

Rights issues versus private placements: theory and UK evidence

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Abstract

UK companies and their shareholders commonly choose to place newly issued shares privately rather than sell them via a rights issue. We interpret a sale of rights on the market as akin to the type of issue analysed by Myers and Majluf (1984), in which there is information asymmetry concerning the issuer. In contrast, an issue with placed shares enables potential places to investigate the value of the issuer and implies an increase in the share price. In order to explain the widespread use of the placement method, we suggest that shareholders must care about the share price post issue. We derive formally a range of testable predictions which are strongly supported empirically.

1 Introduction

The nature of seasoned equity offers (SEOs) has changed in the UK. Before the mid-1980s, almost all SEOs for cash by British companies were rights issues, but since then it has become common practice for some or all of the shares issued to be placed privately with investors. This state of affairs has so far attracted limited academic attention. We argue that UK issuers face a choice between a pure rights issue and an issue with privately placed shares, and we analyse this choice.

Previous research proposes two types of explanation for the private placement of seasoned equity. One explanation is based on the idea that the placement process involves investigation of issuer value, either by investors or by the underwriter of the issue. The issuer can then sell its new shares at a price which reflects fuller information than was previously in the public domain. A second explanation is that placements concentrate shares in the hands of one or a few ‘active’ investors who reduce agency costs (Wruck, 1989), and that placees might bring other benefits such as product-related know-how from a corporate investor (Cronqvist and Nilsson, 2000). A positive market reaction to placements is predicted by both types of explanation and is reported in several studies.

Our analysis assumes that the placement method involves investigation of issuer value. Our initial reasons for exploring this explanation were that the buyers of placed shares receive substantial rewards and that they do not usually consist of one or a few active investors who acquire large stakeholdings. The shares are bought by a group of investing institutions. Such institutions avoid acquiring blocks which represent more than a few percent of the company’s equity and are not normally active shareholders (Holland, 1995). It therefore seemed unlikely that agency motives could, in general, explain the widespread use of the placement method observed in the UK.

Our paper is in the mould of others which extend and modify the framework presented by Myers and Majluf (1984). They analyse the decision whether a company with an investment opportunity will issue shares, under the assumptions that managers know more about the true value of the company than do stock market investors, that managers maximise the wealth of existing shareholders, and that the new shares are bought by new investors. Given

these assumptions, an SEO will result in a loss in wealth to existing shareholders if the market value of the firm at the time of the would-be issue is sufficiently below the true value of the firm. A firm in this position chooses not to issue. The analysis implies that firms which do issue are more likely to be overvalued than undervalued, so that the announcement of an SEO is predicted to result in a fall in the share price of the issuer.

Eckbo and Masulis (1992) consider the role of underwriting in the above context. They hypothesise that the benefit of paying for an issue to be underwritten is that the underwriter provides imperfect certification that the issuer is not overvalued. The imperfect certification reduces the fall in price on announcement of an SEO which would otherwise occur. They interpret the fall in price as an indirect cost of issue, since a lower market price means a lower issue price, which is detrimental to existing shareholders. The predicted price fall on announcement, and hence the benefit of underwriting, are negatively related to the take-up by existing shareholders. If all the issue is to be bought by existing shareholders, the company will always issue no matter how undervalued it is at the time, because the undervaluation can not result in any transfer of wealth from the existing shareholders. So the share price would not be expected to fall on announcement of the SEO, and underwriting provides no benefit. For some value of take-up which is less than 100%, the benefit of underwriting exceeds the cost, and the firm chooses an underwritten issue.

In a similar vein, Slovin, Sushka and Lai (SSL, 2000) analyse the choice between underwritten private placements, underwritten rights issues and non-underwritten rights issues in the UK. They report average abnormal returns on announcement of 3.3% for private placements, -1.9% for underwritten rights and -5.5% for non-underwritten rights. They suggest that the reliability of certification by the underwriter varies across the type of issue with the financial risk borne by the underwriter. The underwriter's risk is greatest for private placements, because it buys a block of shares from the issuing company at a fixed price, and then has to find buyers. The risk is less in an underwritten rights issue, because the new shares are normally issued at a substantial discount to the market price. The underwriter bears no financial risk in a non-underwritten issue.

Hertzel and Smith (1993) argue that certification in US private placements is done by the buyers of the new shares; they do not assign a special role to the underwriter. They note

that the offer price is usually substantially below the prevailing market price, so that the buyers benefit from a discount. They interpret the discount as compensation to the buyers for costs of investigating the issuer. In their formal extension to the Myers-Majluf theory, the company is assumed to sell new shares in a placement at the true value per share, net of the compensation for new investors. The company will choose to issue via a placement if this maximises the true value of the existing shares.

We argue that the investigation/certification theory of placements can explain the choice of issue method in the UK, but that none of the above versions are capable of doing so as they stand. We first document that the selling of shares via private placement is now a much more widespread feature of SEO practice in the UK than might be inferred from previous studies, in particular from SSL (2000) and Competition Commission (1999). We go on to demonstrate that privately placed shares are normally sold at a substantial discount to the post-announcement market price. The discount provides a reward to the buyers of the placed shares, and the buyers also receive a cash fee. We suggest, as do Hertznel and Smith (1993), that the reward is to compensate buyers for costs of investigating the issuer, and for the future cost of selling an illiquid block of shares. We therefore interpret an issue with placed shares as one in which investors investigate issuer value and in which the placement price reveals the true value per share, net of compensation for the investor. We interpret a pure rights issue as a Myers-Majluf style SEO, in which information asymmetry prevails at the time of the issue.

However, the condition for choice of a placement presented by Hertznel and Smith can not explain why most of the companies in our sample which chose an issue with placed shares preferred this method rather than a pure rights issue. The Hertznel-Smith condition requires that the issue price in a placement be higher than it would have been had a Myers-Majluf style SEO been chosen instead. We show that this condition is unlikely to have been fulfilled for most of the issues with placed shares in our sample. Non-subscribing shareholders would usually have been better off had the firm chosen a pure rights issue. Our solution to this puzzle depends on the prediction of the certification theory that the issuer's *market* price following a placement will be higher than it would have been following a Myers-Majluf style SEO. We conjecture that the utility of existing shareholders is affected by the issuer's market

value post issue, as well as by the price at which the new shares are sold. This modification to the theory makes it possible to predict that the issue price in a placement will be less than it would have been in a Myers-Majluf style SEO.

Part of the paper's contribution is to analyse formally, for the first time, how the choice between a Myers-Majluf style SEO and a placement is related to firm-specific variables. The variables in our model are: i) the realisations of the true values of assets in place and of the investment opportunity which motivates the issue; ii) the equity from new investors required to exploit the opportunity; iii) the firm-specific investigation and liquidity costs incurred by placees; iv) outsiders' uncertainty about the firm's true value; and v) the degree to which existing shareholders care about market value post issue. We test the theory using data from a large sample of UK SEOs, and find strong empirical support. We conclude that a model in which the benefit from placement is investigation of issuer value can explain the widespread use of the placement method in the UK.

2 Types of issue and rewards to placees

This section briefly describes pure rights issues and the three types of issue with placed shares. The institutional background on issues with placed shares is not common knowledge as yet. We learned about such issues from reading SEO prospectuses, from interviews with seven investment bankers and from SG Warburg (1995).

Pure rights issues. In a pure rights issue, new shares are offered to existing shareholders in proportion to the number of shares they own. The rights can be traded in the same way as can shares during the offer period, which lasts at least three weeks. The offer price is usually set at a discount to the market price, but the depth of discount does not matter to non-subscribing shareholders because they can sell their rights, and any rights not subscribed for by the close of the offer are automatically sold by the broker on behalf of the shareholders concerned. The fair price of a right to one new share is the difference between the ex-rights share price and the offer price (ignoring the right's time value), and the actual price is kept

close to this by the possibility of arbitrage between the shares and the rights.¹

Open offers. An open offer is a cross between a private placement and a rights issue. The new shares are privately placed with investing institutions by verbal agreement before the offer is publicly announced; potential buyers agree to become insiders and not to trade the issuer's shares before the announcement. Legally binding contracts are signed on the announcement day, and it is rare for institutions to renege on their verbal agreements. The shares are also offered pro rata to existing shareholders, who have priority, and the offer period is usually three weeks. But the rights can not be sold. This means that any discount implies a transfer of wealth from non-subscribing shareholders; the share price falls on the ex-rights day, as in a rights issue, and non-subscribers are not compensated for the fall in value of their existing shares. The investors with whom the shares have been placed receive all the shares not subscribed for by the existing shareholders. Open offer terminology reflects the fact that the primary function of the placement process is to sell the shares rather than to transfer underwriting risk. The investors are referred to as 'placees' and the new shares are said to be 'placed with clawback'; an institution acting as a placee agrees to buy a certain number of shares, some of which will be 'clawed back' to satisfy demand from existing shareholders wishing to subscribe.

Rights issues with pre-renounced shares. Rights issue and open offer prospectuses often record the intentions of directors and major shareholders (who know about the issue before the public announcement) to take up or, alternatively, to renounce their entitlements to new shares. In open offers at a discount, the rights are worth nothing unless taken up, so it makes no difference whether a non-subscribing shareholder pre-renounces his rights or merely fails to exercise them. But a decision to pre-renounce rights in a rights issue means that the rights are privately placed before the announcement instead of being sold on the stock market during the offer period. If the pre-renounce-and-place route is chosen, the shareholder receives from the placees 50% of an ex ante estimate of the value of each right to

¹A study of the market for rights during 1995-97 by Credit Suisse First Boston, summarised in Competition Commission (1999, pp. 244-6), finds that rights trade at an average discount to their fair price of 0.5% of the ex-rights share price, using mid-point prices. The sample is restricted to large issues of £50m or more. The study notes that traders do arbitrage between the shares and the rights.

buy one new share, given by the difference between the theoretical ex-rights price (TERP) as at the day before the announcement and the offer price. This is a rule of the London Stock Exchange (1997, 4.17(c)), and it is clear from prospectuses that the rule is adhered to. The TERP is the price to which the existing shares will fall on the ex-rights day, assuming no change in the market price for any other reason.²

Private placements are issues in which the new shares are placed with one or more investors and are not offered pro rata to existing shareholders. They are known in the UK as private placings or subscriptions or placings without clawback. A special resolution has to have been passed which disapplies shareholders' pre-emption rights; there is no restriction on re-sale of the shares; and any discount is a cost to the issuer. Some private placements are made on a stand-alone basis; these are the type of placement studied by SSL (2000). Others are made in conjunction with a rights issue or open offer. The placement is not part of the rights issue or open offer because the shares are not offered pro rata to existing shareholders. But the placement shares are issued on the same terms as the shares offered pro rata, and the placement is described in the rights or open offer prospectus.

2.1 Sample and adoption of issues with placed shares

Our sample consists of 882 SEOs made between 1 January 1985 and 30 September 1996. There are 410 pure rights issues and 472 issues with placed shares. To be included in the sample, we required that the issue have been completed by a UK company other than an investment trust; that there was a prospectus, so we could obtain company-specific information; that there was sufficient share price data for the purpose of an event study; and that the reward received by buyers of placed shares could be calculated. Prospectuses and share prices were obtained from Primark Extel. Our need for a prospectus means that there are no stand-alone private placements in the sample, since there is no prospectus for this type of placement.

Table 1 shows the number of issues by year. The reason for the relative scarcity of issues

²The TERP as at day t is defined as $[P_t S + P_O N]/(S + N)$, where P_t is the mid-point market price of the share at the close of day t , P_O is the offer price, S is the number of existing shares and N is the number of new shares offered pro rata to existing shareholders.

before 1991 is that Extel's collection of prospectuses becomes progressively less complete before that date. The proportion of issues with placed shares increases from one-sixth of all issue during 1985-88 to two-thirds during 1994-96. Table 1 also shows that pure rights issues are considerably larger on average and are chosen by larger companies than are issues with placed shares.

Table 1 around here.

Before the mid-1980s, the bulk of SEOs in the UK were pure rights issues, although open offers, private placements and pre-renunciations of rights were allowed and occasionally took place (Marsh, 1977, pp. 39-40). It is not entirely clear why the placement method went from being rare to being common in the space of a few years. In 1986 the Investment Committees of the Association of British Insurers and the National Association of Pension Funds recommended that their members vote at company meetings in favour of waiving pre-emption rights for up to 15 months at a time, for new shares up to 5% of the number in issue. This made it more convenient to arrange an issue which was not offered pro rata to existing shareholders, because a separate extraordinary general meeting was not required at the time, and presumably it signalled a more positive attitude on the part of institutions towards issues with placed shares in general.³ The Stock Exchange reforms of Big Bang 1986 made it easier and cheaper to trade large blocks of shares, which probably increased the demand from institutions for large blocks purchased via issues with placed shares. Another factor may have been the growing market share in London of US investment banks, which were used to the bookbuilding process in firm commitment offers at home. The process of finding placees is similar to bookbuilding.

2.2 Rewards to placees

Placees are rewarded through being offered new shares at a discount and through receipt of a fee. The discount obtained by a placee is the difference between the market price and the

³The 5% limit is non-statutory, but large private placements are still rare. The limit does not apply to shares in open offers or pre-renounced shares in rights issues, because these shares are initially offered pro rata to existing shareholders.

offer price at the offer close, when the new shares are paid for. But since there is a gap of at least three weeks between announcement and offer close, the market price at close might be regarded as a rather noisy estimate of the price the company expected when it set the offer price just before the announcement, so we also report the discount measured against the market price at the close of the announcement day. If the share had not gone ex-rights on the announcement day, we adjust the market price for that day by a factor reflecting the scrip element of the issue. If the new shares were not entitled to the next dividend per share, we subtract the next DPS (net of advance corporation tax) from the market price of the existing shares. The rewards to buyers of pre-renounced shares in rights issues are calculated as above, except that we subtract half the difference between the TERP and the offer price, because buyers pay this amount on top of the offer price to the pre-renouncing shareholders.

It is common for placees to receive from the issuer, via its investment bank, a cash payment in addition to a discount. For shares in a private placement or which are placed having been pre-renounced, this fee is unambiguously a reward for buying the shares and is generally referred to as a ‘firm placing’ fee in prospectuses. For shares placed at the start of an open offer, the placees are acting as both buyers and underwriters, and the norm is for placees to receive the same fee for shares which they actually buy as for shares which they have agreed to buy, but which are ‘clawed back’ by existing shareholders. Shares actually bought rarely attract an extra ‘take-up’ fee. We take the view that the fee(s) attaching to shares actually bought by placees is a reward for purchase, whilst the fee attaching to shares not bought is an underwriting fee which we ignore. No other types of reward for placees, such as warrants, are recorded in prospectuses.

Table 2 shows estimates of the rewards to buyers of placed shares, expressed as a percentage of the offer price. The mean discount is 13% (median 7%) of the offer price measured against the announcement day price, and is 15% (median 7%) measured against the price at offer close. The mean and median cash placing fee is 1%. Table 2 also shows that placees typically end up buying a substantial proportion of the issue, the mean being 42% (median 40%).

Table 2 around here

3 A theory of the choice of issue method

3.1 Assumptions

We argue that firms in the UK face a choice between a pure rights issue and an issue with placed shares. We interpret a pure rights issue as an issue of the type envisaged by Myers and Majluf (1984). This may seem odd at first glance, because the shares are sold to new investors in a Myers-Majluf issue, whereas the shares in a rights issue are offered first to existing shareholders. But rights *are* sold during rights issues, and the wealth of non-subscribing shareholders is affected by the choice of issue method. The process of selling new shares via sale of rights is similar to a Myers-Majluf issue. The price buyers of rights pay for the new shares includes the cost of the rights and is the same as the post-announcement market price of the existing shares. The rights are sold in a competitive market with many potential buyers, who receive no reward for purchase. There is no reason to believe that buyers of rights during a rights issue have private information about the issuer, so it is reasonable to assume that information asymmetry prevails during the issue. This is a key feature of a Myers-Majluf issue.

The wealth of existing shareholders is only affected by the price and number of new shares sold to *new* investors. Therefore, the measure of proceeds which is relevant in determining the issuer's choice of issue method is the proceeds from new investors. The proceeds from shares bought by existing holders are equivalent to financial slack in the Myers-Majluf model. We assume, as do Eckbo and Masulis (1992), that the issuer can predict the proportion of the issue which will be bought by existing holders, whether it is a pure rights issue or an issue with placed shares. We also assume that the reasons why shareholders do or do not take up their entitlements are considerations of liquidity and diversification, rather than exploitation of inside information.

In issues with placed shares, the placement process gives would-be placees the opportunity to investigate the issuer. In practice, the process by which the company and its advisers

liaise with potential placees takes place over several days or weeks before the announcement, and it is expected that the company provides inside information. In the theory, we assume that placees become as well informed as the managers, but at a cost. The price at which they agree to buy the shares is thus the full-information value per share, net of the compensation per share which placees require (discussed in Section 3.3). Placees are assumed to value highly their reputation as certifiers of value in the placement process, which guarantees that they always investigate and are believed to do so by outside observers (see Appendix for further discussion of this point).

We assume that investigation is done by placees rather than by the underwriting bank. One reason for this is that, in the issues in our sample, the rewards for buying placed shares clearly go to the placees, not to the underwriting bank. We have shown this in Section 2.2. In addition, Armitage (2002) tests predictions from the Eckbo-Masulis theory and finds almost no evidence consistent with underwriter certification in UK rights issues and open offers.⁴ We therefore assume that there is no investigation of issuer value in a pure rights issue, and that there is investigation in an issue with placed shares, whether or not either type of issue is underwritten. It is possible that the underwriter investigates in a stand-alone private placement, as SSL (2000) maintain. Such a placement can readily be accommodated in our theory, since it involves investigation of issuer value. The question of who does the investigating in this type of placement is a second-order question.⁵

Our other assumptions follow those in Myers and Majluf (1984) and Hertz and Smith (1993). The notation is summarised below.

MMS = Myers-Majluf style issue.

a = true value of the firm's assets in place.

b = NPV of a new project the firm could undertake.

E = external equity from new investors required to fund the project.

⁴Armitage (2002) presents evidence that the more negative reaction to non-underwritten rights issues noted by SSL (2000) is a reaction to bad news released at the same time as the issue is announced.

⁵SSL view the discount in stand-alone placements as a reward for the underwriting bank. But some of the discount may be passed on to buyers of the shares, as in a US firm commitment offer (Hansen and Torregrosa, 1992, p. 1546). Also, buyers may have been found *before* the placement is announced publicly, as is the case in the issues with placed shares which we study.

P_0 = price of existing shares immediately before issue is announced.

P_1 = price of existing shares immediately after announcement of issue via placement.

P_p = issue price of new shares in a placement.

P_m = price of existing shares immediately after announcement of Myers-Majluf style issue, and price of new shares in such an issue.

T = investigation and liquidity costs associated with buying the placed shares, assumed to be publicly known.

The managers of a would-be issuer act in the interests of existing shareholders and have just discovered a new short-lived opportunity to invest in a project with positive NPV of b . The managers have to decide whether to issue, and if they do, whether to issue via *MMS* or placement. The firm knows a and b whilst outsiders only know the probability distribution function (pdf) of a and b . For convenience, we normalise the existing number of shares of all firms to unity, so that the pre-issue price, P_0 , the post-placement market price, P_1 , the placement price, P_p , and the *MMS* price, P_m , may also be thought of as the corresponding market values of the existing shares at each price.

3.2 The condition for choice of placement

Under the above assumptions, P_p reveals the true value of the firm, net of costs T of investing in the issuer. The post-placement market value of the firm, $P_1 + E$, is the same as the true value $a + b + E - T$, so $P_1 = a + b - T$. Myers and Majluf, and Hertz and Smith, assume that existing shareholders care only about the true value of their shares, because true value will be revealed to the market at some date after the issue. The true value of the existing shares following an *MMS* is the proportion of the firm owned by the existing shareholders times the true value of the firm, $(\frac{P_m}{P_m + E})(E + a + b)$. Thus, the firm will choose a placement if

$$a + b - T \geq \frac{P_m}{P_m + E}(E + a + b), \quad (3.1)$$

which is the inequality presented by Hertz and Smith (their equation 3).

This theory can not, as it stands, explain the choice of issue method for the bulk of the issues with placed shares in our sample. The problem is that observed placement prices are

not high enough for one to believe that the above inequality is often satisfied. An alternative way of stating the Hertzels-Smith condition is that the placement price P_p must exceed the market price P_m had the firm chosen an *MMS*. To see this, observe first that the relation between P_m and P_1 can be found by re-arranging (3.1), bearing in mind that $P_1 = a + b - T$:

$$P_1 \geq P_m \frac{E + T}{E}. \quad (3.2)$$

Second, the relation between P_p and P_1 can be inferred from the condition that the reward to placees must be equal to the total costs of investing, T , assuming competition amongst placees. The reward to placees is the discount per share, $P_1 - P_p$, times the number of shares placed, $\frac{E}{P_p}$, so we have $(P_1 - P_p) \frac{E}{P_p} = T$, or

$$P_1 = P_p \frac{E + T}{E}. \quad (3.3)$$

Using (3.3) to substitute for P_1 in (3.2), we see that a placement will be chosen if $P_p \geq P_m$.

In the vast majority of our issues with placed shares, the placement price P_p is below P_0 , the pre-issue market price. One could still believe that P_m would have exceeded P_p , so long as a firm which chose a placement could have expected its market price to have fallen sufficiently were it to have chosen an *MMS*. Had a firm which chose an issue with placed shares chosen a pure rights issue (= *MMS*) instead, a plausible maximum fall in the share price to be expected on announcement would be 3%, which is the average abnormal return we find on announcement of a pure rights issue (Section 4.1). It is unlikely that the firms which chose an issue with placed shares would have suffered a mean fall in price larger than 3%, had they chosen a pure rights issue instead. On the contrary, a point of agreement in papers on placements is that issuers tend to choose the placement method if they are undervalued. Consistent with this is the finding of SSL (2000) that the average abnormal return on announcement of rights issues became more negative after placements became common in the UK in the mid-1980s. In 430 (91%) of our sample, the placement price P_p is less than a conservative estimate of what P_m would have been, given by the share price at the close of the day before the announcement, minus 3% and minus any net DPS the new shares are not entitled to. Hence, the Hertzels-Smith condition is unlikely to be satisfied for a

large majority of the issuers which actually chose a placement.⁶ For these issuers, the wealth of non-subscribing shareholders would have been maximised by choosing an *MMS*.

One possible inference from this finding is that there are benefits from a placement which are additional to the opportunity provided for investigation of issuer value. But if we stick with the hypothesis that the main benefit is investigation, the natural inference is that the utility of some or all shareholders is affected by the market value of their shares post announcement. Although true value is assumed to be revealed eventually following an *MMS*, in the meantime the share price following choice of a placement can be higher than following an *MMS*.

Shareholders likely to be concerned about this are those who might wish to sell some

⁶The condition that placement is chosen if $P_p > P_m$ is only approximately correct, due to a difference between the mechanics of an *MMS* and a pure rights issue. Funds are raised from new investors by the sale of shares at the post-announcement market price P_m in an *MMS*, but by the sale of *rights* to new shares in a rights issue. Although the cost of the new shares in a rights issue is the market price P_m of the existing shares, the potential transfer of wealth from old to new investors is a function of the offer price as well as of P_m .

Consider an example. A company has 100 shares in issue and a true value of £10,000. The market price per share is £100, equal to the true price (to make for a close choice between a rights issue and a placement). The company raises £4,000 by issuing 50 new shares at a price of £80 via a rights issue, and all shareholders sell their rights. Suppose the issue announcement is expected to cause the cum-rights share price to fall by 3%, so $E(P_m) = £97$. Then the TERP is $£13,700/150 = £91.3$, and shareholders suffer a permanent loss worth £2 per new share, or £100 in total, from sale of rights at less than their true value. This assumes that the market price later becomes the true value of £93.3, as in the Myers-Majluf model.

The £4,000 could be raised on different terms, for example by issuing 100 shares at a price of £40. Assuming the share price again falls to £97 on announcement, the TERP is $£13,700/200 = £68.5$, and shareholders lose £1.5 per new share or £150 in total.

However, the condition that placement is chosen if $P_p > P_m$ is a very close approximation if the discount to the TERP in the rights issue is assumed to be in the range of 10% to 20%, as it is in the example if the offer price is £80 (the mean discount to the TERP in our sample is 15%). In a placement, the price of existing shares would be $£100 - T$, because the true value would be revealed. Suppose investing costs $T = £100$, so shareholders should be indifferent between a rights issue with offer price of £80 and a placement, since they lose £100 in each. P_p should be close to P_m of £97. In fact, $P_p = P_1 \frac{E}{E+T} = £9,900 \frac{£4,000}{£4,100} \approx £9,659$ or £96.59 per share, since P_p is the market value of the 100 existing shares at the placement price.

of their existing holding in the undefined short term after the issue, before the market discovers the true value. They might wish to sell to raise cash or to achieve a more diversified portfolio. Furthermore, if they are not efficiently diversified, they will care about the idiosyncratic risk of the issuer's shares. Information in prospectuses shows that the shareholders who pre-renounce their rights in rights issues and open offers are usually directors or other individual shareholders, not institutional investors. Individuals are more likely to be liquidity-constrained and poorly diversified than are institutions.

In the light of the above, we extend the theory in a straightforward way by adding a term δ , which reflects the utility derived by existing shareholders from the change in the market price of the shares in the short term post issue. If $\delta = 1$, shareholders derive as much utility per unit of market value as they do per unit of true value; if $\delta = 0$, they care only about true value. The new term allows the rise or fall in market price following an issue to have a weighted value which can be added to the gain in true value from the issue. The total gain π^p from a placement now becomes

$$\pi^p = a + b - T + \delta(P_1 - P_0) - a = b - T + \delta(P_1 - P_0).$$

The corresponding total gain π^m from an *MMS* is

$$\pi^m = \frac{P_m}{P_m + E}(E + a + b) - a + \delta(P_m - P_0).$$

For a firm to choose placement over *MMS*, its realisations of a and b must be such that $\pi^p \geq \pi^m$, which can be written as

$$a + b - T \geq \frac{P_m}{P_m + E}(E + a + b) + \delta(P_m - P_1). \quad (3.4)$$

Multiplying both sides by $P_m + E$, using the fact that $P_1 = a + b - T$ and simplifying gives

$$a + b - T \geq P_m \frac{(1 + \delta)E + \delta P_m + T}{(1 + \delta)E + \delta P_m}.$$

Since $P_p = P_1 \frac{E}{E+T} = (a + b - T) \frac{E}{E+T}$, we can write this as

$$\begin{aligned} P_p / qr &\geq P_m \quad \text{or} \quad P_1 \geq qP_m \\ \text{where } q &= \frac{(1 + \delta)E + \delta P_m + T}{(1 + \delta)E + \delta P_m} \quad \text{and} \quad r = \frac{E}{E + T}. \end{aligned} \quad (3.5)$$

If $\delta = 0, qr = 1$, and (3.5) reduces to the Hertz-Smith condition. But if $\delta > 0$, it is always possible for the placement price P_p to lie below P_m , the price that would have obtained had there been an *MMS*. In contrast, the market price following a placement, P_1 , must always exceed P_m , since $q > 1$. In addition, we show in the Appendix that the mean difference between P_1 and the pre-issue price P_0 is positive, so that a positive average abnormal return is predicted on announcement of a placement.

To complete the model of the choice between placement and *MMS*, we need to consider the determination of P_m in an *MMS*. P_m is the expected value of the firm if it chooses an *MMS*, i.e. $P_m = E(a + b | MMS)$. We have seen that an *MMS* will be chosen if $P_1 \leq qP_m$, or equivalently if $a + b \leq qP_m + T$. The standard formula for a conditional expectation gives P_m implicitly as

$$P_m = E(y | MMS) = E(y | y \leq qP_m + T) = \frac{\int_{y \min}^{qP_m + T} y f(y) dy}{\int_{y \min}^{qP_m + T} f(y) dy}, \quad (3.6)$$

where $y = a + b$, $f(y)$ is the pdf of y and $y \min$ is the smallest value of $a + b$ for an issue to take place. The problem with (3.6) as it stands is that it is analytically intractable. However, by assuming that y has a uniform pdf, we show in the Appendix that

$$a) P_m^T > 0 \quad b) P_m^E < 0 \quad c) P_m^\varepsilon < 0 \quad \text{and} \quad d) P_m^\delta < 0, \quad (3.7)$$

where P_m^x is the partial derivative of P_m with respect to any variable x , and ε is the standard deviation of the true value, ie the degree to which the true value of the firm varies over time. The Appendix describes checks, via numerical simulations, that the results in (3.7) are robust with respect to changes in the pdf for y .

The positive partial of P_m with respect to T is explained by the fact that, as investing costs rise, some firms with a relatively high value, but on the margin of placement, switch from placement to *MMS*. Hence there is a rise in the average value of *MMS* firms and of P_m . The negative effect of E on P_m arises because an increase in E reduces the investing costs per £1 placed, given T , and so has the opposite effect to an increase in T . Increasing the standard deviation of true value extends the left hand tail of the pdf for $a + b$, whilst the effect on the right is limited by the switch into placement beyond a certain value of $a + b$. Hence, the average value of *MMS* firms declines with ε . Increasing δ tends to lower P_m

because, as δ rises, market value becomes more important and placement more attractive. This in turn takes some (relatively) high value firms out of an *MMS* and into placement, and so the average value decreases of firms which undertake an *MMS*.

The results in (3.7) can be used to predict how the market reaction to a placement, and the probability that a firm will choose a placement, are related to firm characteristics. We show in the Appendix that the share price after announcement of a placement is related to firm characteristics as follows:

$$\begin{aligned} a) E(P_1)^T &= P_m^T - 1 > 0 & b) E(P_1)^E &= P_m^E < 0 \\ c) E(P_1)^\varepsilon &= P_m^\varepsilon + 1 < 0 & d) E(P_1)^\delta &= P_m^\delta < 0. \end{aligned} \quad (3.8)$$

The effects of increases in T, E, ε and δ on the market reaction occur via their respective effects on P_m . The intuition is that P_m is an opportunity cost of placement. The higher is P_m , the more undervalued is a firm which still chooses placement, and the higher is its post-issue price. For example, an increase in investing costs T shifts some of the less undervalued firms from placement to *MMS*, which means that the remaining firms choosing placement are more undervalued on average.

The probability that the firm chooses the placement method is related to the above firm characteristics with the *opposite* signs to those in (3.7) and (3.8). Higher T makes choice of placement less probable; higher E, ε and δ make it more probable.

3.3 A simple model of investing costs

Whilst our model does not require an explicit formulation for investing costs T , exploring a particular scheme helps to fix ideas concerning its nature. One reasonable assumption for investing costs per placee is that they consist of a fixed firm-specific investigation cost c plus the cost of disposing of the block of shares. Suppose the number of placees is n . A reasonable function for total investing costs might be

$$T = nc + n\lambda\left(\frac{E}{n}\right)^2 = nc + \lambda\frac{E^2}{n},$$

where λ is a firm-specific constant equal to one half of the bid-ask spread associated with trading one share. The second term on the right represents the cost to a placee of selling

his block. It assumes that the effective bid-ask spread rises with the value of the block sold, $\frac{E}{n}$, as predicted by many models of stock trading under asymmetric information (for example, Kyle, 1985). The investing costs T in a placement are borne entirely by the existing shareholders. Therefore, if a firm is free to choose n , the optimal value will minimise T and be determined as

$$n = \left(\frac{\lambda E^2}{c}\right)^{\frac{1}{2}},$$

making minimised investing costs of

$$T = 2(\lambda E^2 c)^{\frac{1}{2}}. \tag{3.10}$$

In the above scheme, T is positively related to E , c and λ . If liquidity costs are absent or are fixed, the optimal number of places is one.

4 Empirical results

4.1 Market reaction by type of issue

The first predictions we test are that the share price following a placement is higher than it would have been had the firm chosen an *MMS*, and that the average change in share price on announcement of a placement is positive. These predictions imply that the average abnormal return (AAR) on announcement of issues with placed shares is positive and that it exceeds the AAR on announcement of pure rights issues. We measure abnormal returns by the method in Eckbo and Masulis (1992). For each offer, a market model regression is run using daily data and dummy variables to distinguish the event period or periods. The combined estimation and event period is from 85 days before the announcement to 100 days after the close of the offer. We run all the tests using conventional market model abnormal returns and the results are very similar to those reported. The two-day announcement AAR is -3.2% for pure rights issues and 1.9% for issues with placed shares, a difference which is highly significant ($t = 7.0$). We also examine cumulative AARs for longer event periods after the announcement, and the difference persists. The cumulative AAR measured from the day before the announcement to twenty days after the offer close is -2.5% for pure rights issues

compared with 2.6% for issues with placed shares (a t -test of the difference is not possible because offer periods differ in length).

Several previous studies across various stock markets have found an AAR close to zero on announcement of rights issues (for example, Bigelli, 1998). However, our announcement AAR is almost identical to the -3.1% reported by SSL (2000) for a sample of 220 UK rights issues made during 1986-94. The positive AAR for issues with placed shares echoes the positive AARs for stand-alone private placements reported by Cronqvist and Nilsson (2000), Hertz and Smith (1993), SSL (2000) and Wruck (1989).

4.2 Compensation for placees and proxies for investing costs

In this section, we test the relation between observed compensation for placees and proxies for costs of investing in the issuer. Our estimate of the compensation per share received by placees is the discount as at the close of the announcement day plus any cash fee paid to the buyer, as explained in Section 2.2. We denote this estimate $\frac{\hat{T}}{E}$. If we take the view of investing costs put forward in Section 3.3, $\frac{\hat{T}}{E}$ should be loglinearly and positively related to investigating costs c and liquidity costs λ . We proxy c using the issuer's market-to-book ratio m/b and market capitalisation $mcap$, on the justification that m/b is related to the proportion of intangible assets whose value is hard to ascertain and that large firms are easier to investigate than small firms. Regressions involving the m/b variable exclude firms with negative book values. We measure λ by the average bid-ask spread calculated over five trading days starting one month before the issue announcement. The spread for each day is defined as $(\text{offer price} - \text{bid price}) / (\text{offer price} + \text{bid price}) / 2$, using the offer and bid prices reported in Datastream. We assume that $\ln c$ is linearly related to $\frac{m}{b}$ and $\ln mcap$. $\ln \frac{\hat{T}}{E}$ is predicted to be positively related to $\ln \lambda$ and $\frac{m}{b}$, and negatively related to $\ln mcap$. If T is linear homogeneous in E , as suggested in Section 3.3, then $\ln E$ should be insignificant when added to this regression.

After dropping placements by firms with missing measurements and negative book values, we are left with a sample of 325 placements. The regression results are given below with

White-adjusted t -ratios in brackets.

$$\begin{aligned}
 R^2 &= .069 & N &= 325 \\
 \ln \frac{\widehat{T}}{E} &= \text{const.} + .255 \ln \lambda + .004m/b + .009 \ln mcap - .004 \ln E & (4.11) \\
 & & (2.75) & (2.13) & (.18) & (.16)
 \end{aligned}$$

The spread and market-to-book variables have the right sign and are significant at the 1% and 5% levels, respectively. The size variable is wrongly signed but wholly insignificant, as are normalised proceeds. The insignificance of proceeds supports the homogeneity hypothesis proposed in Section 3.3. These results are similar in essence to those in Hertz and Smith (1993) and support the hypothesis that discounts in placements are a device to compensate investors for investigation and liquidity costs.

4.3 Abnormal returns and firm characteristics

The theory predicts that the market reaction to placements is increasing in investing costs T , and decreasing in proceeds E , standard deviation of value ε and the degree δ to which shareholders care about market value post issue. Our proxy for ε is the standard error in a market model regression using daily returns. Unfortunately we do not have a wholly satisfactory proxy for δ . The implicit assumption in omitting δ is that shareholders' utility from the post-issue share price varies across firms independently of the other firm characteristics which we use as explanatory variables. The theory assumes that E , and thus T , differ across firms in a way that is not correlated with the firm's true value. In reality, E and T are likely to be highly related to value through scale effects. We therefore normalise E and T by the firm's market capitalisation pre-announcement.

The OLS results are given below with White-corrected t -ratios in brackets.

$$\begin{aligned}
 N &= 472 & R^2 &= .308 \\
 AR &= \text{const.} + .054 \ln \widehat{T}/mcap - .049 \ln E/mcap - .637\varepsilon & (4.12) \\
 & & (7.68) & (6.98) & (1.74)
 \end{aligned}$$

The coefficients have the predicted signs and $\ln \widehat{T}$ and $\ln E$ are highly significant. There is, however, a potential simultaneity problem in the relation between AR and $\ln \widehat{T}$. Although

the theory assumes that a placement reveals a firm's true value, its market price on the announcement date may, in practice, differ from the price the firm anticipated when it fixed the placement price. If so, the announcement-day discount (and hence \widehat{T}) and the abnormal return may contain a common component by construction rather than through the existence of a behavioural relationship. This common component would generate a spurious positive regression coefficient even if the true coefficient were zero. We check the robustness of the above results by means of a Hausman-Wu variable addition test whereby we examine the significance of the fitted values for $\ln \widehat{T}$ from (4.11) in (4.12). This test may only be executed for the 325 placements for which we have market-to-book and bid-ask spread figures. The test statistic (asymptotically, a standard normal variate in this case) is wholly insignificant at -0.81 which suggests that there is no simultaneity problem with the $\ln \widehat{T}$ term. Despite dropping a third of the observations for the Hausman-Wu regression, the coefficients on $\ln \widehat{T}$, $\ln E$ and ε are virtually the same as their full sample counterparts in (4.12). This provides reassurance that the parameters for sub-samples are stable.

4.4 Probability of placement

The final predictions we test are that the probability that a firm chooses a placement decreases with T , and increases with E and ε . We use a logit regression with the explanatory variables $\ln E$, ε and a proxy for $\ln \widehat{T}$.⁷ We construct the proxy as follows

$$\begin{aligned} \ln \widetilde{T} &= \ln \frac{\widehat{T}}{E} + \ln E && \text{for placements} \\ \ln \widetilde{T} &= [.255 \ln \lambda + .004m/b + .009 \ln mcap - .004 \ln E] + \ln E && \text{for rights issues.} \end{aligned}$$

The term in square brackets is a 'forecast' of what $\ln \frac{\widehat{T}}{E}$ would have been, had a firm which chose a pure rights issue chosen a placement instead. The forecast uses the regression coefficients in 4.11. We have 472 placements and 235 pure rights issues available for the logit regression.

⁷Strictly speaking, the logit pdf is inconsistent with that assumed in the theory. However, logit is the 'industry standard' in this area and is a good vehicle for examining first-order effects of a group of variables on probability.

$$\begin{aligned}
N &= 706 \quad \text{Maddala } R^2 = .63 \\
\Pr(\textit{placement}) &= \frac{e^{\beta'x}}{1 + e^{\beta'x}} \\
\text{where } \beta'x &= \textit{const} - 4.384 \ln \tilde{T}/\textit{mcap} + 3.99 \ln E/\textit{mcap} + 110.39\varepsilon \quad (4.13) \\
&\qquad\qquad\qquad (11.71) \qquad\qquad\qquad (9.17) \qquad\qquad\qquad (8.09)
\end{aligned}$$

The coefficients have the predicted signs and are highly significant.

We end the empirical section with a test of the view that the motive for placements is to reduce agency costs. We discussed this view briefly in the Introduction. One proxy for the extent of agency problems in issuing firms is the concentration of pre-issue ownership; the existence of a small number of large blockholders may indicate that the problems are less severe than in firms with highly dispersed ownership. We measure ownership concentration by the proportion of shares owned by shareholders who have at least a 10% stake, and add this variable to the logit regression (4.13) above. If agency problems are an important motivation for placement, we would expect this variable to have a negative coefficient; firms with concentrated ownership should be less likely to choose a placement. In fact the coefficient on the concentration variable is positive with a *t*-ratio of 2.1.⁸ Furthermore, stakeholdings in excess of 10% are usually owned by individuals rather than by investing institutions. Since individuals are more likely to be liquidity-constrained and poorly diversified than are institutions, concentration may also act as a proxy for the extent to which shareholders care about market value. If so, the positive effect of concentration on the probability of placement is further evidence for the hypothesis that shareholders care about the share price post issue.

5 Conclusion

It is common in the UK to raise seasoned equity from new investors by means of a private placement of rights or shares, rather than via sale of rights on the market. This paper

⁸Wruck (1989) argues that the relationship between agency problems and concentration is negative up to some critical value of concentration but positive thereafter. Allowing for this via the addition of linear *and* quadratic concentration terms to the logit regression still gives coefficient estimates (positive and negative respectively) which refute the agency story.

has developed and tested a theory which envisages that firms and their shareholders choose between a pure rights issue and an issue with placed shares. In a pure rights issue, buyers of rights do not gain additional information about the issuer, and we therefore treat sales of rights as akin to the type of issue analysed by Myers and Majluf (1984), in which information asymmetry prevails around the time of the issue. We treat a placement as an issue which enables potential buyers to investigate the issuer and to arrive at a more accurate estimate of its true value, as in Hertz and Smith (1993). It turns out that most issues with placed shares in our sample do not appear to maximise the true value of the wealth of existing holders, contrary to the prediction of Hertz-Smith. We therefore modify their theory by assuming that shareholders' utility is affected by the post-issue market price. We go on to analyse formally how the choice between a Myers-Majluf style issue and a placement is related to various firm-specific characteristics.

The theory plainly does not incorporate all the factors which might affect the choice of issue method. Agency and possibly other factors may be important in some issues. Also, we have not considered the second-order choice between particular types of placement. Our case is simply that a model based on investigation of value, along the lines we have presented, can explain the widespread use of the placement method. The detailed predictions of the model are strongly supported in our empirical tests.

We conclude by asking what the theory says about the future of rights issues. The question of whether pre-emption rights should be retained 'proved to be by far the most controversial aspect' of the Competition Commission's recent enquiry into underwriting services (1999, p. 19). Will pre-emption rights disappear, as they have in the USA? The theory does not predict that pure rights issues will disappear. Amongst any random sample of issuers, it is in the interests of some to choose a rights issue, and this would no longer be possible if companies had abandoned pre-emption rights. However, there may be costs in retaining them. For example, issues which combine placement with pre-emption rights - the issues with placed shares which we have studied - may be sub-optimal methods of effecting a placement, for some reason. We leave this as an area for future research.

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TABLE 1. SAMPLE

Pure rights issues have no placed shares; other types of issue combine a pro rata offer to existing shareholders with private placement of some shares. Proceeds are from all shares, placed or otherwise. Market capitalisation of issuer is at the close of the day before the offer announcement.

Year	Pure rights issues	Issues with placed shares	<i>Of which: rights issues with pre-renounced shares</i>		Rights issues with private placement	Open offers
1985-88	35	7	2		2	3
1989	17	25	17		4	4
1990	31	13	4		2	7
1991	69	58	24		0	34
1992	38	42	13		5	24
1993	102	95	27		10	58
1994	59	101	44		3	54
1995	34	66	26		1	39
1996 (3/4)	25	65	19		3	43
All issues	410	472	176		30	266
Mean proceeds (Sept 1996 £m)	71.5	18.7	22.9		7.9	17.2
Mean mkt cap of issuer (Sept 1996 £)	344.2	85.8	116.1		13.0	74.1

TABLE 2. REWARDS FOR BUYERS OF PLACED SHARES AS A PERCENTAGE OF THE OFFER PRICE

Reward from the discount is $(P1 - Pp)/Pp$, where $P1$ = mid-point share price at close of announcement day or day offer closes and Pp = offer price. For pre-renounced shares in rights issues, reward from discount is net of half the discount to the theoretical ex-rights price calculated using the mid-point market price the day before the announcement. Shares bought by placees include: (i) pre-renounced shares in a rights issue or open offer; (ii) shares in an open offer not pre-renounced but not taken up by those entitled to them by the offer close; (iii) shares in a private placement accompanying a rights issue or open offer, and not offered pro rata to existing shareholders. Take-up of open offers by existing shareholders is announced by the issuer's broker at the offer close. Data on take-up are missing for 28 open offers. Source: prospectuses, from Primark Extel.

	Discount to announcement day price	Discount to price at offer close	Cash fee for placees	% of total issue bought by placees	N
Rights issues with Pre-renounced shares					
Mean	8.60%	7.86%	1.13%	33.3%	176
Median	5.99%	4.26%	1.25%	33.7%	
Private placements					
Mean	54.31%	70.17%	1.11%	42.1%	30
Median	16.42%	9.76%	1.25%	46.5%	
Open offers					
Mean	11.35%	12.89%	0.94%	47.1%	266
Median	8.26%	7.85%	1.00%	45.7%	
All issues with placed shares					
Mean	13.06%	14.65%	0.96%	41.6%	472
Median	7.26%	7.09%	1.25%	39.5%	

Appendix

Existence of equilibrium

This section establishes the existence of an equilibrium in which i) placees always investigate; ii) the placement price P_p reflects the firm's true value minus investing costs; iii) the firm always accepts the placees' offer price; and iv) firms act according to type, i.e. the equilibrium is separating. If placees always investigate, firms will act according to type. There is no incentive for *MMS* firms to offer themselves for placement because the best price they will be offered is true value minus investing costs, which will be rejected by *MMS* firms (as reversing the inequality in (3.5) shows). However, things are somewhat different from the placees' perspective. If placement firms always place and *MMS* firms always opt for an *MMS*, a placee will be able to gain by making an offer to a placement firm without investigating. In order to rule out such 'cheating' (non-investigation) by the placees, we must add the assumptions that true firm value is revealed to the market some time after the issue regardless of issue method, and that the cost to a placee in lost reputation as a certifier of value is high. Both these assumptions are reasonable. When the true value of the issuer becomes apparent, the placee involved will be seen to have paid the 'wrong' price for the firm. In our model, investigation and certification add significant value to the issue process so that any publicly-identifiable agent claiming to provide certification services, but having a reputation for not investigating its purchases, will not be able credibly to certify firm value via its purchase of shares. It will therefore not be invited into future placements. If the costs of being driven out of the placing business because of reputation loss are sufficiently high, placees will always investigate. They will then always offer the fair price of $P_p = rP_1 = r(a + b - T)$. A higher price implies they will suffer a loss of reputation, a lower price implies a financial loss on the investment. The firm always accepts this price because no placee will pay more and the alternative is an *MMS* which by construction is less advantageous to a placement firm.

Relationship between P_m and firm characteristics under a uniform pdf for y

We analyse the choice between placement and *MMS* under the assumption that the firm chooses to issue. We make this assumption to simplify the analysis: the theory in the main

text before (3.6) does not assume that firms always issue. The pdf of a and b is conditional on the issue condition, $\min[\pi^p, \pi^m] \geq 0$. This conditionality places constraints on the support of $a + b$ that are in addition to those arising through limited liability ($a \geq 0$) and the positivity of the NPV of investment projects ($b \geq 0$). We assume a uniform pdf for $y (= a + b)$,

$$y \sim U[\bar{y} - \varepsilon, \bar{y} + \varepsilon].$$

$\varepsilon (> 0)$ is proportional to the standard deviation of y and therefore represents outsiders' uncertainty about the company's private information.⁹ It is easy to show that there exists a positive value of y min(= $\bar{y} - \varepsilon$) which will guarantee issuance, limited liability and positive NPV of investment projects. Under the above pdf, the price in an *MMS* is the average of the lower and upper bounds for y implied by the *MMS* as specified in (3.6), that is, the average of $\bar{y} - \varepsilon$ and $qP_m + T$. Firms with $y < qP_m + T$ choose an *MMS*. Hence,

$$P_m = \frac{1}{2}(\bar{y} - \varepsilon + qP_m + T).$$

Re-arrangement gives a more useful implicit form for P_m :

$$P_m = \frac{z}{2 - q}, \quad \text{where } z = \bar{y} - \varepsilon + T. \quad (5.14)$$

From (5.14) and the assumed positivity of z , we see that for P_m to be positive, q , which we already know exceeds unity, must be less than two. Using (5.14) and the definition of q in (3.5), it can be shown that

$$a) P_m^T > 0, \quad b) P_m^E < 0, \quad c) P_m^\varepsilon < 0 \quad \text{and} \quad d) P_m^\delta < 0.$$

as in the main text (3.7).¹⁰

⁹It is possible that T and ε may be positively related via a positive association of λ and (possibly) c with ε . However in the empirical work, we measure ε , λ and c separately so that we do not have to model the relationship between these items to run and interpret regressions properly. We henceforth refer to the effect of a change in c or λ on issue price as the effect via T only. Conversely, when we refer to the effect of a change in ε on issue price we mean its direct effect and not its effect via T .

¹⁰The results here refer to partial derivatives which are computed treating T as an independent variable, when in reality it is itself dependent (in part) on E . However, we focus on these partials in anticipation of regressing abnormal returns on E and T . The partials should therefore predict the signs of the coefficients in this regression. The derivations are available on request.

Relationship between market reaction to placement and firm characteristics under the uniform pdf

We now develop testable predictions concerning the market's reaction to SEOs. We show first that the *average* abnormal return on announcement of a placement is unambiguously positive. We have shown in the main text that the condition for choosing a placement is

$$\pi^p = b - T + \delta(P_1 - P_0) \geq 0.$$

If b is less than T , then this implies that P_1 must exceed the pre-issue price P_0 . If b exceeds T , then using the fact that $P_1 = a + b - T$, we have

$$P_1 [= a + b - T] \geq a.$$

Now, P_0 is the expected value of a before announcement of the issue, $E_0(a)$. Assuming that P_0 is an unbiased estimate of the true value of a , the preceding equation implies that

$$E[P_1 \geq P_0 = E_0(a)] \geq 0.$$

Hence, the expected value of the change in market price on announcement of a placement is positive.

We can also predict the signs of first-order effects of a firm's characteristics on the abnormal return when a placement is announced. Let y^* be the point on the support of y that divides *MMSs* and placements, given by

$$y^* = qP_m + T,$$

from (3.5). Then the expected value of P_1 for any given T is

$$E(P_1) = E[y|y \geq y^*] - T = E[(a + b - T) | a + b - T \geq qP_m].$$

An explicit form for $E(P_1)$ follows from this equation and from the uniform distribution for y

$$E(P_1) = \frac{1}{2}(qP_m + T + \bar{y} + \varepsilon) - T.$$

Substituting for P_m using the expression given in (5.14), and rearranging, gives

$$E(P_1) = P_m + \varepsilon - T.$$

It follows from the above and (3.7) that

$$\begin{aligned} a) E(P_1)^T &= P_m^T - 1 > 0, & b) E(P_1)^E &= P_m^E < 0, \\ c) E(P_1)^\varepsilon &= P_m^\varepsilon + 1 < 0, & d) E(P_1)^\delta &= P_m^\delta < 0, \end{aligned}$$

as in the main text (3.8).

Robustness of the results with respect to different pdfs for y

In view of the special nature of the uniform pdf of y used in the above analysis, we check that the effects of T, E, ε and δ on P_m, P_p and the probability of placement are robust with respect to changes in the pdf for y . We assume that y follows, first, a semi-normal pdf (where probability of y monotonically declines with value) and, second, an exponential pdf (where probability of y rises and then falls with value). Using the technique of numerical integration, we compute P_m, P_p and probability of placement for 10,000 parameter combinations given by

$$\frac{T}{E} = .1i, \quad \varepsilon = .5 + .05j, \quad \delta = .1k \quad \text{and} \quad E = .1l \quad \text{for all integral values of } i, j, k \text{ and } l \in [1, 10].$$

In all the experiments, \bar{y} was held at unity by shifting the pdf horizontally by the relevant amount. Then, the 10,000 observations on T, ε, E and δ were treated as explanatory variable data in loglinear regressions explaining P_m and P_p , and in a logit regression explaining the probability of placement (denoted Pr in the table below). The results of these regressions for the semi-normal and exponential pdfs are given below (t -ratios in brackets).

	Semi-Normal					Exponential				
	T	E	ε	δ	R^2	T	E	ε	δ	R^2
Pr	-.747 (209.8)	.213 (60.0)	.437 (61.3)	.149 (41.7)	.878	-.649 (253.7)	.166 (64.9)	.462 (90.4)	.106 (41.6)	.916
P_m	.460 (212.6)	-.125 (57.7)	-.639 (147.6)	-.095 (43.8)	.903	.430 (257.1)	-.101 (60.3)	-.948 (283.2)	-.075 (44.9)	.949
P_p	1.155 (237.5)	-.279 (57.4)	-.019 (2.0)	-.283 (58.1)	.902	1.330 (240.1)	-.289 (52.0)	-.127 (11.5)	-.263 (47.4)	.905

All estimates are significant and have signs which agree with those predicted by the theory above. Further experimentation using the chi-square pdf and over more extreme values for

the parameters produced similar results.¹¹ This is strong evidence that the theoretical results derived using the uniform distribution are robust over a reasonably wide range of ‘sensible’ pdfs for y .

¹¹Exploring the parameter space to allow for more extreme values altered the signs in only one case, namely the coefficient on ε in the P_p regression. In one or two cases this turned out to be positive, albeit insignificantly so. Further analysis showed that this coefficient was unstable over small sub-ranges for ε , and that when it was estimated over these smaller sub-ranges it always took the correct sign. The sensitivity of the coefficient to the level of ε is probably the reason why it is the least significant of all the estimates given in the table.