Changes in Corporate Capital Structures: Evidence from the 1986 Tax Reform Act

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Abstract

This paper employs choice-theoretic models to study the impact of the 1986 Tax Reform Act on firms' issue behavior and the determinants of corporate capital structures. Choice-theoretic models allow researchers to examine firms' leverage decisions at the margin. Both parametric and semi-parametric estimations are employed to perform a more precise statistical inference. The results show that firms tend to issue more debt after the 1986 Tax Reform Act. The results also support the theories based on the trade-off between tax shields and financial distress costs, corporate non-debt tax shields, and agency costs inclusive of those from free cash flows.

I. Introduction

The 1986 Tax Reform Act, which drastically changed the tax regime, provides a good opportunity to evaluate the impact of taxes on corporate capital structure decisions. Ben-Horim, Hochman, and Palmon (1987) theoretically developed an argument that the Tax Reform Act is likely to induce firms to increase their leverage. The intent here is to empirically investigate the effect of the 1986 act by examining the influence of the act on corporate decisions to issue debt or equity while controlling for a number of other variables that have theoretic or empirical relevance to the decision.

For the controlling variables, theories often produce different empirical predictions. For example, while Miller (1977) and Haugen and Senbet (1978) argue for the irrelevancy of corporate capital structures, Kraus and Litzenberger (1973), Scott (1976), and Kim (1978) assert that there is an optimal capital structure. Therefore, the second objective of this paper is to delineate the explanatory power of various theories.

The third objective is to improve on the estimation technique. This paper addresses the following two issues which make it difficult to perform a successful empirical analysis in this area. First, capital structure theories express the relevant firm attributes in fairly abstract concepts. Thus, obtaining good proxies for the unobservable theoretical attributes becomes a very difficult task. To overcome the problem, several different variables are used for each theoretical attribute as explained in the next section. Second, using inappropriate estimation techniques can lead to a false inference about empirical data. To address this problem, both parametric and semi-parametric techniques are employed to estimate the parameter values. The coefficients obtained from binary response analyses imposing

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normal and logistic distributions are then compared with those obtained from a semi-parametric technique called the maximum score estimation.

Moreover, this paper addresses the question of how companies actually select between different financing instruments when they need new capital. Previous studies examined the debt/equity ratios, which are the cumulative result of past capital structure decisions taken under varying circumstances. However, to perform a more precise test of theories, researchers must investigate firms' capital structure decisions at the margin[1]. This paper employs choice-theoretic models to study firms' actual financing decisions at the margin, given their current situation[2]. The remainder of the paper is organized as follows. In the next section, the variable definitions and the empirical predictions for them are discussed. Section III describes the data set used in the analysis. Empirical results are presented in Sections IV. Finally, Section V concludes the paper.

II. Variables and Empirical Predictions

This section discusses variable definitions and the empirical predictions for them. To examine the effect of the tax regime change on corporate capital structures requires the use of a tax reform dummy variable. The value of the dummy variable is set to zero if the firm issues securities before 1986 and one otherwise. Since the Tax Reform Act has reduced the maximum tax rate for individual income from 50 percent to 28 percent, the tax burden on interest income has been substantially reduced. Although the Tax Reform Act has also reduced the maximum tax rate for corporate income from 46 percent to 34 percent, thereby reducing the tax burden on the returns to equity at the corporate level, the latter reduction was smaller. Furthermore, reduction in the tax burden on equity returns has been partially offset since the tax burden on capital gains at the security holder level has increased. Thus, the overall tax burden on the returns to equity has not been reduced as much as the tax burden on the returns to debt, which predicts an increased use of debt[3]. In addition, the DeAngelo and Masulis (1980) argument that there is substitution between debt and other deductions in shielding corporate income taxes also predicts a leverage increase since the 1986 Tax Reform Act has eliminated the investment tax credit.

Several other variables are also employed along with the tax dummy to control for other factors that have relevance to the decision to issue debt or equity. First, the standard deviation of the percentage change in operating income and the ratio of the standard deviation of operating income over average total assets are used as proxies for financial distress. As Kraus and Litzenberger (1973), Scott (1976), Kim (1978), and Altman (1984) argue, if the trade-off between tax shields and bankruptcy costs is a valid description of the practice, firms' optimal debt level should be a decreasing function of the variability of earnings. Also, the risk shifting arguments of Galai and Masulis (1976), Jensen and Meckling (1976), and Myers (1977) predict a negative relationship between the level of debt and the variability of operating income. They suggest that shareholders of levered firms have an incentive to invest suboptimally to expropriate wealth from debtholders. Then, ceteris paribus, firms with a higher variability of earnings have a greater possibility that shareholders expropriate wealth from debtholders. The resulting high cost of debt for such firms will discourage the use of debt capital. However, Miller (1977) and Haugen

and Senbet (1978) predict no relationship between leverage and earnings variability. Miller argues that the bankruptcy costs are too small to work as a balancing factor to corporate tax shields benefits, and shows the capital structure irrelevancy by incorporating both corporate and personal income taxes in the equilibrium framework. Haugen and Senbet also suggest the insignificance of bankruptcy costs claiming that the costs commonly attributed to bankruptcy are more appropriately attributed to liquidation which is a capital budgeting decision independent of bankruptcy.

The second group of variables contains sales volume and total assets as indicators for firm size. Scott (1976), in his multi-period model, shows that the optimal level of debt is an increasing function of the size of the firm. Warner (1977) and Ang, Chua, and McConnell (1982) provide evidence that direct bankruptcy costs appear to constitute a larger proportion of firm value as firm value decreases. Presumably, relatively large firms may tend to be more diversified and less prone to bankruptcy. Thus, large firms will tend to employ more debt than small firms. As for the size variable, agency theories offer two different predictions. On the one hand, large firms will tend to be more carefully monitored, which reduces the possibility of conflicts among stakeholders. The resulting lower cost of debt enables large firms to issue a relatively greater amount of debt. On the other hand, however, Grossman and Hart (1982) predict a negative relationship between leverage and firm size. Large firms do not have to employ a large amount of debt to monitor the suboptimal behavior of managers such as 'perk' consumption, since they will be more carefully monitored than small firms.

The third group of variables holds the ratio of fixed assets over total assets and the ratio of the sum of inventory and gross plant and equipment over total assets as proxies for the size of collateralizable assets. Scott (1976) argues that the optimal leverage increases with the liquidation value of the firm's assets. Stulz and Johnson (1985) prove that secured debt actually increases the value of the firm. In general, the value of tangible, i.e., collateralizable, assets is reduced less than that of intangible assets when the firm files bankruptcy. Then, the trade-off theory predicts that the firm with a large amount of collateralizable assets can use a higher level of debt. Agency theories again offer different predictions about collateralizable assets. Galai and Masulis (1976), Jensen and Meckling (1976), and Myers (1977) predict a positive relationship between leverage and the capacity of firms to collateralize their debt. If debt can be collateralized, the borrower is restricted to use the funds for a specified project. Therefore, firms can avoid the agency costs associated with the stockholders' incentive to invest suboptimally. Stulz and Johnson (1985) also predict a positive relationship between leverage and collateral value by arguing that secured debt creditors are less likely to require restrictive covenants about what the firm can or cannot do later on. Contrary to the above prediction, Grossman and Hart (1982) suggest a negative relationship between leverage and the size of collateralizable assets. Firms with a higher level of collateralizable assets do not have to employ a large amount of debt to monitor the suboptimal behavior of managers, since monitoring the capital outlays of such firms is presumably easier.

The fourth group of variables consists of the ratio of the sum of depreciation and investment tax credits over operating income as a proxy for corporate non-debt tax shields. DeAngelo and Masulis (1980) predict that firms with relatively large tax deductions for depreciation and investment tax credits will use a low amount of debt.

The fifth group of variables consists of the proportion of operating income to total sales, the ratio of operating income over total assets, the proportion of retained earnings to total assets, and the fixed charge coverage ratio as proxies for profitability. In a multi-period framework as in Scott (1976), the firm will go bankrupt if operating income is not enough to pay the interest to debtholders. Therefore, the firm with a higher profitability will be able to use a greater debt amount. DeAngelo and Masulis also predict a positive relationship between leverage and profitability. According to the theory based on corporate non-debt tax shields, the more profitable the firm is, the smaller is the probability that the tax shields from debt financing become redundant.

Two additional variables are included to test agency cost based theories. The first group of variables contains the proportion of capital expenditures to total assets and the growth rate of total assets measured by the percentage change in total assets as proxies for growth[4]. As Myers (1977) argues, the agency costs related to the suboptimal investment by equity-controlled firms will be particularly higher for growing firms because firms in their growth phase have more flexibility in their choice of future investments. Thus, Myers predicts a negative relationship between debt amount and growth opportunity. Also, the free cash flow theory by Jensen (1986) predicts a negative relationship between debt and growth opportunity. Jensen asserts that corporate debt can play the role of reducing agency costs by decreasing the resources under managers' control and by exposing the firm to the monitoring of capital markets. Therefore, low growth firms may attempt to maintain a high leverage level to reduce the amount of free cash flows.

The last group of variables tests agency theory, especially free cash flow theory, and includes the ratio of cash over total assets and Tobin's Q. Tobin's Q is computed by dividing the summation of the value of debt and preferred stock and the market value of common stock by the value of total assets. Lang, Stulz, and Walkling (1989, 1991) have also used Tobin's Q to test Jensen's free cash flow hypothesis. The free cash flow theory predicts a positive relationship between leverage and the amount of cash, and a negative relationship between leverage and Tobin's Q. Firms in the maturity stage of their life cycles tend to generate a large amount of cash flow, have fewer investment opportunities, show slower growth rates, and have lower Q-ratios. These firms with a large amount of free cash flow, i.e., firms with low Q-ratios, will use more debt. Table 1 summarizes these variables and the empirical predictions for them from previous studies.

III. Data

The values for all independent variables are computed using data obtained from annual Compustat tapes, and the binary dependent variable, which will be explained in the next section, is collected from the Investment Dealers' Digest. The Investment Dealers Digest is a weekly magazine which contains data for security issues of U.S. companies. As of November 23, 1982, the magazine classifies corporate security issues into four different categories; shelf registration, swaps, initial public offerings, and others. Before 1982, however, the magazine did not specify issue categories, making data for prior years unavailable. From the total of 319 issues, 226 issues which satisfy the following criteria from 1982 to 1987 are selected[5]:

1) Shelf registration, swaps, and initial public offerings are excluded.

2) Convertible debt issues and convertible debt issues with warrants are excluded, because they have characteristics of both debt and equity.

3) Companies missing data from the Compustat tape are excluded.

4) There are 14 companies which issued securities twice during the sample period. In this case, all issues are counted separately so that the final sample size is 226 (182 equity issues and 44 debt issues).

IV. Estimation

This section presents the empirical evidence obtained from parametric estimation followed by the robustness test using semi-parametric estimation. Eight explanatory variables from those variables discussed in the previous section are selected based on the following criteria.

1) At least one variable is selected from each group of variables reviewed in the previous section.

2) There is a potential multicollinearity problem among several variables, since there are several representatives with the same underlying theoretical attributes. In this case, the variable with the higher F-statistic value obtained from a one-way ANOVA test between equity and debt is selected for the test[6]. Formal definitions of the selected variables are presented in the appendix.

Table 2 shows the correlation coefficients among selected variables. All variables have real values which are computed using GNP deflators with the base year of 1980. Correlations among the variables do not appear to be problematic except for NDTS and GROW.

A. Econometric Model

It is assumed that the optimal debt-equity ratio of a firm i at time t, D^*_{it}, is a function of a vector of independent variables, $\underline{X}_{it}$, plus the stochastic error term, u_{it}, i.e.,

$$D^*_{it} = g(\underline{x}_{it}) + u_{it} \qquad (1)$$

With perfect capital markets, the firm would continuously adjust its actual debt-equity ratio to its optimal debt-equity ratio, D^*_{it}, responding immediately to variations in independent variables. However, if there are market imperfections, then the firm may not always equalize its actual debt-equity ratio to D^*_{it}. In this case, the firm will attempt to maximize firm value by considering the marginal benefits and costs of adjusting its capital structure. Therefore, D^*_{it} becomes unobservable, and it is impossible to test directly for those factors which have an influence on the firm's optimal debt-equity ratio decision.

Thus, this paper employs choice-theoretic models to address the question of how companies actually select between different financing instruments when they need new capital. In other words, the firm will issue debt (equity) if the optimal debt-equity ratio is greater (less) than the existing actual debt-equity ratio, i.e., $D^*_{it} > D_{it-1}$ ($D^*_{it} < D_{it-1}$). One of the advantages of the choice-theoretic model is that it allows researchers to study firms' actual financing decisions at the margin, given their current situation. Like other economic theories, corporate capital structure theories are concerned with the marginal decision, not the cumulative result of past capital structure decisions taken under varying circumstances. Therefore, to perform a more precise test of the theories, researchers must investigate firms' capital structure decisions at the margin.

The binary response variable, Y_{it}, is defined as follows.

Y_{it} =1 (0) if firm i issues debt (equity) at time t.

Then,

$$pr(Y_{it} = 1|\underline{x}) = pr(D^*_{it} > D_{it-1}|\underline{x}) \text{ for debt issues, and}$$

$$pr(Y_{it} = 0|\underline{x}) = pr(D^*_{it} < D_{it-1}|\underline{x}) \text{ for equity issues,} \quad (2)$$

where pr(.|.) denotes the conditional probability. For the balance of the paper, all subscripts are suppressed for notational simplicity. Substituting D* in equation (1) into equation (2) and assuming $g(\underline{x}) = \underline{x}' \underline{b}$ provides

$$pr(Y=1|\underline{x}) = pr(u < \underline{x}' \underline{b}\text{-}D|\underline{x}) = F(\underline{x}' \underline{b}\text{-}D) \text{ for debt issues, and}$$

$$pr(Y=0|\underline{x}) = pr(u > \underline{x}' \underline{b}\text{-}D \mid x) = 1\text{-}F(\underline{x}' \underline{b}\text{-}D) \text{ for equity issues,} \quad (3)$$

where F(.) denotes the cumulative distribution function. Then, the probability mass function of $Y|\underline{x}$ is equal to

$$[F(\underline{x}'\underline{b}\text{-}D)]^Y[1\text{-}F(\underline{x}'\underline{b}\text{-}D)]^{1-Y} = [pr(Y=1|\underline{x})]^Y[pr(Y=0|\underline{x})]^{1-Y} \quad (4)$$

Depending on the distributional assumption for F(.), the model can be either logit or probit regression. From equation (4), the logarithm of the likelihood of observing a sample of n observations with r debt issues and (n-r) equity issues is equal to

$$L = \sum_{i=1}^{r} ln\,[pr(y_{i=1} \mid \underline{x})] + \sum_{i=r+1}^{n} ln[1-pr(Y_{i=1} \mid \underline{x})] \quad (5)$$

Equation (5) provides the maximum likelihood estimators which maximize the value of L using logit and probit regressions.

B. Results

Table 3 shows the results from the probit regression over the sample period of 1982 to 1987[7]. The coefficient of the tax reform dummy variable is highly significant with a positive sign, implying that firms are more likely to issue debt after the 1986 Tax Reform Act. This result supports the tax-based theories, including the substitutability between non-debt tax shields and corporate tax shields from debt financing.

The sign of the coefficient of the RISK variable is negative, implying that the more variable the operating income is, the less debt firms tend to issue. This result is consistent with the theory based on the trade-off between tax shields and bankruptcy costs, but does not support the capital structure irrelevancy arguments. The result is also consistent with agency theories based on the risk shifting argument.

The coefficient of the SIZE variable is statistically significant at the 5% level with a positive sign. Thus, large firms tend to issue more debt, either because the direct bankruptcy costs appear to constitute a smaller proportion of firm value for large firms, or because relatively large firms tend to be more diversified and less prone to bankruptcy. The result is also consistent with the agency theory argument that large firms tend to be more carefully monitored, and thus, have lower debt issuance costs. However, the result does not support the argument of Grossman and Hart (1982) that large firms do not have to employ a large amount of debt to monitor the 'perk' consumption, since they will be more carefully monitored than small firms.

The result for the variable proxying collateral values of assets is also consistent with the argument based on the trade-off between tax shields and bankruptcy costs. Because the value of tangible assets will be reduced to a less degree than the value of intangible assets when firms go bankrupt, firms with a larger amount of collateralizable assets can use a higher level of debt. For agency theoretic arguments, there are two conflicting predictions. The positive coefficient of the COL variable is consistent with the arguments of Galai and Masulis (1976), Jensen and Meckling (1976), and Myers (1977). Because the collateralization of assets can serve as a bonding mechanism against the equityholders' incentive to invest suboptimally to expropriate wealth from debtholders, firms with a large amount of fixed assets can use more debt than firms with a small amount of collateralizable assets. However, the result does not support the argument of Grossman and Hart (1982) that, because monitoring management perk consumption is relatively easier for firms with a large amount of tangible assets, these firms do not have to issue more debt to control perk consumptions.

As DeAngelo and Masulis (1980) predict, the corporate non-debt shields (NDTS) have a negative relationship with leverage, although the coefficient of the variable is not statistically significant.

The significantly negative coefficient for Tobin's Q is consistent with the free cash flow theory. Firms in the maturity stage of their life cycles tend to generate a large amount of cash flow, have fewer investment opportunities, and have lower Q-ratios. Corporate debt reduces the agency cost by decreasing the free cash flow of firms with lower Q-ratios.

The other two variables, GROW and PROF, do not show significant coefficients. However, the positive sign of the PROF variable is supportive of the tax-based arguments. In general, the empirical results are consistent with the theories based on trade-off between corporate tax shields and financial distress costs, but do not support the capital structure irrelevancy arguments or 100% debt financing argument. The results are also consistent with the theories relying on corporate non-debt tax shields and free cash flows.

Table 4 shows cumulative distributions of estimated probability of debt and classification errors. If the value of the estimated probit function is smaller (greater) than the classification probability, then the model predicts an equity issue (a debt issue). For example, 51.6 percent of equity and 6.8 percent of debt issues have smaller values of the estimated probit function than the classification probability of 10 percent, respectively. Thus, 51.6 percent of total 182 equity issues are correctly predicted to be equity issues, but the remaining equity issues are falsely predicted to be debt issues, leading to the Type II error of 48.4 percent. As for debt, 6.8% of debt issues are falsely predicted to be equity issues, resulting in the Type I error of 6.8%. Assuming equal costs of misclassification, the sum of Type I and Type II errors is minimized at a classification probability of 20 percent.

Table 5 shows the classificatory power of the model based on the classification probability of 20 percent. The proportion of debt issues which are incorrectly predicted to be equity issues is 29.6%, while the proportion of equity issues which are incorrectly predicted to be debt issues is 24.2%. On average, the model classifies almost 75% of the issues correctly.

To investigate the robustness of parametric estimation results, a semi-parametric regression called the maximum score estimation developed by Manski and Thompson (1986) was applied. One of the drawbacks of parametric estimation is that it assumes an arbitrary distribution for the error term, although the true form of the error distribution is unknown. Since the measurement errors caused by working with proxy variables for the unobservable theoretical attributes are impounded in the error term, and since most of the variables used in this type of study are not symmetrically distributed, using an appropriate econometric technique is of critical importance. For example, as shown in the table of descriptive statistics in Givoly et al., many variables are not normally distributed and have skewed distributions. Then, in principle, the empirical inference based on the assumption of normal distribution cannot be employed. The maximum score estimation of a linear model from binary response data makes the binary response analysis possible under very weak distributional assumptions[8]. Thus, a false statistical inference which can be induced by misspecifying the error distribution can be avoided.

Overall, the parametric regression results are supported by the semi-parametric regression results. The signs and magnitudes of the coefficients are very comparable with those obtained from parametric regressions[9].

V. Concluding Remarks

This paper examines the influence of the 1986 Tax Reform Act on firms' issue behavior when they are faced with the need for new capital. It also presents empirical evidence on

the determinants of corporate capital structures. A choice-theoretic approach is used for estimation to study corporate capital structure decisions at the margin. Also, both parametric and semi-parametric regressions are applied to check the robustness of the results.

The results show that firms tend to issue more debt after the 1986 Tax Reform Act. This is because the Tax Reform Act has reduced the maximum tax rate for corporate income from 46 percent to 34 percent and that for individual income from 50 percent to 28 percent, leading to an increased net tax advantage of debt. In addition, the 1986 Tax Reform Act has eliminated the investment tax credit. Since the non-debt tax shields are substitutes for debt tax shields, companies increase their debt levels after 1986. The results also support the theories based on the trade-off between corporate tax shields and financial distress costs, non-debt tax shields, and agency costs including those from free cash flows.

Table 1
Summary of Theories and Their Predictions[a]

Variables[b]	Tax-Based Theories	Agency Theories
TAX	(+) Kraus & Litzenberger(73) Scott (76) Kim (78) DeAngelo & Masulis (80)	
RISK	(-) Kraus & Litzenberger(73) Scott (76) Kim (78) Altman (84) (0) Miller (77) Haugen & Senbet (78)	(-) Galai & Masulis(76) Jensen & Meckling(76) Myers (77)
SIZE	(+) Scott (76) Warner (77) Ang, Chua, & McConnell (82)	(+) Galai & Masulis(76) Jensen & Meckling(76) (-) Grossman & Hart(82)
COL	(+) Kraus & Litzenberger(73) Scott (76) Kim (78) Stulz & Johnson (85)	(+) Galai & Masulis(76) Jensen & Meckling(76) Myers (77) Stulz & Johnson (85) (-) Grossman & Hart(82)
NDTS	(-) DeAngelo & Masulis (80)	
PROF	(+) Scott (76) DeAngelo & Masulis (80)	
GROW		(-) Jensen (86) Myers (77)
Q		(-) Jensen (86)

Table 2
Correlations among Variables

	TAX	RISK	SIZE	COL	NDTS	PROF	GROW	Q
TAX	1.00							
RISK	-.06	1.00						
SIZE	-.04	-.18	1.00					
COL	.04	-.07	.09	1.00				
NDTS	.11	.03	-.06	.05	1.00			
PROF	-.14	-.04	-.02	-.14	.00	1.00		

Table 3
Coefficient Estimates from the Probit Analysis[a]

Variables	Coeficients	t-Statistic	P-Value
Const	-18.372	-1.276	.201
TAX	38.554	3.424	.001**
RISK	-339.745	-1.879	.060*
SIZE	0.229	1.989	.047**
COL	39.218	1.947	.052*
NDTS	-3.936	-1.436	.151
PROF	46.902	1.526	.127
GROW	1.649	.979	.327
Q	-22.538	-2.019	.044**

[a] Dependent Variable = 1 (0) for debt (equity) issues.
* Significant at the 10% level.
** Significant at the 5% level.

Table 4
Cumulative Distributions of Estimated Probability of Debt and Classification Errors

Classification Probability(P)[a]	Percentage of issues with estimated probability of debt ≤ P		Type I error (%) (Predict equity when debt)	Type II error (%) (predict debt when equity)
	Equity	Debt		
.05	33.5	0.0	0.0	66.5
.10	51.6	6.8	6.8	48.4
.15	63.1	18.2	18.2	36.9
.20	75.8	29.6	29.6	24.2
.25	80.6	38.7	38.7	19.4
.30	86.1	47.8	47.8	13.9
.35	90.5	56.9	56.9	9.5
.40	93.8	61.4	61.4	6.2
.45	94.3	68.2	68.2	5.7
.50	95.9	75.0	75.0	4.1
.55	97.0	77.3	77.3	2.5
.60	98.0	81.8	81.8	2.0
.65	98.0	84.1	84.1	1.5
.70	98.5	86.4	86.4	1.0
.75	99.0	86.4	86.4	0.5
.80	100.0	90.9	90.9	0.0
.85	100.0	93.2	93.2	0.0
.90	100.0	93.2	93.2	0.0
.95	100.0	95.5	95.5	0.0
1.00	100.0	100.0	100.0	0.0
Number of observations	182	44		

[a] Predict equity (debt) if the value of probit function is smaller (larger) than P.

Table 5
Predictive Value of the Model

	Actual Outcome		
Predicted Outcome	Debt	Equity	Total
Debt	31	44	75
Equity	13	138	151
Total	44	182	226

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Endnotes

1. Givoly, Hayn, Ofer, and Sarig (1992) focus on leverage changes, not levels of leverage. Although they improved on this problem, their approach is still subject to the same criticism.

2. There are several papers which use choice-theoretic models. For example, Marsh (1982) uses a similar parametric technique, but his focus is on United Kingdom firms.

3. Another aspect of TRA was the increase in capital gains taxes and the decrease in the marginal tax rate on dividends. Thus, firms with low dividend payouts will find it more difficult to compensate their investors on an after-tax basis than will the firms with high dividend payouts. Therefore, low dividend firms have a stronger incentive to issue debt than high dividend firms.

4. The R&D expenditure could be selected as a proxy for the growth. However, I exclude this variable, since most companies contain missing values for the variable.

5. The sample data are not concentrated in any one year or in any particular issue size.

6. Most selected variables have been used in other studies. For example, the same or similar variables for collateral value, corporate non-debt tax shield, growth, and risk were employed by Marsh (1982), Bradley, Jarrell, and Kim (1984), Titman and Wessels (1988), and Givoly et al (1992), respectively. In general, it is difficult to decide which proxy variable is better in representing the abstract theoretical attributes.

7. The corresponding results from the logit regression are very similar to those from the probit regression. In addition, there is not much difference between the regressions using book and market value debt-equity ratios.

8. For the maximum score estimation, it suffices to assume only that for a given constant $\alpha E(0,1)$, the α-quantile of the conditional probability density function is unique and equal to zero. Thus, the shape of the distribution can be unknown, and the error term may be arbitrarily heteroskedastic.

9. The maximum score estimation model classifies 85% of all issues combining both equity and debt correctly, while the parametric estimation predicts 75% of the issues correctly. Therefore, the semi-parametric estimation technique relying on weak distibutional assumptions produces empirically better results than the parametric models.

Appendix - Variable Definitions

The values for all variables used in the following definitions are the real values which are calculated by dividing nominal values by the GNP deflators.

Debt-Equity Ratio:

$$\frac{\textit{Total Assets} - (\textit{Common Equity} + \textit{Preferred Stock})}{(\textit{Number of Shares Outstanding}) \times \frac{\textit{High Price} + \textit{Low Price}}{2}}$$

Independent Variables:

1) Tax Dummy $X8 = 1$ *if year 1986 or 1987*; 0 *Otherwise*

2) Proxy for financial distress $X1 = \dfrac{\textit{Standard Deviation of the Operating Income}}{\textit{Average Total Assets}}$

where average total assets is the arithmetic average of the company's time series of total assets.

3) Proxy for size $X2 = \textit{Total Assets}$

4) Proxy for collateral values $X3 = \dfrac{\textit{Fixed Assets}}{\textit{Total Assets}}$

5) Proxy for corporate non-debt tax shields

$$X4 = \frac{\textit{Depreciation} + \textit{Investment Tax Credit}}{\textit{Operating Income}}$$

6) Proxy for profitability $X6 = \dfrac{\textit{Retained Earnings}}{\textit{Total Assets}}$

7) Proxy for growth $X5 = \dfrac{\textit{Retained Earnings}}{\textit{Total Assets}}$

8)Proxy for free cash flows (Q-ratio)

$$X7 = \frac{\textit{Market Value of Equity} + \textit{Preferred Stock} + \textit{Debt}}{\textit{Total Assets}}$$