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The Choice between Firm-Commitment and Best-Efforts Offering Methods in IPOs: The Effect of Unsuccessful Offers*

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Previous research questions the use of best-efforts offering methods for IPOs since firm-commitment offerings have lower direct issue costs. This paper attempts to explain the choice of best-efforts methods by focusing on an indirect offering cost: the possibility that an offering will be unsuccessful. Determinants of offering success, including offering size, price, underwriter reputation and the clustering of filings, have different impacts on the likelihood of success for these offering methods. Unsuccessful offerings are also found to be costly. Issuers select the offering method that provides the greater ex ante probability of success, all else equal, consistent with cost minimization. *Journal of Economic Literature* Classification Numbers: G24, C25. © 1998 Academic Press

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I. INTRODUCTION

Virtually all firms going public use either best-efforts or firm-commitment methods to market their initial public offerings (IPOs). Once the Securities and Exchange Commission (SEC) approves the registration of a firm-commitment IPO, the investment bank purchases the shares from the issuer and then attempts to resell them to the public. In a best-efforts offering,

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the bank only pledges to provide its "best efforts" to sell between some prespecified minimum and maximum number of shares. Several theoretical studies predict that direct offering costs should be lower if an issuer uses best-efforts offering methods. Ritter (1987) and Benveniste and Spindt (1989) argue that IPO initial returns should be lower and Mandelker and Raviv (1977) and Booth and Smith (1986) argue that investment bank compensation should be lower for issuers using best-efforts methods. The empirical evidence is not supportive of these theories, however. Ritter (1987), for example, finds that best-efforts offerings have higher direct offering costs (underpricing and investment bank compensation), controlling for offering size. This evidence is puzzling since it suggests that issuers choosing best-efforts methods could have reduced offering costs by using firm-commitment methods. Why then did they choose best-efforts offerings?

In this paper, I attempt to explain the puzzling choice of best-efforts methods in IPOs by focusing on an indirect offering cost: the possibility that an offering will be unsuccessful. After SEC approval, a best-efforts IPO can be canceled if a minimum level of sales is not met. Both firm-commitment and best-efforts IPOs can also be withdrawn *prior* to SEC approval.[1] I argue that an IPO would have different probabilities of success if offered by best-efforts or firm-commitment methods. I also argue that unsuccessful offerings are costly to issuers. Cost minimizing issuers, therefore, should select the offering method with the highest probability of success, all else equal.

The empirical evidence presented in this paper is consistent with these propositions. For firm-commitment IPOs between 1979 and 1982, the likelihood of success is positively related to offering price and size and the reputation of the investment bank. In contrast, the likelihood of best-efforts offering success over the same period is *negatively* related to offering price and size and the reputation of the investment bank. An issuing firm of given characteristics, therefore, has different probabilities of success using best-efforts and firm-commitment methods.

Unsuccessful offerings are also found to be costly for issuers. Less than 10% of issuers having unsuccessful best-efforts or firm-commitment IPOs ever go public. Also, for successful issuers, the ex ante probability of offering success (estimated using a probit model) has a negative impact on investment bank compensation (cash spread, expenses and warrants). The relation is similar for best-efforts and firm-commitment offerings.

[1] Most existing studies have ignored this second mechanism through which an offering can be unsuccessful (see, for example, Ritter, 1987; Benveniste and Spindt, 1989; Chua, 1995). A third mechanism of failure, not addressed in this paper, is when an issuer stops the offering process before registration documents are filed with the SEC. Unfortunately, these cases are not identifiable.

Finally, to assess the effect of offering success on offering method choice, I carry out a probit regression where the dependent variable takes the value one if the issuer uses the firm-commitment method. I include the difference in ex ante predicted probabilities of offering success (firm-commitment minus best-efforts) as an independent variable in this probit regression. This variable has a significantly positive effect on the likelihood that the firm-commitment method is used. This is consistent with my prediction that cost-minimizing issuers select the offering method which provides the highest probability of success, all else equal.

The organization of the remainder of this paper is as follows. In Section II, predictions regarding the determinants of success and the effect of success on offering method choice are developed. Section III describes the primary data set used in the paper. Analysis of the determinants of success is presented in Section IV. Evidence on the costs of unsuccessful offerings is presented in Section V. Section VI examines the empirical relation between the probability of success and offering method choice. The robustness of the evidence is examined in Section VII. Finally, I summarize the paper in Section VIII.

II. OFFERING SUCCESS AND UNDERWRITING METHOD CHOICE

The Determinants of Offering Success

There are three theories in the literature that can be used to make predictions regarding the determinants of IPO success. Benveniste and Spindt (1989) present a model where investment banks precommit to allocation and pricing schemes that induce investors to truthfully reveal information regarding the value of securities being issued prior to final pricing. When information revealed is sufficiently negative, offerings can be withdrawn.[2] Benveniste and Spindt argue that negative information is more likely to arise in offerings by firms whose value, ex ante, is more uncertain. This suggests that offerings by firms with greater ex ante valuation uncertainty are more likely to be unsuccessful.[3]

Welch (1992) presents a model where investors have some ability to "eye" the demand of prior investors contacted to purchase shares. Offerings can be unsuccessful if early demand is weak. They are more likely to succeed

[2] Withdrawals would not affect the equilibrium in Benveniste and Spindt's model since the return to regular investors is zero whether the shares are issued or not. Sherman (1992) presents a similar model solely for best-efforts offerings.

[3] Cho's (1992) signaling model also predicts that offerings by firms with greater ex ante valuation uncertainty are more likely to be unsuccessful.

if communication between investors is reduced, however. Welch argues that investment banks play an important role in reducing communication by offering shares diffusely (e.g. nationally or internationally). Offerings by banks that place shares widely are more likely to succeed.

Booth and Chua (1996) present a model of the IPO market where information gathering costs are reduced when offerings are clustered. This results in a greater precision of IPO valuation by investment banks, increasing the probability of offering success (see Booth and Chua, pp. 298–299). While this suggests that the likelihood of offering success should increase during periods of heavy IPO volume, the opposite relation could hold if investor resources are limited.

While the theories generally do not distinguish between best-efforts and firm-commitment offerings, there are many differences between these methods. Importantly, the offering price is set much earlier in the IPO process for best-efforts offerings. For IPOs, the initial prospectus must indicate a tentative offering price range. During the SEC's review of registration documents, which include the initial prospectus, the investment bank in a firm-commitment offering conducts a marketing campaign to solicit interest. When the offering is approved for formal sales, the issuing firm together with its investment bank set the final price, which can differ from the initial range. In a best-efforts offering, banks generally do not solicit indications of interest prior to final pricing.[4] The offering price, therefore, rarely differs from that in the initial filing.[5]

Differences in the timing of IPO pricing should affect the relation between offering characteristics and the probability of success. If negative valuation information arises between the filing and offering, a best-effort offering would be unlikely to succeed since its price, set at the filing date, would be too high. In contrast, a firm-commitment offering could succeed if the issuer chooses to lower its price. Offering characteristics associated

[4] Bloomenthal (1996) states that "A principal difference between a firm underwriting and a best-efforts underwriting ... is that in a best-efforts underwriting, there will be no underwriting group and much of the selling cannot take place until after the registration statement has become effective" (p. 8–68). He also notes that "in a best-efforts underwriting, distribution of the preliminary prospectus may not occur until after receipt of [the SEC] staff's comments" (p. 8–97). This is partly because best-efforts are marketed to small retail investors (investment bankers indicate that institutions avoid these offerings) making multiple mailings of prospectuses impractical (offers to buy cannot be solicited without a prospectus). See Ibbotson and Ritter (1995) and Bloomenthal (1996) for a more complete discussion of the differences between firm-commitment and best-efforts offering methods.

[5] Less than 8% of the best-efforts IPOs in my sample have price adjustments. Only one third of those cases result in changes to the offering size (i.e., in two-thirds of the cases, prices and shares are adjusted leaving the proceeds to be raised unchanged). Booth and Chua (1996, p. 298) and Sherman (1992, p. 783) also note that best-efforts offerings rarely have price adjustments.

with the likelihood that negative information arises, such as ex ante firm valuation uncertainty, should have a less significant effect on the likelihood of success in firm-commitment offerings. Welch (1992) also notes that best-efforts offerings take longer to sell than firm-commitment offerings. Communication between investors would be more difficult to prevent, even if shares are placed widely. The breadth of the investment bank's distribution channel should, therefore, have a more significant impact on offering success for firm-commitment offerings. Finally, information spillovers due to the clustering of offerings should have a more significant impact on the success of best-efforts offerings since these offerings do not benefit from pre-market information acquisition (see Booth and Chua, 1996). If the clustering of offerings affects IPO success due to limited investor resources, it would not be possible to predict differences in the effect of this factor for firm-commitment and best-efforts IPOs.

There are two testable propositions that emerge from this discussion. First, for both firm-commitment and best-efforts IPO, the likelihood of success should be positively related to the breadth of the investment bank's distribution channel and the clustering of offerings and negatively related to ex ante firm valuation uncertainty. The clustering of offerings could have a negative effect on the likelihood of success, however, if investor's have limited resources. Second, the effect of ex ante firm valuation uncertainty and the clustering of IPOs on offering success should be less significant for firm-commitment offerings. In contrast, the effect of the breadth of the investment bank's distribution channel on offering success should be more significant for firm-commitment offerings. The effect of the clustering of offerings on offering success could be more or less significant for firm-commitment IPOs, however, given limited investor resources.

The Costs of Unsuccessful Offerings

As noted above, offerings are unsuccessful if either investors do not believe that the issuing firm has good future prospects or the investment bank does an inadequate job of marketing the issue (e.g., by not placing the shares widely). It is generally not possible to identify the primary reason for an offering's failure.[6] As a consequence, firms having an unsuccessful IPO "may be lumped with other businesses whose offerings did not sell because of questionable accounting practices or gross mispricing" (Lerner, 1994, p. 312). An indirect cost of an unsuccessful offering, therefore, is that the issuer may find it difficult to ever raise public equity capital. It should

[6] This is partly because the issuer and its investment bank are limited in the reasons they can give for the withdrawal of an offering (the so-called "market out" provisions in the underwriting agreement; see Bloomenthal, 1996). The most common reason given is "adverse market conditions." This does not allow the market to identify the true source of failure.

be noted that if unsuccessful offerings are solely due to investment bank marketing mistakes, then a failed offering should not affect the firm's ability to return to the capital markets.

Issuers that are more likely to be rejected by investors should also have to pay higher fees to retain an investment bank. Shares in issues that are less likely to succeed would require more extensive due diligence and marketing activities. Association with unsuccessful offerings should also damage a bank's reputation because part of the bank's role is that of screening out unsuitable firms before signing on to underwrite their securities.[7] Investment banks generally cannot be fully compensated for additional marketing effort or damage to reputation in offerings that are actually unsuccessful as the National Association of Securities Dealers (NASD) only allows for reimbursement of out-of-pocket expenses in these cases (Bloomenthal, 1996).[8] Thus, banks should initially demand higher fees in offerings that are less likely to succeed, all else equal, so that expected fees represent appropriate compensation for their additional efforts and potential reputational costs. Again, it should be noted that if unsuccessful offerings are attributable to investment bank mistakes, then this prediction would be reversed. Issuers in a competitive market that are more likely to receive inadequate investment bank services should negotiate *lower* fees.

There are two alternative testable propositions that emerge from this discussion. Unsuccessful offerings will be costly to issuers if failure is due to *either* a rejection of the issuer by investors or an inadequate marketing effort by the investment bank. Issuers having unsuccessful offerings would be unlikely to return to the capital markets. Also, investment banks should demand greater compensation in offerings that are less likely to succeed. On the other hand, unsuccessful offerings will not be costly to issuers if failure is solely due to an inadequate marketing effort by the investment bank. Issuers having unsuccessful offerings would likely return to the capital markets. Also, issuers having IPOs that are less likely to succeed should pay lower investment banking fees.

[7] Chemmanur and Fulghieri (1994) argue that a bank's reputation evolves based on its track record for taking public "high quality" firms. If an offering is unsuccessful because the issuing firm is not viewed to have good future prospects, then association with unsuccessful offerings should damage a bank's reputation. The bank's willingness to withdraw an offering that it discovers to be of low quality could be viewed positively. Unsuccessful offerings do raise questions, however, regarding the stringency of the bank's initial screening of the firm. Dunbar (1998) finds that banks associated with unsuccessful IPOs lose market share, consistent with the argument that unsuccessful IPOs damage the bank's reputation. See also Hughes and Thakor (1992), who develop a model in which poor postissue performance of the firm hurts the underwriter's reputation.

[8] These "accountable" expenses also cannot include reimbursements for general overhead, salaries, supplies, or other similar expenses.

Unsuccessful Offerings and Offering Method Choice

It is possible to make predictions regarding the effect of unsuccessful IPOs on offering method choice conditional on the empirical support for the propositions developed above. If issuers have different probabilities of success using firm-commitment and best-efforts offering methods and unsuccessful offerings are costly then cost minimizing issuers should select the offering method which has the greatest probability of success, all else equal. On the other hand, if unsuccessful offerings are not costly or issuers have similar probabilities of success using firm-commitment and best-efforts offering methods, then the probability of success should not affect the offering method choice.

III. DATA

My initial data set focuses on IPOs that are filed with the SEC between 1979 and 1982. The filings are identified in weekly editions of Investment Dealer's Digest (IDD). Each edition of IDD from January 1979 to December 1982 is searched for announcements of IPO filings. IDD specifies the firm name, the lead investment bank, pricing information and the type of offering method (firm-commitment or best-efforts[9]) for each filing. Pricing information includes the number of shares to be sold and the maximum filing price (or expected offering price for best-efforts offerings[10]). Editions of IDD from January 1979 to December 1983 are then searched to find the outcome of the filing. For offerings approved by the SEC for sale, IDD provides information on the offering date and terms. I examine Jay Ritter's IPO data base (derived using Howard and Company's Going Public: The IPO Reporter) to ensure offerings approved for sale are correctly noted. Ritter's data base is also used as a more detailed source of firm and offering characteristics. For these offerings, CRSP Nasdaq tapes or the OTC daily stock price record is used to obtain secondary market price information.

Firm-commitment and best-efforts filings that are not identified as approved by the SEC are classified as unsuccessful.[11] Best-efforts offerings

[9] The firm-commitment offering method is viewed as a default so IDD only explicitly indicates offering method if it is best-efforts.

[10] IDD occasionally provides the entire filing range for firm-commitment offerings. It also occasionally indicates only an expected offering price. The number of shares includes secondary shares. Results in later sections are unaffected if I only consider IPOs with primary shares.

[11] Unsuccessful offerings are reported in IDD if the issuer formally writes a letter to the SEC to withdraw its offering. Lerner (1994) notes another mechanism for offerings to be unsuccessful prior to SEC approval. Once a registration statement has been on file with the SEC for nine months, the SEC declares the offering abandoned. Since I examine IDD for one year after the last possible filing date, all filings not offered or formally withdrawn are likely to fall in the category of abandoned offerings. Approximately 30% of both firm commitment and best-efforts offerings do not have formal withdrawal announcements in IDD.

can also be unsuccessful if there are insufficient sales after SEC approval. Offerings identified to be approved by the SEC that do not show up on the CRSP Nasdaq tapes or the OTC daily stock price record are also classified as unsuccessful.[12] The analysis in the remainder of the paper focuses on this classification of successful and unsuccessful offerings.[13]

Table I provides descriptive statistics on best-efforts and firm-commitment filings between 1979 and 1982. Panel A reports means and standard deviations of filing characteristics of successful and unsuccessful offerings. Investment bank reputation (based on Carter and Manaster's, 1990, 0 to 9 ordinal ranking) is much higher for firm-commitment filings (banks not identified by Carter and Manaster are assigned a zero ranking). The average number of contemporaneous filings of the same contract type in the month of the filing is approximately 24 and 10 for firm-commitment and best-efforts filings, respectively. The average filing price (expected for best-efforts and maximum for firm-commitment) and size (in constant January 1979 dollars) are larger for firm-commitment offerings. Panel B reports descriptive statistics for successful offerings. Investment bank reputation, offering size and offering price are greater for firm-commitment offerings. Panel B also reports descriptive statistics for sales of successful issuing firms in the year prior to the offering (in millions of dollars). Sales are substantially higher for firm-commitment than best-efforts issuers.

Table II presents evidence on the number of IPOs broken down by year and eventual success. Of the 265 best-efforts offerings, 68% succeed with a range of 56% in 1981 to 92% in 1979 (approximately 50% of unsuccessful offerings are withdrawn prior to SEC approval and 50% fail after SEC approval due to insufficient sales). Of the 481 firm-commitment offerings, 71% succeed and this ranges from 61% in 1982 to 92% in 1980. Differences

[12] It should be noted that this potentially biases upward the number of offerings that are claimed to be unsuccessful as some offerings may only trade on regional exchanges originally. The extent of this bias is probably small, however, as I do not find that any of these firms ever move to a national exchange. These filings also do not have a significant effect on the analyses in later sections. Results documented later are qualitatively similar if these offerings are dropped.

[13] Withdrawn and failed (due to insufficient sales) best-efforts offerings arguably should be considered separately. Withdrawn offerings are abandoned prior to SEC approval whereas failed offerings are rejected by investors after SEC approval when the investment bank still thought the offering could succeed. Given these differences, the determinants of offering success could be different for these offerings. Also, firms generally state reasons for unsuccessful offerings when they are formally withdrawn. Offerings withdrawn (firm-commitment or best-efforts) due to "adverse market conditions" should be different than those that have difficulty obtaining SEC or State ("Blue Sky") regulatory approval. Empirically, however, the differences between these various subclassifications of unsuccessful offerings are not important (as noted earlier, most withdrawal announcements simply indicate that the offerings are canceled due to adverse market conditions).

TABLE I
Descriptive Statistic on Filing and Offering Characteristics of Successful and Unsuccessful Firm-Commitment and Best-Efforts IPOs between 1979 and 1982

	Firm-commitment IPOs		Best-efforts IPOs	
	Mean	Standard deviation	Mean	Standard deviation
	Panel A: Successful and Unsuccessful Offerings			
REPUTATION	4.04	2.9	0.75	1.7
FILINGS	24.47	14.8	9.66	4.2
FILE SIZE	7.91	9.8	2.45	2.2
FILE PRICE	9.14	6.8	1.10	2.3
	Panel B: Successful Offerings			
REPUTATION	4.78	2.7	0.71	1.6
OFFER SIZE	8.61	10.8	2.20	1.5
OFFER PRICE	9.80	6.2	0.77	1.1
SALES	24.22	71.7	0.25	0.8

Note. This table examines 343 successful and 146 unsuccessful firm-commitment IPOs as well as 177 successful and 90 unsuccessful best-efforts IPOs. Characteristics examined include Carter and Manaster's (1990) 0 to 9 ordinal ranking of the lead investment bank [REPUTATION], the number of contemporaneous filings of the same contract type in the calendar month the IPO is filed [FILINGS], the size (expected for best-efforts, maximum for firm-commitments) of the offering in constant million dollars (constant January 1979 dollars) indicated in the initial filing [FILE SIZE], the price (expected for best-efforts, maximum for firm-commitments) indicated in the initial filing [FILE PRICE], the maximum size of the successful offering in constant millions of dollars (constant January 1979 dollars) [OFFER SIZE], the price of the successful offering [OFFER PRICE], and the sales of the offering firm in millions of dollars over the 12 months prior to the offering [SALES].

between the probabilities of success for firm-commitment and best-efforts offerings are not statistically significant.

Table II also presents evidence on proceeds uncertainty for firm-commitment and best-efforts offerings. Following Ritter (1987), proceeds uncertainty is defined as the absolute percentage deviation of actual from expected gross proceeds in an offering (proceeds uncertainty for unsuccessful offerings equals 1). Actual proceeds include overallotment shares sold in firm-commitment offerings. The expected proceeds are the number of shares in the initial filing multiplied by the expected price. For best-efforts and some firm-commitment offerings, the expected price is specified directly by IDD. For other firm-commitment offerings, the expected price is defined as $(LPR + HPR)/2$ where LPR is the low filing price and HPR is the high filing price. If IDD only specifies HPR, LPR is defined as $HPR/1.15$ since Hanley (1993) finds the average percentage filing range to be 15%. For the full sample, the proceeds uncertainty for best-efforts and firm-commitment offerings are 41.3 and 41.2%, respectively (not significantly different). For

TABLE II
Description of the Success of Firm-Commitment and Best-Efforts Initial Public Offerings Filed with the SEC between 1979 and 1982

	Filing period				
	1979–1982	1979	1980	1981	1982
Successful best-efforts	179	12	65	65	37
Unsuccessful best-efforts	86	1	9	50	26
Total best-efforts	265	12	74	115	63
% Successful best-efforts	67.5	92.3	87.8	56.6	58.7
% Absolute deviation of actual from expected gross proceeds	41.3	10.4	18.7	54.5	50.2
Successful firm-commitments	343	18	95	183	47
Unsuccessful firm-commitments	138	4	8	96	30
Total firm-commitments	481	22	103	279	77
% Successful firm-commitment	71.3	81.8	92.2	65.6	61.0
% Absolute deviation of actual from expected gross proceeds	41.2	25.0	19.6	46.5	55.4

Note. This table reports the number of initial public offerings filed with the SEC between 1979 and 1982 broken down by offering type, success, and filing year. Also reported is the percentage of unsuccessful offerings and average absolute percentage deviation of actual from expected gross proceeds, broken down by offering type and filing year. Successful best-efforts offerings are defined as those that are offered to the public and have security sales that exceed the offering's minimum sales constraint. These offerings are eventually traded on an exchange. Unsuccessful best-efforts offerings are either withdrawn (canceled by the offering firm prior to the SEC approval of the offering) or fail due to insufficient sales (the offering is approved by the SEC but sales do not meet the minimum sales objective so all orders are canceled and public trading does not take place). Successful firm-commitment offerings are approved by the SEC and shares are actually sold to the public. Unsuccessful firm-commitment offerings are withdrawn prior to SEC approval of the offering. The percentage deviation of actual from expected gross proceeds is defined as 100 times the actual dollar security sales (zero if unsuccessful) divided by the expected filing size subtract one. The expected filing size is the number of shares in the initial filing multiplied the maximum filing price for firm-commitment offerings and the expected filing price for best-efforts offerings.

best-efforts offerings, proceeds uncertainty ranges from 10.4% in 1979 to 54.5% in 1981. For firm-commitment offerings, proceeds uncertainty ranges from 19.6% in 1980 to 55.4% in 1982.

IV. THE DETERMINANTS OF OFFERING SUCCESS

As discussed in Section II, the likelihood of best-efforts and firm-commitment IPO success should be related to ex ante firm valuation uncertainty, the breadth of the investment bank's distribution channel and the clustering

of offerings. Filing price, filing size and investment bank reputation (as defined in Section III) are commonly used proxies for ex ante firm valuation uncertainty. Uncertainty is typically argued to be greater for smaller and lower priced offerings underwritten by less reputable banks.[14] Banks with broader distributions channels also tend to have higher Carter and Manaster (1990) rankings.[15] The clustering of offerings is measured as the number of filings of the same contract type in the month the IPO is filed. Table III presents evidence on the percentage of successful offerings and proceeds uncertainty (as defined in Section III) for best-efforts and firm-commitment offerings, broken down by filing price, size, investment bank reputation and the number of contemporaneous filings. Since the evidence for proceeds uncertainty is consistent with the evidence for the percentage of successful offerings, my discussion focuses only on the latter.

For firm-commitment offerings, the percentage of successful offerings increases with filing size (rows 1 through 3). The opposite pattern is observed, however, for best-efforts offerings. While larger offerings are made by firms with lower valuation uncertainty, they are more likely to be unsuccessful because size adjustments do not occur. The percentage of successful small (less than $2 million in constant 1979 dollars) best-efforts offerings is significantly greater than the percentage of successful small firm-commitment offerings. In contrast, the percentage of successful large (greater than $6 million in constant 1979 dollars) best-efforts offerings is significantly lower than the percentage of successful large firm-commitment offerings. Virtually identical results are obtained when the samples are broken down by filing price (rows 4 through 6).

For firm-commitment offerings, the percentage of successful offerings increases with investment bank reputation (rows 7 through 9). This is consistent with Benveniste and Spindt's (1989) and Welch's (1992) theoretical models. For best-efforts offerings, there is no apparent relation between investment bank reputation and the percentage of successful offerings. Very few best-efforts offerings are marketed by banks with Carter and Manaster rankings above zero, however. Also, since best-efforts offerings take consid-

[14] Brennan and Hughes (1991) argue that high quality firms with greater valuation uncertainty choose to market common stock at lower prices to attract analyst attention. The Penny Stock Reform Act of 1990, which requires greater information disclosure on transactions in low-priced stocks, also codifies the notion that firms with greater valuation uncertainty have lower prices (see Beatty and Welch 1996). Empirically, price has been commonly used as a proxy for ex ante valuation uncertainty (see, for example, Tinic, 1988; James, 1992; Welch, 1991, Jegadeesh et al., 1993; Chua 1995). Offering size and investment bank reputation are also widely used empirical proxies for ex ante firm value uncertainty (see, for example, Tinic, 1988; Carter and Manaster, 1990; Hanley, 1993; Michaely and Shaw, 1994).

[15] The SEC's Registration and Offering statistic data tape provides a classification of lead investment banks based on their distribution channel (national, regional, local). This classification is highly positively correlated with the Carter and Manaster (1990) rankings.

TABLE III

Percentage of Successful Offerings and Mean Absolute Percentage Deviation of Actual from Expected Gross Proceeds, by Contract Type and Offering Characteristics for Initial Public Offerings Filed with the SEC between 1979 and 1982 (Number of Observations in Parentheses)

	Percentage of successful offerings			Mean absolute percentage deviation of actual from expected gross periods		
Offering characteristic	Best-efforts	Firm-commitment	*t*-Statistic	Best-efforts	Firm-commitment	*t*-Statistic
(1) Filing size ≤ \$2 M	72.7 (121)	50.0 (58)	3.0	37.5 (121)	55.1 (58)	2.5
(2) \$2 M < Filing size < \$6 M	63.4 (131)	64.5 (217)	0.2	43.8 (131)	44.8 (217)	0.2
(3) Filing size ≥ \$6 M	61.5 (13)	84.5 (206)	2.2	50.9 (13)	33.5 (206)	1.7
(4) Filing price ≤ \$1	70.6 (218)	41.8 (79)	4.7	38.2 (218)	61.8 (79)	4.0
(5) \$1 < Filing price < \$4	66.7 (30)	50.9 (53)	1.4	46.1 (30)	53.3 (53)	0.7
(6) Filing price ≥ \$4	29.4 (17)	81.1 (349)	5.3	73.0 (17)	34.7 (349)	4.2
(7) Underwriter reputation = 0	65.5 (203)	31.9 (91)	5.6	44.2 (203)	74.6 (91)	5.6
(8) 0 < Underwriter reputation ≤ 6	77.4 (53)	75.4 (236)	0.3	26.9 (53)	34.7 (236)	1.3
(9) Underwriter reputation ≥ 6	55.6 (9)	88.3 (154)	2.8	61.1 (9)	32.1 (154)	2.6
(10) Number of filings ≤ 5	80.0 (65)	87.8 (41)	1.0	29.6 (65)	21.5 (41)	1.1
(11) 5 < Number of filings < 15	70.3 (158)	74.1 (139)	0.7	38.8 (158)	41.1 (139)	0.5
(12) Number of filings ≥ 15	38.1 (42)	77.8 (301)	3.8	68.9 (42)	43.8 (301)	3.6

Note. The percentage deviation of actual from expected gross proceeds is defined as 100 times the actual dollar security sales (zero if unsuccessful) divided by the expected filing size subtract one. The expected filing size is the by the number of shares in the initial filing multiplied the maximum filing price for firm-commitment offerings and the expected filing price for best-efforts offerings. Offering characteristics are the expected filing size stated in constant 1979 dollars (i.e., the size multiplied by the CPI in January 1979 divided by the CPI in the month of the filing) [filing size], the price (expected for best-efforts, maximum for firm-commitments) in the initial filing [filing price], Carter and Manaster's (1990) 0 to 9 ordinal lead investment bank ranking [underwriter reputation], and the number of filings of the same contract type in the calendar month the IPO is filed [number of filings]. The *t*-statistic tests the hypothesis that the values for firm-commitment and best-efforts offerings are equal.

erable time to complete, even reputable banks cannot prevent investor communication. For investment banks with Carter and Manaster rankings of zero, the percentage of successful best-efforts offerings is significantly greater than the percentage of successful firm-commitment offerings.[16] In contrast, for banks with Carter and Manaster ranks greater than or equal

[16] Hanley (1993) shows that low reputation banks are less likely to acquire valuation relevant information in firm-commitment IPOs. Best-efforts IPOs marketed by less reputable banks may be more likely to succeed because greater latitude in the size of the offering is allowed.

to 6, the percentage of successful best-efforts offerings is significantly lower than the percentage of successful firm-commitment offerings.

For best-efforts offerings, the percentage of successful offerings decreases with the number of contemporaneous filings (rows 10 through 12). This is consistent with the view that filings in heavy volume markets are less likely to succeed given limited investor resources. The percentage of successful firm-commitment offerings also declines with the number of contemporaneous filings, although this decline is not statistically significant. The percentage of successful firm-commitment offerings is significantly greater that the percentage of successful best-efforts offerings only during high volume periods (greater than or equal to 15 filings of the same offering method type in same month).

This univariate analysis is formalized using a probit model,

$$Probability(an\ offering\ succeeds) = \Phi(\beta x), \tag{1}$$

where x is a vector of independent variables and Φ is the standard normal cumulative distribution function.[17] The independent variables include the filing price, filing size, investment bank reputation and the number of contemporaneous filings, as defined previously. Since these variables are known at the time an IPO is filed, the probit model provides an estimate of the ex ante probability of offerings success.[18]

Estimates of the probit model for best-efforts and firm-commitment offerings are presented in Table IV.[19] Unlike ordinary least-squares coefficients in linear models, the coefficients in probit models cannot be interpreted as marginal effects. Therefore, I also report the marginal effect of a unit change in each independent variable on the probability of offering success.[20]

[17] The probit model is estimated using maximum likelihood methods. A commonly applied alternative, the logit model, assumes probabilities follow a logistic distribution. The findings in this paper are qualitatively similar when a logit model is applied (Madalla, 1983, p. 23, notes that this is usually the case).

[18] Hanley (1993) argues that negative information is more likely to arise in declining and volatile markets. In separate analyses (not reported), I include the average daily Nasdaq composite return and the standard deviation of daily Nasdaq composite returns between filing and offering or withdrawal as independent variables in the probit analysis. Consistent with Hanley's argument and Benveniste and Spindt's (1989) theory, the probability of offering success increases with the average market return and decreases with the market return standard deviation. Since these variables are observable after the IPO filing, a probit model including them provide and estimate of the ex post probability of offering success.

[19] The pairwise correlations between independent variables are generally not significant in this sample. One exception is the correlation between filing size and filing price (correlation of 0.48).

[20] Formally, marginal effects in a probit model are given as $\phi(\hat{\beta}\bar{x})\beta$, where $\hat{\beta}$ is the probit coefficient estimate vector, $\bar{x}$ is the vector of independent variable means, and ϕ is the standard normal density function (see Greene, 1993, p. 639, for details).

TABLE IV
Probit Models of Offering Success for Firm-Commitment and Best-Efforts IPOs between 1979 and 1982

	Best-efforts IPOs			Firm-commitment IPOs		
Independent variables	Probit coefficient	*t*-Statistic	Marginal effect	Probit coefficient	*t*-Statistic	Marginal effect
INTERCEPT	1.815**	7.0	0.64	0.181	1.2	0.06
REPUTATION	0.016	0.3	0.006	0.17**	5.2	0.05
FILINGS	−0.112**	−5.3	−0.04	−0.014**	−3.1	−0.003
FILE SIZE	−0.022	−0.4	−0.008	−0.015†	−1.7	−0.004
FILE PRICE	−0.165*	−2.5	−0.06	0.028†	1.7	0.009
Number of observations		267			489	
Percent correct predictions		72.7			74.8	
Pseudo-R^2		0.13			0.15	

Note. The dependent variable is a dummy variable taking on the value 1 if the offering is successful (offered to public with subsequent public secondary market trading) and 0 otherwise. Independent variables include Carter and Manaster's (1990) 0 to 9 ordinal ranking of the lead investment bank [REPUTATION], the number of contemporaneous filings of the same contract type in the calendar month the IPO is filed [FILINGS], the size (expected for best-efforts, maximum for firm-commitments) of the offering in constant millions of dollars (constant January 1979 dollars) indicated in the initial filing [FILE SIZE], and the price (expected for best-efforts, maximum for firm-commitments) indicated in the initial filing [FILE PRICE]. The marginal effects columns transforms the probit coefficient into the marginal effect of the variable on the estimated probability, evaluated at the sample means for the explanatory variable. Formally, this is given as $\phi(\hat{\beta}\bar{x})\hat{\beta}$ where $\hat{\beta}$ is the probit coefficient estimate vector, $\bar{x}$ is the vector of independent variable means, and ϕ is the standard normal density function. Pseudo-R^2 is defined as one minus the log likelihood of the estimated model divided by the log-likelihood of a model which only includes an intercept.

† Significant at the 10% level.

* Significant at the 5% level.

** Significant at the 1% level.

The only significant variables in this probit analysis are the number of contemporaneous filings and the filing price. The coefficient estimate on the number of contemporaneous filings indicates that a decrease of 8 filings (from one standard deviation above to one standard deviation below the mean for this sample) results in a 32% higher probability of success. The coefficient estimate on filing price indicates that a $4.66 decrease in filing price (from one standard deviation above to one standard deviation below the mean for this sample) results in an 28% increase in the probability of success. Since the offering price is set early in the best-efforts offering process, higher priced filings are likely to be overpriced and, therefore, unsuccessful.

Estimates of the probit model for firm-commitment IPOs are also presented in Table IV.[21] The most significant determinant of success, economi-

[21] There are significant pairwise correlations between independent variables that could affect the interpretation of the probit model estimates. Investment bank reputation is significantly positively correlated with filing size and filing price (correlations of 0.50 and 0.74, respectively). Filing size and filing price are also significantly positively correlated (correlation of 0.64).

cally and statistically, is investment bank reputation. Its coefficient estimate indicates that a 6 unit increase in reputation (from one standard deviation below to one standard deviation above the mean for this sample) results in a 30% higher probability of success. The number of contemporaneous filings has a negative effect on offerings success. Its coefficient estimate indicates that an increase of 30 filings (from one standard deviation below to one standard deviation above the mean for this sample) results in a 9% lower probability of success. Finally, filing size has a negative effect on the probability of success and filing price has a positive effect. These variables have only minimal economic and statistical significance.

Overall, the evidence is consistent the propositions developed in Section II. The likelihood of success is positively related to the breadth of the investment bank's distribution channel, as proxied by Carter and Manaster's (1990) reputation measure. Also, this variable has a more significant effect on the likelihood of success for firm-commitment IPOs. Filing size and price have a positive effect on the probability of firm-commitment IPO success. This is consistent with the prediction that the likelihood of success should be greater for firms with lower ex ante valuation uncertainty. For best-efforts offerings, filing size and price have a negative impact on the probability of success. While apparently inconsistent with the proposition developed in Section II, I argue that filing size and price are more likely to capture offer overpricing than ex ante valuation uncertainty for best-efforts IPOs. Finally, the clustering of offerings has a negative effect on IPO success. This is inconsistent with Booth and Chua's (1996) information spillover theory. It is consistent with the view that filings in heavy volume markets are less likely to succeed given limited investor resources.

V. THE COSTS OF UNSUCCESSFUL OFFERINGS

As discussed in Section II, unsuccessful offering may be costly for issuers. One potential cost is that an unsuccessful offering could make it difficult for an issuer to ever return to the capital markets. I, therefore, examine whether firms having unsuccessful best-efforts or firm-commitment offerings between 1979 and 1982 subsequently have a successful IPO. Three sources of data are used to check for subsequent IPOs. First, I search the SEC's Registration and Offer Statistics (ROS) data base for IPOs by firms having the same name as unsuccessful firms in my sample. Since this data base only covers offerings to the end of 1988, I also search Securities Data Corporation's (SDC's) New Issue Data base to the end of 1996. Finally, I examine CRSP's data bases (covering New York, American and Nasdaq stock exchanges) for the presence of firms in my sample of unsuccessful offerings.

I identify 86 firms having unsuccessful best-efforts IPOs between 1979 and 1982. Only 8 of these firms ever go public (9.3%). For these 8 firms, the average time between the filing of the initial unsuccessful offering and completion of the successful offering is 1.7 years. I also identify 138 unsuccessful firm-commitment IPOs between 1979 and 1982. Only 13 of these firms ever go public (9.4%). For these 13 firms, the average time between the filing of the initial unsuccessful offering and the completion of the successful offering is 2.5 years. Association with an unsuccessful IPO, therefore, has a significant effect on a firm's ability to ever issue public equity.

A second potential cost of unsuccessful IPOs is that investment banks could demand greater compensation in offerings that are less likely to succeed. To examine this possibility, I estimate the following regression model:

$$COMP_i/SIZE_i = \beta x_i + \varepsilon_i. \tag{2}$$

Here $COMP_i$ is the investment bank compensation on IPO i, $SIZE_i$ is the gross proceeds raised in the IPO and x_i is a vector of independent variables. Empirically, I examine three components of compensation: the cash spread, offering expenses and warrants. Independent variables in the compensation regressions include a measure of the ex ante probability that an offering will succeed. The ex ante probability is used since compensation terms are generally agreed upon when the offering is initially filed with the SEC, even though they need not be finalized until the registration is approved (Bloomenthal, 1996). This probability is generated using the probit model estimates from Table IV.[22]

Ex ante firm value uncertainty is typically found to have a positive effect on investment bank compensation. Commonly used proxies for ex ante valuation uncertainty, such as the inverse of the offering price, the sales of the issuing firm in the year leading up to the offering and investment bank reputation, are included as independent variables (see James, 1992; Beatty and Welch, 1996). The regressions are not sensitive to the functional form used for these variables. The size of the offering is typically found to have a significant effect on investment bank compensation. Since Hansen and Torregrosa (1992) find that cash spreads in seasoned equity offerings are "U-shaped" in offering size, I include offering size and the natural logarithm of size as independent variables in the compensation regressions. If percentage compensation in IPOs is also "U-shaped," the spread minimiz-

[22] Formally, the probability of offering success is defined as $\Phi(\beta X)$, where Φ is the cumulative standard normal distribution function, X is the vector of independent variables used to predict offering success, and β is the vector of coefficient estimates.

ing offering size would be $-\beta_2/\beta_1$ where β_2 is the coefficient on logarithm of size and β_1 is the coefficient on size (see Hansen and Torregrosa, 1992).

James (1992) argues that setup costs should result in lower IPO compensation for firms that are likely to issue securities again with the same investment bank. I include a variable to proxy for this likelihood in my regressions. Specifically, I include a dummy variable taking on the value 1 if the firm going public has a seasoned equity offering (SEO) within 3 years of the IPO where at least one of the lead investment banks in the IPO acts in the same capacity (see James, 1992). SEOs are identified using SDC's New Issues data base, the SEC's ROS data base and Moody's manuals. Approximately 22% of the firm-commitment IPOs have follow on offerings using the same investment bank in the three years after the offering, consistent with findings by James (1992). In no cases, however, did a best-efforts IPO in my sample have a follow on offering. This dummy variable, therefore, is only included in compensation regressions for firm-commitment IPOs.

Ordinary least-squares regressions of investment bank cash compensation regressions are reported in Table V. Because these regressions include a generated regressor (the probability of offering success), ordinary least squares standard errors are understated. I, therefore, use the technique of Murphy and Topel (1985) to compute asymptotically correct standard errors.[23] The results for best-efforts offerings are presented in Panel A.[24] In the offering expense regression, the coefficient on offering size is significantly positive and the coefficient on the logarithm of size is significantly negative, consistent with a U-shaped relation between size and expenses. The point estimates indicate an expense minimizing offering size of \$7 million (in constant 1979 dollars). For the cash spread, the signs are reverse, suggesting spreads initially increase in offering size (up to \$1.5 million) before realizing economies of scale. For total cash compensation (spread plus expenses), the estimates are consistent with a U-shaped relation, although the coefficient on size is not statistically significant. The total cash compensation minimizing size is \$10 million (in 1979 dollars).

The coefficient on the probability of best-efforts offering success is significantly negative in the offering expense and total cash compensation

[23] Murphy and Topel (1985) show that the correct covariance matrix for the estimators in a regression that includes a generated regressor adds a positive definite matrix to the standard ordinary least squares covariance matrix. The positive definite matrix is a function of the covariance matrix from the regression used to create the generated regressor. Thus, the more precise the estimate of the generated regressor, the smaller the adjustment.

[24] The pairwise correlations between independent variables are generally not significant in this sample. Two exceptions are the correlation between offering size and the logarithm of size (0.86) and the correlation between the logarithm of offering size and the inverse of the offering price (-0.52).

TABLE V

Regressions of Components of Investment Bank Compensation on Various Firm and Offering Characteristics, Broken Down by Offering Contract Type for Successful Initial Public Offerings between 1979 and 1982

	Independent variables								
Dependent variable	Intercept	UW. REP.	OFFER SIZE	LN(OFFER SIZE)	1/OFFER PRICE	SALES	NO SWITCH	PROB. SUCCESS	R^2
				Panel A: 177 Successful Best-Efforts Initial Public Offerings					
Offer expenses	0.11**	−0.0006	0.0077*	−0.052**	−0.0001	0.004		−0.044*	0.42
	(5.6)	(−0.4)	(2.1)	(−6.3)	(−0.5)	(1.1)		(−2.0)	
Cash spread	0.10**	0.001†	−0.003*	0.005†	0.0001	0.001		−0.003	0.06
	(20.0)	(1.8)	(−2.4)	(1.6)	(1.1)	(1.0)		(−0.4)	
Total compensation	0.21**	0.0004	0.005	−0.047**	−0.00003	0.005		−0.047†	0.36
	(9.9)	(0.2)	(1.1)	(−4.9)	(−0.1)	(1.3)		(−1.9)	
				Panel B: 343 Successful Firm-Commitment Initial Public Offerings					
Offer expenses	0.11**	0.002	0.0009**	−0.038**	−0.004**	0.00003†	−0.0009	−0.017	0.61
	(12.0)	(1.5)	(5.1)	(−15.5)	(−3.7)	(1.7)	(−0.4)	(−1.0)	
Cash spread	0.11**	−0.001**	−0.00006	−0.0064**	0.001**	−0.00002**	−0.0022*	−0.019*	0.68
	(36.8)	(−4.2)	(−0.2)	(−6.5)	(2.6)	(−3.0)	(−2.3)	(−2.0)	
Total compensation	0.22**	0.0009	0.0008**	−0.045**	−0.002*	0.00001	−0.0032	−0.036†	0.73
	(19.6)	(0.7)	(4.1)	(−16.6)	(−2.4)	(0.4)	(−1.1)	(−1.8)	

Note. The dependent variables are the percentage offering expenses (cash expenses divided by the size of the offering), the percentage cash spread (cash spread per share divided by the offering price per share) and total compensation, defined as the percentage offering expenses plus the percentage cash spread. Independent variables include Carter and Manaster's (1990) 0 to 9 ordinal reputation ranking of the lead investment bank [UW. REP], the maximum size of the offering in constant million dollars (constant January 1979 dollars) [OFFER SIZE], the natural logarithm of the size of the offering [LN(OFFER SIZE)], the inverse of the offering price [1/OFFER PRICE], the sales of the offering firm in million dollars over the 12 months prior to the offering [SALES], a dummy variable taking the value 1 if the lead investment bank in the IPO acts as lead investment bank in a follow on seasoned equity offering for the firm within 3 years of the IPO and 0 otherwise [NO. SWITCH], and the ex ante (at time of filing) probability of offering success, generated using the probit models from Table IV [PROB. SUCCESS]. The *t*-statistics (based on Murphy and Topel, 1985, standard errors) are provided in parentheses.

† Significant at the 10% level.

* Significant at the 5% level.

** Significant at the 1% level.

regressions. The coefficient estimates also indicate an economically significant relationship between the probability of success and investment bank compensation. An increase in the probability of success of 30 percentage points (from one standard deviation below to one standard deviation above the mean for this sample) reduces total cash compensation as a percentage of offering size by 1.4 percentage points. Since average percentage compensation is 16.1%, this represents a 9% reduction. Economically, the relation is more dramatic for offering expenses. A 30 percentage point increase in the probability of success results in a 20% reduction in expenses.

While these regression show a significant positive relation between investment bank compensation and the ex ante probability of offering success, I have not measured all possible forms of compensation. Investment banks often receive additional non-cash compensation, such as warrants. It is possible, for example, that banks only accept warrants in offerings that are more likely to succeed. In this case, total compensation (including warrants) may not be related to the probability of offering success. To check this possibility, I identify the use of warrants as compensation using the SEC's ROS data base. Offerings are dropped from the analysis if they are not covered by this data source. Of the final sample of 124 best-efforts offerings, 108 have warrant compensation. Warrants are valued using the constant elasticity of variance (CEV) model as in Dunbar (1995). In cases where warrants are used, their average value as a percentage of the offering size is 10.1%.

For the 124 offerings, I regress total percentage compensation (spread plus expenses plus warrants) on the independent variables considered in Table V. The coefficient on the probability of best-efforts offering success is -0.04 (significant at the 5% level). To ensure that this subsample is representative, I replicate the total cash compensation regression from Table V. The coefficient on the probability of best-efforts offering success is qualitatively unaffected (the point estimate is a slightly less negative -0.02, suggesting that warrants are used as a substitute for cash compensation).

The cash compensation regressions for firm-commitment offerings are presented in Panel B of Table V.[25] In the offer expense regression, the coefficient on the inverse of the offering price is significantly negative and the coefficient on historical sales is significantly positive. Surprisingly, these findings suggest that percentage expenses are greater for offerings by firms

[25] There are significant pairwise correlations between independent variables that could affect the interpretation of the compensation regression estimates. Investment bank reputation is significantly positively correlated with offering size and the logarithm of size (correlations of 0.44 and 0.66, respectively). Offering size and the logarithm of size are also significantly positively correlated (correlation of 0.79).

having lower valuation uncertainty. Coefficients on the offering size variables are significant and their signs are consistent with a U-shaped relation. The implied expense minimizing offering size is $43 million (in constant 1979 dollars). In the cash spread regression, the coefficient on the inverse of the offering price is significantly positive and the coefficients on historical sales and investment bank reputation are significantly negative, consistent with offerings by firms with greater valuation uncertainty having larger spreads. The coefficients on size and logarithm of size are both negative (although only the latter is significant) indicating unlimited economies of scale. Finally, the coefficient on the follow on offering dummy variable is significantly negative, consistent with the evidence in James (1992). The coefficients in the total cash compensation regression are qualitatively similar to those in the expense regression. Coefficients on the size variables are significant and their signs are consistent with a U-shaped relation. The implied total cash compensation minimizing offering size is $54 million (in constant 1979 dollars).

The coefficients on the probability of firm-commitment offering success are negative in all the regressions but not significant in the offering expense regression. An increase in the probability of success of 33 percentage points (from one standard deviation below to one standard deviation above the mean for this sample) reduces expenses, the cash spread and total cash compensation by 14, 7, and 9%, respectively. Economically, these reductions are similar to those observed for best-efforts offerings.

To check the validity of these results, I again examine the use of warrants as compensation. Of the 291 firm-commitment offerings identified using the SEC's ROS data base, 122 have warrant compensation. In cases where warrants are used, their average value based on the CEV model as a percentage of the offering size is 7.8%. For the 291 offerings with complete data, I regress total percentage compensation (spread plus expenses plus warrants) on the independent variables considered in Table V. The coefficient on the probability of firm-commitment offering success is -0.096 (significant at the 1% level). To ensure that this subsample is representative, I replicate the total cash compensation regression from Table V. The coefficient on the probability of offering success is qualitatively unaffected (the point estimate is a slightly more negative -0.046, suggesting that warrants are used as a complement to cash compensation).

In sum, the evidence in this section suggests that unsuccessful offerings are costly to issuers. Firms having unsuccessful IPOs are unlikely to return for an IPO in the future. Also, investment banks demand higher levels of compensation in offerings that are less likely to succeed. The evidence, therefore, does not support the proposition that IPOs are unsuccessful solely because investment banks provide inadequate marketing services.

VI. THE PROBABILITY OF SUCCESS AND OFFERING METHOD CHOICE

The analyses in the previous sections indicates that there are difference in the determinants of offering success for best-efforts and firm-commitment IPOs. Also, association with unsuccessful offerings is costly. As argued in Section II, cost minimizing issuing firms should, therefore, select the offering method that maximizes the probability of success, all else equal. To test this proposition, I estimate a probit model where the dependent variable is a dummy variable taking on the value 1 if a firm-commitment contract is chosen [FC]. Independent variables include the difference in predicted probabilities of offering success if the issuer had used a firm-commitment and best-efforts contract. Specifically, I generate the ex ante predicted probability of success as a best-efforts IPO for all offerings filed between 1979 and 1982 using the best-efforts probit model from Table IV. I also generate the ex ante predicted probability of success as a firm-commitment IPO for all offerings using the firm-commitment probit model from Table IV. The probability of success as a firm-commitment IPO minus the probability of success as a best-efforts IPO is included as an independent variable [DIFSUC]. Ex ante probability models are used since the choice of offering method is made at the time of the filing (I find no cases where the offering method is changed after filing with the SEC).

In addition to concerns regarding offering success, the choice of offering method should be affected by factors such as the relative issue costs for the two methods if the offering is successful. I, therefore, include other independent variables in the probit model to proxy for these relative costs. Specifically, I include investment bank reputation based on Carter and Manaster's (1990) ordinal ranking [REP], the inverse of the filing price [1/FPR], the size of the filing in constant 1979 dollars [SIZE], and the natural logarithm of the filing size [LG(SIZE)] since these variables are commonly used to explain issue costs for successful offerings (see, for example, Hansen and Torregrosa, 1992; James, 1992; Jegadeesh *et al.*, 1993). The estimated probit model (marginal effects are reported) is as follows (Murphy and Topel, 1985, *t*-statistics in parentheses[26]):

$$\begin{array}{lllllllll} FC = & -0.02 & -0.004\,REP & -0.01\,(1/FPR) & +0.001\,SIZE & -0.02\,LG(SIZE) & +1.00\,DIFSUC \\ & (-0.2) & (-0.2) & (-1.8) & (0.1) & (-0.4) & (6.3) \end{array}$$

[26] See Murphy and Topel (1985, Sect. 5.1). The Murphy–Topel standard errors account for the fact this offering method choice regression is estimated with the same data used to generate DIFCUS. The pseudo-R^2, defined as 1 minus the log-likelihood of the estimated model divided by the log-likelihood of a model including only an intercept, is 0.56.

The most significant variable is DIFSUC. Its point estimate indicates that a 80% increase the relative probability of success as a firm-commitment offering (from one standard deviation above the mean to one standard deviation below the mean for this sample) increases the probability the firm-commitment method is used by approximately 80%. This is consistent with firms selecting the offering method that results in the highest probability of success, all else equal.

VII. ROBUSTNESS

While the data set used in the previous sections provides comprehensive information on all best-efforts and firm-commitment filings, it covers a relatively short period. To ensure that results obtained are not due to peculiarities of that time period, I also examine a larger sample of IPOs from SDC's New Issues data base. SDC provides information on all firm-commitment IPOs starting in 1984. Unfortunately, it does not cover best-efforts offerings. The purpose of this analysis, therefore, is to replicate the analyses in Sections III through V with a larger sample of firm-commitment offerings. If the findings with this sample are qualitatively similar to those for firm-commitment IPOs between 1979 and 1982, then confidence in the generality of previous findings is enhanced.

My data for this analysis contains all successful and unsuccessful offerings between 1984 and 1993.[27] The success rates and proceeds uncertainty for these offerings are reported in Table VI. Over the entire period, 82% of the 3486 filings are successful. This success rate is higher than that reported in Table II for firm-commitment offerings between 1979 and 1982 in part because of differences in how unsuccessful offerings are identified. SDC only reports offerings as unsuccessful if a formal letter to withdraw is sent by the firm to the SEC (form RW). It, therefore, misses offerings that are simply abandoned (see footnote 11). The percentage of successful offerings varies over time from 72% in 1984 to 92% in 1989. Proceeds uncertainty, as defined in Section III, is also examined in Table VI. For the full sample, the average proceeds uncertainty for firm-commitment offerings is 33.8%. It ranges from a low of 25.3% in 1989 to a high of 46.1% in 1990. These findings are qualitatively similar to those obtained using data from the early 1980s.

The determinants of offering success for firm-commitment offerings between 1984 and 1993 are examined using a probit model,

[27] I restrict the sample to securities offered by U.S. corporations and exclude closed-end fund and real estate investment trust offerings. I also exclude offerings of American Depositary Receipts and units (bundles of warrants and common stock). These restrictions are similar to those applied by Lee *et al.* (1996).

TABLE VI
Description of the Success of Firm-Commitment Initial Public Offerings between 1984 and 1993

	Filing period										
	1984–1993	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Successful firm-commitment IPOs	2869	213	233	514	293	145	138	135	352	396	450
Unsuccessful firm-commitment IPOs	617	83	34	86	86	40	12	43	38	112	83
Total firm-commitment IPOs	3486	296	267	600	379	185	150	178	390	508	533
% Successful firm-commitment	82.3	72.0	87.3	85.7	77.3	78.4	92.0	75.8	90.3	78.0	84.4
% Absolute deviation of actual from expected gross proceeds	33.8	38.7	29.6	28.4	36.7	33.1	25.3	46.1	31.3	39.8	32.2

Note. This table reports the number of firm-commitment initial public offerings between 1984 and 1993 broken down by offering success and filing year. Also reported is the percentage of unsuccessful offerings and average absolute percentage deviation of actual from expected gross proceeds, broken down by filing year. Successful firm-commitment offerings are approved by the SEC and shares are actually sold to the public. Withdrawn firm-commitment offerings are canceled by the offering firm prior to SEC approval of the offering. The percentage deviation of actual from expected gross proceeds is defined as 100 times the final proceeds of the offering, excluding overallotments (zero if unsuccessful), divided by the expected filing size subtract one. The expected filing size is the number of shares multiplied the average of the high and low prices in the initial filing.

TABLE VII
Probit Models of Offering Success for Firm-Commitment IPOs between 1984 and 1993

	Descriptive statistics on the independent variables		Probit model estimates		
Independent variables	Mean	Standard deviation	Probit coefficient	*t*-Statistic	Marginal effect
INTERCEPT			0.41**	7.1	0.10
REPUTATION	0.036	0.05	2.13**	3.5	0.53
FILINGS	42.07	22.2	0.012**	9.8	0.003
FILE SIZE	28.34	62.5	−0.0002	−0.6	−0.0001
FILE PRICE	11.03	10.3	−0.0007	−0.3	−0.002
Number of observations				3540	
Percent correct predictions				82.6	
Pseudo-R^2				0.03	

Note. The dependent variable is a dummy variable taking on the value 1 if the offering is successful (offered to public with subsequent public secondary market trading) and 0 otherwise. Independent variables include the market share of the book manager of the IPO, defined as the sum of the proceeds, excluding overallotments, of IPOs over the 3 calendar years prior to the year of the IPO that the investment bank acted as book manager divided by the sum of the proceeds of all IPOs over the same period [REPUTATION], the number of filings of the same contract type in the calendar month prior to the filing of the IPO [FILINGS], the expected size of the offering in constant (January 1984) millions of dollars indicated in the initial filing (average of low and high filing price multiplied by the expected number of shares in the filing) [FILE SIZE], and the expected indicated in the initial filing (average of low and high filing price) [FILE PRICE]. The marginal effects columns transforms the probit coefficient into the marginal effect of the variable on the estimated probability, evaluated at the sample means for the explanatory variable. Formally, this is given as $\phi(\hat{\beta}\bar{x})\hat{\beta}$ where $\hat{\beta}$ is the probit coefficient estimate vector, $\bar{x}$ is the vector of independent variable means, and ϕ is the standard normal density function. Pseudo-R^2 is defined as one minus the log-likelihood of the estimated model divided by the log-likelihood of a model which only includes an intercept.

† Significant at the 10% level.
* Significant at the 5% level.
** Significant at the 1% level.

$$Probability(an\ offering\ succeeds) = \Phi(\beta x), \tag{3}$$

where x is a vector of independent variables. Consistent with the analysis in Section IV, independent variables include the filing price (average of the low and high filing price), the filing size in constant January 1984 dollars (filing price multiplied by the number of shares filed and a CPI adjustment factor), the number of firm-commitment filings in the month prior to the filing and a measure of investment bank reputation. Since Carter and Manaster (1990) derive their investment bank ranking using IPOs from the early 1980s, they are unlikely to be appropriate for more recent offerings. Consistent with Hanley (1993), I use the market share (based on gross proceeds raised) of the book manager in the IPO over the three years prior to the month of the filing as a reputation measure. The first two columns of Table VII present the means and standard deviations of these variables. The average filing price of $11 is similar to that observed in the 1979 to 1982 period. The average filing size of $28.34 million is much larger, however

(for comparison, this is $19.01 million in January 1979 dollars). There are also nearly twice as many filings per month in the 1984 to 1993 period than the 1979 to 1982 period.

The probit model estimates are also presented in Table VII. The most significant independent variable, economically and statistically, is the number of contemporaneous filings. Its coefficient estimate indicates that an increase of 44 filings (from one standard deviation below to one standard deviation above the mean for this sample) results in a 13% higher probability of success. This positive relation is the opposite to that detected in the 1979–1982 period and is consistent with Booth and Chua's (1996) clustering theory. Investment bank reputation has a significantly positive impact on offering success, consistent with the findings for the early 1980s. Its coefficient estimate indicates that an increase in market share of 10 percentage points (from one standard deviation below to one standard deviation above the mean for this sample) results in a 6% higher probability of success (although this suggests a weaker relation than reported in Section IV for the earlier time period, the economic significance cannot be compared since the definition of reputation has changed). Filing size and price have an insignificant effect on the probability of success, consistent (economically) with previous findings.

To determine whether unsuccessful offerings from 1984 to 1993 are costly, I again examine whether firms with unsuccessful IPOs ever go public. As in the previous analysis, I search SDC's New Issues data base to the end of 1996 for IPOs by firms having unsuccessful offerings. I also examine CRSP's data bases (covering New York, American, and Nasdaq stock exchanges) for the presence of these firms. Of the 647 firms having unsuccessful offerings between 1984 and 1993, only 39 ever go public (6%). For these firms, the average time between the filing of the initial unsuccessful offering and the completion of the successful offering is 2.3 years. These findings are similar to those for firm-commitment offerings in the early 1980s.

A second potential cost to unsuccessful IPOs is that investment banks could demand greater compensation in offerings that are less likely to succeed. To examine this possibility, I estimate the following regression model:

$$COMP_i/SIZE_i = \beta x_i + \varepsilon_i. \tag{4}$$

Here $COMP_i$ is the investment bank compensation on IPO i (the cash spread, offering expenses and warrants), $SIZE_i$ is the gross proceeds raised in the IPO and x_i is a vector of independent variables. Independent variables include investment bank reputation (proxied by the past three year book manager market share), the offer size in constant 1984 millions of dollars, the logarithm of the offer size, the inverse of the offer price, sales of the

offering firm in the 12 months prior to the IPO in million dollars, a dummy variable taking the value 1 if the issuer has a seasoned equity offering within 3 years of the IPO using the same investment bank and the probability of offering success, generated using the probit model in Table VII. Descriptive statistics for these independent variables are presented in Panel A of Table VIII. The offering size and historic sales are much larger than found for IPOs in the 1979 to 1982 period. The offer price and fraction of IPOs having follow on offerings are not different in the more recent period, however.

Investment bank cash compensation regressions are reported in Panel B of Table VIII.[28] Because these regressions include a generated regressor, I report *t*-statistics based on Murphy and Topel (1985) standard errors. The regression estimates are similar to those for offerings in the early 1980s with some exceptions. The inverse of the offering price has a significantly positive impact on cash compensation. Historic sales has an insignificant impact on cash compensation. Follow on offerings have a more significant impact on cash compensation in the more recent period. The coefficients on size and the logarithm of size are consistent with a U-shaped relation for all forms of cash compensation. The compensation minimizing offering sizes are much larger in the recent period, suggesting a greater ability of banks to realize economies of scale in large offerings (for example, the implied total cash compensation minimizing size is $267 million in constant 1984 dollars). Finally, the coefficient on the probability of offering success is significantly negative in all cash compensation regressions. The economic significance of this variable is similar to that found for offerings in the early 1980s.

To check the validity of these results, I again examine the use of warrants as compensation. The use of warrants is identified using SDC's New Issues data base. Details of warrant compensation are contained in the SDC text variable "NOTES." SDC's coverage of warrant compensation began in the early 1990s. Since no exact start date is available, my analysis focuses on IPOs from 1991 to 1993. Of the 1168 offerings in this period 196 have warrant compensation. In cases where warrants are used, their average value based on the CEV model[29] as a percentage of the offering size is

[28] The pairwise correlations between independent variables are generally not significant in this sample. Two exceptions are the correlation between offering size and the logarithm of size (0.61) and the correlation between the logarithm of offering size and investment bank reputation (0.51)

[29] In many cases, exact details of warrant terms are not available. The time to maturity, warrant exercise price and number of shares exercisable are not explicitly provided in 50, 40, and 11% of the observations, respectively. When such data is not provided, the maximum allowable warrant terms are assumed (a time to maturity of 5 years, an exercise price of 1.2 multiplied by the offering price and the number of shares exercisable of 0.1 multiplied by the number of shares offered in the IPO), consistent with the finding of Barry *et al.* (1991) and Dunbar (1995) that most firms use these limits.

TABLE VIII

Regressions of Components of Investment Bank Compensation on Various Firm and Offering Characteristics, Broken Down by Offering Contract Type for Successful Firm-Commitment Initial Public Offerings between 1984 and 1993

	Independent variables								
Dependent variable	Intercept	UW. REP.	OFFER SIZE	LN(OFFER SIZE)	1/OFFER PRICE	SALES	NO SWITCH	PROB. SUCCESS	R^2
				Panel A: Means of Independent Variables (Standard Deviations in Parentheses)					
		0.037	28.11	2.63	0.32	146.7	0.22	0.83	
		(0.05)	(66.1)	(1.1)	(3.5)	(676.1)	(0.4)	(0.07)	
				Panel B: Offering Cost Regression Estimates for 2919 Offerings					
Offer expenses	0.11**	0.026 *	0.0001**	−0.025**	0.0003*	0.00	−0.0028*	−0.013*	0.55
	(21.8)	(2.5)	(11.9)	(−47.0)	(2.4)	(0.7)	(−2.8)	(−2.1)	
Cash spread	0.11**	−0.017**	0.00002**	−0.0085**	0.00008†	−0.00	−0.0008†	−0.010**	0.51
	(47.5)	(−3.7)	(5.6)	(−37.8)	(1.6)	(−1.4)	(−1.9)	(−3.7)	
Total compensation	0.22**	0.009	0.0001**	−0.034**	0.0004**	0.00	−0.0036**	−0.023**	0.64
	(36.5)	(0.7)	(12.4)	(−54.9)	(2.7)	(0.1)	(−3.2)	(−3.2)	

Note. The dependent variables are the percentage offering expenses (cash expenses divided by the size of the offering), the percentage cash spread (cash spread per share divided by the offering price per share) and total compensation, defined as the percentage offering expenses plus the percentage cash spread. Independent variables include the market share of the book manager of the IPO , defined as the sum of the proceeds, excluding overallotments, of IPOs over the 3 calendar years prior to the year of the IPO that the investment bank acted as book manager divided by the sum of the proceeds of all IPOs over the same period [UW. REP], the maximum size of the offering in constant million dollars (constant January 1984 dollars) [OFFER SIZE], the natural logarithm of the size of the offering [LN(OFFER SIZE)], the inverse of the offering price [1/OFFER PRICE], the sales of the offering firm in million dollars over the 12 months prior to the offering [SALES], a dummy variable taking the value 1 if the lead investment bank in the IPO acts as lead investment bank in a follow on seasoned equity offering for the firm within 3 years of the IPO and 0 otherwise [NO SWITCH], and the ex ante (at time of filing) probability of offering success, generated using the probit model in Table VII [PROB. SUCCESS]. The *t*-statistics (based on Murphy and Topel, 1985, standard errors) are provided in parentheses.

† Significant at the 10% level.

* Significant at the 5% level.

** Significant at the 1% level.

8.8%. For the 1168 IPOs from 1991 to 1993, I regress total percentage compensation (spread plus expenses plus warrants) on the independent variables considered in Table VIII. The coefficient on the probability of firm-commitment offering success is −0.015 (significant at the 5% level). To ensure that this subsample is representative, I replicate the total cash compensation regression from Table VII using this sample. The coefficient on the probability of offering success is qualitatively unaffected (the point estimate is a slightly less negative −0.012, suggesting that warrants are used as a substitute for cash compensation.[30]). Overall, the evidence suggests that investment banks demand greater compensation in offerings that are less likely to succeed.

In sum, the analysis of firm-commitment IPOs from 1984 to 1993 has uncovered some changes in the determinants of offering success and investment bank compensation. The effect of investment bank reputation, filing size and filing price on offering success have not changed significantly, however. Also, the costs of unsuccessful offerings are virtually identical in the two periods examined. This suggests that the evidence in earlier sections is not likely to be peculiar to the short period examined.

VII. CONCLUSIONS

From 1979 to 1982, approximately 70% of both best-efforts and firm-commitment IPOs are successful. This is lower than the 83% success rate observed by Mikkelson and Partch (1988) for seasoned offerings over the same period. From 1984 to 1993, 82% of firm-commitment offerings are successful. While apparently higher than in the earlier period, the data used to examine the 1984–1993 period does not include offerings that are abandoned by their issuers (30% of unsuccessful firm-commitment offerings in the earlier period are abandoned). The average percentage deviation in actual capital raised from that expected in the initial filing is approximately 40% for both offering methods over all periods examined. This is inconsistent with widely held views in the literature that best-efforts offerings are more likely to be unsuccessful and, therefore, involve greater proceeds uncertainty for issuers.

While the likelihood of success is virtually identical for the two offering methods, differences emerge when I control for offering characteristics. Small and low priced best-efforts offerings marketed by less reputable investment banks are more likely to succeed than similar firm-commitment offerings. In contrast, large and high priced best-efforts offerings marketed

[30] The weaker economic effect of warrant compensation in the recent period is likely due to the difficulties in precisely identifying warrant terms for so many offerings.

by more reputable banks are less likely to succeed than similar firm-commitment offerings.

Less than 10% of issuers having unsuccessful best-efforts or firm-commitment IPOs ever raise public equity. Also, for successful issuers using either offering method, the ex ante probability of success, estimated using a probit model, has a negative impact on investment bank compensation (cash spread, expenses, and warrants). Cost minimizing issuers should, therefore, prefer the offering method having the highest probability of success, all else equal. The probit models of IPO success are used to predict probabilities of success for all IPO filings had they used either offering method. The difference between the probabilities of success as a firm-commitment and best-efforts offering is then used as independent variable in a probit model of offering method choice. This variable has a significantly positive effect on the probability that an issuer uses a firms-commitment offering method.

The investment bank compensation regressions also yield several interesting new findings. Percentage compensation is generally found to be U-shaped in offering size, consistent with Hansen and Torregrosa's (1992) evidence for seasoned offerings. The total cash compensation minimizing offer size is $10 million for best-efforts IPOs between 1979 and 1982 (in constant 1979 dollars). For firm-commitment offerings over the same period, the total cash compensation minimizing offer size is $54 million (in constant 1979 dollars). The ability of investment banks to realize economies of scale in larger firm-commitment offerings also explains the dearth of large best-efforts offerings. The estimated total compensation minimizing firm-commitment offer size is much larger during the 1984–1993 period ($179 million in constant 1979 dollars). The downward trend in compensation observed since 1980 (Kidwell *et al.*, 1987) could, therefore, be due to changes in investment banks' ability to realize economies of scale in larger offerings over time.

Overall, the evidence in this paper indicates that the probability of success is an important determinant of offering method choice in IPOs. While this is consistent with issuers selecting offering methods which minimize costs, it is likely that there are other institutional differences between firm-commitment and best-efforts offerings that can help to explain their selection. As noted earlier, best-efforts offerings rarely involve an underwriting group (Bloomenthal, 1996). This could make aftermarket stabilization costly (see Hanley *et al.*, 1996; Hanley *et al.*, 1993). Stabilization may not be required, however, given the greater discretion in setting the number of shares to be offered. Consistent with this, only 12% of the best-efforts IPOs in my sample between 1979 and 1982 experience negative first day returns. In contrast, 21% of firm-commitment IPOs over the same period experience negative first day returns. I leave consideration of such alternative explanations for offering method choice for future research.

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