An Investigation of The Relationship Between Financial Risk And Accounting Method Choice

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Abstract

This study examines the relationship between financial risk and management's choice of accounting methods. Leverage has traditionally been used as a surrogate for financial risk, but in this study, a variable measuring the firm's debt beta is developed representing a market assessment of financial risk. The results indicate a significant relationship between increases in financial risk and management's decision to change accounting methods. Also, the results indicate that debt betas do not always behave in the same manner as leverage variables, suggesting that the market considers other factors besides leverage in assessing financial risk.

I. Introduction

This paper empirically investigates the relationship between financial risk and management's choice of accounting methods. The investigation was conducted with U.S. extractive industry firms where management may choose between the full-cost and successful-efforts methods of accounting for pre-production exploration and development costs. The U.S. extractive industry was chosen for this study because no cash flow differences exist between firms using the full-cost and successful-efforts accounting methods. Therefore, the real probability of payment default is not affected by the choice of accounting method.

Prior empirical work by Deakin (1979), Dhaliwal (1980), Foster (1980), Lilien and Pastena (1982), and Johnson and Ramanan (1988) used leverage as a proxy for financial risk. However, an informationally efficient market may consider factors other than leverage in assessing financial risk. Lys (1984) recognized the shortcoming of using leverage as a proxy for financial risk, and instead, used an estimate of the variance of the firm's cash flows in addition to leverage in measuring financial risk. But other factors may also affect the assessment of financial risk. In this study, a variable, debt beta, is developed which represents a market assessment of financial risk and reflects these other factors. One of these other factors is the amount of proved reserves held by the company.

In the next section, theory relating financial risk and

choice of accounting method is reviewed. The third section identifies the research questions, the fourth section describes the research design, and the fifth section presents the empirical results. The sixth section discusses overall conclusions, and suggestions for future research are presented in the final section.

II. Financial Risk and Choice of Accounting Method

According to agency theory, a relationship exists between financial risk and the manager's choice of accounting methods. This relationship is present because of the existence of debt covenants. Because debtholders have rational expectations, they recognize that stockholders have an incentive to make decisions which transfer wealth from debtholders to equityholders. Hence, debtholders will invest in various types of covenants and monitoring devices to protect their wealth. Smith and Warner (1979, pp. 117-161) indicate that such covenants protect the debtholders by serving as a disincentive for management to engage in high-risk activities on behalf of stockholders.

When debt covenants are in technical default, they signal creditors about conditions which may increase the probability of payment default. The firms then often need to negotiate amendments to the covenants which are costly to secure, and these costs, which are agency costs, are borne by the stockholders. Public debt may be more difficult to renegotiate, but renegotiation with

private lenders is not costless. For example, according to Watts and Zimmerman (1986, p. 215) the lender may require a new higher interest rate, especially if interest rates have changed substantially since issuance of the debt.

Agency theory predicts that the managers of firms which are approaching technical default on their debt covenants will attempt to avoid costs of renegotiating debt covenants to maximize firm value. That is, they will choose acceptable accounting methods which tend to reduce the possibility of technical default by increasing net income and net tangible assets. As explained by Sunder (1976), in oil and gas accounting the full-cost method tends to increase net tangible assets and creates a more stable income for companies engaged in exploration activities. Choice of accounting method can affect the possibility of technical default, because as shown by Fogelson (1978), covenants normally include provisions based on accounting numbers which are defined with reference to generally accepted accounting principles (GAAP).

Through informal talks with several banking leaders in Louisiana and Texas,¹ some interesting aspects of their concerns in assessing financial risk relative to oil and gas loans were revealed. Most notably, it was found that while financial ratios are used in oil and gas loan covenants, the bankers' primary concern in assessing risk is not with the ratio provisions of the covenants, but with provisions concerning the amount of the firm's developed producing reserves.

However, all of the bankers stated that when a company is in technical default on its covenants based only on financial ratios, some form of action always will be taken. When a company enters technical default, its financial position is scrutinized by the bank to determine the extent of its problems. If the default appears to be of a self-correcting nature, the company may be granted a cure period during which to correct the default. If the default is not corrected, the loan may be renegotiated at a higher interest rate, extra fees could be imposed on the borrower, or future credit may be limited or cut off by the bank. At a very minimum, in the case of a minor technical default, the bank talks to the firm's management, admonishing them of the possibility of penalties if the severity of the "default" should become more pronounced. Therefore, the possibility of technical default is a genuine threat to the corporate manager, since penalties could be imposed on the manager's firm by the bank.

Conversations with banking leaders revealed that they tend to utilize the financial ratio provisions of loan covenants as a means of maintaining a position of control over the borrowing firms. In actuality, however, their main concern is really with the reserves reports.

If bankers evaluate financial risk based primarily on reserves reports of the company, then leverage may not be an appropriate proxy for financial risk in the oil and gas industry. Instead, a variable which measures financial risk based on market data may be a better measure of financial risk. This study introduces such a variable, the debt beta which is based on market data. In an efficient market, reserves figures, cash flow variability, and leverage are considered when assessing financial risk.

III. Research Questions

When debt covenants are in technical default, the corporate manager feels threatened since the bank could impose penalties on the firm. Because the full-cost method serves to increase reported earnings and net tangible assets of firms with exploratory activities while not affecting cash flows, and because debt covenants are based in part on these accounting numbers, use of this method tends to reduce the possibility of technical default on debt covenants. Thus, managers of firms with high financial risk should prefer to use the full-cost accounting method to reduce the possibility of technical default on debt covenants.

In order to determine whether the firm level of financial risk affects the manager's choice of full-cost or successful-efforts accounting in the oil and gas industry, the following research questions are addressed: (1) Is the level of financial risk of firms using the full-cost method higher than that of firms using the successful-efforts method? and (2) Do firms which switch to the full-cost method experience an increase in financial risk prior to the change?

IV. Research Design

A. Sample Selection

The samples of firms used in this study were obtained from the 1986 *Oil and Gas Journal's* OGI 400 which annually lists the top 400 oil and gas entities by total assets and revenue. The 1986 ranking was used. All companies with primary SIC codes of 1310 and 1311 were included in the study since they engage primarily in the exploration and production of crude petroleum and natural gas. This procedure ensured that the firms included in the samples derived a significant portion of their income from exploration and production, and, therefore, their choice of the full-cost or successful-efforts accounting method would significantly impact their financial statements.

Other criteria for the samples included: (1) The firm must be incorporated, (2) The firm must be listed on the American or New York stock exchanges or be on the National Association of Securities Dealers Automatic

Quotations System (NASDAQ), and (3) The firm must have 10-Ks on file with the SEC for the period tested for each sample.

The entities meeting the above requirements were divided into firms which had not switched accounting methods during the 1977-1986 time period, and those firms that had switched methods during the period. Random samples of firms maintaining both methods were drawn from this population. However, because there were a small number of firms changing methods in the population, descriptive statistics for all firms changing to full-cost were examined.

B. The Leverage Variables

Dhaliwal (1980) tested for differences in the leverage of full-cost versus successful-efforts firms by comparing their debt to equity ratios. Significant differences in leverage were found, but because retained earnings is affected by accounting method, these differences could have been attributable to the use of accounting equity in the variable measuring financial risk. The first variable used in this study is the debt to equity ratio using book values, for which the results may be compared with previous studies. The second leverage variable is the debt to equity ratio using the market value of equity; the use of this variable eliminates the problem addressed above of the book value of equity being affected by accounting method choice.

The third leverage variable, the debt to revenue ratio, was utilized by Deakin (1979). It is included in this study so that the results may be compared with previous research.

C. The Market Variable

The stock beta, also called the equity beta, depends on both the business risk of the assets held by the firm and the level of financial risk of the firm. As explained by Hamada (1969), because borrowing while maintaining a fixed amount of equity increases the risk of the equityholder, the beta for the stock of a levered firm should be greater than the beta of the stock of an otherwise identical unlevered firm. Thus, the covariance of the levered firm's stock returns with the market returns should be greater than the covariance of an otherwise identical unlevered firm's returns with market returns.

A firm's asset beta reflects the business risk of the firm's existing assets. As the firm issues debt, its common stock becomes riskier, thereby increasing the firm's equity beta above its asset beta. The difference between the firm's equity and asset betas reflects the firm's financial risk. This risk increases as debt increases (Brealey and Myers, 1984, pp. 173-174).

Hamada (1969) analytically derived the additive relationship among a firm's betas. The asset beta may be represented as a weighted average of the debt and equity betas. The relationship is represented by the following equation:

$$\beta_A = \beta_D \frac{\text{debt}}{\text{debt} + \text{equity}} + \beta_E \frac{\text{equity}}{\text{debt} + \text{equity}} \quad (1)$$

Solving this equation for the debt beta yields:

$$\beta_D = \beta_A \frac{\text{debt} + \text{equity}}{\text{debt}} - \beta_E \frac{\text{equity}}{\text{debt}} \quad (2)$$

This equation was used in this study to calculate the individual firms' debt betas.

Each firm's equity beta was determined by regressing that firm's weekly returns against the weekly market returns for the 78 week period ending with the final week in December of the year for which the measurement was being taken. This was done through use of the market model which was developed by Sharpe (1963):

$$R_{Et} = a_E + \beta_E R_{Mt} + \epsilon_t \quad (3)$$

where:

R_{Et} = the rate of return for stock E during period t,
 R_{Mt} = the rate of return for the market portfolio during period t,

a_E = the intercept term of the regression,

β_E = the slope coefficient for the regression which is equal to $\text{Cov}(R_{Et}, R_{Mt}) / \text{var}(R_{Mt})$,

ϵ_t = the random error term during period t.

An equally weighted index of the New York and American stock exchanges was used to represent the market portfolio. To test for autocorrelation, a Durbin-Watson test was performed on each regression. The results revealed that no autocorrelation was present for the sample firms in the years considered.

An asset beta is equal to the equity beta of an unlevered firm (Brealey and Myers, 1984, p. 177). Therefore, an average of the equity betas for the appropriate years of firms with no debt may be used as a surrogate for an industry-wide asset beta which reflects the risk of holding petroleum products. For purposes of this study, firms with market value based debt to equity ratios of less than .05 were considered as entities with no debt. In most cases, the debt held by these firms was in the form of short-term trade payables. Therefore, for all practical purposes, these are all-equity firms.²

An asset beta reflects business risk. A major form of

business risk in the petroleum industry is the volatility of oil prices. Because all firms in the industry face the risk of changing prices, a good estimator of the risk of assets industrywide can be obtained. Empirical studies by Gaumnitz (1970), Meyers (1973), and Livingston (1977) found that extractive industries have strong industry components in their stock movements. Therefore, it is reasonable to assume a constant asset beta for the industry as a whole.

The debt betas were derived using equation (2) given above by taking a weighted difference between the industry asset beta and the firm's equity beta. In the equation, the market value of equity was used for all sample firms. Because this debt beta is computed using market data, it reflects all factors considered by the market in assessing financial risk.

V. Results of Tests

A. Comparisons of Full-Cost and Successful-Efforts Firms

The first test was designed to determine if the level of financial risk of full-cost firms is greater than that of successful-efforts firms. Thirty firms using each method were randomly selected to test the hypothesis. Group means of the 1986 risk levels for each variable were computed for each sample. Shapiro-Wilks tests revealed that none of the variables was normally distributed. Therefore, Wilcoxon sum-ranks tests were performed for each variable. All of the tests were performed at the .05 level of significance which is consistent with prior research in oil and gas accounting performed by Dhaliwal (1980) and Lys (1984). Summary statistics for these tests are presented in Table 1.

The debt to revenue ratio was found to be significantly greater for full-cost firms. The finding regarding the debt to revenue ratio is consistent with previous research performed by Deakin (1979) in which the debt to revenue ratios of full-cost firms were found to be higher than those of successful-efforts firms.

The debt to equity ratio utilizing book values for full-cost firms was not found to be significantly greater than the ratio for successful-efforts firms. Prior research performed by Dhaliwal (1980) and Lilien and Pastena (1982) found that the debt to equity ratios of full-cost firms tend to be higher than those of successful-efforts firms. However, in this study, the P-value of .0585 indicates that the hypothesis was close to being rejected at the .05 level of significance. The mean of the variable for full-cost firms was 5.7151 which is quite higher than the mean of .9949 for successful-efforts firms.

Thus, to the extent of the aforementioned variables, the results of this study are generally consistent with prior research. Whatever inconsistencies may remain in this regard may result from the different time periods used. Dhaliwal (1980) used 1976 as the year for which the test for differences was performed, while Lilien and Pastena (1982) used 1978 as the test year. These years were periods of generally high exploration activities, especially in comparison to 1986, the year used in this study, which was generally a period of low exploration activities. The use of full-cost or successful-efforts accounting affects the book value of equity, and this effect becomes more pronounced as exploration activities increase resulting from the capitalization of unsuccessful exploratory wells under the full-cost accounting method.

TABLE 1
TESTS OF FINANCIAL RISK VARIABLES
OF FULL-COST AND SUCCESSFUL-EFFORTS FIRMS

Variable	Group Means		Test Performed	Critical Value	Level of Significance for a One-Tailed Test	Reject Hypothesis
	SE	FC				
D/E book	.9949	5.7151	Wilcoxon	Z=1.567	.0585**	No
D/E market	2.0855	2.5486	Wilcoxon	Z=1.515	.0648**	No
D/R	1.8534	2.6263	Wilcoxon	Z=2.025	.0214*	Yes
Beta	.9508	.8533	Wilcoxon	Z= .282	.3890	No

* Significant at the .05 level.
** Significant at the .10 level.

In this study, the debt beta of full-cost firms was not found to be significantly higher than that of successful-efforts firms. This result is consistent with agency theory which would predict that firms facing increases in risk have incentives to switch to full-cost accounting, but firms maintaining methods over fairly long time periods may not exhibit differences in risk levels.

B. Tests of Firms Changing to Full-Cost

The purpose of these tests are to determine if the financial risk level of firms changing to the full-cost accounting method increases prior to the change. The financial risk levels of these firms were examined for both five years and one year preceding the accounting method change. Because the population of firms changing to the full-cost method during the test period consisted of only seven companies, descriptive statistics for the entire population were obtained. These statistics are presented in Table 2.

in that firms that changed to full-cost accounting had increases in their debt betas prior to the change. Agency theory predicts that firms with increasing financial risk may tend to change to the full-cost method in order to avoid technical default on their loan covenants.

For firms maintaining the use of one method, it could not be concluded that the debt betas for full-cost firms exceed those for successful-efforts firms. This finding is also consistent with agency theory which does not predict the necessary use of one method or the other for firms with stable risk over time.

An important finding of this research is that the debt betas do not always behave in the same manner as the leverage variables. This suggests that the market does consider other factors besides leverage when assessing financial risk. Therefore, the use of leverage as surrogate for financial risk may not be appropriate. This may

TABLE 2
DESCRIPTIVE STATISTICS OF THE FINANCIAL RISK VARIABLES
OF FIRMS CHANGING TO FULL-COST ACCOUNTING

Variable	5 Years Before Change Mean	Std. Deviation	1 Year Before Change Mean	Std. Deviation	Increase(Decrease) in Mean	Percent Increase(Decrease)
D/E book	2.3219	2.3048	1.4259	.6923	(.8960)	(38.59%)
D/E market	.2942	.1517	.8169	.4563	.5227	177.69%
D/R	1.8134	.7289	1.6373	.7373	(.1761)	(9.71%)
Beta	.6664	.3871	1.7393	.9190	1.0729	160.99%

The group means reveal that the debt to equity ratio using market values and the debt beta variable increased prior to the change. This result is consistent with agency theory which would predict that as a firm's financial risk increases, the management of that firm may switch to use the full-cost accounting method in order to avoid technical default on their loan covenants.

The debt to equity ratio utilizing book values and the debt to revenue ratio decreased prior to the change. The amount of debt held by these firms generally increased prior to the change, but not proportionately as great as the increase in revenue and the book value of equity.

VI. Conclusions

This study has agency theory implications. The findings of this study are consistent with agency theory

hold in other industries as well as in the oil and gas industry.

VII. Suggestions for Future Research

The findings of this study have important implications to the design of future research projects. Leverage can no longer automatically be accepted as a proxy for financial risk. The market considers additional information in assessing a firm's financial risk. Future research could be performed which would attempt to reveal what factors are considered by the market in assessing this risk.

*****Footnotes*****

1. The bankers spoken to are executives with banks in Houston and Dallas, Texas, and in Shreveport and Baton Rouge, Louisiana. Three of the bankers hold

the position of Executive Vice-President of the Energy Division, while two bankers hold the position of Senior Vice-President of Loans.

2. Debt betas for these firms are not defined, so the firms were excluded from tests of debt betas. However, the leverage variables could be measured for these firms, so the firms were included in the samples for tests of the other variables.

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