

Overallotment option restrictions and contract choice in initial public offerings¹

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Abstract

Relaxation of the national association of securities dealers (NASD) limit on overallotment option use in 1983 provides a natural experiment to test the substitutability or complementarity of underwriting contract terms in initial public offerings. For firms that would find the initial limit constraining, use of terms that are substitutes (complements) should decrease (increase) after the limit is raised. The evidence indicates that warrant compensation and overallotment options are substitutes. Underwriter reputation and overallotment options are substitutes if warrants are used as compensation and complements otherwise. The significant change in contract terms after 1983 suggests the initial NASD policy was costly.

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1. Introduction

The contracts used by firms raising capital have been extensively examined. Most studies, however, focus on only one part of these contracts. For example, Carter and Manaster (1990) and Carter and Dark (1992) examine the choice of

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lead underwriter reputation. Beatty (1989) examines the choice of auditor reputation. Barry et al. (1991) and Dunbar (1995) examine the use of warrants as underwriter compensation. Hansen et al. (1987) and Carter and Dark (1990) examine the inclusion of an overallotment option in firm-commitment offerings (this option gives the underwriter the right, usually within 30 days of the offering, to increase the number of shares sold). This study, in contrast, examines how firms raising capital through an initial public offering of equity choose between contract terms.

An empirical study of the substitutability or complementarity of contract terms must recognize that these terms are endogenous. A simple cross-sectional regression of the choice of one term on others would lead to biased inferences regarding substitutability or complementarity. For example, even if the reputation of the lead underwriter and the level of the overallotment option in firm-commitment offerings are complements *for a given firm*, a regression of reputation choice on the use of an overallotment option would likely uncover a *negative* relation since existing evidence indicates that speculative firms are more likely to use less reputable underwriters and larger overallotment options.

There are at least two ways to address this endogeneity problem. First, the choice of contract terms can be modeled as a system of equations. One difficulty with this approach is that there is little empirical or theoretical guidance in making required distributional assumptions. A second alternative, used in this paper, is to design an experiment that is not affected by endogeneity. I exploit the fact that the National Association of Securities Dealers (NASD) relaxed its limit on the level of the overallotment option in 1983. Prior to 1983, the NASD determined that underwriting contracts including overallotment options greater than 10% of the base number of shares in the offering are 'unfair'². In August, 1983, the NASD changed this limit to 15%. For firms that would be constrained by the 10% limit, the use of terms that are complements to the overallotment option would be increased after August 1983 whereas the use of terms that are substitutes would be reduced. I examine changes in the use of warrants as underwriter compensation and the choice of lead underwriter reputation around the NASD regulatory change.

Prior to August 1983, I find that approximately 73% of offerings use a 10% overallotment option. Using a Tobit model of overallotment option choice, I find that the 10% limit is binding for almost all of these offerings. After the NASD limit is relaxed to 15%, over 50% of offerings use an option greater than 10%. This suggests that the 10% NASD constraint had a binding effect on contract choice. For firms finding the constraint binding, the probability of including warrants as compensation drops 17% after the constraint is relaxed, suggesting warrant compensation and the overallotment option are substitutes. For constrained

² The NASD's determination of the fairness of underwriting contract terms is necessary for the Securities and Exchange Commission to approve an offering for public sale.

firms that use warrants as compensation, the probability of using a reputable underwriter falls 29% after the NASD constraint is relaxed. This suggests that underwriter reputation and the overallotment option are substitutes. For constrained firms *not* using warrants, however, the probability of using a reputable underwriter *increases* 17% after the NASD constraint is relaxed, suggesting that underwriter reputation and the overallotment option are complements for this group of firms. Finally, for firms that find the initial 10% limit not to be constraining, the use of warrants as compensation and the choice of underwriter reputation are unaffected by the NASD policy change.

This evidence on the substitutability and complementarity of contract terms in initial public offerings provides insights into the role of different theories that have been developed in the literature to explain contract choice. Specifically, I examine the implications of the reneging (Hansen et al., 1987), certification (Booth and Smith, 1986a) and preselling (Benveniste and Spindt, 1989) theories regarding the joint determination of contract terms. I argue that the evidence is most consistent with the reneging and certification theories.

This study also provides insights on the costs of regulation. Since firms changed their firm-commitment underwriting contracts to include larger overallotment options, once allowed, the 10% NASD limit was presumably costly to issuers since suboptimal contracts had to be used prior to the policy change³. As additional evidence, I examine whether relaxing the limit affects the relative desirability of best-efforts and firm-commitment contracts. I find that firms are 3 to 5% more likely to use firm-commitment contracts after the NASD policy is relaxed, suggesting the 10% limit had a significant effect on contract choice. While this evidence on contract choice suggests the 10% NASD limit on overallotment options was costly, allowing firms to use more optimal contracts after the policy change did not result in detectable direct cost savings for constrained issuers. I argue that this is due to difficulties in measuring direct offering costs. This suggests that future studies on the costs of regulations should focus on contract choices.

The remainder of this paper is organized as follows. In Section 2, the alternative hypotheses regarding the choice of contract terms are developed. The analysis of the restrictiveness of the NASD limit is presented in Section 3. I examine the choice of contract terms for firm-commitment offerings around the NASD policy change in Section 4. The effect of the NASD policy change on direct offering costs and the use of best-efforts contracts is examined in Section 5. Finally, I summarize the work in Section 6.

³ It should be noted that while the contracts used prior to August 1983 were suboptimal, they were not untenable (firms and their underwriters agreed to go ahead with these offerings). The evidence suggests, however, that issuers and their underwriters would have been better off if contracts with greater overallotment options were allowed.

2. Alternative explanations for the choice of contract terms

2.1. *The reneging hypothesis*

Even though investment banks contact regular clients to get indications of interest for the shares in a firm-commitment initial public offering, there can be significant uncertainty regarding the actual demand for shares once formal sales commence. Investors may renege on their indications if the actual offer price is determined to be too high⁴. Banks typically manage this uncertainty by lining up more investors than necessary to sell the issuer prior to the securities and exchange commission (SEC) approval of the offering. While this reduces the chance the underwriter will be forced to hold an inventory of overpriced securities⁵, it presents different problems should demand be strong. In this case, investment banks could ration shares to investors but this strategy is costly in terms of lost reputation (goodwill). Alternatively, they could create a short position and cover that position through aftermarket purchases. Since demand is more likely to be strong when the offering is, *ex post*, underpriced, underwriters would lose money on these short sales. These costs can be reduced, however, if the firm includes a formal overallotment option in the underwriting contract since this option allows the underwriter to purchase additional shares at the offering price less the cash spread, and not the higher aftermarket price.

Inclusion of an overallotment option should affect other aspects of the underwriting contract. Since the underwriter's short position can be covered at lower cost, it is less likely to ration shares given strong demand. The overallotment option, therefore, reduces the potential damage to the underwriter's reputation given mispricing. Chemmanur and Fulghieri (1994) and Carter and Manaster (1990) argue that reputable underwriters avoid speculative offerings because *ex post* mispricing would more significantly damage their reputation. Since the overallotment option reduces this potential damage, reputable underwriters are more likely to underwrite speculative offerings. This suggests that reputation and the overallotment option are complements. An alternative to overallotment options in managing reneging is to compensate underwriters with warrants. If the securities sold in the offering are, *ex post*, underpriced and demand is strong, the underwriter could create a short position and exercise warrants to cover this

⁴ Hansen et al. (1987) describe the potential for reneging as "the conventional rationale for using the overallotment option" (p. 25).

⁵ In addition to the direct costs to the investment bank in selling shares below the offering price or being forced to engage in stabilization practices (Hanley et al., 1993), Nanda and Yun (1995) find that bank's market value are significantly reduced if they manage overpriced initial public offerings.

position. This suggests that warrant compensation and the overallotment option are substitutes ⁶.

2.2. *The certification hypothesis*

Because insiders have an incentive to issue securities when investors are expected to overvalue them, the model of Booth and Smith (1986a) argues that offering prices must be discounted unless firms can credibly certify that the shares are not overpriced. One certification mechanism is to hire an investment bank to manage the offering and use its reputation to certify that the pricing of the offering is consistent with inside information. This is credible since underwriters return to the capital markets frequently so the cost to false certification (loss of reputation) would likely exceed one time gains from cheating.

Booth and Smith (1986b) argue that the underwriter's acceptance of an overallotment option is a credible certification mechanism because this option is more valuable to the underwriter when the offering is underpriced. This suggests that the overallotment option is a substitute for underwriter reputation. Booth and Smith (1986b) and Dunbar (1995) also argue that warrant compensation is an alternative mechanism to certify that the offering's price is consistent with inside information because warrants are less valuable if the offering is overpriced. Thus, the certification hypothesis predicts that warrant compensation and the overallotment option are substitutes ⁷.

2.3. *The preselling hypothesis*

Benveniste and Spindt (1989) present a model of the initial public offering market where underwriters attempt to obtain private information about the value of

⁶ Institutional constraints make warrant compensation a weak substitute for the overallotment option, however. Warrants must be held by the underwriter for at least one year before exercising, making warrants a risky mechanism to cover short positions at the time of the offering. Warrants are costly to sell once exercisable as the shares underlying warrants are considered restricted stock. The exercise price of warrants must be at least 20% above the offering price, whereas the overallotment option allows the underwriter to purchase shares below the offering price. Finally, the number of shares underlying warrants is not allowed to exceed 10% of the size of the offering. See Barry et al. (1991) for a complete description of the institutional constraints on warrant compensation.

⁷ Identical predictions are obtained using the winner's curse model of the initial public offering market of Rock (1986). Ritter (1987) argues that an overallotment option can ameliorate the winner's curse since uninformed investors are more likely to receive allocations in underpriced offerings. Carter and Manaster (1990) argue that firms retain reputable underwriters to certify that uncertainty regarding the offering price is low, reducing the winner's curse. Finally, since warrants given to underwriters are less valuable if the offering is overpriced, the underwriter bears part of the cost of overpricing, diminishing the winner's curse. Taken together, the winner's curse model predicts that warrant compensation, the overallotment option and underwriter reputation are substitutes. Since these predictions are identical to those based on the certification model, my discussion focuses on certification for ease of exposition. Any evidence consistent with certification should also be considered consistent with the winner's curse model, however.

the securities prior to final pricing. In order to induce regular investors to truthfully reveal positive information, the underwriter precommits to allocate more shares at a price below that revealed to those indicating positive information. When regulars respond negatively, the underwriter prices close to the revealed value as investors have no incentive to falsely indicate positive information. On average, offerings are priced below expected value given information revealed in the premarket. This underpricing increases with the uncertainty regarding firm value and the level of presales (the number of shares the underwriter precommits to selling to regular investors).

Benveniste and Spindt argue that reputable underwriters can reduce expected underpricing because regular investors caught revealing false information can be excluded from future offerings. The required discount to induce truthful revelation of positive information is reduced by the expected value of investor's profits from future offerings which should be larger for more reputable underwriters who are expected to manage more future offerings. Benveniste and Spindt also note that underwriters have an incentive to increase presales to minimize the costs of renegeing and this increase in presales results in higher levels of underpricing. They argue that inclusion of a formal overallotment option in the underwriting contract limits the amount of stock an underwriter has an incentive to presell. This suggests that overallotment options are a substitute mechanism to using a reputable underwriter in reducing expected underpricing.

Compensating underwriters with warrants has two effects in Benveniste and Spindt's model. Warrant compensation reduces the uncertainty regarding share value purchased by investors in the initial public offering as the underwriter bears part of any loss due to offering overpricing. This also gives the underwriter the incentive to increase preselling to reduce the probability of receiving low compensation. The net effect on underpricing is uncertain. Since the overallotment option reduces the incentive to presell, this option and warrant compensation should be complements.

3. The restrictiveness of the NASD limit on overallotment options

I propose to test the substitutability or complementarity of offering contract terms by examining how these terms change around the relaxation of the NASD's overallotment option restriction. There are two requirements for this experiment to be valid. First, contract choices in the absence of the NASD regulatory change must be predictable. If there is unexplained variation over time in contract choices, for example, any changes observed in contracts could not be solely attributed to the NASD policy change. Second, the 10% limit on overallotment options prior to August, 1983 must have been restrictive. Increasing the limit to 15% should have no effect on contract choice for firms that find the 10% limit unrestrictive. For constrained firms, the use of terms that are complements to the overallotment

option would be increased whereas the use of terms that are substitutes would be reduced. This section examines whether the 10% limit is restrictive. The predictability of contract terms is examined in Section 4.

In order to determine the restrictiveness of the NASD limit on overallotment options, I examine the actual choice of these options in offerings between 1980 and 1984. My initial sample consists of all firm-commitment initial public offerings recorded on Howard and Company's *Going Public: The IPO Reporter*, compiled by Jay Ritter. This data base contains firm and offering information including details of overallotment option choice. It is merged with observations from the SEC's registered offering statistics (ROS) data base which is used to obtain details on warrant compensation of underwriters. Offerings with inconsistent terms in the merging of these databases are dropped.

Since the analysis in this paper focuses on the effects of an NASD regulatory change on firm-commitment offering terms, it is important to accurately identify the date the change occurred. NASD (1983) indicates that the change in the limit on overallotment options was approved by the SEC on August 4, 1983 and is effective as of the date of the notice, which was August 17, 1983. My analysis assumes that all offerings before August 17, 1983 have a 10% limit on overallotment options, and all offerings afterward have a 15% limit.

The distribution of overallotment option choice as a percentage of the base number of shares offered is presented in Table 1. Approximately 73% of offerings use the maximum allowable overallotment option of 10% between January 1980 and August 17, 1983. Over the period between August 17, 1983 and December 1984 less than 50% of offerings use the new limit of 15%. This suggests that the limit is more restrictive prior to the regulatory change. It should be noted, however, that approximately 41% of offerings use a 10% overallotment option in the later period. These offerings are spread fairly uniformly over this period suggesting the choice of a 10% overallotment option is not simply due to

Table 1
Distribution of overallotment option choice between 1980 and 1984

Overallotment option range	Offerings between January 1, 1980 and August 17, 1983		Offerings between August 18, 1983 and December 31, 1984	
	Number of offerings	Percentage of total	Number of offerings	Percentage of total
= 0	35	7.9	6	2.1
> 0 and ≤ 0.05	7	1.6	1	0.4
> 0.5 and < 0.1	78	17.4	14	5.0
= 0.1	328	73.1	117	41.2
> 0.1 and < 0.15			14	4.9
= 0.15			132	46.4

The overallotment option is defined as the number of shares that can be exercised as an overallotment option divided by the base (or minimum) number of shares to be offered.

ignorance of the regulatory change. The significant use of a 10% overallotment option over a period where larger options are allowed suggests that many of the offerings prior to August 1983 are potentially not constrained by the NASD limit.

The restrictiveness of the NASD limit is formally tested using a Tobit model of overallotment option choice. The Tobit model recognizes that some firms may wish to use a larger option than that allowed by the NASD (even though the restricted option is acceptable). For these firms, the overallotment option choice observed is censored at the NASD limit. The Tobit model recognizes and adjusts for that censoring (see Ref. Maddala, 1983)⁸. An important advantage of this modeling approach is that the estimates can be used to predict the level of overallotment option choice in the absence of censoring.

Previous studies indicate that larger overallotment options are more likely to be used in speculative offerings (Hansen et al., 1987; Carter and Dark, 1990). Proxies for ex ante uncertainty regarding firm value are therefore used as independent variables in the Tobit analysis. These include the percentage of secondary shares (existing shares sold by insiders), sales in the year before the offering divided by the offering size, the standard deviation of aftermarket daily stock returns, the natural logarithm of the size of the offering and the inverse of the offering price. The overallotment option should be larger in smaller and lower priced offerings with smaller secondary components from firms with lower sales having more volatile stock returns. An additional independent variable in the Tobit analysis is the absolute value of the elasticity of the offering firm's book to market ratio with respect to the number of shares offered (see Appendix A for a formal definition). Underwriters set prices in stock offerings based on their valuation of assets in place and growth opportunities. Firms with greater absolute book to market elasticities would find larger overallotment options desirable if growth opportunities are difficult to value⁹. It should be noted that this elasticity is negatively correlated with the book to market ratio. It could also, therefore, be interpreted as a risk proxy.

The Tobit model is estimated separately for offerings before and after August 17, 1983. The results are presented in Panel A of Table 2. The only significant explanatory variable for the period prior to August 17, 1983 is the percentage of

⁸ In examining the determinants of the choice of overallotment option level, most researchers have utilized different forms of logit rather than the Tobit models (e.g., Hansen et al., 1987; Carter and Dark, 1990). The problem with logit models, however, is that they do not recognize that some firms may actually prefer larger options than what are observed.

⁹ In most cases, this elasticity is negative indicating that the book to market ratio declines as the number of shares in the offering increases. The underwriter could set the price of the offering based on a high estimate of the book to market ratio. Investors would purchase additional overallotment shares until the book to market ratio declines to a level the market deems appropriate. Since the percentage of new shares is limited, firms with greater elasticities will have more latitude in letting the market determine the appropriate book to market ratio.

secondary shares. The negative coefficient on this variable is consistent with riskier firms using smaller overallotment options. In the period after August 17, 1983, the absolute elasticity of book to market and the standard deviation of

Table 2

Tobit model of overallotment option level choice for firm-commitment initial public offerings of equity between 1980 and 1984 and descriptive statistics on its predictions

Independent variable	Offers from January 1, 1980 to August 17, 1983	Offers from August 18, 1983 to December 31, 1984
<i>Panel A. Tobit model estimation</i>		
Intercept	0.13 ^a (6.2)	0.09 ^a (4.7)
Absolute elasticity of book to market with respect to offer size	0.01 (0.6)	0.02 ^b (1.9)
% secondary	−0.08 ^a (−3.0)	−0.04 ^b (−1.9)
Sales/offer size	−0.0004 (−0.7)	0.0 (0.8)
Standard deviation	0.02 (1.0)	0.04 ^c (2.3)
Log offer size	0.005 (0.8)	0.007 (1.3)
1/offer price	−0.06 (−1.2)	0.07 (1.0)
Log-Likelihood	20	139
Number of observations	448	284
<i>Panel B. Descriptive statistics on predicted overallotment option choice for offers using the maximum allowable option (319 prior to August 17, 1983 and 131 after)</i>		
Mean predicted overallotment option from Tobit model (%)	14.1	14.5
Percentage of cases where predicted option is strictly greater than that used	99.1	28.2

Panel A presents the Tobit model estimates where the dependent variable is the number of shares that can be offered as an overallotment as a percentage of the base number of shares to be offered. The estimation takes into account the censoring involved in the choice of this percentage. Prior to August 17, 1983 the maximum overallotment is 10% and after that date the maximum overallotment is 15%. Independent variables include the absolute value of the elasticity of the book to market value of equity ratio with respect to the number of shares offered where the book to market value of equity ratio is defined as the book value of equity prior to the offering plus the net proceeds of the offering divided by the number of shares to be outstanding after the offering times the offering price (Absolute elasticity of book to market with respect to offer size), the number of shares sold by insiders divided by the total number of shares sold (% secondary), the sales for the issuing firm in the year prior to the offering divided by the minimum gross dollar size of the offer (sales/offer size), the standard deviation of common stock returns in percent with the variance estimated using daily stock returns (r) for the year following the offering as follows: $\sum_{i=20}^{270} r_i^2 + 2\sum_{i=20}^{269} r_i r_{i+1}$ (standard deviation), the logarithm of the minimum offer size in millions of dollars (log offer size) and the inverse of the offer price (1/offer price). t -statistics are provided in parenthesis. ^a Indicates significance at the 1% level. ^b Indicates significance at the 10% level. ^c Indicates significance at the 5% level.

In Panel B, the Tobit model estimates are used to derive forecasts of overallotment option choice in the absence of regulatory constraints. For each firm, the regression coefficients are multiplied by the independent variables to obtain forecasted overallotment option choice. (B) presents means of these forecasts for firms using the maximum allowed overallotment option (10% prior to August 17, 1983 and 15% after).

aftermarket stock returns are significantly positive and the percentage of secondary shares is significantly negative. The positive coefficient on the absolute book to market elasticity indicates that firms with larger elasticities prefer larger overallotment options. It should be noted that economic and statistical significance of this variable increases in this later period when greater offering share size adjustments are allowed. The positive coefficient on the standard deviation of stock returns and negative coefficient on the percentage of secondary shares offered indicates that speculative offerings are more likely to include larger overallotment options.

These estimated Tobit models can be used to predict overallotment option use in the absence of censoring. This involves multiplying the parameter estimates by the independent variables for each offering. Descriptive statistics on these predictions are presented in Panel B of Table 2 for firms choosing the maximum allowable option. Over the 10% limit regime, the mean predicted overallotment option is 14.1%. Over 99% of offerings have predicted options greater than the 10% limit. This suggests that censoring is significant for this sample. Over the 15% regime, the mean predicted overallotment option is 14.5% with 28.2% of offerings having predicted options greater than the 15% limit. This indicates that the NASD limit is much less restrictive in the later period.

4. Underwriting contract changes around the 1983 nasd policy change

4.1. Overallotment options and underwriter warrant compensation

The choice of warrants as underwriter compensation is examined using a probit model in Table 3. The dependent variable is a dummy variable taking on the value 1 if warrants are used as compensation and 0 otherwise. If warrants and overallotment options are complements, as predicted by the preselling hypothesis, the probability of using warrants should increase after August 17, 1983 for firms that would be constrained by the 10% limit. If warrants and overallotment options are substitutes, as predicted by the renegeing and certification hypotheses, the probability of using warrants should decrease after August 17, 1983 for firms constrained by the 10% limit¹⁰. For unconstrained firms, the probability of using warrants should not change. Constrained firms are defined as those using strictly greater

¹⁰ This probit analysis is potentially misleading, however, because it ignores the level of warrant compensation. If, for example, warrant compensation and the overallotment option are substitutes, firms may reduce, rather than eliminate, warrant compensation once larger options are allowed. The characteristics of warrants granted as underwriter compensation are not significantly different after the NASD policy changes, however. The mean ratio of warrant exercise price to offering price is 1.20 before August 1983 and 1.22 afterwards. The number of shares underlying warrants as a fraction of the number of shares offered is 0.086 before August 1983 and 0.085 afterwards. This suggests that examining changes in the likelihood of warrant compensation use is an appropriate test for the substitutability or complementarity of warrant compensation and the overallotment option.

Table 3

Probit underwriter warrant compensation choice model estimations for firm-commitment initial public offerings. Models are estimated separately for firms constrained and unconstrained by the 10% limit on the overallotment option (constrained firms use a 10% overallotment option prior to August 17, 1983 and strictly greater than 10% afterward)

Independent variables	Offers from 1/1/80 to 8/17/83		Offers from 1/1/80 to 12/31/84	
	(1) constrained offers	(2) unconstrained offers	(3) constrained offers	(4) unconstrained offers
Intercept	-0.21 (-0.8)	0.28 (1.0)	-0.31 (-1.6)	0.26 (1.5)
Hot issue market dummy	0.008 (0.1)	-0.03 (-0.3)		
Post 8/17/83 dummy			-0.17 ^a (-2.7)	-0.07 (-1.1)
Absolute elasticity of book to market with respect to offer size	0.21 ^b (2.4)	0.40 ^b (2.4)	0.26 ^a (3.5)	0.32 ^a (3.3)
% secondary	-0.60 ^b (-2.3)	-0.41 (-1.0)	-0.59 ^a (-2.8)	-0.33 (-1.5)
Sales/offer size	-0.02 (-1.1)	-0.02 (-1.0)	-0.004 (-0.5)	-0.01 (-1.0)
Standard deviation	0.18 (1.2)	0.55 (1.3)	0.18 (1.5)	0.27 (1.3)
Log offer size	-0.14 ^b (-2.0)	-0.29 ^a (-2.6)	-0.07 (-1.3)	-0.25 ^a (-3.7)
1/offer price	3.03 ^a (0.2)	0.11 (3.4)	3.03 ^a (4.2)	0.62 (1.2)
Underwriter reputation	-0.03 (-1.5)	-0.05 ^b (-2.0)	-0.05 ^a (-3.7)	-0.04 ^a (-2.9)
Number of observations	319	129	465	267
Log-likelihood	-94	-33	-134	-82
Pseudo R ²	0.54	0.61	0.53	0.51
Percent correct predictions	88.7	90.7	87.7	88.0

The dependent variable is a dummy variable taking on the value 1 if warrants are used as compensation and 0 otherwise. Independent variables include a dummy variable taking on the value 1 if the offering occurs between August 1, 1980 and December 31, 1980 or January 1, 1983 and June 30, 1983 (Hot issue market dummy), a dummy variable taking on the value 1 if the offer is after August 17, 1983 and 0 otherwise (Post 8/17/83 dummy), the absolute value of the elasticity of the book to market value of equity ratio with respect to the number of shares offered where the book to market value of equity ratio is defined as the book value of equity prior to the offering plus the net proceeds of the offering divided by the number of shares to be outstanding after the offering times the offering price (Absolute elasticity of book to market with respect to offer size), the number of shares sold by insiders divided by the total number of shares sold (% secondary), the sales for the issuing firm in the year prior to the offering divided by the minimum gross dollar size of the offer (sales/offer size), the standard deviation of common stock returns in percent with the variance estimated using daily stock returns (r) for the year following the offering as follows: $\sum_{i=20}^{270} r_i^2 + 2\sum_{i=20}^{269} r_i r_{i+1}$ (standard deviation), the logarithm of the minimum offer size in millions of dollars (Log offer size), the inverse of the offer price (1/offer price) and the reputation of the lead underwriter in the offer measured using Carter and Manaster's (1990) 0 to 9 ordinal ranking where the most reputable underwriter is given a ranking of 9 (underwriter reputation). The table reports the comparative statics for each variable. Specifically, the change in the probability of using warrants as underwriter compensation given a unit change in the independent variable for a firm having mean characteristics is reported for each 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 mean levels for each independent variable and ϕ is the standard normal density function. To determine the probit model coefficient estimates, the scaling factor $\phi(\hat{\beta}\bar{x})$ equals 0.329657 for model (1), 0.239515 for model (2), 0.319937 for model (3) and 0.270655 for model (4). t-statistics are provided in parentheses. ^b Indicates significance at the 5% level. ^a Indicates significance at the 1% level.

than a 10% overallotment option after August 17, 1983 and those using exactly 10% before. While the former group clearly would find the 10% limit constraining, the latter group is assumed to be constrained given the evidence in panel B of Table 1. It should be noted that the evidence on substitutability or complementarity would be weakened if this assumption is not valid ¹¹.

The independent variables in the probit regressions include the risk proxies used in the Tobit analysis as Barry et al. (1991) and Dunbar (1995) find warrants are more likely to be used as compensation in speculative offerings. The absolute elasticity of book to market value with respect to the number of shares in the offering is also included as an independent variable. The renege hypothesis argues that warrants are used to manage renege. Firms having larger elasticities will, therefore, be more likely to use warrants. Since this elasticity is negatively correlated with the book to market ratio, a positive relation between this elasticity and the use of warrant compensation would also be consistent with riskier offerings using warrants.

As noted in Section 3, to determine whether the NASD overallotment option policy change affects the use of warrants as compensation, this use must be predictable over time. Ritter (1984) finds that time series variation in underpricing for initial public offerings cannot be explained by changes over time in their risk characteristics. Underwriters could prefer warrants as compensation during 'hot markets' (periods with high levels of underpricing) since they are more valuable (the exercise price of warrants is generally stated as a percentage of the offering price). This possibility is tested in probit regressions (1) and (2) of Table 3 which include a dummy variable taking on the value 1 if the offering occurs between August 1, 1980 and December 31, 1980 or January 1, 1983 and June 30, 1983, periods with high average underpricing. If warrant compensation choice is different during hot issue markets, this variable would be significantly different from zero ¹². The table presents estimates of the comparative statics for each independent variable, measured for the mean firm in the sample.

Regression (1) of Table 3 presents the probit model estimates for the subset of firms constrained by the 10% limit prior to August 17, 1983. The use of warrants

¹¹ Formally, I examine the joint hypothesis that firms are constrained by the 10% NASD limit and relaxing the constraint affects contract choice. No changes in contract choice could be observed if either part of this joint hypothesis does not hold. Since I do find significant changes, this supports the Tobit finding that virtually all firms using a 10% overallotment option are constrained in the earlier regime.

¹² This dummy variable regression assumes that the relation between warrant choice and the other independent variables remains the same in different periods. An alternative approach is to carry out separate probit regressions for the different periods. These regressions could be used to forecast warrant use over the entire period, representing the expected use of warrants given a constant hotness of the market. The forecasted warrant uses could then be compared to determine differences across regimes. Since results from this approach are qualitatively similar, the dummy variable regressions are reported for ease of exposition.

is significantly positively related to the absolute elasticity of the book to market ratio and the inverse of the offering price and significantly negatively related to the percentage of secondary shares in the offering and the natural logarithm of the offering size. This is consistent with riskier offerings using warrant compensation. The coefficient on the hot issue market dummy variable is insignificant. Regression (2) of Table 3 presents the probit model estimates for the subset of firms unconstrained by the 10% limit prior to August 17, 1983. The results are similar to those for constrained firms except the percentage of secondary shares and the inverse of the offering price are not significant. Also, the coefficient on underwriter reputation is significantly negative, consistent with riskier offerings using warrant compensation. The hot issue dummy variable is again insignificant. In sum, regressions (1) and (2) indicate that the hotness of the market has no effect on the use of warrants as compensation.

Probit regressions (3) and (4) of Table 3 examine the choice of warrants as compensation for all offerings between 1980 and 1984. In addition to the independent variables used in the previous regressions, a dummy variable is included which takes on the value 1 if the offering occurs after the NASD policy change¹³. Regression (3) presents results for constrained offerings. The coefficients on the absolute elasticity of book to market ratio and the inverse of the offering price are significantly positive and the coefficients on the percentage of secondary shares and the underwriter reputation are significantly negative. This is consistent with riskier offerings using warrant compensation. The coefficient on the offering period dummy variable is significantly negative. Its point estimate indicates that warrants are 17% less likely to be used after the NASD relaxes its overallocation option constraint. This suggests that warrant compensation and the overallocation option are substitutes, consistent with the reneging and certification hypotheses.

Regression (4) of Table 3 presents the results for the full sample of unconstrained firms. The coefficient on the absolute elasticity of book to market is significantly positive and the coefficients on the logarithm of offering size and underwriter reputation are significantly negative, consistent with more speculative offerings using warrants. The coefficient on the offering period dummy variable is insignificant. Firms not constrained by the original NASD limit do not alter their contracts afterward, as expected.

4.2. Overallocation options and underwriter reputation

The choice of the reputation of the lead underwriter reputation is examined using a probit model in Table 4. Separate models are estimated for firms constrained and unconstrained by the 10% overallocation option limit. Also,

¹³ The results are unaffected if the approach described in footnote ¹² is used.

Table 4

Probit underwriter reputation choice model estimations for firm-commitment initial public offerings of equity. Models are estimated separately for firms constrained and unconstrained by the 10% limit on the overallotment option (constrained firms use a 10% overallotment option prior to August 17, 1983 and strictly greater than 10% afterward)

Independent variables	Constrained offers		Unconstrained offers	
	(1) underwriters receive warrant compensation	(2) underwriters do not get warrants	(3) underwriters receive warrant compensation	(4) underwriters do not get warrants
Intercept	0.15 (0.6)	-1.10 ^a (-3.9)	-0.42 (-1.2)	-0.67 ^b (-2.2)
Post 8/17/83 dummy	-0.29 ^a (-2.6)	0.17 ^b (2.3)	0.17 (1.2)	0.002 (0.3)
Absolute elasticity of book to market with respect to offer size	-0.46 ^b (-2.4)	0.05 (0.5)	-0.26 (-1.4)	-0.14 (-1.1)
% secondary	2.06 ^a (2.9)	0.007 (0.0)	0.18 (0.3)	0.13 (0.5)
Sales/offer size	0.005 (0.2)	0.006 (1.4)	-0.002 (-0.1)	0.001 (0.1)
Standard deviation	0.0001 (0.0)	0.38 ^a (2.1)	0.35 (1.1)	-0.21 (-0.7)
Log offer size	0.19 ^b (2.0)	0.38 ^b (5.7)	0.32 ^b (2.2)	0.40 ^a (4.8)
1/offer price	-0.58 (-1.4)	-1.54 (-1.0)	-1.17 (-1.5)	-1.27 (-0.8)
Number of observations	145	320	86	181
Log-likelihood	-76	-169	-52	-94
Pseudo R ²	0.24	0.24	0.13	0.24
Percent correct predictions	76.6	75.0	68.6	76.8

For offerings where the underwriter is not compensated with warrants, the dependent variable is a dummy variable taking on the value 1 if the lead underwriter has a Carter and Manaster (1990) reputation rank of 8 or more (high reputation) and 0 otherwise (low reputation). For offerings where the underwriter is compensated with warrants, the dependent variable is a dummy variable taking on the value 1 if the lead underwriter has a Carter and Manaster (1990) reputation rank of 3.5 or more (high reputation) and 0 otherwise (low reputation). Independent variables include a dummy variable taking on the value 1 if the offer is after August 17, 1983 and 0 otherwise (Post 8/17/83 dummy), the absolute value of the elasticity of the book to market value of equity ratio with respect to the number of shares offered where the book to market value of equity ratio is defined as the book value of equity prior to the offering plus the net proceeds of the offering divided by the number of shares to be outstanding after the offering times the offering price (Absolute elasticity of book to market with respect to offer size), the number of shares sold by insiders divided by the total number of shares sold (% secondary), the sales for the issuing firm in the year prior to the offering divided by the minimum gross dollar size of the offer (sales/offer size), the standard deviation of common stock returns in percent with the variance estimated using daily stock returns (r) for the year following the offering as follows: $\sum_{i=20}^{270} r_i^2 + 2\sum_{i=20}^{269} r_i r_{i+1}$ (standard deviation), the logarithm of the minimum offer size in millions of dollars (Log offer size) and the inverse of the offer price (1/offer price). The table reports the comparative statics for each variable. Specifically, the change in the probability of using a high reputation underwriter given a unit change in the independent variable for a firm having mean characteristics is reported for each 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 mean levels for each independent variable and ϕ is the standard normal density function. To determine the probit model coefficient estimates, the scaling factor $\phi(\hat{\beta}\bar{x})$ equals 0.387804 for model (1), 0.397530 for model (2), 0.393469 for model (3) and 0.386581 for model (4). t -statistics are provided in parentheses. ^a Indicates significance at the 1% level.

^b Indicates significance at the 5% level.

separate models are estimated for offerings with and without warrant compensation. The dependent variable for the sample where warrants are used as compensation is a dummy variable taking on the value 1 if the lead underwriter has a Carter and Manaster (1990) rank of 3.5 or higher and 0 otherwise. For the sample where warrants are not used, the dependent variable is a dummy variable taking on the value 1 if the lead underwriter has a Carter and Manaster rank of 8 or higher and 0 otherwise¹⁴. If underwriter reputation and the overallotment option are complements, as predicted by the reneging hypothesis, the probability of using a more reputable underwriter should increase after August 17, 1983 for firms that would be constrained by the 10% limit. If underwriter reputation and the overallotment option are substitutes, as predicted by the preselling and certification hypotheses, the probability of using a more reputable underwriter should decrease after August 17, 1983 for firms constrained by the 10% limit. For firms unconstrained by the 10% limit, the probability of using a more reputable underwriter should not change.

The independent variables in the probit regressions include the risk proxies used in the previous analyses as Carter and Manaster (1990) find that speculative offerings are more likely to use less reputable underwriters. The absolute elasticity of book to market value with respect to the number of shares in the offering is also included as an independent variable. The reneging hypothesis argues that firms having larger elasticities will be able to attract more reputable underwriters as the probability of damage to reputation due to mispricing is reduced. A negative relation is possible, however, if this elasticity is viewed as a proxy for the *ex ante* uncertainty regarding firm value.

As noted previously, to determine whether the NASD overallotment option policy change affects the choice underwriter reputation, this choice must be predictable over time. As in the previous analysis, this is tested by including a hot issue market dummy variable in the probit analysis. The results (not reported) indicate that the probability of using a more reputable underwriter is not affected by the hotness of the market¹⁵.

The choice of underwriter reputation for offerings where warrants are used as compensation is examined in probit regressions (1) and (3) of Table 4. In addition to the independent variables used in previous analyses, a dummy variable is included which takes on the value 1 if the offering occurs after the NASD policy

¹⁴ These cutoffs are the median reputation level of underwriters in the two samples over the period from 1980 to 1984. Similar results are obtained if different definitions of the dependent variable are used. Also, similar results are obtained if an ordered probit model is used which recognizes that intermediate reputation choices are available. The simpler probit results are presented for ease of exposition.

¹⁵ Specifically, the regressions reported in Table 4 are estimated over the period prior to August 17, 1983 including the hot issue market dummy variable. In no case is the coefficient on that dummy variable significantly different from zero.

change¹⁶. The estimates reported are the comparative statics for each independent variable, measured for the mean firm in the sample. Regression (1) presents results for constrained firms. The coefficient on the absolute elasticity of book to market ratio is significantly negative and the coefficients on the percentage of secondary shares and logarithm of the offering size are significantly positive. This is consistent with riskier offerings using less reputable underwriters. The coefficient on the offering period dummy variable is significantly negative. Its point estimate indicates that the probability of using a more reputable underwriter by constrained firms is 29% lower after the NASD policy change. This suggests that reputation and overallocation options are substitutes, consistent with the preselling and certification hypotheses.

Regression (3) of Table 4 presents the results for the sample of unconstrained firms using warrants as compensation. The coefficient on the logarithm of offering size is significantly positive, consistent with more speculative offerings using less reputable underwriters. The coefficient on the offering period dummy variable is insignificant. Firms not constrained by the original NASD limit do not alter their contracts afterward.

The choice of underwriter reputation for offering where warrants are not used as compensation is examined in probit regressions (2) and (4) of Table 4. Regression (2) presents results for constrained firms. The coefficients on the standard deviation of aftermarket stock returns and the logarithm of the offering size are significantly positive. Curiously, only the latter finding is consistent with riskier offerings using less reputable underwriters. The coefficient on the offering period dummy variable is significantly positive. Its point estimate indicates that probability of a constrained firms using a more reputable underwriter increases 17% after the NASD relaxes its constraint. This suggests that reputation and the overallocation option are complements, consistent with the reneging hypothesis. While not statistically significant, the positive point estimate on the absolute elasticity of the book to market ratio is also consistent with reneging.

The finding that reputation and the overallocation option are complements for firms not using warrant compensation appears at odds with the previous finding that they are substitutes for firms using warrants. It should be noted, however, that explanations for warrant use are not mutually exclusive. Firms constrained by the 10% limit on overallocation options would likely include warrants as compensation if the primary purpose of these contract terms is certification. Since the constrained firms in regression (2) do not use warrants, certification is less likely to be important.

Regression (4) of Table 4 presents the results for the sample of unconstrained firms not using warrants as compensation. The coefficient on logarithm of offering size is significantly positive, consistent with speculative offerings using less

¹⁶ Again, the results are unaffected if the approach described in footnote ¹¹ is used.

reputable underwriters. The coefficient on the offering period dummy variable is insignificant. Firms not constrained by the original NASD limit do not alter their contracts afterward.

5. Additional evidence on the cost of the NASD overallotment option policy

5.1. *Direct offering cost changes for firm-commitment offerings*

Since firms changed their firm-commitment underwriting contracts to include larger overallotment options, once allowed, the 10% NASD limit was presumably costly to constrained issuers. In this section, I examine whether allowing firms and their underwriters to move to more optimal contracts resulted in lower offering costs. All three theories discussed in Section 2 argue that offering costs should be reduced. Larger overallotment options reduce the potential costs to investment banks in managing the renegeing problem. Their demanded compensation should, therefore, be reduced. Larger overallotment options enhance the investment banks certification of the offering price as this option becomes more valuable if the offering is underpriced. In the model of Benveniste and Spindt (1989), larger overallotment options reduce the incentive of the investment bank to presell the issue. The implication of both the certification and preselling theories, therefore, is that required underpricing should be reduced.

I examine whether offering costs change by regressing costs (percentage underwriter cash compensation plus initial public offering underpricing) on the independent variable used in Sections 3 and 4, as existing research indicates offering costs should be greater for more speculative offerings. I also include a dummy variable which takes on the value 1 if the offering occurs after the NASD policy change. The results for constrained offerings between 1980 and 1984 (not reported) indicate that offering costs are reduced approximately 8% after the NASD policy change. While this suggests that direct costs are reduced, I also find that costs are reduced by approximately 8% after the NASD policy change for *unconstrained* firms. One problem with this offering cost regression is that costs, unlike contract terms, are not predictable over time. Controlling for risk proxies, there are periods where costs are significantly higher (so-called ‘hot-issue’ markets). If these periods are simply dropped from the analysis, the offering cost reductions noted above disappear for *both* constrained and unconstrained firms.

There are at least three reasons for my inability to detect direct cost savings. First, there may be some omitted risk proxy that helps to explain time series variations in offering costs and if that proxy were included, significant changes could emerge. Unfortunately, the literature has been unable to uncover such a proxy. Second, James (1992) shows that initial public offering costs cannot be examined in isolation. He finds that underwriter cash compensation in initial public offerings is lower for firms having follow on equity offerings and argues that this is consistent with a model where some of the costs of an initial public

offering are recouped through higher compensation in follow on offerings. It is possible, therefore, that any cost savings due to the NASD policy change are mainly passed on as lower compensation in follow on offerings. Finally, Blume (1993) documents the significant use of 'soft dollars' in the brokerage industry. This refers to the practice where investors receive research services in return for sending an equity trade to a specific broker. Cost savings from the NASD policy change could, therefore, be passed on as increased research coverage of the firm by the investment bank in the aftermarket.

5.2. The choice between firm-commitment and best-efforts offering methods

This section examines whether the NASD over-allotment option policy change affects the choice between firm-commitment and best-efforts contracts. All three theories developed in Section 2 predict that firm-commitment contracts should be more attractive after the policy change. First, it was previously argued that the over-allotment option allows firms to reduce the costs due to reneging. In best-efforts offerings, reneging can be managed by setting a low minimum sales constraint (the minimum number of shares to be sold as a percentage of the maximum number). Since the minimum sales constraint is not regulated by the NASD, firms finding valuation difficult are more likely to use best-efforts offerings¹⁷. Welch (1991) shows that many firms choose minimum sales constraints between 85 and 95%, which is equivalent from the perspective of managing reneging to a firm-commitment contract with a 10 to 15% over-allotment option. The relaxation of the NASD constraint on over-allotment options would, therefore, make firm-commitment contracts relatively more attractive.

Second, Booth and Smith (1986a) argue that firms use best-efforts contracts if the cost to acquiring underwriter certification is too great. Since the same level of certification can be attained after the NASD relaxes its limit on the over-allotment option with a less reputable underwriter, the relative attractiveness of firm-commitment contracts should increase after the policy change¹⁸. Finally, in the theory of Benveniste and Spindt (1989), an alternative to the over-allotment option in reducing the number of shares the underwriter has an incentive to precommit to selling is the use of a best-efforts contract with a low minimum sales constraint. Relaxing the NASD limit on over-allotment options again increases the relative attractiveness of firm-commitment contracts.

¹⁷ Sherman (1992) notes that the cost to acquiring information regarding demand is likely to be prohibitive for the small firms that choose the best-efforts offering method.

¹⁸ Ritter (1987) argues that all-or-nothing best-efforts contracts manages the winner's curse problem since overpriced offerings fail. The choice between best-efforts and firm-commitment offerings depends on which contract better manages the winner's curse. Relaxing the NASD limit increases the likelihood that firm-commitment contracts will better manage this problem for some firms. The winner's curse theory, therefore, again makes the same prediction as the certification theory.

The choice between best-efforts and firm-commitment contracts is examined using a probit model in Table 5. The dependent variable is a dummy variable taking on the value 1 if a firm-commitment offering is used and 0 if a best-efforts offering is used. If firm-commitment contracts are relatively more attractive with larger overallotment options, the probability of their use should increase after August 17, 1983. The sample for this analysis consists of all firm-commitment and best-efforts initial public offerings recorded on Howard and Company's *Going Public: The IPO Reporter* as compiled by Jay Ritter.

The independent variables in this analysis include the risk proxies used previously as Ritter (1987) and Chua (1995) find that speculative offerings are more likely to use best-efforts contracts. The absolute elasticity of book to market value with respect to the number of shares in the offering is also included as an independent variable. Firms with larger elasticities are more likely to use best-efforts contracts since they allow greater offering size flexibility. Since, as noted earlier, this elasticity is negatively correlated with the book to market ratio, a similar prediction would result if it is viewed as a risk proxy.

In order to determine whether the NASD overallotment policy change affects the choice between firm-commitment and best-efforts contracts, this choice must be predictable. This is tested by including a dummy variable which takes on the value 1 if the offering occurs between August 1, 1980 and December 31, 1980 or January 1, 1983 and June 30, 1983, periods with high average underpricing for firm-commitment offerings. A second dummy variable is also included which takes on the value 1 if the offering occurs between January 1, 1980 and March 31, 1980 or August 1, 1980 and March 31, 1981 or May 1, 1983 and July 31, 1983, periods with high average underpricing for best-efforts offerings. If the 'hotness' of the market affect contract choices, one or both of these variables should be significantly different from zero.

Regression (1) of Table 5 presents the probit model estimates for full sample of offerings prior to August 17, 1983. The point estimates are the comparative statics for each independent variable, measured for the mean firm in the sample. The use of firm-commitment contracts is significantly positively related to the underwriter's reputation, the logarithm of the offering size and the percentage of secondary shares in the offering and significantly negatively related to the inverse of the offering price. This is consistent with riskier offerings using best-efforts contracts. The coefficients on the firm-commitment and best-efforts hot issue market dummy variables are insignificant. Regression (2) presents the probit model estimates for the subset of firms where the absolute elasticity of book to market with respect to the number of shares in the offering can be computed. The results are similar to those for the full sample. The coefficient on the absolute book to market elasticity is significantly negative, consistent with expectations. The hot issue market dummy variables are again insignificant. In sum, regressions (1) and (2) indicate that the hotness of the market has no effect on the choice of offering contract.

Probit regressions (3) through (5) of Table 5 examine whether the probability of

Table 5
Probit model estimations for the choice of firm-commitment or best-efforts initial public offerings of equity between 1980 and 1984

Independent variables	Offers from January 1, 1980 to August 17, 1983		Offers from January 1, 1980 to December 31, 1984	
	(1)	(2)	(3)	(5)
Intercept	-0.04 ^a (-2.7)	0.01 (0.7)	-0.17 ^a (-9.1)	-0.02 (-0.7)
Best-efforts hot issue dummy	0.001 (0.1)	0.003 (0.4)	0.003 (0.1)	0.004 (0.2)
Firm-commitment hot issue dummy	-0.01 (-0.9)	-0.008 (-1.1)	-0.01 (-0.7)	-0.02 (-0.9)
Post 8/17/83 dummy			0.05 ^a (2.9)	0.02 (1.2)
Underwriter reputation	0.08 ^a (6.0)	0.04 ^a (-5.5)	0.12 ^a (7.8)	0.09 ^a (5.4)
1/offer price	-0.02 ^a (-8.7)	-0.01 ^a (-8.5)	-0.004 ^a (-4.7)	-0.03 ^a (-10.2)
Log offer size	0.07 ^a (7.3)	0.03 ^a (5.9)	0.16 ^a (14.3)	0.09 ^a (8.1)
% secondary	0.94 ^a (3.3)	0.45 ^a (3.1)	0.38 ^a (4.9)	0.35 ^a (4.1)
Absolute elasticity of book to market with respect to offer size		-0.05 ^a (-2.7)	-0.003 (-1.2)	-0.04 ^b (-2.3)
Absolute elasticity of book to market with respect to offer size × Post 8/17/83 dummy				0.04 ^b (2.2)
Number of observations	1054	932	1771	1512
Log-likelihood	-263	-222	-556	-371
Pseudo R^2	0.58	0.58	0.45	0.51
Percent correct predictions	89.5	90.1	85.7	89.9

using firm-commitment contracts changes after the NASD policy change. In addition to the independent variables used above, a dummy variable is included which takes on the value 1 if the offering occurs after the NASD policy change. Regression (3) presents results for the full sample. The use of firm-commitment contracts is significantly positively related to the underwriter's reputation, the logarithm of the offering size and the percentage of secondary shares and significantly negatively related to the inverse of the offering price. This is consistent with riskier offerings using best-efforts contracts. The coefficient on the offering period dummy variable is significantly positive. Its point estimate indicates that the probability of using firm-commitment contracts increases 5% after the NASD policy change. Regression (4) presents the probit model estimates for the subset of firms where the absolute elasticity of book to market with respect to the number of shares in the offering can be computed. The results are similar to those for the full sample. The coefficient on the absolute book to market elasticity is insignificantly negative. The coefficient on the offering period dummy variable is significantly positive. Its point estimate indicates that the probability of using firm-commitment contracts increases 4% after the NASD policy change.

The change in significance of the absolute elasticity measure between regressions (2) and (4) is further examined in probit regression (5). This probit model includes all the independent variables in regression (4) plus a variable defined as the absolute book to market elasticity multiplied by the offering period dummy

Notes to Table 5:

The dependent variable is a dummy variable taking on the value 1 if the offering is firm-commitment and 0 if the offering is best-efforts. Independent variables include a dummy variable taking on the value 1 if the offer takes place between January 1, 1990 and March 31, 1990 or August 1, 1990 and March 31, 1991 or May 1, 1993 and July 31, 1993 (Best-efforts hot market dummy), a dummy variable taking on the value 1 if the offer takes place between August 1, 1990 and December 31, 1990 or October 1, 1992 and June 30, 1993 (Firm-commitment hot market dummy), a dummy variable taking on the value 1 if the offer is after August 17, 1993 and 0 otherwise (Post 8/17/93 dummy), a dummy variable taking on the value 1 if the lead underwriter is located in New York City and 0 otherwise (Underwriter reputation), the inverse of the offer price (1/offer price), the logarithm of the maximum dollar size of the offering (Log offer size), the number of shares sold by insiders divided by the maximum number of shares to be sold (% secondary) and the absolute value of the elasticity of the book to market value of equity ratio with respect to the number of shares offered where the book to market value of equity ratio is defined as the book value of equity prior to the offering plus the net proceeds of the offering divided by the number of shares to be outstanding after the offering times the offering price (Absolute elasticity of book to market with respect to offer size). The table reports the comparative statics for each variable. Specifically, the change in the probability of using a firm-commitment contract given a unit change in the independent variable for a firm having mean characteristics is reported for each 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 mean levels for each independent variable and ϕ is the standard normal density function. To determine the probit model coefficient estimates, the scaling factor $\phi(\hat{\beta}\bar{x})$ equals 0.0951 for model (1), 0.04751 for model (2), 0.16106 for model (3), 0.14151 for model (4) and 0.14142 for model (5). *t*-statistics are provided in parentheses. ^a Indicates significance at the 1% level.

^b Indicates significance at the 5% level.

variable. This interactive variable identifies the change in the absolute elasticity's effect on contract choice from the earlier to later period. The results are similar to regression (4) with two exceptions. The coefficient on the absolute book to market is significantly negative. Its point estimate is similar to that obtained in regression (2), as expected. Also, the offering period dummy variable is no longer significant. The interactive variable is significantly positive, however. Since the mean value of the absolute elasticity is 0.78 after August 17, 1983, the point estimate on the interactive variable indicates that the probability of using firm-commitment contracts increases about 3% after the NASD policy change. The reduction in significance of the absolute elasticity on contract choice is consistent with offer size flexibility becoming a less important factor once firm-commitment contracts have greater flexibility.

6. Conclusions

This paper explores how firms choose between contract terms when attempting to raise capital through an initial public offering of equity. I specifically examine the substitutability or complementarity of warrant compensation of underwriters and underwriter reputation with the over-allotment option. The tests exploit the fact that the NASD relaxed its constraint on over-allotment options from 10 to 15% of the offering size in August of 1983. If warrant compensation and underwriter reputation are substitutes (complements) for the over-allotment option, their use should decline (increase) after the NASD policy change for firms that would be constrained by the original limit.

Three alternative hypotheses are developed to explain the choices between contract terms. The evidence in this paper is most consistent with the reneging and certification hypotheses. For firms that would be constrained by the original NASD limit on over-allotment options, the probability of warrant use drops 17% after the limit is relaxed. This indicates that warrant compensation and the over-allotment option are substitutes, consistent with reneging and certification but not preselling. For constrained firms using warrant compensation, the probability of using a reputable underwriter drops 29% after the NASD policy is relaxed. This indicates that underwriter reputation and the over-allotment option are substitutes, consistent with preselling and certification. For constrained firms that do not use warrants, however, the probability of using a reputable underwriter increases 17% after the NASD policy is relaxed. This indicates that reputation and the over-allotment are complements for this sample, consistent with reneging.

Since firms significantly changed their firm-commitment underwriting contracts after the NASD policy change, the original 10% limit on over-allotment option was presumably costly to issuers. This view is supported by additional evidence on the relative desirability of firm-commitment and best-efforts contracts. Consistent with the NASD policy change having a significant effect on contract choices, I find that

the probability of firm-commitment contract use increases 3 to 5% after August 17, 1983. I can find no evidence of direct offering cost savings after the policy change, however. I argue that this inability to detect cost savings is primarily due to difficulties in measuring offering costs for initial public offerings. Since direct contracting costs in various settings can be difficult to measure for similar reasons, these findings suggest that policy makers and researchers should focus on contract terms changes after regulations are relaxed to uncover the costs of regulation

Appendix A. Definition of the absolute elasticity of book to market with respect to the number of shares in the offering

Let:

- N = the total number of shares in the offering;
- I = the number of shares to be sold by existing shareholders (secondary shares);
- P = the offering price;
- S = the underwriter cash spread stated as a percentage of the offering price;
- E = other expenses (in dollars) of the offering which includes cash expenses other than the underwriter spread plus the value of any warrants given to the underwriter as compensation. Warrants are valued using the constant elasticity of variance model (see Barry et al., 1991);
- B = the book value of equity prior to the offering; and
- O = the number of shares outstanding before the offering.

The book to market ratio is the book value of equity prior to the offering plus the net proceeds of the offering divided by the number of shares outstanding after the offering multiplied by the offering price. Formally, this can be written as follows:

$$BM = \frac{B + N \times P \times (1 - S) - P \times I - E}{P \times (N - I + O)} \quad (A.1)$$

where BM is the book to market ratio.

The elasticity of book to market with respect to the number of shares in the offering is:

$$E_{BM, N} = \frac{\partial BM}{\partial N} \times \frac{N}{BM} \quad (A.2)$$

This can be precisely defined by taking the partial derivative of Eq. (A.1) with respect to N and substituting in to Eq. (A.2). After simplifying, the elasticity is given as:

$$E_{BM, N} = \frac{O \times P \times (1 - S) + P \times S \times I + E - B}{N \times P \times (1 - S) - P \times I - E + B} \times \frac{N}{N - I + O} \quad (A.3)$$

The numerator of the first expression is the difference between the market and book value of the existing shares (net of offering expenses) if the market value is determined using the offering price. Offerings where the market to book ratio is close to one will, therefore, have low elasticities. The denominator is the book value of equity for the firm. The second part of this expression is the ratio of shares in the offering to the total outstanding. Firms with larger offerings relative to total outstanding will also have large elasticities.

It should be noted that this elasticity holds all other variables constant. For example, warrant compensation (part of E) is assumed to be unaffected by changes in the number of shares offered, which is not accurate. Since the value of warrants is generally low relative to the size of the offering (see Barry et al., 1991), I assume any change in warrant value would have a second order effect on book to market. Also, this measure holds the number of secondary shares constant. This assumes that all shares offered through exercise of the overallotment option would be new. Again, this is not accurate as many overallotment options include secondary shares. As an alternative, I define an elasticity where secondary shares, I , are a fixed percentage of the number of shares offered, N . The empirical results are similar using this alternative measure.

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