The Relationship between Firm Performance and Capital Structure: Evidence from American Listed Companies

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1 Introduction

It's always crucial for companies to establish an ideal capital structure to maximize their value when making financial decisions. The relationship between capital structure and firm performance has long been a key topic in finance, with various theories attempting to explain it. The Modigliani and Miller (1958), seen as a foundational concept, asserts that a company's value remains unaffected by its capital structure. However, this theory relies on idealized assumptions of a perfect market, which doesn't mirror real-world conditions.

Capital structure encompasses a company's mix of long-term debt, short-term debt, equity, and retained earnings used to fund its operations and growth. This structure, particularly the use of financial leverage, impacts both a company's performance and market worth. Debt financing is the primary external funding avenue for companies, with its cost typically lower than that of equity due to reduced transaction expenses. Despite numerous studies on debt financing, empirical research hasn't yielded a consensus on its effects on firm performance. There are two main benefits of debt for a company. The first one is the tax shield: interest payments usually are not taxable; hence the debt can increase the value of firm. Another benefit is that debt disciplines managers. Managers use free cash flows of the company to invest in projects, to pay dividends, or to hold on cash balance. But if the firm is not committed to some fixed payments such as interest expenses, managers could have incentives to waste excess free cash flow.

Prior studies generally report a negative link between leverage and firm performance, though theoretical literature suggests a possible variety of associations. Due to different results above, I deduce that the relationship between debt financing and firm performance maybe nonlinear. Moreover, the effectiveness of debt financing might be contingent upon situational factors, causing inconsistencies. Therefore, understanding the situational and contingent factors that moderate this relationship is crucial. This study aims to explore how changes in inflation might influence the impact of debt financing on the financial profitability of industrial companies listed in United States. When inflation is high, bank's interest rates may rise, as a result, the interest rate on firm loan will also increase, and higher payments are expected. In this case, firms tend to have less debt financing, which may affect its profitability.

To have a scientific approach to this study I came up with the following research questions:

1. Does capital structure have an effect on firm's financial performance?
2. What is the effect of capital structure on the financial performance of US-listed firms?
3. Does inflation play an important role in moderating capital structure on firm performance?

To shed the light on the impact that debt financing has on a firm performance, the

following study explores the context of inflation changes [1] by investigating the obtained data of the US companies, therefore, contributing to the academia of this field from this specific perspective. The study is based on the analysis of secondary data collected from Compustat Industrial Annual files (2000 – 2022) and involves regression tests performed via statistical software (STATA).

According to the existing research so far, many of them having been focused on studying different moderating rules that might be important to be considered when it comes to the topic between capital structure and firm performance. However, few speaks of the impact of inflation as a moderator between capital structure and firm performance.

The rest of the paper includes six main sections, section 2 presents the theoretical and empirical literature review illustrating the relation between leverage and firm performance. In section 3 describes data and methodology. Section 4 gives empirical findings. Section 5 shows the result. The closing section is dedicated to the conclusion of the final output of the research with a discussion. An Appendix presents all the relevant tables, figures and code used in this study.

2 Literature Review

2.1 Theoretical Framework

The Modigliani-Miller (MM) theory of capital structure, proposed in 1958, serves as a foundational concept asserting that a firm's value remains unaffected by its capital structure. This theory, however, relies on the assumption of a perfect capital market, a condition rarely met in the real-world business environment. In recognizing the limitations posed by these idealized assumptions, alternative theories have emerged to address imperfections in actual markets. Three prominent theories that have gained prominence as alternatives to MM theory in imperfect markets are agency theory, trade-off theory, and pecking order theory. These theories offer insights into how various factors, such as agency conflicts, trade-off between tax benefits and financial distress costs, and information asymmetry, can influence a firm's capital structure decisions and ultimately impact its value.

2.1.1 Agency Theory

Agency theory focuses on the relationship between principals (shareholders) and agents (manager). Originating from Means (2017), who argued that due to a continuous dilution of equity ownership of large corporations, ownership and control become more separated. This separation allows professional managers to prioritize their own interests over shareholders'.

[1] The data can be referred here `https://www.usinflationcalculator.com/inflation/current-inflation-rates/#google_vignette`

Jensen and Meckling (2019) expanded on this, proposing an optimal debt level in the company's financial structure to minimize agency costs arising from conflicting interests between managers, shareholders, and providers of debt finance. Their suggestions involve aligning managerial interests with owners' by increasing managers' stake in the company or motivating the use of debt to control excessive spending by managers. Jensen further highlighted the agency problem related to free cash flow, proposing that increasing managers' ownership or introducing more debt into the capital structure could mitigate this issue by limiting the surplus cash available to managers.

Consequently, companies relying more on debt financing tend to limit managerial decision-making compared to those mainly funded through equity. Debt, therefore, serves as a mechanism for control, with lenders and shareholders assuming pivotal roles in the corporate governance structure. According to agency theory, an optimal capital structure, aiming to maximize firm value, should minimize conflicts of interest among stakeholders.

2.1.2 Trade-off Theory

The capital structure's trade-off theory suggests that companies decide on the proportion of debt and equity financing by carefully weighing the associated costs and benefits. A key objective of this theory is to elucidate the common practice of corporations securing a mix of both debt and equity in their financial structure. According to this theory, financing with debt offers advantages in the form of tax benefits, but it also incurs costs related to financial distress, encompassing both bankruptcy and non-bankruptcy expenses. As a firm increases its reliance on debt, the additional benefits diminish, while the associated costs rise. Therefore, an optimally managed firm striving to maximize its overall value will conscientiously consider this trade-off when determining the optimal blend of debt and equity for financing. The trade-off theory asserts that companies carefully balance the costs and benefits of debt to enhance their overall value. The benefit of debt primarily stems from the tax advantages gained by reducing taxable income through interest payments, while the cost of debt arises from direct and indirect bankruptcy expenses, thereby amplifying financial risk.

2.1.3 Pecking Order Theory

Donaldson's pecking order theory, a prominent perspective on corporate leverage, challenges the notion that firms should aim for an optimal blend of debt and equity to minimize their cost of capital. Instead, this theory posits that firms have a specific order of preference when seeking financing for long-term investments. According to the pecking order theory, a firm's primary choice is to use internal funds, followed by debt, and then external equity.

The theory suggests that as firms become more profitable, they tend to borrow less since they can rely on internal funds to support their investment projects. Only when internal funds are insufficient does a firm turn to external financing, with a preference for

sources such as bank borrowings or corporate bonds. The issuance of new equity capital is considered the last resort and the least preferred option after exhausting internal funds, bank borrowings, and corporate bonds.

In essence, the pecking order theory establishes a hierarchical approach to financing, where internal funds are utilized first, followed by debt issuance, and equity issuance comes into play only when further debt is not feasible.

It's important to note that the impact of capital structure on firm value may vary across different contexts. Traditional capital structure theories may face scrutiny or present different outcomes under diverse conditions. The pecking order theory recognizes the dynamic nature of financial decision-making and acknowledges that firm behavior in obtaining financing may deviate from the assumptions of traditional theories based on specific circumstances and contexts.

2.2 Empirical Evidence

The relationship between capital structure and firm performance remains a contentious topic, and empirical studies have yielded varying conclusions regarding this association. Despite the complexities and divergent findings, a considerable body of research tends to suggest a negative relationship between leverage (debt) and firm performance. Harris and Raviv (1991) investigated that higher levels of debt could lead to agency costs, resulting in a negative impact on firm values. Vithessonthi and Tongurai (2015) found that the negative effect of leverage on performance is substantially larger in magnitude for the large domestic firms than for the small domestic firms. Le and Phan (2017) also provided a negative relationship between capital structure and firm performance in transitional and emerging market. Ahmed and Bhuyan (2020) examined that Australian services sector firms are not benefiting much from the use of debts to finance their operations, which implies a negative relationship between leverage and firm performance.

While the literature on the relationship between leverage and firm performance often suggests a negative correlation, there is also a huge number of research indicating a positive relationship between these variables. Two notable studies contributing to this perspective are those conducted by Berger and Di Patti (2006) as well as Warokka et al. (2011). Berger and Bonaccorsi di Patti's study suggested a positive relationship between leverage and firm performance. This aligns with the notion that increased reliance on debt can be associated with improved firm performance. Similar to Berger and Bonaccorsi di Patti's findings, the empirical evidence from Warokka, Herrera and Abdullah's research indicated a positive correlation between leverage and firm performance. This implies that, firms with higher leverage impacts efficiency positively.

Indeed, the relationship between capital structure and firm performance is complex, and some studies have introduced the idea of a non-linear relationship. This suggests that the impact of leverage on firm performance may have both positive and negative effects at different levels of debt. Two notable studies that have explored this non-linear perspective

are those conducted by Stulz (1990) and Margaritis and Psillaki (2010). Stulz proposed that moderate levels of debt might enhance firm value, excessively high levels could lead to financial distress and a subsequent decline in firm value. The research of Margaritis and Psillaki indicated a U-shaped relationship, implying that there might be an optimal level of debt that positively influences firm performance. However, beyond this optimal point, increasing leverage may have detrimental effects on firm performance.

2.3 Reverse Causality from Firm Performance to Capital Structure

There could also be a reverse causality between firm performance and leverage, leading to an endogeneity problem, as highlighted by Berger and Di Patti (2006). Margaritis and Psillaki (2010) identify two competing hypotheses to interpret the effect of firm profitability on capital structure.

According to the efficiency-risk hypothesis, more efficient firms may opt for higher debt-to-equity ratios. This is because efficient firms are better positioned to generate cash flows and manage their operations effectively, reducing the perceived risk associated with higher levels of debt. Their efficiency mitigates the likelihood of financial difficulties.

In contrast, the franchise-value hypothesis suggests that more efficient firms may opt for lower leverage to safeguard against the possibility of liquidation. These firms, being more valuable as ongoing concerns, may prioritize preserving their franchise value. Thus, they choose a more conservative capital structure to avoid financial distress that could lead to liquidation.

In this study, the instrumental variable method is employed to address this issue. Specifically, the share of interest expenses divided by total assets, which is highly correlated with leverage but minimally associated with firm profitability, is utilized as the instrumental variable.

2.4 Hypothesis Development

Based on agency theory, higher leverage may result in agency costs, potentially negatively affecting firm performance. This hypothesis finds support in the works of Harris and Raviv (1991) and Vithessonthi and Tongurai (2015), both of whom oberved similar negative relationships in their studies.

H1: There exists a negative relationship between leverage and firm performance in American listed firms.

Pecking order theory suggests a non-linear relationship, implying an optimal level of leverage. Previous research by Margaritis and Psillaki (2010) as well as Le and Phan (2017) has identified non-linear patterns in the relationship between leverage and firm performance. This hypothesis aims to explore the nuanced impact of leverage on firm performance.

H2: There exists a non-linear U-shaped relationship between leverage and firm performance in American listed firms.

3 Methodology

3.1 Data

The study sample consists of non-financial companies listed in the United States for the period spanning from 2000 to 2022. During the selection process, companies within the financial sector, including banks, insurance, and financial services, were excluded. This decision was made due to the distinct profit and capital structure characteristics of financial sector companies compared to those in the non-financial sector.

Data for the study were sourced from Compustat Industrial Annual files and organized into a panel format. Panel data facilitate the use of instrumental variables to address endogeneity, a common issue in research. Specifically, independent variables from previous time periods were utilized for this purpose.

Following the application of selection criteria to the population, the final sample comprised 7,818 firms and 99,246 observations. The definitions and construction of the variables are summarized in Table 1.

3.2 The Variables

3.2.1 Measure of Firm Performance

Firm performance can be assessed through various financial indicators such as revenue, market share, and profitability. In this study, firm profitability was selected as the focal point. Specifically, two measurements for firm profitability were utilized: Return on Assets (ROA) and Earnings Before Interest and Taxes (EBIT). ROA was computed by dividing earnings after interest and tax by total assets, providing insight into how efficiently a company generates profit relative to its total assets. EBIT, on the other hand, was determined by earnings before interest and tax, representing a company's profit inclusive of all incomes and expenses except for interest and income tax expenses. The utilization of these two measurements in the study aims to compare whether there is a discrepancy in the impact that debt financing has on firm performance.

3.2.2 Measure of Capital Structure

Capital structure encompasses a company's funding sources for its assets and the blend of equity and debt used to support its overall operations and expansion. Various metrics can measure capital structure, including long-term debt, specific short-term debt, common equity, preferred equity, and retained earnings. However, this research exclusively concentrates on firms' debt financing, thus focusing solely on leverage and its quadratic

term. Leverage is computed by dividing total debts—comprising long-term and short-term debts—by total stockholders' equity.

3.2.3 Measure of Inflation

Inflation denotes the overall trend of rising prices within an economy. The prevalent metric for measuring inflation is the inflation rate. For this study, the inflation rate in the United States from 2000 to 2022 has been chosen. Notably, three years stand out due to their extreme high or low inflation rates, namely 2008, 2021, and 2022 as showed in Figure 1.

3.2.4 Measure of Firm Size

Firm size is a crucial factor in the decision-making process regarding capital structure. It is typically computed as the natural logarithm of total assets. The effect of firm size on efficiency is expected to be positive, suggesting that larger firms with lower asset volatility tend to exhibit better performance.

3.2.5 Measure of Tangibility

Tangibility is determined by the ratio of net fixed assets to total assets. This metric reflects the level of fixed asset investment and the long-term resources held by the firm. Tangibility has the potential to alleviate the agency problem to some extent by offering valuable collateral.

3.2.6 Measure of Sales Growth

Sales growth refers to the percentage change in sales from one year to the next, typically measured on a year-to-year basis. This metric can act as a proxy for a firm's growth prospects and investment opportunities. A higher sales growth rate generally indicates better performance for the firm.

3.3 Data Analysis

Multiple regression analysis is conducted on the panel data to examine the degree and direction of the variables' relationships, while controlling for firm characteristics. Generally, Ordinary Least Squares (OLS), Fixed Effects (FE), and Instrumental Variable (IV) estimation methods are commonly used techniques for estimating panel data. Specifically, the non-linear model can be represented as follows:

$Y_{i,t} = \alpha_i + \gamma_t + \beta_i X_{i,t-1} + \beta_j X^2_{i,t-1} + \varepsilon_{i,t}$, where i is firm and t is time,

$Y_{i,t}$: the dependent variable of firm i in year t,

$X_{i,t}$: K*1 vector of explanatory variables,

$X^2_{i,t}$: L*1 vector of explanatory variables,

β_i : K*1 vector of constants,

β_j : L*1 vector of constants,

$\varepsilon_{i,t}$: error term,

If α_i is correlated with $X_{i,t}$, the Fixed Effects model would yield consistent estimators, whereas Ordinary Least Squares estimators would be inconsistent. Although model-adjusted standard errors can address heteroskedasticity and autocorrelation, bias due to endogeneity remains. This bias arises because FE models primarily control for unobserved heterogeneity and do not address endogeneity issues stemming from measurement errors, time-invariant endogenous variables, and reverse causality common in finance research. Consequently, FE models may exhibit bias, particularly in short panel data. To mitigate this issue, previous studies have suggested employing Instrumental Variable estimators. However, the challenge with IV estimators lies in finding valid instruments because weak instruments can lead to biased estimates. In essence, IV estimators utilizing invalid instruments may not offer improvements over OLS estimators.

3.4 Empirical Model

There exists reverse causality issue in the model that makes it challenging to identify a causal link going from capital structure to firm performance. Firms with better performance may have more or less debt financing due to two different theory which are already discussed as above. So even if we get a positive relationship between capital structure and firm performance, we cannot simply say that capital structure have a positive effect on firm performance. To tackle the potential endogeneity problem, this study uses an identification strategy which is the instrumental variable approach. I take interest expenses as exogenous variation at the industry-level. A robust fixed-effect panel model is also applied to avoid problems of heterogeneity in our model. This method mainly controls for omitted variables bias due to unobserved heterogeneity when this heterogeneity is constant over time. To test the relationship between capital structure and firm performance, this research used the following model:

$$\begin{aligned}\text{ROA}_{i,t} = {} & \alpha_i + \gamma_t + \beta_1 \text{Leverage}_{i,t-1} + \beta_2 \text{Leverage}^2_{i,t-1} \\ & + \beta_3 \text{Leverage}_{i,t-1} \# \text{Inflation}_{i,t-1} + \beta_4 \text{Leverage}^2_{i,t-1} \# \text{Inflation}_{i,t-1} \\ & + \beta_5 \text{Firmsize}_{i,t-1} + \beta_6 \text{Tangibility}_{i,t-1} + \beta_7 \text{Salesgrowth}_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{1}$$

$$\begin{aligned}\text{EBIT}_{i,t} = {} & \alpha_i + \gamma_t + \beta_1 \text{Leverage}_{i,t-1} + \beta_2 \text{Leverage}^2_{i,t-1} \\ & + \beta_3 \text{Leverage}_{i,t-1} \# \text{Inflation}_{i,t-1} + \beta_4 \text{Leverage}^2_{i,t-1} \# \text{Inflation}_{i,t-1} \\ & + \beta_5 \text{Firmsize}_{i,t-1} + \beta_6 \text{Tangibility}_{i,t-1} + \beta_7 \text{Salesgrowth}_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{2}$$

Where subscripts i,t represent firm and year respectively. α_i is a vector of time-invariant firm fixed effects and γ_t is a vector of time fixed effects. The dependent variable

is a proxy of firm performance measured by ROA and EBIT. Leverage$_{i,t}$ represents debt financing observed for firm i at time t measued by the ratio of long-term debt and short-term debt of total assets. Leverage#Inflation$_{i,t}$ is the interaction between debt financing and inflation rate. Our main focus is on the coefficient estimates β_1, β_2, β_3 and β_4. Firmsize$_{i,t}$, Tangibilty$_{i,t}$ and Salesgrowth$_{i,t}$ are control variables that are commonly believed to affect capital structure.

According to hypothesis 1 (H1), leverage would have a negative effect on firm performance, hence, a negative sign on beta1 in model 1 and model 2 was expected. In addition, testing the linear relationship between capital structure and firm performance, hypothesis 2 (H2) proposed that there would be a non-linear U-shaped relationship between capital structure and firm value. In particular, leverage is associated negatively with firm value, however, at a high leverage, the relationship switches from negative to positive. This quadratic function allows that the relationship between capital structure and firm performance may not be monotonic, that is, it may switch from negative to positive at higher debt ratio. The adequate condition for the U-shaped relationship between capital structure and firm value is that $\beta_1 < 0$ and $\beta_2 > 0$.

There are so many outliers and missing values on the basis of a huge amount of dataset. To make variables have a better distribution and get an ideal result, I first drop those total assets with no value, then trim all variables by eliminating five percent of the data at both ends of the distribution. The definition of dependent, independent, dummy, and control variables are listed in Table 1. Descriptive Statistics is used in our model which can be referred to Table 2.

4 Findings

4.1 Descriptive Statistics of Data

Table 2 presents a descriptive analysis of the empirical findings obtained from the study dataset. The dataset includes information such as observations, mean, median, standard deviation, maximum and minimum of the American firms in sample, which composed of 99,246 observations within 2000 to 2022. The dependent variables are ROA and EBIT, having a mean of -0.07 and 234.04 respectively. The ROA of listed firms ranges from -1.60 to 0.17, and the EBIT of those firms ranges from -62 to 3,044. This implies that there was a significant gap in firm performance among American listed firms during this period. The independent variables leverage and leverage squared have a mean of 0.64 and 1.64 respectively which indicates that most of the American companies are highly levered.

4.2 Correlation Analysis

Table 3 shows the correlation between all the independent variables considered under the research. It can be observed that the correlation of debt ratios used as proxies of

capital structure are high. Debt ratio was found to be negatively related to ROA and EBIT because all coefficients of pairwise correlation among these variables are negative and significant at the 5 % level. Specifically, the correlation coefficients presenting the link of Leverage with ROA and EBIT are 0.0749 and 0.2011.

4.3 OLS Regression

Table 4 presents the ordinary least square regression results for firm performance equation using ROA and EBIT as dependent variables, respectively. As shown in Table 4, both leverage and its squared term are statistically significant in two ways of firm performance but with different signs. More specifically, when firm performance is measured by EBIT, capital structure is negatively associated with firm performance, because the coefficients estimators for the debt ratios are significantly negative at the 1% level, which denotes that an increase of 1 unit in total debt ratio at time t-1 from 0 to 1 leads to a decrease of approximately 86.24 units in EBIT at time t, holding all other variables constant and without considering inflation. The quadratic term of capital structure has positive and significant impact on firm performance at 1% confidence level. After calculation, the turning point equals 1.86, which means once leverage is bigger than 1.86, the effect on firm performance starts to increase. Hypothesis 1 is validated in this model, there is an negative relation between capital structure and firm performance. These results also verify hypothesis 2, there is a non-linear U-shaped relationship between leverage and firm performance. However, the interactions between inflation and leverage terms cannot interpret much under EBIT measurement.

On the contrary, the coefficients of debt ratios is positive at 10% significance level when firm performance is measured by ROA, suggesting that when total leverage rises 1 unit from 0 to 0.5 at time t-1, the ROA increase about 0.225% at time t, all else held fixed and not taking inflation into consideration. The quadratic term of leverage has negative effect on firm performance and statistically significant at 1% level. The turning point here is 0.7, meaning that once leverage is bigger 0.7, the effect on firm performance starts to decrease. In this case, the relationship between debt financing and firm performance presents hump-shaped which contradicts hypothesis 2. Moreover, the interaction terms between leverage and inflation are both showing significance. Assuming that inflation stay fixed, if there is 1 unit of increase in leverage from 1 to 2 at time t-1 in one specific firm, then there will be a 1% decrease in firm profitability at time t. In general, there has a better statistical result under ROA measurement while the other approach is consistent more with the assumptions.

Another significant point is that all control variables with p-values below 1% report good fitness of the models. In addition, R-squared values of ROA and EBIT with both models are around 15% to 39%, reflecting that the models can explain 15% and 39% change of ROA and EBIT. In general, the fitness results of ROA is slightly better than those of EBIT. However, as discussed in the methodology chapter, regression using the

OLS method cannot control for unobserved individual effects, which commonly appear in most research using cross-sectional data. Therefore, FE modeling were conducted alongside OLS for unobserved individual effects.

4.4 Fixed Effect Regression

Table 5 presents the results of panel regressions examining the effect of capital structure on firm performance. The results of the empirical model using the FE method in table 5 confirm that the relationship between capital structure and firm performance is negative under EBIT measurement. The Wald test shows that FE model is better than OLS. Hence, the FE estimator was used to investigate the effect of leverage on firm performance.

When looking at EBIT approach, a 1 unit of increase in leverage from 0 to 1at time t-1 is associated with 15.99 units of decrease in EBIT at time t when holding others fixed and not considering inflation factor. The quadratic term of capital structure has positive and significant impact on firm performance at 1% confidence level. After calculation, the turning point equals 1.53, which means once leverage is bigger than 1.53, the effect on firm performance starts to increase. Hypothesis 1 and 2 again are both applicable in this model. If the inflation is taken into consideration, then the coefficients of the interactions between inflation and leverage are significant at 1% and 5% level respectively. Assuming that inflation stay fixed, if there is 1 unit of increase in leverage from 0 to 1 at time t-1 in one specific firm, then there will be a 10.53 units decrease in firm profitability at time t.

Now turn to ROA approach, apart from control variables, none of the independent variables is statistically significant which can not be referred as economical interpretation.

A worthy point is that the adjusted R-squared values in both regressions are quite good, from 59.2% to 81.7%. In particular, these figures in the EBIT model are considerably high, implying that the model could explain up to 81.7% of the change of EBIT in American listed firms. In addition, the F-test results show that the fitness of models is fairly good. Results also demonstrate that the effect of leverage ratio on EBIT is stronger than that of leverage ratio on ROA because the coefficients of leverage in EBIT are much higher and more significant than those in ROA regression, which provides support to the assumption, suggesting that the more debt financing the firms have at time t-1, the worse the firm performance becomes at time t.

4.5 IV Regression

Using the FE model with robust standard error can help to control unobserved effects as well as heteroskedasticity, however, the endogenous issue, which leads to biased and inconsistent estimators, may still exist. This is caused by the inability to ascertain if a simultaneous reverse relation link exists between capital structure and firm performance. In addition, capital structure can be considered simply an indicator of unobserved features that influence performance. To strengthen the research outcomes, system two-step IV with

adjusted standard error was applied to cope with the endogenous problem. The outcomes of the system IV are reported in Table 6.

It once again confirms the negative relationship between capital structure and firm performance when EBIT is used as the proxy of firm profitability. This negative relation is statistically significant at 1% level, showing 1 unit of increase in leverage results in 720.45 units of decrease in firm performance when holding all others unchanged and not taking inflation into consideration. The quadratic term of capital structure has positive and significant impact on firm performance at 1% confidence level. After calculation, the turning point equals 1.21, which means once leverage is bigger than 1.21, the effect on firm performance starts to increase. Hypothesis 1 and 2 again are both applicable in this model. If the inflation is taken into consideration, then the coefficients of the interactions between inflation and leverage are significant at 5% level. Assuming that inflation stay fixed, if there is 1 unit of increase in leverage from 0 to 1 at time t-1 in one specific firm, then there will be a 663.49 units decrease in firm profitability at time t.

When ROA is used as proxy of firm profitability, both leverage and its quadratic term are statistically significant at 1% confidence level, while the interaction terms are not. Using the same method to interpret as above, the turning point is equal to 1.15, which means once leverage is bigger than 1.15, the effect on firm performance starts to decrease. However, we can not give an exact conclusion to the moderating effect of inflation here.The results also reveal that the signs of most control variables including firm size, tangibility and sales growth are consistent with OLS method, but slightly different in significant level.

5 Results

5.1 Capital Structure

On one hand, all models utilizing EBIT measurement demonstrate a consistent negative relationship between capital structure and firm performance. The uniformity of the debt ratios' signs across various applied methods underscores the robustness of these findings. Additionally, inflation rates are shown to moderate debt financing, resulting in a detrimental effect on firm performance.

On the other hand, the relationship between capital structure and firm performance exhibits inconsistency under the ROA measurement, attributable to differing signs of debt ratios and varying levels of significance. This inconsistency also extends to the interaction terms between inflation rates and debt financing, leading to inconclusive results.

5.2 Control Variables

In reference to control variables, firm size and tangibility have significant coefficients in all regressions, whereas sales growth has not consistent effects on firm performance while us-

ing EBIT measures. Under ROA measures, sales growth is always statistically significant in all regressions while firm size and tangibility are not during the same time. Furthermore, the estimated coefficients of sales growth are positive and statistically significant at 1% level in almost all models, indicating that firms with higher debt financing can enhance their performance measured by ROA and EBIT. The result is consistent with the studies of Margaritis and Psillaki (2010) which argued that firms with high growth rate are able to create more profit and value from investment opportunities. The coefficient estimates of firm size are positive and statistically significant at 1% level nearly in all models. This result is in line with the studies of **?**. These authors explained that firm size has a strong association with firm's profitability and productivity, when the firm size increases then companies achieve the economies of scale and increase the earings.

5.3 Non-linear Relationship between Capital Structure and Firm Performance

The study employed models to explore the potential non-linear correlation between capital structure and firm performance. Utilizing a quadratic function informed by the research of Berger and Di Patti (2006) and Margaritis and Psillaki (2010), the analysis identified a non-linear relationship. Findings presented in Tables 4, 5, and 6 indicate that such a relationship manifests only when firm performance is assessed by EBIT and capital structure by total debt divided by total equity. Specifically, in the EBIT equation, the coefficient of the debt ratio exhibits negative significance, while the quadratic term of the debt ratio shows significant positivity. However, these coefficients demonstrate different signs or insignificance in ROA regressions. Notably, at lower levels, the debt ratio correlates negatively with EBIT, suggesting that increased debt ratios initially decrease EBIT due to heightened financial leverage. Nevertheless, at higher levels, this relationship shifts from negative to positive. Consequently, it can be inferred that capital structure typically exerts a negative impact on firm performance. In the context of EBIT, the observed U-shaped non-linear relationship stems from the utilization of financial leverage.

6 Conclusion and Discussion

The relationship between capital structure and firm performance has long been a complex and context-dependent subject in corporate finance theory. A vast body of literature explores firms' financing decisions to optimize their capital structures and enhance long-term performance and shareholder value. This study focuses specifically on the role of debt financing in shaping capital structure.

Using various regression methods, this study aims to elucidate the impact of debt financing on firm performance within the sample of non-financial companies listed on American stock exchanges. After establishing and carrying out the methods, this study

comfirms that there is a negative relationship between capital structure and firm profitability at certain levels of leverage. Interestingly, once the debt ratio exceeds a certain threshold, the influence of leverage on firm performance switches to positive direction, indicating a non-linear relationship, specifically a U-shaped one. This finding is consistent with the research conducted by Le and Phan (2017). Additionally, this study introduces inflation rates to investigate their potential role as a moderating factor between capital structure and firm performance. The results demonstrate that inflation rates can moderate leverage, resulting in a negative impact on firm performance. This can be attributed to the scenario where high inflation leads to increased bank interest rates, subsequently elevating debt interest rates and reducing firm profitability.

The study also addresses the issue of reverse causality, examining the relationship from firm performance to capital structure based on two hypotheses: the efficiency-risk hypothesis and the franchise-value hypothesis. To tackle this problem, the instrumental variable method is employed. However, the challenge lies in finding a suitable instrument that satisfies both conditions: causal effect and exclusion restriction.

In pursuit of greater robustness, firm performance is assessed using two financial indicators, namely ROA and EBIT. This approach aims to ensure the empirical results to be more consistent. Notably, EBIT yields more significant and consistent results compared to ROA in empirical studies. This discrepancy can be attributed to several factors. Firstly, ROA and EBIT capture different aspects of firm performance; ROA measures profitability by assessing the efficiency with which a company utilizes its assets to generate earnings, while EBIT reflects operating profitability before accounting for interest and taxes. Hence, variations between model results may stem from the distinct nature of the measurements. Secondly, the impact of debt financing on firm profitability, as measured by ROA and EBIT, can vary. Increased debt may enhance ROA by amplifying returns on equity, yet simultaneously diminish EBIT through higher interest expenses. Consequently, the effect of leverage on these performance measures may exhibit discrepancies.

Future research endeavors may explore the effects of equity financing on firm performance, delve deeper into debt financing specifics, and extend the analysis to encompass diverse geographical regions.

7 References

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Appendix

Table 1: **Data Definition**

Data	
Variables	**Definition**
ROA	Net Income(NI)/Total Assets(AT)
$EBIT$	Earnings before interest and taxes
$Leverage$	(Long-term Debts(DLTT)+Debt in current Liabilities(DLC))/Stockholders Equity total(SEQ)
$Leverage^2$	$(Long-termDebts(DLTT)+DebtincurrentLiabilities(DLC))^2/StockholdersEquitytotal(SEQ)^2$
$Firmsize$	log(Total Assets (AT))
$Tangibility$	Tangible Assets(PPENT)/Total Assets (AT)
$Salesgrowth$	(Current sales-prior sales)/Prior sales
$Inflation$	2000-2022 inflation rate in United States

Table 2: **Descriptive Statistics**

Variables	**Obs**	**Mean**	**Std.Dev.**	**Min**	**Max**
ROA	89,321	-0.07	0.27	-1.60	0.17
$EBIT$	89,293	234.04	496.12	-62	3,044
$Leverage$	82,011	0.64	0.83	-0.98	4.08
$Leverage^2$	86,361	1.64	3.94	0	30.71
$Firmsize$	82,258	6.37	2.41	0.48	10.82
$Tangibility$	79,817	0.21	0.22	0.00	0.79
$Salesgrowth$	71,077	0.09	0.22	-0.41	0.98
$Inflation$	91,097	2.38	1.54	0.1	7
$Interestexpenses$	77,932	0.24	6.35	-0.29	692.79

Table 3: **Correlation Analysis**

	ROA	**EBIT**	**Leverage**	**Leverage^2**	**Firmsize**	**Tangibility**	**Salesgrowth**	**Inflation**	**Interestexpenses**
ROA	1.0000								
EBIT	0.2135	1.0000							
Leverage	0.0749	0.2011	1.0000						
Leverage^2	0.0226	0.1211	0.9162	1.0000					
Firmsize	0.4010	0.6570	0.3341	0.1966	1.0000				
Tangibility	0.1223	0.1396	0.2224	0.1267	0.2394	1.0000			
Salesgrowth	0.0105	-0.0257	-0.0339	-0.0201	-0.0456	-0.0811	1.0000		
Inflation	-0.0238	0.0053	0.0107	0.0081	0.0062	-0.0146	0.1363	1.0000	
Interestexpenses	-0.1877	-0.0171	0.1275	0.1312	-0.0713	0.0453	0.0064	0.0033	1.0000

Table 4: **Ordinary Least Square Regression**

Table 4 presents results of panel regressions examining the effect of capital structure on firm performance. The dependent variable is $\text{ROA}_{i,t}$ (net income/total assets) and $\text{EBIT}_{i,t}$. Column 1 and column 2 report the result of two different measure of firm profitability respectively. The sample is based on Compustat Fundamentals Annual files over the 2000-2022 period. The symbols ***,** and * indicate statistical significance at the 1%,5%, and 10% levels, respectively.

	$\text{ROA}_{i,t}$	$\text{EBIT}_{i,t}$
$Leverage_{i,t-1}$	0.0072272*	-117.9576***
	(0.0037956)	(9.433375)
$\text{Leverage}^2_{i,t-1}$	-0.0053353***	31.71656***
	(0.0013297)	(3.601788)
$Leverage_{i,t-1}\#\text{Inflation}_{i,t-1}$	-0.0050022***	4.799641
	(0.0011222)	(3.029365)
$\text{Leverage}^2_{i,t-1}\#\text{Inflation}_{i,t-1}$	0.0012981***	-1.949606*
	(0.0004556)	(1.186321)
$Firmsize_{i,t-1}$	0.032866***	146.6335***
	(0.0005479)	(1.225149)
$Tangibility_{i,t-1}$	0.0360209***	194.078***
	(0.0028213)	(8.84135)
$Salesgrowth_{i,t-1}$	0.0145646***	46.60297***
	(0.0051528)	(7.689082)
Constant	-0.2393522***	-694.8631***
	(0.0042715)	(6.62023)
Standardized Coefficients		
Controls	✓	✓
R^2	0.15	0.39
Observations	50,918	50,614

Table 5: **Robust Fixed Effect Regression**

Table 5 presents results of panel regressions examining the effect of capital structure on firm performance. The dependent variable is $\text{ROA}_{i,t}$ (net income/total assets) and $\text{EBIT}_{i,t}$. Column 1 and column 2 report the result of two different measure of firm profitability respectively. The sample is based on Compustat Fundamentals Annual files over the 2000-2022 period. The symbols ***,** and * indicate statistical significance at the 1%,5%, and 10% levels, respectively.

	$\text{ROA}_{i,t}$	$\text{EBIT}_{i,t}$
$Leverage_{i,t-1}$	-0.0051406	-23.72673**
	(0.0051165)	(9.433)
$\text{Leverage}^2_{i,t-1}$	0.0008871	7.738337***
	(0.0014687)	(2.917006)
$Leverage_{i,t-1}\#\text{Inflation}_{i,t-1}$	-0.0023764	7.35217***
	(0.0011447)	(2.205561)
$\text{Leverage}^2_{i,t-1}\#\text{Inflation}_{i,t-1}$	0.0004441	-1.896365**
	(0.0004755)	(0.7804438)
$Firmsize_{i,t-1}$	0.032***	109.8624***
	(0.0024488)	(5.759159)
$Tangibility_{i,t-1}$	-0.170199	-105.8091***
	(0.0165399)	(29.27582)
$Salesgrowth_{i,t-1}$	0.0677237***	78.50244***
	(0.0046347)	(7.556649)
Constant	0.0060965	-433.4684***
	(0.0175591)	(37.8275)
Standardized Coefficients		
Controls	✓	✓
$Adj.R^2$	0.5920	0.8172
Observations	50,210	49,907

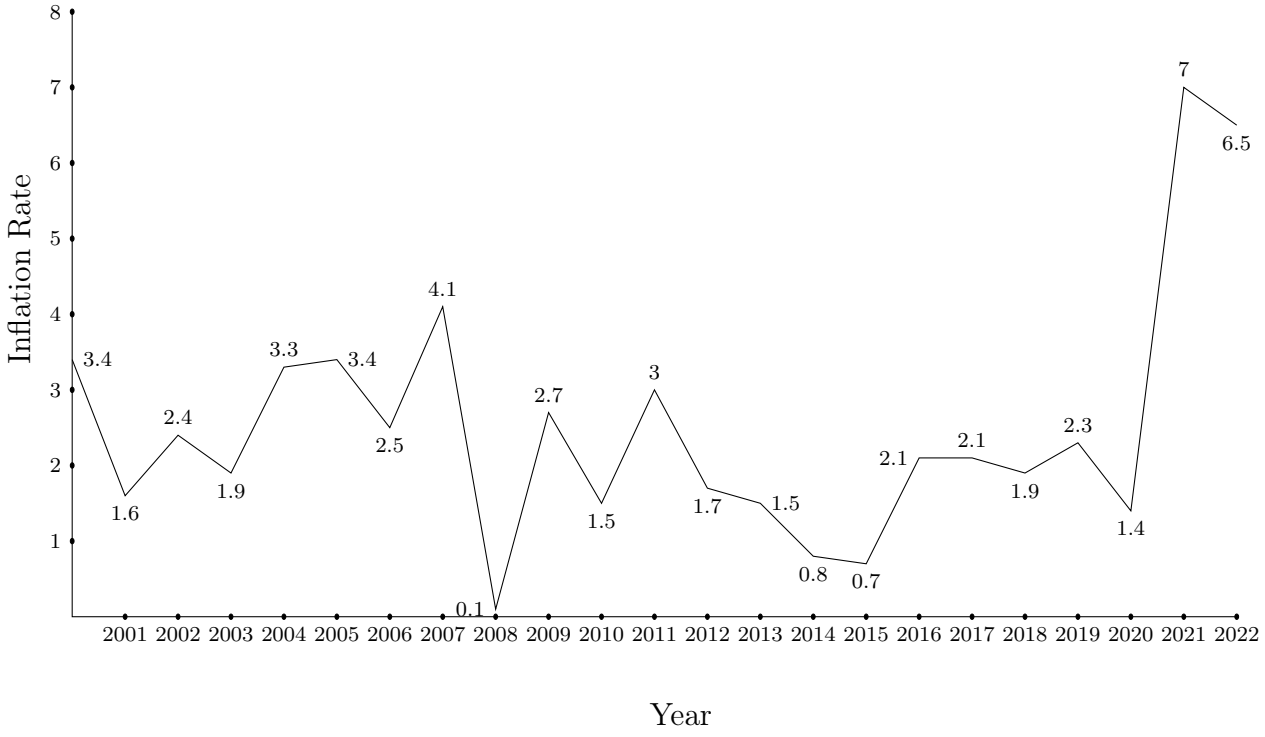
Table 6: **Intrusmental Variable Regression**

Table 6 presents results of panel regressions examining the effect of capital structure on firm performance. The dependent variable is $\text{ROA}_{i,t}$ (net income/total assets) and $\text{EBIT}_{i,t}$. Column 1 and column 2 report the result of two different measure of firm profitability respectively. The leverage and leverage squared are instrumented by the share of interest expenses in total assets and its squared term. The sample is based on Compustat Fundamentals Annual files over the 2000-2022 period. The symbols ***,** and * indicate statistical significance at the 1%,5%, and 10% levels, respectively.

	$\text{ROA}_{i,t}$	$\text{EBIT}_{i,t}$
$Leverage_{i,t-1}$	1.297043***	-1229.669***
	(0.3086832)	(125.1206)
$\text{Leverage}^2_{i,t-1}$	-0.5585667***	509.2241***
	(0.141754)	(53.55794)
$Leverage_{i,t-1}$#$\text{Inflation}_{i,t-1}$	-0.0656966	114.1912**
	(0.100679)	(37.3299)
$\text{Leverage}^2_{i,t-1}$#$\text{Inflation}_{i,t-1}$	0.0286061	-57.23454**
	(0.049712)	(17.80994)
$Firmsize_{i,t-1}$	0.0025947	190.142***
	(0.0064581)	(4.275642)
$Tangibility_{i,t-1}$	-0.1393192***	139.0325***
	(0.0380921)	(4.275642)
$Salesgrowth_{i,t-1}$	0.0384418**	2.174858
	(0.0173088)	(14.44865)
Constant	-0.2537385***	2.174858***
	(0.0086273)	(9.892364)
Standardized Coefficients		
Controls	✓	✓
R^2	.	0.0565
Observations	41,717	41,383

Figure 1: **Inflation Rate Changes**

Figure 1 presents changes of inflation rate in United States in the time period from 2000 to 2022.



Stata code

```
//time setting
egen firmid= group(gvkey)
duplicates drop firmid year,force
tsset firmid year

//delete observations with total assets equal zero or blank
drop if at == 0
drop if at == .

//generate dependent and independent variables
gen ROA= ni/at
gen Leverage= (dlc+dltt)/seq
gen Leverage_2= Leverage^2
gen Firmsize= log(at)
gen Tangibility= ppent/at
gen Salesgrowth= (sales-L_sales)/L_sales
gen interest= Interestexpenses/at
gen interest_2=interest^2

//trim the top and bottome 5% for each variables
ssc install winsor2
gen ROA_trim=ROA
winsor2 ROA_trim, replace cut (5 95) trim
hist ROA_trim
gen EBIT_trim=EBIT
winsor2 EBIT_trim, replace cut (5 95) trim
hist EBIT_trim
gen Leverage_trim=Leverage
winsor2 Leverage_trim, replace cut (5 95) trim
hist Leverage_trim
gen Leverage_2_trim=Leverage_2
winsor2 Leverage_2_trim, replace cut (5 95) trim
hist Leverage_2_trim
gen Firmsize_trim=Firmsize
winsor2 Firmsize_trim, replace cut (5 95) trim
hist Firmsize_trim
gen Tangibility_trim=Tangibility
winsor2 Tangibility_trim, replace cut (5 95) trim
```

```
hist Tangibility_trim
gen Salesgrowth_trim=Salesgrowth
winsor2 Salesgrowth_trim, replace cut (5 95) trim
hist Salesgrowth_trim

//scatter plot with trimmed variables
twoway scatter ROA_trim Leverage_trim || lfit ROA_trim Leverage_trim
twoway scatter ROA_trim Leverage_2_trim || lfit ROA_trim Leverage_2_trim
twoway scatter ROA_trim Firmsize_trim || lfit ROA_trim Firmsize_trim
twoway scatter ROA_trim Tangibility_trim || lfit ROA_trim Tangibility_trim
twoway scatter ROA_trim Salesgrowth_trim || lfit ROA_trim Salesgrowth_trim
twoway scatter EBIT_trim Leverage_trim || lfit EBIT_trim Leverage_trim
twoway scatter EBIT_trim Leverage_2_trim || lfit EBIT_trim Leverage_2_trim
twoway scatter EBIT_trim Firmsize_trim || lfit EBIT_trim Firmsize_trim
twoway scatter EBIT_trim Tangibility_trim || lfit EBIT_trim Tangibility_trim
twoway scatter EBIT_trim Salesgrowth_trim || lfit EBIT_trim Salesgrowth_trim

//generate prior year sales
gen L_sales=l.sales

//generate lagged variables
xtset firmid year
gen LLeverage=l.Leverage_trim
gen LLeverage_2=l.Leverage_2_trim
gen Linflation=l.inflation
gen LFirmsize=l.Firmsize_trim
gen LTangibility=l.Tangibility_trim
gen LSalesgrowth=l.Salesgrowth_trim
gen Linterest=l.interest
gen Linterest_2=l.interest_2

//rename variables
rename ROA_trim ROA
rename EBIT_trim EBIT
rename Leverage_trim Leverage
rename Leverage_2_trim Leverage_2
rename Linflation inflation
rename LFirmsize Firmsize
rename LTangibility Tangibility
rename LSalesgrowth Salesgrowth
```

rename Linterest interest
rename Linterest_2 interest_2

//descriptive statistics
sum ROA EBIT Leverage Leverage_2 Firmsize Tangibility Salesgrowth Inflation Interest-expenses

//correlation analysis
correlate ROA EBIT Leverage Leverage_2 Firmsize Tangibility Salesgrowth Inflation Interestexpenses

//OLS regression
reg ROA Leverage Leverage_2 c.Inflation#c.Leverage c.Inflation#c.Leverage_2 Firmsize Tangibility Salesgrowth, robust

reg EBIT Leverage Leverage_2 c.Inflation#c.Leverage c.Inflation#c.Leverage_2 Firmsize Tangibility Salesgrowth, robust

//fixed effect regression
ssc install reghdfe
ssc install ftools

reghdfe ROA Leverage Leverage_2 c.Inflation#c.Leverage c.Inflation#c.Leverage_2 Firmsize Tangibility Salesgrowth, absorb(firmid year) vce(cluster firmid)

reghdfe EBIT Leverage Leverage_2 c.Inflation#c.Leverage c.Inflation#c.Leverage_2 Firmsize Tangibility Salesgrowth, absorb(firmid year) vce(cluster firmid)

//IV regression
ivregress 2sls ROA_*trim* Firmsize Tangibility Salesgrowth (Leverage c.inflation#c.Leverage Leverage_2 c.inflation#c.Leverage_2 =c.interest c.interest#c.inflation c.interest_2 c.interest_2#c.inflation,first

ivregress 2sls EBIT_*trim* Firmsize Tangibility Salesgrowth (Leverage c.inflation#c.Leverage Leverage_2 c.inflation#c.Leverage_2 =c.Linterest c.interest#c.inflation c.interest_2 c.interest_2#c.inflation,first

8 Statement of Authorship

I hereby confirm that the work presented has been performed and interpreted solely by myself except for where I explicitly identified the contrary. I assure that this work has not been presented in any other form for the fulfilment of any other degree or qualification. Ideas taken from other works in letter and in spirit are identified in every single case.

Ich versichere hiermit, dass ich die vorstehende Masterarbeit selbstständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt habe, dass die vorgelegte Arbeit noch an keiner anderen Hochschule zur Prüfung vorgelegt wurde und dass sie weder ganz noch in Teilen bereits veröffentlicht wurde. Wörtliche Zitate und Stellen, die anderen Werken dem Sinn nach entnommen sind, habe ich in jedem einzelnen Fall kenntlich gemacht.

Bonn, 22nd March 2024, Zhichen Ou