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The Pricing of Best Efforts New Issues

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ABSTRACT

This paper offers an explanation for the underpricing of best efforts new issues and demonstrates that best efforts contracts allow issuers to use information from the market. If investors obtain information which indicates that a project will not be profitable, their demand will be low and the offering will be withdrawn. If this information is costly, investors will have to be compensated for its purchase through a lower offering price, which means that issuers will have to underprice. This result is consistent with the empirical observation that underpricing is considerably greater for best efforts than for firm commitment contracts.

THE APPARENT UNDERPRICING OF new issues is a long-established puzzle which has recently received much attention. Most of this attention has been on the more common, usually larger firm commitment offerings, with far less focus on the other type of initial public offering (IPO), best efforts. Best efforts offerings account for about 1/3 of all IPOs in the U.S.,[1] and they have some interesting characteristics. One of these is that a best efforts offering may fail. Firms using this type of offering know that even after going through a long, expensive registration process and revealing considerable amounts of information, their offering may be cancelled.[2]

Another interesting feature is that the degree of underpricing seems greater for best efforts than for firm commitment offerings. The average initial return (the percentage difference between the offering price and the first market price) from 1977–1982 was 15% for firm commitment offerings and 48% for best efforts (Ritter (1987b)).

The possibility that a best efforts offering may fail has typically been considered a disadvantage to the issuer, but it may be an advantage. The offering fails if the number of shares ordered does not reach the minimum level chosen by the issuer within a certain amount of time. This essentially

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[1]See Ritter (1987b), p. 271, Table 1. For 1977–1982, 364 of the 1,028 firms which went public (35.4%) were best efforts.

[2]Ritter (1987b) reports that 47% of the best efforts offerings in 1982 failed, while information from *Going Public: The IPO Reporter's* No Go IPO lists gives a rough estimate of 25% for 1983–1984.

gives the issuer an option to back out of the offering after observing demand. If the market has information that the issuer does not have on the success of the proposed projects, then this information should be reflected in the demand for the offering, and this option to cancel will be valuable. The idea that low demand is a bad signal is supported by the fact that companies seldom try again after their first attempt to go public fails (Ritter (1987), p. 276, footnote 8).

This paper considers a model of best efforts contracts in which investors can, for a cost, acquire information which the firm does not already have about a proposed project. Because the issuer can arrange to have the issue withdrawn if demand is too low, the issuer can make the investment contingent on the investors' information. The investors must be compensated for the cost of acquiring information, and thus the issue must be underpriced.

Although it is crucial to this model that the market as a whole has some information that the issuer does not have and cannot get more cheaply through other methods, it is not necessary that investors know "more" in some absolute sense. To evaluate this assumption, it is important to keep in mind the character of best efforts offerings: they are relatively small issues from small, young companies, many of which are start-ups, and they are seldom backed by venture capital. A common example is a scientist with a new drug formula going public to raise funds for production and distribution. Although the scientist may know all about her formula, she probably has no production, management, or marketing experience. Another example is a restaurant owner who wants to expand his restaurant into a chain. Both the scientist and the restaurant owner can benefit from market information, and they both have something to lose from taking public a company that may do poorly.

Section I of this paper contains background information on new issues and a review of recent literature on them. Section II presents the model. In Section III the equilibrium is characterized. The key results are that the issues are underpriced and that investors will choose to evaluate an issue even if issues that get a bad signal fail with probability one. Section IV is the conclusion.

Section I. Background and Institutional Detail

There are two types of offerings for new issues in the U.S., firm commitment and best efforts. For both types, the issuer must set in advance both the price per share and the maximum number of shares to be sold. With firm commitment offerings, the underwriter guarantees the proceeds by buying all of the shares at a given price and then attempting to resell them at the offering price. With best efforts offerings, the underwriter agrees only to put its "best efforts" into selling the issue. Both a maximum and a minimum number of shares is announced, the offering begins on a certain date and it continues until (1) the maximum number of shares is sold (the issue is fully subscribed), (2) at least the minimum number is sold and the issuer feels that the offering has gone on long enough, or (3) the offering has continued quite a while, usually 90 days,[3] without reaching the minimum number of shares, and the issuer decides to cancel the offering.

For firm commitment offerings there is considerable premarket communication with investors, as discussed in Benveniste and Spindt (1989). The issuer and underwriter do "road shows" and collect indications of interest from informed investors before setting the terms of the offering. In fact, Ritter (1987b) gives evidence that the role of the underwriter in firm commitment offerings is as an information-gatherer rather than an insurer. Best efforts offerings typically do not include these premarket activities, however. This paper argues that information-gathering for best efforts offerings is done during the selling period rather than before and is reflected in the number of shares ordered. A best efforts offering is more likely to be used if the offering is too small to justify the fixed costs of a road show and underwriter's time, or if information on the issue is too diffuse to be efficiently gathered by the underwriter.

This research has been greatly influenced by Rock (1986) and Ritter (1984, 1987a, 1987b). In addition to his extensive empirical work on this subject, Ritter's 1987a paper develops a theoretical model of best efforts underpricing in which risk-averse issuers underprice to reduce the probability that their issue will fail. Other work on the underpricing of new issues has not made the distinction between firm commitment and best efforts offerings. The approach closest to this paper is in Chemmanur (1989), in which high quality issuers underprice to encourage information production because that information will increase the price they receive in subsequent issues.[4]

Section II. The Model

The economy contains two types of agents, J issuers and IJ investors (or I investors per issuer). There are two time periods. Both types of agents receive their endowments in the first period and consume only in the second period, and they are all risk neutral.

Each issuer has access to one production technology. Since all issuers are alike, we will describe the problem of a representative issuer. The production technology is linear with a gross return of θ, where θ is a random variable that can take one of two values, G or B, with $G > B = 0$.

The unconditional probability that θ equals G is fixed and known. The investors can, at a cost, improve the forecast. For cost c, the investor can purchase a signal which takes on the values g and b. The improvement in the knowledge of the probability distribution is expressed by

$$P(G \mid g) \equiv P(\theta = G \mid \text{signal} = g) > P(G)$$

[3]After 90 days, the issuer must refile with the SEC to continue selling shares.

[4]Other recent work on IPOs include Allen and Faulhaber (1989), Grinblatt and Hwang (1989), Mauer and Senbet (1988), Tinic (1988) and Welch (1989).

and, of course

$$P(B \mid b) \equiv P(\theta = B \mid \text{signal} = b) > P(B),$$

where $P(G)$ and $P(B)$ are the unconditional probabilities. The signal is about one issue only, and each investor can evaluate only once. All investors who evaluate a particular project receive the same signal on that project. Others cannot observe whether or not an individual has purchased a signal.

There is also an alternative riskless technology. The gross return on this is 1.

A particular market arrangement is imposed on this economy. If the representative issuer wants investors to invest in his technology, he must announce $\{p, N\} \in R^{2+}$ where:

$$p = \text{the price per share;}$$
$$N = \text{the minimum number of shares to be sold.}$$

The issuer really chooses p, N and n, where n is the number of shares which belong to the issuer. The number of shares owned by the issuer can be fixed, however, because the solution depends only on the value of the issuer's shares, pn, relative to the total value of the offering. Fixing either n or p simplifies the model without affecting the results. Without loss of generality, then, assume that the issuer owns one share ($n = 1$). The percentage of the issue that he owns will depend on how many shares are sold to investors.[5]

An issuer must invest his entire endowment, Y units of period 1 good, if he has a successful offering. If the offering fails, he can invest in the riskless technology. It is also assumed that all shares are perfectly divisible.

Each issuer has access to only one technology. Thus, if information reveals his project to be type B, with a negative NPV, the only alternative is to cancel the issue. This seems consistent with best efforts offerings for two reasons. First, securities regulations require issuers to specify in their prospectus what they plan to do with the proceeds, committing them to a particular path. Second, best efforts issuers usually are, by nature, small companies built around a single investment plan. Firms of this type would be unequipped to immediately develop another investment.

To get an underpricing equilibrium, we will make the following restrictions on the parameters of the model.

$$P(G)G > 1 \tag{1}$$

$$\{P(g)P(G \mid g)G + P(b)\}(W - c) > P(G)GW \tag{2}$$

Condition (1) is that the expected total return on issues is greater than that on the riskless asset. Condition (2) simply says that evaluating is efficient. It requires that the cost of the signal, c, is low enough (relative to the investor's

[5]The issuer could also choose a maximum number of shares to be sold. Given the constant returns to scale technology of this model, however, there is no reason for the issuer to ever choose a binding upper limit to the number of shares sold. Again, without loss of generality, we can ignore this possiblility.

endowment, W) and the increase in the expected return to evaluation is large enough that purchasing the signal increases expected output. We will also assume that there are many issuers and many investors per issuer (i.e., J and I are large). These conditions are sufficient for an underpricing equilibrium.

The timing is as follows.

Period 1:

(a) the issuers announce an offering, $\{p, N\}$,
(b) the investors acquire/do not acquire signals,
(c) the investors order shares in issues,
(d) shares in issues are allocated, and
(e) investment is made in the alternative technology.

Period 2:

(a) issues pay off, everyone consumes.

The timing is significant for two reasons. First, if an offering fails, there is still time to invest in the alternative security, but it is too late to order shares in another issue. Second, because everyone places their orders at once, an investor cannot observe the orders of other investors before placing his own order.

Section III. An Underpricing Equilibrium

In this section we will find the equilibrium of our model and show that issues will be underpriced. Because of the timing, this is a two-stage game. The issuer has to "move first" by announcing an offering, and so he must have expectations not only about the choices made by other issuers, but also about how the investors will react to his choices. The investor's problem is less complicated since she makes her decisions given the announcements of the issuers. However, she must still have expectations about the actions of the other investors.

Because the investor is risk neutral, she simply chooses the investment strategy with the highest expected return. The investor has two choices to make: whether or not to acquire a signal, and what to invest in. This leads to three[6] distinct alternative strategies:

(1) Invest in the riskless technology.
(2) Order shares in an issue without evaluating it.
(3) Evaluate, and order shares in an issue.

Those who follow Strategy 2 could be thought of as uninformed investors, while Strategy 3 will lead to informed investors. Those following Strategy 1

[6]There are other possible strategies, but they are clearly dominated in equilibrium, given conditions (1) and (2), and thus they can be ignored without loss of generality.

are completely out of the new issue market. It is assumed for Strategy 3 that the investor evaluates an offering and then invests in that offering only if the evaluation results in a good signal, g. If the investor gets a bad signal, he will invest in another offering without evaluating it, since he is only allowed to purchase one signal.[7]

The following are the expected consumptions for an investor following each of the three strategies, given that all other investors are following Strategy 3. We will show later that Strategy 3 will be the Nash equilibrium choice. These expected values depend on the probability that the issue will succeed, $P(S)$.

$$c^{[1]} = W \tag{3}$$

$$c^{[2]} = \{P(S)E(r \mid S) + 1 - P(S)\}W \tag{4}$$

$$\begin{aligned} c^{[3]} = \{&P(g)[P(S \mid g)E(r \mid S, g) + 1 - P(S \mid g)] \\ &+P(b)[P(S)E(r \mid S) + 1 - P(S)]\}(W - c) \end{aligned} \tag{5}$$

Although all investors will order shares in equilibrium, there is still a chance that the offering will fail, in which case the investor must invest in the alternative riskless security which has a gross rate of return of 1. We are treating the expected returns and the probability of being allocated shares as being the same for all issues because in equilibrium all issuers will choose the same offering.

The issuer chooses p and N to maximize his expected consumption subject to the constraint that it is optimal for investors to do what he expects them to do. When choosing p, the issuer wants the highest offering price possible as long as it is still low enough for investors to be willing to order shares. When choosing N, the issuer will either choose 0, allowing all issues to succeed, or choose an N such that the issue will be withdrawn only when demand is low enough to indicate that the informed investors received a bad signal.

The issuer must also decide whether or not he wants investors to evaluate. It will be shown that, given the parameter restrictions (1) and (2), there is no Nash equilibrium with only uninformed investors (all investors choosing Strategy 2). Basically, the parameter restrictions guarantee that the signal is cheap enough and strong enough that investors will want to purchase it. Thus, the problem of the issuer is simply to maximize his expected consumption subject to the constraint that investors are willing to evaluate and buy shares in the offering (all investors will choose Strategy 3).

Thus, consider the case where the issuer wants all investors to follow Strategy 3, and he sets N so that the issue will fail if investors receive a bad signal and succeed if investors get a good signal.[8] Later we will consider the

[7] The investment problem has the same basic form even if the investor is allowed to purchase signals on all of the issues rather than only one, as long as there is a fixed cost per signal. An investor who gets a good signal will invest all remaining capital in that project, while an investor who gets too many bad signals will eventually stop purchasing signals, because the fixed cost of another evaluation will be too large relative to his remaining capital.

alternative choices for N and for the investors' strategies. For this first case, the issuer's maximization problem is:

$$\max_{p} P(g)E(r \mid g)p + P(b)Y$$

subject to

$$\{P(g)E(r \mid g) + P(b)[P(g)E(r \mid g) + P(b)]\}(W - c) \geq W \qquad (6)$$

$$\{P(g)E(r \mid g) + P(b)[P(g)E(r \mid g) + P(b)]\}(W - c) \geq \{P(g)E(r \mid g) + P(b)\}W \qquad (7)$$

The constraints, (6) and (7), are incentive-compatibility constraints which guarantee that the price chosen by the issuer is a Nash equilibrium price for investors.[9] Equation (6) requires that the expected consumption for an investor following Strategy 3 is at least as high as the expected consumption for an investor following Strategy 1, given that all other investors are expected to follow Strategy 3. Similarly, equation (7) requires that following Strategy 3 is at least as good as following Strategy 2.

The optimal price p that solves this maximization problem will be such that there is underpricing, with $E(r \mid g)$, the expected return on successful issues, strictly greater than 1 as long as there is a cost to evaluation (note that, with risk neutrality, you might expect issuers to be able to attract investors as long as the expected return is equal to the return on alternative securities). Underpricing occurs because the offering price must be low enough to compensate investors for the cost of evaluation. This can be seen from equation (6). If both sides of the equation are divided by $W - c$, we have something greater than one on the left side and a weighted average of one and $E(r \mid g)$ on the right side, with all the weights positive and adding up to one. A weighted average of one and $E(r \mid g)$ can only be greater than one if $E(r \mid g)$ is greater than one.

In addition to underpricing, we have another interesting result. Investors will pay to see the signal even if all issues that get bad signals fail with probability one. The reason that they are still willing to purchase a signal is that it gives them a higher probability of finding a successful issue. By the

[8] Since all investors who evaluate an issue get the same signal, I investors will evaluate the issue and, if the signal is good, all I investors will order shares. If the signal is bad, none of the I investors who evaluated that offering will order shares. That offering may still get some orders, however, since investors who evaluated another issue and got a bad signal may order shares in that offering at random. Our assumption that I is large implies that, if N is chosen properly, there is very little chance of an issue succeeding purely because of these random orders by uninformed investors. In fact, we will assume that issues that get a bad signal will fail with probability one. This will allow us to show that, even in this extreme case, it is still optimal for each investor to pay to purchase the signal.

[9] Since we have assumed that issues that get a good signal will succeed and that issues that get a bad signal will fail, the formulas for expected consumption given in equations (3)-(5) have been adjusted to reflect the assumptions that $P(S) = P(g)$ (the probability of an issue succeeding is the probability that investors will get a good signal on it) and $P(S \mid g) = 1$ (if investors get a good signal, the issue succeeds).

time an offering fails, their only choice is to invest in the alternative security with a return of 1. On the other hand, if they evaluate before investing, there is still time to order shares in another issue if they get a bad signal on the first issue. This opportunity cost is consistent with the procedures for best efforts offerings in the U.S.: investors' funds are put into escrow until the offering is either completed or cancelled. To maintain a claim on the shares, the investor loses access to those funds.

It can easily be shown that the binding constraint in the issuer's maximization problem will be equation (7), which will hold with equality. Rearranging this to solve for $E(r \mid g)$, it can again be shown that the expected return on successful issues is greater than one. Substituting from equation (1) and rearranging further would give us the optimal offering price.

A possibility that we have not yet considered is that the issuer will not want his offering to fail, even if investors receive a bad signal. After all, the signal is not perfect and the issuer will make a large profit if the underlying technology turns out to be good. Whether or not the issuer chooses N equal to 0 depends on how much the issuer has invested in the issue, Y. If Y is large, he may want the issue to fail (if investors get a bad signal) since this will allow the issuer to invest instead in the alternative security. We will show that underpricing occurs even if the issuer chooses $N = 0$. The issuer's maximization problem is:

$$\max_{p} E(r)p,$$

subject to

$$\{P(g)E(r \mid g) + P(b)E(r)\}(W - c) \geq W, \tag{8}$$

$$\{P(g)E(r \mid g) + P(b)E(r)]\}(W - c) \geq E(r)W. \tag{9}$$

Note that, with $N = 0$, $P(S) = 1$ (i.e., no issues fail). The constraints again require that Strategy 3 is an incentive-compatible Nash equilibrium choice for investors. It can be shown that, when the optimal choice is $N = 0$: 1) the binding constraint will be (9), which means that $E(r) \geq 1$; and 2) $E(r \mid g) > E(r)$. Therefore, in equilibrium $E(r \mid g) > 1$. Underpricing occurs whenever investors are evaluating issues.

Finally, we must show that investors will choose [3] rather than [2]. In other words, we must show that investors will want to purchase signals. To see this, we must look at the maximization problem for the issuer with incentive-compatibility constraints requiring the price to be such that Strategy 2 is a Nash equilibrium for investors. If investors are not evaluating, there is no reason for the issuer to choose an N other than zero, and so the issue will succeed with probability one. The issuer's maximization problem, assuming that all investors will follow Strategy 2, includes the incentive compatibility constraints:

$$E(r)W \geq W \tag{10}$$

$$E(r)W \geq \{P(g)E(r \mid g) + P(b)E(r)\}(W - c) \tag{11}$$

Again, the constraints guarantee that the investors will make the choice the issuer expects them to make. If the second constraint (equation (11)) is violated, each investor would follow Strategy 3 given that she expected all other investors to follow Strategy 2. This obviously is not an equilibrium. It can be shown that, given the assumptions made in Section II, equation (11) cannot be satisfied. In other words, if the signal is cheap enough and accurate enough to increase investors' expected returns, the investors will purchase it.

We've shown that all investors will purchase signals in equilibrium even though all signals on a particular issue are the same. It may seem that a mixed strategy equilibrium would be more efficient in this environment, since only part of the investors would pay the cost of evaluation. In fact, a mixed strategy equilibrium would be less efficient, even if issues that received bad signals failed with probability one, because investors' funds would be allocated less efficiently. Given our parameter assumptions, evaluating increases expected output, even though there is a cost to it, because it gives the investor a better chance of investing in a good project. The crucial assumption is that there is an opportunity cost to investing in a proejct that later fails, since it will be too late to invest in another project. The only Nash (competitive) equilibrium for investors is a pure strategy equilibrium.

There is a role, however, for some cooperation among investors. Since all signals on a particular issue are alike, there are obvious economies of scale to pooling information. There may also be incentive problems when purchasing information from someone, though, particularly if (as in this model) others cannot observe whether or not a particular person has obtained information. If someone is paid a fixed amount for evaluating, his incentive is to simply make up a report and save the cost of purchasing the signal.[10] One way of giving him an incentive to purchase the information and report it accurately is to make his payment dependent on whether or not his report is correct, for instance by requiring him to invest his own portfolio based on his report. This gives us some insight into the advantages of this particular market arrangement as a way of gathering information from the market. Making the success of an issue dependent on demand should be an incentive-compatible way of getting accurate information because it forces investors to "put their money where their mouth is."

Section IV. Conclusion

This paper has demonstrated that best efforts contracts allow issuers to use information from the market. If investors have information which indicates that a project will not be profitable, their demand will be low and the offering will be withdrawn. If this information is costly, investors will have to be compensated for it through a lower offering price, which means that issuers will have to underprice. This result is consistent with the empirical

[10]For a description of the problems with purchasing information in a similar environment and of how coalitions among investors may be arranged, see Boyd and Prescott (1986).

observation that underpricing is considerably greater for best efforts than for firm commitment contracts.

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