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Determinants of Contract Choice: The Use of Warrants to Compensate Underwriters of Seasoned Equity Issues

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ABSTRACT

The issuer's decision to include warrants as compensation to underwriters is studied for a sample of 1,991 negotiated firm commitment issues of seasoned equity. Using a two-stage logit model to correct for self-selection bias, we find direct evidence that warrant compensation functions as a bond, substituting for reputational capital and enabling the underwriter to certify the issue price. To a lesser degree, the decision also is affected by regulations on underwriter compensation and on the use of underwriter warrants. Issuers' decisions are consistent with an objective of minimizing total underwriting cost, including cash compensation, warrants, and underpricing.

COMPENSATION TO UNDERWRITERS OF equity issues can be in either cash in the form of a spread, or a combination of cash spread plus warrants to purchase new shares of the issuer at a future date. Use of warrant compensation has been puzzling and controversial for several reasons: (1) since expectations about future stock performance may diverge, the value of cash compensation is easier for the issuer and the underwriter to agree upon; (2) legal restrictions on resale and exercise of warrants used as compensation reduce their value to the underwriter; (3) since the exercise price is tied to the issue price, warrants reinforce the underwriter's incentive to underprice.

Previous research offers three hypotheses for use of warrant compensation. First, in an early study of securities markets, the U.S. Securities and Exchange Commission (SEC) (1963a, at 500–512; and 1963b) hypothesizes that the market for underwriting services is segmented between small and large issuers. Large issuers enter into cash compensation contracts with well-established underwriters, whereas small issuers are constrained to deal with less well-established underwriters who demand warrant compensation. The SEC suggests that warrants are used to mislead small issuers about the value of

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total compensation. Second, Booth and Smith (1986) hypothesize that certification of the issue price to prospective investors is one aspect of the underwriting function. They maintain that underwriters can use warrants and/or reputational capital to bond representations about the value of an issue. Thus, they expect warrant compensation to be more prevalent among underwriters with less well-established reputations. Third, Barry, Muscarella, and Vetsuypens (1991) hypothesize that underwriters accept warrants as a substitute for higher cash spreads to circumvent maximum compensation guidelines of the National Association of Securities Dealers (NASD). They contend that the NASD undervalues warrant compensation. Accordingly, they expect warrants to be used when cash compensation would exceed NASD guidelines.

Evidence on the reasons for using warrant compensation is mixed and incomplete. The SEC (1963a) finds that issues with warrants have higher cash spreads and are more underpriced than others. Although the study does not provide a statistical test of the segmentation hypothesis, the SEC discounts claims by investment bankers that warrants compensate for higher costs of underwriting small issues. Barry et al. (1991), in their study of initial public offerings (IPOs), find evidence of circumvention, but recognize that certification against overpricing also may affect the choice. They do not test whether the choice of contract form is consistent with segmentation. Dunbar (1995), who also studies IPOs, finds that the decision to include warrant compensation tends to minimize issue costs. He therefore rejects the SEC's notion that issuers who use warrants are over-compensating underwriters. Though Dunbar suggests that his results are consistent with certification, he does not provide a direct test of whether certification affects the choice. In addition, his empirical results appear to be inconsistent with circumvention since his estimates imply that, instead of being reduced, cash spreads for issues with warrants are substantially higher than they otherwise would have been.

We use a comprehensive framework to test all three hypotheses concerning warrant compensation. Our econometric approach allows us to test the SEC's segmentation hypothesis against the alternative that warrant compensation is a contract choice that is selected by the issuer to maximize net proceeds and leads us to reject the segmentation hypothesis. We examine the effects of certification and regulation using this choice model. In contrast to Dunbar, we find the choice leads to both reduced underpricing and reduced cash compensation. We provide the only direct test for an independent effect of certification and find that both certification and circumvention are distinct and important determinants of the contract choice. Our evidence suggests that certification has a stronger impact on the decision than does circumvention. However, we also find that the effects of regulation extend beyond circumvention. Irrespective of whether warrants are used for circumvention, regulations discourage firms with high dividend payouts, low volatility of stock returns and limited growth opportunities from using warrant compensation. Since we examine seasoned equity issues, our results generalize some of the findings that are based on the IPO market.

Sections I and II provide essential background on regulation of underwriter compensation and on the relation between warrant compensation and underpricing in the context of certification. The database is described in Section III. Section IV and V set out specific testable implications of the three hypotheses and provide empirical evidence with respect to each. Section VI concludes.

I. Regulation of Underwriter Compensation and the Use of Warrants

Issue expenses and underwriter compensation are subject to review by the NASD under its Rules of Fair Practice. These rules and various NASD Notices to Members require underwriting expenses to be "fair and reasonable." For the period relevant to our study, the Rules of Fair Practice cite the following safe harbors:

> A guideline for underwriting compensation of ten percent of proceeds received, plus a maximum of 0.5% for reimbursement of bona fide due diligence expenses, was published in Notice to Members 82-51 (October 19, 1982).
>
> A guideline for organization and offering expenses of 15 percent of proceeds received was published in Notice to Members 82-51 (October 19, 1982).[1]

In determining the value of compensation to the underwriter, the NASD imputes a cash-equivalent value to warrants using the following formula.[2]

$$W_{\text{NASD}} = \{[(1.65S - X)n/2 - c]F/NS\} \tag{1}$$

where W_{NASD} is NASD cash equivalent value as a percent of gross proceeds, S is offer price, X is exercise price, c is cost to the underwriter of acquiring the warrants, n is number of shares that can be acquired through exercise, N is number of shares issued and F is a restriction period adjustment factor. If, as Barry et al. find for IPOs, this formula undervalues warrants compared to theoretical value, then underwriters can use warrants to circumvent NASD limits on compensation.

In addition to restricting the maximum dollar value of compensation, the NASD and the states impose other restrictions that affect the decision to use warrants. The NASD provides that warrants can only be issued to the lead

[1] The SEC will not allow an issue to be marketed unless it has satisfied this review. The NASD was established under authority granted by the 1938 Maloney Act as a self-regulatory association of broker/dealers. The SEC (1963a, at 72) recognizes that NASD membership is "essential to engage profitably in almost any underwriting and in most over-the-counter business." See NASD Rules of Fair Practice (1989, at 2192). Subsequent publications of the Rules of Fair Practice do not make reference to specific guidelines, but those reported are appropriate to the time frame of our study.

[2] The formula is inferred from Notice to Members No. 88–92, at 165–166. See also Barry et al. (1991).

underwriter and that warrant shares cannot exceed ten percent of shares issued to the public. Warrants cannot be offered for a term longer than five years, and cannot be sold or exercised by the underwriter during the first year after issue. With revision of the Corporate Financing Rule in 1981, the exercise price must exceed the offer price and cannot be adjusted downward for payment of dividends after the issue. State blue sky laws often are more restrictive, commonly requiring the exercise price to be at least 120 percent of the issue price.[3]

II. Certification, Warrant Compensation and Underpricing

Underwriter certification and other bonding arrangements are market responses to informational asymmetry. In the Booth and Smith (1986) model, the underwriter's reputational capital helps to mitigate informational asymmetry by enabling the underwriter to credibly certify that an issue is not overpriced. In the event of overpricing, an underwriter who receives cash compensation suffers a loss of reputational capital and may be compelled to make restitution to investors to restore its reputation.[4] Warrant compensation can substitute for reputational capital. By accepting warrants that tie compensation to long-run price performance of the issue, an underwriter who lacks reputational capital can provide the bond that is necessary for issue price certification.

The credibility of warrants as a bond depends on a number of factors. All else equal, the larger the number, as a fraction of issue size, the more credible is the bond. However, if the cash spread alone is sufficient compensation, then supplemental warrant compensation is not a credible signal. Thus, underwriters who accept warrants should receive lower cash spreads than they otherwise would. Also, to preclude false signaling, restriction periods on resale and exercise of warrants must be long enough for investors to learn of inside information that may have existed at time of issue. Thus, the NASD's one year restriction on resale and exercise enhances the usefulness of warrant compensation as a bond.

In the context of certification, underpricing is a substitute for additional compensation to the underwriter. The issuer compensates the underwriter for due diligence investigations up to the point where marginal cost equals marginal benefit in the form of enabling the underwriter to support a higher issue price. An issuer seeking maximum net proceeds is indifferent between a dollar

[3] Since most issues are registered in several states, the most stringent blue sky restriction tends to be binding. Thus, most issues in our sample have initial exercise prices of 120 percent of the issue price.

[4] Securities Act of 1933, Release No. 5275 by the SEC (1972) makes the investment banker's certification responsibility explicit, particularly for IPOs: "Although there are no express provisions of the Act requiring an underwriter to conduct a due diligence investigation, in order to establish a defense under the civil liability provisions of Section 11 of the Act, an underwriter must exercise reasonable care in verifying the statements in the prospectus.... Where no public market price exists, the underwriter should exercise care to assure that the price reflects what he reasonably believes, after his due diligence investigation, to be the value of the securities...." Smith (1992) reviews the relevant literature.

of compensation and a dollar of underpricing. Since the underwriter is harmed by overpricing, the equilibrium involves a combination of underpricing and compensation.[5] Since warrants substitute for reputational capital, an underwriter who accepts warrants has the same incentive to underprice as one who has reputational capital at risk. Thus, total underwriting cost can be viewed to include underpricing as well as the cash spread and warrant value. If, as we assume, the issuer's objective is maximum net issue proceeds, then these three components of total underwriting cost are additive.

III. Data Description

Our primary data source is the Registered Offering Statistics (ROS) tape of the SEC. We use the period from January 1981 through December 1988 since it is one of consistent practice by the NASD.[6] The ending date is when compilation of the ROS tape was discontinued by the SEC. Our final sample includes all negotiated firm commitment seasoned equity issues where adequate data are available. We use the National Stock Summary to identify lead underwriters that are not identified on the ROS tape. Offer price and warrant compensation information that is not reported on the ROS tape is collected from 10-K reports. Aftermarket prices are obtained from the CRSP and Nasdaq tapes or from the Daily Stock Price Record.

The final sample includes 220 issues with warrants and 1,771 with only cash compensation.[7] For 195 of the issues using warrants, resale and exercise are restricted for only one year, and for 175 the warrants expire at the end of five years. Thus, the sample is quite homogeneous with respect to these aspects of the contract. For 95 percent of the issues the initial exercise price is at least 20 percent above the issue price. While most of the issues have positive initial returns, the first aftermarket price is below the exercise price for 94.1 percent of the sample.

Based on underwriter classifications from the ROS tape, 80.1 percent of issues without warrants are underwritten by investment bankers with national distribution networks, compared to 13.6 percent of issues with warrants. New York Stock Exchange (NYSE) and American Stock Exchange (AMEX) listed firms account for 51.7 percent of issues without warrants, compared to

[5] Allen and Faulhaber (1989), Grinblatt and Hwang (1989) and Welch (1989) develop models that are consistent with Booth and Smith, in which underpricing permits more attractive terms on future financing. Booth and Smith, however, demonstrate that such investments in reputation normally can be employed more intensively by the investment banker.

[6] New issues are regulated under the Corporate Financing Rule (Section 44) of the Rules of Fair Practice. The rule was developed in the early 1980s to replace the less formalized Interpretations of the Board of Governors Review of Corporate Financing.

[7] After deleting observations with incomplete information, the initial with-warrants sample consisted of 289 observations, and the without-warrants sample consisted of 2,011 observations. In the final sample we exclude competitively bid and best efforts issues. Of the initial sample, all with-warrants issues and 98.6 percent of without-warrants issues were done on a negotiated basis. Furthermore, 76.1 percent of the with-warrants group and 89.0 percent of the without-warrants group were firm commitment issues.

Table I

Comparisons of Sample Means Between Issues Using Warrants to Compensate Underwriters and Issues Not Using Warrants

The sample includes 1,991 negotiated firm commitment seasoned equity issues for the period from 1981 through 1988. Cash compensation is measured as a percentage of gross issue proceeds. Underpricing is measured as ((first aftermarket closing price or average of bid and ask price) − issue price)/issue price. If the bid price is used in lieu of the average of bid and ask, underpricing averages 3.17 percent for issues with warrant compensation and 0.70 percent for issues without warrant compensation. The difference between groups remains statistically significant (t-value = 3.14*). Volatility is measured as a percentage of gross proceeds, using historical stock returns for the prior year. Dividend yield is measured as cumulative cash dividend/issue price, for the year before issue from COMPUSTAT PDE tape. Beta, standard error, and standard deviation of the market are measured over 250 business days before the issue date. The market index includes all CRSP and Nasdaq firms.

Variable Name	220 Issues with Warrant Compensation	1,771 Issues without Warrant Compensation	t-Value
Cash compensation	10.51%	6.81%	3.00*
Underpricing	4.83%	0.73%	4.07*
Cash compensation plus underpricing	15.34%	7.54%	3.22*
Galai-Schneller warrant valuation	5.67%		
Total underwriting cost	21.01%	7.54%	4.13*
Issue size (gross proceeds in thousands, 1981)	$5,012	$39,125	6.39*
Issuer size (market equity is millions, 1981)	$393	$878	3.47*
Age of issuer	16.7 years	36.1 years	2.33*
Dividend yield (annualized)	0.07%	5.18%	3.28*
Book equity/market equity	0.40	0.71	2.78*
Volatility of stock returns (daily variance)	2.90%	1.20%	2.23*
Beta of equity (equal weighted market)	1.37	1.12	2.14*
Error standard deviation	5.12%	3.87%	2.01*
Standard deviation of market	1.37%	1.28%	1.47

* Difference between means is significant at 0.05 level or beyond.

5.0 percent of issues with warrants. The distributions over time of both types of underwriting compensation provisions are approximately uniform.

IV. Preliminary Evidence

Descriptive information on the variables used in our analysis is reported in Table I. Issues with and without warrant compensation differ substantially across many dimensions. All components of total underwriting cost as percentages of gross proceeds are higher for issues with warrants. Underpricing, though recognized to be slight for seasoned issues, averages 4.83 percent for those with warrants. This finding establishes the importance of incorporating underpricing into our analysis of seasoned issues. Cash compensation plus underpricing averages 15.34 percent for issues using warrants, compared to 7.54 percent for issues without warrants. As has been found for IPOs, in the market for seasoned equity, warrant compensation tends to be used for small issues of small firms.

In our sample, 65.2 percent of issues with warrants have cash compensation above ten percent of proceeds. In contrast, 92.3 percent of issues without warrants have cash compensation of ten percent or less. In addition to demonstrating that the NASD guidelines function only as a safe harbor, the higher cash compensation of the group with warrants is consistent with circumvention. High cash compensation increases the incentive to use warrants to satisfy NASD concerns.

As one test of circumvention, we follow Barry et al. (1991) in comparing NASD imputed warrant values to theoretically based estimates of market value. As reported in Table I, using the Galai and Schneller (1978) warrant valuation model, we estimate the average value of warrant compensation for our sample to be 5.67 percent of gross proceeds.[8] This compares to NASD imputed value of 2.15 percent. The difference is significant at the five percent level (t-value = 3.16) and is consistently positive for subsets of the data grouped by issue size.

NASD rules and state blue sky laws have differential impacts on issuing firms. Other things equal, warrant value is positively related to the volatility of stock returns and to expected stock price appreciation. As a result, small and risky firms with important growth options and low dividend payouts are better able to use warrants to circumvent restrictions on total compensation or to provide a bond against overpricing. Table I examines the relations between these factors and use of warrants. As expected, issues with warrants have lower dividend yields and higher volatilities than other issues. The higher volatility includes both higher market and residual risk. Issuers using warrants also have more important growth options as reflected (inversely) by the ratio of book-to-market equity.

In Table II we examine the relation between warrant use and underwriter reputation. Using the Carter and Manaster (1990) ranking as our measure of reputation, the difference in mean rankings between the groups is statistically significant. Furthermore, 74.0 percent of issues with warrants are underwritten by lead investment bankers ranked 4.5 or lower, while 99.0 percent of issues without warrants are underwritten by lead investment bankers ranked 5.0 or higher. The findings in Table II are consistent with certification and suggest that a ranking of 5.0 or above is an indication that the underwriter has sufficient reputational capital to certify an issue without accepting warrants.[9] In a subsequent test we use 5.0 as the critical value for grouping underwriters according to reputation.

In Panel A of Table III we examine the effects of issue size on the relation between use of warrants and level of cash compensation. For both types of contracts (with and without warrant compensation) the cash compensation

[8] The model extends Black-Scholes to allow for the dilution that results if warrants are exercised. It does not take into consideration the reduction in value that results from the restriction period on resale. The estimate of average warrant value is similar using the CEV model, 6.32 percent.

[9] Carter and Manaster (1990) report the identities of individual underwriters by ranking. Underwriters ranked at 5.0 or above may vary in size but generally have many years of experience as underwriters.

Table II

Comparison of Underwriter Reputation Using the Carter-Manaster Rankings for Issues Underwritten with and without Warrant Compensation

The sample includes 1,991 negotiated firm commitment seasoned equity issues from 1981 through 1988. The Carter-Manaster ranking of underwriter reputation ranges from zero (lowest) to nine (highest). Some underwriters are not included in the Carter-Manaster listing. In subsequent analysis, a rank of zero is assumed for these cases. Our statistical results do not change significantly when the following three other methods are used, viz. (i) a new ranking is created based on issuance-related exogenous variables, (ii) by omitting the missing observations, and (iii) the mean ranking of the group is assigned whenever the actual ranking is missing. Means are comparable in magnitude to those reported by Barry, Muscarella, and Vetsuypens (1991).

	Issues with Warrants		Issues without Warrants	
Carter-Manaster Ranking	Frequency	Cumulative Percentage of Ranked Underwriters	Frequency	Cumulative Percentage of Ranked Underwriters
0	5	2.50	0	0.00
1	10	7.50	0	0.00
1.5	12	13.50	0	0.00
2	27	27.00	2	0.12
3	21	37.50	5	0.42
3.5	9	42.00	1	0.48
4	62	73.00	8	0.95
4.5	2	74.00	1	1.01
5	30	89.00	80	5.77
5.5	1	89.50	20	6.96
6	1	90.00	23	8.33
6.5	0	90.00	15	9.23
7	12	96.00	120	16.37
7.5	0	96.00	89	21.67
8	8	100.00	730	65.12
9	0	100.00	586	100.00
Not Ranked	20		91	
Total	220		1,771	
Mean ranking	3.72		7.99	
Std. dev. of rank	1.78		1.11	
t-ratio for difference in means between groups = 4.77*				

* Statistically significant at the .05 level or beyond.

percentage is negatively related to issue size. Most of the difference in cash compensation levels between the contract types is accounted for by the difference in mean issue size. Nevertheless, in comparisons holding issue size constant, there remains a significant tendency for issues with warrants to involve higher cash compensation.[10] Although the comparison appears to be consistent with the SEC's (1963a) view that warrants do not substitute for higher cash compensation, it does not exclude the possibility that factors other

[10] The probability of 11 or more positive differences over 13 size groupings is approximately one percent.

Table III

Underwriter Cash Compensation and Underpricing as Percentages of Gross Issue Proceeds, Grouped by Issue Size

The sample includes 1,991 negotiated firm commitment seasoned equity issues from 1981 through 1988. Size is in 1981 dollars. Cash compensation = underwriting cash compensation/gross proceeds. Underpricing = ((first aftermarket closing price or average of bid and ask price) − issue price)/issue price.

Range of Issue Size ($000)	Issues Underwritten with Warrants			Issues Underwritten without Warrants			Difference in Means	*t*-Value
	Mean	Median	No. of Issues	Mean	Median	No. of Issues		
Panel A: Cash Compensation								
0 ≤ Size < 1,000	10.31%	11.50%	8	10.37%	10.32%	5	−0.06%	−0.81
1,000 ≤ Size < 2,000	11.51	11.00	27	9.53	9.46	18	1.98	2.46*
2,000 ≤ Size < 3,000	10.43	10.75	40	10.23	9.75	38	0.20	1.22
3,000 ≤ Size < 4,000	11.76	11.00	46	10.77	9.88	50	0.99	1.78
4,000 ≤ Size < 5,000	11.01	10.95	27	10.70	9.95	49	0.31	1.36
5,000 ≤ Size < 6,000	10.05	10.67	14	9.62	9.10	64	0.43	1.51
6,000 ≤ Size < 7,000	10.02	10.45	17	9.42	8.73	71	0.60	1.60
7,000 ≤ Size < 8,000	9.88	10.10	15	8.43	8.20	80	1.45	2.63*
8,000 ≤ Size < 10,000	9.43	9.96	12	8.89	7.97	73	0.54	1.36
10,000 ≤ Size < 15,000	9.47	9.81	6	8.12	7.67	68	1.35	2.18*
15,000 ≤ Size < 20,000	9.08	8.40	4	7.12	7.05	227	1.96	2.71*
20,000 ≤ Size < 30,000	6.89	7.75	3	6.00	5.89	395	0.89	1.84
30,000 ≤ Size	5.36	5.36	1	5.70	5.47	633	−0.34	−1.02
Mean cash compensation	10.51%		220	6.81%		1,771	3.70%	3.00*
Panel B: Underpricing								
0 ≤ Size < 5,000	5.42%		148	1.64%		160	3.78%	4.33*
5,000 ≤ Size < 10,000	3.70		58	1.10		288	2.60	2.89*
10,000 ≤ Size	3.30		14	0.54		1,323	2.76	3.14*
Mean underpricing	4.83%		220	0.73%		1,771	4.10%	4.07*

* Statistically significant at the 0.05 level or beyond.

than issue size also influence cash compensation levels and may account for the use of warrants. Indeed, in the next section we control for choice selectivity of the compensation contract and find that for issuers who select warrants, the cash spreads are lower than they otherwise would have been.

In Panel B we show mean underpricing for the two groups, stratified by issue size. Controlling for issue size in this way does not account fully for the difference in underpricing between the groups. Again, the evidence appears to support the SEC's view that using warrants leads to increased underpricing, but does not control for choice selectivity and does not exclude the possibility that underpricing substitutes for higher compensation. After controlling for choice selectivity, we find that issuers who select warrants experience less underpricing than they otherwise would have.

Table IV

Reduced-Form Logit Estimate of the Choice Equation

The dependent variable is the contract choice: contracts with warrant compensation = 1, contracts without warrant compensation = 0. The sample includes 1,991 negotiated firm commitment seasoned equity issues for the period from 1981 to 1988.

Explanatory Variable	Coefficient	Asymptotic t-Value
Intercept	−3.921	−3.57*
Log of firm age	−1.298	−9.14*
Market value of equity	−0.0008	−2.57*
Book equity/market equity	−0.434	−8.03*
Issue size	−0.00003	−3.27*
Log of issue size	−0.757	−10.74*
Beta	0.814	4.76*
Error st. dev.	1.244	6.39*
Market std. dev.	0.672	10.55*
Pseudo r^2	0.54	

* Statistically significant at the 0.05 level or beyond.

V. The Choice of Underwriter Compensation

The alternative to the segmentation hypothesis is that an issuer is free to select a contract that includes or excludes warrant compensation and is expected to select the contract that results in maximum net proceeds. Since compensation and underpricing can only be observed for contracts that actually are selected, estimates of the cost of the foregone alternative by OLS regression are biased and inconsistent. We control for choice selectivity using the two-stage logit procedure developed by Lee (1978). Since the econometric procedure is described by Smith (1987), in a study of the choice between competitive and negotiated underwriting and by Dunbar (1995), we limit discussion here to a methodological description that is specific to this study.

A. Market Segmentation Versus Maximization of Net Issue Proceeds

In our econometric model, issuing firms decide whether to use warrants by comparing warrant value to the difference between expected cash compensation plus underpricing for contracts with and without warrants. We expect an issuer to use warrants if doing so results in lower total underwriting cost. Since both certification and circumvention imply that warrants and cash compensation are substitutes, we also examine the separate effects of warrant use on cash compensation and underpricing.

We use the two-stage procedure to estimate unbiased models of expected cash compensation plus underpricing for issues with and without warrant compensation. In the first stage (Table IV), we estimate a logit model of the contract choice. The independent variables in this reduced form equation are

Table V

Second Stage Estimates of Cash Compensation Plus Underpricing for Issues with Warrant Compensation and without Warrant Compensation

Estimates are based on a sample of 1,991 negotiated firm commitment seasoned equity issues for the period from 1981 through 1988. Inverse Mills ratios are included to adjust for selectivity bias.

	Contracts with Warrants		Contracts without Warrants	
Explanatory Variable	Coefficient	*t*-Value	Coefficient	*t*-Value
Intercept	27.432	15.47*	8.031	27.13*
Log of firm age	−1.186	−9.67*	−0.792	−7.43*
Market value of equity	−0.0003	−4.31*	−0.0001	−1.39
Book equity/market equity	−1.433	−8.76*	−1.118	−1.99*
Issue size	−0.0007	−5.42*	−0.0001	−6.41*
Log of issue size	−0.189	−14.17*	−2.361	−17.34*
Beta	0.367	5.15*	0.128	6.78*
Error std. dev.	0.573	6.14*	0.493	17.14*
Market std. dev.	0.509	5.88*	0.407	8.77*
Inverse Mills ratio	−2.972	−14.12*	0.603	1.48
r^2	0.26		0.80	
Number of observations	220		1,771	

* Statistically significant at the 0.05 level or beyond.

those exogenous variables that, based on prior literature, are expected to affect total underwriting cost. The dependent variable has the value of one if warrants are used and zero otherwise. Results from the first stage are used to construct an inverse Mills ratio for each observation, that reflects the likelihood of selecting warrant compensation.[11] In the second stage (Table V), cash compensation plus underpricing is regressed on the inverse Mills ratio and the same list of independent variables. This is done separately for issues with and without warrants. The inverse Mills ratio is a metric for the likelihood of choosing warrant compensation for a particular observation. Observations close to the switch point are more likely than others to reflect indifference between warrant and cash compensation contracts. Choice selectivity arises because we can observe only those contract terms that are regarded by the issuer to be most favorable. Thus, failure to control for choice selectivity can yield biased estimates of expected underwriting cost. Coefficients on the inverse Mills ratios provide a test of the segmentation hypothesis. If neither is significant, then there is no evidence that issuers could actually choose between warrant and cash compensation and we cannot reject segmentation. To test the specific alternative of net issue proceeds maximization, the coefficients

[11] For empirical models of the underwriting costs of seasoned issues see Smith (1977), Bhagat and Frost (1986), and Smith (1986). The inverse Mills ratio is calculated from the logit regression as the ratio of the standard normal density function to the standard normal distribution function. See Lee (1978).

Table VI

Expected Average Cash Compensation and Underpricing by Type of Contract Actually Selected and for Data Grouped According to Whether the Underwriting Contract Includes Warrant Compensation

Results are based on a sample of 1,991 negotiated firm commitment seasoned equity issues for the period from 1981 through 1988. Panel A contains results for cash compensation plus underpricing and Panel B contains separate results for cash compensation and underpricing. The *t*-values refer to the difference between the predicted numbers conditional on using and not using warrants.

	Average Cost Estimates for 220 Issues that Used Warrant Compensation				Average Cost Estimates for 1,771 Issues that Did Not Use Warrant Compensation			
	Actual Average Cost (1)	Expected Cost Conditional on Using Warrants (2)	Expected Cost Conditional on Not Using Warrants (3)	*t*-Value for Difference (4)	Actual Average Cost (5)	Expected Cost Conditional on Using Warrants (6)	Expected Cost Conditional on Not Using Warrants (7)	*t*-Value for Difference (8)
Panel A								
Cash compensation plus underpricing	15.34%	11.72%	24.97%	2.83*	7.54%	8.21%	7.10%	1.92†
Panel B								
Cash compensation	10.51	8.22	15.72	3.02*	6.81	7.09	6.96	1.32
Underpricing	4.83	4.19	7.79	2.64*	0.73	0.82	0.67	1.57

* Statistically significant at the 0.05 level.
† Statistically significant at the 0.10 level.

on the independent variables are used to generate unbiased estimates of expected cash compensation plus underpricing, either with or without warrants. We compare (in Table VI) the differences in cash compensation plus underpricing to our estimate of average warrant value and expect that issuers will select warrants when doing so results in lower total underwriting cost.

Since comparing issue cost with and without warrants requires extrapolations between the data ranges of the second stage models, it is important that the models in Tables IV and V include all variables that have important effects on underwriting cost and that the functional form of the models be tested. Accordingly, we use three variables to capture the effects of information asymmetry on issue cost. Following Barry and Brown (1985), we include issuing firm age. Since we expect information asymmetry to approach zero as age increases, we use the natural log of age. We also include firm size measured as equity market value in 1981 dollars. Since we expect information asymmetries to be greatest for firms whose primary assets are intangible growth opportunities, we include book-to-market equity. This variable is negatively related to the importance of growth opportunities. We use this speci-

fication since it is defined at the point where book equity is zero and is continuous around that point.

Because some components of total underwriting cost are fixed, larger issues exhibit economies of scale. Accordingly, we include issue size measured as gross proceeds in 1981 dollars. To allow for a non-linear relationship we also include the natural log of issue size.

We include three statistical measures of risk: beta, error standard deviation, and market standard deviation. Each is measured over the 250 market days before issue. Beta is included to reflect underwriting risk that cannot be reduced by diversification. It also controls for any association between book-to-market equity and the issuer's cost of capital. Following the information cost argument of Bhagat and Frost (1986), the error standard deviation is included to measure the effect of unsystematic risk on underwriting cost and the market standard deviation is included to measure the effect of market uncertainty on underwriting cost.[12]

In Table IV we regress the binary choice variable on the independent variables that are expected to affect total underwriting cost. All included variables are statistically significant and conform to the expectation that warrant compensation is more likely to be selected for small and risky issues. The significance of these variables for explaining the choice is one indication that estimates of expected underwriting costs by OLS would be biased.

Using the results in Table IV, the inverse Mills ratio is constructed to reflect cross-sectional differences in the likelihood of using warrants. In Table V we regress cash compensation plus underpricing on the same variables as in Table IV and the inverse Mills ratio. All coefficients are signed consistently with expectations. Except for firm size and the inverse Mills ratio in the without-warrants model, all coefficients are highly significant.[13] The results for the inverse Mills ratios are inconsistent with segmentation. The signs of the coefficients on the inverse Mills ratios suggest that the choice is made to maximize net issue proceeds. Thus, for firms actually using warrants, an OLS model would be significantly biased. Cash compensation plus underpricing would be overestimated conditional on use of warrants, and would be underestimated conditional on non-use of warrants. An OLS model would yield the converse for firms actually not using warrants.[14] However, the results in Table V do not indicate whether the differences in cash compensation plus under-

[12] We do not include underwriter ranking in the two-stage analysis since it is expected to be determined endogenously. Including it in our two-stage model does not qualitatively alter our results.

[13] As a check on functional form we ordered the residuals from each regression by issue size and found no evidence of misspecification. We also tested several different specifications of the models in Tables IV through VII and found that our conclusions were not affected. To assess the sensitivity of results to the unequal sample proportions and to inclusion of very large issues in the group without warrants, we replicated the analysis on the subset of issues done by unlisted firms. The resulting sample included 209 issues with warrants and 855 issues without. Results using that sample are substantially the same.

[14] See Lee (1978), Smith (1987), or Dunbar (1995) for discussion of the underlying econometrics.

pricing with and without warrant compensation are large enough to offset the value of the warrants.

In Table VI we test for maximization of net issue proceeds by comparing expected underwriting costs for issues done with and without warrants. We report overall findings for cash compensation plus underpricing in Panel A, and findings based on separate (unreported) estimates for cash compensation and underpricing in Panel B. Columns 1 through 4 are constructed for issues that actually were done using warrants. So that the effects of controlling for selectivity can be compared to OLS results, actual average underwriting costs for issues using warrants are reported in column 1. For the issues that used warrants, Columns 2 and 3 contain unbiased estimates of underwriting costs conditional on using and not using warrants. Estimates for cash compensation plus underpricing are derived by solving for the predicted values of the two models in Table V but without the inverse Mills ratio. The separate results for cash compensation and underpricing in Panel B are based on similar models. Column 4 reports t-values for the difference between columns 2 and 3. Columns 5 through 8 contain analogous results for the sample of issues that were done without warrant compensation.

For issues done with warrants, maximization of net proceeds implies that the expected value of cash compensation plus underpricing will be lower conditional on using warrants than on not using them and that the difference will exceed the value of warrant compensation. Using 5.67 percent as our estimate of average warrant value, we expect the value in column 3 of Table VI to exceed the value in column 2 by at least 5.67 percent. Consistent with this expectation, the difference in the table of 13.25 percent (i.e., 24.97 − 11.72) is well above the estimate of average warrant value. For issues done without warrants the difference is negative 1.11 percent (i.e., 7.10 − 8.21), indicating that for those issues, total underwriting cost would have been higher if warrants had been used.

Our findings for separate estimates of cash compensation and underpricing are similar. For issues using warrants, both cash compensation and underpricing are significantly lower than they otherwise would be. Since average warrant value is 5.67 percent, whereas the reduction in cash compensation is 7.50 percent, our results suggest that the value of cash compensation plus warrants is lower for issues done with warrants than it otherwise would be. The result is consistent with both certification and circumvention. However, since the reduction in cash compensation exceeds warrant value, it is more than would be implied by circumvention alone. In addition, the reduction in underpricing of 3.60 percent indicates that decreased compensation is not offset by increased underpricing. Though the differences for issuers who do not use warrants are not statistically significant, they are in the same direction as for cash compensation plus underpricing and suggest that issuers who do not use warrants otherwise would face higher total underwriting cost.

As a further test of our specification, and a check on the reasonableness of our findings, we use the models in Table V to estimate expected total underwriting cost for each issue in our sample that used warrants. Based on our

estimate of average warrant value, the comparison of total underwriting cost with and without warrants indicates that for 95.0 percent of the issues, net proceeds would have been lower if warrants had not been used. We could find no subset of the data where the predicted values implied that systematic non-value maximizing choices were being made by issuers. Thus, it does not appear that our conclusions are sensitive to extrapolation of the models outside the ranges of the data.

In summary, the results in Tables V and VI enable us to reject the segmentation hypothesis and are supportive of the view that issuers select compensation contract terms to maximize net proceeds. The comparisons of underwriting costs with and without warrants provide indirect evidence that certification and regulation influence the decision to include warrant compensation. However, the analysis does not explain why including warrants is value maximizing for some issues but not others.

B. Certification and Regulation

To test the separate effects of certification and regulation on the compensation decision, we begin with the (unreported) two-stage model of expected cash compensation conditional on not using warrants. We include this estimate of expected cash compensation for each observation, along with other regressors, in a logit model to explain the choice. Using this model, we provide direct evidence of the separate effects of certification and regulation on the decision.

Table VII reports the results of this choice model. We include the independent variables that are indicated by the hypotheses: circumvention implies that warrant use is more likely for issues where cash compensation, if used alone, would be high. Thus, we anticipate a positive sign on expected cash compensation conditional on not using warrants; certification implies that underwriters with well-established reputations are less likely than others to accept warrants. Therefore, the sign on the Carter-Manaster ranking of the underwriter is expected to be negative; regulatory constraints on warrant compensation, such as the minimum exercise price of 120 percent of the issue price, imply that warrant use is negatively related to dividend payout and book-to-market equity and positively related to the volatility of stock returns. Results for the first five variables in the table are consistent with these expectations.

Since issues that are done with warrants tend to involve both high cash compensation and underwriters with low Carter-Manaster rankings, distinguishing between certification and circumvention is difficult. We test for a separate effect of circumvention by including an indicator variable and an interaction term that, together, are intended to isolate expected cash compensation levels for the issues done with underwriters who have strong reputations. Specifically, we interact expected cash compensation with an indicator variable that identifies issues involving underwriters with Carter-Manaster rankings of at least 5.0. For this subset of issues, circumvention implies a positive relation between expected cash compensation and the decision to use

Table VII

Logit Regression of the Decision to Use Warrant Compensation to Test the Effects of Certification and Regulation on the Contract Choice

The dependent variable is the contract choice: contracts with warrant compensation = 1, contracts without warrant compensation = 0. The sample includes 1,991 negotiated firm commitment seasoned equity issues for the period from 1981 to 1988. Expected cash compensation is conditional on not using warrants and is estimated by regressing cash compensation on the same variables as in Table V. The model for the without-warrants sample is used to compute expected cash compensation conditional on not using warrants for each observation. The rank indicator variable is assigned a value of one if a Carter-Manaster ranking is reported and a value of zero otherwise. Results are not materially different if observations with missing rankings are assigned a value of zero and the rank indicator is dropped from the model; if they are assigned the Carter-Manaster rankings for their respective groups (with and without warrants); if an instrument for ranking is constructed using issuance related exogenous variables; or if observations with missing rankings are dropped from the analysis. Cash dividend yield is the ratio of cumulative dividends 250 business days before the offer day to the offer price. The highly ranked underwriter indicator is assigned a value of one if the Carter Manaster rank is five or greater, and is assigned a value of zero otherwise. The low cash compensation indicator is assigned a value of one if expected cash compensation would be less than ten percent if the issue were done without warrants, and is assigned a value of zero otherwise.

Explanatory Variable	Coefficient	Asymptotic t-Value
Intercept	0.1712	26.11*
E(cash compensation)	0.0134	2.98*
Ranked	−4.1400	−27.11*
Carter-Manaster ranking	−0.1017	−4.78*
Cash dividend yield	−0.0012	−1.67
Book equity/market equity	−0.0201	−4.19*
Volatility of stock returns	0.0117	2.76*
E(cash compensation) *Highly ranked underwriter indicator	0.0611	8.71*
Highly ranked underwriter indicator	−5.1300	−41.11*
Carter-Manaster ranking *Low cash compensation indicator	−0.1134	−6.17*
Low cash compensation indicator	−0.0694	−3.11*
Pseudo r^2	0.51	
Number of observations	1,991	

* Statistically significant at the 0.05 level or beyond.

warrants. Certification implies a negative sign on the indicator for highly ranked underwriters. Results are consistent with expectations and provide evidence of a separate effect of circumvention on the choice.

We test for a separate effect of certification by including an indicator variable and an interaction term that, together, are intended to isolate Carter-Manaster rankings for issues where expected cash compensation is well within the NASD safe harbor. We interact the Carter-Manaster ranking with an indicator that identifies issues with expected cash compensation of less than ten percent if done without warrants. Certification implies a negative relation between the Carter-Manaster ranking and the decision to use warrants, even

when expected cash compensation without using warrants is within the safe harbor. Circumvention implies a negative sign on the indicator for low cash compensation. Results provide evidence of a separate effect of certification on the choice.

To help assess the relative importance of certification and circumvention for the contract choice, we use the model in Table VII to determine changes in the probability of using warrants that are associated with changes in the Carter-Manaster ranking and with changes in expected cash compensation conditional on warrants not being used. Holding expected cash compensation constant at ten percent, we evaluate the effect of certification using an increase in the Carter-Manaster ranking from 3.7 to 8.0 (i.e., the mean values for the groups with and without warrants). Starting from a 50.0 percent probability of using warrants, the increase in ranking reduces the probability of using warrants to less than one percent. Holding the ranking constant at five, we evaluate the effect of circumvention using a decrease in expected cash compensation from 16.2 percent to 7.5 percent of gross issue proceeds (i.e., the means of cash compensation plus warrant value for the two groups). Again, starting from 50.0 percent, the decrease in cash compensation decreases the probability of using warrants to 32.0 percent. These comparative static estimates imply that certification has a substantially greater impact on the choice than does circumvention.

We evaluate the impact of regulations on using warrants in the same way. Results indicate that differences in dividend yield, volatility of stock returns, and growth opportunities between the groups have a combined effect of about three percent on the probability of using warrants.

VI. Conclusion

We examine the decision to use warrants to compensate underwriters of seasoned equity issues, focusing on the effects of the choice and on the factors that affect the choice. Our evidence of the effects of the choice on total underwriting cost is inconsistent with the hypothesis that the market is segmented between small and large issuers. Instead, we find that issuers select underwriting contracts that include warrant compensation when net issue proceeds would have been lower if warrants had not been used. We find that both cash compensation and underpricing are lower for the firms that select warrant compensation than they otherwise would have been. As discussed in the paper, these results provide indirect evidence that is consistent with the use of warrants for certification of the issue price and/or for circumvention of NASD guidelines that limit underwriter compensation.

We find direct evidence that the choice of compensation contract is affected by both certification and regulations on underwriter compensation. When warrants are issued to compensate an underwriter who lacks reputational capital, they function as a bonding mechanism that enables the underwriter to certify the issue price. The results also indicate that warrant compensation is used to circumvent NASD limitations on the value of total compensation.

Because of NASD and state blue sky regulations, the use of warrants tends to be restricted to firms with high rates of expected stock price appreciation, important growth opportunities and high volatility of stock return. Our evidence suggests that the effect of certification on the decision to use warrants is substantially larger than the combined effects of regulations that limit compensation and restrict the use of warrants.

REFERENCES

Allen, Franklin, and Gerald R. Faulhaber, 1989, Signaling by underpricing in the IPO market, *Journal of Financial Economics* 23, 303–324.

Barry, Christopher B., and Stephen J. Brown, 1985, Differential information and security market equilibrium, *Journal of Financial and Quantitative Analysis* 20, 407–422.

Barry, Christopher B., Chris J. Muscarella, and Michael R. Vetsuypens, 1991, Underwriter warrants, underwriter compensation, and the cost of going public, *Journal of Financial Economics* 29, 113–135.

Bhagat, Sanjai, and Peter A. Frost, 1986, Issuing costs to existing shareholders in competitive and negotiated underwritten public utility equity offerings, *Journal of Financial Economics* 15, 233–259.

Booth, James R., and Richard L. Smith, II, 1986, Capital raising, underwriting and the certification hypothesis, *Journal of Financial Economics* 15, 261–281.

Carter, Richard, and Steven Manaster, 1990, Initial public offerings and underwriter reputation, *Journal of Finance* 45, 1045–1067.

Dunbar, Craig G., 1995, The use of warrants as underwriter compensation in initial public offerings, *Journal of Financial Economics* 38, 59–78.

Galai, Dan, and Meir I. Schneller, 1978, Pricing of warrants and the value of the firm, *Journal of Finance* 33, 1333–1341.

Grinblatt, Mark, and Chuan Yang Hwang, 1989, Signaling and the pricing of new issues, *Journal of Finance* 44, 393–420.

Lee, Lung-Fei, 1978, Unionism and wage rates: A simultaneous equations model with qualitative and limited dependent variables, *International Economic Review* 19, 415–433.

National Association of Securities Dealers (NASD) Manual, 1990, (Commerce Clearing House, Inc., Chicago).

Ng, Chee, 1992, Use of underwriter warrants in seasoned equity issues: An optimal contract choice explanation, Doctoral dissertation, Arizona State University.

Smith, Clifford W., Jr., 1977, Alternative methods for raising capital: Rights versus underwritten offerings, *Journal of Financial Economics* 5, 273–307.

Smith, Clifford W., Jr., 1986, Investment banking and the capital acquisition process, *Journal of Financial Economics* 15, 3–29.

Smith, Richard L., 1987, The choice of issuance procedures and the cost of competitive and negotiated underwriting: An examination of the impact of rule 50, *Journal of Finance* 42, 703–720.

Smith, Richard L., 1992, Underwriting of new issues, in John Eatwell, Murray Milgate, and Peter Newman, Eds: *The New Palgrave Dictionary of Money & Finance* (MacMillan Press, London), 722–724.

U.S. Securities and Exchange Commission, 1963a, Report of special study of securities markets, (U.S. Government Printing Office, Washington, D.C.).

U.S. Securities and Exchange Commission, 1963b, Special Market Study, Release No. 23.

U.S. Securities and Exchange Commission, 1972, Securities Act of 1933, Release No. 5275.

Welch, I., 1989, Seasoned offerings, imitation costs and the underpricing of initial public offerings, *Journal of Finance* 44, 421–449.