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Firm's Financial Leverage and Its Impact on Differential Roles of Earnings and Book Value for Equity Valuation

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ABSTRACT

The purpose of this study is to investigate whether the firm's financial leverage affects the value relevance of earnings and equity book value. In particular, we compare the valuation coefficients and explanatory powers of earnings and equity book value between high-leverage and low-leverage firms. Using a sample of 869 levered firms over twenty-year period (1989-2008), we find that equity book value (earnings) response coefficients are larger (smaller) for high-leverage firms vis-à-vis low-leverage firms. We also find that incremental explanatory power of equity book value is also larger for high-leverage firms than low-leverage firms. These results are robust across different model specifications and testing methods.

1. INTRODUCTION

The purpose of this study is to investigate the firm's financial leverage as an additional contributing factor to the cross-sectional variation in the value relevance of earnings and equity book value. In particular, we examine whether the value relevance of earnings and equity book value is systematically different between high-leverage firms and low-leverage firms.

We use two different but complementary approaches to measure differences in the value relevance of earnings and equity book value between all equity and levered firms. First, we compare the magnitudes of valuation coefficients on earnings and equity book value similar to Barth et al. (1998). Second, we compare the incremental explanatory power (R^2) of earnings and equity book value (Barth et al (1998) and Collins et al. (1997)).

Using a sample of 869 levered firms over twenty-year period (1989-2008), we find that equity book value (earnings) response coefficients are larger (smaller) for high-leverage firms vis-à-vis low-leverage firms. We also find that *incremental* explanatory power of equity book value is larger for high-leverage firms than low-leverage firms. These results are robust across different model specifications and testing methods.

The remainder of this paper is organized as follows. First, a hypothesis development is discussed. Then, sample selections and measurements of variables are described. The empirical tests and their results are followed. In the final section, conclusions are addressed

2. HYPOTHESIS DEVELOPMENT

Since the seminal work by Ball and Brown (1968), numerous researchers have examined the roles of accounting information for equity valuation, and provided evidence on strong relationship between accounting numbers and stock prices. For example, earnings for US firms explain, on average, 59 percent of stock prices (Collins, Maydew and Weiss (1997)) and US book values explain 68 percent (Collins et al. (1997) of market prices.

Given this well-documented value relevance of earnings and book value of equity, several studies have investigated specific conditions under which book value is more value relevant than earnings, or *vice versa*. For example, empirical studies show that book value of equity is more value relevant than earnings for the firms with negative earnings (Hayn(1995); Collins, Pincus and Xie (1999)), extreme return-on-equity (Penman (1998)), low return on equity (Burgstahler and Dichev(1997)), deteriorating financial health (Barth, Beaver and Landsman (1998)), and low earnings persistence (Ou and Sepe (2002)).

This study examines the financial leverage as additional factor affecting the cross-sectional variation in the relative value relevance of earnings and book value of equity. The level of debt in a firm's capital structure would cause earnings and book value to play differential roles in pricing its equity for the following reasons.

First, the balance sheet provides information for loan decisions, monitoring of debt contracts and liquidation values, while income statement provides information about the firm's abnormal earnings generating abilities. This distinctive role of balance sheet suggests that book value of equity would play more important role on firm valuation for the high-leverage firms than for the low-leverage firms (Barth et al (1998)).

Second, given the distinctive role of balance sheet, the importance of equity book value (earnings) would increase (decrease) as the firm's default risk increases, because liquidation values and probability of default affect equity values. This negative relation between default risk and the valuation importance of earnings has been well-documented (Dhaliwal et al (1992); Dhaliwal and Reynolds (1994); Barth et al (1998); Kwak et al (2007)).

Third, contracting costs and earnings management literature provides evidence that highly levered firms tend to choose liberal accounting methods and manipulate earnings. As a result, the quality of earnings would be lower for the high-leverage firm than for low-leverage firms, and investors will look for and put more weight on balance sheet information. Hence, equity book value (earnings) would be more (less) important to valuation for high-leverage firms than for low-leverage firms. Therefore, testable hypothesis would be

Hypothesis: Value relevance of *equity book value (earnings)* is *larger (smaller)* for high-leverage firms than for low-leverage firms.

3. SAMPLE SELECTION AND RESEARCH METHOD

3.1 Sample selection

Our sample firms were drawn from the COMPUSTAT database. To be included in the sample, each firm must have relevant financial data (earnings, equity book value, number of shares outstanding and year-end stock price) available over twenty year period (1989-2008). The sample of levered firms was selected by requiring that each firm had long-term debt outstanding

throughout the 20 year period. Implementation of these procedures yielded a sample of 869 levered firms.

From this initial sample of levered firms, high-leverage and low-leverage firms were selected by classifying firms into three groups (high, medium, and low) each year according to the level of their financial leverage. Financial leverage was measured by the ratio of long-term debt to market value of equity. Firms in the medium level of financial leverage were excluded in the analysis.

The selection of firms using above criteria may bias the sample in favor of excluding firms with high default risk. For example, bankrupted firms and firms with discontinuing operations during the period are less likely to be included. However, such bias would work against finding a significant difference in the value relevance between high-leverage and low-leverage firms.

The breakdown of sample firms by industry is shown in Table 1. The sample consists of 14 industries and there is some clustering in particular industries. For example, durable manufacturers and utilities industries account for 23.48% and 10.70%, respectively. Other than this clustering, however, sample firms are well-distributed among industries.

<Insert Table 1>

3.2. Research Method

The value relevance of accounting information can be defined as the ability of financial statements to summarize information that affects firm value (Collins et al. (1997); Francis and Schipper (1999)). Although financial statements provide lots of value relevant information, earnings and book value of equity have been considered as two key measures. Following the valuation model developed by Ohlson (1995) and subsequent empirical studies, we operationalize the value relevance of earnings and book value by estimating the following regression model:

$$P_{it} = \alpha_0 + \alpha_1 EPS_{it} + \alpha_2 BV_{it} + \varepsilon_{it} \qquad (1)$$

Where, P_{it} = the price of stock for firm i at the end of year t;

EPS_{it} = the earnings per share of firm i during the year t;

BV_{it} = the book value per share for firm i at the end of year t.

As our metrics to measure the value relevance of earnings and book value, we use both the coefficient estimates ($\hat{a}_1$ and $\hat{a}_2$) and explanatory power (R^2) of regression model (1). We estimate the model (1) for the sample of high-leverage firms and low-leverage firms separately. Regression coefficients, $\hat{a}_1$ and $\hat{a}_2$, can be interpreted as the weight of earnings and book value in pricing equity, respectively. Alternatively, they are called 'earnings response coefficient' and 'book value response coefficient'. Using this metric of value relevance, we can state our hypothesis as:

Hypothesis: $\hat{a}_2$ (high-leverage firms) > $\hat{a}_2$ (low-leverage firms)

$\hat{a}_1$ (high-leverage firms) < $\hat{a}_1$ (low-leverage firms);

When explanatory power (R^2) is used to measure value relevance of earnings and book value, we have to obtain the *incremental* explanatory power (R^2) of earnings and book value by estimating the following two equations:

$$P_{it} = b_0 + b_1 BV_{it} + \varepsilon_{it} \qquad (2)$$

and

$$P_{it} = c_0 + c_1 EPS_{it} + \varepsilon_{it} \qquad (3)$$

The *incremental* explanatory power (R^2) of earnings and book value can be defined as:

Incremental R^2 of EPS = R^2 of Model (1) – R^2 of Model (2);

Incremental R^2 of BV = R^2 of Model (1) – R^2 of Model (3).

Again, using this metric of value relevance, we can state our hypotheses as:

Hypothesis: Incremental R^2 of BV > Incremental R^2 of EPS, for high-leverage firms;

Incremental R^2 of EPS > Incremental R^2 of BV, for low-leverage firms;

4. EMPIRICAL RESULTS

4.1 Descriptive Statistics

Table 2 provides descriptive statistics for selected variables of the sample firms. Also reported are Wilcoxon rank test statistics for the differences in these variables between high-leverage firms and low-leverage firms. Selected variables include financial leverage (LEV), stock price (P), earnings per share (EPS), book value of equity per share (BV), firm size as measured by market value of equity (MV) and return on equity (ROE).

The average (median) debt to equity ratio (LEV) is 2.007 (0.872) for high-leverage firms and 0.072 (0.067) for low-leverage firms, and the difference is statistically significant (at $\alpha<0.001$). High-leverage firms also exhibit larger BV than low-leverage firms. However, other variables (P, EPS, MV and ROE) are significantly smaller for high-leverage firms than for low-leverage firms. Especially, ROEs of high-leverage firms are not only lower (median values of 9.1% versus 15.3%), but also more fluctuating than those of low-leverage firms as shown in negative mean value and high standard deviation.

<Insert Table 2>

4.2 Results of Comparing Valuation Coefficients

Table 3 presents the results of comparing the value relevance of earnings and book value, as measured by the coefficients from regression model (1). In order to avoid potential problem of cross-sectional dependence from pooling cross-sectional and time-series data, we estimate equation (1) each year for twenty years (1989-2008) and for the high-leverage and low-leverage firms, separately.

Table 3 summarizes the yearly regression results. The coefficients reported for each independent variable are the sample means of the parameter estimates from the 20 yearly cross-sectional regressions. The t-statistics are calculated from the time-series sampling distribution of parameter estimates and, thus, the statistical inferences are not subject to the cross-sectional dependence problem.

The coefficients on EPS and BV have the predicted sign (positive) and are statistically significant (at $\alpha<0.001$) for both high-leverage and low-leverage firms. The coefficient on EPS (earnings response coefficient: ERC) of high-leverage firms (1.930) is smaller than that of low-leverage firms (6.964). Wilcoxon rank sum test shows that the difference in ERCs is statistically significant. This result is consistent with those of Dhaliwal et al (1992) and Dhaliwal and Reynolds (1994)). More importantly, the coefficient on BV (book value response coefficient: BVRC) of high-leverage firms (1.016) is *larger* than that of low-leverage firms (0.616), and the difference is also statistically significant, supporting our hypothesis.

<Insert Table 3>

As an additional approach to test our hypothesis, we estimate the pooled cross-sectional and time-series model which includes a dummy variable, D_{it}, which takes a value one if the observation belongs to the sample of high-leverage firms and zero otherwise:[1]

$$P_{it} = b_0 + b_1 D_{it} + b_2 EPS_{it} + b_3 EPS_{it} * D_{it} + b_4 BV_{it} + b_5 BV_{it} * D_{it} + \varepsilon_{it} \quad (4)$$

In this model, the coefficients, b_3 and b_5, represent the differences in ERCs and BVRCs, respectively, between high-leverage and low-leverage firms.

Table 4 presents the results of estimating the above model separately for high-leverage and low-leverage firms, as well as for the pooled sample. The ERC is 1.898 for high-leverage firms, but 6.399 for low-leverage firms. Along with significantly negative value of coefficient b_3, this result means that EPS has smaller effect on equity price for high-leverage firms than for low-leverage firms. As for BV, the coefficient b_5 is positive and statistically significant, indicating that BV has larger effect on equity price for high-leverage firms than for low-leverage firms.

[1] Year dummy variables, which take a value of 1 if the observation belongs to a specific year and 0 otherwise over the years 1989 to 2007, are also included in order to avoid the potential problem of cross-sectional dependence.

Overall, these results lend strong support to our hypothesis. Our findings are also consistent with the notion that investors will place more weight on book value (balance sheet) than on earnings (income statement) in valuing equity for firms with more debt in their capital structures.

<Insert Table 4>

4.3 Results of Comparing Explanatory Powers

Table 5 presents the results of comparing the explanatory powers of earnings and book value between high-leverage firms and low-leverage firms. Shown in the Table 5 are sample mean of different measures of R^2 and Wicoxon test statistics from the results of estimating the regression models (1)-(3) each year for 20 years (1989-2008). The total R^2 indicates that earnings and book value jointly explain 61.6% (59%) of the variation in equity prices for high-leverage firms (low-leverage firms), which is lower than 75% reported in the study by Collins et al. (1997) over the period 1983-1993. An interesting result is that there is no significant difference in total R^2 between high-leverage and low-leverage firms.

However, the results show significant differences in incremental explanatory powers. For example, average incremental R^2 of EPS is smaller for high-leverage firms than low-leverage firms (5.1% versus 14.2%). On the other hand, average incremental R^2 of BV is larger for high-leverage firms (30.9%) than for low-leverage firms (9.0%), and the difference is statistically significant. This indicates that for high-leverage firms, equity book value alone accounts for 50.2% (0.309/0.616) of total explanatory power provided by both earnings and book value, while book value alone accounts for only 9% (0.053/0.590) of total R^2 for low-leverage firms. This result is consistent with our hypothesis.

Overall, these results suggest that relative value relevance of equity book value (over earnings) is larger for high-leverage firms than for low-leverage firms, as measured by the explanatory power of book value and earnings for equity prices.

<Insert Table 5>

4. CONCLUSION

This study investigates the firm's level of financial leverage as an additional contributing factor to the cross-sectional variation in the value relevance of earnings and equity book value. In particular, we examine whether the value relevance of earnings and equity book value is systematically different between high-leverage firms and low-leverage firms. Using prior empirical results and arguments regarding the distinctive roles of balance sheet, we hypothesize that value relevance of equity book value is larger for high-leverage firms than for low-leverage firms.

Our empirical results, using a sample of 869 levered over twenty-year period (1989-2008), indicate that value relevance of equity book value is larger for high-leverage firms than for low-leverage firms. Specifically, we find that book value (earnings) response coefficients are larger (smaller) for high-leverage firms vis-à-vis low-leverage firms. We also find that *incremental* explanatory power of equity book value (earnings) is larger (smaller) for high-leverage firms than for low-leverage firms, while common explanatory powers of earnings and equity book value are larger for low-leverage firms than high-leverage firms. These results are robust across different model specifications and testing methods.

Several related issues are left for future research. First, the differential effects of financial leverage on value relevance of earnings and book value can be conducted by using more refined measures for the firm's level of financial leverage. For example, we may classify firms into two groups of all-equity versus levered firms, or as many as ten groups of firms based on the level of financial leverage. Second, an inter-temporal analysis that examines the direction of changes in value relevance of earnings and book value associated with the changes in the firm's financial leverage would be an interesting approach, and particularly useful for controlling for other firm characteristics affecting the variations in value relevance of earnings and book value. For example, we may conduct this approach by using a sample of firms that retire old debt or issue new debt. Finally, a natural extension would be to apply the same methodology to comparing the value relevance of other pieces of information available on financial statements such as cash flows and dividends.

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<Table 1>

Industry Classification of Sample Firms

Industry	Primary SIC codes [1)]	Number of Firms	%
Mining & Construction	1000-1999	42	4.83
Food	2000-2111	32	3.68
Textile & Printing	2200-2780	61	7.02
Chemicals	2800-2824, 2840-2899	33	3.80
Pharmaceuticals	2830-2836	24	2.76
Extractive industries	2900-2999, 1300-1399	35	4.03
Durable manufactures	3000-3999, excluding 3570-3579 And 3670-3679	204	23.48
Computers	7370-7379,3570-3579,3670-3679	48	5.52
Transportation	4000-4899	50	5.75
Utilities	4900-4999	93	10.70
Retail	5000-5999	79	9.09
Financial institutions	6000-6411	83	9.55
Insurance & Real estate	6500-6999	44	5.06
Services	7000-8999, excluding 7370-7379	41	4.72
Total		869	100.00

1) Industry classification criteria are same as those used in Barth et al (1998).

<Table 2>

Descriptive Statistics of Selected Variables

Variables	High-leverage Firms			Low-leverage Firms			Wilcoxon z-statistics (p-value)
	Mean	Std Dev	Median	Mean	Std Dev	Median	
LEV [1)]	2.007	19.593	0.872	0.072	0.051	0.067	91.819 (0.0001)
P [2)]	23.591	20.443	19.438	37.474	26.868	32.600	-31.639 (0.0001)
EPS [3)]	1.187	2.570	1.139	2.006	2.097	1.682	-19.453 (0.0001)
BV [4)]	15.874	12.256	13.790	13.720	12.381	10.817	13.053 (0.0001)
MV [5)]	4.609	18.041	0.638	12.889	33.665	1.879	-24.286 (0.0001)
ROE [6)]	-0.057	2.284	0.091	0.136	0.703	0.153	-36.366 (0.0001)

1) Leverage as measured by the ratio of long-term debt to market value of equity.
2) Price per common share at the end of fiscal year end.
3) Earnings per share.
4) Book value of equity per share.
5) Market value of equity (in $Billions).

6) Return on equity = Net Income / Equity

<Table 3>

Coefficients from Regressions of Stock Price on Earnings and Equity Book Value: Using Yearly Regression [1)]

$$P_{it} = a_0 + a_1 EPS_{it} + a_2 BV_{it} + \varepsilon_t$$

	Expected sign	High-leverage firms	Low-leverage firms	Difference [2)] (Wilcoxon z-stat)
Intercept	?	4.965 (8.465)***	15.014 (16.093)***	-10.049 (5.207)***
EPS	+	1.930 (10.388)***	6.964 (18.725)***	-5.034 (5.397)***
BV	+	1.016 (27.245)***	0.616 (13.573)***	0.400 (4.531)***
Adj. R^2 (%)		61.564	58.983	

1) Coefficient estimates and adjusted R-squares are averages of 20 yearly estimates.

2) Wilcoxon z-statistics are based on these 20 yearly data.

*** Significant at α<0.01; ** Significant α<0.05; * Significant α<0.10;

<Table 4>

Coefficients from Regressions of Stock Price on Earnings and Equity Book Value: Using Pooled Regression with Dummy Variables [1), 2)]

$$P_{it} = b_0 + b_1 D_{it} + b_2 EPS_{it} + b_3 EPS_{it} * D_{it} + b_4 BV_{it} + b_5 BV_{it} * D_{it} + \varepsilon_{it}$$

	Expected sign	High-leverage firms	Low-leverage firms	Pooled Sample
Intercept	?	-2.457 (3.190)***	7.320 (6.860)***	7.707 (11.040)***
D	?			-10.518 (23.110)***
EPS	+	1.898 (25.360)***	6.399 (41.540)***	6.375 (47.400)***
*EPS*D*	-			-4.488 (27.780)***
BV	+	1.028 (66.650)***	0.682 (26.360)***	0.675 (29.770)***
*BV*D*	+			0.361 (12.270)***
Adj. R^2 (%)		62.83	58.32	62.40

1) D_{it} is a dummy variable which takes a value of one if the firm i in year t belongs to the sample of 'high-leverage' firms, and zero if it belongs to the sample of 'low-leverage' firms.

2) Year dummy variables were also included in the regression model,

but not specified for brevity.

*** Significant at $\alpha<0.01$; ** Significant $\alpha<0.05$; * Significant $\alpha<0.10$;

<Table 5>

R-Squares (R^2) from the Regression of Stock Price on Earnings and/or Equity Book Value

$$P_{it} = a_0 + a_1 EPS_{it} + a_2 BV_{it} + \varepsilon_t$$

Classification of R-squares [1)]	High-leverage Firms		Low-leverage Firms		Differences in R^2 (Wilcoxon z-stat)
	R^2	% of Total	R^2	% of Total	
Total	0.616		0.590		0.026 (0.176)
EPS incremental	0.051	8.3	0.142	24.1	-0.091 (4.937)***
BV incremental	0.309	50.2	0.053	9.0	0.256 (5.261)***
Common	0.256	41.5	0.395	66.9	-0.139 (3.557)***

1) Each R-square measure is obtained from the following models:
Model 1: $P_{it} = a_0 + a_1 EPS_{it} + a_2 BV_{it} + \varepsilon_t$

Model 2: $P_{it} = b_0 + b_1 BV_{it} + \varepsilon_t$

Model 3: $P_{it} = c_0 + c_1 EPS_{it} + \varepsilon_t$

• Total R^2 = R^2 of Model 1.

• Incremental R^2 of EPS = R^2 of Model 1 – R^2 of Model 2.

• Incremental R^2 of BV = R^2 of Model 1 – R^2 of Model 3.

• Common R^2 = R^2 of Model 1 – R^2 of Model 2 – R^2 of Model 3.

2) Wilcoxon z-statistics and p-values are based on 20 yearly R^2 data.

*** Significant at $\alpha<0.01$; ** Significant $\alpha<0.05$; * Significant $\alpha<0.10$;