is computed using equation 2.10.

sector. The industry classifications are those prepared by the KPMG Peat Marwick McLintock. Any individual industries were included into the broader industry category. If, however, there were 10 or more individual IPOs in the sample, then individual industries were listed separately. Moreover, the 30 privatised utilities are reported under a separate heading. This procedure resulted in the formation of 14 different industry groups. As indicated in table 2.15, the firms going public between 1984–1992 are not evenly distributed across the various industrial sectors. Capital goods, agencies and electronics are heavily represented, whereas very few health and household and food manufacturing firms went public during our sample period.

As table 2.15 reveals, there is no cross–sectional variation in the long–run performance among different industries. Almost all industrial sectors severely underperform in the long–run across both benchmarks. Superior performance is only reported by IPOs in the leisure industry (excluding the privatised utilities). Also reported in table 2.15 are the mean initial returns and the mean gross proceeds raised per industry. As shown, some industries with high initial returns tend to perform rather poorly in the long–run. For example, the stores industry, which reports the highest level of underpricing (excluding privatisations), is the second worse performing sector in the long–run relative to the FTA and the third worse performing sector relative to the HGSC. A similar pattern, but not to the same extent, is also observed for agencies, food manufacturing and electronics. The privatised utilities, however, provide an exception to this pattern. Following an initial return of 20.24%, the 30 privatisations report mean three year holding period returns of 98.94% and average wealth relatives well above one across both benchmarks[17]. Table 2.15 also indicates that there are substantial differences in the average gross proceeds raised by IPOs in the various industrial sectors. There is, however, no indication that issue size is related in any way to long–run performance.

2.4.6. Aftermarket performance by year of flotation.

Ritter (1991) claims that a negative relation between the annual volume of issues and aftermarket returns provides evidence in support of the notion that issuing firms are

[17] Similar findings are presented by several other academic researchers. Levis (1993) reports mean initial and long–run returns of 37.25% and 96.91% respectively, for 12 utilities that were privatised in the U.K. between 1980 and 1988. Menyah *et al.* (1996) examine 40 U.K. privatised utilities that were sold between 1981 and 1991. Excluding an initial return of 23.62%, they find that four years after the IPO the utilities were significantly overperforming the market by 84.13%. Ikoku (1998) examines 29 utilities that were privatised in Nigeria during 1989–1993, and reports average market adjusted initial and aftermarket returns of 18.50% and 26.40% respectively. In contrast to these findings, Aggarwal *et al.* (1993) find that 9 privatised utilities sold in Chile between 1982 and 1990, significantly underperform the market by 13.70% three years after the IPO.

Table 2.15: aftermarket performance by industrial sector, exclusive of the initial return.

Industrial sector	Number of IPOs	Mean gross proceeds (£000)	UP (%)	R_T (%)	WR_{FTA}	WR_{HGSC}
Capital goods	113	13574.67	8.58	13.66	0.849	0.816
Constructions	38	35947.42	3.13	10.42	0.911	0.979
Electronics	68	7181.97	8.22	11.82	0.804	0.700
Consumer group	57	7740.64	13.41	35.67	0.969	0.887
Food Manufacturing	12	11190.71	11.39	22.28	0.840	0.730
Health and Household	13	38483.63	14.38	16.16	0.901	0.872
Leisure	34	8794.09	12.80	69.16	1.254	1.141
Publishing and printing	31	15795.05	13.49	22.43	0.966	0.912
Stores	62	11773.06	16.63	7.75	0.805	0.742
Agencies	88	12737.88	9.99	6.34	0.816	0.806
Financial group	30	71855.37	4.93	20.94	0.895	0.864
Property	34	12488.51	6.00	30.13	0.963	0.900
Privatisations	30	1341141	20.24	98.94	1.464	1.457
Other	43	20525.79	6.99	13.59	0.853	0.831
All Issues	653	77797.13	10.42	22.27	0.915	0.866

Notes: UP, the level of underpricing, is computed using equation 2.1. R_T denotes the mean three year holding period return and is computed using equation 2.9. WR denotes the wealth relative and is computed using equation 2.10. Gross proceeds are measured in pounds of 1992 purchasing power.

successfully timing their flotation for periods when the costs of raising external equity capital are low. To test this hypothesis, IPOs are segmented on a year–by–year basis. The results, reported in table 2.16, show that the wealth relatives vary depending on the year of issuance and the benchmark used in assessing long–run performance. Although the average wealth relatives across both indexes for most years are below one, IPOs in some years overperform in the aftermarket. This result indicates that the long–run underperformance phenomenon is not as consistent as the initial underpricing anomaly. IPOs issued in 1985 and 1986 overperform the FTA benchmark but not the HGSC. This finding is as expected, given that up to the start of 1989 the HGSC outperformed the FTA by 6% per year. Superior performance relative to the HGSC is reported by new issues quoted in 1989 and 1990, a period during which the performance of smaller companies started declining as a result of the recession. Despite this variation, however, in the long–run performance of IPOs across different years of issuance, there is no evidence to suggest that a negative relation exists between the annual volume of issues and aftermarket performance. This result is in line with our previous findings and suggests that the timing hypothesis cannot account for the underperformance of the IPOs in our sample.

Table 2.16: aftermarket performance by year of flotation, exclusive of the initial return.

Year	Number of IPOs	UP (%)	R_T (%)	WR_{FTA}	WR_{HGSC}
1984	81	12.81	69.10	0.930	0.723
1985	95	7.75	50.06	1.046	0.794
1986	125	5.00	41.47	1.028	0.875
1987	105	22.20	–20.00	0.756	0.807
1988	111	5.83	–12.02	0.703	0.968
1989	62	12.29	–11.41	0.806	1.098
1990	26	11.89	74.39	1.238	1.265
1991	18	7.45	33.23	1.081	0.989
1992	30	7.38	20.60	0.894	0.818
All Issues	653	10.42	22.27	0.915	0.866

Notes: UP, the level of underpricing, is computed using equation 2.1. R_T denotes the mean three year holding period return and is computed using equation 2.9. WR denotes the wealth relative and is computed using equation 2.10.

2.5. Conclusions.

In this chapter we have examined the initial and aftermarket performance of 653 IPOs listed on the London Stock Exchange from 1984 through 1992. The conclusions to emerge from the initial and long–run performance analysis are relatively clear–cut. First, IPOs rise on average by 10.42% above their offer prices by the end of the first day of trading. As a result, the total costs of raising external equity capital for these firms are significantly increased. Second, *new issues are poor investments in the* long–run. By comparing abnormal returns estimated under three different models, the market–adjusted model, Ibbotson's (1975) RATS model and the Fama and French (1993) three factor asset pricing model, we find that IPOs significantly and economically underperform two benchmarks after three years. The magnitude of underperformance varies between 14% and 34% depending on the choice of benchmark and the model used in computing abnormal returns. Third, although the underperformance of new issues is widespread, investors can minimise their long–run losses by subscribing to shares offered by IPO firms floated on the official list or taken to the market through an offer for sale. Lastly, there is a tendency for IPOs with the highest initial returns to have the worse aftermarket performance. This reverse pattern in returns provides indirect evidence in support of the notion that new offerings are initially overvalued by faddish investors.

Kothari and Warner (1997) and Barber and Lyon (1997) suggest that long–run tests are severely misspecified, and that the null hypothesis of no positive long–run abnormal performance is significantly over–rejected. The main result to emerge from this chapter, however, is that newly listed firms significantly underperform in the long–run.

Given this finding, it is improbable that the size of the results can be accounted for by specification errors.

CHAPTER 3

"*EX ANTE* UNCERTAINTY AND SEASONED EQUITY OFFERINGS (SEOs): IS UNDERPRICING A SIGNAL OF QUALITY?"

3.1. Introduction.

The results obtained in the previous chapter seem to suggest that IPOs may not be underpriced, but rather may be initially overvalued by optimistic investors. Despite this finding, however, other explanations as to why new issues generate positive returns in the short–run must also be explored. As was noted in chapter 1, section 1.3, many theories have been advanced as possible explanations to the underpricing puzzle. Most of these theories, however, either have largely untestable implications, or they cannot explain the underpricing anomaly for IPOs in the U.K. Among the only theories which yield testable implications, either direct or indirect, are the *ex ante* uncertainty hypothesis advanced by Beatty and Ritter (1986), and the signalling hypothesis put forward by Allen and Faulhaber (1989), Griblatt and Hwang (1989) and Welch (1989). It is the objective of this chapter to examine whether these two theories can explain away some, or all, of the observed level of underpricing.

The first theory under investigation is the *ex ante* uncertainty hypothesis. Following Beatty and Ritter, we examine whether a positive relation exists between the *ex ante* uncertainty surrounding the post–issue value of IPOs and the level of initial returns. The second hypothesis investigates the signalling model theories. Following Welch, Allen and Faulhaber and Grinblatt and Hwang, we examine whether, faced with asymmetric information in the new issues market, the issuer uses underpricing as a vehicle whereby firms with favourable private information can signal their quality.

The chapter is organised into nine sections. Sections 3.2, 3.3 and 3.4 deal with the *ex ante* uncertainty hypothesis. More specifically, in section 3.2 we discuss the possible explanatory variables to be used as measures for *ex ante* uncertainty. Section 3.3 describes the empirical methods to be employed, whereas the empirical results are presented in section 3.4. In addition, section 3.4 reports several robustness checks on our main empirical findings as well as results for the Main Market and the USM separately. In section 3.5 we present the hypotheses to be tested within the framework of the signalling models. Sections 3.6 and 3.7 contain the empirical methods and results respectively, whereas section 3.8 evaluates the relation between reissuance activity and aftermarket performance of IPO firms. Concluding remarks are presented in section 3.9.

3.2. *Ex ante* uncertainty: hypotheses.

Given that *ex ante* uncertainty cannot be measured directly, a number of variables are used in the empirical analysis as substitutes. The proxies to be employed are the proportion of equity retained in the firm, post–flotation, by pre–offering shareholders, the size of issue, the market of flotation, the method of flotation, a firm's annual sales revenue in the most recent 12–month period before going public, a firm's variation of earnings three years immediately prior to flotation, the quality of the auditor involved with the issue and the quality of the underwriter involved with the issue[1].

3.2.1. Ownership retention.

Leland and Pyle (1977) present a model in which higher entrepreneurial ownership is a credible signal of project quality. The signal is credible because by retaining a significant ownership interest in the firm, the issuer faces increased risk because his personal portfolio will be less diversified[2]. An entrepreneur would be willing to forego the benefits of diversification only if his private knowledge as to the future cash flows of the firm is favourable. As a result, higher levels of retained equity should be associated with lower *ex ante* uncertainty, because of the entrepreneur's signal about

[1] It has to be said that within the finance literature several other variables have also been used as proxies for *ex ante* uncertainty. There is, however, no general consensus among researchers as to which proxies best capture this hypothesis. Therefore, we employ the eight variables outlined above which we believe adequately capture the *ex ante* uncertainty hypothesis.

[2] Gale and Stiglitz (1989) note that the proportion of retained equity can serve as a credible positive signal of firm value only if insiders are not able to sell their firm's shares in the early aftermarket. In contrast to the U.S., where under rule 144 of the Securities Act 1933 shares retained by insiders at the IPO cannot be sold in the immediate aftermarket, in the U.K. there are no legal restrictions on the sale of retained shares by initial owners. However, there is normally an agreement between the initial owners and the underwriter which prevents initial owners from selling shares retained at the IPO in the immediate secondary market. In special circumstances, however, such as takeover bids, this agreement may be breached.

the value of the firm[3]. On the contrary, Keasy and Short (1991) argue that when entrepreneurs retain a high proportion of equity, the perceived marketability of the shares, post–flotation, decreases. As a result, the shares will be subject to infrequent (thin) trading, which is likely to increase *ex ante* uncertainty. We examine the relation between retained equity and *ex ante* uncertainty by testing the following hypothesis:

> H_{01}: *IPOs whose pre-offering shareholders retain a large (small) proportion of equity, post-flotation, will not be significantly associated with lower (higher) or higher (lower) levels of underpricing.*

3.2.2. Issue size.

Barry and Brown (1984) suggest that a positive relation exists between firm specific information in the equity market and firm size. Under Barry and Brown's arguments, larger offerings (higher gross proceeds) must be associated with larger firms, and therefore less *ex ante* uncertainty. On the contrary, Holland and Horton (1993) argue that issue size and *ex ante* uncertainty may be positively related. Their argument is based on the fact that higher gross proceeds increase the level of suitable investment opportunities. To the extent that the number of projects is related to the amount of

[3] The relation between firm value and the proportion of equity retained has been the subject of extensive research. Downes and Heinkel (1982) employ OLS and WLS regression analysis on 297 IPOs made in the U.S. between 1965–1969 and produce results consistent with the Leland and Pyle model. Krinsky and Rotenberg (1989) find no significant relation between ownership retention and firm value for a sample of 115 Canadian offerings that were floated between 1971–1983. Clarkson *et al.* (1992) extent the analysis of Krinsky and Rotenberg using a sample of 180 IPOs that went public on the Toronto Stock Exchange between 1984–1987. In contrast to the results of Krinsky and Rotenberg, they find that the initial valuation of a firm is significantly increasing as owners retain higher proportions of equity. Keloharju and Kulp (1996) examine the relation between firm value, measured by market–to–book ratios, and equity retained for a sample of 60 IPOs made in Finland during the period 1960–1993, and find results consistent with the Leland and Pyle model.

gross proceeds, increased proceeds could increase the risk of a firm, and hence *ex ante* uncertainty, because of the increasing burden on management. These arguments are tested by the following hypothesis:

H_{02}: *large (small) IPOs will not be significantly associated with lower (higher) or higher (lower) levels of underpricing.*

3.2.3. Issue market.

Affleck–Graves *et al.* (1993) suggest that the degree of underpricing depends on the market on which the offering takes place. Their argument is based on the fact that the listing requirements imposed by a Stock Exchange provide investors with reliable information about the quality of new issues, reduce uncertainty about their prospects, and thereby lower the expected underpricing of IPOs[4]. We test for a relation between *ex ante* uncertainty and the market of flotation on the basis of the following hypothesis:

H_{03}: *IPOs floated in the Main Market (USM) will not be significantly associated with lower (higher) levels of underpricing.*

3.2.4. Issue method.

Heinkel and Schwartz (1986) note that the method of flotation reveals, either partially or totally, the quality of the firm. They suggest that because different methods of

[4] The differences between the listing requirements for entry in the Main Market and the USM are reported in table 2.1.

introduction have different requirements, high value firms can signal their quality to investors by choosing the flotation method with the highest requirements[5]. Similar arguments are presented by Bower (1989), who notes that the offering method chosen by a firm making an IPO affects the investors' perceptions about the value of the offering itself. This assertion is tested by the following hypothesis:

> H_{04}: *IPOs floated via an offer for sale (placing) will not be significantly associated with lower (higher) levels of underpricing.*

3.2.5. Pre-flotation sales.

Ritter (1984a) suggests that a firm's annual sales revenue in the most recent 12–month period before going public is an adequate measure of risk. Higher sales should therefore be associated with lower risk and hence less *ex ante* uncertainty. This argument is tested on the basis of the following hypothesis:

> H_{05}: *IPOs with a high (low) annual sales revenue in the most recent 12-month period before flotation will not be significantly associated with lower (higher) levels of underpricing.*

3.2.6. Pre-flotation earnings.

Another proxy to be considered as a measure for *ex ante* uncertainty is a firm's

[5] The differences between the listing requirements for quotation through an offer for sale or a placing are reported in table 2.1 and are discussed in detail in chapter 2, section 2.2.

variation of earnings three years immediately prior to flotation. This proxy is employed following Keasy and Short's (1991) suggestions, that higher variation in pre–flotation earnings increases the perceived risk of a firm, and hence *ex ante* uncertainty. We evaluate the above argument by testing the following hypothesis:

> H_{06}: *IPOs with increasing (fluctuating) earnings for the three years immediately prior to flotation will not be significantly associated with lower (higher) levels of underpricing.*

3.2.7. Auditor quality.

A company making an IPO must employ an auditor to perform an audit on its records and to provide an auditor's opinion in the registration documents. Titman and Trueman (1986) present a model in which the costs incurred in employing a high quality auditor discourage owners with unfavourable information about their firm's value from doing so. They suggest that only insiders with favourable information are willing to pay the higher fees required by prestigious auditors because the information provided to investors will be favourable. Given that investors are aware of this behaviour, they are able to infer the nature of the entrepreneur's information from his choice of auditor quality. The higher the quality of the auditor involved with an issue, the more favourable will investors infer the information to be, and as a result the *ex ante* uncertainty surrounding the true value of IPO firms will be reduced. Beatty (1989) suggests that high quality auditors have greater reputation capital at stake than low quality auditors, and hence have greater incentives to investigate misrepresentations by offering firms. By reducing measurement errors, investors can estimate more precisely the distribution of firm value. In other words, a high quality auditor attests to a report that reduces an investors' *ex ante* uncertainty. To examine the relation between auditor quality and *ex ante* uncertainty we test the following hypothesis:

> H_{07}: *IPOs appointing a high (low) quality auditor will not be significantly associated with lower (higher) levels of underpricing.*

3.2.8. Underwriter quality.

When making an IPO an entrepreneur must choose an underwriter to market the firm's securities. Logue (1973) suggests that the choice of a prestigious rather than a non–prestigious underwriter might influence the price which investors are willing to pay for the shares sold. Based on Rock's (1986) winner's curse theory, which implies that IPO underpricing compensates uninformed investors for the risk of trading against superior information, Carter and Manaster (1990) present a model in which the prestige of an underwriter determines the expected level of informed investor activity, and hence the degree of underpricing. Given that underpricing is costly for issuing firms, Carter and Manaster suggest that in order to avoid underpricing, low risk firms attempt to reveal their low risk characteristics to the market by employing a prestigious underwriter. This implies that underwriter prestige and IPO riskiness are negatively related. Given that underwriter prestige reduces the risk of an IPO, fewer investors would seek to obtain information about a low risk issue, and therefore fewer investors would want to invest in IPOs offered by prestigious underwriters. As a results, an inverse relation will exist between underwriter prestige and *ex ante* uncertainty. This is tested by the following hypothesis:

H_{08}: *IPOs appointing a high (low) quality underwriter will not be significantly associated with lower (higher) levels of underpricing.*

3.3. *Ex ante* uncertainty: data and methodology.

The data used are comprised of 653 IPOs listed on the London Stock Exchange from 1984 through to 1992. To examine the relation between underpricing and *ex ante* uncertainty we use statistical analysis, correlation analysis and OLS regression analysis[6]. We regress underpricing, computed using equation 2.1, against the eight proxies discussed in the previous section and summarised in table 3.1. The multivariate regression model can be stated as follows:

$$UP = a_0 + a_1 ER + a_2 LGP + a_3 MK + a_4 MD + a_5 LS + a_6 CV + a_7 AQ + a_8 UQ + e_i \quad (3.1)$$

ER is the proportion of equity retained in the firm, post–flotation, by pre–offering shareholders. LGP is the natural logarithm of the gross proceeds raised by each firm on flotation and it measures the size of an issue. MK is a dummy variable capturing the effect of the listing requirements on the level of initial returns. One (zero) is assigned to IPOs quoted in the Main Market (USM). MD is a dummy variable representing the method of flotation. One is assigned to IPOs taken to the market through an offer for sale, whereas zero is assigned to offerings floated via a placing. LS is the natural logarithm of a firm's annual sales revenue in the most recent 12–month period before going public. CV is a dummy variable representing a firm's variation of earnings three years immediately prior to flotation. One is assigned to offerings whose annual earnings are increasing over all the three years, and zero

[6] The significance of the t–statistics for the market and method of flotation, the quality of auditors and underwriters, a firm's annual sales revenue and a firm's variation of earnings are calculated using one–tailed tests, whereas for the proportion of equity retained and the size of issue a two–tailed test is employed.

otherwise. AQ is a dummy variable indicating the quality of the auditor involved with an issue. One (zero) is assigned to an offering audited by a high (low) quality auditor. Unlike previous U.K. studies[7], an auditor was regarded as being of high quality if he was a member of the big–five[8] audit firms, and of low quality otherwise. Finally, UQ is a dummy variable indicating the quality of the underwriter involved with an issue. One (zero) is assigned to an offering underwritten by a high (low) quality underwriter. An underwriter was regarded as being of high quality depending on the number of IPOs dealt with in the preceding years. For example, in 1984 an underwriter was classed as being prestigious or non–prestigious depending on the number of IPOs underwritten between 1980–1983, and so forth. The distinction, however, between high and low quality underwriters in this manner suffers from two drawbacks. First, it does not take into account the number of IPOs dealt with in the Main Market and the USM separately. We therefore use an alternative proxy which is based on the number of issues underwritten in the two different markets. The second drawback is that the most frequently used underwriter may not always be the most prestigious. We therefore use a third measure under which underwriters are classified into prestigious and non–prestigious using the annual rankings of the top merchant and investment banks given in The Annual Broker Survey.

[7] Keasy and Short (1991) categorise auditors on the basis of big 11, whereas Holland and Horton (1993) use a big 9 classification. It might be argued, however, that such classifications are more appropriate for U.S. IPOs rather than U.K. IPOs where a finer classification is more appropriate.

[8] The auditors included in the top five are KPMG Peat Marwick Mclintock, Ernst & Young, Coopers & Lybrand, Price Waterhouse and Arthur Andersen.

Table 3.1: description of variables employed as proxies for *ex ante* uncertainty.

			Expected sign
ER	–	proportion of equity retained	+ve or –ve
LGP	–	natural logarithm of gross proceeds	+ve or –ve
MK	–	market of flotation	–ve
MD	–	method of flotation	–ve
LS	–	natural logarithm of a firm's annual sales revenue in the most recent 12 month period before going public	–ve
CV	–	coefficient of a firm's variation of earnings three years immediately prior to flotation	–ve
AQ	–	auditor quality	–ve
UQ1	–	underwriter quality: classification based on the number of IPOs underwritten (definition 1)	–ve
UQ2	–	underwriter quality: classification based on the number of IPOs underwritten in the Main Market and the USM separately (definition 2)	–ve
UQ3	–	underwriter quality: classification based on the annual rankings of the top merchant and investment banks given in The Annual Broker Survey (definition 3)	–ve

3.4. *Ex ante* uncertainty: empirical results.

3.4.1. Statistical Analysis.

Table 3.2 reports summary statistics for the proxies used as measures for *ex ante* uncertainty. As table 3.2 reveals, the majority of our null hypotheses cannot be rejected. Despite the fact that the degree of underpricing is lower for offerings listed in the Main Market and via an offer for sale, the difference in means is not statistically significant[9]. On the contrary, IPOs involving the services of high quality auditors are significantly less underpriced than issues dealt with by low quality auditors. The test for difference of means yields a significant t–statistic of –1.735. Contrary to our expectations, a significant positive relation exists between underpricing, a firm's annual sales revenue and a firm's variation of earnings. For IPOs where the level of sales is below £ 4.1 million, mean initial returns of 7.22% are reported, whereas for IPOs with sales of more than £ 41.1 million, underpricing rises to 11.90%. Similarly, firms reporting increasing earnings over all three years prior to flotation are underpriced on average by 11.42%, while offerings with fluctuating earnings report mean returns of 8.90%. The test for difference of means yields a t–statistic of 1.727, significant at the 5% level. Finally, no significant differences are observed in the level of initial returns when IPOs are segmented by issue size, proportion of equity retained and underwriter

[9] The test for the difference between two means is computed as:

$$t=\frac{X_1-X_2}{\sigma_{X_1-X_2}}$$

where X_1 and X_2 are the mean initial returns for two different sub–samples and σ_{X1-X2} is computed as:

$$\sigma_{X_1-X_2}=\sqrt{\frac{\sigma_1^2}{N_1}+\frac{\sigma_2^2}{N_2}}$$

where σ^2 and N denote the variance and number of observations for each sub–sample respectively.

quality (for all three reputation measures).

Table 3.2: descriptive statistics and tests of the variables employed as proxies for *ex ante* uncertainty.

Panel A: proportion of equity retained.

Equity retained (%)	Number of IPOs	Mean (%)	Std.deviation	t-statistic
0 – 54.99	127	7.99	16.76	5.37**
55 – 63.99	133	8.82	15.38	6.61**
64 – 69.99	131	10.87	15.80	7.87**
70 – 74.99	138	9.76	18.11	6.33**
75 +	124	14.88	24.16	6.85**

F–test = 1.020

Panel B: size of issue.

Gross proceeds (£000)	Number of IPOs	Mean (%)	Std.deviation	t-statistic
1 – 2,294	131	13.04	23.73	6.28**
2,295 – 3,850	131	11.92	14.69	9.28**
3,851 – 6,100	132	8.95	15.99	6.43**
6,101 – 14,300	130	10.33	18.31	6.43**
14,301 +	129	7.82	17.46	5.08**

F–test = 0.707

Panel C: market of flotation.

Market	Number of IPOs	Mean (%)	Std.deviation	t-statistic
Main Market	286	9.49	16.50	9.72**
USM	367	11.14	19.77	10.79**

t–test = –1.161

Panel D: method of flotation.

Method	Number of IPOs	Mean (%)	Std.deviation	t-statistic
Offers for sale	165	8.67	18.25	6.10**
Placements	488	11.01	18.42	13.20**

t–test = –1.420

Notes: mean initial returns are computed using equation 2.1. Two asterisks denote statistical significance at the 1% level. Gross proceeds are measured in pounds of 1992 purchasing power.

Table 3.2 continued.

Panel E: annual sales revenue prior to flotation.

Sales (£000)	Number of IPOs	Mean (%)	Std.deviation	t–statistic
0 – 4,140	130	7.22	19.74	4.17**
4,141 – 8,360	131	10.90	17.97	6.94**
8,361 – 15,700	130	12.22	18.22	7.64**
15,701 – 41,100	132	9.85	19.08	5.93**
41,101 +	130	11.90	16.29	8.32**

F–test = 10.720**

Panel F: Variation of pre–flotation earnings.

Variation	Number of IPOs	Mean (%)	Std.deviation	t–statistic
CV=1	395	11.42	18.61	12.19**
CV=0	258	8.90	17.97	7.95**

t–test = 1.727*

Panel G: auditor quality.

Quality	Number of IPOs	Mean (%)	Std.deviation	t–statistic
High	276	8.99	17.13	8.71**
Low	377	11.47	19.21	11.59**

t–test = –1.735*

Panel H1: underwriter quality (definition 1).

Quality	Number of IPOs	Mean (%)	Std.deviation	t–statistic
High	364	10.64	17.55	11.56**
Low	289	10.13	19.86	8.67**

t–test = 0.342

Panel H2: underwriter quality (definition 2).

Quality	Number of IPOs	Mean (%)	Std.deviation	t–statistic
High	331	10.81	17.07	11.52**
Low	322	10.02	19.66	9.14**

t–test = 0.547

Panel H3: underwriter quality (definition 3).

Quality	Number of IPOs	Mean (%)	Std.deviation	t–statistic
High	262	10.40	15.61	10.78**
Low	391	10.43	20.05	10.28**

t–test = –0.021

Notes: mean initial returns are computed using equation 2.1. One and two asterisks denote statistical significance at the 5% and 1% levels respectively. Sales are measured in pounds of 1992 purchasing power.

3.4.2. Correlation analysis.

In table 3.3 we present the correlation matrix of the variables employed as measures for *ex ante* uncertainty. The correlation matrix not only reveals whether there is a significant correlation between underpricing and the independent variables, but also examines possible multicollinearity problems with the independent variables. The correlation matrix indicates that all of our null hypotheses cannot be rejected. Despite the fact that underpricing is negatively correlated with five proxies, the correlation is not significant[10]. Consistent with the findings in table 3.2, underpricing is positively and significantly correlated with a firm's annual sales revenue and a firm's variation of earnings at the 1% and 5% levels respectively.

As table 3.3 shows, most of the independent variables are slightly correlated. None of the correlation coefficients, however, is significantly higher than 0.80 at the 5% and 1% levels respectively. Berry and Feldman (1985) argue that multivariate combinations of the independent variables may be more appropriate for evaluating the full magnitude of multicollinearity than bivariate correlations. Following Berry and Feldman, each of the independent variables is regressed against the remaining seven independent variables. The results of the auxiliary regressions are presented in table 3.4. As table 3.4 reveals, none of the R^2s is significantly higher than 0.80. More specifically, the coefficients of determination, estimated using UQ1 as the variable capturing the quality

[10] The significance of the correlation coefficients is tested as:

$$t=\frac{r}{\sqrt{\frac{1-r^2}{n-2}}}$$

where r is the correlation coefficient and n denotes the number of observations.

Table 3.3: correlation matrix of the variables employed as proxies for *ex ante* uncertainty.

	UP	ER	LGP	MK	MD	LS	CV	AQ	UQ1	UQ2	UQ3
UP	1	0.0	–0.0	–0.0	–0.0	0.1[b]	0.0[a]	–0.0	0.0	0.0	–0.0
ER		1	–0.6[b]	–0.3[b]	–0.4[b]	–0.2[b]	0.0[a]	–0.2[b]	–0.1[b]	–0.1[b]	–0.2[b]
LGP			1	0.6[b]	0.6[b]	0.4[b]	–0.0	0.2[b]	0.2[b]	0.2[b]	0.4[b]
MK				1	0.4[b]	0.2[b]	–0.0[a]	0.1[b]	0.2[b]	0.1[b]	0.4[b]
MD					1	0.3[b]	–0.0	0.1[b]	0.1[b]	0.2[b]	0.4[b]
LS						1	0.2[b]	0.1[a]	0.1[b]	0.1[b]	0.2[b]
CV							1	–0.0	–0.0	–0.0	–0.0
AQ								1	0.0	0.0	0.1[b]
UQ1									1	0.8[b]	0.4[b]
UQ2										1	0.4[b]
UQ3											1

Notes: a and b denote statistical significance at the 5% and 1% levels respectively. None of the correlation coefficients between the independent variables is significantly higher than 0.80.

of underwriters, for issue size, fraction of equity retained, issue method and market of flotation are 0.73, 0.51, 0.41 *and* 0.39 *respectively. In addition*, less than 26% of the variance in the remaining four proxies is accounted for by the other seven independent variables. These results indicate that multicollinearity is not likely to bias the partial regression coefficients in the regression model.

3.4.3. OLS regression analysis.

Although we are interested on the joint effect of the variables employed on underpricing, we also examine the relevance of each variable individually. The OLS analysis therefore consists of univariate and multivariate regressions. The results of

Table 3.4: auxiliary regressions.

Independent variables	R^2 (UQ1)	R^2 (UQ2)	R^2 (UQ3)
ER	0.51	0.50	0.50
LGP	0.73	0.73	0.73
MK	0.39	0.39	0.41
MD	0.41	0.41	0.42
LS	0.26	0.26	0.26
CV	0.09	0.09	0.09
AQ	0.06	0.06	0.06
UQ1	0.11		
UQ2		0.10	
UQ3			0.28

Notes: the R^2s have been computed by regressing each independent variable against the remaining seven independent variables. None of the above R^2s is significantly higher than 0.80.

the univariate regressions are presented in table 3.5[11]. Consistent with the findings reported in table 3.2 and the correlation results presented in table 3.3, the majority of our null hypotheses cannot be rejected. Of the variables employed to capture *ex ante* uncertainty, only one, the quality of auditors, significantly reduces the level of initial returns. Also consistent with our previous findings, IPOs with higher sales prior to flotation are significantly associated with higher levels of underpricing. Three other

[11] Several diagnostic tests were first performed on the various OLS models. Two problems emerged. First, significant serial correlation was detected. For this purpose, the Newey–West (1987) correction technique was employed. This technique calculates standard errors using parsen weights which are robust in the presence of serial correlation. Second, the distributions were not normally distributed. Since tests for normality ave very sensitive to the presence of outlier observations, we tried to achieve normality by introducing several dummy variables in the models which were found to be significant. Although this problem was reduced, it was not eliminated. Alternatively, we tried to achieve normality by excluding several outlier observations from our sample. As before, however, normality was not completely achieved. Therefore, given that t and F–statistics assume normality, they are biased and should be interpreted with caution.

Table 3.5: univariate OLS regressions of initial returns on the variables employed as proxies for ex-ante uncertainty.

Explanatory variables	Intercept	Estimated coefficients	Standard errors	t–statistics	Adj–R^2
ER	8.95*	0.016	0.055	0.290	0.136
LGP	10.60	–0.035	0.725	–0.048	0.136
MK	10.47**	–0.974	1.007	–0.967	0.136
MD	10.71**	–2.639	2.389	–1.104	0.140
LS	1.91**	0.620**	0.218	2.833	0.150
CV	8.95**	1.823	1.492	1.222	0.138
AQ	11.23**	–2.796**	1.147	–2.437	1.141
UQ1	9.90**	0.437	0.884	0.495	0.135
UQ2	9.82**	0.634	0.761	0.832	0.135
UQ3	10.03**	0.285	1.588	0.180	0.135

Notes: the standard errors of the independent variables are corrected for serial correlation using the Newey-West (1987) procedure. One and two asterisks denote statistical significance at the 5% and 1% levels respectively.

coefficients, issue size, issue market and method of flotation, are correctly signed, but are not statistically different from zero. Finally, the proportion of equity retained, the coefficient of variation of earnings and the quality of underwriters, for all three reputation measures, are positively signed and insignificant.

In table 3.6 we present the results of the multivariate regression. The overall regression is statistically significant at the 1% level, meaning that the joint hypothesis that all coefficients in the regression are equal to zero is rejected. Five of the eight variables employed to capture *ex ante* uncertainty have the predicted negative sign, however, only two are significantly different from zero at conventional significance levels.

The coefficient for the method of flotation is negative and reliably different from zero at the 1% level. This result rejects the null hypothesis that no significant relation exists between underpricing and issue method, and provides evidence in support of the arguments put forward by Heinkel and Schwartz (1986) and Bower (1989), that the method of introduction provides investors with *ex ante* information regarding the issuing firm's value. Within this context, investors who subscribe to shares offered to the public via the placing method can expect to earn a substantially higher return than if the offering is performed through an offer for sale.

Consistent with previous U.S. evidence, and as expected, the coefficient for auditor reputation is negative and statistically significant at the 1% level. This result is in line with our previous findings, and supports the proposition of Titman and Trueman (1986), that high quality firms can convey their value to investors by appointing a prestigious auditor.

Also consistent with our previous findings, the coefficient for a firm's annual sales revenue in the most recent 12–month period before going public is positive and significantly different from zero at the 1% level. We therefore cannot accept the hypothesis advanced by Ritter (1984a), that lower risk (higher sales) firms have substantially lower mean initial returns.

The slope coefficient estimate on the proportion of equity retained in the firm, post–

flotation, by pre–offering shareholders is negative but insignificant. This insignificant relation rejects both, the hypothesis proposed by Leland and Pyle (1977), that a greater percentage of retained equity should reduce *ex ante* uncertainty by acting as a signal of firm value, and the argument put forward by Keasy and Short (1991), that *ex ante* uncertainty is increased if the post–flotation market for the shares is perceived to be thin.

A negative but non–significant relation is also observed between issue size (gross proceeds) and underpricing. This finding not only rejects the proposition of Barry and Brown (1984), that larger firms are associated with less *ex ante* uncertainty, but also the argument advanced by Holland and Horton (1993), that larger proceeds increase the risk of a firm because of the increasing burden on management.

The slope coefficient on the market of flotation is negatively signed but is not significantly different from zero. This result implies that the listing requirements imposed by the London Stock Exchange authorities on the Main Market and the USM respectively, are not perceived by investors to be relevant. In other words, investors do not expect to earn differential premia for the fact that shares are introduced on different markets. Therefore, the hypothesis that the market of introduction might reduce *ex ante* uncertainty because of its listing requirements as proposed by Affleck–Graves *et al.* (1993) cannot be accepted.

The coefficient capturing the effect of earnings on the level of underpricing is both incorrectly signed and non–significant. We therefore cannot accept the hypothesis put forward by Keasy and Short (1991), that greater variation in pre–flotation earnings increases *ex ante* uncertainty about firm value.

Finally, contrary to what was anticipated, and in sharp contrast to prior U.S. evidence, the coefficient for underwriter quality, for all three reputation measures, is positive but not statistically different from zero at conventional significance levels. Thus, the hypothesis put forward by, among others, Carter and Manaster (1990), that underwriter prestige and *ex ante* uncertainty are inversely related cannot be accepted[12].

Having found that five of the eight proxies used to capture *ex ante* uncertainty are statistically insignificant using the t–statistic, it is interesting to examine whether these five variables have any joint effect on the level of underpricing. This is reflected in the joint hypothesis that $a_1=a_2=a_3=a_6=a_8=0$, which implies that the proportion of equity retained, the size of issue, the market of flotation, the coefficient of variation of earnings three years prior to flotation and the prestige of underwriters do not explain any of the variability of the dependent variable. The F–statistic for the joint hypothesis, estimated using UQ1 as the variable capturing the quality of underwriters, is 0.163 (with 5 and 642 degrees of freedom) and is statistically *insignificant at the 1% level.* This result suggests that these five proxies for *ex ante* uncertainty are jointly not important in determining underpricing.

As shown in table 3.6, and as anticipated, the adjusted R^2 is very low, 0.159. This is

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[12] Kim *et al.* (1993) examine the proposition of Carter and Manaster for a sample of 177 Korean IPOs issued during 1980–1990. By dividing their sample into two categories depending on the motive of going public, and by using OLS regression analysis, Kim *et al.* find a significant negative relation between underwriter quality and underpricing when the motive for going public is to raise new equity capital. However, when the motive for going public is diversification by existing shareholders, they find that underwriter prestige and initial returns are positively and significantly related. Based on these results, it might be said that the quality of the underwriter involved with an issue may not reduce *ex ante* uncertainty when the prime motive of making an IPO is diversification by existing shareholders.

consistent with the propositions of Beatty and Ritter (1986). They argue that the adjusted coefficient of determination must not be high because a high coefficient implies that investors are able to predict the actual initial return on an offering, whereas the theory of *ex ante* uncertainty and underpricing is based on the premise that it is difficult for investors to make predictions as to which IPOs are likely to end up having positive initial returns. Therefore, a low adjusted R^2 is consistent with the *ex ante* uncertainty hypothesis and is comparable to those found in the literature on IPO underpricing. In particular, Keasy and Short (1991), Holland and Horton (1993) and Clarkson (1994) report adjusted coefficients of 0.165, 0.110 and 0.180 respectively, while Beatty and Ritter explain 7% of the variation in underpricing.

Overall, the empirical results reported in this section suggest that the *ex ante* uncertainty hypothesis advanced by Beatty and Ritter is, at best, a minor reason for the underpricing anomaly.

Table 3.6: multivariate OLS regression of initial returns on the variables employed as proxies for *ex ante* uncertainty.

Explanatory variables	UQ1	UQ2	UQ3
Intercept	1.652 (0.216)	1.932 (0.246)	2.388 (0.288)
ER	−0.008 (−0.229)	−0.009 (−0.253)	−0.010 (−0.249)
LGP	−0.039 (−0.061)	−0.076 (−0.111)	−0.103 (−0.149)
MK	−0.685 (−0.578)	−0.665 (−0.549)	−0.898 (−0.635)
MD	−4.619** (−3.282)	−4.639** (−3.268)	−4.817** (−3.771)
LS	1.242** (4.133)	1.239** (4.161)	1.226** (4.288)
CV	0.402 (0.262)	0.421 (0.275)	0.437 (0.295)
AQ	−2.546** (−3.220)	−2.535** (−3.218)	−2.611** (−3.383)
UQ1	0.379 (0.554)	———	———
UQ2	———	0.671 (0.940)	———
UQ3	———	———	1.176 (0.843)
Adjusted-R^2	0.159	0.159	0.159
F-tests: overall $a_1=a_2=a_3=a_6=a_8=0$	13.38** 0.163	13.40** 0.160	13.43** 0.164

Notes: the standard errors of the independent variables are corrected for serial correlation using the Newey-West (1987) procedure. Two asterisks denote statistical significance at the 1% level. Figures in parentheses are t-statistics.

3.4.3.1. Robustness checks.

Having examined the impact of the variables employed on initial returns, we now try to determine whether or not our results are sensitive to model specifications. First, we re–estimate underpricing using an alternative methodology [Ruud (1993)]. Second, we include the offer price of each IPO in the multivariate regression in order to control for transaction costs [Chalk and Peavy (1987)]. Third, we exclude the privatised utilities from the sample. Fourth, we use two alternative proxies to capture the effect of the size of an issue on underpricing, namely the inverse of gross proceeds and the natural logarithm of the market value of an issue on the date of flotation.

It may be argued that the failure of the *ex ante* uncertainty hypothesis to adequately explain why IPO firms are on average underpriced is because the method used in estimating the level of underpricing is not appropriate[13]. To examine this possibility, we re–estimate underpricing with the methodology proposed by Ruud. Initial returns are therefore measured as:

$$UP = \log\left(\frac{P_t}{P_0}\right) \qquad (3.2)$$

where P_t is the market price at the end of the first day of public trading and P_0 is the offer price. The log return is the continuously compounded yield from holding the security. Although the dependent variable is log–transformed, the extent of non–

[13] Recall that underpricing is computed as the percentage increase from the offer price to the closing market price of the first trading day.

normality is only slightly decreased. The results from re–estimating equation 3.1 are presented in column 2 of table 3.7. As indicated, the results are not sensitive to the method of estimating underpricing. All coefficients remain unchanged in terms of both signs and significance.

Using a sample of 649 U.S. IPOs that went public between 1975–82, and by dividing the sample into several price categories, Chalk and Peavy find that IPOs with the lowest offer price, $1 or less, show the highest average initial returns, 56.43%, almost fivefold the mean return for the price group showing the next highest initial return, 11.95%[14]. They suggest that this high initial return for low priced stocks might be the result of high transaction costs. Therefore, in order to control for the effect of transaction costs, we include the offer price of an issue in the multivariate regression model. An inverse relation is expected between the level of underpricing and offer price. The inclusion of price in equation 3.1 results in the OLS estimates reported in column 3 of table 3.7. The coefficient of price has the predicted negative sign but is not statistically significant. Inclusion of price in the multivariate regression does not alter our previous findings. All coefficients, except issue size which becomes positive, remain unchanged.

In column 4 of table 3.7 we report results which have been computed by excluding the 30 privatised utilities from the sample. In terms of the variables employed, the privatised utilities have several features which might influence our main empirical findings. First, the 30 privatisations account for almost 80% of the total amount of new equity capital raised in IPOs in the London markets, USM and Main Market, over the

[14] Similar results are reported by Ibbotson *et al.* (1994).

period 1984–1992. Second, all privatisations were floated in the Main Market via an offer for sale. Third, in most privatised utilities no equity was retained by the British government and in all cases a prestigious auditor and/or underwriter was involved in the flotation process. Given these characteristics, it is interesting to examine how sensitive our findings are to the exclusion of these particular offerings from our sample. As column 4 reveals, our main empirical results are slightly changed. The vehicle of flotation, as before, significantly affects the level of underpricing. However, the quality of the auditor involved with an IPO, although having the predicted negative sign, is no longer significant. The annual sales level remains positive and significant, however, it loses its significance at the 1% level. In addition, the proportion of equity retained and the market of flotation change in signs, but still remain statistically insignificant. Finally, issue size, the coefficient of variation in pre–flotation earnings and underwriter quality, for all three reputation measures, remain unchanged in terms of both sings and significance.

In equation 3.1 we used the natural logarithm of the gross proceeds raised by the issue as a proxy for issue size. We repeat the analysis using two different proxies, the inverse of gross proceeds and the natural logarithm of the market value of an issue on the date of flotation. The results, reported in columns 5 and 6 of table 3.7, indicate that our main empirical findings remain unchanged.

Table 3.7: robustness checks of the multivariate OLS regression of initial returns on the variables employed as proxies for *ex ante* uncertainty.

Explanatory variables	Sub UP	Include price	Exclude priv.	Sub igp	Sub log mv
Intercept	0.026 (0.365)	0.447 (0.064)	6.914 (0.666)	0.207 (0.070)	−2.916 (−0.354)
ER	−0.000 (−0.654)	−0.002 (−0.063)	0.113 (0.824)	−0.012 (−0.380)	−0.002 (−0.064)
LGP	−0.004 (−0.609)	0.181 (0.304)	−1.371 (−0.704)	———	———
MK	−0.004 (−0.423)	−0.504 (−0.419)	1.540 (0.460)	−0.227 (−0.281)	−1.068 (−0.975)
MD	−0.043** (−3.093)	−4.682** (−3.295)	−4.116** (−2.968)	−4.438** (−2.753)	−5.099** (−3.375)
LS	0.013** (4.397)	1.232** (4.027)	0.802* (1.980)	1.266** (4.003)	1.183** (4.091)
CV	0.004 (0.328)	0.484 (0.328)	0.580 (0.201)	0.506 (0.334)	0.433 (0.279)
AQ	−0.019** (−2.536)	−2.509** (−3.363)	−1.758 (−1.038)	−2.562** (−3.145)	−2.612** (−3.302)
UQ1	0.006 (0.914)	0.524 (0.737)	0.023 (0.027)	0.671 (1.010)	0.198 (0.309)
UQ2	0.008 (1.306)	0.815 (1.278)	0.023 (0.031)	0.808 (1.129)	0.478 (0.709)
UQ3	0.014 (1.182)	1.290 (0.923)	0.897 (0.738)	1.300 (0.882)	0.996 (0.715)
PRICE	———	−0.010 (−0.895)	———	———	———
IGP	———	———	———	2344100 (1.186)	———
LMV	———	———	———	———	0.473 (0.690)
Adjusted-R^2	0.107	0.159	0.181	0.161	0.160
F-test	8.830**	12.28**	14.81**	13.52**	13.42**

Notes: the standard errors of the independent variables are corrected for serial correlation using the Newey-West (1987) procedure. One and two asterisks denote statistical significance at the 5% and 1% levels respectively. Figures in parentheses are t-statistics. The results reported above are estimated using UQ1 as the variable capturing the prestige of underwriters. All coefficients estimated using UQ2 and UQ3 remain virtually unchanged in terms of both sings and significance and are therefore not reported.

3.4.4. Empirical results by market of flotation.

Having found that the proxy used to capture the effect of the market of flotation does not significantly affect the level of initial returns, we now try to examine whether the market of introduction has any effect on the other variables employed as measures for *ex ante* uncertainty. Summary statistics for the proxies employed for the Main Market and the USM separately are presented in table 3.8, panels A to G. Consistent with the results obtained for the whole sample, most of our null hypotheses cannot be rejected, and this is true for both markets. Table 3.8 reveals that, for both markets, there is no significant difference in mean returns when IPOs are categorised by issue size, auditor quality and method of flotation. Regarding the Main Market, there is no significant difference in the level of initial returns irrespective of whether IPOs are segmented by fraction of equity retained or the variation of earnings. There are, however, significant differences in the mean returns of IPOs depending on their annual sales revenue and the quality of underwriters. Consistent with the results obtained for the whole sample, a positive relation seems to exist between sales and underpricing. For example, offerings with an annual sales revenue of less than £ 9.3 million report average initial returns of 4.71%, whereas for offerings with an £ 87.8 million or more sales revenue underpricing is much higher at 11.69%. A positive relation is also observed between underwriter quality and underpricing. However, for reputation measures one and two the differences in initial returns are not significant. For reputation measure three, however, IPOs dealt with by prestigious underwriters are significantly more underpriced than issues dealt with by non–prestigious underwriters at the 5% level. For the USM, a positive relation exists between *ex ante* uncertainty, the proportion of retained equity and a firm's variation of earnings. As panel A reveals, there are significant differences in initial returns for USM offerings categorised by fraction of equity retained. For example, for issues where insiders retain less than 63%, mean initial returns of 6.53% are reported, while for issues where insiders retain more than 75%, average returns of 15.58% are obtained. Similarly, as indicated in panel G, IPOs with increasing earnings over all three years immediately prior to flotation are underpriced more, 12.88%, than offerings with fluctuating earnings, 8.08%. This difference in initial returns is statistically different from zero at the 1% level. Finally, no significant differences are reported when USM offerings are segmented by sales revenue and underwriter quality (for all three reputation measures).

Table 3.8: descriptive statistics and tests of the variables employed as proxies for *ex ante* uncertainty by market of flotation.

Panel A: proportion of equity retained.

Equity retained (%)	Number of IPOs	Mean (%)	Std.deviation	t–statistic
		Main Market		
0 – 46.99	70	9.20	17.42	4.41**
47 – 61.99	75	9.11	17.81	4.42**
62 – 69.99	68	9.04	13.39	5.56**
70 +	73	10.60	16.75	5.40**
		F–test = 1.280		
		Unlisted Securities Market		
0 – 62.99	85	6.53	10.15	5.93**
63 – 69.99	93	11.99	18.93	6.10**
70 – 74.99	85	9.39	18.53	4.67**
75 +	104	15.58	25.49	6.23**
		F–test = 10.130**		

Notes: mean initial returns are computed using equation 2.1. Two asterisks denote statistical significance at the 1% level.

Table 3.8 continued.

Panel B: size of issue.

Main Market

Gross proceeds (£000)	Number of IPOs	Mean (%)	Std.deviation	t-statistic
1 – 5,580	57	11.17	11.09	7.60**
5,581 – 9,700	57	7.99	18.27	3.30**
9,701 – 15,300	57	12.06	16.16	5.63**
15,301 – 47,000	57	4.33	15.11	2.16*
47,001 +	58	11.88	19.08	4.74**

F–test = 0.708

Unlisted Securities Market

Gross proceeds (£000)	Number of IPOs	Mean (%)	Std.deviation	t-statistic
1 – 1,700	73	11.38	23.35	4.16**
1,701 – 2,480	73	14.82	24.05	5.26**
2,481 – 3,445	74	11.25	13.67	7.07**
3,446 – 4,500	74	7.95	11.23	6.08**
4,501 +	73	10.34	22.23	3.97**

F–test = 1.851

Panel C: method of flotation.

Main Market

Method	Number of IPOs	Mean (%)	Std.deviation	t-statistic
Offers for sale	137	9.11	17.05	6.25**
Placements	149	9.85	15.91	7.55**

t–test = –0.379

Unlisted Securities Market

Method	Number of IPOs	Mean (%)	Std.deviation	t-statistic
Offers for sale	28	6.55	22.98	1.50
Placements	339	11.52	19.39	10.93**

t–test = –1.112

Panel D: annual sales revenue prior to flotation.

Main Market

Sales (£000)	Number of IPOs	Mean (%)	Std.deviation	t-statistic
0 – 9,300	71	4.71	16.55	2.39*
9,301 – 24,950	73	11.65	18.27	5.44**
24,951 – 87,800	70	9.85	12.46	6.61**
87,801 +	72	11.69	16.91	5.86**

F–test = 11.439**

Notes: mean initial returns are computed using equation 2.1. One and two asterisks denote statistical significance at the 5% and 1% levels respectively. Gross proceeds and sales are measured in pounds of 1992 purchasing power.

Table 3.8 continued.

Unlisted Securities Market

Sales (£000)	Number of IPOs	Mean (%)	Std.deviation	t-statistic
0 – 3,750	92	9.31	19.97	4.47**
3,751 – 7,650	92	12.11	19.54	5.94**
7,651 – 14,650	92	12.10	17.21	6.74**
14,651 +	91	11.03	21.86	4.81**

F–test = 1.654

Panel E: variation of pre-flotation earnings.

Main Market

Variation	Number of IPOs	Mean (%)	Std.deviation	t-statistic
CV=1	161	9.50	13.94	8.64**
CV=0	125	9.48	19.24	5.50**

t–test = 0.010

Unlisted Securities Market

Variation	Number of IPOs	Mean (%)	Std.deviation	t-statistic
CV=1	234	12.88	21.13	9.32**
CV=0	133	8.08	16.68	5.58**

t–test = 2.400**

Panel F: auditor quality.

Main Market

Quality	Number of IPOs	Mean (%)	Std.deviation	t-statistic
High	152	8.52	15.03	6.98**
Low	134	10.60	17.90	6.85**

t–test = –1.056

Unlisted Securities Market

Quality	Number of IPOs	Mean (%)	Std.deviation	t-statistic
High	124	9.64	19.36	5.54**
Low	243	11.90	19.89	9.32**

t–test = –1.047

Panel G1: underwriter quality (definition 1).

Main Market

Quality	Number of IPOs	Mean (%)	Std.deviation	t-statistic
High	193	9.57	16.92	7.85**
Low	93	9.35	15.49	5.82**

t–test = 0.109

Notes: mean initial returns are computed using equation 2.1. Two asterisks denote statistical significance at the 1% level. Sales are measured in pounds of 1992 purchasing power.

Table 3.8 continued.

Unlisted Securities Market

Quality	Number of IPOs	Mean (%)	Std.deviation	t-statistic
High	171	11.86	17.33	8.94**
Low	196	10.51	21.61	6.80**

t-test = 0.663

Panel G2: underwriter quality (definition 2).

Main Market

Quality	Number of IPOs	Mean (%)	Std.deviation	t-statistic
High	174	9.90	17.41	7.50**
Low	112	8.86	14.87	6.30**

t-test = 0.539

Unlisted Securities Market

Quality	Number of IPOs	Mean (%)	Std.deviation	t-statistic
High	157	11.82	16.62	8.91**
Low	210	10.63	21.77	7.07**

t-test = 0.593

Panel G3: underwriter quality (definition 3).

Main Market

Quality	Number of IPOs	Mean (%)	Std.deviation	t-statistic
High	183	10.68	16.73	8.63**
Low	103	7.39	15.78	4.75**

t-test = 1.656*

Unlisted Securities Market

Quality	Number of IPOs	Mean (%)	Std.deviation	t-statistic
High	79	9.74	12.64	6.84**
Low	288	11.52	21.27	9.19**

t-test = −0.939

Notes: mean initial returns are computed using equation 2.1. One and two asterisks denote statistical significance at the 5% and 1% levels respectively.

Table 3.9, panels A and B, present the correlation matrix of the variables employed for each market separately. The results are in line with the statistical findings presented in table 3.8 and indicate that the *ex ante* uncertainty hypothesis is rejected for both markets. For the Main Market, three proxies have the predicted negative sign, but none is significantly correlated with underpricing. The only significant correlation of initial returns is with the coefficient representing a firm's annual sales revenue, but the correlation is positive. For the USM, four proxies are significantly correlated with underpricing but the correlation is positive[15].

Table 3.9: correlation matrix of the variables employed as proxies for *ex ante* uncertainty by market of flotation.

Panel A: Main Market

	UP	ER	LGP	MD	LS	CV	AQ	UQ1	UQ2	UQ3
UP	1	–0.0	0.0	–0.0	0.2[b]	0.0	–0.0	0.0	0.0	0.0
ER		1	–0.6[b]	–0.3[b]	–0.2[b]	0.0	–0.2[b]	–0.1[a]	–0.1[b]	–0.1[b]
LGP			1	0.5[b]	0.4[b]	–0.0	0.2[b]	0.2[b]	0.2[b]	0.3[b]
MD				1	0.2[b]	–0.0	0.0	0.1[a]	0.1[b]	0.3[b]
LS					1	0.2[b]	0.0	0.1	0.1[a]	0.1[b]
CV						1	–0.0	–0.0	–0.0	–0.0
AQ							1	–0.0	0.0	–0.0
UQ1								1	0.8[b]	0.5[b]
UQ2									1	0.6[b]
UQ3										1

Notes: a and b denote statistical significance at the 5% and 1% levels respectively. None of the correlation coefficients between the independent variables is significantly higher than 0.80.

[15] Consistent with the results obtained for the whole sample, most of the independent variables across both listing markets are slightly correlated. However, as before, none of the bivariate correlation coefficients is significantly higher than 0.80. Moreover, all of the R^2s, reported in table 3.10, are less than 0.80. These results indicate that a significant level of multicollinearity does not appear to be present.

Table 3.9 continued.

Panel B: Unlisted Securities Market.

	UP	ER	LGP	MD	LS	CV	AQ	UQ1	UQ2	UQ3
UP	1	0.1[b]	–0.0	–0.0	0.1[a]	0.1[a]	–0.0	0.0	0.0	–0.0
ER		1	0.3[b]	–0.1[b]	0.0	0.0	–0.0	0.1[a]	0.1[b]	0.1[b]
LGP			1	0.4[b]	0.1[b]	0.0	0.0	0.2[b]	0.2[b]	0.2[b]
MD				1	0.0	0.0	–0.0	0.1[a]	0.1[a]	0.1[b]
LS					1	0.3[b]	0.0	0.1[a]	0.1[a]	0.1[b]
CV						1	–0.0	–0.0	–0.0	–0.0
AQ							1	–0.0	–0.0	–0.0
UQ1								1	0.8[b]	0.3[b]
UQ2									1	0.3[b]
UQ3										1

Notes: a and b denote statistical significance at the 5% and 1% levels respectively. None of the correlation coefficients between the independent variables is significantly higher than 0.80.

Table 3.10: auxiliary regressions by market of flotation.

	Main Market			**USM**		
Independent variables	R^2 (UQ1)	R^2 (UQ2)	R^2 (UQ3)	R^2 (UQ1)	R^2 UQ2)	R^2 (UQ3)
ER	0.49	0.49	0.50	0.20	0.20	0.15
LGP	0.63	0.63	0.63	0.36	0.34	0.32
MD	0.28	0.28	0.30	0.18	0.18	0.19
LS	0.24	0.24	0.24	0.14	0.14	0.16
CV	0.08	0.08	0.07	0.12	0.12	0.13
AQ	0.06	0.06	0.06	0.00	0.00	0.00
UQ1	0.06			0.13		
UQ2		0.08			0.11	
UQ3			0.15			0.09

Notes: the R^2s have been computed by regressing each independent variable against the remaining six independent variables. None of the above R^2s is significantly higher than 0.80.

Table 3.11, panels A and B, presents univariate regression results. For the Main Market, the findings are almost identical to the results presented in tables 3.8 and 3.9. All proxies are insignificant except the annual sales revenue, which again is positively related to the level of initial returns. For the USM, however, the results offer some mild support to the *ex ante* uncertainty hypothesis. Three proxies, issue size, issue method and the prestige of auditors, are negatively and significantly related to underpricing at the 5% and 1% levels respectively. Two other coefficients, the proportion of retained equity and the variation of pre–flotation earnings are also significant but are positively signed. Finally, the proxies for the annual sales revenue and the quality of underwriters, for all three reputation measures, are not significantly associated with the level of initial returns.

Table 3.11 univariate OLS regressions of initial returns on the variables employed as proxies for *ex ante* uncertainty by market of flotation.

Panel A: Main Market

Explanatory variables	Intercept	Estimated coefficients	Standard errors	t–statistics	Adj–R^2
ER	11.70**	–0.047	0.047	–0.998	0.129
LGP	–1.52	0.626	0.847	0.739	0.128
MD	8.89**	0.220	2.509	0.087	0.123
LS	–2.61**	0.699	0.384	1.822	0.153
CV	8.36**	1.115	1.498	0.744	0.125
AQ	9.58**	–1.085	1.641	–0.661	0.124
UQ1	8.26**	0.451	1.907	0.237	0.124
UQ2	8.31**	1.018	1.888	0.540	0.125
UQ3	6.76**	3.380	2.560	1.320	0.134

Notes: the standard errors of the independent variables are corrected for serial correlation using the Newey-West (1987) procedure. One and two asterisks denote statistical significance at the 5% and 1% levels respectively.

Table 3.11 continued.

Panel B: Unlisted Securities Market

Explanatory variables	Intercept	Estimated coefficients	Standard errors	t–statistics	Adj–R^2
ER	–5.06	0.212**	0.045	4.723	0.222
LGP	40.16**	–1.996*	0.890	–2.243	0.212
MD	11.09**	–8.085**	3.077	–2.627	0.219
AQ	11.56**	–3.194**	1.300	–2.457	0.213
LS	0.74	0.634	0.392	1.616	0.217
CV	8.42**	3.230*	1.915	1.686	0.214
UQ1	10.17**	1.145	0.952	1.203	0.202
UQ2	10.31**	0.904	1.084	0.834	0.205
UQ3	10.97**	–1.224	1.021	–1.198	0.206

Notes: the standard errors of the independent variables are corrected for serial correlation using the Newey-West (1987) procedure. One and two asterisks denote statistical significance at the 5% and 1% levels respectively.

In table 3.12, panels A and B, we report the results of the multivariate regressions. The results seem to suggest that the market of introduction might have some mild impact on the variables employed to capture *ex ante* uncertainty. Focusing first on panel A, where results for the Main Market are reported, it can be observed that while most of the coefficients have the predicted negative sign, only one, the method of flotation, significantly reduces the level of underpricing. The coefficient for auditor quality is no longer an important determinant of initial performance, whereas the significant positive coefficient for the annual level of sales is in accordance with the results presented in tables 3.8, 3.9 and 3.11 respectively. Also consistent with our previous findings, prestigious underwriters are significantly associated with higher levels of underpricing, but only for reputation measure three. Overall, it has to be concluded that, for the Main Market, the *ex ante* uncertainty hypothesis as an explanation to underpricing cannot be accepted. In panel B, we report the results for the USM. As it can be observed, although the USM findings are different than those reported for the Main Market, the support for the *ex ante* uncertainty hypothesis remains weak. Consistent with the univariate results, the method of flotation and the quality of auditors are negatively and statistically related to *ex ante* uncertainty. The fact that the coefficient for auditor quality regains its significance implies that prestigious auditors can influence the level of *ex ante* uncertainty only when they offer their services to young growing firms. The proportion of equity retained is statistically significant and has a positive sign. This result is consistent with the notion that a greater percentage of equity retained by pre–offering shareholders reduces the perceived marketability of the shares, post–flotation, and as a result of infrequent trading underpricing is increased. This finding should be interpreted cautiously, however, since the USM is the market for smaller capitalization stocks and is characterized by infrequent trading. Finally, the slope coefficient estimates on issue size, annual sales revenue, variation of earnings and underwriter quality, for all three reputation measures, are insignificant.

Table 3.12: multivariate OLS regression of initial returns on the variables employed as proxies for *ex ante* uncertainty by market of flotation.

Panel A: Main Market

Explanatory variables	UQ1	UQ2	UQ3
Intercept	6.019 (0.598)	6.117 (0.592)	7.899 (0.751)
ER	–0.061 (–1.121)	–0.062 (–1.122)	–0.071 (–1.236)
LGP	–0.452 (–0.399)	–0.498 (–0.422)	–0.771 (–0.671)
MD	–2.295** (–2.795)	–2.302** (–2.767)	–2.869** (–3.620)
LS	1.363** (2.340)	1.359** (2.343)	1.339** (2.408)
CV	–0.363 (–0.268)	–0.317 (–0.238)	–0.278 (–0.212)
AQ	–2.199 (–1.303)	–2.164 (–1.280)	–2.310 (–1.298)
UQ1	–0.289 (–0.199)	———	———
UQ2	———	0.295 (0.192)	———
UQ3	———	———	3.330* (1.825)
Adjusted-R^2	0.160	0.160	0.168
F–test	7.060**	7.060**	7.430**

Notes: the standard errors of the independent variables are corrected for serial correlation using the Newey-West (1987) procedure. One and two asterisks denote statistical significance at the 5% and 1% levels respectively. Figures in parentheses are t-statistics.

Table 3.12 continued.

Panel B: Unlisted Securities Market

Explanatory variables	UQ1	UQ2	UQ3
Intercept	−4.653 (−0.334)	−5.702 (−0.392)	−7.950 (−0.621)
ER	0.164** (3.752)	0.166** (3.502)	0.176** (4.559)
LGP	−0.490 (−0.419)	−0.373 (−0.294)	−0.162 (−0.147)
MD	−7.974** (−2.520)	−8.055** (−2.542)	−7.893** (−2.447)
LS	0.768 (1.315)	0.780 (1.357)	0.819 (1.434)
CV	2.455 (1.301)	2.436 (1.272)	2.320 (1.245)
AQ	−2.184* (−1.958)	−2.184* (−1.952)	−2.166* (−1.980)
UQ1	0.857 (0.710)	———	———
UQ2	———	0.546 (0.351)	———
UQ3	———	———	−0.765 (−0.613)
Adjusted-R^2	0.233	0.233	0.233
F-test	13.77**	13.66**	13.36**

Notes: the standard errors of the independent variables are corrected for serial correlation using the Newey-West (1987) procedure. One and two asterisks denote statistical significance at the 5% and 1% levels respectively. Figures in parentheses are t-statistics.

3.5. Signalling by underpricing: hypotheses.

As was noted in section 3.1, among the only theories which suggest that IPOs are deliberately offered at a discount and yield testable implications is the signalling theory advanced by Allen and Faulhaber (1989), Grinblatt and Hwang (1989) and Welch (1989). Within the framework of the signalling models we evaluate four propositions. First, the signalling models imply that issuing firms intentionally underprice their offerings to signal firm value. Once their quality is revealed in the secondary market, these firms approach the market for a SEO in order to recoup the losses of selling their issues at a discount. We examine the relation between underpricing and the probability of reissue by testing the following hypothesis:

H_{01}: *firms with higher initial returns have the same probability of making a SEO as firms with lower initial returns.*

Second, under the signalling models, the total costs of raising external equity capital are much higher for firms which deliberately underprice their offerings. As a result, these firms are likely to approach the reissue market with larger offerings than firms which have been priced more fully. The validity of this argument is tested by the following hypothesis:

H_{02}: *firms with higher initial returns are not likely to issue larger amounts of seasoned equity than firm with lower initial returns.*

Third, a premise of the signalling models is that IPO firms which nave been heavily underpriced will return to the market for a SEO much quicker than firms underpriced by a smaller amount[16]. The relation between the timing of SEOs and underpricing is tested on the basis of the following hypothesis:

> H_{03}: *firms with higher initial returns are not likely to make a SEO more quickly after the IPO than firms with lower initial returns.*

Lastly, under the signalling models, firms which underprice more should experience a less unfavourable price response at the time of the announcement of a SEO than firms which underprice less. This is tested by the following hypothesis:

> H_{04}: *firms with higher initial returns are not likely to experience a smaller price decline when the SEO is announced than firms with lower initial returns.*

[16] Welch (1996) argues that high quality firms wait longer before making a SEO because the longer they wait, the higher the probability that their quality will be revealed. He further notes that high quality firms reissue early only when their quality is randomly revealed, and that such firms are usually associated with price runups prior to the SEO.

3.6. Signalling by underpricing: data and methodology.

The empirical results are based on a sample of 653 U.K. IPOs issued during 1984–1992. Data on SEOs were taken form the London Stock Exchange official yearbooks, Extel Financial, DATASTREAM and the Quality of Markets monthly fact sheet. Unlike Levis (1995), who focuses only on rights issues, our sample of SEOs includes both rights issues and other further issues of equity such as open offers, placements, issues for cash and vendor placements. The signalling hypotheses reported in the previous section are tested using the level of underpricing (UP) as the main explanatory variable. Following several academic researchers [Garfinkel (1993), Jegadeesh *et al.* (1993) and Levis (1995)], we also conduct our tests by using a measure of unexplained underpricing (UUP) as well. The unexplained underpricing is the residual from regression equation 3.1, after including industry and year dummy variables[17].

To examine whether there is a relation between underpricing and subsequent equity decisions we use logit analysis. The logit model, which uses the method of maximum likelihood, can be expressed as follows:

$$Reissue = f(UP, R_3) \qquad (3.3)$$

where Reissue takes the value of one if a firm reissued equity within three years of the IPO, and zero otherwise, and R_3 is the three month holding period adjusted return

[17] The use of industry and year dummy variables does not significantly affect the results reported in section 3.4, although some industrial sectors and years are significantly associated with the level of underpricing.

computed as:

$$R_3=[(\prod_{t=1}^{3}(1+r_{it}))-(\prod_{t=1}^{3}(1+r_{mt}))] \tag{3.4}$$

where r_{it} measures the return from a buy and hold strategy where a stock is purchased at the closing market price of the first trading month after going public and held for the first three months of seasoning, and r_{mt} is the benchmark (FTA) return for the same period. R_3 is included in the analysis because the probability of a SEO may be affected by the price performance of IPO firms in the early secondary market. Given that the degree of underpricing can be affected by many factors, our logit model also includes as explanatory variables the eight proxies for *ex ante* uncertainty summarised in table 3.1. Lastly, industry and year dummy variables are also included in the logit model to allow for potential differences in SEO activity across industry and year groups.

To evaluate the hypothesis that the size of the seasoned offering is related to the level of underpricing we employ OLS regression analysis. Formally, we regress the following equation:

$$SIZE=a_0+a_1 UP+a_2 R_3+e_i \tag{3.5}$$

where SIZE measures the size of the seasoned offering as a fraction of the capital raised in the initial offering.

The relation between the timing of SEOs and underpricing is tested through the following OLS model:

$$LDAYS=a_0+a_1UP+a_2R_3+e_i \tag{3.6}$$

where LDAYS is the natural logarithm of the time between the IPO and the SEO.

Finally, we examine the relation between the price response to the announcement of a SEO and underpricing by estimating the following model through an OLS regression:

$$AAR=a_0+a_1UP+a_2R_3+a_3LDAYS+a_4SIZE+a_5LSSEO+e_i \tag{3.7}$$

where AAR is the announcement adjusted (FTA) abnormal return, computed as in equation 2.4, over the event days –1, 0 (SEO announcement date) and +1, and LSSEO is the natural logarithm of the size of the seasoned offering. As with the logit analysis, the three OLS models include as explanatory variables the eight proxies for *ex ante* uncertainty and a full set of industry and year dummy variables. Moreover, given that the dependent variables in these three OLS models are relevant only for reissuing firms, our tests are restricted to IPO firms making a SEO.

3.7. Signalling by underpricing: empirical results.

3.7.1. Underpricing and the probability of reissue.

Table 3.13 presents descriptive statistics for IPOs broken down by reissuance activity. Given that almost 72% of the IPOs in our sample have produced positive initial returns (see table 2.5), if Welch (1989), Grinblatt and Hwang (1989) and Allen and Faulhaber (1989) are correct in arguing that underpricing is undertaken deliberately by issuing firms to cash in on secondary offerings, we would expect to find a very large proportion of IPO firms approaching the market for additional equity issuance. As table 3.13 reveals, however, only 29.40% of the firms reissue equity within three years of the initial offering, a percentage which is comparable to prior U.S. and U.K. findings. Moreover, of the 192 IPOs reissuing equity, only 130 offerings (67.70%) generate positive returns on the first day of trading. In sharp contrast to the predictions of the signalling models, the average initial return for firms that do not reissue, 11.02%, is higher than that reported for firms that reissue, 8.97%. The difference in mean returns, however, is not statistically significant (t–test=–1.206). Lastly, as predicted by the signalling models, insiders of reissuing firms retain a higher, but insignificant (t–test=1.025), proportion of equity in the IPO. Overall, these preliminary results suggest that signalling to improve seasoned offering prices does not appear to be the sole motivation for underpricing.

Further evidence as to the relation between underpricing and the probability of a SEO is presented in table 3.14 which reports the results of the logistic model. Consistent to previous U.S. and U.K. findings, the hypothesis that more underpriced offerings are more likely to return to the market for a SEO cannot be accepted. Both UP, the level of underpricing, and UUP, the level of unexplained underpricing, are not significantly

Table 3.13: descriptive statistics of IPOs broken down by reissuance activity.

	Reissuers	Non–reissuers
Number of IPOs	192	461
% of all IPOs	29.40	70.60
% of IPOs reissuing with positive initial returns	67.70	N/A
Mean (%)	8.97	11.02
Median (%)	6.08	6.88
Standard deviation	20.72	17.30
t–statistic	5.99**	13.67**
Mean equity retained at the IPO (%)	67.41	65.83
Median equity retained at the IPO (%)	71.00	72.00
Mean gross proceeds raised from the IPO (£000)	21663.60	101176.00
Median gross proceeds raised from the IPO (£000)	3916.78	4823.69

Notes: mean initial returns are computed using equation 2.1. Two asterisks denote statistical significance at the 1% level. Gross proceeds are measured in pounds of 1992 purchasing power.

associated to the probability of reissuing. Moreover, the slope coefficient on the proportion of retained equity is insignificant and has the wrong negative sign. R_3, the coefficient for the performance of IPOs in the first three months of seasoning, is positive and significantly different from zero at the 1% level[18]. This result provides evidence in support of the market feedback hypothesis advanced by Jegadeesh *et al.* (1993), which posits that the price performance of IPOs in the early secondary market will have an equal or higher explanatory power for the probability of a SEO than the

[18] Similar results are also found when R_3 is computed relative to the HGSC.

Table 3.14: logistic model relating the probability of reissue to the level of initial underpricing, the level of unexplained underpricing, proxies for *ex ante* uncertainty, industry and year dummy variables and the three month aftermarket performance of IPOs.

Explanatory variables	UP	UUP
Intercept	0.431 (0.054)	0.199 (0.025)
ER	–0.055 (–1.521)	–0.052 (–1.458)
LGP	–0.406 (–0.533)	–0.396 (–0.515)
MK	–0.433 (–0.339)	–0.405 (–0.316)
MD	0.283 (0.206)	0.192 (0.143)
LS	–0.013 (–0.054)	–0.014 (–0.058)
CV	–0.073 (–0.068)	–0.010 (–0.010)
AQ	0.489 (0.489)	0.504 (0.503)
UQ1	0.305 (0.307)	0.323 (0.325)
UQ2	1.043 (1.037)	1.029 (1.037)
UQ3	–0.784 (–0.651)	–0.751 (–0.632)
R3	0.037** (3.564)	0.037** (3.580)
UP	0.010 (0.409)	————
UUP	————	–0.003 (–0.103)
Pseudo–R^2	0.048	0.048

Notes: UP, the level of underpricing, is computed using equation 2.1, whereas UUP, the level of unexplained underpricing, is the residual from regression equation 3.1. Two asterisks denote statistical significance at the 1% level. Figures in parentheses are t-statistics. Results for industry and year dummies are not reported. The results reported above are estimated using UQ1 as the variable capturing the prestige of underwriters. All coefficients estimated using UQ2 and UQ3 remain virtually unchanged in terms of both sings and significance and are therefore not reported.

level of initial returns. In addition, the positive coefficient for R_3 is also consistent with the predictions of Lucas and McDonald (1990), who suggest that SEOs are preceded by a runup in the stock prices of issuing firms.

3.7.2. Underpricing and the size of SEOs.

Table 3.15 reports summary statistics on the (relative) size of SEOs for different methods of reissuance. The most frequently used method is the rights issue, accounting for 50% of the SEOs in our sample. Open offers account for almost 30%, whereas placements and other issue methods are less frequently employed. As table 3.15 reveals, reissuing firms raise substantial amounts of funds. The average size of SEOs is 2.45 times the size of IPO proceeds. The mean *multiple*, *however*, of SEO proceeds to IPO proceeds varies significantly across the different issue methods. Open offers report the highest average multiple, 3.61, whereas for rights issues, placements and other issues the mean multiples are lower at 2.56, 0.99 and 2.31 respectively.

Table 3.16 examines the relation between the size of seasoned offerings and initial returns. In line with previous U.K. findings, although both coefficients for initial performance, UP and UUP, have the predicted positive sign, they are not significantly related to the size of SEOs. In contrast, the slope coefficient estimates on the percentage of equity retained and the market of flotation are positive and reliably different from zero, whereas LGP, the coefficient for IPO size, is negatively and significantly associated to the size of seasoned offerings. These results suggest that firms whose pre–offering shareholders have retained higher fractions of equity capital

Table 3.15: (relative) size of SEOs by issue method.

	Rights	Open offers	Placements	Other issues	All
Number of SEOs	84 (97)	25 (56)	25 (31)	8 (8)	142 (192)
Total SEO proceeds (£m)	2676.40	317.81	180.88	64.49	3239.59
Mean SEO proceeds (£000)	31861.97	12712.48	7235.40	8061.62	22814.06
Median SEO proceeds (£000)	9226.50	10262.60	2068.12	3228.15	6085.82
Mean multiple of SEO proceeds to IPO proceeds	2.56	3.61	0.99	2.31	2.45
Minimum multiple	0.03	0.18	0.01	0.04	0.01
Median multiple	1.56	2.06	0.48	0.92	1.47
Maximum multiple	33.90	28.03	6.05	8.16	33.90
Standard deviation of mean multiple	3.81	5.60	1.25	2.86	3.93

Note: the gross proceeds raised from IPOs and SEOs are measured in pounds of 1992 purchasing power.

in the IPO, firms quoted in the Main Market and smaller offerings are more likely to raise larger amounts of capital through SEOs.

3.7.3. Underpricing and the timing of SEOs.

Table 3.17, panel A, reports details of the timing of seasoned offerings by issue method. The mean time between the initial offering and the SEO is 1.65 years (603 calendar days). On average, firms reissuing through an open offer wait longer before returning to the market, 608 calendar days, whereas for SEOs performed via a placing the mean time between the IPO and the seasoned offering is slightly lower at 591 calendar days. In panel B of table 3.17 we present some preliminary findings as to the relation between underpricing and the timing of SEOs. The results are consistent to

Table 3.16: multivariate OLS regression of the size of SEOs relative to the size of IPOs on the level of initial underpricing, the level of unexplained underpricing, proxies for *ex ante* uncertainty, industry and year dummy variables and the three month aftermarket performance of IPOs.

Explanatory variables	UP	UUP
Intercept	4.746* (1.969)	5.160* (2.185)
ER	0.036* (2.183)	0.035* (2.261)
LGP	–0.599* (–2.214)	–0.643* (–2.299)
MK	1.160* (2.489)	1.081* (2.310)
MD	–0.394 (–0.694)	–0.332 (–0.657)
LS	0.012 (0.110)	0.032 (0.338)
CV	–0.237 (–0.284)	–0.215 (–0.274)
AQ	–0.654 (–1.157)	–0.682 (–1.275)
UQ1	0.218 (0.335)	0.243 (0.375)
UQ2	0.435 (0.667)	0.433 (0.671)
UQ3	–0.104 (–0.207)	–0.070 (–0.143)
R3	0.044 (1.600)	0.040 (1.513)
UP	0.012 (0.612)	———
UUP	———	0.000 (0.007)
Adjusted–R^2	0.125	0.121

Notes: UP, the level of underpricing, is computed using equation 2.1, whereas UUP, the level of unexplained underpricing, is the residual from regression equation 3.1. The standard errors of the independent variables are corrected for heteroscedasticity using White's (1980) procedure. One asterisk denotes statistical significance at the 5% level. Figures in parentheses are t-statistics. Results for industry and year dummies are not reported. The results reported above are estimated using UQ1 as the variable capturing the prestige of underwriters. All coefficients estimated using UQ2 and UQ3 remain virtually unchanged in terms of both sings and significance and are therefore not reported.

Table 3.17: timing of SEOs and the relation between timing and underpricing by issue method.

Panel A: timing of SEOs by issue method

	Rights	Open offers	Placements	Other issues	All
Number of SEOs	97	56	31	8	192
Mean time between IPO and SEO (days)	603.60	608.25	591.32	605.87	603.07
Minimum time (days)	124.00	92.00	169.00	244.00	92.00
Median time (days)	633.00	542.00	562.00	580.00	592.00
Maximum time (days)	1085.00	1090.00	1072.00	900.00	1090.00
Standard deviation of mean time	248.01	257.70	265.94	203.47	252.23

Panel B: relation between underpricing and timing of SEOs by issue method

	Rights		Open offers		Placements		Other issues		All	
Month since IPO	N	UP (%)	N	UP (%)	N	UP (%)	N	UP (%)	N	UP (%)
0–6	5	42.13	3	7.32	1	30.40	_	______	9	29.22
6–12	16	19.98	5	−7.34	8	3.91	1	−10.90	30	10.11
12–18	19	5.31	20	14.83	5	11.24	3	10.78	47	10.34
18–24	25	6.05	10	12.88	7	7.37	2	−16.64	44	6.78
24–30	20	2.78	9	11.96	4	2.00	2	3.28	35	5.08
30–36	12	−0.61	9	8.91	6	20.18	_	______	27	7.18
All	97	8.56	56	10.69	31	9.63	8	−0.65	192	8.97

Notes: N denotes the number of SEOs. UP, the level of underpricing, is computed using equation 2.1.

the predictions of the signalling models. More underpriced firms return to the market for a SEO quicker than offerings which have been priced more fully. For example, firms which reissue within the first six months of the initial offering report an average initial return of 29.22%, whereas for firms reissuing within months 6–18 and 18–30 the average underpricing is much lower at 10.25% and 6.02% respectively. When seasoned offerings are segmented by issue method, the inverse relation between underpricing and the timing of SEOs is only observed for rights issues. For open offers, placements and other issues the results are rather inconclusive.

Table 3.18 reports results of regression equation 3.6. Our empirical findings are in line with prior U.S. and U.K. evidence, and provide support to both the signalling hypothesis and the market feedback hypothesis. Both measures of underpricing, UP and UUP, as well as the slope coefficient on the three month aftermarket performance of IPOs, R_3, are negative and reliably different from zero at the 1% level. This result suggests that IPO firms return more quickly to the reissue market not only when they have been heavily underpriced, but also when their stock prices in the secondary market experience a runup[19].

3.7.4. Underpricing and the stock price response to SEO announcement.

Table 3.19, panel A, presents descriptive statistics for the three day average abnormal returns, computed over the event days −1, 0 (SEO announcement date) and +1. The mean three day abnormal return for the entire sample of SEOs is negative, −0.95%, and statistically significant at the 5% level[20] (t–statistic=−2.16). This result is in line with the findings reported in previous studies [Asquith and Mullins (1986), Masulis and Korwar (1986) and Slovin *et al.* (1994)], and implies that the announcement of a SEO

[19] This result is also in line with the predictions of Welch (1996). [See footnote 16].

[20] The choice of benchmark in computing announcement abnormal returns does not significantly affect our results.

Table 3.18: multivariate OLS regression of the time between the IPO and the SEO on the level of initial underpricing, the level of unexplained underpricing, proxies for *ex ante* uncertainty, industry and year dummy variables and the three month aftermarket performance of IPOs.

Explanatory variables	UP	UUP
Intercept	5.183** (8.502)	5.052** (8.306)
ER	0.031 (0.316)	0.000 (0.209)
LGP	−0.009 (−0.193)	−0.001 (−0.035)
MK	0.046 (0.466)	0.050 (0.495)
MD	0.079 (0.608)	0.084 (0.644)
LS	0.028 (1.841)	0.025 (1.632)
CV	0.015 (0.220)	0.019 (0.270)
AQ	−0.012 (−0.165)	0.002 (0.039)
UQ1	0.045 (0.709)	0.047 (0.748)
UQ2	0.106 (1.515)	0.109 (1.560)
UQ3	0.243** (3.082)	0.240** (3.012)
R3	−0.015** (−3.752)	−0.015** (−3.853)
UP	−0.004** (−2.803)	———
UUP	———	−0.004** (−2.527)
Adjusted−R^2	0.138	0.134

Notes: UP, the level of underpricing, is computed using equation 2.1, whereas UUP, the level of unexplained underpricing, is the residual from regression equation 3.1. The standard errors of the independent variables are corrected for heteroscedasticity using White's (1980) procedure. Two asterisks denote statistical significance at the 1% level. Figures in parentheses are t-statistics. Results for industry and year dummies are not reported. The results reported above are estimated using UQ1 as the variable capturing the prestige of underwriters. All coefficients estimated using UQ2 and UQ3 remain virtually unchanged in terms of both sings and significance and are therefore not reported.

Table 3.19: announcement abnormal returns of SEOs by issue method and the relation between underpricing and announcement abnormal returns.

Panel A: announcement abnormal returns of SEOs by issue method

	Rights	Open offers	Placements	Other issues	All
Number of SEOs	97	56	31	8	192
Mean (%)	–0.96	–0.85	–1.07	–1.26	–0.95
Minimum (%)	–53.50	–6.32	–8.97	–4.65	–53.50
Median (%)	–1.12	–1.08	–1.25	–1.44	–1.05
Maximum (%)	20.70	15.75	6.11	4.65	20.70
Standard deviation	7.90	3.70	2.67	2.60	6.09
t–statistic	–1.20	–1.72	–2.23*	–1.37	–2.16*

Panel B: announcement abnormal returns of SEOs by initial return quintiles

Initial return quintile	Number of SEOs	Mean (%)	Standard deviation	t–statistic
–45.71– –0.01	40	–1.28	3.36	–2.41*
0.00–4.00	38	–1.92	5.72	–2.07*
4.01–9.99	38	–1.82	9.40	–1.52
10.00–23.10	38	–0.99	5.03	–1.21
23.11 +	38	1.27	5.13	1.52

Notes: Initial returns are computed using equation 2.1, whereas announcement abnormal returns are computed using equation 2.4. One asterisk denotes statistical significance at the 5% level.

is perceived as bad news about the firm. When seasoned offerings are broken down by issue method, however, significant negative announcement abnormal returns are only reported for firms reissuing through a placing. For rights issues, open offers and other issues the average three day abnormal returns are negative but insignificant, varying between –0.85% and –1.26%. Panel B of table 3.19 reports announcement abnormal returns for quintiles of initial returns. Overpriced issues experience an average abnormal return of −1.28%, whereas for IPO firms in the largest underpricing quintile the mean three day abnormal return is positive and very high at 1.27%. These results appear to be consistent to the predictions of the signalling models that a positive relation exists between underpricing and the stock price response to the announcement of a SEO.

Further evidence that the market reacts less unfavourably to the announcement of a SEO by heavily underpriced IPO firms is presented in table 3.20 which reports the OLS estimates of regression model 3.7. The slope coefficient estimates on UP and UUP are positive and significant at conventional statistical levels. This evidence is in sharp contrast with the results of Levis (1995), but is consistent with the findings of Jegadeesh *et al.* (1993) and Slovin *et al.* (1994), and provides some support in favour of the signalling models.

Table 3.20: multivariate OLS regression of the SEO announcement period abnormal return on the level of initial underpricing, the level of unexplained underpricing, proxies for *ex ante* uncertainty, industry and year dummy variables, the three month aftermarket performance of IPOs, the natural logarithm of the time between the IPO and the SEO, the size of the SEO relative to the size of the IPO and the natural logarithm of the funds raised at the SEO.

Explanatory variables	UP	UUP	UP	UUP
Intercept	6.076 (0.952)	6.522 (1.024)	9.901 (1.262)	10.60 (1.342)
ER	–0.001 (–0.060)	0.000 (0.040)	–0.018 (–0.571)	–0.015 (–0.486)
LGP	0.356 (0.635)	0.282 (0.508)	1.406 (1.439)	1.322 (1.369)
MK	0.424 (0.443)	0.365 (0.383)	0.448 (0.321)	0.367 (0.263)
MD	0.068 (0.053)	0.004 (0.004)	–0.658 (–0.467)	–0.727 (–0.515)
LS	0.002 (0.019)	0.060 (0.425)	–0.183 (–1.062)	–0.117 (–0.718)
CV	0.018 (0.027)	0.020 (0.030)	0.347 (0.397)	0.348 (0.398)
AQ	–0.146 (–0.181)	–0.218 (–0.270)	–0.195 (–0.225)	–0.271 (–0.316)
UQ1	–0.353 (–0.364)	–0.337 (–0.349)	–0.005 (–0.005)	0.019 (0.018)
UQ2	–0.949 (–0.947)	–0.935 (–0.936)	0.222 (0.213)	0.246 (0.237)
UQ3	1.308 (1.370)	1.382 (1.447)	1.771 (1.895)	1.869 (1.884)
R3	0.004 (0.071)	0.004 (0.067)	0.083 (0.989)	0.083 (0.980)
UP	0.053** (2.345)	———	0.061** (2.450)	———
UUP	———	0.053** (2.345)	———	0.060** (2.399)
LDAYS	–1.365 (–1.762)	–1.359 (–1.748)	–1.892 (–1.391)	–1.876 (–1.381)
SIZE	———	———	0.382 (1.279)	0.383 (1.271)
LSSEO	———	———	–0.593 (–1.132)	–0.592 (–1.127)
Adjusted–R^2	0.090	0.089	0.128	0.107

Notes: UP, the level of underpricing, is computed using equation 2.1, whereas UUP, the level of unexplained underpricing, is the residual from regression equation 3.1. The standard errors of the independent variables are corrected for heteroscedasticity using White's (1980) procedure. Two asterisks denote statistical significance at the 1% level. Figures in parentheses are t-statistics. Results for industry and year dummies are not reported. The results reported above are estimated using UQ1 as the variable capturing the prestige of underwriters. All coefficients estimated using UQ2 and UQ3 remain virtually unchanged in terms of both sings and significance and are therefore not reported.

3.8. Aftermarket performance and reissuance activity.

Table 3.21 reports aftermarket performance measures, computed using equations 2.9 and 2.10, for IPOs broken down by reissuance activity. Assuming market efficiency, and given the arrival of new information in the aftermarket, good news are likely to generate positive abnormal returns, whereas bad news should generate negative abnormal returns. Given that high quality firms (reissuing firms) are more likely to enjoy good news than low quality firms (non–reissuers), it is reasonable to expect high quality IPO firms to outperform low quality firms in the long–run. The results in table 3.21 appear to be consistent with this notion. Using the HGSC as the market benchmark, the average wealth relative for non–reissuers is 0.902 at month 12 and declines monotonically thereafter. For reissuing firms, however, the time series behaviour of the mean wealth relative exhibits a different pattern; it rises to 1.021 by the end of month 12, peaks at 1.065 at month 24 and then declines to 0.936 in the third year of seasoning. As was shown in table 3.17, panel A, the average time between the initial offering and the seasoned offering is 20 months (1.65 years). Thus, the superior performance of reissuing firms for the first 24 months of seasoning provides additional evidence in support of the notion that reissuing firms experience significant price runups prior to a SEO. Moreover, the decline of the average wealth relative to below one between months 24 and 36, a period during which most reissuers pass to their post–SEO era, provides evidence of post–SEO underperformance similar to the one documented for IPOs. Loughran and Ritter (1995), Spiess and Affleck–Graves (1995) and Levis (1995) report similar results.

The relation between aftermarket performance and reissuance activity is further tested

Table 3.21: aftermarket performance of IPOs broken down by reissuance activity.

	Reissuers	Non–reissuers
Number of IPOs	192	461
Mean 1–year R_T (%)	27.36	10.74
WR_{FTA}	1.111	0.961
WR_{HGSC}	1.021	0.902
Mean 2–year R_T (%)	40.52	11.88
WR_{FTA}	1.129	0.894
WR_{HGSC}	1.065	0.872
Mean 3–year R_T (%)	33.82	17.46
WR_{FTA}	1.009	0.876
WR_{HGSC}	0.936	0.837

Note: average holding period returns, R_T are computed using equation 2.9, whereas wealth relatives, WR, are computed using equation 2.10.

through OLS regression analysis. Formally, we regress the following equation:

$$R_i = a_0 + a_1 R_m + a_2 UP + a_3 Reissue + e_i \qquad (3.8)$$

where R_i is the raw IPO 12, 24 and 36 month return, computed using equation 2.8, R_m is the equivalent return on the FTA and the HGSC respectively, UP is the initial return and Reissue is a dummy variable which equals to one if an IPO firm reissued equity within three years of the initial offering, and zero otherwise. In addition, the eight proxies for *ex ante* uncertainty, as well as industry and year dummy proxies are also included as explanatory variables. The results, presented in table 3.22, are in line with our previous findings and show that reissuing firms perform better in the long–run than non–reissuers. The slope coefficient estimate on Reissue is positive and reliably different from zero at the 1% level for all three years of seasoning. Table 3.22 also provides further evidence as to the signalling by underpricing hypothesis. If underpricing is likely to be a positive signal of firm value, then, under the signalling models, a positive relation should exist between initial and aftermarket performance. The coefficient for underpricing has the predicted positive sign at month 12 but is not significantly meaningful, whereas for months 24 and 36 respectively, UP becomes negative but still remains insignificant. Moreover, the slope coefficient for the proportion of equity retained has the wrong negative sign, but is not statistically different from zero. We can interpret these results as being inconsistent with the signalling hypothesis.

Table 3.22: multivariate OLS regression of the holding period return of IPOs for 12, 24 and 36 months in the aftermarket on the equivalent holding period return of two market proxies, the level of initial underpricing, proxies for *ex ante* uncertainty, industry and year dummy variables and a proxy for the reissuance activity of IPOs.

Explanatory variables	YEAR-1	YEAR-2	YEAR-3
Intercept	−48.72* (−1.987)	−19.13 (−0.450)	28.34 (0.580)
ER	0.085 (0.602)	−0.351 (−1.610)	−0.379 (−1.581)
LGP	2.889 (1.156)	−5.712 (−1.360)	−9.338* (−2.070)
MK	0.698 (0.150)	1.739* (2.077)	1.523* (2.021)
MD	−9.670 (−1.686)	−5.845 (−0.652)	2.569 (0.250)
LS	0.032 (0.031)	3.003 (1.873)	4.902** (2.852)
CV	−1.905 (−0.500)	0.028 (0.005)	−3.902 (−0.551)
AQ	3.175 (0.802)	4.788 (0.748)	5.996 (0.822)
UQ1	9.909* (2.463)	20.81** (3.444)	23.72** (3.314)
UQ2	11.55** (3.050)	19.84** (3.332)	23.36** (3.351)
UQ3	−0.549 (−0.137)	1.112 (0.173)	9.482 (1.230)
UP	0.100 (0.834)	−0.050 (−0.278)	−0.085 (−0.449)
RM_{FTA}	1.168** (5.788)	0.897** (3.953)	0.618** (3.181)
RM_{HGSC}	1.049** (5.701)	0.638** (3.872)	0.409** (3.514)
REISSUE	15.67** (3.386)	30.90** (4.680)	22.89** (2.923)
Adjusted-R^2	0.260	0.171	0.199

Notes: the standard errors of the independent variables are corrected for heteroscedasticity using White's (1980) procedure. One and two asterisks denote statistical significance at the 5% and 1% levels respectively. Figures in parentheses are t-statistics. Results for industry and year dummies are not reported. The results reported above are estimated using UQ1 as the variable capturing the prestige of underwriters and RM_{FTA} as the proxy for the returns of the market. All coefficients estimated using UQ2, UQ3 and RM_{HGSC} remain virtually unchanged in terms of both sings and significance and are therefore not reported.

3.9. Conclusions.

This chapter tested the *ex ante* uncertainty hypothesis, which posits that greater uncertainty about an offering's value increases the degree of underpricing, and the underpricing signalling model theories, which posit that more underpriced IPO firms are more likely to: (1) issue seasoned equity, (2) issue larger amounts of seasoned equity, (3) return more quickly to the reissue market after the initial offering and (4) experience a smaller price decline at the time of the announcement of a seasoned offering.

The evidence in support of the *ex ante* uncertainty hypothesis is not overly strong. Using eight explanatory variables as measures for *ex ante* uncertainty, we find that most of these proxies, individually or jointly, have no significant impact on the level of initial returns. In particular, the degree of underpricing is found to be significantly reduced only when IPO firms are taken to the market through an offer for sale and when prestigious auditors are involved in the flotation process. Further analyses, however, suggest that high quality auditors can reduce the level of discount on IPOs only when they offer their services to small firms. Lastly, contrary to what was anticipated, proxies such as issue size, equity retained, underwriter quality and issue market are not important determinants of initial performance.

Regarding the signalling model theories, although some of our results are in line with the predictions of the signalling models, when the empirical evidence is viewed in its entirety, the support for the signalling by underpricing hypothesis is essentially weak. More specifically, even though we find that more underpriced IPO firms return more quickly to the reissue market after the initial offering and that a positive relation exists between underpricing and the stock price response at the time of the announcement of a SEO, the basic implication of the signalling models that initial returns have a positive effect on the likelihood and size of seasoned offerings is strongly rejected. Instead, we find that IPO firms are more likely to return to the market for a SEO when their stock prices experience significant price runups. These results are more consistent with the market feedback hypothesis rather than with the signalling by underpricing hypothesis.

CHAPTER 4

"TESTING FOR DELIBERATE PREMARKET UNDERPRICING."

4.1. Introduction.

Despite the fact that our findings in the previous chapter show that the evidence in support of the signalling hypothesis, which posits that issuers intentionally offer their IPOs at a discount to signal firm quality, is essentially weak, the possibility that newly listed firms are deliberately underpriced cannot be totally dismissed. As was noted in chapter 1, section 1.3, many theories have been put forward to explain the underpricing anomaly, most of which suggest that new issues are intentionally offered at a discount. The majority of these theories, however, have largely untestable implications. In this chapter, however, we employ a unique methodology which allows us to examine whether, and by how much, IPOs are deliberately underpriced in the premarket, that is, prior to an IPO being floated.

Testing for deliberate underpricing in the IPO premarket is achieved by using the stochastic frontier methodology developed by Aigner *et al.* (1977). What the stochastic frontier approach implies, is that for a given set of information a maximum offer price exists, and actual offer prices can deviate from this maximum either because of statistical noise (randomness) or because of technical inefficiency (deliberately). Any difference between the maximum frontier price and the actual offering price caused deliberately can be measured by a one–sided error term using the methodology put forward by Jondrow *et al.* (1982).

The chapter is organised in five sections. In section 4.2 we explain how the stochastic frontier model is estimated and the way deviations from the frontier can be measured. Section 4.3 provides empirical findings of the stochastic frontier estimation, whereas section 4.4 tests for the relation between deliberate premarket and actual aftermarket underpricing. Concluding remarks are presented in section 4.5.

4.2. Data and methodology.

The data used consist of 653 U.K. IPOs obtaining a quotation on either the Main Market or the USM during the period 1984–1992. The variables to be employed in the empirical analysis, explained in detail in chapter 3, section 3.2, are outlined in table 4.1. They are used in estimating the stochastic frontier not only because they may act as proxies for a reduction in *ex ante* uncertainty, but also because they are related to firm value, firm–specific risk, profitability and to the costs of going public, all of which may influence the setting of the offering price[1].

The stochastic frontier is a production function expressing the maximum offer price available for a given offering under full information. Any difference between the predicted maximum frontier price and the actual offer price can either be the result of random error (statistical noise) or deliberate underpricing (technical inefficiency). Any deviation between the two prices caused by technical inefficiency will be measured by a systematic one–sided error term which, under the stochastic frontier maximum likelihood estimation, will appear in the form of skewness in the residuals and can be measured either for each offering separately or for a group of IPOs together. If no deliberate underpricing exists, then the one–sided error term will not appear, and as Waldman (1982) has shown, the maximum likelihood estimator will be equivalent to OLS estimation. If, however, IPOs are deliberately underpriced, as indicated by the one–sided error component, under OLS the systematic one–sided error term will be

[1] Some evidence as to the influence of the proxies used on the actual offer price is presented in table 4.2 which shows the correlation matrix. The actual offer price is positively and significantly correlated with six variables, negatively and significantly correlated with the proportion of equity retained and positively but insignificantly correlated with the coefficient of variation in pre–flotation earnings.

incorporated into the intercept and thus will be unidentifiable, and instead of estimating the maximum offer price, OLS will estimate the mean offer price.

The stochastic frontier regression model is a classical linear regression model with a non–normal asymmetric disturbance. The general formulation of the model developed by Aigner *et al.* (1977) is:

$$P_i = f(X_i;B) + e_i \tag{4.1}$$

where P_i is the actual initial offer price, X_i is a vector of non–stochastic inputs, B is a vector of coefficients of the IPO pricing frontier and e_i is the error component, where $e_i = v_i - u_i$. V_i represents the symmetric disturbance and is assumed to be independently and identically distributed as $N(0, \sigma^2_v)$, and u_i represents the asymmetric disturbance and is assumed to be distributed independently of v_i and to satisfy $u_i \leq 0$. V_i is a two–sided error term representing randomness or statistical noise, and u_i is a one–sided error term representing technical inefficiency. The nonpositive one–sided component reflects the fact that each firm's offer price must lie on or below the stochastic frontier, whereas the two–sided component implies that offer prices may lie above or below the frontier. The frontier is stochastic, given that it can vary randomly across firms, or over time for the same firm.

In order to estimate the stochastic frontier model, Aigner *et al.* (1977) used the distribution function of the sum of a truncated normal variable derived by Weinstein (1964), and a symmetric normal random variable. This resulted in the following density function:

$$f(e_i)=\frac{2}{\sigma}f^{*}(\frac{e_i}{\sigma})[1-F^{*}(e_i\lambda\sigma^{-1})] \tag{4.2}$$

where $\sigma = (\sigma^2_u + \sigma^2_v)^{1/2}$, $\lambda = \sigma_u / \sigma_v$, $f^*(e_i / \sigma)$ and $F^*(e_i\lambda\sigma^{-1})$ are the standard normal density and distribution functions respectively. This density is asymmetric around zero, with its mean and variance given as:

$$E(e)=E(u)=-\frac{\sqrt{2}}{\sqrt{\Pi}}\sigma_u \tag{4.3}$$

$$V(e)=V(u)+V(v)=(\frac{\Pi-2}{\Pi})\sigma_u^2+\sigma_v^2 \tag{4.4}$$

By assuming that a random sample of N observations exist, the log likelihood function is:

$$\ln L(P,B,\lambda,\sigma^2)=N\ln\frac{\sqrt{2}}{\sqrt{\pi}}+N\ln\sigma^{-1}+\sum_{i=1}^{N}\ln[1-F^{*}(e_i\lambda\sigma^{-1})]-\frac{1}{2\sigma^2}\sum_{i=1}^{N}e_i^2 \tag{4.5}$$

where $e_i = P_i - BX_i$.

What we are mostly interested about is the value of λ, the skewness in the systematic one–sided error term. A positive significant λ implies that any difference between the maximum predicted price and the actual offer price is the result of deliberate premarket underpricing. If λ goes to zero, it is implied that deliberate premarket underpricing does not exist, and that deviations between actual and predicted prices is the result of random error alone. If this is the case, then maximum likelihood estimation does not significantly differ from OLS estimation. In this context, a nonzero λ indicates gains in statistical efficiency of the stochastic frontier estimator over OLS.

Having estimated the model, one obtains a fitted value for $(v_i - u_i)$. For inefficiency measurement, however, we need an estimate of the systematic one–sided error term alone. This can be done by applying the formula developed by Jondrow *et al.* (1982), which is given as:

$$u_i^* = M(u_i|e_i) = -e_i\left(\frac{\sigma_u^2}{\sigma^2}\right) \qquad (4.6)$$

if $e_i \leq 0$, or

$$u_i^* = 0 \qquad (4.7)$$

if $e_i > 0$.

To estimate the percentage by which an issue is deliberately underpriced in the premarket relative to the frontier price, we employ the formula adapted by Hunt–McCool *et al.* (1996), which is as follows:

$$\frac{u_i^*}{P_i^*} = \exp M(u_i|e_i) - 1 \qquad (4.8)$$

where P_i^* is the predicted maximum frontier price for each IPO.

Table 4.1: description of variables employed as estimates of the stochastic frontier.

Variable		Description	Expected sign
ER	–	proportion of equity retained	+ve or –ve
LGP	–	natural logarithm of gross proceeds	+ve or –ve
MK	–	market of flotation	+ve
MD	–	method of flotation	+ve
LS	–	natural logarithm of a firm's annual sales revenue in the most recent 12 month period before going public	+ve
CV	–	coefficient of a firm's variation of earnings three years immediately prior to flotation	+ve
AQ	–	auditor quality	+ve
UQ1	–	underwriter quality: classification based on the number of IPOs underwritten (definition 1)	+ve
UQ2	–	underwriter quality: classification based *on the number of IPOs underwritten* in the Main Market and the USM separately (definition 2)	+ve
UQ3	–	underwriter quality: classification based on the annual rankings of the top merchant and investment banks given in The Annual Broker Survey (definition 3)	+ve

Table 4.2: correlation matrix of the variables employed as estimates of the stochastic frontier.

	OP	ER	LGP	MK	MD	LS	CV	AQ	UQ1	UQ2	UQ3
OP	1	-0.2^{b}	0.4^{b}	0.3^{b}	0.2^{b}	0.1^{b}	0.0	0.1^{b}	0.2^{b}	0.2^{b}	0.2^{b}
ER		1	-0.6^{b}	-0.3^{b}	-0.4^{b}	-0.2^{b}	0.0^{a}	-0.2^{b}	-0.1^{b}	-0.1^{b}	-0.2^{b}
LGP			1	0.6^{b}	0.6^{b}	0.4^{b}	−0.0	0.2^{b}	0.2^{b}	0.2^{b}	0.4^{b}
MK				1	0.4^{b}	0.2^{b}	-0.0^{a}	0.1^{b}	0.2^{b}	0.1^{b}	0.4^{b}
MD					1	0.3^{b}	−0.0	0.1^{b}	0.1^{b}	0.2^{b}	0.4^{b}
LS						1	0.2^{b}	0.1^{a}	0.1^{b}	0.1^{b}	0.2^{b}
CV							1	−0.0	−0.0	−0.0	−0.0
AQ								1	0.0	0.0	0.1^{b}
UQ1									1	0.8^{b}	0.4^{b}
UQ2										1	0.4^{b}
UQ3											1

Note: a and b denote statistical significance at the 5% and 1% levels respectively.

4.3. Empirical results.

Results for the whole sample are presented in table 4.3. Four coefficients, the proportion of equity retained, the size of issue, the market of flotation and the quality of underwriters, for all three reputation measures, are statistically significant at conventional significance levels and have the expected positive sign. The slope coefficient estimate on the method of flotation is negative but it does not significantly shift the frontier down. The quality of the reporting auditor, a firm's annual sales revenue one year prior to flotation and the coefficient of variation in pre–flotation earnings have no effect whatsoever on the predicted maximum offer price. Consistent with U.S. findings, λ, the measure of the asymmetric one–sided error term to the symmetric two–sided error term, is positive and significantly different from zero at the 1% level. A nonzero significant λ not only implies that the IPO premarket is characterized by deliberate underpricing, but also that substantial gains in statistical efficiency of maximum likelihood estimation over OLS estimation exist[2].

As was shown in chapter 2, section 2.3, although underpricing is a consistent phenomenon, its magnitude varies from one time period to another. It may well be the case that the level of initial returns varies across different time periods because the degree of premarket underpricing varies as well. To examine this possibility, we first estimate the stochastic frontier for high and low return periods. Using the mean initial return as a cut–off point, we define high return periods, HRP, as those periods which have produced initial returns above the mean, and low return periods, LRP, as those

[2] It has to be said that other information not used in our empirical analysis may also influence the setting of the offer price. Some variables are therefore omitted from the model and this is likely to have some impact on σ_u and σ_v, and hence to the value of λ.

periods in which the level of underpricing is below the mean. Thus, HRP include those issues that went public in 1984, 1987, 1989 and 1990, whereas LRP include offerings issued in 1985, 1986, 1988, 1991 and 1992. The results are presented in panels A and B of table 4.4. When compared across the different return periods, most of the estimated coefficients are quite similar in terms of both signs and significance. For HRP, the slope coefficient estimate on the market of flotation is no longer significant, whereas the quality of the auditor involved in the flotation process is positively and significantly related to the maximum potential offer price. For LRP, the results are identical to those observed for the whole sample, the only difference being that CV, the coefficient of variation in pre-flotation earnings, becomes reliably different from zero at the 5% level. λ, the skewness in the one-sided error term, is positive and significant across both periods inferring the presence of deliberate premarket underpricing. The magnitude of λ, however, is higher for HRP than for LRP. This finding, although not conclusive, might be interpreted to mean that a positive relation exists between premarket and aftermarket returns.

Table 4.5 presents the findings obtained by estimating the stochastic frontier on a year-by-year basis. The results indicate that, unlike underpricing, deliberate premarket underpricing is not a consistent phenomenon. λ is positive and significant in only three years, 1984, 1985 and 1986. A positive but non-significant λ is found for 1988 and 1989. A positive insignificant λ implies that although IPOs may be deliberately underpriced in the premarket, the amount by which they are underpriced is not significantly different from zero. For the remaining four years, 1987, 1990, 1991 and 1992, λ is equal to zero. This result implies that any difference between the actual offering price and the predicted maximum price is the result of random error alone, and that maximum likelihood estimation is equivalent to OLS estimation.

Results for the Main Market and the USM separately are presented in panels A and B of table 4.6. In terms of significance, the estimated coefficients across the two different markets are almost identical. In terms of deliberate premarket underpricing, λ is positive and significant for both markets, but the magnitude of λ is higher for IPOs listed in the USM than offerings listed in the Main Market. Given that the actual level of underpricing is higher for USM IPOs than their Main Market counterparts (see table 3.2, panel C) this result provides further evidence in support of the notion that a positive relation might exist between premarket and aftermarket returns.

Table 4.3: estimated frontier for all IPOs.

Explanatory variables	UQ1	UQ2	UQ3
Intercept	3.088** (15.32)	3.079** (15.06)	3.051** (14.84)
ER	0.004** (3.659)	0.004** (3.706)	0.005** (3.951)
LGP	0.173** (8.379)	0.175** (8.397)	0.181** (8.660)
MK	0.142** (2.676)	0.145** (2.709)	0.120* (2.040)
MD	–0.070 (–1.190)	–0.072 (–1.214)	–0.080 (–1.350)
LS	0.000 (0.069)	0.001 (0.150)	0.000 (0.046)
CV	0.059 (1.288)	0.054 (1.194)	0.053 (1.165)
AQ	0.018 (0.413)	0.018 (0.406)	0.009 (0.219)
UQ1	0.134** (2.836)	———	———
UQ2	———	0.113** (2.481)	———
UQ3	———	———	0.101* (1.741)
λ	1.928** (11.51)	1.956** (11.46)	1.929** (11.69)

Notes: one and two asterisks denote statistical significance at the 5% and 1% levels respectively. Figures in parentheses are t-statistics.

Table 4.4: estimated frontier by return periods.

Panel A: high return periods

Explanatory variables	UQ1	UQ2	UQ3
Intercept	2.895** (5.711)	2.901** (5.778)	2.741** (5.521)
ER	0.005* (1.964)	0.005* (1.975)	0.006* (2.193)
LGP	0.200** (4.379)	0.200** (4.463)	0.222** (5.182)
MK	0.092 (1.148)	0.095 (1.193)	0.065 (0.714)
MD	–0.164 (–1.440)	–0.167 (–1.470)	–0.173 (–1.534)
LS	–0.008 (–0.441)	–0.008 (–0.453)	–0.008 (–0.452)
CV	0.031 (0.426)	0.027 (0.379)	0.024 (0.032)
AQ	0.169* (2.177)	0.172* (2.227)	0.166* (2.151)
UQ1	0.131* (1.705)	———	———
UQ2	———	0.131* (1.761)	———
UQ3	———	———	0.038 (0.404)
λ	2.358** (6.309)	2.376** (6.646)	2.380** (6.196)

Notes: one and two asterisks denote statistical significance at the 5% and 1% levels respectively. Figures in parentheses are t-statistics.

Table 4.4 continued.

Panel B: low return periods

Explanatory variables	UQ1	UQ2	UQ3
Intercept	3.261** (15.75)	3.254** (15.15)	3.340** (16.12)
ER	0.004* (2.414)	0.004* (2.476)	0.004* (2.492)
LGP	0.171** (6.474)	0.172** (6.466)	0.165** (6.317)
MK	0.182* (2.026)	0.187* (2.067)	0.165* (1.814)
MD	−0.011 (−0.135)	−0.012 (−0.139)	−0.032 (−0.357)
LS	−0.010 (−0.697)	−0.009 (−0.588)	−0.011 (−0.707)
CV	0.111* (1.678)	0.106* (1.653)	0.111* (1.699)
AQ	−0.094 (−1.296)	−0.096 (−1.329)	−0.102 (−1.425)
UQ1	0.119* (1.739)	———	———
UQ2	———	0.079 (1.152)	———
UQ3	———	———	0.151* (2.023)
λ	1.753** (6.047)	1.770** (6.039)	1.728** (6.183)

Notes: one and two asterisks denote statistical significance at the 5% and 1% levels respectively. Figures in parentheses are t-statistics.

Table 4.5: estimated frontier by year of flotation.

Explanatory variables	1984	1985	1986	1987	1988
Intercept	1.951 (1.651)	3.360* (2.296)	4.769** (4.726)	2.486** (2.901)	3.717** (6.233)
ER	0.011 (1.206)	0.002 (0.384)	−0.003 (−0.562)	0.004 (0.930)	0.004 (1.469)
LGP	0.250** (2.677)	0.191* (2.212)	0.076 (0.864)	0.198** (2.959)	0.094 (1.496)
MK	−0.017 (−0.075)	0.132 (0.504)	0.320* (2.085)	0.099 (0.862)	0.026 (0.279)
MD	−0.115 (−0.426)	−0.064 (−0.309)	0.135 (0.740)	−0.205 (−1.322)	−0.037 (−0.198)
LS	−0.000 (−0.016)	−0.049 (−0.760)	−0.042 (−1.084)	−0.019 (−0.896)	0.007 (0.253)
CV	0.082 (0.504)	0.353** (2.945)	−0.040 (−0.302)	0.236* (2.216)	0.029 (0.354)
AQ	0.191 (1.071)	0.004 (0.035)	−0.148 (−1.302)	0.017 (0.162)	0.057 (0.714)
UQ1	0.219 (1.117)	0.074 (0.524)	0.192 (1.539)	0.148 (1.429)	0.111 (1.316)
UQ2	0.099 (0.529)	0.075 (0.538)	0.163 (1.263)	0.192* (1.887)	−0.000 (−0.009)
UQ3	−0.143 (−0.997)	0.175 (1.061)	0.089 (0.563)	0.140 (1.211)	0.146 (1.535)
λ	3.394* (2.446)	1.838** (2.766)	1.923** (2.700)	———	3.991 (1.230)

Notes: one and two asterisks denote statistical significance at the 5% and 1% levels respectively. Figures in parentheses are t-statistics. The results reported above are estimated using UQ1 as the variable capturing the prestige of underwriters. All coefficients estimated using UQ2 and UQ3 remain virtually unchanged in terms of both sings and significance and are therefore not reported.

Table 4.5 continued.

Explanatory variables	1989	1990	1991	1992
Intercept	1.680 (1.058)	1.987 (0.724)	2.870 (1.343)	1.471 (1.501)
ER	0.008 (1.151)	0.011 (0.666)	0.008 (0.598)	0.010** (2.723)
LGP	0.319* (2.079)	0.190 (0.743)	−0.382 (−0.897)	0.309** (2.850)
MK	0.215 (1.119)	0.318 (0.532)	1.723 (1.394)	0.317 (0.858)
MD	−0.823** (−2.665)	0.478 (0.375)	−0.215 (−0.231)	0.069 (0.236)
LS	0.042 (0.698)	−0.009 (−0.126)	0.340* (2.253)	−0.016 (−0.472)
CV	−0.514** (−2.857)	0.132 (0.306)	0.279 (0.408)	−0.038 (−0.171)
AQ	0.252* (1.807)	0.212 (0.633)	0.111 (0.146)	−0.287 (−1.001)
UQ1	0.052 (0.228)	−0.223 (−0.423)	1.571 (0.963)	−0.080 (−0.387)
UQ2	0.281 (1.051)	−0.008 (−0.011)	1.571 (0.963)	−0.142 (−0.681)
UQ3	0.089 (0.259)	−0.321 (−0.439)	0.920 (0.691)	−0.093 (−0.411)
λ	1.872 (1.478)	———	———	———

Notes: one and two asterisks denote statistical significance at the 5% and 1% levels respectively. Figures in parentheses are t-statistics. The results reported above are estimated using UQ1 as the variable capturing the prestige of underwriters. All coefficients estimated using UQ2 and UQ3 remain virtually unchanged in terms of both sings and significance and are therefore not reported.

Table 4.6: estimated frontier by market of flotation.

Panel A: Main Market

Explanatory variables	UQ1	UQ2	UQ3
Intercept	3.731** (16.27)	3.753** (16.40)	3.802** (16.93)
ER	0.002* (1.972)	0.002* (1.974)	0.002* (1.977)
LGP	0.136** (5.938)	0.134** (5.860)	0.130** (5.774)
MD	–0.056 (–0.696)	–0.057 (–0.710)	–0.076 (–0.931)
LS	–0.001 (–0.126)	–0.002 (–0.149)	–0.002 (–0.185)
CV	0.135* (1.778)	0.135* (1.774)	0.130* (1.713)
AQ	–0.030 (–0.369)	–0.030 (–0.370)	–0.039 (–0.495)
UQ1	0.079 (1.011)	———	———
UQ2	———	0.095 (1.206)	———
UQ3	———	———	0.132* (1.659)
λ	1.831** (6.325)	1.860** (6.313)	1.864** (6.390)

Notes: one and two asterisks denote statistical significance at the 5% and 1% levels respectively. Figures in parentheses are t-statistics.

Table 4.6 continued.

Panel B: Unlisted Securities Market

Explanatory variables	UQ1	UQ2	UQ3
Intercept	1.936** (3.543)	1.807** (3.294)	1.569** (3.143)
ER	0.008* (2.502)	0.008** (2.664)	0.008** (2.969)
LGP	0.288** (5.311)	0.303** (5.586)	0.328** (6.319)
MD	–0.000 (–0.001)	–0.005 (–0.058)	–0.060 (–0.618)
LS	0.004 (0.284)	0.007 (0.429)	0.013 (0.788)
CV	–0.048 (–0.859)	–0.056 (–1.003)	–0.040 (–0.678)
AQ	0.068 (1.133)	0.070 (1.117)	0.057 (0.933)
UQ1	0.125* (1.889)	———	———
UQ2	———	0.088 (1.329)	———
UQ3	———	———	0.040 (0.433)
λ	2.391** (8.492)	2.420** (8.359)	2.110** (8.120)

Notes: one and two asterisks denote statistical significance at the 5% and 1% levels respectively. Figures in parentheses are t-statistics.

4.4. Testing for a relation between premarket and aftermarket returns.

In order to examine whether there is a relation between premarket and aftermarket returns, we first present, in table 4.7, empirical results which show by how much IPOs are deliberately underpriced in the premarket, computed using equation 4.8, relative to the actual level of initial returns, computed using equation 2.1. As table 4.7 shows, a positive relation seems to exist between premarket and aftermarket abnormal returns: higher levels of deliberate premarket underpricing are mostly associated with higher levels of first day returns. Furthermore, the level of deliberate premarket underpricing, as we have measured it, varies from 2.14% to 8.60%. Although the percentage of deliberate premarket underpricing appears to explain away a very large portion of the actual level of initial returns, it has to be said that this result is not sufficient to rule out the hypothesis that the market for IPOs is not only dominated by deliberate premarket underpricing, but also by high aftermarket abnormal returns. Given the level of information asymmetries which characterize unseasoned offerings, the coexistence of the two anomalies should come as no surprise. In order to shed more light into the relation between deliberate premarket underpricing and aftermarket returns, we estimate the following regression using an OLS:

$$UP = a_0 + a_1\left[\frac{U_i^*}{P_i^*}\right] + e_i \tag{4.9}$$

where UP is the actual level of initial returns and U_i^*/P_i^* is the degree of deliberate premarket underpricing. A significant positive relation between the two variables will be interpreted to mean that underpricing results from the failure of the offer price to correctly indicate the true value of the firm and this will have been caused deliberately. In this context, once adjustments for deliberate premarket underpricing are made, abnormal aftermarket returns should largely disappear, given that the metric against which premarket and aftermarket returns are measured is the actual offering price. On the other hand, if both phenomena exist independently, then no significant relation between them is expected. The results, reported in table 4.8, show that for all IPOs, and across different time periods and listing markets, there is no significant positive relation between deliberate premarket underpricing and aftermarket abnormal returns. The low adjusted coefficients of determination are as expected, given that both variables, especially the independent one, contain a large number of zeros. These findings indicate that even if adjustments are made to eliminate deliberate premarket underpricing, positive initial returns will still dominate the IPO aftermarket.

Table 4.7: comparisons between actual initial returns and deliberate premarket underpricing.

	Number of IPOs	Actual UP[a]	Deliberate UP[b] (UQ1)	Deliberate UP[b] (UQ2)	Deliberate UP[b] (UQ3)
All IPOs	653	10.42	7.53	7.71	7.66
HRP	274	16.20	7.18	7.34	7.49
LRP	379	6.23	2.89	3.03	2.61
MM	286	9.49	4.92	5.21	5.36
USM	367	11.14	8.44	8.60	7.98
1984	81	12.81	6.95	7.29	7.12
1985	95	7.75	5.89	6.22	5.72
1986	125	5.00	2.14	2.43	2.59

Note: a denotes the actual level of underpricing, computed using equation 2.1, whereas b denotes the level of deliberate premarket underpricing, computed using equation 4.8.

Table 4.8: univariate OLS regressions of initial returns on the level of deliberate premarket underpricing.

	Intercept	u_i^* / p_i^*	Adjusted R^2
All IPOs	8.972**	0.029	0.003
	(8.506)	(0.189)	
HRP	14.191**	0.041	0.009
	(4.843)	(1.012)	
LRP	6.149**	–0.012	0.002
	(6.184)	(–0.218)	
MM	9.948**	0.042	0.007
	(9.215)	(1.286)	
USM	10.985**	–0.019	0.002
	(9.144)	(–0.096)	
1984	8.269	–0.024	0.003
	(1.714)	(–0.698)	
1985	6.679	0.028	0.002
	(1.889)	(0.102)	
1986	6.312	–0.064	0.012
	(1.749)	(–1.188)	

Notes: the standard errors of the independent variables are corrected for serial correlation using the Newey-West (1987) procedure. Two asterisks denote statistical significance at the 1% level. Figures in parentheses are t-statistics. The results reported above are estimated using the level of deliberate premarket underpricing measured when UQ1 is used as the variable capturing the prestige of underwriters. Results estimated using UQ2 and UQ3 remain virtually unchanged in terms of both sings and significance and are therefore not reported.

4.5. Conclusions.

This chapter examined, using the stochastic frontier estimator of Aigner *et al.* (1977), whether newly listed firms are deliberately underpriced in the premarket (prior to an IPO being floated), and whether such underpricing is related in any way to the level of first day returns. The conclusions to emerge from this examination are relatively clear–cut. First, IPOs are deliberately underpriced in the premarket and the level of premarket returns varies from 2.14% to 8.60%. Second, unlike the initial underpricing anomaly, deliberate premarket underpricing is not a consistent phenomenon. Third, deliberate premarket underpricing, as we have measured it, cannot explain away the abnormalities in aftermarket returns.

Despite our findings, however, it appears that the application of stochastic frontiers to the IPO underpricing problem is very useful. When a company is making an unseasoned issue, financial officers can apply the stochastic frontier to estimate the maximum offer price under full information. Within this context, financial officers can determine whether the offer price proposed by the underwriter is appropriate. In turn, underwriters have an upper bound on which they can base their decision when setting the offer price.

CHAPTER 5

"INITIAL RETURNS AND THE PRICE STABILISATION HYPOTHESIS."

5.1. Introduction.

Having failed to establish a significant relation between deliberate premarket and actual aftermarket underpricing, the focus of investigation is now concentrated in trying to explain the high IPO initial returns from the viewpoint that newly listed firms are correctly priced, but because of aftermarket inefficiencies, such as underwriter price support, abnormal returns are generated once trading begins.

As was noted in chapter 1, section 1.3, underwriter price support, or price stabilisation, is an effort by an underwriter to prevent or retard declines in aftermarket prices which would have declined in free market trading. The purpose of such price support is to maintain an offering at or above its offer price. Under chapter 3, part 10, of the Securities and Investment Board (SIB) rules and regulations, underwriters are legally allowed to intervene and support aftermarket prices. Prior to any stabilising action, however, an underwriter must make sure that several conditions have been fulfilled. First, he must take proper steps to make it known that stabilisation is possible. In the case of IPOs this information must be conveyed to investors through the offering prospectus which must contain the following statement: "in connection with this issue an underwriter may effect transactions which stabilise or maintain the market price of the offering at a level which might not otherwise prevail. Such stabilising, if commenced, may be discontinued at any time". Second, he must inform in writing the Exchange on which a security is traded, or will be trading, that stabilising transactions in a security may be effected by or on behalf of the underwriter during the stabilising period. Third, he must establish proper systems for recording everything he does in relation to each stabilising transaction. Fourth, he must be absolutely sure that the prices he wishes to stabilise are not already false. Once these conditions have been fulfilled, an underwriter may go into the market with a view of stabilising or maintaining the market price of any security he is offering, and this can be done by purchasing, agreeing to purchase or offering to purchase stock for later resale[1]. It has to be said, however, that once an underwriter is engaged in any stabilising activity he must make sure that the limits as to the maximum price at which stabilising action may be taken are not exceeded. In the case of IPOs the maximum support price is the offer price. In other words, an underwriter can intervene and support IPOs which trade at or below their offer price, but not IPOs which produce positive initial returns.

The chapter is organised into 3 sections. In section 5.2 we present the tests and the empirical findings regarding the underwriter price support hypothesis, whereas concluding remarks are presented in section 5.3.

[1] It has to be said that even though an underwriter may intervene to support aftermarket prices, he may not be successful in doing so. Baron (1982) notes that stabilisation efforts occasionally fail.

5.2. Price stabilisation: data, methodology and empirical results.

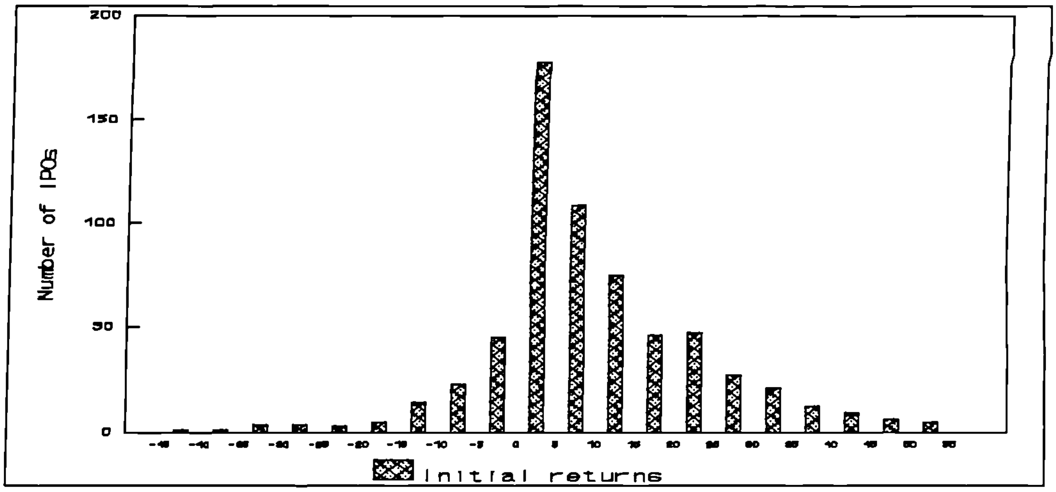
We examine the influence of price stabilisation on the level of initial returns for 653 IPOs listed on the London Stock Exchange between 1984–1992. Following Ruud (1993), the underwriter price support hypothesis is tested via statistical analysis, migration analysis and Tobit analysis.

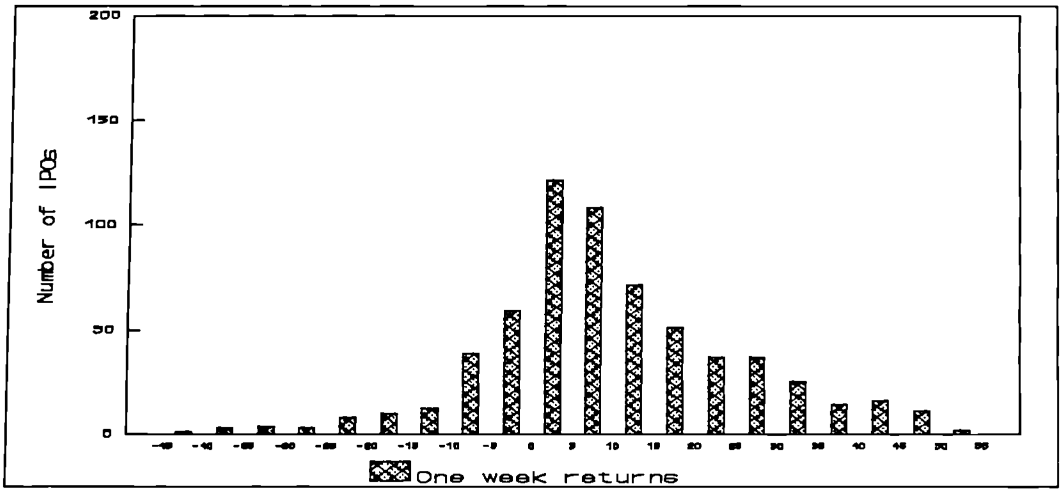
5.2.1. Statistical analysis.

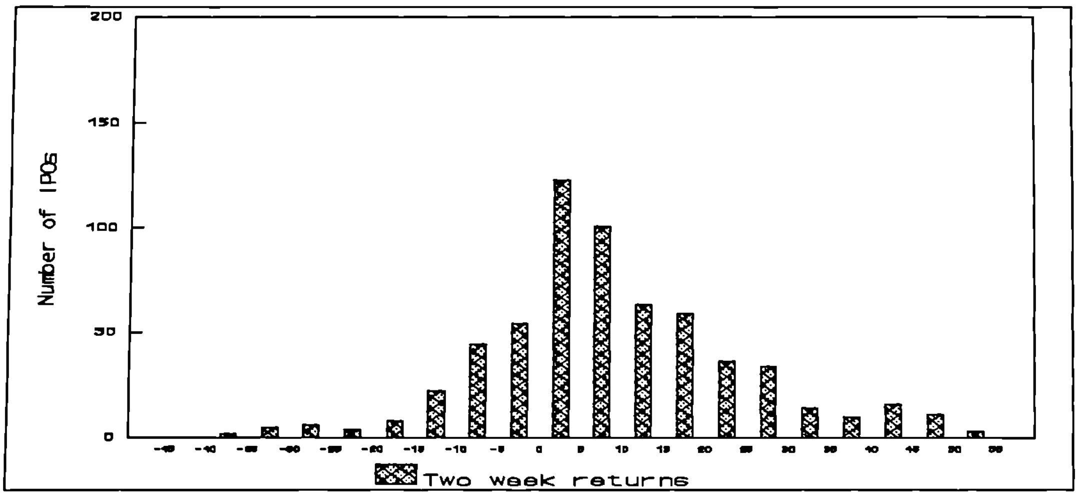
In order to examine whether underwriter price support can explain part of the abnormally high IPO returns we first employ statistical analysis. Instead of focusing on the mean, we examine the distribution of initial returns. Based on the third and fourth moments of distribution, skewness and kurtosis, inferences about possible price stabilisation activities can be drawn. As noted earlier, underwriters can intervene and support offerings with zero and negative returns. As a result, observations that would have produced negative returns and would have appeared in the left tail of the distribution are propped up, most likely to zero, whereas slightly positive returns may be generated by issues which would have produced zero returns without intervention. This implies that price stabilisation will allow the right tail of the distribution to be observed, but not the true left tail. As a result, the distribution of initial returns will be positively skewed. Once, however, underwriter price support is gradually withdrawn, then the distribution of subsequent returns should become symmetric, given that the left tail of the distribution would no longer be censored. In the same context, if underwriters actively support aftermarket prices, then the distribution of initial returns should be, in terms of peakedness, leptokurtic, that is, peaked, with a large number of the observed values around zero. Once price stabilisation is terminated, subsequent distributions should become mesokurtic.

Figures 5.1 to 5.5 show the distributions of initial, one week, two week, three week and four week returns. Consistent with the stabilisation hypothesis, the distribution of initial returns is positively skewed with a large number of the observed values concentrated within the distribution range 0–4.99%. In contrast to U.S. findings, however, the shapes of the remaining distributions seem to suggest that underwriter price support may only slightly affect the level of underpricing. Despite the fact that the U.K. SIB rules and regulations do not state any definite time limit for stabilisation, practising underwriters have suggested that price support, if undertaken, does not continue for more than a few days [Ruud (1993)]. Therefore, the impact and gradual withdrawal of any stabilisation activities should be reflected in the distribution of one week returns. However, the distribution of one week returns remains asymmetric and leptokurtic. Infact, a similar behaviour is also reported for the distributions of two, three, and four week returns. Thus, even if we assume that aftermarket price support is continued for more than a few days, the shapes of the subsequent distributions do not provide strong evidence in favour of this hypothesis.

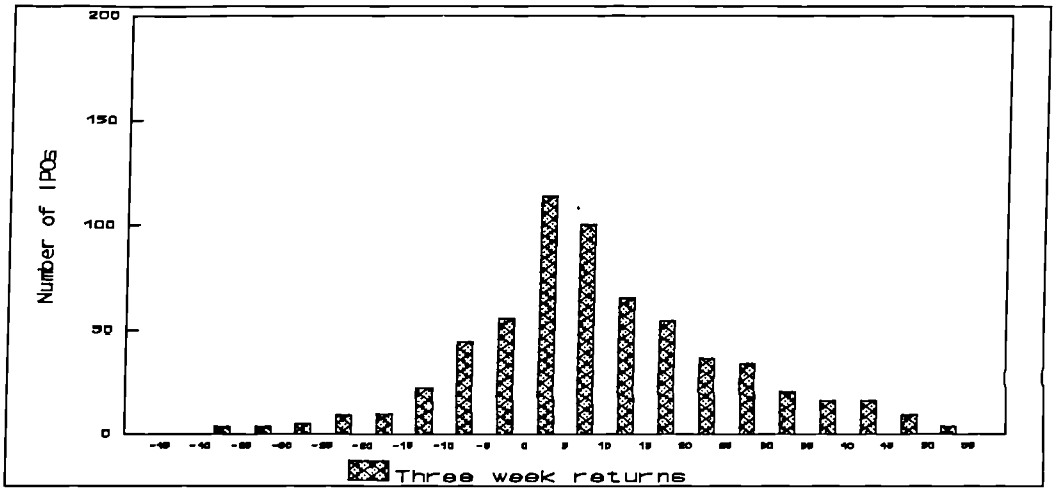
<u>Figures 5.1 to 5.5: distributions of initial, one week, two week, three week and four week returns.</u>

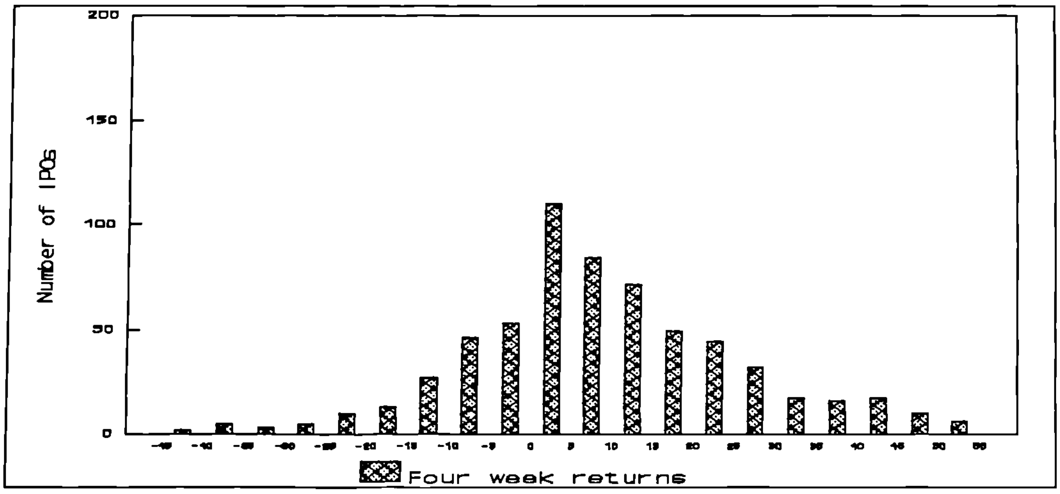






Figures 5.1 to 5.5 continued.





Note: each range begins at the first indicated value and continues to, but does not include the next range. For example, the distribution range 0-5% includes returns from 0 to 4.99%.

A clearer indication as to whether aftermarket prices are actively supported by underwriters can be obtained by examining some descriptive statistics for these distributions which are reported in table 5.1. The minimum return, –45.71%, remains virtually unchanged from the first day to the end of the first week, and then drops to

−53.66% by the end of the second week. Although this result might indicate the impact and gradual removal of price support after the first week, it has to be said that the effect of price stabilisation is again not obvious. If we assume that underwriters actively intervene to support aftermarket prices, it should be expected that great emphasis will be given to those IPOs which trade well below their offer price, with an objective of pushing them as close to their offering price as possible. Hence, offerings with the greatest support are expected to experience huge declines once aftermarket support is withdrawn. Therefore, even though the minimum return drops, its decline is relatively small. The maximum return, 158.20%, increases dramatically to 215.80% by the end of the second week. This result is rather surprising, given that there is no price intervention for IPOs which trade above their offer price. It appears that, in some cases, very high abnormal returns can be generated to investors who buy in the aftermarket.

In rows 1 and 3 of table 5.1 mean and median values for each distribution are reported. In a symmetric distribution the mean and median coincide. However, as shown, there is a wide variation between the two values which increases over the first two weeks and then decreases as the holding period lengthens. The positive increasing, and then decreasing skewness is also shown in row seven. Recall that if aftermarket support exists, skewness should decrease as the holding period increases. Thus, the results obtained are rather inconsistent with the stabilisation hypothesis. Even though skewness is decreasing after the second week, the distributions of three and four week returns remain significantly positive.

In row 8 of table 5.1 the kurtosis of the distributions is reported. Instead of decreasing

Table 5.1: descriptive statistics for initial, one week, two week, three week and four week returns.

	First day	First week	Second week	Third week	Fourth week
Mean (%)	10.42	11.39	11.33	11.54	11.55
Minimum (%)	–45.71	–46.29	–53.66	–52.22	–53.66
Median (%)	6.66	7.36	7.27	7.77	7.82
Maximum (%)	158.20	189.50	215.80	194.70	180.70
Std.deviation	18.40	21.21	22.28	22.90	23.33
t–statistic	14.47**	13.72**	12.99**	12.87**	12.65**
Skewness	1.75	1.99	2.27	1.84	1.60
Kurtosis	12.70	14.11	17.60	12.61	10.06
B–J statistic	2893.3**	3789.3**	6358.7**	2880.4**	1634.3**

Notes: mean returns are computed using equation 2.1. Two asterisks denote statistical significance at the 1% level.

as the holding period increases, the initial kurtosis increases over the first two weeks. Decreasing kurtosis is only reported after the second week. In addition, all return distributions are significantly leptokurtic at conventional significance levels. Thus, the kurtosis of the distributions provide further evidence against the underwriter price support hypothesis.

5.2.2. Migration analysis.

Additional evidence as to whether underwriters are engaged in price stabilisation activities can be obtained by examining the substantial migration of IPOs with initial returns of zero and in the distribution range 0–4.99% to subsequent negative returns.

Of the total sample, 83 offerings, 12.71%, produced initial returns of zero. Table 5.2 shows the way these IPOs have shifted over the four week period. As before, however, and in contrast to U.S. findings, the results in table 5.2 do not provide strong evidence in support of the stabilisation hypothesis. Recall that in the presence of aftermarket support, observations that would have produced negative returns are propped up to zero. Thus, as underwriter support is gradually withdrawn, IPOs with zero initial returns should shift to the left tail of the distribution. However, by the end of the first week, only 30.12% of those offerings with zero initial returns produce negative returns. By the end of the fourth week, this proportion rises to 38.55%. In contrast, more than 50% of those IPOs with zero first day returns shift to the right tail of the distribution by the end of the first week.

Table 5.2: migration of IPOs with zero initial returns.

	First week	Second week	Third week	Fourth week
Change to negative (%)	30.12	33.73	32.53	38.55
No change (%)	19.27	8.43	10.84	7.22
Change to positive (%)	50.61	57.84	56.63	54.23

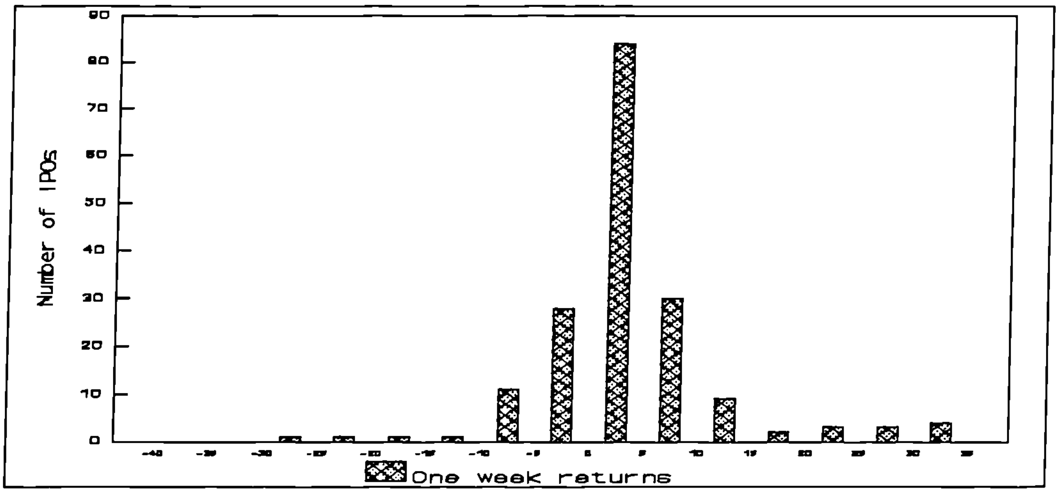
178 IPOs, 27.25%, have produced initial returns within the distribution range 0–4.99%. The concentration of so many offerings within this return area may be caused by the

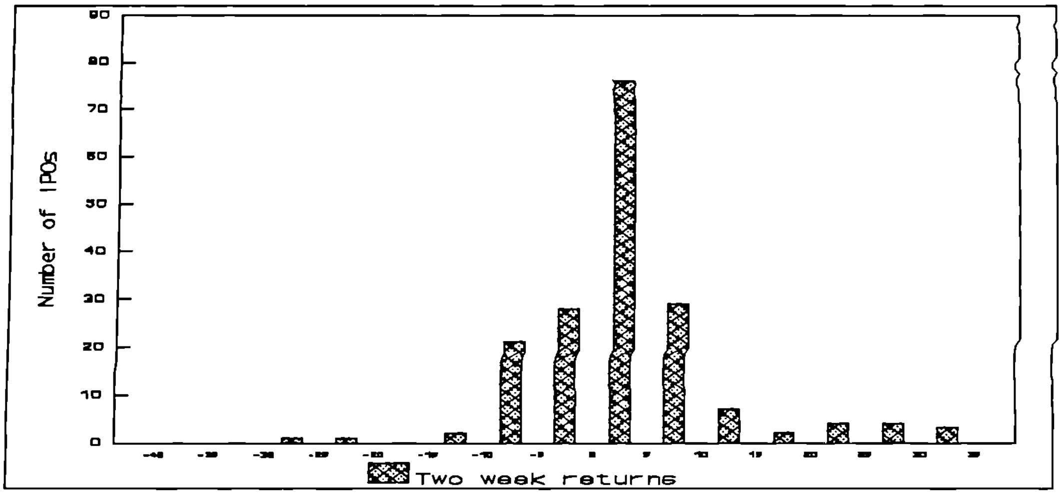
influence of aftermarket price support. Figures 5.6 to 5.9 show the distributions of one week, two week, three week and four week subsequent returns for the 178 IPOs with initial returns within the range 0–4.99%, whereas table 5.3 shows the migration of these offerings over the four week period. The results in table 5.3 provide some mild indirect evidence in favour of the stabilisation hypothesis. Of those offerings with initial returns within the distribution range 0–4.99%, almost a quarter, 24.15%, produce negative returns by the end of the first week. Furthermore, as the holding period lengthens, the number of IPOs shifting to the left tail of the distribution increases. The increasing number of IPOs producing negative returns is also shown in figures 5.6 to 5.9. Almost half, 47.19%, of those offerings within the specified return area report one week returns in the same distribution range, whereas the remaining 28.66% exhibit subsequent one week returns of 5% or more. As the holding period increases, the percentage of IPOs remaining in the same distribution area decreases, whereas the proportion of issues reporting returns above 5% remains virtually unchanged. These results indicate that the underwriter price support hypothesis may explain away a very small portion of the abnormally high IPO returns.

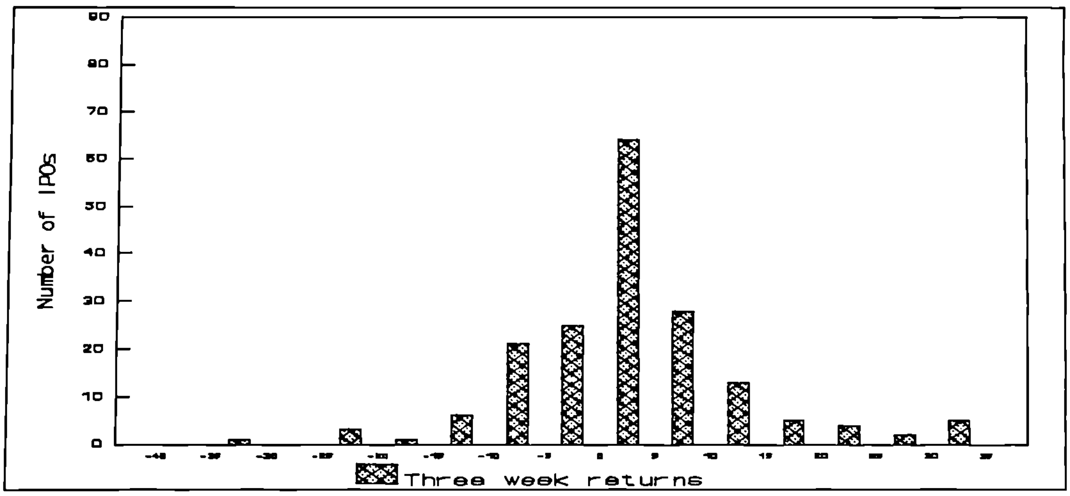
Table 5.3: migration of IPOs with initial returns within the distribution range 0-4.99%.

	First week	Second week	Third week	Fourth week
Change to negative (%)	24.15	29.77	32.02	33.70
Remain within 0–4.99% (%)	47.19	43.25	35.96	34.26
Increase to more than 5% (%)	28.66	26.98	32.02	32.02

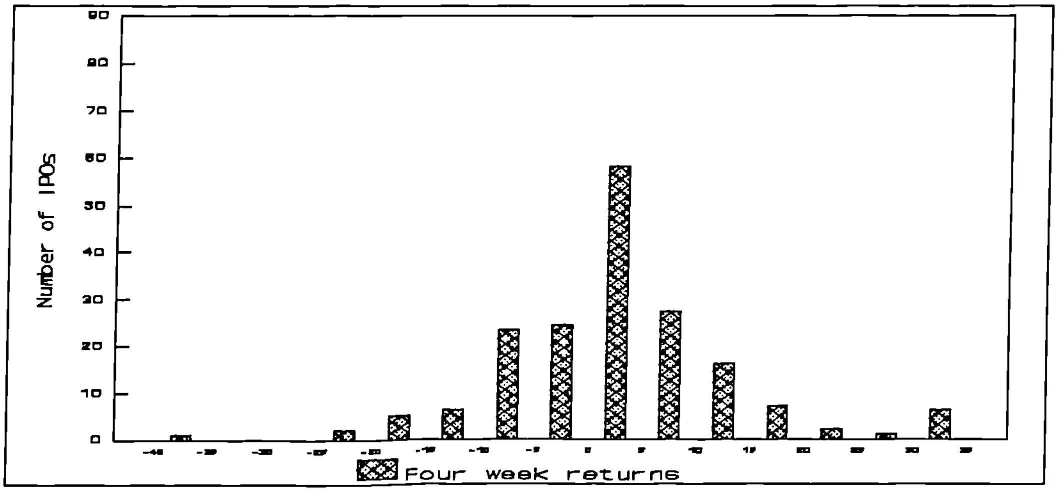
Figures 5.6 to 5.9: distributions of subsequent one week, two week, three week and four week returns of those IPOs with initial returns within the range 0-4.99%.







Figures 5.6 to 5.9 continued.



Note: each range begins at the first indicated value and continues to, but does not include the next range. For example, the distribution range 0-5% includes returns from 0 to 4.99%.

The relatively weak influence of the price stabilisation hypothesis on the level of underpricing is also apparent when the sample is partitioned into two depending on the prestige of underwriters. Given that underwriter price support requires a commitment of capital, prestigious underwriters may be more frequently involved in any stabilisation activities than non–prestigious underwriters. If this is the case, then our failure in chapter 3, section 3.4, to establish a negative relation between underwriter quality and initial returns may be partly attributed to the price stabilisation hypothesis. For reputation measures one, two and three respectively, 11.53%, 12.08% and 12.59% of those IPOs underwritten by prestigious underwriters generate zero initial returns. For non–prestigious underwriters this proportion is slightly higher at 14.18%, 13.35% and 12.78% respectively. Furthermore, for all three reputation measures, the proportion of offerings with first day returns in the distribution range 0–4.99% is higher for non–

prestigious underwriters, 29.41%, 29.19% and 27.62%, than for prestigious underwriters, 25.54%, 25.37% and 26.71% respectively. These findings suggest that low quality underwriters may be more frequently engaged in the practice. Further evidence can be obtained by examining the substantial migration of offerings with initial returns within the return area 0–4.99% to subsequent negative returns by underwriter prestige. The results, reported in panels A and B of table 5.4, confirm the fact that if underwriters intervene to support aftermarket prices, non–prestigious underwriters are more likely to be involved in the practice. For measures one, two and three respectively, of those IPOs within the distribution range 0–4.99% dealt with by non–prestigious underwriters, 42.35%, 40.42% and 36.11% generate negative returns by the end of week four. In contrast, for new issues dealt with by high quality underwriters, only 26.88%, 27.38% and 31.42% of those IPOs within the specified return area generate negative *returns* by the end of the fourth week.

Table 5.4: migration of IPOs with initial returns within the distribution range 0-4.99% by underwriter prestige.

Panel A1: prestigious underwriters (definition 1)

	First week	Second week	Third week	Fourth week
Change to negative (%)	22.58	26.88	30.10	26.88
Remain within 0–4.99% (%)	48.38	47.31	40.86	40.86
Increase to more than 5% (%)	29.04	25.81	29.04	32.26

Table 5.4 continued.

Panel B1: non-prestigious underwriters (definition 1)

	First week	Second week	Third week	Fourth week
Change to negative (%)	27.05	34.11	35.29	42.35
Remain within 0–4.99% (%)	45.90	37.64	30.60	23.54
Increase to more than 5% (%)	27.05	28.25	34.11	34.11

Panel A2: prestigious underwriters (definition 2)

	First week	Second week	Third week	Fourth week
Change to negative (%)	21.42	26.19	26.19	27.8
Remain within 0–4.99% (%)	47.61	47.61	46.42	41.66
Increase to more than 5% (%)	30.97	26.20	27.39	30.96

Panel B2: non-prestigious underwriters (definition 2)

	First week	Second week	Third week	Fourth week
Change to negative (%)	27.65	34.04	38.31	40.42
Remain within 0–4.99% (%)	46.80	38.31	26.59	24.48
Increase to more than 5% (%)	25.55	27.65	35.10	35.10

Panel A3: prestigious underwriters (definition 3)

	First week	Second week	Third week	Fourth week
Change to negative (%)	24.28	30.00	30.00	31.42
Remain within 0–4.99% (%)	47.14	41.42	40.00	40.00
Increase to more than 5% (%)	28.58	28.58	30.00	28.58

Table 5.4 continued.

Panel B3: non-prestigious underwriters (definition 3)

	First week	Second week	Third week	Fourth week
Change to negative (%)	25.00	30.55	34.25	36.11
Remain within 0–4.99% (%)	47.52	43.51	33.33	28.70
Increase to more than 5% (%)	27.78	25.94	32.42	35.19

5.2.3. Tobit analysis.

As noted earlier, the effect of price stabilisation is to prevent the true left tail of the distribution from being observed. The statistical term for this effect is censoring. When a sample is censored it is possible to observe values of that sample within a certain range, but not outside that range. Underwriter price support causes the sample to be censored at zero. This implies that although nonpositive values are presumed to exist, such values cannot be observed. Parameters of censored data can be estimated by means of a censored normal regression model. This model is also known as a Tobit model and was first analyzed in the econometrics literature by James Tobin. In order to further examine the eventual effect of price stabilisation on the size of initial returns, we estimate the true average raw return, μ, by employing a Tobit regression. Given that the sample is censored at zero, the Tobit regression model is as follows:

$$r_i^* = \mu + e_i \tag{5.1}$$

where $r_i^* = r_i$ when $r_i > 0$, or $r_i^* = 0$ when $r_i \leq 0$.

In contrast to the actual mean of 10.42%, the true average raw return, estimated by maximum likelihood, is equal to 8.10%. The rather high average raw initial return points to the conclusion that the censored sample hypothesis can explain away only a very small portion of the positive first day returns.

5.3. Conclusions.

This chapter has evaluated the underwriter price support hypothesis which posits that newly listed firms are priced at their intrinsic values, but because of the intervention of underwriters in the aftermarket, positive initial returns are generated once trading begins. Our indirect findings, however, point to the conclusion that the price stabilisation hypothesis alone cannot account for the observed magnitude of underpricing. By first employing statistical analysis, we find that the distributions of one week, two week, three week and four week returns are asymmetric and leptokurtic, whereas the underwriter price support hypothesis implies that the distributions should become symmetric and mesokurtic once aftermarket support is terminated. In addition, when the substantial migration of IPOs with initial returns around zero is examined, we find that most IPOs subsequently increase in price instead of decreasing. The impact of the underwriter price support hypothesis on the level of initial returns is more apparent when the artificial suppression of the left–tail of the distribution is taken into account through Tobit analysis. The Tobit mean is 8.10%, 2.32% lower than the actual mean of 10.42%.

CHAPTER 6

"CONCLUSIONS"

6.1. Introduction.

As was noted in the introduction of this thesis, our main objective is to investigate why IPOs generate positive returns in the short–run and negative returns in the long–run. This chapter concludes the thesis summarizing the evidence which suggests that IPOs may not be underpriced, but rather may be initially overvalued by optimistic investors. Although most of the empirical evidence on the fads theory is indirect, it provides an explanation for many of the price patterns observed.

There are many pieces of evidence which tend to suggest that the market for initial offerings is subject to mean reverting fads. First, prices in early secondary market are rising producing positive abnormal returns. As firms season, however, and optimistic investors are assumed to revise their expectations, the rising trend in returns is reversed, and by the third year anniversary of their public listing IPOs significantly and economically underperform the market by at least 12%. Second, there is a tendency for IPOs with the highest short–run returns to have the worse aftermarket performance. Moreover, by regressing long–run returns against the level of underpricing, we find that a negative relation exists between initial and aftermarket returns. Third, although we find that newly listed firms are deliberately underpriced in the premarket, we find no significant relation between premarket and aftermarket returns. This result implies that even if adjustments are made to eliminate deliberate premarket underpricing, positive initial returns will still dominate the IPO aftermarket. Fourth, we find the evidence in support of a hypothesis which assumes that the high IPO initial returns are the result of aftermarket inefficiencies, other than the fads explanation, to be rather weak.

The chapter is organised in 3 sections. Section 6.2 discusses our results, whereas the final section offers suggestions for further research.

6.2. Summary and conclusions.

We begin the thesis by reviewing the international evidence on short–run underpricing and long–run underperformance. We also discuss the various theories which have been advanced to explain these patterns. Three conclusions emerge: (1) in almost every country with a Stock market newly listed firms generate positive abnormal returns in the short–run and negative abnormal returns in the long–run, (2) the level of underpricing and the extent of underperformance vary considerably from one market to another and (3) while individually none of the proposed explanations can adequately capture these anomalies, collectively the theories can explain away most of the price patterns that are observed.

In chapter 2, we evaluate the short–run and long–run performance of IPOs. In line with prior empirical evidence, we find that newly listed firms generate significant positive initial returns. By the end of the first day of trading, IPOs rise on average by more than 10% above their offer prices. We also provide evidence that there are cycles in both the magnitude of underpricing and the number of companies going public. To assess the aftermarket performance of IPO firms we employ the cumulative return and the buy and hold return measures. We compute long–run abnormal returns using three different models: (1) the market–adjusted model, (2) the RATS model developed by Ibbotson (1975) which allows the estimate of beta to vary over time, and (3) the Fama and French (1993) three factor model which takes into account size and book–to–market effects. We find that new offerings perform poorly in the long–run. A one pound investment in IPOs is worth, at best, 88 pence after three years. Finally, we examine whether any of the individual characteristics of IPOs can account for the observed magnitude of underperformance. We find the market and method of flotation to be important determinants of long–run performance.

In chapter 3, we evaluate two hypotheses regarding the underpricing anomaly. First, following Beatty and Ritter (1986), we investigate whether a positive relation exists between the *ex ante* uncertainty surrounding the true value of IPOs and underpricing. Given that *ex ante* uncertainty cannot be measured directly, we employ eight variables, the fraction of equity retained in the firm, post–flotation, by pre–offering shareholders, the size of issue, the market of flotation, the method of flotation, a firm's annual sales revenue in the most recent 12–month period before going public, a firm's variation of earnings three years immediately prior to flotation, the quality of the auditor involved with the issue and the quality of the underwriter involved with the issue, as proxies for *ex ante* uncertainty. Employing statistical, correlation and OLS regression analysis respectively, we find that of the selected proxies, only auditor quality and issue method significantly reduce the level of underpricing, and therefore conclude that the support for the *ex ante* uncertainty hypothesis is not overly strong. Second, following Allen and Faulhaber (1989), Grinblatt and Hwang (1989) and Welch (1989), we examine whether issuing firms use underpricing as a signal of firm quality in order to increase the price received in seasoned offerings. Utilizing logit and OLS regression analysis, although we find, in line with the predictions of IPO signalling, that heavily underpriced firms return to the market for a seasoned offering quicker than firms which have been priced more fully, and that underpricing is positively related to the stock price response at the time of the announcement of a SEO, on balance our empirical results offer limited support for the signalling hypothesis.

In chapter 4, we test for deliberate premarket underpricing. For this purpose, we employ the stochastic frontier model pioneered by Aigner *et al.* (1977), whereas in order to estimate the proportion by which IPOs are deliberately underpriced in the premarket we use the methodology advanced by Jondrow *et al.* (1982). We find that IPOs are deliberately underpriced in the premarket, and that the level of underpricing varies between 2.14% and 8.60%. Such underpricing, however, cannot explain away the abnormalities in aftermarket returns. Employing OLS regression analysis, we find that both premarket and aftermarket underpricing exist independently.

In chapter 5, we examine the price stabilisation hypothesis which posits that IPOs generate positive initial returns because underwriters intervene and support prices in the early secondary market. Employing statistical and migration analysis, we find that IPOs with initial returns around zero subsequently increase in price. Moreover, by utilizing Tobit regression analysis to take into account the artificial suppression of the left tail of the initial return distribution, we find that the Tobit (true) mean is only 2.32% lower than the actual mean. We interpret these findings as being mostly inconsistent with the underwriter price support hypothesis.

Overall, our main empirical findings can be summarised as follows:

(1) Consistent with previous studies, IPOs in the U.K. generate positive returns in the short–run and negative returns in the long–run.

(2) The two anomalies associated with the process of going public, underpricing and long–run underperformance, cannot be explained away without relying on the hypothesis that prices are affected by faddish investors.

(3) The market for newly listed firms is not only dominated by high levels of aftermarket

returns, but also by high levels of deliberate premarket underpricing.

(4) Although individually the *ex ante* uncertainty, the underwriter price support and the signalling hypotheses have a very weak impact on underpricing, collectively these three explanations can account for a small part of the observed magnitude of initial returns.

6.3. Future research suggestions.

Despite the fact that our findings may have answered several questions regarding the initial and long–run price patterns of IPOs, they provide several directions for future research. First, although the fads theory appears to explain away most of the abnormalities in aftermarket returns, alternative explanations such as *ex ante* uncertainty and price stabilisation need to be further explored. Our finding that *ex ante* uncertainty cannot explain away positive initial returns may be due to the fact that the selected measures for uncertainty are not suitable. Future studies should test this hypothesis by employing alternative proxies (particularly the role of venture capitalists), samples and methodologies, and may consider the effectiveness of these proxies under different time periods and market conditions. Regarding the underwriter price support hypothesis, academic researchers should consider the grounds on which price stabilisation may be undertaken, and may examine in detail the relation between the extent of price support and the prestige of underwriters.

Second, if aftermarket prices are set by overly optimistic investors, to what extent can issuing firms time their flotation to coincide with periods of excessive optimism thereby reducing the costs of raising external equity capital? Moreover, if issuing firms have the ability to time their IPO, why do they prefer to leave "money on the table" for primary market investors rather than selling their shares at the maximum price investors appear willing to pay? If, on the other hand, the timing decision resides with the underwriter involved in an IPO rather than the issuing firm, then the underwriter's role in the process of going public should be examined in more detail.

Lastly, in line with previous U.K. studies, our findings show that the reputation of the underwriter involved in an IPO does not significantly reduce the level of underpricing. Given, however, the empirical evidence from the U.S. IPO literature that underwriter quality is one of the most important determinants of initial performance, our results, and those of prior studies, must not be regarded as conclusive. Future studies needing to control for underwriter prestige should consider whether there is any specialisation within the underwriter market. In particular, measures for reputation should consider, apart from the identity of the underwriter, the industrial sector in which newly listed firms operate.

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