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Ivo Welch*

Abstract

This study examines initial public offering contract choice decisions. In best-efforts offerings, minimum sales constraints allow issuers to precommit to withdraw the offering if a fixed minimum number of shares is not sold. In firm-commitment offerings, the over-allotment option allows the underwriter to increase sales when demand is strong. Two theories of contract choice—Benveniste and Spindt (1989) and Ritter's (1987) extension of Rock (1986)—offer predictions about the role of these contract features. We find that the 1977–1982 evidence is consistent with Benveniste and Spindt (1989). The evidence is less supportive of the Ritter (1987) hypothesis that minimum sales constraints serve to reduce the winner's curse of the riskier issuers.

I. Introduction

Among recent theories explaining the well-known phenomenon of initial public offering (IPO) underpricing are models of principal-agent conflict (Baron (1982)), the winner's curse (Rock (1986)), legal liability (Tinic (1988)), reputation and reissuing (Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989)), and preselling (Benveniste and Spindt (1989)).[1] This paper primarily examines two of these models: Ritter's (1987) extension of the Rock (1986) model, henceforth RR, against the Benveniste and Spindt (1989) model, henceforth BS.[2] Furthermore, this paper presents (in passing) evidence bearing on hypotheses in Smith (1986) and Tinic (1988). Tests focus on two contract

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[1]Ibbotson, Sindelar, and Ritter (1988) provide a summary of the principal empirical regularities and theoretical models pertaining to IPOs.

[2]Rock (1982) endogenizes the number of informed investors. Ritter (1988) formally models Ritter's (1987) argument, although both the number of informed investors and their bidding strategy are endogenous only in Ritter (1988). The intuition behind both papers is that MSCs act as insurance for uninformed issuers.

choice features of IPOs that allow the size of the offering to change without demand:

> The minimum sales constraint (henceforth, MSC) in best-efforts offerings. In best-efforts offerings, a minimum and a maximum number of shares are specified. The issuer precommits to withdrawing the issue if there is insufficient demand; that is, if the MSC is not reached.
>
> The over-allotment option (henceforth, OAO) in firm-commitment offerings. It allows the underwriter to sell up to 15 percent more shares (prior to August 1983, 10 percent) when demand is strong.[3] The offering is not withdrawn when demand is weak, as is the case with a MSC.

The two theories provide implications for the effect of MSCs. In the Rock (1986) model of the winner's curse, issuers must compensate uninformed investors against adverse allocation bias through underpricing since informed investors participate only when an offering is underpriced. First introduced into the literature by Ritter (1987), MSCs can be viewed as an implicit insurance for uninformed investors. When an offering is so overpriced that it cannot generate sufficient demand, uninformed investors are released from their obligation to accept their allocation. Hence, ceteris paribus, an offering with a high MSC requires less ex ante IPO underpricing, but increases the probability that the offering will fail. Ritter argues that MSCs are of more value to riskier issuers in which investors face greater adverse selection risk. Another prediction of Ritter ((1987), p. 280) is that an over-allotment option can reduce IPO underpricing, because it allows an increase in the number of shares supplied when informed investors participate and there is excess demand.

In contrast, Benveniste and Spindt present a theory in which underwriters share their pricing uncertainty with a pool of regular investors by preselling the offering before the market opens. By promising bargains—more underpricing and allocations when the market opens—upon indication of interest, underwriters can induce these investors to reveal their private information, and compensate them for accepting allocations before the market opens. BS prove that offering these bargains can indeed be optimal behavior for the issuer and its underwriter. Compared to an offering that succeeds even if the underwriter fails in his efforts, an offering with a MSC (in which an underwriter receives no compensation unless the MSC is reached) or without an OAO (in which the underwriter must accept all shares that are for sale from the firm) can be interpreted as requiring more preselling effort by the underwriter, and thus more IPO underpricing.

The paper proceeds as follows. Section II describes the two models, and elaborates on the above and other implications tested. Section III presents the variables used to proxy for the theoretical constructs and discusses the statistical methodology. Section IV presents the results. In sum, we find that for about 660 firm-commitment offerings during the 1977–1982 period, the data are consistent with both BS and RR. Moreover, for about 360 best-efforts offerings during the same period, the data favor BS. Section V describes alternative explanations for

[3]This regulation is imposed by the National Association of Securities Dealers (NASD) and discussed in Hansen, Fuller, and Janjigian (1987), p. 25.

these empirical findings, as well as alternative explanations of IPO underpricing in the literature. Section VI concludes.

II. Comparing Theories

A. The Benveniste and Spindt Theory of Contract Choice

Benveniste and Spindt (1989) focus on preselling activity. An underwriter sells to a pool of regular investors before the market opens in order to acquire information about their private valuations. These regular investors truthfully reveal their private information since the underwriter promises them bargains—larger share allocations and more underpricing—if they indicate that they believe the offering is of high quality. BS prove that the optimal truth-revealing contract can indeed provide these bargain incentives to regular customers. In their context, an issuer induces the underwriter to presell more of the offering by reducing the variability of shares for sale, either by increasing the minimum sales constraint (MSC) or reducing the over-allotment option (OAO).[4] Consequently, issuers with stricter capital requirements should employ higher MSCs or lower OAOs.[5] We test this implication by constructing an (admittedly ad hoc) proxy for capital requirements.

Moreover, preselling is expensive for the underwriter, who must entertain a pool of regular investors. BS show that it is in the underwriter's interest to provide regular customers not only with a bargain on the IPO being sold but also with bargains on future IPOs. This implies that an issuer should compensate his underwriter for imposing higher MSCs or granting lowers OAOs—since both require more pre-selling activity and thus the loss of the underwriter's future bargaining leverage with his regular customers. We therefore test if issuers compensate their underwriters for imposing high MSCs or low OAOs. Finally, BS derive the implication that underwriters must compensate (by underpricing) their regular investors for (truthfully) revealing their information and committing to accept allocations. The intuition is that a reduced variation in the number of shares for sale prevents the underwriter from giving regular investors a lot of lightly underpriced shares when they reveal good information; instead he must give regular investors a small number of highly underpriced shares. That is, offerings with high MSCs or low OAOs should be more underpriced.

Yet, while BS's implications apply to both best-efforts and firm-commitment offerings, casual observation of the IPO market indicates that formal elicitations of interest (i.e., preselling activity) are considerably more common among firm-commitment than best-efforts offerings. Thus, it is important not to overinterpret the evidence for best-efforts offerings; only the evidence as a whole should be considered.

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[4]Sternberg (1989) discusses a substitute mechanism for OAOs: "Direct Variation in Terms." That is, an underwriter can ensure flexibility in the final number of shares for sale by indicating a wide range of possible number of shares for sale in the preliminary prospectus, and adjust according to early market indications. This paper ignores this possibility.

[5]The signalling literature also assumes that issuers require minimum funding (e.g., Leland and Pyle (1977)). Yet, Welch (1989) documents that many IPO issuers pursue a multiperiod issuing strategy.

B. The Ritter Theory of Contract Choice

The essence of Ritter's (1987) extension of Rock (1986) is that, for any given offering, informed investors add their demand only when the offering is underpriced. By increasing the MSC, an issuer can reduce the probability that an offering will succeed if informed investors do not participate. Therefore, higher MSCs act as filters that are more likely to eliminate overpriced offerings due to their lower (informed) demand.

From an uninformed investor's point of view, MSCs reduce the probability that an offering is overpriced. They increase the probability that this investor will not have to accept an allocation for an offering that is so poorly received that it cannot generate enough demand. A MSC is thus "insurance" by issuers to uninformed investors to withdraw the offering if informed demand is not forthcoming. In other words, a MSC can be interpreted as an option granted to the investor to put the shares back to the issuer if demand is insufficient. This insurance reduces the necessary ex ante underpricing required to attract uninformed investors to take the offering public.[6] However, higher MSCs increase the probability that the offering will fail. In Ritter (1988), the most risky issuers are more inclined to choose (all-or-nothing) best-efforts contracts, trading off some probability of offering success (when there is no informed demand) against insurance for uninformed investors with its requisite reduction in underpricing. Ritter (1987) provides evidence for this implication in a sample of firm-commitment offerings (which he interprets as offerings with no MSCs) and best-efforts offerings (all of which he interprets as all-or-nothing offerings). He finds, consistent with his prediction, that risky issuers are more likely to choose best-efforts offerings than firm-commitment offerings.

This paper deviates from RR in two ways:

1) RR interprets firm-commitment offerings to be without any selling requirements and *all* best-efforts offerings to be *all-or-nothing*. Firm-commitment offerings are not, however, simply best-efforts offerings with zero sales requirements. By committing to accept any unsold part of the offering, the underwriter not only can never withdraw the offering, but also may certify the offering's quality and ensure project funding.

2) Ritter ((1987), p. 277) argues that a riskiness threshold exists below which less risky issuers choose firm-commitment offerings (i.e., offerings with no MSC) and above which more risky issuers choose best-efforts offerings. The rationale is that the reduction in underpricing due to the commitment to withdraw undersubscribed shares is more valuable when the required underpricing without the MSC would be too high. Thus, riskier issuers are more inclined to trade an increased probability that their offering will fail for a reduction in underpricing.

This paper tests if this argument holds both for a range of offerings with different uncertainties, and for a range of feasible contracts (with varying MSCs). As in RR, issuers are presumed to face a trade-off between underpricing (IR) or risking failure (MSC). The riskiness of the offering determines the optimal mix of the two: if both IR and MSC have diminishing effectiveness (and the

[6]Ex post, successful offerings with high MSCs can actually be more underpriced. An example that shows that this can be true is available from the author upon request.

optimal choice is not a corner), a riskier issuer would optimally choose both higher underpricing and a higher probability of issue failure than a less risky issuer. Consequently, as in RR, the most risky issuers set the highest MSCs, and the least risky issuers set the lowest.[7]

In contrast, in a firm-commitment offering, uninformed investors never get the opportunity to put the shares back to the issuer. Ritter ((1987), p. 280) argues that, unlike high MSCs over-allotment options (OAOs) reduce the issuer's underpricing, because there are more shares to allocate when demand is strong, i.e., when informed investors are in the market. Thus, both RR and BS predict a negative correlation between OAOs and underpricing.

C. A Direct Comparison of the Tested Implications

This section outlines the tested implications of the two theories of contract choice, prefixing the predictions of Benveniste and Spindt (BS) with *BS*, those of Ritter (RR) with *RR* In BS, an over-allotment option (OAO) allows more shares to be allocated to regular investors when there is good news than when there is bad news, and thus regular investors can receive the same profit with less underpricing per share. In RR, an OAO increases the number of shares for sale when demand is strong. Thus, both RR and BS predict that

Implication BS1/RR1. Overallotment options (OAOs) reduce IPO underpricing.

Since flexibility in the number of shares reduces underpricing, BS also predicts that investors must be compensated for accepting preselling allocations:

Implication BS2. Minimum sales constraints (MSCs) increase IPO underpricing.

In RR, the choice of MSC is endogenous:

Implication RR2. (The prediction of Ritter ((1987), p. 287; (1988)).) Risky issuers set higher MSCs.

Since the necessary winner's curse underpricing is highest for the riskiest issuers, they benefit the most by offering MSC insurance. In contrast, in any model in which the contract choice is exogenous (including BS), one would expect:

Implication BS3. Issuers with high capital requirements set high MSCs and small OAOs.[8]

One further implication of BS relates contract choice to underwriter compensation:

Implication BS4. Underwriters are compensated for accepting high MSCs, and low OAOs.

Table 1 summarizes these implications. Arrows indicate the theoretically implied causality in the predicted correlations. Implication *BS*3 is parenthesized, since it also could be incorporated into an adverse selection model.[9]

[7]It is easy to show that in a Rock (1982) equilibrium, a higher MSC must decrease the probability of offering success, and thus reduce ex ante underpricing. Showing that both IR and MSC have diminishing returns is, however, not easy at all. Yet, the empirical results are similar when the tests in Section IV.B are not run on the full sample, but instead only on the extreme thirds (in terms of MSC and risk) of the data set.

[8]The relationship between capital requirements and OAO is not tested in this paper because we cannot find a good proxy of capital requirements for larger (firm-commitment) offerings.

[9]The rationale for sharply distinguishing the two motives for issuers' choice of MSCs is that the Ritter (1987) model concentrates on risk as the driving force in the contract choice decision.

TABLE 1

Predicted Effects

	OAO→ Underpricing	MSC→ Underpricing	MSC← Uncertainty	MSC/OAO← Capital Requirements	MSC/OAO→ Underwriting Costs
Benveniste and Spindt dynamic information acquisition	⊖ *BS*1	⊕ *BS*2		⊕/⊖ (*BS*3)	⊕/⊖ *BS*4
Ritter (Rock) adverse selection	⊖ *RR*1		⊕ *RR*2		

This table summarizes the predictions of the two theories that are tested in this paper. The arrow (→) indicates the theoretically implied causality, ⊕ indicates positive predicted correlation, ⊖ indicates negative predicted correlation. For example, both BS and RR predict that an over-allotment option reduces underpricing. Prediction *BS*3 is parenthesized to indicate that it could be incorporated into an adverse selection model. Variables MSC and OAO are the minimum sales constraints and the over-allotment option, respectively. An all-or-nothing offering has a MSC of 1.0, an offering without any sales constraints, a MSC of 0.0. The NASD limited the maximum OAO to 15 percent before 1983.

III. Data and Methodology

A. Data and Variable Definitions

The data set includes all underwritten offerings listed in *Howard & Company's Going Public: The IPO Reporter* in the period 1977–1982. This data set was used in Beatty and Ritter (1986) and Ritter (1984), (1987). There are 363 best-efforts offerings and 660 firm-commitment offerings.[10] We define the proxies for theoretical constructs as follows.

MSC is the minimum sales constraint, that is, the percentage of the maximum number of shares for sale that must be sold for the offering to become effective. It is computed by dividing min by max, where min is the minimum number of shares and max the maximum number of shares for sale. An all-or-nothing offer has a MSC of 1.0; an offer without any sales requirement has a MSC of 0.0.

OAO is the over-allotment option, computed as the additional number of shares the underwriter can purchase divided by the minimum committed number of shares for sale. The interpretation of OAO is different from that of MSC: a more "flexible" offering has a higher OAO.

IR is the IPO initial return, calculated using the offering price and the first available after-market bid price.

LUWC is a measure of underwriter compensation. It is the natural log of total underwriter compensation indicated in the prospectus, computed by adding the underwriter discount, accountable and nonaccountable expenses.[11] Consequently, LUWC is highly correlated with the offering size.

[10]In specific regressions, a number of offerings had to be excluded due to invalid contract choice or pricing data. For best-efforts offerings, at most three offerings were excluded in some regressions. Five offerings that combined features of both best-efforts and firm-commitment offerings were also excluded.

[11]This definition clearly omits some of the compensation accruing to the underwriter, including, for example, warrants granted to the underwrtier and future business opportunities. Note that LUWC is measured in log of absolute dollars. We repeated all relevant regressions with underwriter compensation being measured as a proportion of the offering size, and did not find any substantial difference. See also footnote 23.

The proxies for ex ante uncertainty (risk), project funding needs, and offering size are more contestable. The proxies for ex ante risk are as follows.

LUSES is the natural log of one plus the number of uses of proceeds listed in the prospectus. This variable was a risk proxy in Beatty and Ritter (1986).

1/PROC is the reciprocal of the *maximum* total proceeds of the offering, multiplied by 10^6. Beatty and Ritter (1986) used a highly correlated variable, the reciprocal of the *actual* total proceeds. The use of maximum proceeds is justified because actual proceeds are not known ex ante (at the time of the offering).

LRISKS is the natural log of one plus the number of project risk factors listed in the prospectus. Since all participants are legally liable for omitted project risk factors (see also Tinic (1988)), LRISKS is likely to be a good proxy for ex ante uncertainty. This variable was investigated (but its effects described only in a footnote) in Beatty and Ritter (1986).

1/OP is the reciprocal of the nominal offering price. An empirical justification of this measure is that "penny stocks" are usually quite risky. This variable was used in Tinic (1988).

Since these risk proxies are highly correlated, and since it can be convenient to examine the influence of "risk," we define two alternative summary statistics for these four variables as follows.

STDRISK is the average of the normalized scores of each of the above four original risk proxies, and

RANKRISK is the average of the ranks of each of the above four original risk proxies.

A proxy for funding requirements is difficult to construct. Still, to the extent that IPOs serve a valuable role in satisfying immediate capital needs,[12] we introduce an admittedly ad hoc proxy for funding requirements as follows.

SALES, defined as the last 12 months of sales revenues (in million dollars).

The justifications are: (1) startup firms without previous sales often rely on technological advances that are likely to be profitable only until competitors catch up; thus, these firms may have more urgent capital needs; and (2) firms with higher sales have alternative revenue sources and thus depend less on IPO funding.[13] Alternatively, the reader may interpret SALES as an inverse proxy of ex ante uncertainty. Yet, evidence not reported in this paper shows that, given other risk proxies, SALES is *not* marginally related to underpricing. This indicates that SALES' marginal contribution is *not* as a proxy for risk.

Finally, as a proxy for the offering size, which in turn proxies for the effort required by the underwriter to take an offering public, we define the following.

[12]Issuers probably also employ public and private debt and seasoned offerings in their capital-raising strategy. Welch (1989) documents that issuers typically raise three times as much capital in seasoned offerings than in their IPO. See also footnote 5.

[13]This argument is more convincing for small best-efforts offerings, i.e., for firms that do not have access to a wide array of sophisticated financial services. In firm-commitment offerings—which are strong enough to attract an underwriter willing to put his reputation on the line—SALES is not a good proxy. See also foonote 8. We should also note that the log of SALES is not as good a predictor as SALES itself.

TABLE 2

Descriptive Univariate Statistics

Name	Description	N	Mean	Std. Dev.	Minimum	Maximum
Panel A. Best-Efforts Offerings						
Dependent Variables						
MSC	Minimum Sales Constraint	363	0.73621	0.20980	0.00000	1.00000
IR	Initial Return	363	0.46452	0.79630	−0.68750	4.00000
LUWC[1]	Nat. Log of Underwriter Compensation	361	5.43405	0.65419	2.52104	6.91832
Risk Proxies						
RANKRISK	Average Rank of Risk Proxies	363	182.00000	61.32034	4.87500	313.37500
STDRISK	Average Z-Score of Risk Proxies	363	0.00000	0.61998	−2.86961	4.56271
LUSES	Nat. Log of Listed Uses of Proceeds	363	2.26973	0.50076	0.69315	3.66356
LRISKS	Nat. Log of Listed Risk Factors	363	2.99854	0.38037	0.00000	3.66356
1/PROC[1]	Reciprocal of Maximum Proceeds ($*10^6$)	363	0.66513	0.90591	0.02603	11.36204
1/OP	Reciprocal of Nom. Offering Price	363	6.21936	13.45742	0.00143	100.00000
Size and Sales						
LMXSZ[1]	Nat. Log of Maximum Offering Size	363	14.52476	0.69675	11.38523	17.46402
SALES[1]	Company Sales ($*10^{-6}$)	363	0.59374	2.69430	0.00000	36.12637
Panel B. Firm-Commitment Offerings						
Dependent Variables						
OAO	Over-Allotment Option	660	0.08047	0.03625	0.00000	0.10909
IR	Initial Return	655	0.14728	0.37612	−0.29167	4.00000
LUWC[1]	Nat. Log of Underwriter Compensation	660	6.28314	0.72397	3.69424	8.83576
Risk Proxies						
RANKRISK	Average Rank of Risk Proxies	659	332.30690	163.04095	55.12500	637.62500
STDRISK	Average Z-Score of Risk Proxies	659	−0.00272	0.72532	−1.24794	3.79963
LUSES	Nat. Log of Listed Uses of Proceeds	660	1.55848	0.61269	0.00000	3.49651
LRISKS	Nat. Log of Listed Risk Factors	660	1.51010	1.29671	0.00000	3.43399
1/PROC[1]	Reciprocal of Maximum Proceeds ($*10^6$)	659	0.23324	0.20619	0.00779	1.37723
1/OP	Reciprocal of Nom. Offering Price	659	0.32225	0.93397	0.00074	10.00000
Size and Sales						
LMXSZ[1]	Nat. Log of Maximum Offering Size	659	15.63279	0.89805	13.49544	18.67025
SALES[1]	Company Sales ($*10^{-6}$)	660	20.73602	53.77415	0.00000	766.90585

[1] Expressed in December 1982 purchasing power.

LMXSZ is the natural log of the maximum size of the offering (in million dollars), where the maximum size equals the maximum number of shares for sale times the offering price.[14]

All variables computed from nominal dollar quantities (except 1/OP, which is used to screen penny issues) have been properly discounted to one base (to December 1982 with the CPI). Table 2 provides descriptive univariate statistics for these variables.

B. Methodology

The primary objective of this paper is to test for the partial correlations between a predicted variable and a set of regressors. Yet, the standard assumptions to run an ordinary least squares regression are often not satisfied, and two inference problems will be explicitly corrected for:

1) According to the histograms in Figures 1 and 2, MSC and OAO are not distributed in a way that a familiar distribution can describe.[15]

When the dependent variable is not conditionally normally i.i.d. distributed, the OLS coefficient estimates are not the maximum-likelihood estimates and the coefficient t-statistics are not distributed Student-t. The regression coefficients, however, are unbiased. We adjust for nonnormal conditional distribution with an "Approximate Randomization" (AR) technique, discussed in Noreen (1989). This technique provides more robust significance levels on unbiased coefficient estimates by bootstrapping the distribution of unbiased coefficient estimates under the null hypothesis of no correlation. The procedure is as follows: first, a distribution of least-squares coefficient vectors under the null hypothesis is created. To obtain a single coefficient vector under the null hypothesis, the ordering of the dependent variable's observations is randomly rearranged. This amounts to resampling the dependent variable without replacement. A new regression is run on this modified data set and the coefficient vector is recorded. This coefficient vector should not indicate a relationship between the dependent and the independent variables. After repeating this procedure 10,000 times, the location of the original coefficient vector under this empirical null distribution of 10,000 coefficient vectors is reported (variable by variable.)[16]

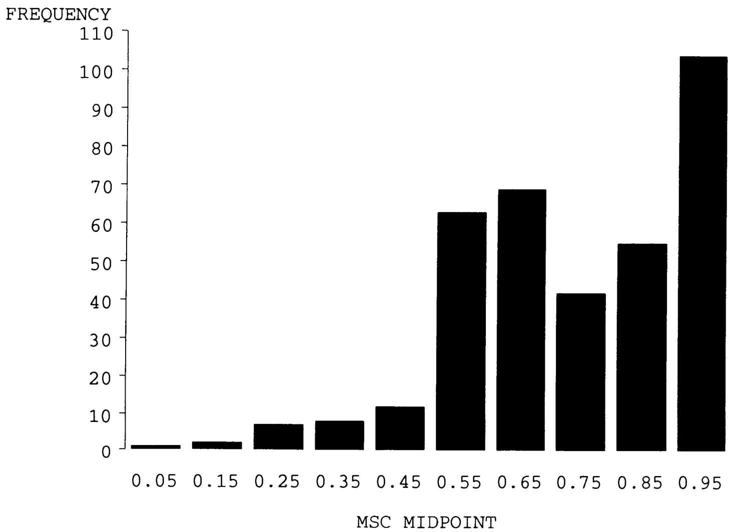
There are further problems of potential importance, which deserve explicit mention:

1) The data set is correlated across time and industry dimensions (but is not equally spaced to permit standard correction techniques). For example, Ritter (1984) provides evidence of nonstationary returns across industries in the data set. The inclusion of industry dummies in all regressions should alleviate this problem.

[14] Tinic (1988) uses the actual offering size as a risk proxy (see also the definition of 1/PROC).

[15] The distributions of the residuals from the OLS regressions estimated on these (dependent) variables are no more Gaussian-normal than the graphed distributions of the original variables.

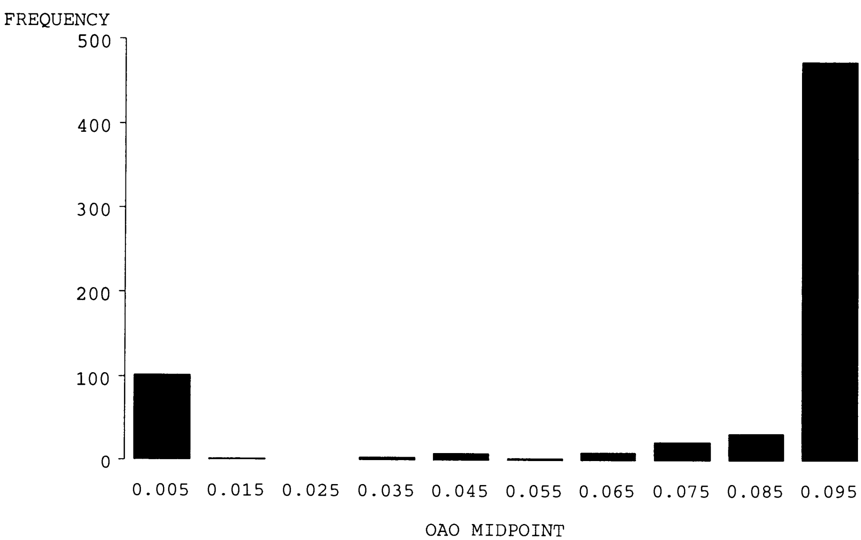
[16] While it is important to provide bootstrapped significance levels to allow proper interpretation of our results, for the most part, we find that the OLS significance levels are fairly close to the bootstrapped levels.



n=363, mean=0.74, stddev=0.21, skew= -0.39, kurt= -0.38
Min=0.0,1%=0.22,5%=0.4,25%=0.58,Median=0.75,75%-Max=1.0

FIGURE 1

Contract Choice
Distribution of MSC



n=662, mean=0.08, stddev=0.04, skew= -1.63, kurt= 0.88
Min-5%=0.0, 25%=0.08, Median-Max=0.1

FIGURE 2

Contract Choice
Distribution of OAO

2) Ultimately, all tests are joint tests of the adequacy of the proxies and the described hypotheses. Failure to reject the null hypothesis can be either because the proxies are poor, or the hypothesis is wrong. To reduce this problem for the risk proxies, (1) we use more risk proxies than other papers in the IPO literature; (2) we include dummy variables to capture industry effects (if the risk factors were to vary in the industry subgroups, these industry variables could pick up omitted risk);[17] and (3) we have subjected the reported regressions to a number of robustness tests, and found the reported relationships to be quite stable.[18]

3) An IPO is a one-time event. Thus, we must pool offerings without a good justification for cross-sectional stationarity. This means that the coefficients in subsequent regressions can be interpreted only as estimates of average coefficients, not of stationary, typical coefficients. In other words, some issuers may choose their contract according to the BS model, others according to the RR model. Our results can only indicate that issuers were more inclined to behave, *on average,* in a way consistent with one of the two models.

4) Worse, while the two theories are built on different premises, even the same issuer may consider both preselling and adverse-selection problems. For example, exogenous capital requirements could influence the degree of adverse selection that investors must face. Indeed, Benveniste and Wilhelm (1990) examine a model in which an issuer is concerned with both adverse selection and dynamic information acquisition.

IV. Results

We now examine one-by-one the hypotheses summarized in Table 1.

A. The Effect of Contract Choice on Underpricing

1. Firm-Commitment Offerings (Hypotheses *BS*1 and *RR*1)

We begin by examining the effect of the over-allotment option (OAO) on underpricing (IR). Hypothesis *BS*1 predicts that a large OAO reduces underpricing, because it reduces the underwriter's incentives to fully succeed. Hypothesis *RR*1 predicts that a large OAO reduces underpricing, because it provides more allocations when informed investors purchase and demand is high.

To compensate for the problem of holding risk properly constant, we provide as risk proxies either the summary proxies (RANKRISK and STDRISK), or the full set of risk proxies. Further, in all regressions in this paper, we include—but do not report the coefficients on—eight industry dummies (for 1-digit SIC codes) to hold industry effects constant. The regressions in Table 3 confirm that

[17]Ritter (1984) documents that underpricing is highly related to industry; thus, if risk differs across industries, the eight dummies are likely to capture some of this risk.

[18]For example, in various (WLS and OLS) regressions, we did include measures of residual underwriter compensation, underwriter quality, offering size, sales, principal risk components extracted from the four risk proxies, and nonlinear transformations of the risk proxies. The results remained essentially the same. MSC and OAO always displayed the same sign, and usually similar significance. The only difference appears to be that some of the coefficients indicated stronger results (for example, for the effect of MSC on IR) within the second half of the sample.

TABLE 3

The Determinants of IPO Underpricing (Firm-Commitment Offerings)

$$\mathrm{IR}_i = \theta_0 + \sum_{j=1}^{8} \theta_j \mathrm{SIC}(j)_i + \theta_9 \mathrm{OAO}_i + \theta_{10}\mathrm{STDRISK}_i + \theta_{11}\mathrm{RANKRISK}_i + \theta_{12}\mathrm{LUSES}_i + \theta_{13}\mathrm{LRISKS}_i + \theta_{14} 1/\mathrm{PROC}_i + \theta_{15} 1/\mathrm{OP}_i + \epsilon_i$$

	θ_9	θ_{10}	θ_{11}	θ_{12}	θ_{13}	θ_{14}	θ_{15}	
Hypothesis	$\theta_9 < 0$	$\theta_{10} > 0$	$\theta_{11} > 0$	$\theta_{12} > 0$	$\theta_{13} > 0$	$\theta_{14} > 0$	$\theta_{15} > 0$	
Coefficient	−0.70662							n = 655
OLS significance	0.0412*							R^2 = 0.0273
AR significance	0.0481*							$\bar{R}^2$ = 0.0122
Coefficient	−0.75821	0.17903						n = 655
OLS significance	0.0236*	0.0000**						R^2 = 0.1439
AR significance	0.0387*	0.0001**						$\bar{R}^2$ = 0.1293
Coefficient	−0.81985		0.000546					n = 655
OLS significance	0.0192*		0.0000**					R^2 = 0.0821
AR significance	0.0297*		0.0001**					$\bar{R}^2$ = 0.0664
Coefficient	−0.56524			0.08064	−0.00005	0.03371	0.15118	n = 655
OLS significance	0.0633			0.0023**	0.5015	0.3265	0.0000**	R^2 = 0.2133
AR significance	0.0891			0.0049**	0.5048	0.3148	0.0001**	$\bar{R}^2$ = 0.1961

The dependent variable is IR (IPO underpricing). For other variable definitions, refer to Table 2. Row 2 of the table indicates the hypothesis for which significance levels are quoted. The two lines following each coefficient estimate display the significance level of this coefficient estimate, as obtained through the standard OLS T-statistic and through the "Approximate Randomization" bootstrapping procedure, respectively. (Superscripts "**" and "*" emphasize significance at the 1- and 5-percent levels.)

the coefficient on OAO is consistently negative and significant at the 10-percent (5-percent) level in a one-sided test in all (but one) regressions. A one standard deviation (3.3 percent) decrease in OAO increases IPO underpricing by 2–3 percent. This supports implications *BS*1 and *RR*1. As far as other variables are concerned, IPO underpricing is highly related to offering risk (as documented in the literature): RANKRISK and STDRISK are positive and highly significant.[19]

2. Best-Efforts Offerings (Hypothesis *BS*2)

Turning to the effect of MSCs in best-efforts offerings, the results of regressions with initial return as the dependent variable are in Table 4. It appears that MSC has a positive effect on underpricing (holding ex ante uncertainty constant). This effect is significant both statistically (all coefficients on MSC are significant at the 3-percent level in a test of the hypothesis that this coefficient is positive) and economically (a 21 percent [one standard deviation] higher MSC implies 8–10 percent more underpricing). That is, consistent with Hypothesis *BS*2, offerings with more preselling activity are more underpriced. As for other included variables, only the relationship between the summary (but not the individual) proxies for ex ante uncertainty and IPO underpricing is statistically significantly positive.

[19]However, the relative significance of the individual risk factors—both in firm-commitment and best-efforts offering regressions—is surprising. The reciprocal of the nominal offering price is the best ex ante predictor of underpricing. Section IV.C.2 interprets this finding.

TABLE 4

The Determinants of IPO Underpricing (Best-Efforts Offerings)

$$\begin{aligned} \mathrm{IR}_i = {} & \theta_0 + \sum_{j=1}^{8} \theta_j \mathrm{SIC}(j)_i + \theta_9 \mathrm{MSC}_i + \theta_{10} \mathrm{STDRISK}_i + \theta_{11} \mathrm{RANKRISK}_i + \theta_{12} \mathrm{LUSES}_i \\ & + \theta_{13} \mathrm{LRISKS}_i + \theta_{14} 1/\mathrm{PROC}_i + \theta_{15} 1/\mathrm{OP}_i + \epsilon_i \end{aligned}$$

Hypothesis	θ_9 $\theta_9 > 0$	θ_{10} $\theta_{10} > 0$	θ_{11} $\theta_{11} > 0$	θ_{12} $\theta_{12} > 0$	θ_{13} $\theta_{13} > 0$	θ_{14} $\theta_{14} > 0$	θ_{15} $\theta_{15} > 0$	
Coefficient	0.46173							n = 363
OLS significance	0.0111*							R^2 = 0.0516
AR significance	0.0115*							$\bar{R}^2$ = 0.0246
Coefficient	0.38539	0.26123						n = 363
OLS significance	0.0263*	0.0001**						R^2 = 0.0906
AR significance	0.0305*	0.0006**						$\bar{R}^2$ = 0.0621
Coefficient	0.45914		0.002279					n = 363
OLS significance	0.0106*		0.0005**					R^2 = 0.0808
AR significance	0.0117*		0.0001**					$\bar{R}^2$ = 0.0520
Coefficient	0.39402			0.11214	0.11040	0.06466	0.00715	n = 363
OLS significance	0.0245*			0.1028	0.1878	0.1730	0.0605	R^2 = 0.0925
AR significance	0.0275*			0.1099	0.1932	0.1637	0.0734	$\bar{R}^2$ = 0.0560

The dependent variable is IR (IPO underpricing). SIC indicates 1-digit industry dummies. For other variable definitions, refer to Table 2. Row 2 of the table indicates the hypothesis for which significance levels are quoted. The two lines following each coefficient estimate display the significance level of this coefficient estimate, as obtained through the standard OLS T-statistic and through the "Approximate Randomization" bootstrapping procedure, respectively.

B. The Evidence on Contract Choice (Hypotheses *BS*3 and *RR*2)[20]

1. Best-Efforts Offerings

Table 5 reports the results of regressions with MSC as the dependent variable and with independent variables suggested by the two theories: capital requirements (SALES) and ex ante uncertainty (LRISKS, LUSES, 1/PROC, and 1/OP; STDRISK; and RANKRISK). In all regressions, the estimated coefficient on SALES is negative and significant at about the 1-percent level. This is consistent with Hypothesis *BS*3 that issuers with higher capital requirements use higher MSCs. Risk plays only a limited role in the contract choice decision. When one representative risk variable is used, RANKRISK's coefficient is not only not significant but also has the wrong sign from the view of RR (a negative sign associates riskier offerings with lower MSCs). STDRISK's coefficient has the correct sign, but similarly no significance. In a regression with all risk proxies, LUSES and 1/OP have negative (but insignificant) coefficients, and only LRISKS is significantly (though barely) positively related to contract choice (as predicted by *RR*2).

The failure to find risk to be a good predictor of MSCs is not completely inconsistent with Ritter (1988). He shows only that the most (least) risky issuers choose all-or-nothing contracts, not a generally unambiguous relationship

[20]Ritter (1988) examines the differences between best-efforts and firm-commitment offerings. Guenther (1990) uses a logit model to predict issuers' choice of either a best-efforts offering or a firm-commitment offering.

between risk proxies and contract choice. The results of these regressions, however, remain the same only if the two extreme thirds of observations (in terms of risk and MSC) are included.[21]

Therefore, in sum, we interpret the evidence in Table 5 to not favor Hypothesis *RR*2 that risk is an important positive determinant of MSC. All in all, it appears that the evidence favors theories in which contract choice is exogenous: for example BS, but not RR. Still, the explanatory power of these regressions is low (the R^2 is about 7 percent). There are two explanations. (1) Economically, SALES is a very ad hoc proxy for capital requirements. (2) Statistically, R^2 is not a meaningful number when a proportion is predicted. The explanatory power could be increased by simple procedures (e.g., by truncating predictions to lie in the domain [0,1]).

TABLE 5

The Determinants of Minimum Sales Constraints (Best-Efforts Offerings)

$$\text{MSC}_i = \theta_0 + \sum_{j=1}^{8} \theta_j \text{SIC}(j)_i + \theta_9 \text{SALES}_i + \theta_{10} \text{STDRISK}_i + \theta_{11} \text{RANKRISK}_i + \theta_{12} \text{LUSES}_i + \theta_{13} \text{LRISKS}_i + \theta_{14} 1/\text{PROC}_i + \theta_{15} 1/\text{OP}_i + \epsilon_i$$

	θ_9	θ_{10}	θ_{11}	θ_{12}	θ_{13}	θ_{14}	θ_{15}	
Hypothesis	$\theta_9 < 0$	$\theta_{10} > 0$	$\theta_{11} > 0$	$\theta_{12} > 0$	$\theta_{13} > 0$	$\theta_{14} > 0$	$\theta_{15} > 0$	
Coefficient	−0.01228							n = 363
OLS significance	0.0014**							R^2 = 0.0638
AR significance	0.0024**							$\bar{R}^2$ = 0.0372
Coefficient	−0.01104	0.02144						n = 363
OLS significance	0.0046**	0.1235						R^2 = 0.0674
AR significance	0.0061**	0.1305						$\bar{R}^2$ = 0.0382
Coefficient	−0.01300		−0.000129					n = 363
OLS significance	0.0011**		0.7541					R^2 = 0.0651
AR significance	0.0019**		0.7532					$\bar{R}^2$ = 0.0358
Coefficient	−0.01065			−0.01127	0.04461	0.02001	−0.000505	n = 363
OLS significance	0.0073**			0.6823	0.0957	0.1368	0.6599	R^2 = 0.0722
AR significance	0.0107*			0.6729	0.1078	0.1346	0.6680	$\bar{R}^2$ = 0.0348

The dependent variable is MSC (the minimum sales constraint). SIC indicates 1-digit industry dummies. For other variable definitions, refer to Table 2. Row 2 of the table indicates the hypothesis for which significance levels are quoted. The two lines following each coefficient estimate display the significance level of this coefficient estimate, as obtained through the standard OLS *T*-statistic and through the "Approximate Randomization" bootstrapping procedure, respectively.

C. The Effect of Contract Choice on Underwriter Compensation (Hypothesis *FS*4)

Finally, we test whether underwriters are compensated for providing preselling services (Hypothesis *BS*4). We predict the log of underwriter compensation (LUWC) with either MSC or OAO, holding constant a number of incidental variables (offering size, sales, risk, and industry).[22]

[21]Regression results are available from the author upon request.

[22]The regressions were repeated with a prediction of the relative share of underwriter compensation as a function of the offering size. The results were very similar—except that OAO was statistically significant in all AR significance levels.

TABLE 6

The Determinants of Underwriter Compensation (Best-Efforts Offerings)

$$\text{LUWC}_i = \theta_0 + \sum_{j=1}^{8} \theta_j \text{SIC}(j)_i + \theta_9 \text{LMXSZ} + \theta_{10}\text{MSC}_i + \theta_{11}\text{SALES}_i + \theta_{12}\text{STDRISK}_i + \theta_{13}\text{RANKRISK}_i + \theta_{14}\text{LUSES}_i + \theta_{15}\text{LRISKS}_i + \theta_{16} 1/\text{PROC}_i + \theta_{17} 1/\text{OP}_i + \epsilon_i$$

	θ_9	θ_{10}	θ_{11}	θ_{12}	θ_{13}	θ_{14}	θ_{15}	θ_{16}	θ_{17}	
Hypothesis	$\theta_9 > 0$	$\theta_{10} > 0$	$\theta_{11} \neq 0$	$\theta_{12} > 0$	$\theta_{13} > 0$	$\theta_{14} > 0$	$\theta_{15} > 0$	$\theta_{16} > 0$	$\theta_{17} > 0$	
Coefficient	0.9029									n = 361
OLS significance	0.0000**									R^2 = 0.8608
AR significance	0.0001**									$\bar{R}^2$ = 0.8569
Coefficient	0.9102	0.41329								n = 361
OLS significance	0.0000**	0.0000**								R^2 = 0.8775
AR significance	0.0001**	0.0066**								$\bar{R}^2$ = 0.8736
Coefficient	0.9097	0.41546	0.00146							n = 361
OLS significance	0.0000**	0.0000**	0.7741							R^2 = 0.8775
AR significance	0.0001**	0.0071**	0.9718							$\bar{R}^2$ = 0.8733
Coefficient	0.9118	0.41503	0.00159	0.00438						n = 361
OLS significance	0.0000**	0.0000**	0.7577	0.4306						R^2 = 0.8775
AR significance	0.0001**	0.0071**	0.9596	0.4637						$\bar{R}^2$ = 0.8730
Coefficient	0.9358	0.42437	0.00352		0.000528					n = 361
OLS significance	0.0000**	0.0001**	0.4971		0.0175*					R^2 = 0.8791
AR significance	0.0001**	0.0064**	0.8478		0.2262					$\bar{R}^2$ = 0.8746
Coefficient	0.8673	0.41682	0.00324			0.00768	0.05938	−0.04217	0.000243	n = 361
OLS significance	0.0000**	0.0000**	0.5340			0.3880	0.0790	0.9415	0.4305	R^2 = 0.8797
AR significance	0.0001**	0.0069**	0.8610			0.4559	0.2801	0.7268	0.4874	$\bar{R}^2$ = 0.8741

The dependent variable is LUWC (the log of underwriter compensation). SIC indicates 1-digit industry dummies. For other variable definitions, refer to Table 2. Row 2 of the table indicates the hypothesis for which significance levels are quoted. The two lines following each coefficient estimate display the significance level of this coefficient estimate, as obtained through the standard OLS T-statistic and through the "Approximate Randomization" bootstrapping procedure, respectively.

1. Best-Efforts Offerings

Table 6 shows that the log of underwriter compensation is highly related to the log of the maximum offering size in best-efforts offerings. This is consistent with the view that underwriters are compensated foremost for the amount of effort required to take an offering public (which is, of course, positively correlated with the size of the offering). Confirming Ritter (1987), the coefficient on LMXSZ is less than one, indicating that there are economies of scale.[23] A MSC appears to have a significant positive effect on underwriting costs. This is consistent with the BS prediction that underwriters have to be compensated for accepting higher MSCs.[24]

2. Firm-Commitment Offerings

Table 7 examines the effect of the over-allotment option on underwriter compensation in firm-commitment offerings. The results are similar to the results for best-efforts offerings. The coefficient on offering size (LMXSZ) may indicate that there are economies of scale in underwriting services. Yet, only the OLS but not the AR significance levels indicate that underwriter compensation is higher for offerings with small OAOs.[25] Thus, the evidence in Table 7 is weaker than the evidence in Table 6.

Unlike the best-efforts offerings, underwriter compensation in firm-commitment offerings is strongly positively related to the ex ante offering risk and in particular to LRISKS: riskier offerings require more underwriter compensation. Note, however, that LRISKS—the number of risk factors for which the underwriter can be held legally liable—is not significantly related to IPO underpricing (Table 3).[26] Together, these two findings are inconsistent with Tinic (1988). In Tinic, underwriters insist on IPO underpricing because it reduces the probability that the after-market stock price will fall below the offering price, which reduces the probability of a lawsuit against the underwriter. The evidence in this paper

[23]On one hand, since LMXSZ is the maximum, not actual offering size, this does not prove economies of scale. On the other hand, as mentioned in footnote 11, the measures of underwriter compensation exclude not only the value of future relationships with the client, but also the value of (typically long-term) warrants granted to the underwriter. Barry, Muscarella, and Vetsuypens (1990) find that these warrants can represent a significant fraction of underwriter compensation, and are frequently used in smaller offerings. This implies that the reported coefficient on offering size understates the true economies of scale.

[24]The insignificant coefficient on SALES in Table 6 further indicates that underwriters cannot take advantage of issuers' capital requirements. This is consistent with a competitive market for underwriting services—but also with the plausible hypothesis that SALES is a weak proxy for capital requirements.

[25]In contrast, both the OLS and AR significance levels are significantly positive even at the 0.1-percent level in all regressions when the predicted variable is underwriter compensation divided by the offering size (not reported).

[26]In these regressions explaining underwriter compensation in firm-commitment offerings, we also experimented with dummy variables indicating underwriter quality (ranked as in Carter and Manaster (1990)). The coefficients on underwriter quality fluctuated widely when different sets of risk proxies were included. However, the coefficients on MSC displayed the same sign (and for the most part, similar significance) with or without inclusion of underwriter quality proxies. For best-efforts offerings, only two offerings were by New York major-bracket underwriters, i.e., there is very little measurable cross-sectional difference in underwriter quality in best-efforts offerings, and thus we did not experiment with underwriter quality.

TABLE 7

The Determinants of Underwriter Compensation (Firm-Commitment Offerings)

$$\text{LUWC}_i = \theta_0 + \sum_{j=1}^{8} \theta_j \text{SIC}(j)_i + \theta_9 \text{LMXSZ} + \theta_{10} \text{OAO}_i + \theta_{11} \text{SALES}_i + \theta_{12} \text{STDRISK}_i + \theta_{13} \text{RANKRISK}_i + \theta_{14} \text{LUSES}_i + \theta_{15} \text{LRISKS}_i + \theta_{16} 1/\text{PROC}_i + \theta_{17} 1/\text{OP}_i + \epsilon_i$$

	θ_9	θ_{10}	θ_{11}	θ_{12}	θ_{13}	θ_{14}	θ_{15}	θ_{16}	θ_{17}	
Hypothesis	$\theta_9 > 0$	$\theta_{10} < 0$	$\theta_{11} \neq 0$	$\theta_{12} > 0$	$\theta_{13} > 0$	$\theta_{14} > 0$	$\theta_{15} > 0$	$\theta_{16} > 0$	$\theta_{17} > 0$	
Coefficient	0.782010									n = 659
OLS significance	0.0000**									R^2 = 0.9437
AR significance	0.0001**									$\bar{R}^2$ = 0.9428
Coefficient	0.78231	−0.5422								n = 659
OLS significance	0.0000**	0.0019**								R^2 = 0.9444
AR significance	0.0001**	0.2607								$\bar{R}^2$ = 0.9434
Coefficient	0.79411	−0.6469	−0.00050							n = 659
OLS significance	0.0000**	0.0003**	0.0003**							R^2 = 0.9455
AR significance	0.0001**	0.2234	0.3890							$\bar{R}^2$ = 0.9445
Coefficient	0.89241	−0.6954	−0.00036	0.1736						n = 659
OLS significance	0.0000**	0.0001**	0.0012**	0.0000**						R^2 = 0.9592
AR significance	0.0001**	0.2072	0.5302	0.0023**						$\bar{R}^2$ = 0.9584
Coefficient	0.96139	−0.88644	−0.00020		0.00119					n = 659
OLS significance	0.0000**	0.0000**	0.0614		0.0000**					R^2 = 0.9691
AR significance	0.0001**	0.1442	0.7315		0.0001**					$\bar{R}^2$ = 0.9684
Coefficient	0.86125	−0.83156	−0.00020			0.07070	0.06847	−0.03551	0.01360	n = 659
OLS significance	0.0000**	0.0000**	0.0782			0.0000**	0.0000**	0.7456	0.0151*	R^2 = 0.9640
AR significance	0.0000**	0.1611	0.7311			0.1415	0.0194*	0.5621	0.3388	$\bar{R}^2$ = 0.9631

The dependent variable is LUWC (The log of underwriting compensation). SIC indicates 1-digit industry dummies. For other variable definitions, refer to Table 2. Row 2 of the table indicates the hypothesis for which significance levels are quoted. The two lines following each coefficient estimate display the significance level of this coefficient estimate, as obtained through the standard OLS T-statistic and through the "Approximate Randomization" bootstrapping procedure, respectively.

suggests that, while risk factors listed in the prospectus are important to the underwriter, they appear to be less important in the pricing of firm-commitment offerings. Underwriters are compensated directly for accepting high risk offerings, not indirectly through more IPO underpricing.[27]

V. Alternative Explanations

A. Alternative Explanations for the Results

Evidence can be consistent with many hypotheses. Furthermore, evidence is more useful if it can distinguish among reasonable hypotheses. This section, therefore, offers some alternative explanations that are either consistent or inconsistent with the results in Section IV.

Hypotheses *RR*1 and *BS*1 predict a negative relationship between underpricing and OAO. Yet, Smith ((1986), p. 20) points out that an OAO has more value to the underwriter the more underpriced the offering is.[28] Thus, an underwriter has an incentive to reduce the price of an offering when it has an OAO. The evidence in this paper rejects Smith's hypothesis.

Hypothesis *BS*2 relates underpricing to MSC. Since Rock's model can produce both negative and positive correlation between ex post underpricing and MSC, *BS*2 is informative. All of the above hypotheses are inconsistent with a theory in which insufficient funding reduces the probability of project success and/or too much funding increases managers' incentives to waste funding. In such a theory, reaching exactly the fixed project funding requirements would increase project value. High MSCs and/or low OAOs could reduce the range of possible funding outcomes, and thus reduce the need for underpricing. The evidence in this paper rejects such a theory.

An altogether different motive for issuers' contract choice (Hypotheses *BS*3 and *RR*2) is that underwriters set higher MSCs/lower OAOs options for offerings that they know will sell out more easily. Contract choice could thus be a signal from the underwriter to the public that he has indications of high demand (given the offering price). The signal is more costly when an underwriter has information that early indications of interest are weak (which increases the probability of offering failure). The details of such a model have yet to be worked out.

The fact that underwriters receive more compensation for accepting offerings with higher MSCs or lower OAOs (Hypothesis *BS*4) also can be explained by survival bias. If underwriters are compensated only for successful offerings, they may ex ante require more compensation for offerings that are more likely

[27] If underwriter quality were exogenous, then the expected correlation would have been negative (indicating that underwriters are willing to accept less compensation when there are more risk factors in the prospectus). If underwriter quality were endogenous and riskier issuers were to choose underwriters who are willing to accept more legal risk factors for more compensation, then the correlation would be—as observed—positive. Yet, inconsistent with Tinic, the larger number of risk factors does not translate into more underpricing for these issuers. (It must be pointed out, however, that the data are less inconsistent with Tinic's prediction (1) in the sample of best-efforts offerings where LRISKS explains neither IPO underpricing nor underwriter compensation, and (2) if the multi-collinear LUSES proxy were assumed to be a perfect substitute for LRISKS.)

[28] Hansen ((1986), p. 50) shows that the over-allotment option gains in value when underpricing increases.

to fail.[29] And, ex ante, offerings with high MSCs may have been more difficult to sell. Still, the finding that underwriters indeed received compensation for accepting offerings with higher MSCs or lower OAOs can reject some plausible hypotheses. For example: (1) if underwriters were to lose reputation by offering overpriced offerings to investors, MSCs could have provided underwriters with insurance (e.g., in a winner's curse context) so that their clients would be less likely to face an overpriced offering. Therefore, underwriters could have accepted lower compensation for better-insured offerings. (2) If lower MSCs or higher OAOs would have been chosen by issuers less likely to succeed otherwise, these same issuers would have had to offer higher compensation to their underwriters. A researcher could thus have observed a negative relationship between MSCs and underwriter compensation.

In sum, the results in Section IV can reject some but not all alternative explanations. Other theories can be equally consistent with the data. Such models will have to be tested on additional implications, either of themselves or against tests of RR or BS, that were not performed in this paper.

B. Alternative Theories of IPO Underpricing

This paper finds mixed evidence in favor of Ritter's extension of Rock's adverse selection model. On one hand, among best-efforts offerings, higher MSCs are not chosen by riskier issuers. On the other hand, OAOs reduce underpricing, and Ritter (1987) finds that best-efforts offerings are more underpriced than firm-commitment offerings. Other tests also have found more supportive evidence. Beatty and Ritter (1986) derive from the Rock (1982) model a positive relationship between ex ante uncertainty and IPO underpricing and provide supportive evidence for this implication. Still, Beatty and Ritter's test is weak: a number of other models predict this relationship, even a model in which issuers do not have perfect information about market conditions (a winner's curse is not required). In this sense, the contract choice tests in Ritter (1987) and in this paper are better tests since they relate issuers' decisions explicitly to the demand of customers. Koh and Walter (1989) provide an even better test that is based on actual demand data. They find, consistent with Rock's model, that IPO shares in Singapore were rationed such that an uninformed investor would have indeed earned a zero return.[30]

Other recent supportive evidence for Benveniste and Spindt's (1989) dynamic information acquisition model can be found in Sternberg (1989) and Weiss (1990). They document that underwriters adjust offering prices in response to the results of their "elicitations of interest." This supports the notion of dynamic information acquisition before the offering opens. The adjustment process in

[29] An important but unresolved question is why underwriters are willing to accept and issuers to write contracts with higher failure probability. In other words, why is this contract optimal?

[30] Yet, even this finding is not conclusive evidence for a winner's curse as the justification for IPO underpricing. A further necessary condition is that issuers could not sell out by selling to informed investors. To illustrate, in the signalling models of Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989), issuers voluntarily leave money on the table to signal quality. The consequent rationing of issues may lead to a winner's curse among uninformed investors, although underpricing is generated by a different phenomenon.

the offering price, however, is not only consistent with BS, but also with other theories, e.g., a theory in which investors compete to receive allocations before the market opens, and issuers just raise the price when many investors approach them.[31] The tests in this paper are complementary because they rely on a different mechanism, and thus are robust to different alternatives.

Two further theories, Smith's (1986) agency theory and Tinic's (1988) lawsuit theory, were already described and examined in passing. Yet, the tests in this paper have shed little light on other theories of IPO underpricing. These theories deserve brief mention in any paper that hypothesizes about the causes of IPO underpricing. In Baron's (1982) principal-agent model, IPO underpricing is due to issuers' inability to observe the distribution effort of their underwriter. But Muscarella and Vetsuypens (1989) provide evidence that underwriters underprice their own IPOs more than those of clients. This suggests that it is not a conflict between the underwriter and the client that causes IPO underpricing. Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989) present models in which some issuers underprice to signal higher quality for the sake of obtaining higher returns in subsequent offerings. Welch (1989) also provides some evidence that IPO issuers indeed return to the market frequently and soon after the IPO, and Jegadeesh, Weinstein, and Welch (1990) find that more underpriced IPOs are more active in issuing a second time. Finally, both Rock (1986) and Welch (1990) argue that demand is extremely sensitive to pricing, which induces even risk-neutral issuers to underprice.

VI. Conclusion

In this paper, we have presented the implications of contract choice for two theories of IPO choice: the Benveniste and Spindt (1989) theory, which predicts that higher minimum sales constraints (MSCs) or lower over-allotment options (OAOs) induce underwriters to force more of the offering in preselling activity onto their clients; and the Ritter (1987) theory, which predicts that both high MSCs and high OAOs protect uninformed investors against the winner's curse, by eliminating offerings with poor demand or by adding shares when demand is high, respectively.

We find that, for best-efforts offerings from 1977 to 1982, the data provide good support for the Benveniste and Spindt theory, and mixed support for the Ritter theory. The data, moreover, reject hypotheses in Smith (1986) and Tinic (1988). We found:

1) In best-efforts offerings, issuers' choices of MSCs are more related to their funding needs than to their offering's risk.

2) Both investors and underwriters receive more compensation (IPO underpricing and underwriter spread, respectively) for offerings with high MSCs.

[31]Partial rather than full adjustment requires further frictions, e.g., a reluctance by underwriters to exceed a limited price range that was indicated in the preliminary prospectus. Also, casual observation suggests that not only firm-specific but also market-wide factors can cause price and quantity revisions; this is more consistent with the simple alternative than with the dynamic acquisition hypothesis.

3) Investors receive less compensation and underwriters may receive less compensation for offerings with OAOs.

4) Underwriter fees may be marginally related to legal risk, while underpricing may not.

References

Allen, F., and G. R. Faulhaber. "Signalling by Underpricing in the IPO Market." *Journal of Financial Economics,* 23 (Aug. 1989), 303–323.

Baron, D. P. "A Model of the Demand for Investment Banking Advising and Distribution Services for New Issues." *Journal of Finance,* 37 (Sept. 1982), 955–976.

Barry, C. P.; C. J. Muscarella; and M. R. Vetsuypens. "Underwriter Warrants, Underwriter Compensation and The Costs of Going Public." Unpubl. Working Paper, Texas Christian Univ. and Southern Methodist Univ. (Feb. 1990).

Beatty, R. P., and J. R. Ritter. "Investment Banking, Reputation, and the Underpricing of Initial Public Offerings." *Journal of Financial Economics,* 15 (Jan./Feb. 1986), 213–232.

Benveniste, L. M., and P. A. Spindt. "How Investment Bankers Determine the Offer Price and Allocation of New Issues." *Journal of Financial Economics,* 24 (Oct. 1989), 343–361.

Benveniste, L. M., and W. Wilhelm. "A Comparative Analysis of IPO Proceeds under Alternative Regulatory Environments." *Journal of Financial Economics,* 28 (Nov./Dec. 1990), 173–207.

Carter, R., and S. Manaster. "Initial Public Offerings and Underwriter Reputation." *Journal of Finance,* 45 (Sept. 1990), 1045–1067.

Grinblatt, M., and C. Y. Hwang. "Signalling and the Pricing of Unseasoned New Issues." *Journal of Finance,* 44 (June 1989), 393–420.

Guenther, A. E. "Best Efforts vs. Firm Commitment Initial Public Offerings: Evidence on the Information Gathering Theory." Unpubl. Working Paper, Univ. of Wisconsin (Oct. 1989).

Hansen, R. S. "Evaluating the Costs of a New Equity Issue." *Midland Corporate Finance Journal,* 4 (Spring 1986), 42–55.

Hansen, R. S.; B. R. Fuller; and V. Janjigian. "The Over-Allotment Option and Equity Financing Flotation Costs: An Empirical Investigation." *Financial Management,* 16 (Summer 1987), 24–32.

Ibbotson, R. G. "Price Performance of Common Stock New Issues." *Journal of Financial Economics,* 2 (Sept. 1975), 235–272.

Ibbotson, R. G.; J. L. Sindelar; and J. R. Ritter. "Initial Public Offerings." *Journal of Applied Corporate Finance,* 1 (Summer 1988), 37–45.

Jegadeesh, N.; M. Weinstein; and I. Welch. "Initial Public Offerings and Subsequent Equity Offerings." Unpubl. Working Paper, Univ. of California/Los Angeles (1990).

Koh, F., and T. Walter. "A Direct Test of Rock's Model of the Pricing of Unseasoned Issues." *Journal of Financial Economics,* 23 (Aug. 1989), 251–272.

Leland, H. E., and D. H. Pyle. "Informational Asymmetries, Financial Structure and Financial Intermediation." *Journal of Finance,* 32 (May 1977), 371–387.

Muscarella, C. J., and M. R. Vetsuypens. "A Simple Test Of Baron's Model of IPO Underpricing." *Journal of Financial Economics,* 24 (Sept. 1989), 125–135.

Noreen, E. W. "Computer Intensive Methods for Testing Hypotheses." New York: John Wiley and Sons (1989).

Ritter, J. R. "The 'Hot-Issue' Market of 1980." *Journal of Business,* 57 (April 1984), 215–240.

______________. "The Costs of Going Public." *Journal of Financial Economics,* 19 (Dec. 1987), 269–281.

______________. "A Theory of Contract Choice." Unpubl. Working Paper, Univ. of Michigan (1988).

Rock, K. "Why New Issues are Underpriced." Unpubl. Ph.D. Diss., Univ. of Chicago (1982).

______________. "Why New Issues are Underpriced." *Journal of Financial Economics,* 15 (Jan./Feb. 1986), 187–212.

Smith, C. W. "Raising Capital: Theory and Evidence." *Midland Corporate Finance Journal,* 4 (Spring 1986), 6–32.

Sternberg, T. "Bilateral Monopoly and the Dynamic Properties of Initial Public Offerings." Unpubl. Working Paper, Vanderbilt Univ. (1989).

Tinic, S. M. "Anatomy of Initial Public Offerings of Common Stock." *Journal of Finance,* 43 (Sept. 1988), 789–822.

Weiss, K. "The Relationship of Offer Price to the Preliminary File Range and the Use of the Overallotment Option in Initial Public Offerings." Unpubl. Working Paper, Univ. of Michigan (1990).

Welch, I. "Seasoned Offerings, Imitation Costs and the Underpricing of Initial Public Offerings." *Journal of Finance,* 44 (June 1989), 421–449.

_______________. "Sequential Sales, Path Dependence and Cascades." *Journal of Finance* (forthcoming).