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Stock vs. stock-warrant units: evidence from seasoned offerings

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Abstract

Recent theories based on sequential financing and information signaling reveal a special role for warrants. Data from initial public offerings (IPOs) of stock-warrant units have been used to test the theories, and we extend the analysis to seasoned offerings. Consistent with predictions from both families of theories, we find that issues made by smaller and younger firms are more likely to involve stock-warrant units, and firms with greater stock price volatility are more likely to issue units in seasoned offerings. Moreover, firms with relatively high levels of long-term debt, and those whose issues are underwritten by less prestigious underwriters are more likely to employ stock-warrant unit financing. Consistent with information signaling, we find that firms with high managerial ownership are more likely to issue units. Firms that include warrants in their stock offerings are predicted to have experienced higher abnormal stock returns than if they had issued shares alone. Thus, consistent with both theoretical explanations, some firms can reduce capital costs by adding warrants to shares in seasoned offerings.

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1. Introduction

Theoretical justifications for warrant financing have been advanced by Schultz (1993) in his sequential financing hypothesis and, more recently, by Chemmanur and Fulghieri (1997) in their signaling model. The sequential financing model of Mayers (1998), though developed in the context of convertible bonds, has implications for warrant financing as

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well. Some of the implications of these theories have been confirmed in studies of initial public offerings (IPOs) (Schultz, 1993; Jain, 1994; How and Howe, 2001). We examine seasoned offerings of stock-warrant units and common stock only. Our purpose is to determine whether the main implications of these models extend to financing actions by firms subsequent to IPOs. The theories share several empirical implications and our results are largely consistent with both.

Schultz (1993) portrays stock-warrant offerings as multistage financing actions that can reduce agency costs of free cash flow (Jensen, 1986). Managers may invest in negative net present value (NPV) projects when they have excess cash available; thus, a desirable feature of warrants in unit offerings is that they generally bring in funds only if they are subsequently needed. If the company grows, it will probably need new equity capital, and growth prospects will increase the price of the stock, thus triggering warrant exercise. On the other hand, if the company is not successful and cannot profitably employ additional funds, the price of its stock will not increase and the warrants will not be exercised.

Mayers' (1998) explanation of convertible debt financing supplements Schultz's (1993) motivation for share-warrant unit financing. Given valuable investment options, unit financing may be used to reduce flotation costs of subsequent financing. The signaling model of Chemmanur and Fulghieri (1997) requires the interaction of asymmetric information and managers' risk aversion. The model predicts that high-quality firms use: (1) the fraction of shares retained by insiders, (2) underpricing of the issue, and (3) inclusion of warrants to distinguish themselves from low-quality firms.

We focus on seasoned offerings because it is important to know the extent to which either theory holds beyond IPOs and also because studies of unit and share IPOs are constrained by data limitations. In contrast to IPOs, for seasoned offerings market prices are observable, analysts follow seasoned firms, and audited accounting information is publicly available.

The first of our tests involves estimating the probability of issuing stock-warrant units (vs. shares only), conditional on various firm and market characteristics.[1] These characteristics should guide the firm's choice according to several financing theories, including those of Chemmanur and Fulghieri (1997) and Schultz (1993). Our probit model correctly classifies over 99% of the share financing choices and 70% of unit offerings, and the model exhibits an R^2 of over 70%. The results are consistent with the signaling explanation (Chemmanur and Fulghieri, 1997), while some, but not all, implications of the sequential financing hypothesis (Schultz, 1993) are supported by our data.

Our second set of tests focuses on stock returns surrounding unit financing and share financing announcements. For our sample of announcement returns, the mean (median) stock price reaction to share offerings is -2.68% (-2.34%), while that for unit offerings is -1.97% (-1.27%). Even though the difference in means is not statistically significant, the difference in medians is significant, providing some tentative evidence of less severe average price reactions to unit financing announcements.

[1] This part of our investigation follows other recent studies which have sought to explain various financing decisions using firm and market characteristics. For example, Guedes and Opler (1996) examine the relation between firm characteristics and debt maturity, and Barclay and Smith (1995) examine firm characteristics and priority classes (e.g., secured debt, subordinated debt, etc.). Johnson (1997) documents links between firm characteristics and the choice of private vs. public debt, while Hertzel and Smith (1993) examine the choice of private vs. public equity financing.

We then model announcement period returns surrounding announcement of each of the two sources of financing, correcting for self-selection bias (Heckman, 1976; Lee, 1978). By controlling for this bias, we are able to quantify the benefit to shareholders of issuing units relative to shares. We find that had unit issuers announced stock offerings instead, the predicted stock price reaction would have been more severe.

In Section 2, we describe our samples of share and unit offers. In Section 3, we motivate and report results of our two sets of tests, i.e., (1) probit analysis of the decision to issue units vs. shares, and (2) analysis of abnormal stock returns associated with the choice of financing. We summarize and conclude in Section 4.

2. The samples of seasoned unit and share offerings

The sample consists of firm-commitment stock and unit seasoned offerings (hereafter SOs) issued between 1980 and 1997. The original data set comes from the New Issues Database recorded by the Securities Data (SDC). This database includes the Securities and Exchange Commission (SEC) filing date, offer date, offer price, underwriter, and proceeds. The following firms are excluded from the original sample: (1) utility firms (SIC codes 4910–4949); (2) closed-end funds (SIC codes 6720–6739) and real estate investment trusts (SIC code 6798); and (3) American Depository Receipts (ADRs). After excluding these firms, the SDC database produced 6018 share offerings and 409 unit offerings. Some firms issued several times during the sample period and this will be taken into account in the analysis.

Announcement dates are identified in the *Wall Street Journal* and the LEXIS–NEXIS information retrieval service. Price records are obtained from the Center for Research in Security Prices (CRSP) 1997 and 1998 files, and Standard and Poor's Daily Stock Price Records that cover the NYSE, AMEX and Nasdaq markets. The Standard and Poor's Compustat databases and various issues of *Moody's Industrial Manual* provide additional information on balance sheet items. For insider ownership, we searched Compact Disclosure, Daily Stock Report, and proxy statements filed with the SEC.

Unit issues in our sample are not clustered along industry lines, and frequency of issuance over time during our sample period 1980–1997 is quite similar for both types of offerings; hence, details are not reported. Share offerings (nearly 700) and unit offerings (46) peaked in 1983, while share offerings (under 100) and unit offerings (8) were at their lowest in 1988.

In Table 1, we compare a variety of characteristics of the firms employing the two financing methods. Average size of the 6018 share offering firms is much larger than that of the 409 unit offerers according to total assets (in book value) and market value of equity (MVE). Proceeds from share offerings are several times larger than from unit issues, consistent with previous findings. Unit issuers have less debt (measured by the long-term debt/assets ratio in book value), on average.

We include a market condition variable (HOT) in Table 1 reflecting the moving average of equity issue volume in dollars during the 3-month period before issuance. This is then normalized by dividing each month's average by the highest moving average. The variable HOT is significantly lower, on average, for unit offerings; hence, market timing could be a distinguishing feature. Stock return volatility (daily standard deviation of stock returns) for

Table 1
Firm characteristics for unit and share seasoned offerings

	Unit offerings	Share offerings	*p* Value for Mean (Median) Difference
	Mean (Median)	Mean (Median)	
Assets (US$ millions)	184.18 (5.98)	1587.79 (120.10)	0.00 (0.00)
Proceeds (US$ millions)	9.39 (4.70)	62.91 (31.50)	0.00 (0.00)
Market value of equity (MVE, US$ millions)	78.97 (13.36)	781.59 (161.64)	0.00 (0.00)
Age (years)	11.49 (6.42)	21.14 (5.72)	0.00 (0.00)
Long-term debt/assets	0.18 (0.06)	0.22 (0.03)	0.00 (0.00)
Owner (%)	35.08 (28.8)	23.78 (15.00)	0.00 (0.00)
Volatility (%)	4.60 (3.86)	2.53 (2.26)	0.00 (0.00)
Underwriter rank	5.18 (5.50)	7.96 (8.75)	0.00 (0.00)
Book/market ratio (BM)	0.31 (0.22)	0.55 (0.22)	0.04 (0.21)
Hot	0.24 (0.21)	0.29 (0.26)	0.00 (0.00)
Dilution	0.67 (0.46)	0.31 (0.13)	0.00 (0.00)
Venture backed (%)	0.97	3.27	0.00

Information is obtained from the SDC New Issues Database, COMPUSTAT, Moody's manuals, Compact Disclosure, Proxy Statements, Daily Stock Price Records, and CRSP for unit and share seasoned offerings announced and issued between January 1980 and December 1997. Variable definitions are as follows: Assets = book value of total assets; Proceeds = gross offering proceeds; MVE = market value of equity as of the day before issue announcement; Age = the number of years since incorporation; Long-term debt = book value of long-term debt as of the year preceding the offering; Owner = the proportion of equity owned by managers before the offering; Volatility = the standard deviation of daily stock returns during the year prior to the offering; Underwriter rank = underwriter's Carter and Manaster (1990) prestige ranking as provided by Carter et al. (1998); BM = book value of assets divided by market value of equity plus book value of liabilities; Venture backed = proportion of venture capital backed offerings; Hot = normalized moving average of equity issue dollar volume during the 3-month period before issuance; Dilution = the proportion of primary shares sold relative to the post-offering total shares outstanding including shares that will be outstanding in the event of warrant exercise. *p* Values are reported in the last column for the null hypothesis that the mean (median) difference is zero. There are 409 unit issues and 6018 equity issues in the sample.

unit offerers is substantially higher than that of share offerers. Underwriter rank is the Carter and Manaster (1990) prestige ranking as provided in Carter et al. (1998), and unit offerers have significantly lower-prestige underwriters (mean = 5.18) than share offerers (mean = 7.96). Owner is the proportion of shares held by managers (including directors) before the offering, and is substantially higher for unit offering firms. Dilution is the proportional increase in shares outstanding and includes potential increases due to warrant exercise. Unit offerings are over twice as dilutive as share offerings.

3. Analysis

3.1. Choice of offer type

We develop and estimate a probability model of the firm's choice of a unit vs. a share offering, and we report estimates of a logit model as a robustness check. The choice variable is defined as 0 for share offerings and 1 for unit offerings. From Schultz' (1993)

sequential financing hypothesis, firms that are more difficult to value will be more likely to issue units. We use two measures to capture difficulty in valuation: the firm's stock return volatility and its age. VOLATILITY is the estimated standard deviation of daily stock returns during the year prior to the offering. The age of the firm (denoted by AGE) is the number of years since incorporation.

Firms with strong growth prospects should prefer unit financing to the extent that warrants are used for sequential financing. This prediction arises in the Schultz (1993) model as well as Mayers' (1998) theory of convertible financing. We use the book/market (BM) ratio as an inverse measure of growth, where book value is total assets and market value is the sum of market value of equity and book value of liabilities. Thus, a negative relation between BM and the choice of units will be consistent with the sequential financing hypothesis.[2]

From Schultz (1993), we expect VOLATILITY to be positively related to the choice of unit offering, while AGE is expected to have a negative influence on the probability of choosing a unit offering. According to the model of Chemmanur and Fulghieri (1997), firms that are riskier should choose unit financing; hence, VOLATILITY should be a choice variable for this reason as well. In both the sequential financing hypothesis and the Chemmanur and Fulghieri model, insider ownership also plays an important role; thus, we employ OWNER defined as the proportion of equity owned by management (including directors) as of the year prior to the offer. OWNER should have a negative influence on the choice of units to the extent that greater managerial ownership reduces agency problems and, thus, reduces the benefit of warrant financing in the sequential financing model. To the extent that warrants in the offering allow a risk-averse manager to reduce ownership while signaling firm quality in the Chemmanur and Fulghieri (1997) model, a positive relation between OWNER and the choice of unit financing is expected.

The agency problem should be more severe when firms use weak underwriters (monitors); hence, units will be preferred to the extent the firm's underwriter is low prestige according to the sequential financing hypothesis. The variable RANK is the Carter and Manaster (1990) prestige ranking as provided by Carter et al. (1998), and we predict RANK to be negatively related to the choice of unit offering. Also, venture capitalists may reduce agency costs by providing intensive monitoring services (Barry et al., 1990). VENTURE is defined as an indicator variable for the presence of a venture capitalist and is expected to be negatively related to the choice of unit financing. The same predictions for RANK and VENTURE hold for the signaling model to the extent that these two variables are inverse measures of information asymmetry.

Size is controlled by the natural logarithm of the market value of equity as of the day before the announcement, denoted by LMVE. We expect LMVE to be negatively related to the choice of units because it is a supplemental inverse measure of the degree of difficulty in assessing value and because of previous empirical work documenting the prominence of unit IPOs among smaller firms.

Firms with higher levels of long-term debt should rely more on warrants in light of the model of convertible financing of Mayers (1998). Hence, we include LTDA, the measure

[2] We repeat the analysis using the market-to-book ratio (MB) as a direct measure of growth potential and all results are materially the same.

of long-term debt to total assets, all in book value, assessed at the end of the year prior to the announcement.

Practitioners argue that firms issue units as sweeteners for otherwise unattractive equity issues. This implies that market conditions may also affect firms' financing decisions. An analysis of unit and stock offerings over the sample period reveals that 1983, 1993 and 1995–1997 are particularly active years for seasoned offerings in terms of both the number of issues and total proceeds. Bayless and Chaplinsky (1996) provide evidence that there exist windows of opportunity ("hot" markets) for equity issuers that result from reduced levels of asymmetric information. Similar in spirit to the measure used by Bayless and Chaplinsky (1996), we include HOT, defined earlier as a moving average of normalized equity issue volume in dollars during the 3-month period before the issue month. HOT is expected to be negatively associated with the probability of unit offering according to the signaling hypothesis.

To summarize predictions related to the probability of unit financing, we note that OWNER should have a positive influence according to information signaling and a negative effect based on sequential financing. Both theories predict that RANK, VENTURE, AGE, and LMVE exert a negative influence. The sequential financing explanation implies a negative relationship between BM and the probability of unit financing. Data requirements result in the loss of sample points so that the analysis is done with 172 unit offerings and 2764 share offerings.

In Table 2, we report estimation results for the probit model in column (1) and note that the model has a pseudo-R^2 of 0.705. The model correctly classifies 99% of share offerings

Table 2
Estimation results of the probability model:

$$\text{Unit} = \beta_0 + \beta_1\text{RANK} + \beta_2\text{VOLATILITY} + \beta_3\text{BM} + \beta_4\text{LTDA} + \beta_5\text{OWNER} + \beta_6\text{VENTURE} + \beta_7\text{AGE} + \beta_8\text{LMVE} + \beta_9\text{HOT} + \varepsilon,$$

where unit = 1 if warrant-share offering and 0 if shares only. Probit results are in column (1) and logit estimates are in column (2)

	(1)	(2)		(1)	(2)
CONSTANT	4.015 (7.80)	7.808 (7.75)	VENTURE	−3.346 (−4.29)	−6.335 (−4.28)
RANK	−0.308 (−8.08)	−0.563 (−7.81)	AGE	−0.031 (−4.36)	−0.059 (−4.12)
VOLATILITY	44.138 (7.04)	80.021 (6.53)	LMVE	−1.149 (−12.40)	−2.246 (−11.91)
BM	−0.035 (−0.14)	−0.156 (−0.32)	HOT	−2.703 (−4.87)	−4.714 (−4.54)
LTDA	1.042 (3.13)	1.960 (3.01)	R^2	0.705	0.704
OWNER	0.012 (3.13)	0.022 (3.13)	Likelihood ratio	922.88	923.02

The definitions of right-hand-side variables are as follows: RANK = underwriter's Carter and Manaster (1990) prestige ranking as provided by Carter et al. (1998); VOLATILITY = the standard deviation of daily stock returns during the year prior to the offering; BM = book/market ratio; LTDA = long-term debt/assets ratio; OWNER = the proportion of equity owned by managers before the offering; VENTURE = 1 if a venture capitalist is involved in the financing and 0 otherwise; AGE = the number of years since incorporation; LMVE = the natural logarithm of market value of equity; and HOT = a moving average of equity issue volume during the preceding 3-month period and normalized so that the maximum value is 1.0. In parentheses are t statistics. The likelihood ratio test statistic is distributed χ^2 (9 degrees of freedom) and is significant at the 0.01 level for both models. Sample size = 2936; 172 unit offerings and 2764 equity offerings.

and 70% of unit offerings. Consistent with the two principal theories, VOLATILITY is positive and significant ($t=7.04$). Smaller firms issue units (LMVE is negative and significant; $t=-12.40$), and younger firms tend to issue units (AGE is negative and significant; $t=-4.36$).

Units are issued less frequently in "hot" markets (HOT is negative; $t=-4.87$), suggesting firms may avoid warrants when the market has a strong appetite for equity. Consistent with the two principal theories, coefficient estimates for RANK and VENTURE are both negative ($t=-8.08$ and $t=-4.29$, respectively). Firms with higher leverage (LTDA) are more likely to issue units ($t=3.13$), consistent with the model of Mayers (1998).

Two variables, BM and OWNER, shed light on which of the two principal theories is dominant. Contrary to the sequential financing hypothesis, BM is insignificant ($t=-0.14$); that is, high-growth firms are not more likely to rely on unit financing. Moreover, OWNER is positive and significant ($t=3.13$), contrary to the sequential financing hypothesis, but consistent with information signaling. While both theoretical explanations may be at work, this finding implies that information signaling may dominate the sequential financing hypothesis in this instance.

In column (2) of Table 2, we report results of estimating a logit model. The significance levels of the coefficient estimates are largely the same as those in the probit analysis (column (1)). The logit model correctly predicts over 99% of share offerings and 70% of unit offerings, essentially the same as the probit results.

3.2. Announcement effects

A variety of well-known theoretical developments predict negative stock price reactions to share and unit financing. For example, the lemons model of Myers and Majluf (1984) predicts that any form of equity financing will reveal negative information, and actions that reduce leverage will reveal poor prospects according to Ross (1977).

For offerings prior to 1984, the announcement period corresponds to the 2-day window $(-1, 0)$ relative to the announcement date in the *Wall Street Journal*. For the post-1984 period, the announcement period is $(-1, 0)$ relative to the announcement date as reported in the LEXIS–NEXIS database.

The original sample of 6018 share offerings is reduced by unavailability of announcement dates (584), confounding events such as mergers, other security issues, dividend and earnings announcements (340), and insufficient return data (486) to a final sample of 4008. The original unit offering sample of 409 is reduced to 251 for the same reasons.

We calculate abnormal performance in two ways: cumulative market model returns and cumulative returns from the generalized Scholes–Williams procedure.[3] Parameters in the

[3] Many securities in the sample have frequent zero returns. An examination of the price data reveals that the zero returns are the result of nontrading or trading at the same price as the previous day's price. As pointed out by Scholes and Williams (1977) and Dimson (1979), infrequent trading introduces an errors-in-variables problem. In addition to nonsynchronous trading, the results in Atchison et al. (1987) and Lo and MacKinlay (1990) imply that other price-adjustment delay factors play a major role in return autocorrelation. Cohen et al. (1983) suggest a method which generalizes the Scholes and Williams (1977) procedure to derive consistent parameter estimates of the market model when observed returns for securities are subject to infrequent trading and asynchronous adjustment to common movement in their true returns.

market model and the generalized Scholes–Williams procedure are estimated using CRSP daily data for the estimation period (− 210, − 10) relative to the announcement date. Observations with fewer than 100 estimation period returns are deleted. The parameters in the generalized Scholes–Williams procedure are estimated using two intertemporal lead and lag market betas and security betas.

In Table 3, we report the event study results for the 4008 share offerings and 251 unit offerings that had sufficient data. The average abnormal returns for the unit offerings are − 1.98% with 34.12% positive for the generalized Scholes–Williams procedure, and

Table 3
Analysis of stock price reactions to issuance announcement and analysis of underpricing at issuance

	Unit offerings	Share offerings	*p* Value for mean (median) difference
	Mean (Median)	Mean (Median)	
(A) Announcement period[a]			
Market model			
Abnormal return (%)	− 1.97 (− 1.27)	− 2.68 (− 2.34)	0.15 (0.06)
Number of observations	251	4008	
Positive returns (%)	32.94	23.01	
Z statistic	− 3.85	− 44.42	
MP test	− 3.76	− 43.91	
BMP test	− 3.73	− 43.95	
Scholes–Williams procedure			
Abnormal return (%)	− 1.98 (− 1.32)	− 2.67 (− 2.35)	0.17 (0.07)
Number of observations	251	4008	
Positive returns (%)	34.12	23.65	
Z statistic	− 3.93	− 43.85	
Mikkelson–Partch test	− 3.88	− 43.37	
Boehmer–Musumeci–Poulsen test	− 3.88	− 43.51	
(B) Underpricing and offer day returns[b]			
Underpricing (%)	1.74 (0.15)	1.08 (0.00)	0.01 (0.09)
Number of observations	328	5424	
Positive (%)	54	59	
Offer day return (%)	− 1.58 (− 1.08)	− 0.32 (− 0.58)	0.00 (0.00)
Number of observations	288	5324	
Positive (%)	21	37	

[a] The sample consists of 251 unit offerings and 4008 share offerings announced and issued between January 1980 and December 1997. The abnormal returns are computed as the cumulative market model residuals and the cumulative residuals from the Scholes–Williams procedure generalized by Cohen et al. (1983). The announcement period corresponds to a 2-day window (− 1, 0) relative to the announcement date. Parameters in the market model and the generalized Scholes–Williams procedure are estimated using CRSP daily data for the estimation period (− 210, − 10) relative to the announcement date. Observations with fewer than 100 estimation period returns are deleted. For the generalized Scholes–Williams procedure, two leads and lags are allowed to adjust for nonsynchronous trading and price adjustment delay. $T(Z)$ statistic p values are reported in the last column for the null hypothesis that the mean (median) difference is zero.

[b] Offer day return is the 1-day return on the offer day, defined as the percentage difference from the last trade price of common share on the day before the offer day to the last trade price of common share on the offer day. Underpricing is defined as the percentage difference between the last trade price on the offering date and the offer price. The average of the reported bid and ask prices is taken as the last trade price.

Table 4
Offering frequencies and mean announcement period abnormal returns

Issuance	Unit offerings		Issuance	Share offerings	
	Mean abnormal return (%)	Number of observations		Mean abnormal return (%)	Number of observations
First	−1.16	204	First	−2.47	2448
Second	−1.98	37	Second	−2.19	833
Third and up	−0.74	10	Third	−2.05	304
			Fourth	−1.79	112
			Fifth and up	−1.25	99

The sample consists of seasoned equity and unit issues announced and offered during January 1980 to December 1997. The sample is obtained from the SDC New Issues Database. The abnormal returns are computed as the cumulative residuals from the Scholes–Williams procedure generalized by Cohen et al. (1983). The announcement period corresponds to a 2-day window (−1, 0) relative to the announcement date. Parameters in the generalized Scholes–Williams procedure are estimated using CRSP daily data for the estimation period (−210, −10) relative to the announcement date. Observations with fewer than 100 estimation period returns are deleted. For the generalized Scholes–Williams procedure, two leads and lags are allowed to adjust for nonsynchronous trading and price adjustment delay.

−1.97% with 32.94% positive for the market model returns. The average abnormal returns for the share offerings are −2.68% with 23.01% positive for the market model procedure, and −2.67% with 23.65% positive for the Scholes–Williams returns. Z statistics, Mikkelson and Partch (1986) tests and Boehmer et al. (1991) standardized cross-sectional tests all indicate the significance of the negative average abnormal returns for both unit and share offerings.[4] While the differences in the mean abnormal returns between unit offerings and share offerings are not statistically significant at conventional significance levels, Wilcoxon tests of the median announcement period abnormal return differences are significant at levels of 0.06 and 0.07 for market model and the Scholes–Williams procedure, respectively.

During the sample period, some firms issued several times; some as many as 12 times. We examine whether the announcement period abnormal returns are different for frequent issuers. In Table 4, we divide the share and unit issues into first-time issuer, second-time issuer, etc., and report the corresponding abnormal returns.[5] For unit offerings, the effect of frequent issuance is not clear, but the announcement period abnormal return tends to be larger as firms issue shares more frequently (significant at the 10% level).

Consistent with the signaling and sequential financing predictions, we conclude that the average equity valuation effect is negative for seasoned unit and share offerings, with some evidence of less severe average announcement returns for unit offerings than for share offerings. We also find that unit offering firms have significantly fewer subsequent equity offerings than stock offering firms: 10.71% of unit offerings and 23.23% of stock

[4] For some issues, there was no public news on their offerings, but the filing dates are available. It is possible that the news about these issues becomes public on the filing date without any previous announcement. Accordingly, we also examine announcement period returns with these issues included and the announcement date defined as the filing date with the SEC. The results were not materially different.

[5] After obtaining the frequency of offerings, we exclude offerings from 1980 to 1984 to ensure a sufficient time period to obtain information on previous offerings.

offerings are followed by issuance of additional shares within 3 years. Thus, warrants included in units may replace subsequent equity offerings.

We now examine whether unit issues produce different wealth effects for shareholders of issuing firms relative to share issues. The answer should be clear if firms issue units as a way of reducing agency costs or signaling firm quality, i.e., positive relative wealth effects for units. Ideally, the stock price reaction to the announcement of units must be compared with what the reaction would have been if issuing firms had issued shares instead. Since regression analysis which includes an indicator variable for unit issues is subject to self-selection bias, a simultaneous equation model similar to those in Heckman (1976), Lee (1978) and Dunbar (1995) is considered. By allowing interactions between the choice of unit issues and the announcement effects, this system of equations provides an estimate of the expected differential wealth effect between unit and share announcements for a given issuer. The wealth effects should be related to the variables used in the probit analysis as these variables affect the magnitude of benefits from unit offerings. Accordingly, we may apply the same predictions for the wealth effects. The same data constraints that apply to the probit analysis are in force for this stage of the analysis; thus, we use 172 unit offerings and 2764 share offerings.

We proceed in two stages. First, we retain the nonselection hazard (or inverse Mills ratio (IMR), Heckman, 1979) from the probit estimation (Table 2).[6] Next, we estimate a regression model of the announcement period abnormal return using the explanatory variables in Table 2 plus the inverse Mills ratio (IMR). The inverse Mills ratio adjusts the non-zero conditional error terms.[7]

In Table 5, we report regression estimates of the self-selection bias-adjusted models of announcement period returns for unit offerings in column (1) and share offerings in column (2).[8] Recall that the same explanatory variables used in the probit analysis in Table 2 are used to explain the abnormal returns. For unit offerings, RANK and VOLATILITY have significant and negative coefficient estimates ($t = -3.16$ and -2.54, respectively); hence, the market reaction is more severe for riskier firms. Firms with higher long-term debt

[6] The inverse Mills ratio is defined as $-\phi(\hat{I})/\Phi(\hat{I})$ for unit offerings, and for $\phi(\hat{I})/[I\text{-}\Phi(\hat{I})]$ share offerings, where $\hat{I}$ is the estimated probability of issuing units from the probit model, ϕ is the standard normal probability density function, and Φ is the cumulative standard normal distribution function.

[7] The presence of self-selection bias can be detected from the estimated coefficient on the inverse Mills ratio which provides an estimate of the correlation between the errors in the regression and probit models. If unit issues contribute to reducing agency costs or signaling firm quality, the announcement of a unit offering should result in a positive price reaction relative to the announcement of a share offering. In this case, the expected error in the abnormal return model for units is negative. Also, the positive price reaction makes the error term in this equation positive, implying a negative correlation between the error in the probit model and the error in the regression. This implies that the coefficient for the inverse Mills ratio will be negative. On the other hand, if firms offer units without any advantage, the estimated coefficient of the inverse Mills ratio is expected to be insignificant or positive (to the extent that the units are not very successful). Similarly, a positive coefficient of the inverse Mills ratio in the regression equation for share offerings should imply that the choice of shares results in greater price reaction than the choice of units for share issuers.

[8] Greene (1981) notes that the standard errors in the OLS stage can either be smaller or larger than the correct standard errors, not just smaller as Heckman (1976) had asserted. He then suggests a simple formula for the correct variance–covariance matrix of the OLS estimates. We use the formula suggested by Greene (1981) to correct the standard errors for the second stage OLS.

Table 5
Estimation results for model of announcement period abnormal return:

$$\mathrm{CAR} = \beta_0 + \beta_1 \mathrm{RANK} + \beta_2 \mathrm{VOLATILITY} + \beta_3 \mathrm{BM} + \beta_4 \mathrm{LTDA} + \beta_5 \mathrm{OWNER} + \beta_6 \mathrm{VENTURE} + \beta_7 \mathrm{AGE} + \beta_8 \mathrm{LMVE} + \beta_9 \mathrm{HOT} + \beta_{10} \mathrm{IMR} + \varepsilon,$$

where CAR = 2-day announcement period abnormal return

	Unit offers	Share offers		Unit offers	Share offers
CONSTANT	0.042 (2.05)	− 0.039 (− 4.81)	AGE	0.001 (0.18)	0.004 (1.29)
RANK	− 0.006 (− 3.16)	− 0.004 (− 5.08)	LMVE	0.002 (0.29)	0.006 (8.69)
VOLATILITY	− 0.461 (− 2.54)	− 0.052 (− 0.62)	HOT	0.029 (1.19)	0.013 (2.66)
BM	− 0.014 (− 1.75)	0.001 (3.88)	IMR	− 0.016 (− 1.51)	0.006 (2.67)
LTDA	0.034 (2.57)	0.007 (1.53)	N	172	2764
OWNER	− 0.003 (− 1.71)	0.002 (5.27)	R^2	0.222	0.128
VENTURE	0.046 (0.92)	0.085 (15.84)	Likelihood ratio	286.01	4783.45

The definitions of right-hand-side variables are as follows: RANK = underwriter's Carter and Manaster (1990) prestige ranking as provided by Carter et al. (1998); VOLATILITY = the standard deviation of daily stock returns during the year prior to the offering; BM = book/market ratio; LTDA = long-term debt/assets ratio; OWNER = the proportion of equity owned by managers before the offering; VENTURE = 1 if a venture capitalist is involved in the financing and 0 otherwise; AGE = the number of years since incorporation; LMVE = the natural logarithm of market value of equity; HOT = a moving average of equity issue volume during the preceding 3-month period and normalized so that the maximum value is 1.0; and IMR = inverse Mills ratio. In parentheses are OLS t statistics. The likelihood ratio test statistic is distributed χ^2 (9 degrees of freedom) and is significant at the 0.01 level for both equations.

(LTDA) experience higher price reactions ($t = 2.57$). OWNER enters with a negative sign and is significant at the 10% level ($t = -1.71$), indicating firms with higher managerial ownership experience more severe price reactions to unit financing decisions. This is contrary to the sequential financing hypothesis. The negative coefficient for IMR is only marginally significant ($t = -1.51$), thus is weakly supportive of self-selection bias, i.e., a positive price reaction to the announcement of a unit offering relative to a share offering.

For share offerings (column (2)), the announcement effect is more severe for low underwriter RANK ($t = -5.08$), but positively related to management ownership (for OWNER, the t statistic is 5.27). The inverse Mills ratio is positive and significant ($t = 2.67$), indicating self-selection bias. As in the case of unit offerings, announcement effects of share offerings are also less severe in the presence of venture capitalists ($t = 15.84$). These findings suggest that seasoned equity offerings with and without warrants have features in common with private placement of equity when venture capitalists participate in the investment.

From the estimated models in Table 5, we obtain forecasts of expected announcement period abnormal returns had the firms issued the alternative type. In determining the forecast, we use coefficient estimates from Table 5 and the independent variables for each issuer, excluding the inverse Mills ratio.[9]

Unit issuers in the sample experienced an average abnormal return of − 1.96%. From our analysis, we predict that had these same firms issued shares only, their average

[9] The inverse Mills ratio is now excluded because it was used to adjust for nonzero regression errors resulting from self-selection bias.

abnormal return would have been −2.71%. Thus, the firms made financing decisions that leave shareholders better off. Firms that issued only shares experienced an average announcement effect of −2.13%. Had these firms chosen to add warrants, we predict their abnormal returns would have averaged −1.27%. The difference in predicted and actual are significant at the 5% level for both types of issues. According to our results, some firms could have benefited shareholders by adding warrants in their share offerings.

3.3. Underpricing

An important implication of the signaling model of unit offerings can be tested using the degree of underpricing defined as the percentage difference between the last trade price on the offering date and the offer price. We report underpricing of share and unit issues in Table 3. Stock prices are obtained from the 1997 CRSP file and unit prices are obtained from the various issues of Daily Stock Price Records from 1980 to 1997. Data limitations reduce our original sample of 6018 share offerings and 409 unit offerings to 5424 and 328, respectively. Most units had been traded for periods ranging from a few days to several months before they were separated. In a few cases where shares and warrants were detached immediately and traded separately, we calculate the unit closing price using available warrant and share closing prices. The average of the reported bid and ask prices is taken as the last trade price on the offering date. The underpricing is, on average, 1.74% with 54% positive for unit offerings. On the other hand, the underpricing is, on average, 1.08% with 59% positive for equity offerings.[10] The two estimates are not significantly different at the 0.05 level.[11] Moreover, the median underpricing amounts are not significantly different from zero for either issue type. Thus, our finding of underpricing is interpreted with due caution.[12]

3.4. Tests of the sequential financing and signaling hypotheses

An important implication of the staged financing model can be tested using the forecast abnormal return from the regression model. We subtract the *forecast* abnormal return under the alternative share offering announcement from the *observed* abnormal return for the unit offering to capture the incremental wealth effect of a unit offering (denoted DABR). According to the staged financing hypothesis, the incremental wealth effect of unit offerings relative to share offerings should be greater for firms with high risk (VOLATILITY) and low levels of managerial ownership. OWNER represents the percentage of shares owned by management before the offering, and we define DILUTION as the proportion of primary shares sold at the seasoned offering relative

[10] Smith (1977) reports 0.82% mean underpricing of seasoned equity offerings, and Loderer et al. (1991) report that the underpricing ranges, on average, from −0.07 for the NYSE market to 1.94% for the NASDAQ market.

[11] Jegadeesh et al. (1993) report significantly lower initial returns for unit IPOs than for share IPOs.

[12] Normal probability plots and tests of normality indicate that the distribution of underpricing cannot be considered normal. As noted in Loderer et al. (1991), in the presence of skewness and outliers, the median value is likely to be a better measure of what a firm could expect to happen in an offering, while the mean underpricing is a better indicator of the profitability of investment strategies designed to exploit systematic mispricing.

Table 6
Estimation results for Eq. (1):

$$\text{DABR} = a + a_1\text{VOLATILITY} + a_2\text{OWNER} + a_3\text{DILUTION} + \varepsilon,$$

and Eq. (2):

$$\text{UNDER} = b + b_1\text{VOLATILITY} + b_2\text{OWNER} + b_3\text{DILUTION} + b_4\text{UNIT} + \varepsilon.$$

	(1) DABR	(2) UNDER
CONSTANT	− 0.035 (− 3.31)	− 0.015 (− 7.12)
VOLATILITY	− 0.366 (− 2.05)	0.641 (10.42)
OWNER	− 0.004 (− 2.17)	0.008 (2.16)
DILUTION	0.008 (0.83)	0.016 (4.46)
UNIT		− 0.013 (− 3.74)
R^2	0.057	0.055
N	172	2936

VOLATILITY = standard deviation of daily stock returns; OWNER = percentage of common stock held by managers prior to offering; DILUTION = percentage increase in shares outstanding including those from potential warrant exercise; UNIT = 1 if unit offering and 0 if shares only; DABR = difference between observed abnormal return for unit offering and forecast under share offering; UNDER = percentage difference between offer prices and market prices at close of first trading day.

to the post-offering shares outstanding, including those due to eventual warrant exercise.[13] DILUTION captures the reduction in ownership concentration. To test these implications, we estimate the following model for unit offering firms;

$$\text{DABR} = a + a_1\text{VOLATILITY} + a_2\text{OWNER} + a_3\text{DILUTION} + \varepsilon, \quad (1)$$

where DABR is the incremental wealth effect. The coefficient estimates for Eq. (1) are presented in Table 6, column (1). Consistent with the staged financing hypothesis, the incremental wealth effect is negatively related to the degree of insider ownership (OWNER). However, contrary to the implications of the hypothesis, the effect of the issuer's riskiness (VOLATILITY) is negative and the effect of DILUTION on insider ownership from the unit offering is not significant. The R^2 value for the model is 0.057.

According to the Chemmanur and Fulghieri (1997) signaling model, ceteris paribus, underpricing should be positively related to the firm's riskiness and insider ownership, and negatively related to the amount of warrants issued. We investigate the implication of the signaling hypothesis from the following regression:

$$\text{UNDER} = b + b_1\text{VOLATILITY} + b_2\text{OWNER} + b_3\text{DILUTION} + b_4\text{UNIT} + \varepsilon, \quad (2)$$

where UNDER is underpricing and UNIT is an indicator for unit offering. Note that DILUTION inversely measures the proportion of shares included in the warrants; thus,

[13] We also use a dilution measure that excludes new shares due to eventual warrant exercise and the results are essentially unchanged.

DILUTION is expected to be positively related to UNDER according to the signaling hypothesis. The estimates are given in Table 6, column (2). After controlling for other variables, unit offerings incur milder underpricing, and issuers with higher risk (VOLATILITY) and greater managerial ownership (OWNER) experience more severe underpricing. Also, as the issuers include fewer warrants in the unit offering (DILUTION), underpricing tends to be greater, consistent with the signaling hypothesis.

4. Conclusions

We examine seasoned stock financing and stock-warrant unit financing decisions announced during 1980–1997 in light of recent theoretical models of warrant financing. For both types of offerings, our tests result in support of the signaling hypothesis of Chemmanur and Fulghieri (1997) and largely in support of the sequential financing hypothesis (Schultz, 1993; Mayers, 1998). The findings imply that warrant financing is a useful device for signaling a firm's prospects not only in initial public offerings (How and Howe, 2001), but in seasoned offerings as well (current study).

Announcements of both types of offerings are associated with negative average stock price reactions, with some evidence of less severe negative announcement returns for unit offerings. The latter finding is consistent with Schultz' (1993) finding for IPOs. For announcements of unit offerings, we find that firms with high risk, low debt, high-prestige underwriters, and low-growth potential experience the lowest abnormal returns. For stock offerings, we find that larger firms with high managerial ownership and low-prestige underwriters suffer less severe stock price reactions. Our results reveal that participation by venture capitalists in share offerings also reduces the severity of the price reaction at announcement. Moreover, we find that issuance of shares during "hot" equity markets mitigates the adverse stock price reaction, but no influence of "hot" markets is uncovered for unit offerings.

Perhaps our most novel findings pertain to announcement effects predicted had firms chosen the opposite financing methods. Unit issuers experienced an average abnormal return of -1.96%, compared to -2.71% predicted, had they issued shares only. On the other hand, those that issued shares only experienced an effect of -2.13%. Had these firms added warrants, we predict they would have experienced a -1.27% average abnormal return. Thus, reluctance to add warrants results in a puzzling incremental wealth loss that may merit further study.

We further test the implications of the sequential financing hypothesis regarding the incremental abnormal return from unit offerings relative to the forecast abnormal return under the alternative share offerings. As implied by the sequential financing hypothesis, firms with lower insider ownership experience a higher announcement period abnormal return by issuing units rather than the alternative shares.

We further investigate the implications of the signaling hypothesis regarding underpricing of offerings and find that unit offerings incur less severe underpricing compared to share offerings, and that issuers with high risk and greater managerial ownership experience more severe underpricing.

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Further reading

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