



## **Fundamental Drivers of Capital Structure: Evidence from Publicly Traded Non-financial U.S. Firms**

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### **ABSTRACT**

This paper investigates the influence of relevant factors in determining capital structure with their respective extent. Excluding financial firms, all publicly traded American firms for the period of 1950-2005 are considered as the sample firms. Five fundamental factors that may explain leverage are growth opportunities, tangible assets, firm profit, firm size, and inflation. I use simple linear regression, BIC, and AIC, to identify the reliably consistent influential factors and a model. Using total leverage to market value of asset (TLMA) as my main model for the entire estimation period (1950-2005), I find that tangibility and firm size are significantly and positively related to leverage. The growth opportunities is also positively related to leverage but statistically insignificant. But firm profit has a significant negative relationship with leverage confirming the implication of the pecking order hypothesis.

**Keywords:** Static Trade-off Theory, Pecking Order Theory, Market Timing Theory, Signaling Theory, Agency Cost Theory

**JEL Classifications:** G1, G3, G10, G20, G32

### **1. INTRODUCTION**

Capital structure decision means deciding the proportion of debt and equity capital in determining the amount of funding for a corporation. It may be considered as one of the most important decisions of a corporation as an optimal capital structure could maximize the value of the firm by lowering the cost of capital. But there could be no universal mechanism that might enable a firm finding an optimal capital structure and staying on it accordingly.

After the introduction of the ground-breaking theory of Modigliani and Miller (1958), capital structure decision gets greater attention in the arena of research. Subsequently, theories like tradeoff theory, pecking order theory, market timing theory, and agency theory emerges.

Different theories might explain leverage decisions from different dimensions based on the underlying empirical findings.

Consequently, it is often difficult to compare the strengths and flaws that might prevail in a particular theory. Besides, Harris and Raviv (1991) identify pitfalls in the fundamental findings of these (capital structure) theories. Titman and Issels (1988) also show the evidence of their disagreement with the central findings of different determinants of leverage which could be supported by previous research. This paper is intended to shed some light on these empirical issues which are expected to exert influence over a longer horizon.

This paper is important because it contributes to comprehending capital structure theories in various ways. Firstly, in comparison to previous literature, it correctly identifies the consistent factors that might influence leverage with their respective signs. Secondly, I relate my empirical findings of influential factors in explaining leverage with the capital structure theories to determine whether the implication of my findings support or contradict a particular theory.

There are various models of leverage which are used empirically. This paper also considers various leverage definitions that are mentioned in the following:

- Total leverage to market based assets (TLMA)
- Total leverage to book based assets (TLBA)
- Long-term leverage to market based assets (LLMA)
- Long-term leverage to book based assets (LLBA).

Although the central focus of this research is based on total leverage to market value of assets to measure leverage but this paper considers four models of leverage. Estimation and findings of this paper are based on total leverage to market value of assets (TLMA) and total leverage to book value of asset (TLBA). Specifically, this paper use TLMA as the main measure of leverage.

Identification strategy of this paper is to use Bayesian Information Criterion (BIC) which is a criterion for selecting one model among various other models. I also consider the Akaike information criterion (AIC) for estimating the relative quality of each model.

The paper is summarized as the mentioned section: Section 1 contains the introduction of the paper. In section 2, I discuss the findings of relevant literature. In section 3, I represent capital structure theories. Section 4 highlights variable measurement. Section 5 covers data structure. Section 6 entails descriptive statistics. In section 7, I show the empirical evidence based on correlation between dependent and independent variables.

Section 8 and 9 highlight the empirical model and empirical findings of this paper respectively. In section 10, I compare the findings of my paper with the findings of some other paper. Section 11 comprises the concluding remarks of this paper.

## 2. LITERATURE REVIEW

Chirinko and Singha (2000) criticize Shyam-Sunder and Myers (1999) conclusion about the innovative assessment of the pecking order model. Shyam-Sunder and Myers (1999) represent a model to evaluate the pecking order theory. Chirinko and Singha (2000) show that evidence from the previous experiment is not sufficient enough to conclude the existence of the application of static trade-off and pecking order theory. Instead, Chirinko and Singha (2000) suggest that unconventional models and tests are required to recognize factors that might plausibly affect capital structure choices.

Giannetti (2003) uses book leverage for eight European countries exploiting firm-level data and the number of firms (unlisted) is 61,557 to examine the factors that can explain capital structure decisions. Giannetti (2003) shows that leverage decision is influenced by the nature of the corporation, legitimate regulation, and financial progress. Using fixed effect and controlling firm-specific characteristics Giannetti (2003) also shows that unlisted firms are obligated more than listed firms but by implementing rights related to debt-holder unlisted firms could avail a higher amount of debt.

Fama and French (2012) use regression to assess the implications of trade-off, pecking order, and market timing theory. Using CRSP

and Compustat data for 1963-2009, excluding financial firms, firms listed in Amex, NYSE, and NASDAQ are considered as sample firms to be analyzed. Fama and French (2012) find that evidence in favor of the trade-off theory is fragile; evidence in favor of market timing theory is moderate but there is no evidence in favor of pecking order theory.

Halov and Heider (2004) show evidence that if the information is symmetrically distributed to the outsiders so that outsiders are well informed about the risk of the firm then debt issuance might be optimal. In other words, the pecking order theory of capital structure might hold in the circumstance of availability of information to the outsiders regardless of firms' tenure, size, Tobin's Q, and tangibility. However, if there is information asymmetry then the hierarchical order of external financing might not prevail. Using publicly traded U.S. firms as the sample, doing OLS regression, and controlling firm and time fixed effect, Halov and Heider (2004) also show that firms might prefer equity to debt in the environment of information asymmetry.

Dong et al. (2012) study Canadian corporations from 1998 to 2007 to assess the implications of the pecking order and market timing theory. Dong et al. (2012) show the evidence that financially sound firms issue equity when the share price is higher than the intrinsic value which is consistent with market timing theory. Dong et al. (2012) also find that if share prices are fairly valued or undervalued then firm might select debt over equity which is also supported by pecking order theory.

Bevan and Danbolt (2002) analyze the leverage decision of 822 U.K. based non-financial corporations. Bevan and Danbolt (2002) find that the factors that might influence leverage are depending on time horizon of debt. Using the OLS regression method for estimating casual effect, Bevan and Danbolt (2002) find that size, profitability, and tangibility are significantly positively related to leverage, whereas growth opportunity is significantly negatively related to leverage.

Fulghieri and Lukin (2001) investigate the challenges that a corporation encounters and also determine capital structure decisions in a market dominated by the uneven flow of information. Fulghieri and Lukin (2001) suggest that the choice of leverage decision is depending on the cost of generating information and the mechanism by which information is generated. Fulghieri and Lukin (2001) propose various implications based on their models which are positively related growth and equity issuance, beginners prefer equity to debt while long-standing favor debt to equity, and lower growth accompanied by higher maturity tends to have higher leverage.

## 3. CAPITAL STRUCTURE THEORIES

Capital structure theories might get more attention after the innovative proposition of Modigliani and Miller (1958) regarding the insignificance role of capital structure in changing the wealth of shareholders. Although this irrelevance theory might be based on some stringent hypotheses: no tax, no transaction cost, no brokerage cost, same borrowing rate for individuals and

corporation, no bankruptcy cost, and symmetric distribution of information to the stakeholders, but in the real world, we could observe some imperfections or deviations from those issues. Thus theories like the trade-off, pecking order, agency cost, market timing, and free cash flow hypothesis emerges and consequently researchers address the fact that capital structure might be relevant since the assumptions of Modigliani and Miller (1958) might not exist in reality.

### 3.1. Static Trade-off Theory

In the real world corporations have to pay tax on their income which is derived after the payment of interest expense. Thus interest is an expense that could shield a portion of the income from tax. Consequently, the saved income from using debt is a strategy that might induce firm use debt financing for investing in wealth enhancing projects. Hence, using debt could be beneficial in terms of taxation. But using more debt might increase the cost of financial distress. Therefore, a balance between benefits and costs could be beneficial for the firm. Kraus and Litzenberger (1973) offer equilibrium capital structure decision which is associated with a balance between gain and cost of debt. Myers (1984) also proposes in the similar direction that corporation might gradually move towards target leverage ratio in which benefits of debt completely offset the bankruptcy-related cost of debt and that target leverage ratio could be considered as the optimal level of leverage. Thus, static trade-off theory means a value maximizing optimal capital structure could only be derived by choosing a debt to equity ratio in which optimal benefits of debt is exactly equivalent to the default cost of debt.

### 3.2. Pecking Order Theory

Myers (1984) suggests that as information is not symmetrically distributed, so the residual owners' riskiness might always be higher. Therefore, corporations could adopt a hierarchy of financing. Consequently, Myers (1984) proposes that if a corporation intends to raise fund then it should use its internal fund first, followed by debt, and then equity. One plausible reason could be that retained earnings might carry the lowest asymmetric information cost. And then debt as external fund because there are commitments related to payment and prior claimant to equity associated with the payback which makes debt cheaper than equity. Finally, the firm could go for equity as it carries the risk of not getting anything after the distribution of earnings, thus becoming the expensive sources of finance. Fama and French (2012) argue that during 1963-1982, U.S. non-financial firms issue more debt than equity and there is evidence of fluctuations in dividend, income, and investment that might be due to the offering of debt, thereby clearly supporting the proof of pecking order theory. In short, firms applying pecking order means internal is desired to use before external and debt is always preferred to equity (Myers, 1984).

### 3.3. Market Timing Theory

Generally market timing theory states that the firm would prefer to issue equity instead of debt in the overheated equity market. Huang and Ritter (2004) states that firm could issue equity when the equity is overvalued in the extent that compared to debt capital cost of equity is lower; however if firm find the cost of debt is lower compared to the cost of equity then firm would go for issuing

debt, thereby timing the issuance to obtain the cost advantage. Nevertheless, the overvalued equity market might not always give incentive to the firm to finance through equity issuance. For example Mahajan and Tartaroglu (2007) test market timing theory in G-7 countries, and find that market-to-book and debt ratio is inversely associated; this inverse relationship could not always be attributed to the presence of equity timing. Mahajan and Tartaroglu (2007) show that corporations in those seven countries equity issuance attempt, to exploit good timing, having minimal effect on debt, is an ephemeral consequence; thus confirming the contradictory stand to market timing hypothesis.

### 3.4. Signaling Theory

Composition of debt and equity capital might give a signal to the investors about the value of the imminent cash flows to the firm as the capital structure is associated with the cost of capital and thereby could have an implied influence on firm value. Koch and Shenoy (1999) state that capital structure puzzles are often designed as an event study to determine the abnormal returns of a stock. Thus capital structure decision could be considered as a signal of future underperformance or over-performance depending on the type of information attached securities that vary in terms of cost based on underlying risk. Ross (1977) argues that a corporation might issue debt when managers are expecting that the firm might be able to generate higher future cash flow; as long as debt represents an obligation, the manager might not issue debt during an unprecedented income fluctuation period. Thus it is plausibly deduced that debt could give a signal about potential future performance compared to equity.

### 3.5. Agency Cost Theory

As there is an existence of separation of ownership and management in a corporation, so the agents (managers) might not always act for the well-being of the principal (shareholders). Rather managers might want to maximize their benefits by squandering resources like perquisites, higher compensation packages, and empire building (Shleifer and Vishny, 1989). So these sorts of actions might lead the way to implicit conflict when agents maximize their interest instead of maximizing the interest of the principal and thereby generating agency cost for the firm. Jensen (1986) suggests that agency conflict between owners and managers could be mitigated by disbursing dividends to the shareholders. Moreover, Gungoraydinoglu and Öztekin (2011) state that the using of debt in capital structure might mitigate agency cost between agents and principal but intensify the clash between owner and lender. Myers and Majluf (1984) mention that if managers have valuable information about investment then raising funds by debt capital is good because it might not reduce the market value of equity whereas using equity capital to fund investment opportunities might reduce the value of equity. Thus it is plausible to believe that because of the presence of agency cost between owners and managers, debt capital might be useful to reduce the free cash flow related problem but it could also pave the way for increasing conflict between shareholders and debt-holders. In brief, agency theory suggests that using debt capital might be useful in terms of mitigating agency cost between manager and shareholder because debt carries bankruptcy related threat which might direct manager become self-controlled.

#### 4. VARIABLES MEASUREMENT, DATA COMPOSITION AND DESCRIPTIVE STATISTICS

I select a list of variables that are expected to have an influence on leverage based on different kinds of literatures. This list includes Profitability, firm size, growth opportunities, assets composition, depreciation, stock market behavior, debt market condition, and macroeconomic fluctuations. To understand the implication of those variables in predicting leverage and therefore connecting a theory, I need to demonstrate the definition, along with the expected direction of influence, of these variables. The Appendix section contains the definition of these variables.

- i. Debt ratio and firm profit: Higher profit reduces the probability of facing financial insolvency and thereby reduces bankruptcy cost. Higher profit also enables a firm to have greater tax shield benefits. Thus tradeoff theory suggests a positive relationship between profit and leverage. Hence, agency cost theory also supports higher leverage for the profitable firm due to the free cash flow problem that could be mitigated by using debt which makes the manager more disciplined (Jensen, 1986).  
Measurement: Profitability

The expected relationship between debt ratio and profit: Positive

- ii. Debt ratio and firm size: Large firms could be assumed as diversified firms with greater resources. Firms with higher resources might face lower bankruptcy risk. Therefore tradeoff suggests a positive relationship between leverage and firm size. On the contrary, the pecking order theory suggests that larger firms are familiar for a longer time and might have the opportunity to preserve their earnings. Thus larger firms might use less leverage.

Measurement: Log of assets

The expected relationship between debt ratio and firm size: Positive or Negative

- iii. Debt ratio and growth: Growing firms need a greater amount of funds for financing their investment. Thus it is plausible to believe that internal financing might not be sufficient enough to fund profitable opportunities all the time. Therefore, the pecking order theory assumes that leverage and growth might be positively related.

Measurement: Market-to-book ratio

The expected relationship between debt ratio and growth: Positive

- iv. Debt ratio and nature of assets: Firms with greater tangible assets might tend to use more leverage than firms with lower tangible assets. It is easier for the lender to value tangible assets that might be used as collateral in considering disbursement. Thus tangibility and leverage should be positively related. In addition to that, the higher RND and selling expense might require a higher amount of funds. Therefore higher RND and selling expenses might induce the firm to use more leverage.  
Measurement: Tangibility

The expected relationship between debt ratio and nature of assets: Positive

- v. Debt ratio and non-debt tax shield: Non-debt tax shield is also expected to reduce the tax burden and could be considered as

an alternative to interest tax shield benefit. Therefore, firms with higher depreciation and investment tax credits could tend to use less leverage.

Measurement: Investment tax credit/assets

The expected relationship between debt ratio and non-debt tax shield: Negative

- vi. Debt ratio and debt market conditions: The real value of debt might be reduced when the inflation rate is higher. Consequently, the manager might issue more debt during the higher inflationary period. Therefore leverage and inflation could be positively related.

Measurement: Expected inflation rates

The expected relationship between debt ratio and inflation: Positive

- vii. Debt ratio and macroeconomic conditions: In a good macroeconomic condition, firms might have wealth enhancing projects for investment and thereby require more funds. Thus I could expect that to meet additional funding needs firm might issue debt instead of equity as equity is costlier than debt in many circumstances.

Measurement: Growth in GDP

The expected relationship between debt ratio and macroeconomic condition: Positive

Excluding financial firms, all publicly traded U.S. firms are considered as a sample. The data are collected from the Compustat website for the period of 1950 to 2005. Macroeconomic data are collected from various websites. The number of observations using fundamental variables for estimating TLMA is 317,182.

In Table 1, I summarize the leverage measures and their associated explanatory variables with their respective mean, standard deviation, and percentile distribution. The mean leverage measured under TLMA, TLBA, LLMA, and LLBA are 0.41, 0.72, 0.27, and 0.27. The mean leverage measured by TLMA, TLBA, LLMA, and LLBA is higher than median leverage. Large firm-level differences in leverage marked by the 10<sup>th</sup> percentile of TLMA are 0.0 while the 90<sup>th</sup> percentile is 1.0. The mean of profitability is negative which indicates that investors are holding underperforming firms with the expectations of forthcoming profitability an indication marked by Fama and French (2001) and DeAngelo et al. (2004). The mean of growth opportunity of a firm measured by the change in log of asset is close to 0.0 but accounts for significant deviation which indicates that some firms are growing robust on average while the others are shrinking. The average inflation rate over the estimation period is 3.88%. Macro growth measured by the growth rate in GDP shows an average value of 0.03% and the standard deviation is also the lowest which is an indication of lower macroeconomic variation during the estimation period.

The correlation between independent variables and various measures of leverage is reported in Table 2. This paper reports correlation for the entire sample period (1950-2005) along with every variable's sign based relation to leverage and significance level. Considering TLMA as a measure of leverage, I find a positive and significant relationship between firm size (log of assets) and leverage. The Investment tax credit is also positive and significant in influencing leverage under TLMA. Conversely,

**Table 1: Descriptive statistics for our selected samples of U.S public companies for the period of 1950-2005**

Variable	n	Mean	STDV	Distribution		
				10 <sup>th</sup>	50 <sup>th</sup>	90 <sup>th</sup>
Leverage methods						
TLMA	345,394	0.41	3.51	0.00	0.30	1.00
TLBA	336,960	0.72	66.46	0.00	0.21	0.60
LLMA	345,394	0.27	3.13	0.00	0.15	0.75
LLBA	336,960	0.26	10.70	0.00	0.11	0.46
Elements						
Profitability						
Profit	336,960	-0.34	48.22	-0.14	0.089	0.23
Firm size						
Logasset	336,960	1.97	1.14	0.57	1.94	3.44
Growthop						
Mrktbook	336,960	5.56	552.23	0.14	0.80	2.77
ChngAsst	376,902	0.00	729.71	-0.77	0.00	0.71
Capitlexp	336,960	0.06	0.00	0.00	0.34	0.14
Nature of Assets						
Tangblty	336,960	0.29	0.26	0.01	0.21	0.72
RNDE	306,123	0.65	28.92	0.00	0.00	0.09
SGAE	306,123	0.38	33.17	0.00	0.16	0.54
Deprcn	336,960	0.01	0.13	0.00	0.00	0.04
InvTxCdt	336,960	0.01	0.04	0.00	0.00	0.06
PriodSprd	44	-0.002	0.06	-0.07	-0.007	0.85
Inflation	55	3.87	2.93	1.00	3.00	7.90
McroGwt	55	0.02	0.01	0.015	0.02	0.04

Various measures of debt ratios and other relevant firm-specific and macroeconomic variables are summarized by calculating their mean, standard deviation and percentile. Selected firms are non-financial and for the period of 1950-2005.

**Table 2: Various measures of debt ratios and their correlations between firm-specific and macroeconomic variables**

	Total debt/Market assets (TLMA)	Total debt/Book assets (TLBA)	Long-term debt/Market assets (LLMA)	Long-term debt/Book assets (LLBA)
Profit	0.0005	-0.0715***	0.000	-0.01***
Logasset	0.022***	-0.025***	0.023***	-0.002***
Mrktbook	-0.000	0.173***	-0.000	0.058***
Cnlogasst	0.0002	-0.054***	-0.000	0.038***
Capitlexp	-0.0013	0.004***	-0.000	0.006***
Tangblty	-0.009***	-0.004***	0.025***	0.00
RNDE	-0.001	0.000	-0.001	-0.004
SGAE	-0.001	-0.002	-0.001	0.001
Deprcn	0.001	0.003*	0.001	0.012***
InvTxCdt	0.013***	-0.023	0.022***	-0.009
PriodSprd	-0.119	-0.319	-0.037	0.130
Inflation	-0.470***	-0.074	-0.360**	-0.160
McroGwt	-0.013	0.278	0.3184**	-0.589**

Following table shows the correlation coefficients between debt ratios measured by four different ratios and relevant variables that might have an impact on debt ratios. Sample period consists of 1950-2005. \*\*\*indicates 1% level of significance, \*\*indicates 5% level of significance and \*indicates 10% level of significance.

tangibility and inflation are negative and significantly correlated with leverage measured by TLMA. Alternatively, growth opportunities (measured by Market-to-book), capital expenditure, and depreciation are significantly and positively correlated with leverage measured by TLBA. On the other hand, Profitability, firm size, and tangibility are significantly and negatively correlated with leverage under TLBA.

## 5. EMPIRICAL MODEL

Linear regressions are used to estimate the effects of selected independent variables on dependent variables. Let  $LR_{j,t}$  denote the leverage of firm  $j$  on date  $t$ . Independent variables for a particular firm  $j$  at time  $t$  is represented as  $F_{j,t}$ , the constant  $\alpha$  and the coefficient  $\beta$  are the parameters that are needed to be estimated.

Standard errors are clustered to ensure preciseness in my estimation. Hence the estimated model is mentioned in the following:

$$LR_{j,t} = \alpha + \beta F_{j,t} + e_{j,t}$$

I use both the AIC and the BIC to select the best model from a particular set of models. Lower the value, higher the preference for a particular model over the others in both AIC and BIC.

BIC: BIC is a criterion used for selecting a model among different models.

 BIC,  Preference

$$BIC = -2 \times \log\text{-likelihood} + P \times \log(N)$$

AIC: Measure the relative quality of a model from a set of models and thereby provides a basis for selecting a model.

$$AIC = 2 \times P - 2 \ln(\hat{L})$$

L = maximum value of the likelihood function for the model.



AIC,



Preference

To ensure robustness in my estimation, I compute heteroskedasticity adjusted standard error and clustering of standard error. Besides that, I divide sample into six sub-sample periods and estimate the parameters accordingly. If baseline specifications and results are precisely significant, then coefficients should also remain the same in each sub-sample group. However, it is important to note that I only consider five core factors in the sub-sample based leverage estimation for both the TLMA and TLBA model.

## 6. EMPIRICAL FINDINGS FOR THE CORE LEVERAGE MODEL

In Table 3, we report the value of parameter estimates, respective t-statistics associated with heteroskedastic standard errors.

Baseline regression is reported in column (1) of Table 3 in which I consider all years (1950-2005) sample data for core independent variables. Each column has the same specification. Column (2) to (7) represents the period-by-period sensitivity of each core factor in influencing leverage. Considering all years of data, I find that these core variables can explain <1% variation in leverage. The tangibility coefficient is positive and significant at 5% level. The tangibility coefficient 0.092 in all years data represent that if I increase the amount of tangible asset by 1 unit then the debt ratio measured by TLMA is expected to increase by 0.092 unit. This is consistent with static trade-off theory because the firm could increase its existent level of debt by using their tangible asset as collateral. By using collateralized tangible asset firm could avail more debt and thereby enjoy the tax-shield benefit. Frank and Goyal (2003) also showed that regardless of the size of the firm, tangibility has a significant positive impact in changing the debt ratio of firms.

The market-to-book ratio is positive during 1950-1959 but in the subsequent years, it has turned into negative. In five sub-sample periods, the market-to-book ratio is significant at 1% level in exerting a negative influence on leverage when debt ratio is measured by TLMA. The higher market-to-book ratio indicates that a firm might earn a higher future profit or cash flow which is currently reflecting in the form of greater intrinsic value of the asset. Thus it could be considered as an indicator of higher growth opportunities of a particular firm. Consequently, if the market-to-book ratio or growth opportunity is higher then according to the pecking order theory firm should use more leverage. So clearly my findings related to market-to-book contradict the theory of the pecking order hypothesis. However, a negative market-to-book ratio and leverage relationship could be plausibly admitted under the market timing theory; because a higher market-to-book ratio might indicate that the market value of the firm is higher which could be stemmed from irrational exuberance of foolish investors. If the market-to-book ratio is higher because of the overvaluation hypothesis, then the manager might be induced to issue equity rather than debt to utilize the opportunity of timing. Thus, the higher market-to-book ratio might have a negative influence on leverage which is supported by market timing theory.

Profitability is significantly and negatively related to leverage in all year specification under TLMA based leverage measurement. And at least in four sub-sample periods, profitability is significant at 5% level and the relationship is negative in influencing leverage. Importantly, the negative relationship between profitability and leverage could be suggested by the pecking order theory of leverage. Pecking order theory assumes that internal fund is always preferred to external fund. Thus higher profit might generate higher internal fund which is cheaper to use and arguably this significant negative relationship could be plausible. Fama and French (2002) also show an inverse relationship between profitability and book based debt. Fischer et al. (1989) also favor the opposite relationship between profitability and debt. Rajan and Zingales (1995) and Kester (1986) also demonstrate an inverse relationship between profitability and debt capital. But arguably profitability and leverage relationship is expected to be positive under static-trade off theory. Static trade-off theory suggests that firms could benefit

**Table 3: Independent variables and their respective BIC and AIC using TDM as dependent variables**

	Coefficient estimate (1)	t-statistics (2)	Individual R <sup>2</sup> (3)	P>t (4)	BIC (5)	AIC (6)
SGAE	0.07	16.8	0.0	0.00	1779920	1779899
Inflation	-0.04	-4.79	0.2	0.00	25.03	21.28
Capitlexp	0.13	4.03	0.0	0.00	1780050	1780028
Deprcn	-0.00	-3.93	0.1	0.00	1657138	1657117
Logasset	-0.00	-2.59	0.0	0.01	1780082	1780060
Profit	-0.00	-2.27	0.0	0.02	1657139	1657117
Cnlogasst	0.98	2.08	0.0	0.03	1780021	1780000
RNDE	0.00	2.02	0.0	0.04	1780082	1780060
Mrktbook	0.04	1.65	0.0	0.10	1780081	1780059
Tangblty	-0.00	-1.13	0.0	0.25	1780081	1780060
InvTxCdt	0.00	1.01	0.0	0.31	1849511	1849490
McroGwt	-0.56	-0.89	0.0	0.37	26.66	23.44
PriodSprd	-0.40	-0.08	0.0	0.93	37.02	33.28

Following table represent the considered independent variables own coefficient with respect to TDM. TDM is considered as the dependent variable. We also include individual R<sup>2</sup>, t-statistics, BIC, and AIC. In order to calculate own R<sup>2</sup>, we use simple univariate measures of regressions. Standard errors are clustered for every independent variable. We rank the variables based on their absolute value of t-statistics.

by using debt in rising profit scenario because tax-deductibility of interest could shield excess profit from tax through debt.

The perspective of Klein et al. (2002) about static trade-off theory is that corporations could find its optimum financing policy by balancing its tax benefit of debt with the asymmetric information and bankruptcy-related cost. So the viewpoint of Klein et al. (2002) could support a positive relationship between profitability and debt.

Asset coefficient under TLMA based measurement is 0.075 and in all years it shows a positive relationship with debt and it is a proxy of firm size. As the asset is measured by the log of asset so the interpretation is that if the asset is increased by 1% then the leverage is expected to increase by 0.00075 unit. Fama and French (2002) recommend that bigger firms might have consistency in earnings and therefore predicts a positive relationship between debt and firm size based on trade-off theory. Moreover, Fama and French (2002) document a positive relationship between firm size and debt capital. Bradley et al. (1984) and Marsh (1982), also document a positive relationship between debt capital adoption and the size of the corporation. Hence, I find that debt and firm size measured by the log of asset is positive and statistically significant at 1% level when I consider all years of sample data.

Besides when I collapse the sample into the sub- sample part, I find that the firm size is positive and statistically significant at 1% level in the Period of 1980-1989, 1990-1999, and 2000-2005 in terms of influencing leverage.

However, when it comes to the macroeconomic variable i find that inflation is negatively related to debt capital raising decisions. Consequently, all core variables have maintained a similar sign (positive) across each sub-sample group. Hence, except for inflation, all fundamental variables are statistically significant in various sub-sample periods under TLMA based leverage measurement. Thus, the sub-sample based estimation confirms my baseline regression results when i consider TLMA based leverage ratio.

I also consider TLBA as an alternative to TLMA to estimate the impact of core variables in explaining leverage. Using TLBA, i find that tangibility is negatively related to leverage and it is significant at 10% level. However, growth opportunities (market-to-book ratio) are positively related to leverage and significant at 10% level. Hence, firm size (log of assets) is negatively and significantly correlated to leverage in sub-divided sample periods under TLBA based estimation.

**Table 4: Fundamental models of leverage**

Section 1: Total leverage to market value of assets (TLMA)							
	All years	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2005
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tangblty	0.092** 0.037	(0.038) 0.04	0.086 0.15	0.152*** 0.031	0.146*** 0.007	0.154*** 0.009	0.142*** 0.006
Mrktbook	0.000 0.00	0.147*** 0.05	(0.10) *** 0.03	(0.061)** 0.012	(0.137)*** 0.003	(0.106)*** 0.001	(0.015)*** 0.001
Profit	(0.00)*** 0.000	0.060 0.07	(0.60) * 0.322	(0.41)** 0.18	(0.054)** 0.022	(0.042)*** 0.008	(0.011)** 0.004
Logasset	0.075*** 0.004	(0.039)** 0.015	(0.001) 0.05	0.004 0.007	0.752*** 0.003	0.067*** 0.002	0.079*** 0.001
Inflation	(0.00) 0.001	0.146* 0.02	(0.04) 0.03	(0.021) 0.0021	(0.000) 0.000	0.02 0.001	(0.040)*** (8.2)
AIC	1,701,348	4713.98	61,551.19	101,017	26,228.5	77,812.18	7347.848
BIC	1,701,412	4750.96	61,595.22	101,067	26,281.2	77,867.19	7399.015
Number of observation	317,182	3507	11,368	33,370	48,671	70,810	37,339
Adjusted R <sup>2</sup>	0.0006	0.0082	0.0019	0.0086	0.1038	0.0581	0.147

\*\*\*indicates 1% level of significance, \*\*indicates 5% level of significance, \*indicates 10% level of significance

Section 2: Total leverage to book value of assets (TLBA)							
	All years	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2005
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tangblty	(0.930)* 0.506	(1.156) 0.832	3.92 7.93	0.031 0.038	(0.043)* 0.024	(0.124) 0.103	0.447 (0.006)
Mrktbook	0.000* 0.000	6.316* 3.25	1.63 2.17	(0.013)* 0.008	(0.006) 0.003	0.003 0.002	(0.006) 0.030
Profit	(0.000) 0.000	9.62* 5.04	(61.09) 46.63	0.174* 0.102	(0.012) 0.216	(0.012) 0.011	(0.078) 0.100
Logasset	0.398 0.27	(2.115)* 1.11	(13.35) 9.59	(0.040)*** 0.015	(0.045)* 0.024	0.157* 0.085	(0.157) 0.222
Inflation	0.09 0.059	(0.21)* 0.11	(2.42) 1.714	(0.014) 0.017	0.014 0.009	(0.040) ** 0.012	(0.046) 0.118
AIC	3,434,874	36,223	162,861	201,954	284,927	497,359	341,210
BIC	3,434,938	36,260	162,905	202,004	284,980	497,414	341,261
Number of Observations	303,058	3833	11,186	32,397	46,982	68,226	35,450
Adjusted R <sup>2</sup>	0.0001	0.0019	0.0007	0.0000	0.0001	0.0002	0.0001

We report the coefficients of core variables using OLS for all years and also for the collapsed sample of the interim years. AIC, BIC, R<sup>2</sup>, and the number of observations for respective periods are also mentioned in the following. \*\*\*Significant at the 1% level, \*\*Significant at the 5% level, \*Significant at the 10% level

Literatures	Comparison of empirical findings:				
	Market-to-book ratio or growth opportunities	Tangibility	Profitability	Log of asset or firm size	Inflation
This paper	Positive and insignificant	Positive and significant (5% level)	Negative and significant (1% level)	Positive and significant (1% level)	Negative and insignificant
Frank and Goyal, (2009)	Negative and significant (1% level)	Positive and significant (1% level)	Negative and significant (1% level)	Positive and significant (1% level)	Positive and significant (1% level)
Bevan and Danbolt (2002)	Negative and significant (1% level)	Positive and significant (1% level)	Negative and significant (1% level)	Positive and significant (1% level)	N/A
Bharath et al. (2009)	Negative and significant (1% level)	Positive and significant (1% level)	Negative and insignificant	Positive and significant (1% level)	N/A
Noulas and Genimakis (2011)	Positive and significant (5% level)	Positive and significant (5% level)	Negative and significant (5% level)	Positive and significant (5% level)	N/A
Wald (1999)	Negative and significant (5% level)	Positive and significant (1% level)	Negative and significant (1% level)	Positive and significant (5% level)	N/A
Lemmon et al. (2008)	Negative and significant (1% level) [Using fixed effect]	Positive and significant (1% level) [Using fixed effect]	Negative and significant (1% level) [Using fixed effect]	Positive and significant (1% level) [Using fixed effect]	N/A
Flannery and Rangan (2006)	Negative and significant (5% level)	Positive and significant (1% level)	Negative and significant (1% level)	Positive and significant (1% level)	N/A

In terms of selecting a better model, to demonstrate the precise estimation of baseline covariates, I prefer TLMA to TLBA. Based on BIC and AIC, I show in Table 4 in the bottom section that each specification under TLMA reports lower value (BIC and AIC) than TLBA. Therefore, TLMA based estimation of core variables is more precise and convincing in influencing leverage than TLBA.

## 7. CONCLUSION

The focal point of this paper lies in the fact that I investigate the relationship between market value based leverage and five fundamental factors for U.S. public firms for the year 1950 to 2005. Although I incorporate various variables but I focus on deriving systematic trend of the association between fundamental variables and leverage. Thus my key findings are summarized as follows:

- Firms with more tangible assets are likely to use more leverage
- Growing firms might not always rely on leverage to finance their opportunities
- Profitable firms might use lower leverage which is consistent with the pecking order theory
- Larger firms might use more leverage which is consistent with the static trade-off theory
- During the higher inflationary period firm might use less leverage.

These core variables are also robust across various sub-sample periods in most of the cases. Thus I could expect reliability in my baseline results in terms of deriving a consistent pattern of influence. Although this paper does not intend to test any capital structure theories but unarguably findings related to tangibility, firm size, and profitability confirms cohesion to the static trade-off and pecking order theory.

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## APPENDIX

### Appendix A: Variable Measurement Measures of debt ratio

Total debt/Market value of assets (TLMA) = Book value of debt/Market value of asset.

Market value of asset = Market capitalization + Preferred stock + Current debt + Long-term debt + Liquidation value – Deferred and investment tax credits.

Total debt/Total assets (TLBA) = Total debt/Total assets.

Long-term debt/Market value of assets (LLMA) = Long-term debt/Market value of assets.

Long term debt/assets (LLBA) = Long term debt/Total assets.

Profitability = Earnings from operation before depreciation/Total assets.

Firm size = Log of total assets

Growth opportunities = Market value of assets/Total assets

Change in log of assets

Capital expenditure/Total assets

Asset composition = Tangibility, RND EXP to Sales, SGA EXP to Sales

Tangibility = Net property, plant, and equipment/Total assets

RND EXP to Sales = Research and development expenditure/Sales

SGA EXP to Sales = Selling, general, and administrative expense/Sales

Tax related variables = Depreciation/Total assets, Investment tax credit/Total assets

Periodic Spread = Treasury U.S. bond of 10-year maturity - Treasury U.S. bond of 1-year maturity.

Inflation = Calculated based on historical inflation rate adjusted for consumer price index. <https://www.usinflationcalculator.com/inflation/historical-inflation-rates/>.

Macroeconomic growth = Changes in log of real GDP.