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# CONVERTIBLE BONDS:
## TEST OF A FINANCIAL SIGNALLING MODEL

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## ABSTRACT

This paper presents an empirical test of the Brennan Kraus (1987) hypothesis of convertible bond financing, according to which firms signal their volatility by their choice of terms of the convertible issue. With additional assumptions about the nature of investors' prior beliefs about firm types the model predicts that the announcement period return will be positively related to the face value of the convertible, and negatively related to the fraction of the firm accruing to the convertible holders on conversion. The empirical evidence for a sample of public issues strongly supports these predictions, while that for a sample of private placements does not, which is consistent with problems of information asymmetry being important for the former but not for the latter.

Despite the popularity of convertible securities as financing instruments, their role in corporate finance remains imperfectly understood. Two types of rationale for the issuance of these securities have been advanced, but there is so far little empirical evidence bearing on them. The earliest rationale for convertibles is that proposed by Green (1984)[1] who argues that convertibles contain an option element whose value increases with an increase in the risk of the firm; this protects convertible holders against an opportunistic increase in firm risk by the stockholders which would otherwise expropriate them. Thus, according to this view, the role of convertibles is to reduce the agency costs that are associated with debt financing. Indirect evidence in support of this view is the popularity of convertibles among small rapidly growing firms, those with the most scope to alter the risk of their assets.

The second explanation for the role of convertibles is that that they act as a signal of firm type, and so mitigate the adverse selection problem associated with security issuance. Brennan and Kraus (1987) propose a model in which the terms of a convertible issue can reveal the risk of the issuing firm. In this model there are no deadweight or dissipative[2] costs of signaling since the Modigliani-Miller(1958) theorem is assumed to apply, and firm insiders are assumed to choose the cheapest source of finance in the sense that they maximize the difference between the amount of capital raised and the 'true' full information value of the security issued; this difference is equal to zero in the fully revealing equilibrium. In this paper we derive and test the empirical implications of the Brennan-Kraus model that the abnormal return

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[1] See also Jensen and Meckling (1976)

[2] See Bhattacharya (1979) for a discussion.

associated with the announcement of an issue of convertible securities will be positively associated with the face value of the bond and negatively associated with the fraction of the firm's equity into which the bond is convertible.

More recent models in which a convertible bond acts as a costly signal of firm type include Kim (1990) and Stein (1992). In Kim's model insiders are constrained to hold the firm's equity so that the risk of their return increases as the equity component of the convertible's return falls; as a result, the lower the future earnings expected by insiders, the higher is the conversion ratio of the convertible chosen in equilibrium. Kim concludes that the theory 'provides a new empirically testable hypothesis that abnormal common stock returns at announcement of convertible debt offerings decrease with conversion ratios'. It seems unlikely that the conversion ratio *per se* could act as a signal since firms with very different stock prices before the issue could be expected to choose different conversion ratios without affecting the announcement return. This points to the care that must be taken in deriving empirical predictions concerning a heterogeneous population of firms from theoretical signalling models in which firms differ in only a single dimension which is revealed by the signal. However, we test whether the conversion ratio has explanatory power for announcement returns relative to the variables suggested by the Brennan-Kraus model.

In Stein (1992)[3] convertibles are issued as a means of delayed equity financing[4]. There are only three types of firm in the model, and low quality firms choose equity

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[3] See also Nyborg (1991)

[4] This lends some support to the popular view that convertibles are issued in order to "sell stock above the current market price". See Brennan and Schwartz (1986).

financing, high quality firms choose debt financing, and firms of intermediate quality

choose convertibles in the expectation that they will be able to force conversion when

good news about their future prospects is subsequently revealed. Stein's model seems

particularly appropriate for those firms that issue convertibles with no call notice

period. However, most convertibles contain a deferred call provision, and it seems less

likely that corporate managements have significant private information about the

value of their firm at the end of the call deferral period, which is typically five years.

Moreover, in Stein's setting the separating equilibrium is as easily achieved by the

medium firm issuing short term debt which is then refinanced with an equity issue. It

is only when the information asymmetry is persistent that the convertible dominates

the short-term debt issue and then, as Stein points out, the convertible is likely to be

dominated by a "reverting bond" as suggested by Brennan(1986)[5]. While Stein's model

is consistent with survey evidence of the reasons for convertible issuance, and with the

types of firms issuing convertibles, the firm characteristics evidence is also consistent

with the agency theory of Green and the (different) signalling story of Brennan and

Kraus(1987). The Stein model does not make strong predictions about the stock price

response to convertible issues, suggesting only that the price drop will be intermediate

between those associated with straight debt and equity issues.

Prior empirical work includes Lee, Jen and Choi (1992). These authors

develop an informal adverse selection hypothesis, motivated by the work of Myers and

Majluf (1984), according to which the announcement return will be negatively related

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[5] A reverting bond is one which converts automatically into a fixed dollar amount of shares at a fixed time. It is essentially a precommitment to issue equity at a future date sufficiently distant that the firm has no information as whether the firm will be undervalued or overvalued at that time. It thus avoids the adverse selection inherent in equity issues first noted by Myers and Majluf (1984).

to the ratio of the stock price to the conversion price which they take as a measure of the equity component of the issue. They find such a relation, and also find that the announcement price effect is negatively related to various measures of the issuer's need for funds - this is consistent with the issue being partially predictable on the basis of the firm's characteristics[6]. Kim and Stulz (1992) study the stock price response to announcements of US domestic and Eurobond convertible issues. The only major determinant of the return that they find is the conversion premium, the ratio of the conversion price to the stock price, which they find to be positively related to the return for domestic issues and negatively related for Eurobond issues. In our empirical analysis we shall test for the incremental explanatory power of this variable relative to those of the Brennan-Kraus model[7]. Finally Fields and Mais (1991) examine price reactions to private placements of convertibles. In contrast to Dann and Mikkelson (1984) who find a significant negative average return of 2.31% associated with announcement of public issues of convertibles, Fields and Mais report a positive average announcement return of 1.80% for private placements of convertibles[8], and find that the announcement return is positively related to the size of the issue expressed as a proportion of the pre-announcement equity value. Since it seems likely that the problems of informational asymmetry that are the basis of the signalling models of convertibles will be less pronounced, or even non-existent, for private

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[6] Eckbo, Maksimovic and Williams (1990) stress the importance of taking account of the endogeneity of firm decisions in cross-sectional event studies.

[7] Kim and Stulz(1987, p76) misinterpret the Brennan-Kraus model and claim that it predicts that the stock price reaction will be positively related to the conversion premium.

[8] This is consistent with the positive announcement returns for private placements of equity reported by Wruck (1989) and Hertzel and Smith(1993), which contrast with the negative announcement returns for public issues of equity.

placements, we also test the explanatory power of the Brennan-Kraus model variables for the Fields-Mais sample of private placements.

In Section I the Brennan-Kraus model is summarized and its empirical predictions are developed. In Section II the data are described, and the empirical tests and their results are presented in Section III.

# I

## The Signalling Model

In this section we sketch the Brennan Kraus model for the sake of completeness, and introduce an auxiliary assumption about investors' prior distribution over firms types that allows is to derive an empirically testable counterpart of the model. In Brennan and Kraus (1987) it is assumed that firms choose security issues to maximize the difference between the price received for the issue and its true value. This objective function implies that in a revealing equilibrium, in which securities are priced properly, each security is priced on the supposition that it was issued by the firm whose characteristics are such as to minimize the true value of the security, and in equilibrium this supposition is correct[9]. Thus, in this model investors infer the characteristics of the issuing firm by assuming the worst about it. We refer to this as the 'pessimism property of revealing equilibria'.

To apply the pessimism principle to a convertible financing when there is asymmetric information about firm risk, consider a two period setting in which investors are risk neutral and the interest rate is zero. At time 0 a firm wishes to raise

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[9] See Brennan and Kraus (1987) Theorem 1.

an amount of capital K in order to finance an investment project. The aggregate

payoff at time 1 of the investment project and the firm's previously owned assets is

uniformly distributed on the interval (m-t, m+t), where m is common knowledge and t

is private information to the firm: investors know only that t lies in some set T with

support $[t_{min}, t_{max}]$. At time 0 the firm has an outstanding senior debt issue with face

value $B_0$ due at time 1. It is assumed that for all possible firm types the outstanding

debt is risky but has some positive probability of being paid in full, so that $m + t_{min} >$

$B_0 > m - t_{min}$. $V^*(B, t)$, the full information value of a subordinated debt issue made

by a firm of type t, with face value B, of a size such that it may be paid in full even by

the least risky firm type $(B_0 + B < m + t_{min})$, is given by

$$V^*(B,t) = \frac{B}{2} + \frac{\left(m - B_0 - \frac{1}{2}B\right)B}{2t} \qquad (1)$$

According to the pessimism principle, in a fully revealing equilibrium the

market will value the issue by assuming that it is made by the worst type in the set T.

i.e by the type t which minimizes its full information value $V^*(B, t)$. Thus, its market

value, V(B), will be given by

$$V(B) = \begin{cases} \dfrac{B}{2} + \left[\dfrac{m - B_0 - \dfrac{1}{2}B}{2t_{max}}\right] & \text{if } m - B_0 - \dfrac{1}{2}B > 0 \\[4em] \dfrac{B}{2} + \left[\dfrac{m - B_0 - \dfrac{1}{2}B}{2t_{min}}\right] & \text{if } m - B_0 - \dfrac{1}{2}B < 0 \end{cases} \qquad (2)$$

Thus, any firm issuing a straight bond will be treated by the market either as a type

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$t_{min}$ or a type $t_{max}$ according to the value of $(m - B_0 - B/2)$, and the market value assigned to the debt will be in general less than its full information value. But this is inconsistent with a revealing equilibrium.

On the other hand, if the firm sells a share $\alpha$ of its equity, the pessimism principle implies that the market will again value the equity issue assuming that it is made by the worst type of firm, which in this case is $t_{min}$, so that the market value of the equity sold, $V(\alpha)$, will be given by

$$V(\alpha) = \alpha[(m + t_{min}) - B_0]^2/4t_{min} \qquad (3)$$

which is less than the full information value so long as $t > t_{min}$. Again, this is inconsistent with a value revealing equilibrium.

Consider next the situation in which the firm issues a convertible bond with face value F, which is convertible into a fraction $\alpha$ of the firm's equity. We assume that there is positive probability that the bond will be converted so that

$$t > B_0 - m + F/\alpha \qquad (4)$$

Then, since $t > m - B_0$, the full information value of the convertible, $V^*(\alpha, F, t)$ is given by:

$$V^*(\alpha, F, t) = \{F^2(1 - \alpha)/\alpha + \alpha(m + t - B_0)^2\}/4t \qquad (5)$$

A revealing equilibrium requires that the market value of the bond, $V(\alpha, F)$, which is the amount of capital raised by the issue, K, be equal to the full information value under the pessimistic assumption that the issue is made by the worst possible issuing type:

Using equation (5), the first order condition for a minimum in (6) implies that $\alpha(t)$, the fraction of equity into which the bond is convertible when it is issued by firm

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$$V(\alpha,F) = \min_{\{t \in T\}} V^*(\alpha,F,t) = K \tag{6}$$

type t in a revealing equilibrium, is given by:

$$\alpha(t) = 2K/(m + t - B_0) \tag{7}$$

Since $\alpha(t) \leq 1$, a revealing equilibrium is possible only if the set T of possible firm types is such that $t_{min} > 2K - m + B_0$.

Solving (6) and (7) for F(t), the face value of the bond that will be issued in equilibrium by firm t, we have

$$F(t) = \sqrt{\frac{\alpha}{1-\alpha}[4Kt - \alpha(m + t - B_0)^2]} \tag{8}$$

To find $t^*(\alpha, F)$, the firm type that investors infer from the convertible with terms $(\alpha, F)$, we eliminate K between (7) and (8) to obtain:

$$t^*(\alpha,F) = \sqrt{(m - B_0)^2 + F^2(1 - \alpha)/\alpha^2} \tag{9}$$

This implies that for $\alpha < 1$ the firm type, t, is increasing in the face value of the bond, F, and decreasing in $\alpha$, the fraction of the equity into which the bond is convertible:

$$\partial t^*/\partial\alpha < 0, \quad \partial t^*/\partial F > 0 \tag{10}$$

Moreover, S(t), the full information value of the equity of a type t firm with senior debt $B_0$, is given by

$$S(t) = \frac{1}{2t}\int_{B_0}^{m+t} dt = \frac{(m + t - B_0)^2}{4t} \tag{11}$$

It follows that $dS/dt > 0$ for $t > B_0 - m$, as we have assumed, so that the model

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predicts that:

$$\partial S / \partial \alpha < 0, \qquad \partial S / \partial F > 0 \tag{12}$$

In order to convert the *theoretical* predictions (12) into *empirical* predictions about the abnormal returns on the stock around the announcement of the convertible issue, it is necessary to introduce an auxiliary assumption about the investors' prior distribution over possible firm types, t, since this will determine $S_0$, the equity value prior to the announcement, and hence affect the announcement return. We shall adopt the following assumption:

Assumption A: f(t; m, B), the density function of firm types, given the common knowledge characteristics, m, the expected firm payoff, and $B_0$, the face value of the outstanding debt, is given by

$$f(t; m, B) \begin{cases} = 0, & \text{for } t < k_1(m - B) \\[2mm] = \dfrac{At}{(m - B)^2}, & \text{for } k_1(m - B) < t < k_2(m - B) \\[2mm] = 0, & \text{for } k_2(m - B) < t \end{cases} \tag{13}$$

for constants $k_2 > k_1 > 0$, and $A > 0$, a constant of integration.

Assumption A implies that the support of the distribution of possible firm types is homogenous of degree one in m and $B_0$, the expected payoff, and the face value of the outstanding debt. Given the firm characteristics m and $B_0$, the distribution of t is triangular, higher dispersion parameters, t, being more likely than low ones. As we shall see, this functional form allows us to eliminate from the expression for the announcement return the parameters m and $B_0$ which, while assumed to be common knowledge, are unknown to the econometrician.

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Then $S_0(m, B_0)$, the pre-announcement equity value of a firm with characteristics $m$ and $B_0$, is given by:

$$S_0(m, B_0) = \int_{k_1(m - B_0)}^{k_2(m - B_0)} S(t) f(t; m, B_0) \, dt \qquad (14)$$

Carrying out the integration in (14), it is seen that the pre-announcement equity value can be written as

$$S_0(m, B_0) = k(m - B_0) \qquad (15)$$

where $k > 0$ is a constant.

Substituting $t^*(\alpha, F)$ from (9) for $t$ in (11), the post-announcement equity value, $S(\alpha, F; m, B)$, may be written as:

$$S(\alpha, F; m, B_0) = \frac{1}{4} \sqrt{(m - B_0)^2 + F^2 \frac{(1 - \alpha)}{\alpha^2}} + \frac{(m - B_0)}{2}$$

$$+ \frac{(m - B_0)^2}{4 \sqrt{(m - B_0)^2 + \frac{F^2(1 - \alpha)}{\alpha^2}}}$$

$$(16)$$

Defining the (gross) abnormal return for a firm that announces a convertible issue with terms $(\alpha, F)$ by $AR(\alpha, F) \equiv S(\alpha, F, m, B_0)/S_0(m, B)$, and using equation (15), the expression for the abnormal announcement return is:

$$AR(\alpha, f) = \frac{1}{4k} \sqrt{1 + f^2 k^2 \frac{(1 - \alpha)}{\alpha^2}} + \frac{1}{2k} + \frac{1}{4k} \left( \sqrt{1 + f^2 k^2 \frac{(1 - \alpha)}{\alpha^2}} \right)^{-1}$$

$$(17)$$

where $f \equiv F/S_0$ is the face value of the convertible expressed as a fraction of the pre-announcement equity value. Equation (17) predicts that the announcement return is

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increasing in f, the face value ratio, and decreasing in $\alpha$, the conversion ratio, for $\alpha < 1$. This is the hypothesis we shall test below.

# II

# DATA

The basic data consist of the details of 155 public offerings of convertible debt announced during the ten year period from 1976 to 1985[10]. As reported by Lee, Jen and Choi (1992), an initial sample of 608 offerings was obtained from the Registered Offering Statistics File of the Securities and Exchange Commission, and an additional 74 offerings were identified from *Moody's Bond Survey*. The total sample of 682 offerings was reduced to 155 by excluding 163 offerings made by utility or financial firms; 242 offerings for which the issuer's stock returns were not available for a period from 250 days prior to the offering to 20 days after the offering; 56 issues because the offering was not announced in the Wall Street Journal or was announced in conjunction with other company news; 20 offerings because they were rights, extended or exchange offerings, private placements or shelf registered offerings; 34 issues because the issuing company could not be identified on the Compustat data base.

For each of the final sample of 155 offerings for which complete data were available, the two-day announcement period abnormal return was calculated by estimating a market model regression using the CRSP equal weighted market index over the 250 trading days preceding the announcement. For each issue the issue date, the conversion price, the face value of the bond, the number of shares outstanding at the time of the issue and the size of the firm, measured by the market value of the equity two days before the announcement, were collected. $f \equiv F/S_0$ was then taken as the ratio of the face

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[10] We are grateful to Seyong-Hyo Lee who kindly made available to us the data he had collected for his dissertation.

value of the debt to the value of the equity two days prior to the announcement, and $\alpha$, the fraction of the equity into which the issue is convertible was calculated from the conversion price, the face value of the issue and the original number of shares outstanding. The Straight Debt Value (SDV) of each issue was estimated by discounting the promised coupon and principal payments by the Baa bond yield at the time of issue. Finally the difference between the coupon rate on the convertible and the prevailing Baa yield (XCOUP)was computed. Summary statistics are presented in Table 1.

It may be seen that the average issue is accompanied by an abnormal announcement return of -2.2%[11]. The fraction of the equity into which the bond is convertible ranges from 3.7% to 52.2% with a mean of 16.3%. On average, the coupon on the convertible is 4.1% below that Baa yield; however, some issues are made at yields in excess of the Baa yield. The coupon savings made possible by the conversion feature are reflected in the statistics for the ratio of the straight debt value to the face value: for the average bond the estimated straight debt value is 85% of the face value, so that the conversion feature accounts for about 15% of the bond value at issue. The convertibles typically have long maturities, the most common being 25 years and the average is over 22 years.

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[11] This compares with an average abnormal announcement return of -2.31% reported by Dann and Mikkelson (1984) for a sample of 132 convertible debt issues, and -1.66% reported by Kim and Stulz(1992) for a sample of 280 domestic convertible issues (they find an average abnormal return of -0.47% for a sample of 166 Eurobond convertibles).

# III

## Empirical Results


Equation (17) predicts a non-linear relation between the announcement return and the face value ratio, f, and the conversion ratio $\alpha$. However the precise functional form of equation (17) is the result of the assumption that the firm's payoff in uniformly distributed and the auxiliary Assumption A about the investors' prior distribution over firm types. Neither assumption is likely to be satisfied in practice and efforts to estimate the parameter of proportionality by non-linear methods were discouraging. Therefore we experimented with a variety of functional forms. Since the expressions involving f and $\alpha$ enter equation (17) in a multiplicative fashion, the dependent variable was taken as the logarithm of (one plus) the announcement return, and the independent variables as the logarithm of the face value ratio and the logarithm of various transformations of the conversion ratio.

The ordinary least squares regression results are reported in Table 2. For all three transformations of the $\alpha$ variable the coefficients of both variables have the predicted sign, and the precise form of the functional specification makes little difference to the results. For all three specifications the announcement return is increasing in the face value ratio, F/S, and decreasing in the conversion ratio, $\alpha$, as the theory predicts, and both coefficients are significant at conventional levels. The regressions explain 12-14% of the abnormal announcement period returns, as compared for example with only 6-9% in the corresponding Kim-Stulz(1992) regressions.

Table 3 reports the results of simple regressions corresponding to those shown in Table 2. In all cases the announcement return is decreasing in the conversion ratio $\alpha$ and

the coefficient is highly significant. This is broadly consistent with the findings of others that an equity issue is a signal of bad news and informal reasoning that the higher is $\alpha$ the bigger is the implicit equity issue. Most significantly however, we find that the coefficient of the face value ratio in the simple regressions is negative, the opposite of its sign in the multiple regressions, and of its theoretical sign in the signalling model. The negative sign in the simple regression is consistent with the Miller-Rock (1985) model in which external financing conveys bad news about the firm's current cash flows since the face value of the debt is approximately equal to the amount of financing raised. However, it is the interaction of the face value ratio and the conversion ratio that it important in the signalling model, and it is striking that the coefficient of the face value ratio changes from the "wrong" sign in the simple regression to the predicted sign, once the conversion ratio is included in the regression.

Table 4 tests for the significance of other variables, not included in the signalling model, which have either been suggested by others as determinants of the abnormal return, or which intuition suggests may be relevant. The signalling model is a single period model and therefore assigns no role to the coupon rate on the debt. In order to determine whether the coupon rate conveys significant information to the market in addition to the theoretical signalling variables, f and $\alpha$, XCOUP, the difference between the coupon rate and the contemporaneous Baa yield at issue, was added to the regressions, and the results are reported in the first column of Table 4. We find that the higher is the coupon rate on the issue relative to the Baa yield the lower is the announcement period return, and that the relation is significant on conventional criteria, though XCOUP is less important than the two variables predicted by the signalling model. In regression (2) bond maturity (MAT) is insignificant. Regression (3) shows that the

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conversion premium (CPREM), which Kim and Stulz (1992) and Lee, Jen and Choi (1992) had found to be a significant predictor of announcement returns, is insignificant once the effect of the signalling variables is controlled for. Finally, the face value of the debt, F, and the conversion ratio, CRATIO, which is the theoretical signalling variable of the Kim (1990) model, are insignificant.

Thus, the theoretical predictions of the Brennan-Kraus model are generally supported by the empirical evidence, insofar as the two theoretical variables implied by the theory enter the announcement return regressions significantly and with the predicted sign, while other variables that have been used or suggested by others are not generally significant, the exception being the excess coupon variable. The significance of this variable points to the need to extend the implications of the Brennan-Kraus framework to a multi-period setting in which the implications different call provisions as well as coupon rates could be considered. A further limitation of the Brennan-Kraus model is that it does not impose the condition that the face value of the debt, F, be equal to the amount of capital raised, K, whereas in fact of course bonds are always sold at a price close to par. The coupon rate, which is neglected in this model, is an important instrument for bringing the bond value to par.

The Brennan-Kraus signalling model rests on an assumed asymmetry of information between the issuing firm and investors. While such an assumption seems reasonable in the case of public issues, it is less compelling for private placements[12]. Therefore it is of interest to determine whether the Brennan-Kraus model performs as well for private placements of convertibles. Paige Fields ran for us the regressions

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[12] Hertzel and Smith(1993, p484) find 'evidence that the discounts at which private placements of equity are made reflect the costs incurred by private investors to assess firm value'.

reported in Table 5 for a sample of 61 private placements of convertible bonds made between 1970 and 1987[13]. In contrast to the success of the model variables in predicting announcement returns for public issues, they have virtually no explanatory power for the private placement sample. This is consistent with the prior studies cited above that find different announcement effects for public and private placements of equity and convertibles, and in particular is consistent with the hypothesis that publicly issued convertibles are designed to mitigate problems of asymmetric information, and that this consideration is less important for private placements so that other considerations predominate in the design of privately placed convertible issues.

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[13] A full description of the data is to be found in Fields and Mais (1991).

# IV

## CONCLUSION

In this paper we have tested the implications of the Brennan-Kraus model of information signalling by a convertible bond issue for the stock returns of issuers of convertible bonds around the date of the issue announcement. Given an additional assumption about investors' prior distribution over firm types, the model predicts that announcement period returns will be positively related to the ratio of the face value of the debt to the pre-announcement equity value, the face value ratio, and negatively related to the fraction of the equity into which the bond is convertible, the conversion ratio. Both model predictions are strongly supported by the data. The finding for the conversion ratio may not appear too surprising in view of intuitions derived informally from Myers and Majluf(1984) suggesting that the more 'equity-like' an issue, the more negative should be the abnormal return. However, the finding for the face value ratio, while consistent with this signalling model, is quite at odds with what would be expected from the model of Miller and Rock (1985), since bonds are typically sold at close to face values, so that the face value ratio is a measure of the size of the financing which, in the Miller-Rock analysis carries negative information about the value of the firm.

On the other hand, we also find that the coupon rate on the bond, which plays no role in the single period Brennan-Kraus model, conveys significant information about firm payoffs. This points to the need to extend the Brennan-Kraus analysis to a multi-period setting in which additional contractual features of convertibles can be considered.

Finally, the model is found to have no explanatory power for announcements of private placements of convertibles which is consistent with asymmetric information

problems being a prime consideration in the design of public issues but not of private

placements.

|  | Average | Standard Deviation | Maximum | Minimum |
|---|---|---|---|---|
| $\alpha$ | 0.163 | 0.104 | 0.522 | 0.037 |
| FV/S | 0.271 | 0.238 | 1.356 | 0.050 |
| ARET | -0.022 | 0.032 | 0.109 | -0.102 |
| XCOUP | -0.010 | 0.010 | 0.020 | -0.035 |
| Maturity (years) | 22.10 | 3.72 | 30 | 7 |
| SDV/FV | 0.850 | 0.156 | 1.440 | 0.480 |

Convertible Bond Sample Characteristics
$\alpha$: fraction of equity into which bond convertible;
FV/S: ratio of bond face value to equity value at announcement;
ARET: 2-day abnormal announcement return
XCOUP: convertible bond yield less Baa yield at announcement
SDV/FV: ratio of estimated straight debt value (using Baa yield)
to face value at time of issue.

Table 1

| Constant | ln F/S | ln[(1-α)/α] | ln[(1-α)/α²] | ln α | $R^2$ | F-stat (d.f.) | N |
|---|---|---|---|---|---|---|---|
| -0.074 | 0.029 | | | -0.049 | 0.12 | 10.65 | 15 |
| (6.21) | (2.50) | | | (3.50) | | (2,152) | |
| -0.051 | 0.035 | 0.048 | | | 0.14 | 12.28 | 15 |
| (7.61) | (2.96) | (3.92) | | | | (2,152) | |
| -0.062 | 0.033 | | 0.024 | | 0.13 | 11.63 | 15 |
| (6.97) | (2.76) | | (3.69) | | | (2,152) | |

(t-ratios in parentheses)

Regressions of log Abnormal Announcement Returns on
log of ratio of Face Value of Convertible to Pre-Announcement Equity (f $\equiv$ F/S)
and transformations of fraction of equity in which bond is
convertible ($\alpha$).

Table 2

| Constant | ln F/S | ln[(1-α)/α] | . ln[(1-α)/α²] | ln α | $R^2$ | F-stat (d.f.) | N |
|---|---|---|---|---|---|---|---|
| -0.039 (6.45) | -0.010 (3.14) | | | | 0.06 | 9.90 (1,153) | 155 |
| -0.046 (6.88) | | 0.013 (3.88) | | | 0.09 | 8.55 (1,153) | 155 |
| -0.049 (6.54) | | | 0.007 (3.85) | | 0.09 | 14.86 (1,153) | 155 |
| -0.053 (6.20) | | | | -0.016 (3.81) | 0.09 | 14.55 (1,153) | 155 |

(t-ratios in parentheses)

Univariate Regressions of log Abnormal Announcement Returns on
log of ratio of Face Value of Convertible to Pre-Announcement Equity (f ≡ F/S)
and transformations of fraction of equity into which bond convertible (α).

Table 3

| Regression | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Constant | -0.066 | -0.059 | -0.063 | -0.053 | -0.045 |
|  | (7.38) | (3.63) | (7.03) | (3.24) | (2.57) |
| ln F/S | 0.037 | 0.033 | 0.033 | 0.037 | 0.037 |
|  | (3.14) | (2.75) | (2.77) | (3.08) | (3.05) |
| $\ln[(1-\alpha)/\alpha^2]$ | 0.026 | 0.025 | 0.025 | 0.026 | 0.026 |
|  | (3.94) | (3.75) | (3.74) | (3.94) | (3.87) |
| XCOUP | -0.006 |  |  | -0.007 | -0.007 |
|  | (2.18) |  |  | (2.36) | (2.44) |
| MAT |  | -0.002 |  | -0.001 | -0.001 |
|  |  | (0.32) |  | (0.94) | (1.21) |
| CPREM |  |  | 0.001 | 0.002 | 0.003 |
|  |  |  | (0.13) | (0.37) | (0.51) |
| F |  |  |  | 0.000 | -0.000 |
|  |  |  |  | (0.12) | (0.28) |
| CRATIO |  |  |  |  | -0.000 |
|  |  |  |  |  | (1.16) |
| $R^2$ | 0.16 | 0.13 | 0.13 | 0.17 | 0.17 |
| F-Statistic | 9.54 | 7.75 | 7.71 | 4.88 | 4.39 |
| (d.f.) | (3,151) | (3,151) | (3,151) | (6,148) | (7,147) |

(t-ratios in parentheses)

Regressions of log Abnormal Announcement Returns on Model Variables (F/S and $\alpha$) and additional non-model variables: XCOUP: excess of coupon rate over Baa yield; MAT: maturity of issue in years; CPREM: conversion premium(proportional excess of conversion price over pre-announcement stock price); F: face value of issue in $m; CRATIO: number of shares into which each $1000 bond is convertible.

Table 4

| Const-ant | ln F/S | $\ln[(1-\alpha)/\alpha]$ | $\ln[(1-\alpha)/\alpha^2]$ | ln $\alpha$ | $R^2$ | F-stat (d.f.) |
|---|---|---|---|---|---|---|
| 0.042 | 0.012 | | | 0.016 | 0.03 | 0.77 (2, 52) |
| (1.87) | (0.75) | | | (0.13) | | |
| 0.006 | 0.003 | 0.007 | | | 0.01 | 0.20 (2,52) |
| (0.31) | (0.19) | (0.60) | | | | |
| 0.004 | 0.003 | | 0.004 | | -0.03 | 0.22 (2,52) |
| (0.20) | (0.21) | | (0.62) | | | |

(t-ratios in parentheses)

Regressions of log Abnormal Announcement Returns on
log of ratio of Face Value of Convertible to Pre-Announcement Equity (f $\equiv$ F/S)
and transformations of fraction of equity in which bond is
convertible ($\alpha$), for a sample of Privately Placed Convertibles[Fields andMais (1991)].

Table 5

# REFERENCES

Bhattacharya, S., 1980, Nondissipative Signalling Structures and Dividend Policy, Quarterly Journal of Economics, 95, 1-24.

Brennan, M.J., 1986, Costless Financing Policies under Asymmetric Information, unpublished manauscript.

Brennan, M.J., and A. Kraus, 1987, Efficient Financing under Asymmetric Information, Journal of Finance, 42, 1225-1243.

Brennan, M.J., and E.S. Schwartz, 1986, The Case for Convertibles, Chase Financial Quarterly, 1, 27-46.

Dann, L.Y., and W.H. Mikkelson, 1984, Convertible Debt Issuance, Capital Structure Change and Financing Related Information, Journal of Financial Economics, 13, 157-186.

Eckbo,, B.E., Maksimovic, V., and J. Williams, 1990, Consistent Estimation of Cross-Sectional Models in Event Studies, The Review of Financial Studies, 3,343-366.

Fields, L.P., and E.L. Mais, 1991, The Valuation Effects of Private Placements of Convertibles, Journal of Finance, 46, 1925-1932.

Green, R.C., 1984, Investment Incentives, Debt and Warrants, Journal of Financial Economics, 13, 115-36.

Hertzel, M., and R.L. Smith, 1993, Market Discounts and Shareholder Gains from Placing Equity Privately, Journal of Finance, 48, 459-485.

Jensen, M.C., and W.H. Meckling, 1976, Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure, Journal of Financial Economics, 3, 305-60.

Kim, Y.O., 1990, Informative Conversion Ratios: A Signalling Approach, Journal of Financial and Quantitative Analysis, 25, 229-44.

Kim, Y.O., and R. M. Stulz, 1992, Is there a Global Market for Convertible Bonds?, Journal of Business, 65, 75-91.

Lee, S-H., Jen, F.C., and D. Choi, 1992, Adverse Selection, Cost of Financial Distress, Growth Funding and Assets Substitution: A Test of the Differential Impact of Convertible Debt Offerings on the Shareholders' Wealth, unpublished manuscript.

Miller, M,H., and K. Rock, 1985, Dividend Policy under Asymmetric Information, Journal of Finance, 40, 1031-51.

Modigliani. F., and M.H. Miller, 1958, The Cost of Capital, Corporation Finance, and the Theory of Investment, American Economic Review, 40, 261-297.

Myers, S.C., and N.S. Majluf, 1984, Corporate Financing and Investment Decisions when Firms have Information that Investors do not have, Journal of Financial Economics, 13, 187-221.

Nyborg, K., 1991, Signalling through Convertible Debt Call Policy and the Mode of External Financing, unpublished manauscript.

Stein, J., 1992, Convertible Bonds as 'Backdoor' Equity Financing, Journal of Financial Economics, 32, 3-22.

Wruck, K., 1989, Equity Ownership Concentration and Firm Value: Evidence from Private Equity Financings, 23, 3-28.