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Signaling and the Valuation of Unseasoned New Issues

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ABSTRACT

This paper is an empirical examination of the relation between firm value and two potential actions by entrepreneurs attempting to signal to investors information about otherwise unobservable firm features. The signals investigated are the proportion of equity ownership retained by entrepreneurs and the dividend policy of the firm; both signals are hypothesized to be positively related to firm value. Using a sample of unseasoned new equity issues, the empirical results are consistent with the entrepreneurial ownership retention hypothesis, but the dividend signaling hypothesis is rejected.

THE VALUATION OF NEW ventures is a complex task that, nevertheless, is done routinely by venture capitalists and investment bankers. When entrepreneurs raise new equity capital, they must reveal certain information about their ventures, such as the size of the venture, the line of business in which it is involved, the present form of financing, and evidence of past performance (sales, earnings, etc.). These *observable* characteristics of the venture are used by outsiders to assess expected future cash flows and the uncertainty associated with these flows. However, there are other characteristics of the venture which cannot be easily reported or observed but which might be useful in valuing the venture. Such characteristics include the quality of the management, the possibility of the entrepreneur developing valuable products that are the property of this venture in the future, etc. Obvious entrepreneurial incentives for misrepresentation prevent outsiders from believing the unsupported claims of entrepreneurs. Thus, entrepreneurs must revert to actions to convince outsiders of their "insider" knowledge and expectations for the future of the venture. Outsiders not only

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must evaluate the observable characteristics but also must interpret entrepreneurial actions or signals in order to estimate the value of a new venture.

This paper examines the empirical relation between a set of observable firm characteristics, entrepreneurial actions or signals and the initial market value of the firm, using a sample of firms making their first public offerings of common equity. Our primary interest concerns the importance of two specific actions which have been proposed in the finance literature as useful signals of the underlying value of a firm: dividend policy and entrepreneurial ownership retention.

The existence of information asymmetries between management and investors has been documented in previous studies of insider trading. For example, Jaffee [6] found that reported insider trading of a sample of NYSE stocks was related to subsequent stock performance, and Scholes [10] finds evidence of an information effect in large block secondary sales.

The hypothesis here is not whether the entrepreneur has insider knowledge, since that is taken for granted, but whether he is able to communicate or signal this by his actions, specifically by dividend policy and by his retention of ownership. If dividend policy and entrepreneurial ownership retention do serve as signals, then they should have an observable relation in equilibrium with firm value.

The characteristics of the sample used here also differ significantly from the earlier insider trading studies. For example, this study examines pure primary and mixed primary and secondary equity issues of unseasoned companies. Scholes points out the informational differences between this sample and pure secondary sales. Also, while "insiders" in the Scholes and Jaffee studies (mutual funds, trusts, corporate officials, etc.) may be assumed to hold reasonably well diversified personal portfolios, the insiders in this sample retain, on average, over 70 percent of the ownership in their firm, indicating a propensity for less well-diversified portfolios.

Section I briefly outlines the signaling hypotheses; Section II describes the research methodology and the data employed. The empirical results are discussed in Section III, and Section IV contains the conclusions.

I. The Theory

We consider the valuation of unseasoned new issues in the context of a model in which entrepreneurs are assumed to possess more information than investors. Firms new to the public equity market require additional, external, equity financing; the entrepreneurs or managers of the firms are assumed to know the distribution of the uncertain end-of-period values, $\tilde{P}_1$, but are unable to convince potential investors of their knowledge directly on account of the incentives for misrepresentation.

One way in which entrepreneurs might communicate their beliefs about the distribution of future cash flows of the firm is by their actions. For example, if the entrepreneur takes an action which will prove to be costly if future cash flows turn out to be low, investors may infer from this that the entrepreneur believes

that cash flows will be high. Such actions serve as signals of entrepreneurial beliefs.

Current share price, P_0, is assumed to be a function of firm descriptors which can be used to predict the risk and value of a firm's equity.[1] Descriptors are classified either as indices or as signals.[2] *Indices* are observable firm characteristics which are largely outside the control of the firm at the time of the equity issue, such as the firm's industry group and size. *Signals* are observable firm characteristics which are directly controllable by the firm at the time of the equity issue and convey information about the distribution of future cash flows. We consider two potential signals: the fraction of equity ownership retained by the insiders, and the stated dividend policy.

Leland and Pyle [8] construct a valuation model in which the current value of a firm, V, is a function of α, the fraction of equity in the firm retained by the entrepreneur. They assume that the entrepreneur knows the expected future cash flow of the firm and that potential investors do not. It is costly for the entrepreneur to retain a significant ownership interest in the firm since by doing so he forgoes diversification of his personal portfolio. Therefore, he will retain a significant ownership interest only if he expects the future cash flows to be high relative to the current firm value, so that rational investors will see α, the fraction of equity retained by the entrepreneur, as a signal of firm value. Leland and Pyle show that in the context of the CAPM the value of the firm will be given by:

$$V(\alpha) = (-bZ/(1 + r))[\alpha + \log(1 - \alpha)] + K \tag{1}$$

where

r = the riskless interest rate;
b = the risk aversion parameter in the entrepreneur's mean-variance utility function;
K = the amount of capital raised; and

$$Z = \frac{\sigma_x^2\sigma_m^2 - [\text{cov}(\tilde{x}, \tilde{m})]^2}{\sigma_m^2}$$

where $\tilde{x}$ and $\tilde{m}$ are the returns on the firm and the market, respectively.

For the signaling equilibrium to be viable there must be relatively few firms with high expected returns.

Both Bhattacharya [1] and Heinkel [4] have constructed asymmetric information models in which dividend policy serves as a signal of firm value. In both models, higher value firms pay larger dividends. In the model of Bhattacharya, dividend policy serves as a signal of the future cash flow, whose distribution is known to management. The signaling equilibrium is based on the existence of two costs associated with paying dividends: the tax disadvantage of dividends relative to capital gains of investors, and an assumed cost to financing any shortfall of ending cash flow to the promised dividend payment. The signaling equilibrium model of Heinkel is obtained without assuming imperfections in

[1] Rosenberg and Marathe [9] describe a firm's risk and return characteristics as a function of an exhaustive list of descriptors.

[2] This classification follows Spence [11].

securities markets and rests on the opportunity costs of investment opportunities forgone in order to finance the dividend. The necessary conditions for dividends to function as a signal in the two models are somewhat different. In Bhattacharya's model, the personal tax disadvantage of dividends is important, whereas in Heinkel's model the conditions are similar to those of Leland and Pyle; specifically, there must be fewer firms with high expected returns, and the elasticity of firm value with respect to investment must be less for firms with higher expected returns.

II. The Data

The data consist of 449 firms which went public between 1965 and 1969 and for which prospectuses could be obtained.[3] All of the issues were registered with the SEC and underwritten by one or more investment banking firms; no "Regulation A" or "best efforts" underwritings were included.[4]

Since there is no trading history for firms in the sample, the information set of investors is assumed to consist solely of the information contained in the prospectus covering the new issue. The signaling hypothesis is tested by determining whether the offer price of the new issue is related to the level of the signals.[5]

The set of descriptors used to characterize the information set concerning the firms is taken from the offering prospectus, and the price of the issue is taken to be the initial offer price.[6] Thus, all the information utilized in the valuation formulae developed below was, in fact, public information at the time of issue.

Since no market history exists for any of the firms in the sample, we require that at least three years of operating data exist. Further, because of the difficulties of finding quantitative descriptors of firms without adequate earnings records, the sample was limited to firms whose initial price-earnings ratio did not exceed 40. These two conditions reduced the sample size to 297.

III. Results

A. *The Leland-Pyle Model*

The Leland-Pyle (LP) model, Equation (1), yields the following regression model of firm value:

$$V_j = b_0 + b_1 K_j + b_2 \hat{\alpha}_j + u_j \tag{2}$$

[3] The prospectuses were borrowed from Cornell University, and we wish to acknowledge Ms. Betsy Ann Olive, Librarian at the Graduate School of Business and Public Administration, for her cooperation and willingness to make long-term, long-distance loans.

[4] "Regulation A" offerings are considered by the SEC to be "small" offerings (less than $300,000), so that the offering firm need only notify the SEC of its intention to sell stock and provide the SEC with its offering circular. Since the SEC makes no attempt to monitor disclosure in "Regulation A" issues, they are omitted from our sample.

[5] In addition, rates of returns over various holding periods, adjusted for market performance, were regressed against firm descriptors and signal variables contained in the prospectus. The lack of significance of the coefficients on the signal variables in all trials indicates that the signals could not be used in a portfolio formation strategy to yield abnormal returns; the results also imply that the signals are not proxies for the risk of the firm.

[6] Replacing the offer price with the market price from the immediate aftermarket does not affect the results shown here.

where, for firm j,

$K = N_pP$: the funds raised by the initial offer;
$\hat{\alpha} = \alpha + \ln(1 - \alpha)$: the LP signal of a firm's future cash flow, as a function of α;
N_p : the number of primary shares in the initial offer;
P : the initial offer (subscription) price for the equity, per share;
α : $(N_0 - N_s)/N$ = the proportionate ownership retained by the entrepreneurs;[7]
N : the total number of shares outstanding after the initial offer;
N_s : the number of secondary shares offered by the entrepreneurs for resale (out of N_0);
$N_0 = N - N_p$: the number of shares allocated to the entrepreneurs;
$V = NP$: the total market value of equity after the initial offer; and
u : a disturbance term.

Since $\partial V/\partial\hat{\alpha} = -bZ/(1 + r) < 0$ in Equation (1), the prediction of the *LP* model is that $b_2 < 0$ in Equation (2). This prediction is tested by estimating Equation (2) using the sample of 297 firms; the results are shown in Table I.

The first line of this table presents the OLS estimates; these estimates are inefficient due to heteroscedasticity.[8] Therefore, the equation was re-estimated using weighted least squares, assuming that the standard deviation of the disturbance term was proportional to the amount of capital raised, K, and to the book value of the firm after the new issue, B. The two WLS estimators yield very similar results and the hypothesis that the LP α has no relation to firm value is clearly rejected. Also, heteroscedasticity is eliminated.

However, the LP regression equation (2) assumes that the risk of the firms in the sample is constant and impounded in the coefficient b_2. In addition, the LP regression equation (2) does not allow for testing of the dividend signaling hypothesis.

B. An Earnings Multiple Model

To adjust for firm risk and the potential effect of dividend signaling, we express firm value as the product of the normalized earnings,[9] E, and a multiple, m, which

[7] For many firms, there was a problem in determining who were the entrepreneurs in the Leland-Pyle context. Some firms, prior to going public, had issued stock to some combination of employees, venture capital firms, insurance companies, and other private investors. It was simply not possible to learn from the prospectus the extent of the involvement of many of these investors. We make the assumption that all parties owning the firm's stock prior to the public offering were insiders, or, in the Leland-Pyle model, entrepreneurs.

[8] We use the ratio of the sums of squared errors derived from separate OLS regressions on population subsamples as a measure of heteroscedasticity, as outlined by Theil [12, pp. 196, 215] and Johnston [7, p. 219]. The subsamples were constructed based on ranking the sample by sales, used as the measure of size.

[9] The normalized earnings figure is the normalized earnings per share times N. The normalized EPS is from an exponential smoothing model applied to all the available historical EPS numbers as far back as 10 years prior to the date of the new issue. The exponential smoothing weights are chosen to minimize the sum of squared errors over all firms; the error is defined as the difference between the exponential forecast for the firm's final annual earnings per share prior to its equity issue and that year's actual reported earnings per share.

Table I

Tests of the LP Model[a]

$$V_j = b_0 + b_1 K_j + b_2 \hat{\alpha}_j + u_j$$

	Weighting factor	b_0	b_1	b_2
(a) OLS	—	−17.05	4.17	−42.31
		(−9.43)	(9.83)	(−13.87)
(b) WLS	$1/K_j$	−.49	3.52	−4.24
		(−.89)	(14.56)	(−5.09)
(c) WLS	$1/B_j$	−.87	2.92	−4.72
		(−1.61)	(7.24)	(−5.17)

[a] $n = 297$. t-values are in parentheses.

varies across firms:

$$V_j = m_j E_j + u_j \tag{3}$$

The multiplier, m, is assumed to be a function of the firm's descriptors, both indices and signals. These are taken from the offering prospectus and are therefore known at the time of the issue. The selection of descriptors was influenced by the findings of previous studies, but was constrained by our limited data sources. Unfortunately, the best single risk descriptor,[10] the historical beta, is obviously not available. The indices used are as follows:

DEBT: the ratio of total debt to total assets after the equity issue;

IND: a dummy variable representing the industry classification of the issues. IND = 1 if the three-digit SIC code is between 357 and 372 (electronics manufacturing) or 730 and 739 (computer services). For all other SIC codes IND = 0;[11]

AGE: the log of the firm's age in years;

SLS: the log of the latest full year's sales;

GRW: the continuously compounded rate of growth in sales over the most recent three-year period;

UWQ: a dummy variable representing managing underwriter prestige; UWQ is 1 for prestigious underwriters and 0 for all others;[12]

HOT: a dummy variable representing the "hot new issue market" that began during 1967 and continued throughout 1969. For those issues offered on or after 1 July 1967, the dummy equals 1 and for all issues prior to that date it equals 0. This variable is included to allow for unusual

[10] See, for example, Rosenberg and Marathe [9].

[11] As many as eight different dummy variables based upon industry classifications were tried, based on the prior belief that the industry class would be a highly significant explanatory variable. However, statistically insignificant coefficients led us eventually to aggregate all of the industry groups except for the set representing the high-technology industries (SIC 357-372 and 730-739).

[12] The classification of prestigious versus nonprestigious managing underwriters uses the investment banking industry's own classification methods as described in S. L. Hayes III [3]. Prestigious firms include all those firms classified as "majors," "majorettes," or "majors out-of-order," and "submajors." All others are classified as nonprestigious.

pricing differences that arise in hot new issue markets, as demonstrated by Ibbotson and Jaffee [5] and Downes [2].

The signals are $\hat{\alpha}$, described above, and a dividend policy variable, γ, which takes on a value of unity if a dividend is declared in the prospectus, and zero otherwise.[13]

The multiplier function, m, is taken as linear in the descriptors so that the final valuation equation is:

$$V = (a_0 + a_1\hat{\alpha}_j + a_2\gamma_j + a_3\text{DEBT}; + a_4\text{IND}_j + a_5\text{AGE}_j + a_6\text{SLS}_j + a_7\text{GRW}_j + a_8\text{UWQ}_j + a_9\text{HOT}_j)E_j + u_j. \quad (4)$$

Both the Bhattacharya and Heinkel models (BH) predict that the coefficient on γ is positive; also, the LP model predicts that the coefficient on $\hat{\alpha}$ is negative. These predictions were tested by estimating Equation (4) using the same 297 firms as were used in the estimates of Equation (2).

The results of estimating Equation (4) using ordinary least squares (OLS) are reported in the first line of Table II. While the LP hypothesis is confirmed by the negative and strongly significant coefficient on $\hat{\alpha}$, the BH dividend signal hypothesis is rejected since the coefficient on γ, the dividend policy variable, is negative rather than positive, as predicted by the BH model. However, the OLS estimate is almost certainly subject to heteroscedasticity so that the resulting estimates are inefficient and the standard significance tests do not apply. Therefore, the equation was re-estimated under two alternative assumptions about the form of the heteroscedasticity.

First, it is assumed that the standard deviation of the error term in Equation (3) is proportional to smoothed earnings, E_j,

$$V_j = m_jE_j + E_je_j$$

where e_j is identically distributed across all firms. The weighted least squares (WLS) estimate obtained by dividing each observation by E_j is reported in the second line of Table II.

The equation was also re-estimated under the assumption that the standard deviation of the error term is proportional to the predicted firm value:

$$V_j = m_jE_j(1 + e_j)$$

where e_j is again identically distributed across all firms. Taking logs yields

$$\ln(V_j/E_j) = \ln(m_j) + \ln(1 + e_j)$$

where

$$m_j = a_0 + a_1\hat{\alpha}_j + a_2\gamma_j + a_3\text{DEBT}_j + a_4\text{IND}_j + a_5\text{AGE}_j + a_6\text{SLS}_j + a_7\text{GRW}_j + a_8\text{UWQ}_j + a_9\text{HOT}_j$$

[13] A second measure of dividend policy that was tried was the payout ratio, defined as the declared dividend divided by the most recent smoothed annual earnings. The regression results from substituting this variable for the one described in the paper were almost identical to the results reported in Table II and, thus, are not reported here.

Table II

Tests of the Earnings Multiple Model[a]

$$V_j = (a_0 + a_1\hat{\alpha}_j + a_2\gamma_j + a_3\text{DEBT}_j + a_4\text{IND}_j + a_5\text{AGE}_j + a_6\text{SLS}_j + a_7\text{GRW}_j + a_8\text{UWQ}_j + a_9\text{HOT}_j)E_j + u_j$$

	a_0	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9
(i) OLS	11.09	−5.85	−2.91	4.63	4.07	−.94	−1.41	9.12	8.47	1.31
	(7.29)	(−10.91)	(−2.65)	(2.79)	(3.22)	(−2.31)	(−3.52)	(4.92)	(8.91)	(1.80)
(ii) WLS	13.54	−9.00	−1.80	−.63	3.03	−.75	−1.39	8.24	3.84	2.43
	(5.24)	(−6.48)	(−1.65)	(−.32)	(3.10)	(−1.70)	(−3.07)	(4.86)	(4.07)	(2.54)
(iii) NLS	12.82	−8.61	−2.09	−2.15	2.75	−.64	−1.17	6.59	3.98	2.41
	(8.59)	(−5.98)	(−2.14)	(−1.23)	(2.72)	(−1.65)	(−2.75)	(3.75)	(4.93)	(2.77)

[a] $n = 297$. t-values are in parentheses.

The coefficients a_0 through a_9 were estimated by a nonlinear least squares (NLS) procedure and are reported in the third line of Table II.

The WLS and NLS estimators of a_1 and a_2 are essentially the same as those yielded by the OLS regression.[14] The results support the LP prediction. For example, the coefficient on $\hat{\alpha}$ in line (ii) of Table II implies that if, for example, an entrepreneur reduces his retained ownership fraction, α, from 80 percent to 70 percent, the P/E ratio would drop by 2.7; reducing α from 40 to 30 percent causes the P/E ratio to fall by 0.50. With a sample mean α of .71, the typical entrepreneur's choice of α has a substantial effect on total firm equity value.

The results of Table II are, however, inconsistent with the BH hypothesis. Indeed, the coefficient on the dividend signal variable implies rejection of the null hypothesis of no effect of dividend policy on firm value at the 5% level under the NLS model and at the 10% level under the WLS estimate. The point estimate suggests that the declaration of a dividend in the prospectus will reduce the P/E ratio based on the offering price by about two. Since it is apparently costless to avoid such a dividend declaration, a negative effect of dividends on firm value is inconsistent with any dividend signaling model and not just with the BH models; such a negative effect is also inconsistent with the declaration of dividends by value-maximizing firms.

One explanation of the anomalous finding with respect to the dividend declaration variable is that it is proxying for some firm characteristic which is perceived by investors but omitted from our regression model. An obvious candidate is future investment opportunities; unfortunately, this is not quantifiable from the data available in the propsectus so that this remains conjectural.

IV. Conclusions

In this paper we attempt to estimate the extent to which two potential actions of entrepreneurs serve to signal or convey to investors information about otherwise unobservable firm characteristics. These are the retention of firm ownership by the entrepreneurs, as modeled by LP, and the declaration of dividends, as modeled by BH.

The empirical results offer strong support for the LP hypothesis. Firms in which entrepreneurs retain high fractional ownership do indeed have higher values, as the theory predicts. On the other hand, the BH dividend signaling hypothesis is rejected by the data. The significant negative role found for dividends suggests that this may be attributable to omitted, not readily observable, variables from the valuation equation.

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[14] Other adjustments to reduce heteroscedaticity in Equation (3), such as assuming the standard deviation of the disturbance is proportional to size, as measured by sales, yield results very similar to those shown in Table II.

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