Underpricing, ownership and control in initial public offerings of equity securities in the UK

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Abstract

In this paper we examine how separation of ownership and control evolves as a result of an Initial Public Offering (IPO) and how the underpricing of the issue can be used by insiders to retain control. Using data from a sample of 69 IPOs in the UK, we show that underpricing is used to ensure oversubscription and rationing in the share allocation process so as to allow owners to discriminate between applicants for shares and to reduce the block size of new shareholdings.

We find that of the pre-IPO shareholders in a firm, directors sell only a modest fraction of their shares at the time of the offering and in the seven subsequent years. In contrast, holdings of non-directors are virtually eliminated during the same period. As a result, in less than seven years, almost two-thirds of the offering company's shares have been sold to outside shareholders, thereby substantially advancing the process of separation of

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ownership and control. Additional evidence in the paper suggests that rationing in the IPO discriminates against applicants who apply for large blocks, and that larger under-pricing is associated with smaller blocks being held by new investors some seven years after the IPO. Also, there is a low level of hostile takeovers in the period of up to ten years after the IPO, which is consistent with effective protection by insiders against hostile changes of control.

Keywords: Underpricing; Initial public offering; Concentrated ownership; Dispersed ownership

JEL classification: G32

1. Introduction

The underpricing of Initial Public Offerings (IPO) of common stock has been confirmed by researchers in many different countries. A plethora of theoretical explanations have been advanced to explain why the owners of a company would rationally sell shares to outsiders for less than the apparent maximum price achievable (see Loughran et al. 1994, for a review of the evidence and the possible causes of underpricing).

In this paper, we cast new light on the underpricing phenomenon by ana-lyzing the costs and benefits to the different contracting parties. On the cost side, we relate the magnitude of the underpricing costs to the value of pre-IPO shareholdings and allocate these costs between directors and other pre-IPO shareholders. We argue that this allocation is important because directors, together with the investment bankers, set the issue price. We find that, for the median issue, over 75% of underpricing costs are borne by non-directors and that costs to directors amount to only 0.77% of the value as a proportion of their pre-IPO holdings.

It is predominantly non-directors, who may not have private benefits of control, that take advantage of the IPO and the post-IPO secondary market to dispose of their shareholdings. In contrast, directors' holdings remain substan-tially intact. We argue that one benefit of underpricing in the IPO is that the resulting oversubscription allows the issuer both to ration the allocation of shares and to discriminate between applicants so as to reduce the individual size of new blockholdings post-IPO. The greater dispersion of outside holdings reduces incentives for the new shareholders to monitor the current management. We call this the reduced monitoring hypothesis.

Booth and Chua (1996) point out that there is another advantage to diffuse ownership. Diffuse ownership may improve liquidity, and this strategy would tend to make for a lower rate of return required by investors and thus a higher equilibrium price for the firm's shares. This result will be important as insiders

dispose of additional shares after the IPO. Maug (1996) provides a model that links underpricing to market liquidity, rationing, and discrimination against large investors in the IPO. Holmstrom and Tirole (1993) argue that an additional advantage of a diffuse shareholding is that it will lead to greater noise trading which, in turn, will encourage more information collection by speculators. Thus, the share price will be more informative permitting more efficient contracting with managers. In contrast, Stoughton and Zechner (1995) provide a model where rationing in the IPO is used to favor large rather than small shareholders so as to obtain an ownership structure that improves monitoring of the firm by outsiders and thereby raises firm value.

This paper is based upon a data set of IPOs made in the UK. The advantage of this data set, compared with that of IPOs made in the US, for example, is that the UK new issue process allows explicit observation of rationing and discrimination between investors in the allocation of shares in the offering. Part of this data set has been provided by two investment banks and is not publicly available.

In Section 2 of the paper we develop the hypotheses and describe the data. In Section 3, we analyze how the costs of underpricing are borne by different groups of pre-IPO shareholders, including directors and non-directors, and show how underpricing is used to discriminate against large subscribers to prevent the formation of large blocks. In Section 4, we track the evolution of ownership for several years following the IPO, distinguishing between the shareholdings of directors and those of other pre-IPO investors. In Section 5, we test the implications of the reduced monitoring hypothesis by regressing the size of large blocks held by new investors on the level of underpricing, and by relating underpricing to the marginal cost of underpricing borne by directors. In Section 6, we summarize our results.

2. Hypotheses and data

In this section, we examine the hypotheses, the data set and the process of going public in the UK.

2.1. Hypotheses

We presuppose that directors of the IPO firm wish to maintain control of the firm after the IPO, to avoid the possibility of a hostile takeover (see Shleifer and Vishny, 1986). Underpricing the issue could reduce the risks of a takeover since underpricing will lead to oversubscription. Oversubscription allows the directors to achieve a more dispersed pattern of ownership by permitting discrimination against large applications. The more dispersed ownership reduces incentives for outside investors to monitor the firm.

Despite the ex post incentive of the owner to allocate shares in full to the smallest subscribers until the issue is fully allocated, it may be more efficient to commit to allocate shares to large subscribers in advance, even if the issue will be oversubscribed. Without such a precomittment, large subscribers will face a significant adverse selection problem and disappear from the market, thereby reducing the probability of a successful issue. This provides a role for the investment banker who can precommit to an allocation rule for large subscribers on account of his repeated appearance in the market (see Benveniste and Spindt, 1989). Chowdhry and Sherman (1995) argue that under certain assumptions discrimination against larger applications may be revenue maximizing, since it reduces the winner's curse or adverse selection problem found by small uninformed investors.

Reduced monitoring resulting from dispersed ownership, then, will tend to lead to lower efficiency. Lower efficiency will reduce the share value and the resulting cost will fall on all pre-IPO shareholders. However, the costs of underpricing which are intended to generate oversubscription in the IPO will fall more heavily on those pre-IPO investors who sell shares in the IPO, and less on those who retain their shares. In our sample, we find that selling shareholders tend to be non-directors rather than directors.

It may be argued that if large shareholders can buy shares in the secondary market after the offering, then large blocks can be assembled which will nullify the effects of discriminatory allocation at the IPO stage. However, if a change in ownership and control is expected, the price will rise to anticipate the gains, thereby eliminating any abnormal returns from such purchases of large blocks. As Shleifer and Vishny (1986) argue, "If ownership structure is very diffuse and trading is public it is not profitable to assemble a large block of shares".

Zingales (1995) provides a theoretical model of insider ownership and the decision to go public. In his model, the entrepreneur seeks a diffuse ownership structure by selling stock so as to maximize his total proceeds from the sale of his company. That is, diffuse ownership with insiders controlling a block of shares is intended to extract more surplus from a potential future buyer. Clearly, if blocks can be assembled with ease, the reduced monitoring motive for underpricing would not be relevant. Therefore, the reduced monitoring hypothesis has the following testable implications.

H1. *In the event of oversubscription, rationing will occur and will tend to discriminate against large applicants.*

H2. *The greater the degree of underpricing, the smaller the block holdings of outsiders.*

The benefits of reduced monitoring are enjoyed by the incumbent management. In choosing the level of underpricing, directors will trade off the expected benefits of reduced monitoring against their expected marginal cost of underpricing. Directors will also take account of the size of their holdings post-IPO.

The smaller their holdings, the more vulnerable directors are to the loss of private benefits and the greater the incentive to underprice. Therefore, we expect that, holding the benefits of control constant,

H3. *The level of underpricing will be negatively related to the marginal cost of underpricing borne by directors in relation to their pre-IPO holdings, and will be negatively related to their expected post-IPO holdings.*

We might also expect to observe that when pre-IPO investors wish to sell stock they will prefer to sell shares in the secondary market after the IPO in order to avoid the costs of underpricing in the offering. An absence of hostile changes in control would also be expected if the protection of control benefits is effective.

The improved liquidity hypothesis of Booth and Chua (1996) implies that directors, in choosing the level of underpricing, will trade off two effects on their wealth that arise from underpricing: first, the immediate cost of underpricing, and, second, the later benefit of being able to sell shares at a price that is higher because of the greater liquidity brought about by a more diffuse shareholding. This tradeoff suggests that the level of underpricing will be negatively related to directors' sales at the time of the IPO and positively related to post-IPO sales of stock by directors. We report below the results of empirical tests that bear on these hypotheses.

2.2. IPO process and the data set

Until recently, there have been three dominant types of initial public offerings in the UK. (i) a *fixed price offering* is an underwritten sale of shares at a fixed price. (ii) an *offer for sale by tender* requires investors to place bids for the shares specifying both quantity and price, and (iii) *placings*, where shares are allocated to institutions and individuals informally through underwriters. For fixed price offerings, the offering is advertised by prospectus to the general public, giving investors an average of 10 days to apply for shares. With offerings made by the second type, offers for sale by tender, the shares are underwritten at a price which is usually the minimum tender price, and a single issue price is struck. Although the issue price could be struck at the market clearing level so that all applicants who apply for shares at or above this price receive their tender in full, it is typically set below this level, and applicants are rationed. However, the underpricing is smaller than in fixed price issues (see, Merrett et al. 1967; Levis, 1993). There are, in addition, *mixed offerings*, in which an initial tender is followed by an offer for sale. In all cases, a London Stock Exchange rule requires that a minimum of 25% of the company's post-IPO shares must be in the hands of the general public (see, The London Stock Exchange, 1996).

An alternative to underpricing as a means of protecting insiders' control is to issue non-voting shares. However, investing institutions and the London Stock Exchange have discouraged the issuance of non-voting shares and other devices

for discriminating against different shareholders. This sanction is confirmed by the sample used in the paper. None of the IPOs included the issuance of dual-class shares, nor did any prospectus provide super priority rights to a particular group of shareholders, or other constraints on the control rights of a particular class of shareholders.

In contrast, NYSE, AMEX, and Nasdaq permit dual-class voting shares to be issued in the IPO and allow restrictions on control changes to be included in the corporate charter. For example, in the 1989 IPO of American Capital and Research, dual class shares were issued. One class of shares, owned by management and employees, represented 97% of the votes. In the 1988 IPO of US West New Vector Group, the corporate charter required an 80% majority to approve a merger and a similar majority for a change to this article. Lastly, in the 1988 IPO of Franklin First National Corporation, the prospectus stipulated that no new shareholder could acquire more than 198,000 shares, comprising about 4% of the share capital, in the offering, and that within 5 years of the IPO no shareholder could amass more than a 10% stake. In a sample of 752 IPOs for the period 1988–1992, 29% contained such specific restrictions.[1] In addition, we have been informed by investment bankers that rationing and discrimination can also occur in US IPOs to deter a hostile change of control. Thus, we might expect IPO underpricing to vary both within and across capital markets because of different mechanisms for protecting insiders against control changes in the IPO process. Chowdhry and Sherman (1996) show that differences in national IPO underwriting practices are associated with differences in average underpricing across countries. IPO underpricing may also vary because private benefits of control are larger in one market than in another.

The original sample of initial public offerings analyzed in this study consists of all UK offers for sale by tender or fixed price offerings reported in The Quality of Markets Quarterly, published by the London Stock Exchange for the years 1986–89. Placings were excluded where data was missing. Offers for sale by investment trusts, or closed-end mutual funds, were also excluded on the grounds that private benefits and control problems were of relatively small importance. For a contrary view of the control problems of investment trusts, see Barclay et al. (1993). Data collected from the prospectus included the size of offering, the names and stakes of existing owners, share sales by existing owners and by the company, and the price at which the shares were sold, or the minimum tender price, where appropriate. Data were also collected from The Financial Times on the level of over- or undersubscription and the share allocations to applicants of different numbers of shares.

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[1] We are grateful to Laura Field of Pennsylvania State University for providing these statistics and for supplying us with the IPO documents in the cases cited above.

Table 1
Summary of initial public offerings (IPOs) by type, for 1986–1989. The sample includes 69 IPOs. Fixed price offerings are shares sold at a fixed price, tender offers require investors to place bids for shares, and mixed offerings involve an initial tender offer followed by an offer for sale.

Type of offer	1986	1987	1988	1989	Total
Tender	4	0	0	0	4
Fixed price	38	12	10	4	64
Mixed	0	1	0	0	1
Total	42	13	10	4	69

The published details of the allocation schemes used for oversubscribed offers do not include the number of applications or the total number of shares allocated to a given size category. However, complete details of the rationing scheme were obtained from two investment banks for a subset of the sample.

Ownership data in the years subsequent to the IPO were taken from the Jordan and Extel data bases. For Jordan, the name and size of holdings for individual shareholders were available for companies for the year ending 1990. For Extel, the same information was available for either 1993 or 1992.

Table 1 shows the number of IPOs in our sample partitioned by the three offering methods. Of the 69 observations, the large majority are offers for sale at a fixed price, only four are by tender, and one is a mixed offering. As a result, the empirical analysis will focus on offers for sale at a fixed price. Since ownership data is available for only 43 companies in our sample, several of the subsequent tables will relate to this sub-sample. Table 2 provides summary statistics for the sub-sample of fixed price offerings, including size of company, size of issue, proportion of firm sold, oversubscription rate, and underpricing. The table shows that the average value of the company post-IPO is almost 76 million pounds, and the average size of offering in the IPO is 24 million pounds. The average rate of oversubscription in the IPO is 18.8 times and the average level of underpricing is 9.5%.

3. Underpricing and rationing

In this section we report the extent of underpricing in our sample of IPOs and analyze the allocation of the costs of underpricing between directors and other shareholders, and between those who sell their shares in the offering and those who do not. We also analyze the allocation of shares in oversubscribed offers and document a general policy of rationing and discrimination against large applicants.

Table 2

Characteristics of a subsample of initial public offerings (IPOs) offered for sale at a fixed price. The subsample includes 64 fixed price offerings. The table reports the value of the company post-IPO, the size of the offering in pounds sterling, the percentage of the firm sold, expressed as a proportion of the pre-IPO value, the rate of oversubscription, where zero is defined as fully subscribed, and the size of underpricing measured as the difference between the issue price and the price at the end of the first 5 days of dealings, adjusted for market movements. Statistics reported are the mean, maximum, minimum, and standard deviation for the subsample.

	Size of company post-IPO (£)	Size of offering (£)	Percentage of firm sold as a proportion of pre-IPO value	Oversubscription	Underpricing %
Mean	75 785 141	23 671 336	52.35%	18.77	9.52
Maximum	752 962 000	177 663 950	233.33%	95.00	48.12
Minimum	11 865 000	3 955 000	24.97%	−0.95	−43.24
Standard deviation	136 918 525	37 972 273	34.65%	24.85	16.43

Table 3

Amount and allocation of underpricing costs between directors and other pre-Initial Public Offerings (IPO) investors for a subsample of 43 firms, for 1986–1989. The table reports (i) the size of underpricing as the difference between the issue price and the price at the end of the first 5 days of trading, adjusting for market movements (u), (ii) underpricing expressed as a percentage of the value of the firm's pre-IPO capitalized value, using the price at the end of the fifth day for the valuation (u_p), (iii) the proportion of the costs of underpricing borne by pre-IPO investors who retained their shares at the time of the IPO (u_r), (iv) the costs of underpricing borne by those investors disposing of their shares, (u_d), (v) the sterling costs of underpricing incurred by directors (C_D) and non-directors (C_O) respectively, (vi) the costs of underpricing borne by directors as a proportion of the value of their pre-IPO holdings (c_D), (vii) the costs of underpricing borne by other investors as a proportion of their pre-IPO holdings (c_O), and (viii) the fraction of total underpricing costs borne by directors (f_D). The column labeled Q1 reports the value of the statistic at the 25th percentile, the column labeled median reports the statistic at the 50th percentile, and the column labeled Q3 reports the value of the statistic at the 75th percentile. The subsample includes 43 IPOs for which ownership data is available.

	Mean	Q1	Median	Q3	Maximum
1 week underpricing: u	9.52	− 2.34	10.01	19.08	48.12
Underpricing as % of the value of old shares: u_p	5.02	− 1.07	4.03	10.52	44.27
Costs borne by retainers as % of pre-IPO holdings: u_r	2.60	− 0.02	0.69	3.33	4.43
Costs borne by disposers as % of pre-IPO holdings: u_d	12.12	− 2.57	1.09	25.80	69.56
Sterling costs of underpricing: directors (C_D)	368 034	0.00	57 912	793 059	4 063 525
Sterling costs of underpricing: others (C_O)	22 264 926	0.00	100 643	2 867 159	410 040 981
Costs borne by directors as % of their pre-issue holdings: c_D	3.13	0.00	0.77	5.49	44.27
Costs borne by outsiders as % of their pre-issue holdings: c_O	3.83	0.00	1.35	10.58	25.96
Fraction of total costs borne by directors: f_D	39.73	4.66	23.98	80.08	100.00

3.1. The degree of underpricing

The first line of Table 3 reports the distribution of underpricing in the sub-sample of 43 fixed- price IPOs from 1986–1989, as measured by the return from the offering price to the close on the fifth day of trading, adjusted by the market return. One week underpricing of 9.52% compares with 9.42% at the end of the first day of trading. The mean underpricing of 9.52% compares with 11.5% found by Levis (1993) for UK IPOs over the period 1980–1988, and 9.87% reported by Miller and Reilly (1987) for the US. Levis (1993) also reports mean long run overpricing of IPOs in the UK, as does Ritter (1991) for the US.

The mean underpricing is only 5.02% of the company's pre-issue value computed at the offer price, which reflects the fact that the size of the new issue is considerably smaller than the pre-IPO size of the company (see Table 2).

Since, on average, about 10 trading days elapse between the time the issue is advertized, when the offer price is set, and the first day's trading, movements in the market and specific information about the company during the 10-day window may produce a difference between the expected and actual level of underpricing. For our sample, the Financial Times Actuaries Index moved, on average, 1.22% over the period of the window. However, movements in the market cannot be the only explanation for the difference between expected and actual underpricing for our sample. An extreme case is Richmond Oil and Gas which suffered a loss of 43% by the end of the first day of trading. Overpricing was anticipated by investors since they applied for only 12% of the issue.

This level of market movement contrasts with the US where price changes between the preliminary and final offer price averaged -4.3%, and were accompanied by significant changes in the size of the issue (see, Hanley, 1993). For UK issues, there were no changes in the issue price or the size of the issue after it had been publicly advertized.

3.2. The allocation of the costs of underpricing

Barry (1989) recognized how the costs of underpricing might fall differentially on pre-IPO investors who sell shares in the IPO and those investors who retain their holdings. In this section we rewrite Barry's equation in terms of holdings by directors and non directors.

We define the proportionate underpricing, u:

$$u = \frac{P_s - P_0}{P_0},$$

where P_0 is the offer price of a share, and P_s is the market-adjusted secondary market price at the close of the first day or the first week of trading. The total cost of underpricing to the company and selling shareholders, TC, is referred to by practitioners as the "amount of money left on the table." TC is equal to the gains of purchasers of newly issued shares sold by the company and of shares sold by pre-IPO investors at the issue price P_0:

$$TC = uP_0(n_N + n_d) = uP_0 n_I,$$

where n_N is the total number of new shares issued by the company, n_d is the number of secondary shares sold by old shareholders, and n_I is the total number of shares sold in the issue, such that $n_I = n_N + n_d$. Since only a fraction of the firm is typically sold in the IPO, the cost of underpricing is a smaller fraction of

total firm value than implied by u. Therefore, we define u_p, the cost of underpricing as a proportion of the pre-IPO firm value at the offering price:

$$u_p = \frac{TC}{n_0 P_0} = u \frac{n_I}{n_0},$$

where n_0 is the pre-issue number of shares. Next, we calculate the cost of underpricing per share for those retaining and for those disposing of shares in the offering. In the absence of sales of newly issued shares, the cost of underpricing is borne solely by those insiders who sell shares in the offering. However, newly issued shares sold at a discount dilute the value of those retaining shares. The cost of underpricing on the newly issued shares borne by each pre-issue share is

$$\frac{u n_N P_0}{n_0}.$$

Then the cost of underpricing borne per dollar of old shares held, valued at P_0, by pre-IPO investors who do not sell in the offering (retainers), u_r, is obtained by dividing the above expression by P_0:

$$u_r = \frac{u n_N}{n_0}.$$

The cost of underpricing for those pre-IPO investors who sell shares in the offering (disposers), u_d, is more complex since the secondary market price P_s is reduced by the underpricing of the issue. In the absence of that underpricing, the shares would be valued at an amount greater than P_s, i.e., $P_s + u n_N P_0/n_0$. The latter term is the dilution effect of issuing new shares at a discount. This implies that u_d, the cost of underpricing borne per dollar of shares sold, valued at the offer price P_0, for an individual who disposes of his shares is given by

$$u_d = \frac{P_s + (u n_N P_0/n_0) - P_0}{P_0}$$

$$= \frac{P_s - P_0}{P_0} + \frac{u n_N}{n_0} = u + u_r.$$

We denote the total costs of underpricing borne by directors by C_D, and the total costs borne by other shareholders by C_O, where

$$C_D = [n_{Dr} u_r + n_{Dd} u_d] P_0$$
$$C_O = [n_{Or} u_r + n_{Od} u_d] P_0,$$

where n_{Dr} and n_{Dd} are the numbers of shares retained and disposed of by the directors and n_{Or} and n_{Od} are the corresponding figures for other, old investors. Note that $TC = C_D + C_O$. Taking the derivative of C_D with respect to the

underpricing variable u, yields

$$\frac{dC_D}{du} = \left(\frac{n_N}{n_0} + \frac{n_{Dd}}{n_D}\right) n_D P_0,$$

where n_D is the total number of shares owned by directors. We see that the marginal cost of underpricing for directors is higher the greater is the ratio of new shares issued to shares outstanding (n_N/n_0), and the greater the fraction of directors' shares disposed of (n_{Dd}/n_D).

In Table 3, the median cost of underpricing expressed as a proportion of the value of the old shares held, valued at the offer price, is 0.69% for those who retain their shares (u_r) and 1.09% for those who dispose of their shares (u_d), although the means are substantially higher at 2.6% and 12.12%, respectively. Thus, u, the average rate of return from the offering price, which is the standard measure of underpricing, substantially overstates the average cost of underpricing for those who retain their shares and substantially understates it for those who dispose of their shares in the offer. Taking account of the size of the holdings disposed of and retained, the median total costs of underpricing for directors and others, C_D and C_O, are £57 912 and £100 643, respectively. This result implies that the costs of underpricing fall more heavily upon other shareholders than directors. The difference in costs borne by directors and other investors results for two reasons: directors typically own less than one half of the stock, and they are less likely to sell in the IPO. The disparity between the means is larger because particular issues, such as Wellcome, were very large and sales of shares in the IPO were solely made by non-directors, and directors had no significant shareholdings.

When the costs of underpricing for directors and others are expressed as a proportion of the value of their respective pre-issue holdings, $c_D = C_D/(n_{Dd} + n_{Dr})P_0$, $c_O = C_O/(n_{Od} + n_{Or})P_0$, the medians are 0.77% for directors and 1.35% for others. The means are substantially higher at 3.13% and 3.83%, respectively, although if one outlier is excluded in which the proportion of new shares issued to pre-issue shares sold is 233%, the means are 2.15% for directors and 3.88% for others. The value-weighted average of c_D and c_O equals 5.02% as in line 2 of Table 3; the means are shown because they represent values for the typical company. Thus, for a typical firm making an IPO, the costs of underpricing may be regarded as modest when compared with the total value of the firm, and the costs borne by directors as a proportion of the value of their shareholdings is approximately half as much as for other shareholders, because directors dispose of relatively few shares in our sample.

3.3. Underpricing, oversubscription and rationing

Just as underpricing represents a cost to the shareholders in the issuing company, so it represents a gain to those who purchase shares in the offer. It is

Table 4

The relation between underpricing and the level of oversubscription for a subsample of 68 firms. The subsample includes 68 initial public offerings (IPOs) from the period 1986–1989. The table partitions the sample by different levels of underpricing (u), measured by one-week market-adjusted returns, the level of oversubscription (OS), the average number of applicants for each issue, and the number of IPOs at each level. If the issue is fully subscribed, the level of oversubscription is defined as 0. The table also reports regression equation results using the data for this sample.

Underpricing levels u	Average level of oversubscription OS	Average number of applicants	N
$u < 0$	0.49	24 255	20
$0 < u < 5\%$	6.84	42 693	11
$5\% < u < 10\%$	16.34	111 433	7
$10\% < u < 20\%$	18.55	230 598	17
$20\% < u < 30\%$	23.75	1 036 435	7
$30\% < u < 40\%$	50.59	209 000	3
$40\% < u < 50\%$	34.58	58 087	3
Regression	OS $= 0.088 + 0.64u$	($t = 4.58$)	$R^2 = 0.24$, $N = 68$

not surprising, therefore, to find that IPOs that are underpriced tend to be oversubscribed, so that the issues must be rationed. Table 4 describes the relation between the level of underpricing, u, measured by the one-week market-adjusted returns, and the level of oversubscription for a sub-sample of 68 firms. The level of oversubscription increases monotonically with underpricing up to a level of 40%, and the average number of applicants for each issue increases with underpricing up to a level of 30%. The regression results reported in the table suggest that for each 1% change in underpricing there is a 0.64 change in oversubscription, a result that is consistent with Levis (1990). For the smaller sample of 43 IPOs used in the paper, the pattern is almost identical.

For oversubscribed offers the underpricing gains must be allocated by rationing the shares awarded to applicants. In the UK, the investment bank must publish the basis for allocation and, subject to some exceptions, the London Stock Exchange requires that the allocation rule discriminates only on the basis of the size of application and not according to the identity of the applicant. However, the allocation rule is published after the applications have been received, so the rule may reflect discrimination against particular applicants. This rule does not prevent the issuing firm from allocating shares to preferential investors prior to the issue. Such allocations are disclosed in the prospectus. Also, the allocation rule is devised after application lists have been closed and therefore will reflect the size and identity of the applicants.

The reduced monitoring hypothesis implies that the scheme used to allocate shares will be designed where possible to prevent the emergence of large shareholders. However, a cost of discriminating against large applicants in

successful offerings is that the resultant adverse selection imposed on them will discourage them from subscribing, increasing the probability that the invest-ment bank will be left with unsuccessful offerings. See Rock (1986) for a model of adverse selection in IPOs. Therefore, we expect that the issuing company will not discriminate against large applicants unless it is necessary to do so to prevent the emergence of large shareholders.

As an example, consider the actual share allocation scheme used by a com-pany to ration shares in an oversubscribed offer described in Table 4. For this company there were 480051 applications for nearly 693 million shares, and the issue was oversubscribed 8.5 times. Almost 45% of the applications were small, with applicants requesting between 400 and 2000 shares, and they totaled about three times the number of shares on offer. There was substantial discrimination for this issue. For example, applicants for between 400 and 1000 shares received 150 shares each, and this category in aggregate received 70% of the total issue compared with its share of 32% of applications, yielding a ratio of allocations to applications of 2.2 to 1 (as shown in the final column of Table 5). For applicants of 15 000 shares, the ratio of allocations to applications falls to 0.24, and for investors applying for between 150 000 and 10 000 000 shares no allocations were made at all. The largest new shareholding was 0.003% of the offering and the five largest shareholders combined held only 0.02% of the issue.

For the 13 companies where we have the detailed allocations data as de-scribed in Table 5, we have used two criteria to measure discrimination. The first reports results of individual company regressions relating the percentage of the issue applied for by an individual applicant within a size category (e.g. 400–2000) to the ratio of the percentage allocation to the percentage application as reported in the last column of Table 5. Where there is discrimination in favor of small and against large applicants, we would expect declining values as reported in the last column and therefore a negative slope coefficient. We find that in nine out of 13 cases, the slope coefficient is negative and in six cases it is significantly so at the 5% level or better. In only one case is it significantly positive. The second criterion measures the percentage of the issue sold to the largest appli-cant and the five largest applicants, respectively. For the sample of 13 com-panies, on average, the largest applicant receives 2.39% of the issue, and the five largest applicants receive 6.96% in aggregate. However, as a proportion of the post-IPO size, these proportions fall to about 0.8% and 2.3%, respectively. These are relatively small holdings for new investors who wish to exercise control through greater monitoring.

A third measure of discrimination reports the extent to which the issuing firm places a limit on the number of shares allocated to the largest applicants in the IPO. This criterion was applied to 29 firms where we have these data. For these 29 firms, one-third of the firms have a cap which takes the form of an absolute number of shares. The cap ranges from 25000 to 250000 shares, except for one case where it is zero. In another third of cases, the level of oversubscription was

Table 5

The size pattern of share applications and allocations for a single Initial Public Offering from the sample of IPOs for 1986–1989. The table reports the number of applications for different sizes of share application categories in the IPO, the proportion of shares applied for in each category, the number of shares allocated per applicant in each category (allocation rule), and the number and proportion of the IPO allocated to each size application category. The final column of the table reports the ratio of shares allocated to the proportion applied for.

Size of application category (Number of applications)	Total number of shares applied for	Proportion of total shares applied for (%)	Allocation rule (no. of shares)	Number of shares allocated	Proportion of total shares allocated (%)	Ratio of proportion of shares allocated to proportion applied for
400–1000 (381 282)	221 000 000	31.89	150	57 192 300	70.08	2.20
1500–2000 (54 718)	96 929 000	13.99	200	10 943 600	13.41	0.96
3000–5000 (29 200)	110 681 000	15.97	250	7 300 000	8.94	0.55
6000–7000 (5889)	36 102 000	5.21	300	1 766 700	2.16	0.41
8000–10 000 (5893)	57 136 000	8.25	350	2 062 000	2.53	0.31
10 000–15 000 (927)	13 905 000	2.01	425	393 975	0.48	0.24
15 000–20 000 (730)	14 600 000	2.11	500	365 000	0.45	0.21
20 000–25 000 (247)	6 175 000	0.89	625	154 375	0.19	0.21
25 000–30 000 (184)	5 520 000	0.80	750	138 000	0.17	0.21
30 000–35 000 (62)	2 170 000	0.31	875	54 250	0.07	0.22
35 000–40 000 (80)	3 200 000	0.46	1000	80 000	0.01	0.02
40 000–45 000 (23)	1 035 000	0.15	1125	25 875	0.03	0.20
45 000–50 000 (326)	16 300 000	2.35	1250	407 500	0.50	0.21
50 000–60 000 (80)	4 800 000	0.69	1500	120 000	0.15	0.22
60 000–70 000 (25)	1 750 000	0.25	1750	43 750	0.05	0.20
70 000–80 000 (42)	3 360 000	0.48	2000	84 000	0.01	0.21
80 000–90 000 (21)	1 890 000	0.27	2250	47 250	0.06	0.22
90 000–100 000 (173)	17 300 000	2.50	2500	432 500	0.53	0.21
150 000–10 000 000 (149)	79 000 000	11.40	0	0	0.00	0.00

less than twice the number of shares available in the IPO, and as a consequence discrimination was difficult to practice. In some of the remaining cases, the level of oversubscription was so great that discrimination was unnecessary to create small post-IPO holdings; for example, Tip Top was oversubscribed 66 times and Golden Greenless, 59 times.

We conclude that, consistent with our hypothesis H1, rationing and discrimination against large applicants is a significant feature of the allocation scheme for the sample of IPOs. The results for this sample are typically not consistent with the hypothesis of Stoughton and Zechner (1995) that large outside holdings are created to increase monitoring activities by external investors. It may be that share allocations are made to new investors prior to the IPO and those investors become non-executive directors and perform the monitoring function described by Stoughton and Zechner (1995). We do not distinguish in our sample between shareholdings of executive and non-executive directors.

In the next section, we examine how the ownership of pre-IPO investors evolves both at the time of the IPO and in years subsequent to it. These data will allow an examination of the extent to which underpricing is related to the changing patterns of ownership of pre-IPO investors, and the need to safeguard the private benefits of control.

4. The evolution of ownership and control around IPOs

Private companies and large public corporations represent opposite extremes of the relation between ownership and control. The initial public offering is a crucial step in the evolution of a management-owned firm into a public corporation and the development of a separation between ownership and control. Tables 6 and 7 document the changes in ownership stakes that take place around the IPO and in subsequent years.

In Table 6, all share amounts are expressed as a percent of the number of shares outstanding before the issue. Prior to the IPO, the mean proportional ownership of the firm by directors is 42% while the median is 24%. The remainder of the firm is owned by other investors who include both institutional and private investors. Private investors who are not directors frequently have the same name as that of some of the directors, and the indications are that they are often related to the founding families. The number of shares sold in the IPO averages 52.4% of the pre-issue number of shares outstanding. The latter consists of 28.4% of newly issued shares, 6.7% shares sold by directors, and the remaining 17.3% shares sold by other pre-IPO investors. Thus, the company increases its number of shares outstanding by an average of only 28.4%, and the corresponding figure for the median is less than 18%. On average, almost as many shares in the offering come from pre-IPO holders as from the company itself, and almost three quarters of sales by pre-IPO investors are from

Table 6
Ownership of shares prior to the Initial Public Offering (IPO), number of shares offered in the IPO, and ownership data immediately following the IPO for a subsample of 43 firms for the period 1986–1989. All holdings presented in the table are expressed as a percentage of the pre-IPO number of shares outstanding. The subsample includes 43 IPOs for which ownership data is available. The column labeled Q1 reports the value of the statistic at the 25th percentile, the column labeled Median reports the value at the 50th percentile, and the column labeled Q3 reports the value at the 75th percentile.

	Mean	Q1	Median	Q3	Maximum
Panel A: Share ownership prior to the IPO					
Shares owned by directors	41.97	6.20	23.99	78.85	100.00
Shares owned by others	58.03	21.62	75.99	93.92	100.00
Total	100.00				
Panel B: Shares sold in the IPO					
New issues by company	28.39	7.18	17.81	33.41	233.33
Shares sold by directors	6.67	0.00	1.88	9.79	40.00
Shares sold by others	17.29	0.00	3.50	23.41	100.00
Total sales in IPO:	52.35				
Panel C: Share ownership after the IPO					
Shares owned by directors	35.30	5.53	20.13	65.92	100.00
Shares owned by other old shareholders	40.74	7.53	41.00	76.33	100.00
Shares owned by new shareholders	52.35	33.53	42.81	53.97	233.33
Total shares outstanding	128.39				

Table 7
Ownership by different categories of pre-IPO shareholders for four different periods: pre-IPO, immediately after the IPO, 1990 and 1993. Numbers are expressed as a proportion of the total number of shares prior to the IPO. The sample size for each item is given in parentheses. The table represents a sample of 43 IPOs from 1986-1989 for which ownership data is available, which includes 15 companies where small amounts of pre-IPO holdings are not identified with any particular shareholding. As a result, those particular shareholdings are assumed to be zero in 1990 and 1993. Directors include the holdings of directors and their family trusts. Vendors are private investors who are closely related to the members of the board of directors, but are not directors themselves. Other investors are institutional investors such as venture capital firms and insurance companies. Shareholdings in 1990 are taken from The Jordan's Data Base of shareholdings and in 1993 from The Extel Company.

| Type of investor | Pre-IPO | Post-IPO | Shareholdings in: | |
			1990	1993
Directors	41.97	35.30	27.89	28.89
	(43)	(43)	(30)	(40)
Vendors	43.60	27.94	10.12	2.95
	(43)	(43)	(35)	(38)
Others	14.43	12.79	0.96	4.73
	(43)	(43)	(31)	(36)

non-directors. Immediately following the IPO, new shareholders own about 52.4% of the company, with the remainder being split between directors and other old investors. The medians give significantly lower ownership for directors pre-IPO and a smaller issue size.

Table 7 describes the evolution of ownership following the IPO. We partition holdings by directors and their family trusts, private investors who are typically members of the family but are not members of the board of directors (and are referred to as vendors in the prospectus) and other investors, who are typically institutional investors such as venture capital funds and insurance companies. The sizes of their shareholdings are given both before and immediately after the offering and in 1990 (Jordan's data) and 1993 (Extel's data). The table provides data for the sample of 43 companies analyzed in Table 6. For 15 companies there are small amounts of missing ownership data about pre-IPO holdings. If we exclude these companies, the results in Table 7 barely change.

Table 7 shows that holdings of directors are reduced by about a third, from 42% of the pre-issue number of shares outstanding prior to the IPO to 29% in 1993. In contrast, holdings of vendors are virtually eliminated over the same period, declining from 43.6% of the pre-issue number of shares to less than 3%. In the IPO itself, vendors sell on average about 36% of their holdings. Holdings of other investors are little changed at the IPO, but fall almost as dramatically as the holdings of vendors in the post-IPO period. In contrast, in German IPOs, the old shareholders retain holdings that are 50% larger than in the UK (see, Goergen, 1996). The analysis also compares with that of Barry et al. (1990) who find substantially larger pre-IPO holdings of venture capitalists and greater stability of ownership post-IPO.

The pattern of ownership post-IPO is consistent with the view that "going public" is a vehicle for the disposal of shares by non-directors. Holdings sold in the IPO may be necessary to meet the 25% rule of the Stock Exchange to ensure a liquid after-market. For example, the sale by vendors of about two thirds of their shares after the IPO is consistent with vendors wishing to avoid the costs of underpricing in the IPO. Also, we found a strongly negative relation at better than the 1% level ($t = 6.06$) between sales made by all pre-IPO shareholders in the IPO and newly issued shares by the company. This negative relation suggests that the greater the number of new shares issued in the IPO the smaller the sales of existing shares.

If discrimination in the allocation process is effective in protecting insiders against monitoring or a change in control, we would expect discrimination to limit the size of stakes assembled in the secondary market after the IPO. Table 8 provides details in a sub-sample of 29 companies of the size of large share stakes, other than those held by insiders, reported by Extel in 1993. A large stake is defined as at least 3% of the outstanding share capital. The maximum number of individual large stakes for any company is 6. On average, the large share stakes total almost 21% of the outstanding shares. In the second column we

Table 8
Average size of large share stakes of outsiders disclosed in 1993 by Extel for 29 companies in the subsample of 43 IPOs from 1986–1989, for which ownership data is available. The percentages are based upon the number of shares in the most recent financial year. A large stake is defined as at least 3% of the company's outstanding shares. The second column excludes nominee holdings which are held by investment banks or brokerage firms on behalf of groups of investors.

Average of the sum of the large share stakes	Average of the sum of the large share stakes excluding nominee holdings	Average of the largest share stake in each company
20.59%	18.74%	10.0%

have subtracted from the data in column 1 nominee or non-beneficial holdings where there is evidence that they are held by an institution, such as a bank, acting as custodians on behalf of a number of shareholders. In this case the average total large share stake falls to 18.74%. The third column reports the size of the largest stake in each company, which averages 10%. In the next section, we shall investigate the extent to which the size of these outside stakes are related to underpricing.

5. Additional tests of the reduced monitoring hypothesis

The evidence reported above shows that underpricing is related to oversubscription, and oversubscription is frequently related to discrimination against large shareholders in the allocation process. In this section, we provide two additional tests of the reduced monitoring hypothesis. H2 predicts that the block holdings of outsiders will tend to be smaller the greater is the degree of underpricing. To test this hypothesis, the aggregate size of all large outside holdings expressed as a proportion of all outside holdings is regressed on the one-week market-adjusted returns. The shareholding data were taken from Extel for 1993, and were available for a limited sample. The results are reported in Table 9. The slope coefficient is negative as predicted, and significant at the 5% level ($t = -2.37$). That is, for every 1% increase in underpricing the aggregate size of large stakes falls by 0.77%. The analysis was repeated using the size of the single largest outside shareholding as a proportion of total outside shareholdings as the dependent variable. This largest relative block size measure was again negatively and significantly associated with the measure of underpricing, despite the fact that the IPOs for some companies had occurred as many as 7 years previously. Thus, consistent with the reduced monitoring hypothesis, there is evidence that underpricing tends to be related to the reduced size of large

blocks of shares in the hands of outside shareholders. This result together with the previous evidence that there is discrimination in the allocation process in the IPO against large shareholders, provides support for Shleifer and Vishny's (1986) proposition that, if ownership is diffuse, it is difficult to assemble large blocks.

H3 predicts that the level of underpricing will be negatively related to the marginal cost of underpricing for directors. We also control for their expected holdings post-IPO since the lower these holdings the more vulnerable directors are to the accumulation of outside shareholdings. In order to test H3, the level of underpricing was regressed on the marginal cost of underpricing by directors divided by the value of their initial holdings, $n_D P_0$. The results for Regression 3 in Table 9 show that the coefficient for the marginal cost variable is positive and not significant and the coefficient for post-IPO holdings of directors is negative and also not significant. This lack of significance may reflect the relatively low costs of underpricing borne by directors and the fact that the private benefits of control may vary across companies.

An important implication of the data shown earlier in Table 7 is that by 1993, the pre-IPO shareholders, on average, no longer have a controlling interest in the company and therefore may be vulnerable to a takeover and change in managerial control. As a result, we examined the fate of all 43 companies in our sample up to June 1996 to determine which ones had been acquired and the extent to which there had been a hostile change of control. Out of 43 companies, 11 had been acquired and 1 had been taken private by pre-IPO shareholders. Of the 11 acquired, there was only one case of a successful hostile bid where hostility was defined as opposition by target management and the incidence of revised bids (definitions used by Franks and Mayer, 1996). In two other cases hostile takeovers failed. In one case the target accepted a bid two years later and in another a white knight was found. In Glaxo's successful hostile takeover of Wellcome, the management opposed the bid but it was immediately accepted by the main shareholder, the Wellcome Foundation, which had a controlling shareholding; management owned virtually no shares. We also examined the incidence of revised bids, which Franks and Mayer (1996) contend are indications of auctions and potential hostility; we found none. This pattern contrasts to aggregate UK takeover activity where almost a quarter of takeovers are hostile and half of those takeovers include revised bids.

The last test concerns the Booth–Chua hypothesis that underpricing will be negatively related to the proportion of director holdings disposed of in the IPO, and positively related to the proportion disposed of in the after market. The results for Regression 4 are reported in Table 9, and we find that although the signs of the coefficients were consistent with the Booth and Chua hypothesis, the size of the coefficients were not significant.

Table 9

Regression results for the reduced monitoring hypothesis, using a subsample of IPOs for 1986–1989. The first regression relates the total of all large share stakes to the size of underpricing. Large holdings are defined as those in excess of 3% as of 1993. The second regression relates the largest outside shareholdings to the size of underpricing. The third regression relates the level of underpricing to the relative marginal costs of underpricing borne by directors, the size of the issue, and the post-IPO holdings of directors. The fourth regression relates underpricing to sales by directors at the IPO and sales by directors post-IPO.

	Regression 1	Regression 2	Regression 3	Regression 4
Variables:				
Dependent	Total of large outside stakes in 1993 as a fraction of all outside holdings	Single largest outside shareholding in 1993 as a fraction of all outside holdings	Level of underpricing (one week abnormal returns)	Level of underpricing (one week abnormal returns)
Independent	1 week abnormal returns	1 week abnormal returns	(i) Relative marginal costs of underpricing for directors (ii) Log size (value of new shares issued) (iii) Post-IPO holdings of directors	(i) Sales by directors at IPO (ii) Sales by directors post-IPO
Results:			(i) (ii) (iii)	(i) (ii)
Slope coefficient	− 0.77	− 0.34	0.02 − 0.13 − 0.04	− 0.08 0.06
t value	− 2.37	− 2.24	0.19 − 1.23 − 0.26	− 0.53 0.79
R^2	0.20	0.19	0.06	0.02
No. of observations	24	24	34	34

6. Conclusion

This paper provides a study of how the separation of ownership and control evolves in British companies. An important finding is that, on average, a large majority of shares owned by pre-IPO shareholders are sold at the IPO or in subsequent years. The shares sold subsequent to the IPO are consistent with pre-IPO investors wishing to avoid some of the costs of underpricing associated with the IPO. Significantly, these sales derive substantially from those insiders who are not directors of the company, which we interpret as evidence that directors derive private benefits of control that are not available to non-directors.

The paper finds that underpricing is typically associated with oversubscription and is followed by substantial rationing and discrimination in the allocation of shares. The discrimination is usually against large applicants and in favor of smaller applicants as predicted by the reduced monitoring hypothesis. In addition, the results show that the size of the underpricing is negatively related to the size of large blocks assembled after the IPO, which is consistent with underpricing being an effective mechanism to secure a diffuse outside shareholding. Furthermore, even though we find a high incidence of acquisition among the sample, there is only one case of a successful hostile change of control, and in that case pre-IPO shareholders recommended the takeover over the objections of management who had virtually no shareholdings. However, we do not find evidence that underpricing is related to the marginal costs of underpricing borne by directors. It may be that the size of underpricing is more a function of differences in private benefits than differences in relative marginal costs.

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