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Introduction

Because bond contracts are incomplete, firms have some discretion to take actions that transfer wealth from bondholders to shareholders. A number of recent studies suggest that increasing leverage is an example of this type of action.[1] Bondholders can react to such opportunistic behavior in a number of different ways. First, if the bondholders believed ex ante that a firm would likely behave opportunistically in some states of nature, those beliefs would already be reflected in the firm's debt contracts and the price of its debt. Accordingly, if the firm were to attempt to transfer wealth from bondholders to shareholders in these states, bondholders would have no need to revise their prior beliefs and adjust their behavior.

In the second case, bondholders are surprised by the opportunistic behavior of a firm. If bondholders believe that this firm shares an important characteristic with a large subset of firms, then they might demand explicit protection against this type of behavior from this entire subset of firms. Crabbe (1991) notes a recent example of this where bondholders demanded super poison puts from U.S. industrial firms in the aftermath of the RJR-Nabisco restructuring.

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[1] Lehn and Poulson (1988) and Marais, Schipper, and Smith (1989) find that there are no significant bondholder losses when LBO's are announced. However, Warga and Welch (1990) argue that this finding is due to the fact that both of these studies use a data set that poorly captures changes in bond prices. Using a different data set, they find that bond prices fall significantly when leveraged buy-outs are announced. Asquith and Wizman (1990) and Crabbe (1991) also find that bondholders suffer statistically significant losses when LBO's are announced.

Finally, if a firm takes unexpected actions that harm bondholders, bondholders might revise their expectations of only this firm's behavior. For instance, assume that bondholders initially believe that a firm's managers would be reluctant to increase leverage because the managers are risk averse and much of their human capital is tied to the survival of the firm. In this case, an increase in leverage could tell bondholders that a firm's managers are more willing to tolerate risk to their human capital than the bondholders had previously thought. If bondholders believe that this information is relevant primarily to this particular firm, then we would expect that they would demand more explicit protection only from this particular firm. This type of bondholder behavior is predicted by reputation models such as Diamond (1989) and Klein and Leffler (1983).

This paper tests whether the relationship between bondholders and firms is captured by these reputation models. Do bondholders actually demand more protection from those firms that have taken actions in the past that were harmful to them? Specifically, this paper considers whether firms that have increased leverage in the past are more likely than other firms to issue convertible debt rather than straight debt.[2] The first section of this paper discusses the advantages and disadvantages

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[2] More detailed bond indentures also give bondholders more explicit protection. However, it would be difficult to obtain some quantitative measure of how well bondholders are protected by both the covenants of a particular bond issue and the covenants of a firm's other bond issues. For this reason, this paper only uses a convertibility privilege to proxy for explicit bondholder protection.

of convertible debt. In the second section, a probit model tests whether past increases in leverage lead to a higher probability that convertible debentures are issued given that debentures are issued.

The Uses of Convertible Debt

Financial economists have advanced two explanations for the use of convertible debt. First, Brennan and Schwartz (1982) and Brealey and Myers (1986) suggest that bondholders prefer convertible debt when it is difficult to evaluate the riskiness of a firm's projects. If there is asymmetric information such that firms know the riskiness of their projects but potential bondholders do not, then there could be an adverse selection problem in which risky firms issue debt but less risky firms do not. Bondholders can ameliorate this problem by demanding convertible bonds. If the firm's projects are risky, then the convertibility option is valuable. If the firm's projects are not risky, then the bonds are valuable.

Convertible debt can also be used to reduce two agency problems between bondholders and shareholders. The first problem arises because shareholders can dilute the bondholders' claim on a firm's assets by selling additional debt. The second problem arises because bondholders loan money with the expectation that the firm will invest in projects with a specific payoff distribution. However, once bondholders have loaned the firm money, the shareholders have an incentive to increase the riskiness of the firm's projects and obtain a payoff distribution

with greater variance. The shareholders gain because they receive the benefits when the riskier projects succeed and bondholders bear the losses when the riskier projects fail.[3]

A convertibility privilege partially protects bondholders against a wealth loss arising from these agency problems, because the convertibility privilege represents a claim on the upper tail of the distribution of cash flows.[4] Also, because bondholders can reclaim part of any wealth that shareholders expropriate by increasing leverage or the variability of the firm's cash flows, shareholders have less incentive to expropriate bondholder wealth. Masulis (1980) finds that convertible debt fares better than nonconvertible debt when leverage is increased. Also, Marais, Schipper, and Smith (1989) find that convertible debt fares better than nonconvertible debt when leveraged buy-outs are announced.

Convertible debt is not a costless means of protecting bondholders against a wealth loss. Convertible debt dilutes the shareholders claim on a firm's residual return, because it offers bondholders a claim on the upper tail of a firm's payoff distribution. Consequently, convertible debt reduces the incentive of shareholders to monitor a firm's managers. Thus, convertible debt ameliorates the shareholder-bondholder agency problem at the cost of exacerbating the shareholder-management agency problem. For this reason, we would expect that

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[3] See Jensen and Meckling (1976)

[4] See Jensen and Meckling (1976) and Green (1984).

convertible debt would be used only where bondholders have little information regarding a firm's riskiness or where the shareholder-bondholder agency problem is especially severe.

In a previous study, Mikkelson (1980) used a probit model to test whether the offer of debt with options privileges was correlated with a set of regressors that proxied for the severity of the shareholder-bondholder agency problem. Mikkelson found a statistically significant positive relationship between the offer of debt with options privileges and the maturity length of a debt issue, the leverage of the firm (debt/equity or debt/assets), and the growth opportunities of the firm (measured as the growth rate of assets). The size of the debt issue (issue size/equity or issue size/assets) was negatively correlated with the offer of debt with options privileges, but this relationship was not statistically significant. Mikkelson argued that these results generally support the agency explanation for convertible debt.

III Empirical Results

In this section, a probit model is used to test whether the probability that a firm issues convertible debentures rather than straight debentures is related to both past changes in the firm's debt/assets ratio and the firm's present characteristics. Thus, whereas Mikkelson's model examines the present characteristics of the firm, this model examines both the firm's present characteristics and its past behavior. In this model an observation is an issue of debentures by a nonfinancial, nonutility firm between Jan. 1, 1980 and Dec. 21, 1987. To be

included the issuing firm must have had outstanding debt ten years prior to the issue. The data were collected from two sources. Moody's Bond Record publishes a list of corporate debt offerings. From this list I obtained the issuing firm, the issue date, the size of the issue, the maturity of the issue, and the type of the issue (e.g. convertible debentures, straight debentures). The income statement data were obtained from Compustat.

The probit model is specified as follows. The summary statistics are listed in Table I.

$$1) \quad CONV^* = \alpha_1 + \alpha_2 D + \beta_1 LEV + \beta_2 DLEV + \beta_3 RND + \beta_4 SIZE + \beta_5 ASSETS + \beta_6 MATUR + \epsilon$$

where:

$CONV^*$ - a latent variable measuring the probability that convertible bonds are issued given that bonds are issued. ($CONV^*$ is unobservable. What we observe is a dummy variable CONV defined as CONV = 1 if $CONV^* > 0$, CONV = 0 otherwise.)

LEV - is the difference between the average debt/assets ratio for the five years immediately preceding the issuance of the debentures and the average debt/assets ratio for the five years preceding that. Thus, if debentures were issued in June 1980 then LEV = $\text{debt/assets}_{75\text{-}79} - \text{debt/assets}_{70\text{-}74}$.

D - is an intercept dummy variable equal to 1 when LEV is positive and equal to 0 otherwise.

DLEV - is a slope dummy variable indicating whether LEV is positive.

RND - is the ratio of research and development to sales.

SIZE - is the size of the new issue ($ billion).

ASSETS - is the total assets of the firm in the year prior to the issuance of the debentures ($ billion).

MATUR - is the maturity length of the debt issue. MATUR is measured as the number of years between the issue date of the debentures and the maturity date.

The inclusion of LEV, D, and DLEV allows us to estimate separate relationships between decreases in leverage and the probability that convertible debt is issued and increases in leverage and the probability that convertible debt is issued. The first relationship is captured by the coefficient of LEV. The second relationship is captured by the sum of the coefficients of LEV and DLEV ($\beta_1 + \beta_2$). The intercept dummy variable allows the intercepts of the two relationships to differ.

The predicted coefficient signs of LEV, D, and DLEV are the following. The coefficient of LEV would be negative if the group of firms that had substantially decreased leverage was more likely to issue convertible debt than the group of firms that had only slightly decreased leverage. We might expect this result if

the group of firms that had substantially decreased leverage was comprised largely of firms that had been highly leveraged in the past. These firms may have increased leverage in the past or may have started out highly leveraged. Firms that substantially increased leverage and then decreased leverage would be more likely to issue convertible debt if bondholders still distrusted them for the initial increase in leverage. Firms that had started highly leveraged and then decreased leverage would be more likely to issue convertible debt if the past high leverage revealed unfavorable information about the firm. For instance, past high leverage might tell bondholders that the firm's managers are willing to tolerate a high level of risk to their human capital.

The coefficient of the intercept dummy would be positive if firms that had increased leverage are more likely to issue convertible debt than firms that had decreased leverage. We would expect this if an increase in leverage revealed unfavorable information about the firm.

The coefficient of DLEV should be positive. If firms that had substantially increased leverage are more likely to issue convertible debt than firms that had increased leverage only slightly, then the sum of the coefficients of LEV and DLEV should be positive. We would expect this if larger increases in leverage reveal more unfavorable information than smaller increases in leverage. Since the coefficient of LEV should be negative, the coefficient of DLEV should be positive.

The coefficient of RND should be positive. Shareholders can more easily increase the riskiness of a firm's payoff distribution when the firm has a wide range of investment opportunities. The ratio of research and development to sales proxies for the scope of these investment opportunities.

The coefficients for both SIZE and ASSETS should be negative. Brealey and Myers (1988) and Brennan and Schwartz (1983) suggest that bondholders prefer convertible debt when it is difficult to evaluate the riskiness of a firm's projects. In a large bond issue the cost of obtaining information regarding the riskiness of the issue is spread over a greater dollar value. Thus the size of the issue proxies for the relative difficulty of assessing the riskiness of the issue. The asset value of a firm proxies for the difficulty in assessing the riskiness of a firm's projects. Bondholders can better assess the riskiness of larger firms, since larger firms are likely to have issued debt and equity previously.

Finally, the coefficient for MATUR should be positive, because it is harder to assess the riskiness of bonds with longer maturities. Mikkelson (1980) found a positive relationship between MATUR and the offer of debt with warrants.

The results are listed in Table II.[5] The coefficient of the intercept dummy is positive but not statistically significant. The coefficient of LEV is negative and statistically significant.

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[5] There is some multicollinearity among the variables. LEV, DLEV, and RND are correlated. SIZE, ASSETS, and MATUR also are correlated.

Thus, firms that have decreased leverage substantially are more likely to rely on convertible debt than firms that have decreased leverage only slightly. Since, only a highly leveraged firm could decrease leverage substantially, this finding suggests that bondholders distrust these firms, because these firms were highly leveraged in the past. The sum of the coefficients of LEV and DLEV measures the effect of an increase in leverage on the probability that convertible debt is issued. The slope of this sum is positive (3.87 - 2.28 = 1.59) and statistically significant.[6] Therefore, firms that have increased leverage substantially are more likely to rely on convertible debt than firms that have increased leverage only slightly. Finally, the addition of LEV and DLEV as explanatory variables significantly increases the explanatory power of the model. The chi-square value of the incremental contribution is 10.1 with 2 degrees of freedom. This is significant at the 0.01 level.

The coefficient of RND is positive and statistically significant.[7] RND proxies for the ease with which shareholders can increase the riskiness of a firm's payoff distribution. Thus, this result supports the agency theory for the use of convertible debt.

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[6] $[Var(LEV) + Var(DLEV) + 2(Cov(LEV,DLEV))^{1/2} = s.e.$

$[1.08 + 1.65 - 2(1.10)]^{1/2} = 0.73 = s.e.$

then $1.59/0.73 = 2.18$

[7] Roughly half of the observations for RND were missing. The mean of the non-missing RND observations was substituted for these missing observations.

The coefficients of SIZE and ASSETS are negative and statistically significant. This suggests that it is easier for bondholders to assess the riskiness of bonds when the firm is large and the issue size is large. This result is consistent with the theory of Brennan and Schwartz (1982) and Brealey and Myers (1986).

The coefficient of MATUR is positive but not statistically significant. This result probably differs from Mikkelson (1980) because Mikkelson examined both notes and debentures, whereas this study examines only debentures. Notes have a shorter maturity and are far less likely to include warrant privileges.

Two other explanatory variables, the debt/assets ratio and the investment/assets ratio were included in another specification of the probit model. The debt/assets ratio was included because Mikkelson (1980) found a positive relationship between a firm's debt/assets ratio and the offer of convertible debt. The investment/assets ratio was included as a second proxy for the ease with which shareholders can increase the riskiness of a firm's payoff distribution. The inclusion of these variables alters neither the significance of the individual coefficients nor the significance of the model. The chi-square value of the incremental contribution is 0.09 with 2 degrees of freedom.

Conclusion

This paper examines whether bondholders use the information that a particular firm increased leverage in the past to revise

their estimate of the probability that that particular firm will take future actions that are harmful to bondholders. If bondholders do revise their estimate, then we would expect that bondholders would demand more explicit protection against an expropriation of their wealth from these firms. To test whether this is the case, this paper examines whether bondholders are more likely to demand convertible debt rather than straight debt from firms that have increased leverage. I find that among firms that have increased leverage, firms that have substantially increased leverage are more likely to issue convertible debt than firms that have increased leverage only slightly. Among firms that have decreased leverage, firms that have substantially decreased leverage are more likely to issue convertible debt than firms that have decreased leverage only slightly. Since only firms that had been highly leveraged in the past can substantially decrease leverage, this result suggests that bondholders demand more explicit protection against an expropriation of their wealth from firms that either have increased leverage in the past or had started out highly leveraged. Thus, this last result is not inconsistent with the reputation theories discussed earlier.

Table I

Descriptive statistics for models where increases in leverage proxy for opportunistic behavior by the firm (N=614)

Variable	Description	Mean	Std. Dev.
LEV	- the change in the debt/assets ratio between the two five year periods prior to the bond issue	0.0239	0.1264
DLEV	- slope dummy variable indicating if LEV is positive	0.0471	0.1028
RND	- the ratio (research and development/sales)	0.0281	0.0183
SIZE	- size of the new issue ($ billion)	0.1340	0.1261
ASSETS	- the total assets of the firm in the year the debt was issued ($ billion)	6.284	12.333
MATUR	- the maturity length of the debt issue (years).	23.187	6.864

Table II

PROBIT ESTIMATES OF AN INCREASE IN LEVERAGE ON THE PROBABILITY THAT CONVERTIBLE DEBENTURES ARE OFFERED GIVEN THAT DEBENTURES ARE OFFERED

	Estimated Coefficient	t-Ratio	Elasticity at the Mean
Intercept (α_1)	-1.03	(-3.74)*	-1.567
D (α_2)	0.23	(1.52)	0.206
LEV (β_1)	-2.28	(-2.18)*	-0.083
DLEV ($\beta 2$)	3.87	(3.01)*	0.277
RND (β_3)	14.9	(3.59)*	0.635
SIZE (β_4)	-1.32	(-1.99)*	-0.137
ASSETS ($\beta 5$)	$-0.13 * 10^{-3}$	(-5.77)*	-1.269
MATUR (β_6)	0.016	(1.62)	0.558

chi-square value	145.2*
degrees of freedom	7

observations

CONV = 0:	433
CONV = 1:	181
total:	614

* significant at the 0.05 level

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