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The Determinants of Capital Structure

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Arvin Ghosh, Francis Cai and Wenhui Li

OBJECTIVES

This paper attempts to analyze the important determinants of capital structure in the U.S. manufacturing industries. Our study extends the empirical works on the determinants of capital structure in three ways. First, apart from taking all the relevant independent variables as determinants, it sheds new light on the relationship between business risk and leverage.[1] Second, it shows rather insignificant role of industry dummies as a proxy for industry characteristics in capital structure determination. Third, it uses *both* the data-sets of *Compustat* and *Fortune 500* largest firms in analyzing the determinants of capital structure, not attempted before.

BACKGROUND

Ever since Stewart Myers' article on the determinants of corporate borrowing (*JFE*, 1977), literature on the determinants of capital structure has grown steadily. Sheridan Titman and Roberto Wessels' article on the determinants of capital structure choice (*JF*, 1988) took such attributes of firms as asset structure, non-debt tax shields, growth, uniqueness, industry classification, size, earnings, volatility and profitability, but found only uniqueness (characterized by the firm's expenditure on research and development, selling expenses, and the rate at which employees voluntarily leave their jobs) was highly significant. But Harris and Raviv (*JF*, 1991) in their seminal article on the subject point out that the consensus among the financial economists is that leverage *increases* with fixed costs, nondebt tax shields, investment opportunities and firm size, and *decreases* with volatility, advertising expenditure, the probability of bankruptcy, profitability and uniqueness of the product.

In a more recent article, Rajan and Zingales (*JF*, Dec. 1995) took asset structure, investment opportunities, firm size and profitability as the determinants of capital structure. They found that leverage *increases* with asset structure and size, but *decreases* with growth opportunities and profitability. However, in an earlier article (1991), Kale, Noe and Ramirez took nondebt tax shields, firm size, and business risk (i.e., volatility of cash flows) as the cross-sectional determinants of capital structure and had found that nondebt tax shields and firm size had positive signs, but business risk was decreasing first and then increasing with the optimal debt level.

For our tests of the determinants of capital structure, we have taken asset size, growth of assets, nondebt tax shields, fixed asset ratio, profit margin, research and development expenditure, advertising expenditure, selling expenses, and the coefficient of variation of cash flows as business risk (volatility). We have also run the tests with and without business risk to see the change of signs and robustness of the test results. Further, we have used the dummy variables for industry classification to see whether industry characteristics have any impact on the capital structure.

Dr. Arvin Ghosh is Professor of Economics and Finance, William Paterson University, Wayne, New Jersey. He has published numerous articles in academic journals and is the author of several books.

Dr. Francis Cai is Associate Professor of Finance, William Paterson University, Wayne, New Jersey. He has published in such journals as *Journal of Multinational Finance* and *Accounting and Business Review.*

Dr. Wenhui Li is Assistant Professor, Center for Business and Government, Baruch College, City University of New York.

DATA SOURCE AND METHODOLOGY

We have used the *Compustat* file for the data source. Our sample was composed of 362 firms, divided into 19 industries. We have selected two years — 1982 and 1992— for our cross-sectional studies. We have also tried to pool the cross-section data into time series covering 1982-1992, but without any success.[2]

However, we did try to delve into *Fortune* magazine's list of the largest 500 manufacturing companies to see whether the results obtained by the *Compustat* files are corroborated by the *Fortune 500* data set.[3] For that, our sample was composed of 256 surviving firms, divided into 21 industries covering 1974-1992. The results were mixed as explained in Table 7.

As for methodology, we have used the ordinary least square (OLS) equations, with the long-term debt ratio (Long-term Debt/ Total Assets) as the dependent variable, and asset size, growth of assets, non-debt tax shields (depreciation allowance and investment tax credit), fixed assets-to- total assets ratio, net profit margin, research and development expenditure(%), advertising expenditure(%), and selling expenses(%) as independent variables. For business risk (i.e., volatility) as an independent variable, we have taken the coefficient of variation of cash flows.

In order to test the relationship between capital structure and its determinants, we estimate the following multiple regression equation for our sample:[4]

$$Y=\beta_0 + \beta_1 AS + \beta_2 GA + \beta_3 NDTS + \beta_4 RFATA + \beta_5 NPM$$

$$+\beta_6 RD + \beta_7 ADV + \beta_8 SE + \beta_9 CVCF + \beta_{10} CVCF^2 + \varepsilon \quad (I)$$

where

Y = Long Term Debt / Total Assets;
AS = Asset Size;
GA = Growth of Assets;
NDTS = Non-debt Tax Shield;
FATA = Fixed Assets/total Assets;
NPM = Net Profit Margin;
RD = Research and Development Expenditure (%);
ADV = Advertising Expenditure (%);
SE = Selling Expense (%);
CV = Coefficient of Variation of Cash Flows.

When we include the industry dummies as explanatory variables, the equation becomes:

$$Y= \beta_0 + \beta_1 AS + \beta_2 GA + \beta_3 NDTS + \beta_4 RFATA + \beta_5 NPM$$

$$+\beta_6 RD + \beta_7 ADV + \beta_8 SE + \beta_9 CVCF + \beta_{10} CVCF^2$$

$$+ \beta_{11} D_1 + \beta_{12} D_2 + \ldots + \beta_{18} D_{18} + \varepsilon \quad (II)$$

where D_1 through D_{18} are industry dummy variables.

Following the capital structure theory, we would expect the signs of β_1, β_3, and β_4 to be positive, and the signs of β_2, β_5, β_6, β_7, and β_8 to be negative. As for β_9 and β_{10}, the relationship is expected to be first positive and then negative, according to the traditional capital structure theory. The results are shown in Table 1 through 7.

THE RESULTS

In Table 1, we have shown the regression results for the year 1992. We find that only the growth of assets, fixed asset ratio, and the R & D expenditure(%) had significant t-values at the 1 percent level.

TABLE 1
Capital Structure Determinants--1992
(Long Term Debt Ratio as Dependent Variable)

Independent Variable	b-coefficient	T-value
Asset	0.0000492	0.370000000
Growth of Assets	-0.1979850	-3.158000000**
Depreciation	-0.0021442	-0.591000000
Investment Tax Credit	0.0308000	0.362000000
Fixed Asset Ratio	0.0811000	2.780000000**
Profit Margin	-0.0808000	-1.042000000
R&d Expenditure (%)	-0.8678000	-2.842000000**
Advertising Exp. (%)	0.0452000	0.121000000
Selling Exp. (%)	-0.0012929	-0.015000000
Adj. R^2	0.0899	

* --significance at 5% Level
**--significance at 1% Level

The negative sign of the b-coefficient for the growth of assets conforms with the conclusion reached by Harris and Raviv, as firms expecting high future growth use a greater amount of equity finance. As for the fixed asset ratio (fixed assets/ total assets), its contribution was very small, although the positive sign means the increase of fixed assets has a collateral value for higher debt. But the negative sign of the b-coefficient for R & D expenditure indicates that firm leverage increases with the decrease in R & D expenditure, again confirming the conclusion reached by Harris and Raviv.

Table 2 shows the regression results for the year 1982. Here we find that the growth of assets was not significant. But the fixed asset ratio was significant at the 1 percent level, as were R & D expenditure and the advertising expenditure. The profit margin was also significant at the 5 percent level. The negative signs of the latter three variables were conformed with the conclusion made by Harris and Raviv.

Tables 3 and 4 show the results of capital structure determinants with risk (a quadratic relationship with CVCF, i.e., the coefficient of variation of cash flows). Although the b-coefficients for COCF1 and COCF2 were not significant at any level in Table 3, they were significant at the 0.05 percent level in Table 4. Whereas

TABLE 2
Capital Structure Determinants --1982
(Long Term Debt Ratio as Dependent Variable)

Independent Variable	b-Coefficient	T-Value
Asset	-0.0002472	-0.698000000
Growth of Assets	4.4247000	1.563000000
Depreciation	0.0013872	0.282000000
Investment Tax Credit	-0.0192000	-0.422000000
Fixed Asset Ratio	0.0837000	3.450000000**
Profit Margain	-0.0710000	-1.663000000*
R&D Expenditure (%)	-0.9771000	-5.417000000**
Advertising Exp. (%)	-0.5700000	-2.660000000**
Selling Exp. (%)	0.0949000	1.620000000
Adj. R^2	0.1558	

* --Significance at 5% level
**--Significance at 1% level

TABLE 3
Capital Structure Determinants with Risk--1992
(Long Term Debt Ratio as Dependent Variable)

Independent Variable	b-Coefficient	T-Value
COCF1	27.2036000	0.890000000
COCF2	-4.3020000	-0.819000000
Asset	0.0000347	0.261000000
Growth of Assets	-19.2271000	-3.065000000**
Depreciation	-0.0013179	-0.360000000
Investment Tax Credit	0.0129000	0.150000000
Fixed Asset Ratio	0.0898000	3.033000000**
Profit Margin	-0.0940000	-1.205000000
R&d Expenditure (%)	-0.8702000	-2.851000000**
Advertising Exp. (%)	0.0384000	0.103000000
Selling Exp. (%)	-0.0132000	-0.157000000
Adj. R^2	0.1933	

* --significance at 5% Level
**--significance at 1% Level

Kale, Noe and Ramirez found the relationship between business risk and leverage to be quadratic—first decreasing and then increasing, we have found it to be the opposite — first increasing and then decreasing. This conforms with the traditional theory which suggests that when risk is low, higher will be the debt level, but with higher risk, debt level should be lower.

In Tables 3 and 4, both the variables depicting growth of assets and fixed asset ratios were significant, along with the variable for R & D expenditure. In Table 4, however, advertising expenditure was also significant at the 1 percent level. The negative signs for both R & D expenditure and advertising expenditure conform with the conclusions reached by Harris and Raviv.

Tables 5 and 6 show the b-coefficients of the nine capital structure determinants with risk and industry dummy variables for 1992 and 1982. Here, again, the growth of assets, fixed asset ratio, and R & D expenditure were significant at the 1 percent level in Table 5. But the growth of assets variable was not significant in Table 6. Similarly, advertising expenditure variable was not significant in Table 5 but was significant at the 1 percent level in Table 6.

TABLE 4
Capital Structure Determinants with Risk--1982
(Long Term Debt Ratio as Dependent Variable)

Independent Variable	b-Coefficient	T-Value
COCF1	26.0692000	1.817000000*
COCF2	-4.5022000	-1.817000000*
Asset	-0.0002313	-0.649000000
Growth of Assets	4.6838000	1.654000000*
Depreciation	0.0011917	0.240000000
Investment Tax Credit	-0.0182000	-0.401000000
Fixed Asset Ratio	0.0839000	3.450000000**
Profit Margain	-0.0704000	-1.638000000
R&D Expenditure (%)	-0.9690000	-5.376000000**
Advertising Exp. (%)	-0.5621000	-2.624000000**
Selling Exp. (%)	0.0938000	1.588000000
Adj. R^2	0.1053	

* --Significance at 5% level
**--Significance at 1% level

TABLE 5
Capital Structure Determinants with Risk and Industry Dummy Variables --1992
(Long Term Debt Ratio as Dependent Variable)

Independent Variable	b-Coefficient	T-Value
COCF1	-19.4276000	-0.477000000
COCF2	2.5560000	0.384000000
Asset	0.0000082	0.061000000
Growth of Assets	-20.5498000	-3.266000000**
Depreciation	0.0001237	0.032000000
Investment Tax Credit	-0.0133000	-0.152000000
Fixed Asset Ratio	0.0993000	3.311000000**
Profit Margin	-0.0969000	-1.242000000
R&D Expenditure (%)	-0.8093000	-2.646000000**
Advertising Exp. (%)	0.0524000	0.140000000
Selling Exp. (%)	-0.0299000	-0.355000000
Dummy Variables	7 Negative 1 positive 10 zero	
Adj. R^2	0.1175	

* --Significance at 5% level
**--Significance at 1% level

TABLE 6
Capital Structure Determinants with Risk and Industry Dummy Variables --1982
(Long Term Debt Ratio as Dependent Variable)

Independent Variable	β-Coefficient	T-Value
COCF1	19.2734000	1.176000000
COCF2	-3.5160000	-1.251000000
Asset	-0.0001286	-0.349000000
Growth of Assets	4.5182000	1.585000000
Depreciation	-0.0002519	-0.050000000
Investment Tax Credit	-0.0086079	-0.187000000
Fixed Asset Ratio	0.0831000	.370000000**
Profit Margin	-0.0707000	-1.640000000
R&D Expenditure (%)	-0.9400000	-5.161000000**
Advertising Exp. (%)	-0.5758000	-2.683000000**
Selling Exp. (%)	0.0879000	1.476000000
Dummy Variables	2 Positive 6 Negative 10 Zero	
Adj. R^2	0.0890	

* --Significance at 5% level,
**--Significance at 1% level

When we include the dummy variables as proxy for industry characteristics, as done in Tables 5 and 6, we have found that only 1 and 2 industries had positive signs for 1992 and 1982, respectively, while 7 and 6 had negative signs for the two selected years, respectively. Our results thus conform with that of Kale, Noe and Ramirez in this regard who had found only 3 industry dummies having positive signs, while 12 had negative signs.

In Table 7, we have used the *Fortune 500* data for the year 1992 where the independent variables were six, instead of nine.[4] Here only the asset size was significant at the 1 percent level. But the signs of COCF1 and COCF2 were significant — first positive and the negative. This conforms with the earlier results we have obtained in Tables 3 and 4, respectively.

TABLE 7
Capital Structure Determinants with Risk --1992
(Using FORTUNE 500 Data)
(Long Term Debt Ratio as Dependent Variable)

Independent Variable	b-Coefficient	T-Value
COCF1	38.6012	0.1556
COCF2	-13.73	-0.0476
Asset	0.000327	9.39205**
Growth of Assets	3.2329	0.1151
Depreciation	-0.0064623	0.00002
Investment Tax Credit	-0.01570	0.00000
Adj. R^2	0.0054	

* --Significance at 5% level
**--Significance at 1% level

CONCLUSIONS

Our results thus confirm the usefulness of taking growth of assets, fixed asset ratio, R & D expenditure and advertising expenditure as the determinants of capital structure. At the same time, our results show that the relationship between business risk and leverage is quadratic, and it is first increasing and then decreasing — a relationship more close to the traditional theory and contradicts the results obtained by Kale, Noe and Ramirez. But the problem of omitted variables remains as the known determinants 'explain' a very small percentage of the variation in capital structure. All this indicates that nothing is "settled" in the area of the determinants of capital structure, and much work is to be done if we want to understand what truly determine the capital structure of a firm or an industry.

NOTES

1. We like to state that our study had shown the *exact opposite* relation of what Kale *et al* got in their study. We have found that the relationship between business risk and financial leverage, although quadratic, was first increasing and then decreasing, just the opposite of the finding of Kale, Noe and Ramirez. Our result in this respect confirms the traditional hypothesis which suggests that when risk is low higher will be the debt level, but with higher risk, debt level should be lower.
2. We have taken 1982 and 1992 because the *Compustat* data go back to 20 years (when we started our research in 1994, the data set we had obtained was from 1972 to 1992). We took the 10-year period because we thought that the 10-year period was enough to explain the capital structure determinants. These were the annual data given by the *Compustat*. We may, in future, take the quarterly data to see whether they conform to the results obtained by using annual data..
3. The main reason we had taken the FORTUNE 500 companies was to see whether the results would vary with a widely-used data-set. We found the results were the same, more or less.
4. We have taken nine independent variables in our regression models because they are the relevant variables to explain the capital structure of a firm as found in finance literature.

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