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Optimal Debt-to-Equity Ratios and Stock Returns

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OPTIMAL DEBT-TO-EQUITY RATIOS AND STOCK RETURNS

by

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ABSTRACT

Optimal Debt-to-Equity Ratios and Stock Returns

by

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Firms that are optimizing returns have a concave value function where market value is dependent on the debt-to-equity ratio and debt-to-equity ratio squared. To obtain the optimal debt-to-equity ratio, I estimate the value function for each firm using regression analysis. Then I maximize this concave function by taking the derivative with respect to debt-to-equity and set it equal to zero. By solving, I find the optimal debt-to-equity ratio or the ratio that maximizes firm value.

Margin is the absolute value of the difference between optimal and observed debt-to-equity ratios. Firms with the smallest margin values acquire 3.45% higher returns than firms with the largest margin values. Margin has a negative impact on returns, which suggests that companies that minimize margin and consequently stay close to their optimal debt-to-equity ratio will experience higher stock returns.

Pages (17)

PUBLIC ABSTRACT

Optimal Debt-to-Equity Ratios and Stock Returns

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Value maximization of a firm depends heavily on the financial leverage of the company. This is measured by the debt-to-equity ratio, which explains what proportions of debt and equity are being used to finance the firm's assets. By adjusting this ratio, firms can influence their stock performance.

In this study, I estimate the value function for each firm and take the derivative with respect to the debt-to-equity ratio. By setting this equal to zero, I solve for the optimal debt-to-equity ratio or the ratio that maximizes firm value. The difference between the optimal and historically observed debt-to-equity ratios is called the margin.

Variables like market capitalization, trading volume, and book-to-market ratio can influence margin, as my test results show. Furthermore, I find that margin can influence stock returns of the firm, and it does so in a negative and significant way.

By minimizing margin, companies are able to influence the magnitude of stock returns.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure Page

CHAPTER ONE

INTRODUCTION

Financial leverage is measured by a firm's debt-to-equity ratio, and it explains what proportion of debt and equity is being used to finance the firm's assets. The firm's optimal debt-to-equity ratio might depend on the industry in which the firm operates or historical levels of debt-to equity. In this study, I estimate the "optimal" debt-to-equity ratio by finding the debt-to-equity ratio that has maximized firm value historically. Then, I test whether firms that are closer to their optimal debt-to-equity ratio experience higher stock returns.

Before Franco Modigliani and Merton Miller published their findings about the financial world in 1958, the world assumed that one "best" debt-to-equity ratio existed for all firms. Modigliani and Miller (M&M) abolish this traditional approach with their theorem on capital structure which states that in an efficient market, the value of firms is not affected by the firm's debt-to-equity ratio under assumptions of the absence of taxes, bankruptcy and agency costs, and asymmetric information. Although this "perfect world" is not evident in reality, M&M's research sparks questions in inquisitive minds which leads to beneficial lessons about how companies should finance their operations. Researchers attempt to prove whether it is advantageous to finance a firm's assets through creditors by borrowing or through its stockholders.

Bhandari (1988) discovers that the expected common stock returns are positively related to the ratio of debt to equity. His evidence suggests that the premium associated with a higher debt-to-equity ratio is not simply a possible kind of "risk premium." Some firms take this aggressive approach in financing the firms' growth by using borrowed funds to purchase assets under the assumption that the income from the asset will offset the cost of borrowing and the risk that accompanies it. Shareholders will benefit if this technique increases earnings.

Bhandari finds evidence supporting this argument. However, if interest payments start to outweigh the return, the companies could face bankruptcy. As a result, firms are in constant debate about how to have a healthy balance between debt and equity. In theory, active firms will find an optimal debt-to-equity ratio and attempt to minimize the margin between the actual and optimal ratios.

In this study, I obtain the optimal debt-to-equity ratio by estimating a concave function using regression analysis where firm value is the dependent variable and the debt-to-equity ratio and the debt-to-equity ratio^2 are the independent variables. After obtaining coefficients from this regression, I maximize this concave function for each firm by dividing the coefficient on the debt-to-equity ratio by negative 2 times the coefficient on the debt-to-equity ratio squared (Optimal $D/E = \beta(D/E) \div -2 * \beta(D/E^2)$). Hovakimian (2001) states that this target ratio may change over time as the firm's profitability and stock price change. Firms will continually monitor the movement of the D/E ratios and adjust accordingly.

Using quarterly data from CRSP and COMPUSTAT, I find that firms that have the smallest margin between actual and optimal debt-to-equity ratios (margin hereafter) achieve the highest alphas. After sorting the data by the ascending margin into five portfolios, I compare the average returns across the board and notice that returns monotonically decrease as margin grows. I discover that firms with the smallest margins acquire 3.45% higher annual returns than the firms with the largest margins on average.

Margin has a negative impact on returns which I find when I regress returns on various stock characteristics. As a firm's margin increases, it will have an adverse effect on the performance of the firm's stock. In further regression analysis, I use the Fama French

Factor Model and Capital Asset Pricing Model and find alpha that are equal to zero in the portfolio with the largest margin.

The results of this study are significant and might be a fruitful avenue for future research. With knowledge of this technique, firms have the ability to control the company's financial position and the performance of the company's stock. Firms that operate closer to their optimal debt-to-equity ratio will experience higher stock returns than firms that stray away from the optimal ratio.

CHAPTER 2

DATA

In this study, I combine data from several sources in order to test whether optimal debt-to-equity ratios matter. First, I extract historical quarterly financial statement information from Compustat for firms from 1980 to 2012. This data provides consistent and comparable variables for analysis including assets and liabilities, which are necessary to obtain a firm's actual and optimal debt-to-equity ratios. Using over 30 years of quarterly financial statement information affirms that the optimal debt-to-equity ratio I calculate is accurate.

Next, I retrieve monthly data from the Center for Research in Security Prices (CRSP) to obtain information about share prices, stock returns, trading volume, market capitalization, price volatility, and shares outstanding for companies in the time period of the financial statement data. I clean up the data by removing missing values, revising the format of the measurements of time, and creating new variables with the absolute values of price, low bid price, and high ask price.[1]

Finally, I use the Wharton Research Data Services to find the Fama-French factors to explain the returns of the firms. These factors include (1) the market risk premium from the Capital Asset Pricing Model, (2) the historic excess returns of small market capitalization firms over big market capitalization firms, (3) the historic outperformance of value stocks (firms with high book-to-market ratios) over growth stocks, and (4) the Carhart (1997) momentum premium.

After aggregating the data to the quarterly level, I sort it by year and quarter, and then merge the three groups by ticker into one large dataset that includes 174,761 observations of 9,870 unique stocks. Once combined, I create the variable of equity (by subtracting liabilities from assets) in order to calculate the debt-to-equity ratios.

CHAPTER THREE

EMPIRICAL RESULTS

Table 1 presents statistics that describe the sample of firms in this study. *D/E* is the debt-to-equity ratio of a firm, and the *Optimal D/E* is the optimal debt-to-equity ratio of a firm. In theory, a company that optimizes returns has a concave function where firm value is a concave function of D/E. I estimate a regression where firm value is the dependent variable and both D/E and D/E^2 are independent variables. In particular, I estimate the following equation for each stock in my sample.

$$Value_{i,t} = \alpha + \beta_1 D/E_{i,t} + \beta_2 D/E^2_{i,t} \quad (1)$$

[1] On occasion, CRSP closing prices are flagged as negative. This means that there was no closing prices and that the reported closing price was calculated using the midpoint between the bid and ask price. Therefore, I'm required to take the absolute value of the negative CRSP price in these cases.

Using the coefficients from the regression in equation (1), I divide a firm's estimate for β_1 by -2 times the estimate for β_2 in order to maximize this concave function and find an optimal D/E ratio for each stock.[2] That is, the optimal D/E ratio for each stock is given below:

$$\textit{Optimal } D/E_{i,t} = \frac{\beta_1}{-2 \times \beta_2} \quad (2)$$

Market Cap, which is the dependent variable in the regression, is the quarterly market capitalization and the dollar market value of a firm's outstanding shares. The standard deviation of average debt-to-equity in column [3] implies the significance of industry type in a firm's approach to financing a company's assets. Capital-intensive industry companies are more likely to use additional debt in order to finance their projects, while other firms want to avoid the risks that accompany borrowing. Shareholders might study the debt-to-equity ratio and the capability of the company to pay interest and eventually repay the debt because their dividends follow these repayments. The financial leverage technique that a firm uses depends on the industry type and analysis of future growth potential. It is because of this condition that I calculate the optimal debt-to-equity ratio for each firm independently based on their own historical approach to financial leverage.

Table 1
Summary Statistics

[2] The ratio $\beta_1/(-2^* \beta_2)$ is the result from taking the partial derivative of the dependent variable with respect to D/E and setting the partial derivative equal to zero and then solving for an optimal D/E.

The table presents statistics that describe the 174,761 observations used in the analysis. D/E is the Debt-to-Equity ratio of a firm in a particular quarter. Optimal D/E is the Optimal Debt-to-Equity ratio of a firm in a particular quarter. A firm that optimizes returns has a concave function. Therefore, I force the data to only include firms that optimize by removing data with negative D/E ratios and positive D/E^2, which produces a concave function. The Optimal D/E ratio is calculated by dividing a firm's D/E ratio by (-2*D/E^2). Market Cap is the dollar market value of a firm's outstanding shares. Price is the price of the firm's stock at the end of the quarter. Volume is the trade volume of a firm's shares in a quarter. Price Volatility is the difference between a firm's quarter's high price and the quarter's low price scaled by the quarter's high price. Assets are the value of a firm's assets at the end of the quarter. Liabilities are the value of a firm's liabilities at the end of the quarter. Equity is the value of a firm's assets and liabilities at the end of the quarter.

	Mean	Median	Std. Deviation	Min	Max
	[1]	[2]	[3]	[4]	[5]
D/E	3.3774850	1.1149349	124.952173	-1600.93	46302.50
Optimal D/E	24.128576	1.7488278	7	0.00004232	23410.08
	5		324.444951	4	
Market Cap		261962.44	2		674351833
Price	3121671.4	16.8541667		0.0000	945.340006
Volume	6	39753.00	16048077.3	0.0236	7
Price	22.419969	0.1242646	0	0.0000	519934650
Volatility	5		25.4212581	0.0000	0.9920923
	413705.96	423.271500	3056176.74		
Assets	0.1458869	0	0.0876538	0.0000	3879171.80
Liabilities		220.878000		-1.3190	3672760.51
Equity	8862.12	0	84790.17	-90520.00	206411.29
	7299.46	147.840000	80100.74		
	1562.66	0	6997.38		

I also report summary statistics for a number of other stock characteristics. *Price* is the price of the firm's stock at the end of the quarter. *Volume* is the trade volume of a firm's shares in a quarter. *Price Volatility* is the difference between a firm's quarter's high price and the quarter's low price scaled by the quarter's high price. *Assets* are the value of a firm's assets, *Liabilities* are the value of a firm's liabilities, and *Equity* is the value of a firm's assets minus liabilities in thousands at the end of the quarter.

3.1 – Univariate Tests – Determinants of Margin

I evaluate the relationship between several company characteristics and the absolute value of the difference between the firm's optimal and actual debt-to-equity ratios ($D/E_{i,t}$ – Optimal $D/E_{i,t}$), hereafter referred to as *margin*, in Table 2. After taking the natural log of market capitalization and trading volume in order to improve the normality of these variables, I find that margin is positively correlated with market capitalization, the volume of trade, price volatility, and the debt-to-assets ratio, which is a firm's liabilities divided by assets. This implies that as a company's price volatility and the market value increase, margin increases.

The book-to-market ratio has a negative correlation with margin which suggests growth firms experience higher margin. However, I note that the correlation is not statistically different from zero (p-value = 0.371).

3.2 – Multivariate Tests – Determinants of Margin

Using regression analysis to control for other factors that influence margin, I estimate the following equation, where the log of margin is the dependent variable and the firm characteristics described above are included as the independent variables in Table 3.

$$Log(Margin)_{i,t} = \beta_0 + \beta_1 Ln(MktCap_{i,t}) + \beta_2 B/M_{i,t} + \beta_3 Ln(Volume_{i,t}) + \beta_4 PriceVolt_{i,t} + \beta_5 D/A_{i,t} + \varepsilon_{i,t}$$

In comparing margin to the natural log of market capitalization and volume of trade, there are negative estimates for these characteristics in column [1]. However, as I control for other variables, the coefficient on market capitalization becomes positive in column [4]. This suggests margin is greater for large market cap firms. The estimate for trading volume remains negative as I control for other variables, demonstrating that margin will decrease as the amount of trading increases.

Table 2
Correlation
The table presents a matrix of correlation coefficients using the factors that could influence Margin. The relationship of interest is across Margin (row 1). The variables include Market Cap (Ln(MktCap)), Book-to-Market ratio which is calculated by dividing the book value of the firm by the market value of the firm (B/M), Volume (Ln(Volume)), Price Volatility (PriceVolt), and Debt-to-Assets ratio which is the calculated by dividing the firm's liabilities by its' assets (D/A). The correlations are estimated using quarterly data over the period 1980-2012.

	Margin	Ln(MktCap)	B/M	Ln(Volume)	PriceVolt	D/A
	[1]	[2]	[3]	[4]	[5]	[6]
Margin	1.0000	0.00509	-0.00214	0.02311	0.03423	0.00798
		(0.0335)	(0.3710)	(0.0000)	(0.0000)	(0.0009)
Ln(MktCap)		1.0000	-0.05953	0.79641	-0.26355	0.00253
			(0.0000)	(0.0000)	(0.0000)	(0.2894)
B/M			1.0000	-0.03708	0.01271	-0.00120
				(0.0000)	(0.0000)	(0.6172)
Ln(Volume)				1.0000	0.10809	-0.00532
					(0.0000)	(0.0267)
PriceVolt					1.0000	-0.00529
						(0.0270)
D/A						1.0000

Table 3
Panel Regression - Margin
The table presents the panel regression results from estimating the following equation where the dependent variable is the log of margin which is the absolute difference between a firm's D/E and Optimal D/E.

$$Log(Margin)_{i,t} = \beta_0 + \beta_1 Ln(MktCap_{i,t}) + \beta_2 B/M_{i,t} + \beta_3 Ln(Volume_{i,t}) + \beta_4 PriceVolt_{i,t} + \beta_5 D/A_{i,t} + \varepsilon_{i,t}$$

The independent variables include Market Cap (Ln(MktCap)), Book-to-Market ratio (B/M), Volume (Ln(Volume)), Price Volatility (PriceVolt), and Debt-to-Assets ratio (D/A). Dummy variables for years were included in this model to control for possible skewness.

	[1]	[2]	[3]	[4]
Intercept	-1.52426	-0.60989	-0.72782	-0.69020
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Ln(MktCap)	-0.01347			0.00873
	(0.0000)			(0.0631)
B/M	0.30829			0.31172
	(0.0003)			(0.0003)
Ln(Volume)		-0.01386		-0.01999
		(0.0000)		(0.0000)
PriceVolt		0.56848		0.65344
		(0.0000)		(0.0000)
D/A			0.04296	0.04268
			(0.0000)	(0.0000)
Adj. R^2	0.0088	0.0094	0.0117	0.0128
Year Dummies	Yes	Yes	Yes	Yes

Also consistent with Table 2, price volatility and debt-to-assets ratio have positive estimates which implies that more volatile firms and firms with greater leverage will have increased margin. The relationships between margin and volume of trade, price volatility, and the debt-to-assets ratio are significant, and the estimated coefficients do not vary greatly when other control variables are included in the regression.

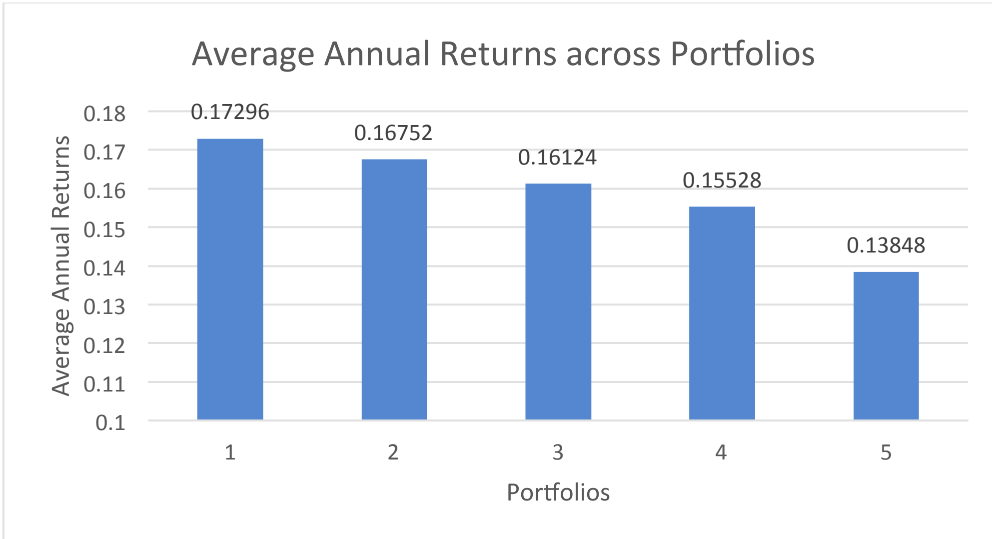
3.3 – Multivariate Tests – Stock Returns and Margin

In this section, I begin to examine the relation between returns and the variable of interest: margin. In Table 4, I measure average returns across increasing portfolios. After I sort the data by ascending margin into five portfolios, I find the average returns, excess returns, and adjusted returns inside each of the portfolios on a quarterly basis. *Returns* are raw quarterly returns for each firm extracted from the CRSP data. *Excess Returns* are the additional returns above the risk free rate for each firm in a quarter. *Adjusted Returns* are the returns above the value-weighted market return, excluding dividends, which is also extracted from CRSP data. As seen in Table 4 and Figure 1, returns are monotonically decreasing across the portfolios suggesting that the firms in portfolio one with the smallest margins have higher returns than firms in portfolio five with the largest margins.

Table 4
Returns across increasing Margin Portfolios
The table presents results for each of the five portfolios sorted by Margin. The variables include average quarterly returns (Returns), excess quarterly returns (Ex. Rets), and adjusted quarterly returns (Adj. Rets). Returns are raw quarterly returns for each firm extracted from CRSP data. Excess Returns are the additional returns above the risk free rate. Adjusted returns are the returns above the Value-Weighted Market Return, excluding dividends, which is also extracted from CRSP data. Column [6] represents the significant difference between Portfolio 5 with the largest margin and Portfolio 1 with the smallest margin.

	P1	P2	P3	P4	P5	P5-P1
	[1]	[2]	[3]	[4]	[5]	[6]
Returns	0.04324	0.04188	0.04031	0.03882	0.03462	0.00862
						(0.0000)
Ex. Rets	0.03377	0.03241	0.03083	0.02935	0.02515	0.00862
						(0.0000)
Adj. Rets	0.01761	0.01621	0.01460	0.01326	0.0089	0.00872
						(0.0000)

To demonstrate this, Column [6] represents the significant difference in returns between portfolio five and portfolio one. On average, firms in portfolio one will have 0.86% higher quarterly returns (3.45% higher annual returns) than firms in portfolio five. The results are robust to each measure of return, and are illustrated in Figure 1.



Consistent with the illustration and the results in Table 4, the alphas in column [1] of Table 5 are monotonically decreasing across the portfolios. Alpha, the measure of excess return, is the variable of interest in these results, but I also note that all of the panels in Table 5 have at least one Fama-French factor with significant explanatory power for each portfolio's average quarterly excess returns. In Panel A, I present the results from the Fama-French 4 Factor model:

$$(Return - Rf)_{i,t} = \alpha + \beta_1 MKT\text{-}RF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \varepsilon_{i,t}$$

MKT-RF is the market return in excess of the risk free return, *SMB* is the size factor (Small market capitalization firms minus Big market capitalization firms), *HML* is the value factor (High book-to-market firms minus Low book-to-market firms), and *UMD* is the momentum factor ("Up" prices minus "Down" prices). The momentum effect comprises the extension of the Fama-French 3 Factor Model described in Carhart (1997). Jegadeesh and Titman (1993) report that stocks with higher returns in the previous 12 months have a tendency to perform better than stocks with lower returns in the previous months.

These factors have various risks associated with them so that we can monitor their effect on returns. For example, smaller cap firms and inferior value firms might be forced to borrow more money to obtain capital, and they show evidence of irregular earnings in their high book-to-market ratios. The stocks of these firms are traded at lower prices in order to compensate for the possible risks involved. Column [1] provides the excess returns when considering these factors, and shows that firms in portfolio 1 with the smallest margin have the highest returns.

In Panel B, I use the Fama-French 3 factor model, which explains stock performance using the three risk factors of market, size and value.

$$(Return - Rf)_{i,t} = \alpha + \beta_1 MKT\text{-}RF + \beta_2 SMB + \beta_3 HML + \varepsilon_i$$

Similar results are shown in column [1] as alphas decrease across increasing portfolios. In fact, there is a 94.43% [(0.01465 – 0.000815)/0.01465] reduction in alpha from portfolio 1 to portfolio 5, suggesting that firms in portfolio 1 have the best stock performance.

In Panel C, I use the Capital Asset Pricing Model, which includes only the *MKT-RF* factor. While the Fama-French Factor Models are highly useful, the CAPM method might still be the most widely used explanation of stock prices in industry (Graham and Harvey, 2001).

$$(Return - Rf)_{i,t} = \alpha + \beta_1 MKT\text{-}RF + \varepsilon_i$$

CAPM uses the single factor of proportional market risk to explain stock performance. The beta coefficient on this factor measures the individual security's level of systematic risk. The expected total return is the sum of this risk factor, the risk free return, and alpha, which can be implied as the impact of management. Results in Table 5 suggest that as management attempts to operate at the optimal debt-to-equity ratio, the firm will experience higher stock performance and returns.

Every panel regression in Table 5 shows that alphas essentially fall to zero in portfolio five where the firms with the largest margin exist.

Table 5

Panel Regression – Fama French and CAPM Models

The table presents the panel regression results from estimating the following equation where the dependent variable is excess return which is the return in excess of the risk free rate.

Panel A reports the results for the Fama-French 4 Factor Model using the following regression equation:

$$(Return - Rf)_{i,t} = \alpha + \beta_1 MKT\text{-}RF + \beta_2 SMB + \beta_3 HML + \beta_4 UMD + \varepsilon_i$$

The independent variables include the market return in excess of the risk free rate (MKT-RF), Small Market Cap minus Big (SMB), High book-to-market ratio minus Low (HML), and Momentum “Up minus Down” (UMD).

Panel B reports the results for the Fama-French 3 Factor Model using the following regression equation:

$$(Return - Rf)_{i,t} = \alpha + \beta_1 MKT\text{-}RF + \beta_2 SMB + \beta_3 HML + \varepsilon_i$$

The independent variables include the market return in excess of the risk free rate (MKT-RF), Small Market Cap minus Big (SMB), and High book-to-market ratio minus Low (HML).

Panel C reports the results for the Capital Asset Pricing Model (CAPM) using the following regression equation:

$$(Return – Rf)_{i,t} = \alpha + \beta_1 MKT\text{-}RF + \varepsilon_i$$

The independent variable is the market return in excess of the risk free rate (MKT-RF).

Dummy variables for years were included in this model to control for possible skewness.

Panel A. 4-Factor Regressions

	Intercept	MKT-RF	SMB	HML	UMD	R^2
	[1]	[2]	[3]	[4]	[5]	[6]
P1	0.01700	0.90666	0.83569	-0.04080	-0.09342	0.1532
	(0.0000)	(0.0000)	(0.0000)	(0.0774)	(0.0000)	
P2	0.01519	0.90484	0.85599	0.11713	-0.15091	0.1469
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
P3	0.01252	0.89248	0.72064	0.28799	-0.12363	0.1479
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
P4	0.01149	0.84626	0.62349	0.39065	-0.12945	0.1350
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
P5	0.00481	0.95326	0.85802	0.40220	-0.15865	0.1332
	(0.0029)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

Panel B. 3-Factor Regressions

	Intercept	MKT-RF	SMB	HML	UMD	R^2
	[1]	[2]	[3]	[4]	[5]	[6]
P1	0.01465	0.93216	0.86503	-0.00715		0.1525
	(0.0000)	(0.0000)	(0.0000)	(0.7487)		

P2	0.01139	0.94599	0.90342	0.17145		0.1451
	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
P3	0.00941	0.92618	0.75947	0.33255		0.1464
	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
P4	0.00823	0.88156	0.66418	0.43724		0.1333
	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
P5	0.00081474	0.99656	0.90786	0.45934		0.1315
	(0.5983)	(0.0000)	(0.0000)	(0.0000)		

Panel C. CAPM Regressions						
	Intercept	MKT-RF	SMB	HML	UMD	R^2
	[1]	[2]	[3]	[4]	[5]	[6]
P1	0.01549	1.12612				0.1325
	(0.0000)	(0.0000)				
P2	0.01434	1.11356				0.1233
	(0.0000)	(0.0000)				
P3	0.01410	1.03011				0.1237
	(0.0000)	(0.0000)				
P4	0.01403	0.94366				0.1092
	(0.0000)	(0.0000)				
P5	0.00715	1.10860				0.1056
	(0.0000)	(0.0000)				

Lastly, I use regression analysis to control for other stock-specific factors, like market capitalization, book-to-market ratio, volume of trade, price volatility, debt-to-assets ratio, and margin on the dependent variable of returns in Table 6.

$$Log(Return)_{i,t} = \beta_0 + \beta_1 Ln(MktCap_{i,t}) + \beta_2 B/M_{i,t} + \beta_3 Ln(Volume_{i,t}) + \beta_4 PriceVolt_{i,t} + \beta_5 D/A_{i,t} + \beta_6 Log(Margin_{i,t}) + \varepsilon_i$$

In order to scale and correct for the non-normal of stock returns in the cross section, I use the log of returns, market cap, volume, and margin. The variable of interest is the log of margin, which is significant and negatively related to returns in every column regression I perform. This implies that as a firm allows its debt-to-equity ratio stray from the optimal ratio, stock returns will suffer.

Book-to-market ratio, trading volume, and debt-to-assets ratio also have negative estimates in column [4]. Although the estimate on debt-to-assets ratio is not significant, it still provides weak evidence that firms will witness lower returns as they increase their debt in relation to their assets.

The main focus of Table 6 is to demonstrate the negative relationship between margin and returns, irrespective of the other variables I control for.

Table 6
Panel Regression - Returns
The table presents the panel regression results from estimating the following equation where the dependent variable is the log of a firm's return.

$$Log(Return)_{i,t} = \beta_0 + \beta_1 Ln(MktCap_{i,t}) + \beta_2 B/M_{i,t} + \beta_3 Ln(Volume_{i,t}) + \beta_4 PriceVolt_{i,t} + \beta_5 D/A_{i,t} + \beta_6 Log(Margin_{i,t}) + \varepsilon_i$$

The independent variables include Market Cap (Ln(MktCap)), Book-to-Market ratio (B/M), Volume (Ln(volume)), Price Volatility (PriceVolt), Debt-to-Assets ratio (D/A), and the Margin (Log(Margin)). The variable of interest is the log of margin which is significant and negatively related to returns.
Dummy variables for years were included in this model to control for possible skewness.

	[1]	[2]	[3]	[4]
Intercept	2.30661	2.29896	2.29908	2.29524
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Ln(MktCap)		0.000570	0.000562	0.00109
		(0.0000)	(0.0000)	(0.0000)
B/M			-0.00490	-0.00480
			(0.0000)	(0.0000)
Ln(Volume)				-0.000438
				(0.0000)
PriceVolt				0.01601
				(0.0000)
D/A				-0.0000208
				(0.3586)
Log(Margin)	-0.000158	-0.000150	-0.0009189	-0.000158
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Adj. R^2	0.0376	0.0395	0.0396	0.0419
Year Dummies	Yes	Yes	Yes	Yes

CHAPTER FOUR

CONCLUSION

This study suggests that the performance of a company's stock depends on their financial position relative to their optimal debt-to-equity ratio. Using this measure of financial leverage as a benchmark is efficient because it dictates how a company obtains assets and how it finances the growth of the company.

I find the optimal debt-to-equity ratio for each firm in this study and show that companies of all industry types are able to optimize their returns based on historical firm value. I then calculate the absolute value of the difference between a firm's current debt-to-equity ratio and their optimal debt-to-equity ratio, which I denote as "margin" for brevity. I find that margin is directly related to price volatility and market capitalization and negatively related to book-to-market ratios.

Sorting stocks into five portfolios based on ascending margin provides evidence of an inverse relationship between margin and returns. Returns monotonically decrease across the portfolios when using the Fama-French and CAPM models as well as average returns. Results suggest that firms with smaller margin obtain higher stock returns than those firms with large margins.

By using this method of monitoring the company's margin and making adjustments relative to the optimal debt-to-equity ratio, companies might be able to influence the magnitude of stock returns.

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