

Burden of Leverage: How Leverage Affects Performance of Companies in America

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Abstract—The questions about the relationship between leverage and company performance have always been under heated discussion. Theories have demonstrated their interaction and drawn diverse conclusions. In order to figure out the proper leverage burden of a company for managers and investors, I study how leverage affect performance of U.S. companies. The results show that leverage has negative impact on the valuation, efficiency and risk of the company. The relationship holds both in the cross section and in the time series. However, leverage has negative impact on profitability for a company while positively influence the profitability for different companies in the same industry. The results suggests that excessive debt is likely to be a burden for the company and harm company performance under most circumstances. The study implies that managers may face lower company performance when burdening excessive debt and investors may take more risks when investing for higher leverage companies.

Index Terms—Leverage, interest coverage, company performance

I. INTRODUCTION

The leverage of a company may influence its performance. Since debt might trap the company into financial stress but could also have some benefits, the relationship between leverage and firm performance is undetermined. In order to find better ways to manage companies, many studies have tried to reveal the relationship between leverage and firm performance. However, different theories draw different conclusions.

In this paper, I address the question of how leverage will influence firm performance. My aim is to use empirical data to test some theories and find out the relationship between leverage and firm performance, including cross-section tests which analyze companies in the same industry and time-series tests which analyze how changes of leverage over time will influence a firm's performance.

The result of this issue is crucial to both managers and investors. For managers, they need to figure out the optimal leverage for their business to maximize profits. For shareholders, they want to get maximum return. For debtholders, they want to make sure the company is operating well so their interest and principal could be paid back.

I use panel database of firms from North America over the period 1980 to 2016 with their Industry Classification Code. The database allows me to analyze how the effect of leverage on company performance varies across industries and

companies. The main contribution of my paper is that I use empirical data to test the theories that analyze how leverage affect the performance of a company, so that people could know which theory is closer to the reality and adjust their strategies according to their demands.

The results indicate that leverage is a burden for companies most of the time. In both analysis, leverage increases the risk of the company and undermines valuation and efficiency. However, in cross section analysis, leverage ratio improves the profitability of the company while in time series analysis, it lowers profitability. The results are consistent with the idea implied in static trade-off theory: more debt increases the default risk of the company and then undermines the valuation. The CAPM model also helps to explain the increase of risk [1]. With more debt and less equity, the earning rate of the company becomes more volatile, which means β is higher. As for interest coverage, it increases a company's profitability, which is reasonable, since high interest coverage reflects the company has strong ability to afford interests or get profits.

With the empirical results, the managers should realize that with excessive leverage, the company's ability of financing and profiting have the tendency to be constrained. Equity holders should be wary about investing in high leverage companies because its return on equity tends to be lower. However, when comparing companies in the same industry, equity holders have chances to get more profit if they engage in company with high leverage. Debt holders are not suggested to lend money to the company with higher leverage, because even if the profitability goes up, they still get fixed amount of interest and they face the risk of not being able to get the certain amount of interest if the company loses too much. Meanwhile, both debt and equity holders face more risk when investing in high leverage companies.

The paper is structured as follows: Section II provides a literature overview to gain insights into researches about the relationship between leverage and company performance. I also put forward some relevant theories. Section III presents the empirical approach and the data used. Section IV provides the empirical results. Section V make some discussions of the results. Section VI provides suggestions for managers and investors based on the results. Section VII summarizes the conclusions.

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Some research find that high leverage is beneficial to a firm's performance. Jensen stresses that debt could discipline managers to operate a firm more efficiently because they need to pay back debt frequently and have less available cash flow [2]. They are also under the threat of not being able to pay

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back debt so they are motivated to make the firm more efficient, like sparing more efforts to operate the company and wasting less resources. The pecking order theory put forward by Myers and Majluf suggests that managers who have a profitable project tend to raise their stock price in the market, resulting less equity holders to buy them due to asymmetric information [3]. Therefore, they should finance through debt. So, companies with higher debt reflects that they have better way to obtain profit and the correlation between leverage and firm performance is positive. Fosu found that leverage has a significant positive effect on firm performance through a panel dataset of South African listed firms and this relationship is strengthened by market competition [4]. Berger and Bonaccorsi di Patti used profit efficiency to measure firm performance and found high leverage leads to high efficiency [5].

Other authors argue that high leverage have negative influences on firm performance. High leverage may cause high agency costs. Jensen and Meckling identify agency costs between shareholders and debt holders [6]. Shareholders tend to engage in risky investments because profits belong to them and risks are burdened by debt holders. Since debt holders realize this situation, borrowing money may be more expensive, especially for high leverage firms. Lang et al proved that firm leverage might limit the growth of firms with low Tobin Q [7]. Banafa showed that leverage has a negative effect on ROA in Kenya while Muritala showed debt ratio is negatively correlated with both ROA and ROE [8, 9].

Some relevant theoretical models are listed as follows.

Modigliani & Miller Theorem: The initial MM Model was proposed by Modigliani and Miller in 1958. They claimed that in a perfect capital market without tax, the value of a firm is irrelevant with its capital structure due to Arbitrage principle. Therefore, there is not a significant correlation between leverage and the valuation of the company.

Since the assumptions of the initial model are too strict, the MM model taking tax into consideration was proposed. As the interest of debt financing can be paid before tax, the tax base and tax expenditure of the firm are reduced, which is called the tax shield effect. Because of it, debt financing turns out to be cheaper than equity financing. Therefore, increasing the proportion of debt can reduce the cost of capital and increase the market value of the firm. According to this theory, the leverage is going to have a significant positive impact on the valuation of the company.

Static Trade-off Theory: The trade-off theory takes the bankruptcy cost into consideration. With more debt, the firm will face potential risk of bankruptcy costs. With the tax shield discussed above, a firm decides its leverage by comparing the marginal benefit of tax shield and the marginal costs of bankruptcy.

Dividend Discount Model: Dividend Discount Model (DDM) is a model to evaluate the intrinsic value of stock. The intrinsic value of stock is evaluated by summing up the present value of the annual dividend income of this stock. If the company has a constant dividend growth rate g , the future dividend is D and the value of return is r , the price of the stock P will be: $P=D/(r-g)$. This model implies that with the increase of risk, which raises investors expected value of return, P will be lower and the valuation of the company is lower.

III. DATA AND METHODOLOGY

According to the purpose of this research, the models are designed as follows:

$$r_{it} = \beta_0 + \beta_1 leverage + \beta_2 X_{it} + u_i + \eta_t + \epsilon_{it}$$

$$r_{it} = \gamma_0 + \gamma_1 leverage + \gamma_2 X_{it} + v_i + \eta_t + \epsilon_{it}$$

Subscript i represents the company and t represents the year. The dependent variable r_{it} represents indicators used to evaluate the performance of company i at year t . X_{it} is the vector of the control variables. u_i is the company fixed effect while v_i is the industry fixed effect. η_t is the time fixed effect and ϵ_{it} is error term. The first model is for time-series analysis and the second model is for cross-section analysis.

The results are considered to show the correlation between independent and dependent variables rather than the causality between them.

Leverage is valued by leverage ratio and Interest Coverage.

Leverage ratio, measured by Debt/Assets in this paper, reflects the percentage of debt on the balance sheet and implies the solvency of the company.

Interest coverage ratio is the ratio of the profit before interest and tax obtained by the firm and the interest expense. This index could also reflect leverage as companies with more debt tend to have higher interest. In this essay, Interest Coverage is measured in two ways: "EBITDA/Interest Expense" in the main part of the paper and "Operating Income/Interest Expense" for robustness test.

Company performance is evaluated in four ways, including valuation, efficiency, profitability and risk.

Valuation is measured by Tobin Q ratio according to Ibhagui and Olokoyo [10]. It reflects the valuation of the company and has a linear relationship with leverage, which better fits the regressions I run.

Efficiency is measured by ROA (return on assets) and ROE (return on equity) according to Liu and Liu [11].

Profitability is measured by EBITDA margin in terms of EBITDA/Sales and Operating Income margin in terms of Operating Income/Sales.

Risk is measured by annualized daily stock volatility of the previous 12 months. Firms with high stock volatility are tend to have higher risk.

According to Ruland and Zhou and Qi et al, I choose size of the company, measured by $\ln(\text{assets})$, to be the control variable of all the indicators [12, 13]. ROA is added as another control variable for Tobin Q ratio.

I use the data of U.S. companies from Compustat database of Wharton Research Data Services to do an empirical analysis. The dataset includes the data of 30788 companies for 37 years, ranging from 1980 to 2016. I regard companies with the same 3-digit DNUM in the same industry. To avoid the influence of outliers, I winsorize the data and make sure it stays within a reasonable range. Considering that some of the companies are too small, which may have abnormal behavior, I only analyze companies that have assets over than 100 million dollars. Over a hundred thousand data are left and the standard error of company size is still large, which means the result will still be trustful.

Table I reports the summary statistics of main variables after data processing. In this sample, the mean value of total assets is 5.3 billion dollars and the median is 0.8 billion

dollars. This indicates that asset is a highly right-skewed distribution, the majority of companies have relatively small amount of assets. The mean and median of leverage ratio are close and there are about two standard deviations between the maximum and the mean as well as the minimum and the mean. These indicates that leverage ratio is similar to normal distribution. Two indicators of Interest Coverage are all highly right-skewed while Tobin Q ratio is a little bit right-skewed. The distribution of ROA, ROE, EBITDA margin and Operate Income Margin are close to normal while Stock Volatility is right-skewed. These statistical results are all in line with our expectations.

IV. RESULTS AND ANALYSIS

A. Across-firm Effect

1) Impacts of leverage ratio

The regression results with industry and year fixed effects are shown in Table II.

Impact on Valuation: Column 1 in Table II explains how leverage ratio influences Q ratio within industry. The coefficient for the regression of valuation in terms of lnQ on leverage in terms of Debt/Assets is -0.476 and it is significant. This means that for the companies in the same industry, an increase of Debt/ Assets by 10%, would reduce Q ratio by about 4.76%.

Impact on Efficiency: Column 2 in Table II explains how leverage ratio influences ROA within industry. The coefficient for the regression of profitability in terms of ROA on leverage in terms of Debt/Assets is not significant. This means that for the firms in the same industry, leverage does not have significant impact on ROA. Column 3 in Table II explains how leverage ratio influences ROE within industry. The coefficient for the regression of profitability in terms of ROE on leverage in terms of Debt/Assets is -0.055 and it is significant. This means that for the firms in the same industry, an increase of Debt/ Assets by 10%, would reduce ROE by about 0.55%.

Impact on Profitability: Column 4 in Table II explains how leverage ratio influences EBITDA Margin within industry. The coefficient for the regression of profitability in terms of EBITDA margin on leverage in terms of Debt/Assets is 0.076 and it is significant. This means that for the firms in the same industry, an increase of Debt/ Assets by 10%, would raise EBITDA margin by about 0.76%. Column 5 in Table II explains how leverage ratio influences Operating Income Margin within industry. The coefficient for the regression of profitability in terms of Operating Income Margin on leverage in terms of Debt/Assets is 0.058 and it is significant. This means that for the firms in the same industry, an increase of Debt/Assets by 10%, would raise operating income margin by about 0.58%.

TABLE I: SUMMARY STATISTICS

variable	N	mean	p50	sd	min	max
Assets (MM\$)	159,983	5,334	802	14,051	100	84,096
Leverage (%): Debt/Assets	158,471	15.2	15.9	31.1	-74.9	86.0
Interest Coverage: EBITDA/Interest Expense	122,041	14.1	5.2	25.6	-17.3	104.0
Operate Income/Interest Expense	127,016	8.6	3.1	18.7	-30.9	71.7
Valuation: Tobin Q ratio	138,250	1.9	1.3	1.6	0.5	10.3
Efficiency (%): ROA	153,748	10.6	10.5	10.6	-29.1	41.6
ROE	159,544	6.5	9.8	27.4	-107.5	85.2
Profitability (%): EBITDA Margin	153,029	18.7	16.2	21.4	-59.3	82.8
Operate Income Margin	158,391	12.8	11.3	22.8	-81.6	79.9
Risk (%): Stock Volatility	112,613	45.3	38.7	25.5	13.3	150.5

TABLE II: LEVERAGE RATIO, ACROSS-FIRM

	Valuation (1) lnQ	Efficiency (2) ROA	(3) ROE	Profitability (4) EBITDA margin	(5) OperIncome/ Sales	Risk (6) Stock Votatility
Debt/Asset	-0.476*** (0.000)	-0.001 (0.825)	-0.055*** (0.000)	0.076*** (0.000)	0.058*** (0.000)	0.066*** (0.000)
ROA	1.928*** (0.000)					
size	0.014*** (0.000)	0.006*** (0.000)	0.020*** (0.000)	0.019*** (0.000)	0.019*** (0.000)	-0.049*** (0.000)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	131812	151798	157591	151119	156370	108306
adj. R ²	0.426	0.233	0.047	0.335	0.306	0.315

p-values in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01.

Impact on Risk: Column 6 in Table II explains how leverage influences annualized stock volatility within industry. The coefficient for the regression of profitability in terms of annualized stock volatility on leverage in terms of Debt/Assets is 0.066 and it is significant. This means that for the firms in the same industry, an increase of Debt/Assets by 10%, would increase annualized stock volatility by about 0.66%.

Overall, when comparing companies in the same industry, company with high leverage ratio will have lower valuation,

efficiency and higher risk and profitability. Leverage is a burden in most situations but have some benefits.

2) Impacts of interest coverage

The regression results of EBITDA/Interest Expense being the explanatory variable with industry and year fixed effects are shown in Table III.

Impact on Valuation: Similarly, Column 1 in Table III shows that an increase of EBITDA/interest by 1 turn would reduce Operating Income Margin by about 0.28% for companies in the same industry.

Impact on Efficiency: Column 2 in Table III means that an increase of EBITDA/interest by 1 turn, would increase ROA by about 0.18% for companies in the same industry. Column 3 in Table III means that an increase of EBITDA/interest by 1 turn would increase ROE ratio by about 0.24% for companies in the same industry.

Impact on Profitability: Column 4 in Table III shows that an increase of EBITDA/interest by 1 turn, would increase EBITDA Margin by about 0.20% for companies in the same industry. Column 5 in Table III shows that an increase of EBITDA/interest by 1 turn would increase Operating Income Margin by about 0.23% for companies in the same industry.

Impact on Risk: Column 6 in Table III shows that an increase of EBITDA/interest by 1 turn would reduce annualized stock volatility by about 0.16% for companies in the same industry.

The results above imply that higher Interest Coverage indicates better performance of a company.

To test robustness, I also measure Interest Coverage in

terms of Operating Income after Depreciation/Interest Expense, the results are consistent with the results in this section. They could be seen in the Appendix.

B. Within-Firm Effect

1) Impacts of leverage

The regression results of leverage ratio being the explanatory variable with company and year fixed effects are shown in Table IV.

The impact of leverage ratio on valuation, efficiency and risk are similar with the cross-section analysis. However, Column 4 in Table IV shows that an increase of Debt/Assets by 10% would reduce EBITDA Margin by 0.12% for a company and Column 5 in Table IV shows that an increase of Debt/Assets by 10% would reduce Operating Income Margin by 0.32% for a company, which are contrast with the cross-section analysis.

The results imply that for a specific firm, higher leverage ratio means worse performance of the company.

TABLE III: EBITDA/INTEREST EXPENSE, ACROSS-FIRM

	Valuation (1) lnQ	Efficiency (2) ROA	(3) ROE	Profitability (4) EBITDA margin	(5) OperIncome/ Sales	Risk (6) Stock Volatility
EBITDA/ Interest Expense	0.0028*** (0.000)	0.0018*** (0.000)	0.0024*** (0.000)	0.0020*** (0.000)	0.0023*** (0.000)	-0.0016*** (0.000)
ROA	1.5982*** (0.000)					
size	0.0033*** (0.001)	0.0078*** (0.000)	0.0227*** (0.000)	0.0273*** (0.000)	0.0274*** (0.000)	-0.0561*** (0.000)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	102774	121693	121655	121304	121302	82105
adj. R2	0.359	0.314	0.078	0.379	0.324	0.360

p-values in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE IV: LEVERAGE RATIO, WITHIN-FIRM

	Valuation (1) lnQ	Efficiency (2) ROA	(3) ROE	Profitability (4) EBITDA margin	(5) OperIncome/ Sales	Risk (6) Stock Volatility
Debt/Asset	-0.249*** (0.000)	-0.045*** (0.000)	-0.132*** (0.000)	-0.012** (0.017)	-0.032*** (0.000)	0.100*** (0.000)
ROA	2.153*** (0.000)					
size	-0.101*** (0.000)	-0.001 (0.541)	-0.001 (0.623)	0.025*** (0.000)	0.019*** (0.000)	-0.044*** (0.000)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
N	130592	150922	156763	150278	155572	107296
adj. R2	0.698	0.641	0.201	0.703	0.676	0.550

p-values in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE V: EBITDA/INTEREST EXPENSE, WITHIN-FIRM

	Valuation (1) lnQ	Efficiency (2) ROA	(3) ROE	Profitability (4) EBITDA margin	(5) OperIncome/ Sales	Risk (6) Stock Volatility
EBITDA/ Interest Expense	0.0019*** (0.000)	0.0015*** (0.000)	0.0022*** (0.000)	0.0016*** (0.000)	0.0019*** (0.000)	-0.0010*** (0.000)
ROA	1.9389*** (0.000)					
size	-0.1263*** (0.000)	-0.0026*** (0.000)	-0.0086*** (0.000)	0.0260*** (0.000)	0.0209*** (0.000)	-0.0467*** (0.000)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
N	101614	120772	120732	120397	120394	81159
adj. R2	0.676	0.648	0.194	0.730	0.685	0.557

p-values in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

2) Impacts of Interest Coverage in terms of EBITDA/Interest Expense

The regression results of Interest Coverage in terms of EBITDA/Interest Expense with company and year fixed

effects are shown in Table V.

The results above imply that higher Interest Coverage indicates better performance of the company. The robustness test could also be seen in the appendix.

With higher Interest Coverage, the company tends to perform better no matter across company or within company. Considering that higher Interest Coverage reflects lower leverage, the results of leverage ratio and Interest Coverage are consistent in exception of profitability.

V. DISCUSSION OF RESULTS

A. *Leverage and Valuation*

The regression results shows that leverage, in terms of Debt/Assets and Interest Coverage, has a negative impact on firm's valuation within industry and within company.¹ This may be explained by high risk of bankruptcy or moral hazard.

Firstly, high risk lowers the company's valuation. A company with high leverage means the company has high debt. This implies it has a high probability of bankruptcy because it has limited fund so managers lack the ability to take good projects to get more profits. In this way, the company tends to performance worse. Therefore, investors hold a negative attitude toward the firm and expect higher rate of return because they face higher risk. According to the Dividend Discount Model, this expectation increases the value of r in equation: $P=D/(r-g)$, and P , the price of the company's stock drops, which means a lower valuation.

Secondly, moral hazard may impact enterprise value. Companies with high debt is incentivized to take excessive risk because managers and equity holders do not have to bear the cost of risk. Debt holders burden the risk of losing money. Therefore, equity holders, who have rights to control the company may take some money-losing project and it will lower debt holders' expectation. Considering that Q ratio evaluate the enterprise valuation, including both debt and equity valuation, moral hazard could explain the reason why high leverage leads to low Q ratio.

Although in some cases, debt drives managers to operate the company more efficiently, the results in this empirical study shows that the risk of bankruptcy or moral hazard are in dominant positions. Chances are that managers and investors are unintentionally put into a different external economic environment as they have expected. The company may have raised debt at a level which is thought to be optimal. However, some external changes appear, like policy change or natural disasters, so the previous amount of debt are not optimal and the company performs badly. Another possibility is that the company incorrectly evaluate its internal ability. Managers may reckon that they have the ability to operate the company well under a certain amount of leverage, but in fact, they are lack of competence and they operate badly with excessive debt. In either case, the company performs worse with more debt. On the contrary, a company may perform well if it has right assessment of its ability and everything goes under expectation.

B. *Leverage and Efficiency*

The result means that the relationship between leverage

and efficiency is negative. (Although in cross-company results, the impact of leverage on ROA is insignificant, the results of ROE still mean the efficiency becomes lower.) This might be caused by risk premium and innovation incentives.

On the one hand, leverage increases a company's risk premium. Since high leverage increases the risk of debt default, banks are more likely to ask the company to pay higher interest costs. The company also need to pay more wages to its employees because of high risk of bankruptcy. These all lowers the outcome.

On the other hand, high leverage may lower a company's innovation incentives. The company may have to increase its investment in mortgaged fixed assets and reduce their investment on developing new technologies in order to meet the collateral requirements of bank loans. Meanwhile, from the perspective of the company itself, facing a high leverage constrains their ability of financing in the future, so it may limit its investment on innovation internally. These all have negative impacts on firm performance.

C. *Leverage and Profitability*

Two indicators all imply that leverage has a positive influence on profitability within industry. The reason might be that a company has higher leverage has more funds to dispose, and with proper management, it will involve in some profitable project. Consequently, the company with higher leverage has higher profits.

However, there is a negative correlation between leverage ratio and company's profitability within company. One possible explanation is moral hazard. This is consistent with the explanation I put forward in the Valuation section: People dominating the company may take some money-losing project which lower profitability. Another explanation is that high leverage controls manager ability to operate the company well because of constrained free cash flow to use. For the positive relationship between Interest Coverage and profitability, it is because higher Interest Coverage implies the firm has better ability to get profits. The difference leverage ratio and Interest Coverage is understandable. Chances are that two companies have same leverage but one company borrow their money with less interest, so leverage ratio and Interest Coverage are not always proportional.

Furthermore, the different results within industry and within companies might due to management. For different companies, their management are likely to be different; however, for a specific company, its management method is less likely to change much. Therefore, when comparing companies within the same industry, higher leverage might motivate managers to operate more efficiently because of financial stress. Another speculation is that only companies that are confident about their management choose to burden a large amount of debt, so their higher profitability comes from the jointed efforts of higher leverage and proficient management. However, for the same managers in a single company, the leverage may go out of control, which leads them to operate the company badly and get less profit.

D. *Leverage and Risk*

These results are reasonable because more debt leads to more risk. If a firm accumulates excessive debt, it may be

¹ To test the robustness of the results, I also regress $-\frac{1}{\ln Q}$ on leverage, and the coefficient is also negative.

caught in a situation of shortage in assets even facing with modest external shocks. This means the firm is not stable enough and it is considered to be a high-risk company. Meanwhile, people lower their trust in the company. What's more, managers in a company with high debt are tend to take excessive risk which also leads to higher stock volatility.

The results show that in most cases, leverage is a burden of a company.

VI. RESEARCH IMPLICATION

A. Implications for Managers of Companies

Managers of companies in America should be aware of the burden of leverage when willing to borrow more debt. They should better evaluate their management skills, since the increase in profitability brought by high debt might due to good management. They also have to make preparations for financial constraint because they have to pay back interest for each period and not too many investors are willing to lend them money.

B. Implications for Investors

For equity holders, they do not gain too much advantage investing in companies with excessive debt or interest, because these companies are likely to have low ROE their investment will not be effective. In other words, they may get same profits more quickly in a low leverage company.

For debt holders, they are not suggested to lend money to the company with high leverage. Even if the company with higher leverage tends to get more profits, debt holders could only get a fixed amount of interest. Nevertheless, if the

company operates badly and could not afford the interest, debt holders are faced with lost.

Both debt and equity holders are taking more risks when investing in high leverage companies.

VII. CONCLUSION

In this paper, I aim to observe the relationship between company's leverage and its performance. I use the data from Compustat to do an empirical study. I find out that leverage, in terms of Debt/Assets and Interest Coverage, has a negative relationship with company's performance at both company and industry level in exception of the relationship between profitability and Debt/Assets across firms. This indicate that more debt tend to undermine company performance and act like the burden of the company. Company managers are suggested to avoid taking excessive leverage under most circumstances. Investors face higher risk if they invest in higher leverage companies.

In subsequent studies, the method of management and leverage should be considered comprehensively to further analyze how to improve company performance. The empirical study could also be extended to different countries in order to get more universal results.

APPENDIX

The regression results of Operating Income after Depreciation/Interest Expense being the explanatory variable with industry and year fixed effects are shown in Table VI.

The regression results of Interest Coverage in terms of Operating Income after Depreciation/Interest Expense with company and year fixed effects are shown in Table VII.

TABLE VI: OPERATING INCOME AFTER DEPRECIATION/INTEREST EXPENSE, ACROSS-FIRM

	Valuation (1) lnQ	Efficiency (2) ROA	(3) ROE	Profitability (4) EBITDA margin	(5) OperIncome/ Sales	Risk (6) Stock Votatility
Interest Coverage	0.0040*** (0.000)	0.0028*** (0.000)	0.0040*** (0.000)	0.0033*** (0.000)	0.0040*** (0.000)	-0.0023*** (0.000)
ROA	1.5101*** (0.000)					
size	0.0018* (0.085)	0.0066*** (0.000)	0.0206*** (0.000)	0.0259*** (0.000)	0.0258*** (0.000)	-0.0542*** (0.000)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	102774	121691	126597	121302	126233	83047
adj. R2	0.359	0.383	0.097	0.407	0.389	0.363

p-values in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE VII: OPERATING INCOME AFTER DEPRECIATION/INTEREST EXPENSE, WITHIN-FIRM

	Valuation (1) lnQ	Efficiency (2) ROA	(3) ROE	Profitability (4) EBITDA margin	(5) OperIncome/ Sales	Risk (6) Stock Votatility
Operating Income After Depreciation/ Interest Expense	0.0031*** (0.000)	0.0023*** (0.000)	0.0036*** (0.000)	0.0026*** (0.000)	0.0031*** (0.000)	-0.0014*** (0.000)
ROA	1.8297*** (0.000)					
size	-0.1276*** (0.000)	-0.0033*** (0.000)	-0.0096*** (0.000)	0.0252*** (0.000)	0.0190*** (0.000)	-0.0449*** (0.000)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Company FE	Yes	Yes	Yes	Yes	Yes	Yes
N	101614	120769	125718	120394	125368	82104
adj. R2	0.677	0.676	0.202	0.738	0.708	0.557

p-values in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

CONFLICT OF INTEREST

The author declares no conflict of interest.

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