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# The Effect of Leverage on Firm Value and How The Firm Financial Quality Influence on This Effect

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*This paper applied the Generalized Method of Moment (GMM) to estimate the effect of leverage on firm values and contextual variables influencing on this relationship. Using 645 companies listed in Taiwan Securities Exchange (TSE) from 2000-2009. The empirical results show as follows: Firstly, the values of leveraged firm are greater than that of an unleveraged firm if we don't consider bankruptcy probability. Secondly, If we consider the benefit and cost of debt simultaneously, the leverage is significantly positively related to the firm value before reaching firm' optimal capital structure. Thirdly, the positive influence of leverage to the firm value tends to be stronger when the firm financial quality is better (i e., the greater Z-score). This finding can provide the insight into the firm debt finance decision to maximize the firm value.*

**Keywords:** Generalized Method of Moment (GMM), Z-score

## 1. Introduction and Motivation

In corporate finance theory, the debt finance and equity finance are main source of external finance, However , the matter is how them to be composed of to minimize the agency costs and maximize the firm value. In capital structure theories, Besides the M&M(1958) capital structure irrelevance theorem, there exists a fit contingency for debt and equity finance respectively. According to the trade off theory, Modigliani and Miller(1963) find that there is a difference between the value of a leveraged firm and that of an unleveraged firm. This difference is the value of the interest tax shield. The trade off theory suggests that firms would seek more debt as long as the present value of the tax shield is greater than the present value of bankruptcy, agency costs and all other costs associated with higher leverage. Based on the agency cost theory, As debt is sold, the agency costs of debt also increase with leverage, while the proportion of equity , and agency costs of equity decreases. The result is a decrease in the total agency costs. Jesen and Meckling (1976) argue that there is an optimum amount of leverage that would be associated with a minimum amount of total agency costs. Besides, Jesen(1986) pointed out that debt may reduce the agency costs of free cash flow by reducing the amount of cash under management control. The optimal debt-equity ratio is the point at which firm value is maximized, the point where marginal costs of debt just offset the marginal benefits. Grounded on the pecking order theory, Myers and Majluf (1984) argued that the firm prefer the debt finance to the equity finance when using

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external financing. The signaling theory (Ross, 1977; Heinkel,1982; Stien, 1992) states that a firm with favorable prospects will raise new capital through debt financing, while a firm with unfavorable prospects will go through equity financing. Incentive-signaling model developed by Ross(1977), provides a theory for the determination of the financial structure of the firm. The manager of a firm maximizes his incentive return by choosing a financial package that trades off the current value of the signal given to the market against the incentive consequences on that return. According to the management entrenchment theory, proponents of this theory argue that subjective reasons may determine leverage choices made by managers. However, different conclusions are drawn by Agrawal and mandelker (1987), and Mehran (1992) on one hand, and Friend and Lang (1988), and Berger et al.(1997) on the other hand. Based on the market timing theory, Baker and Wurgler (2000) argued that when equity prices are too high, existing shareholders benefit by issuing overvalued equity, and when equity prices are too low, issuing debt is preferable, Besides, Baker and Wurgler (2002) stated that"capital structure evolves as the cumulative outcome of past attempts to time the equity market.".

From above analysis, we can come to the following conclusion about capital structure theory. Firstly, there don't exist the optimal capital structure except the trade-off theory. Secondly, there exists information asymmetry except trade-off theory. Thirdly, there don't maximize the firm value except the trade-off theory. In regarding the optimal capital structure, the trade-off theory emphasize the optimal capital structure, where the marginal benefits of debt equals the marginal costs of debt and firm reach it's maximum value. In regarding information asymmetry, the pecking order theory, the signal theory, the management entrenchment theory and the market timing theory, they all face different level of information asymmetry and incur agency costs respectively. In regarding the maximum firm value, the pecking order theory don't lay stress on it, the market timing theory emphasize the maximum value of the existing shareholder, while, the incentive signaling theory and the management entrenchment theory pay attention to self-interests of managers. Therefore, the trade-off theory is more suitable for the capital structure in general. Besides, the average interest rate level[i] of loan is more lower from 2000-2009 than before in Taiwan, which may lead to the lower WACC and offer an incentive for firm to use debt finance. However, firm with different financial quality may accompany different bankrupt costs when using debt finance, In general, firms with better financial quality may incur lower bankrupt costs than those with worse financial quality. Therefore, we can infer that firms with better financial quality may have the more positive leverage effect on firm values than those with worse financial quality. Nevertheless, as we know, there is no paper to explore this contextual variable influencing the effect of leverage on firm value. This is my motivation to explore this article.

The first objective of this paper is to investigate whether and to what extent the leverage has the effect on the firm value. The empirical results show that the value of a leveraged firm is greater than that of an unleveraged firm if we don't consider bankruptcy probability. If we consider the benefit and cost of debt simultaneously, the leverage is positively related to the firm value before reaching firm' optimal capital structure. The second objective of this paper is to examine the leverage effects on firm value under different firm finance quality (I e., Z-score). The empirical results indicate that the positive influence of leverage to the firm value

tends to be stronger when the firm financial quality is better.

This paper contributes to the extant literature in corporate finance in two respects. Firstly, we are the first to employ Moderated Regression Analysis (MRA) as the empirical model to explore the leverage effects on firm value under different firm contextual variables. Secondly, our paper is first to explore the influence of bankruptcy probability and financial quality to the effect of leverage on firm values.

The rest of the paper is organized as follows. In Section2 we present literature review and develop hypothesis. Section3 we construct research design. In Section4 we display the results and discussion. The last section is devoted to conclusions.

## 2. Literature Review and Developing Hypotheses

### 2.1The Tax Shield Effect

Modern capital structure theory started in 1958, when Modigliani and Miller （1958） (M&M hereafter) first brought out “Capital Structure Irrelevance Theory”, advocated that the firm value and weighted average cost of capital (WACC) is unaffected by the financial structure of the firm. However, M&M’s perfect market assumptions: such as no transaction costs, no taxes, symmetric information and identical borrowing rates, and risk free debt, are contradictory to the operations in the real world. Modigliani and Miller (1963) later modified their original M&M’s model and considered the tax deductibility of interest (tax shields effect). Modigliani and Miller (1963) demonstrate that when corporate tax laws allow the deductibility of interest payments, the market value of a firm is an increasing function of leverage. With corporate income tax rate $\tau_c$, and $\rho$ on an after tax basis, the equilibrium market value of levered firm is given by:

$$V_L = \overline{X}(1-\tau_c)/\rho + \tau_c D_L \quad (1)$$

Where, $\overline{X}$ is the expected EBIT, $\overline{V}_U = \overline{X}(1-\tau_C)/\rho$ is the market value of unleveraged firm, also the value of the firm if all-equity-financed, and $\tau_c D_L$ is the present value of the interest tax-shield, the tax advantage of debt. Given $\overline{X}$, $V_L$ increases with the leverage, because interest is a tax-exempt expense. It means that firm can maximize it’s value by using 100 percent of debt financing, In reality, few such firms exist probably because of the uncertainty of interest tax-savings, and the existence of personal taxes (Miller, 1977) and non-debt tax shields (DeAngelo and Masulis, 1980), which limit this infinite tax advantage to debt. Based on the Miller’s (1977),He incorporate the personal income tax along with the corporation income tax into their second modified model , the gain from leverage, $G_L$, for stockholders in a firm holding real assets can be shown to be given by $G_L = D_L\{1-[(1-\tau_c)(1-\tau_g)/(1-\tau_d)]\}$. Therefore, the market value of a levered firm incorporating the effect of both corporate and personal taxes can be expressed as follows:

$$V_L = V_U + D_L\{1-[(1-\tau_c)(1-\tau_g)/(1-\tau_d)]\} \quad (2)$$

Where, $\tau_g$ and $\tau_d$ are the personal marginal tax rates for capital gain and the personal marginal tax rates for dividends and interests respectively. Important implication of expression (2) is that, the tax gain from leverage is now lower than $\tau_c D_L$, because the higher tax liabilities on interest at the personal level may offset the interest tax-shield benefit from leverage at the corporate level. However, when we further decompose the gain from leverage, $G_L$

$$V_L = V_U + \tau_c D_L, \quad \text{If} \quad \tau_g = \tau_d \tag{3}$$

$$V_L = V_U + D_L\{1-[(1-\tau_c)(1-\tau_g)/(1-\tau_d)]\} > V_U + \tau_c D_L, \quad \text{If} \quad \tau_g > \tau_d \tag{4}$$

From expression (3) and expression (4), We can learn that leverage will have the positive effect on firm values If the personal marginal tax rates for capital gain is equal or greater than the personal marginal tax rates for dividends and interests.

In regarding the value of tax shields (VTS hereafter), Fermandez (2005) defined it as the tax rate times the debt, plus the tax rate times the present value of the net increases of debt, which can be expressed as follows:

$$VTS_0 = T \cdot D_0 + T \cdot PV_0[\triangle D_t] \tag{5}$$

Where, T is the tax rate, D is the debt, $PV_0[\triangle D_{tj}$ is the present value of the net increases of debt.

However, no matter the M&M(1963), the Miller(1977) or the Fermandez(2005), they didn't consider the cost of bankruptcy and the risk of the tax shield in their model. Consequently, there were many researchers proposed different theory which consider the cost of leverage and the risk of the tax shield in their model. Myers(1974) defined the present value of the tax shield as the following expression:.

$$PV(taxshields) = \frac{D_0 + r_g + \tau}{r^U} \times \frac{(1+r^U)}{(1+r^D)} \tag{6}$$

Where, $r^D$ is the interest rate, $\tau$ is the corporate tax rate, $r^u$ is the cost of equity capital for unlevered company, the other researchers' model can be expressed as follows:

$$\text{Miles and Ezzell [1980] model, PV } [E(D\tau r_d ; r^u)] \times (1+r^U)/(1+ r_d) \tag{7}$$

$$\text{Harris and Pringle [1985], Ruback [2002] model, PV } [E(D\tau r_d); r^U] \tag{8}$$

$$\text{Damodaran [1994] model , PV } [E\{D\tau r^U - D\times(r_d - r_f) \times(1-\tau)\}; r^U] \tag{9}$$

$$\text{Fernandez [2004] model , PV}[E(D\tau r^U); r^U] \tag{10}$$

Where, $r_f$ is the free risk rate. $r^d$ is the interest rate, $\tau$ is the corporate tax rate, $r^u$ is the cost of equity capital for unlevered company

According above model analysis, we can confirm that no matter whether the model consider the cost and risk of the leverage or not, the present value of the tax shields is always positive, Based on this argument I predicted that: **H1**: The values of a leveraged firm are greater than that of the unleveraged firm.

## 2.2 Trade-Off Theory

### 2.2.1 Bankruptcy Cost

Although Modigliani and Miller (1963) demonstrate that when corporate tax laws allow the deductibility of interest payments, the market value of a firm is an increasing function of leverage. However, M&M's perfect market assumptions( such as no bankruptcy cost etc.) is impracticable in the real world, As firms use more debts in their capital structure, It is more likely to have financial distress. Which is referred by Warner(1977) as to the situation that a firm is unable to liquidate debt or suffering from deteriorating financial conditions and defined by Wruck(1990) as a situation where a firm's operating cash-flows are not sufficient to satisfy current obligations, and the firm is forced to take corrective actions.

There are many previous studies in relationship between the leverage level, bankruptcy costs, and the optimal capital structure. Stiglitz(1972) and Kim(1978) examined the relationship the bankruptcy costs and the capital structure, they stated that when marginal tax shield advantages equals marginal bankruptcy costs, firm value reaches its maximum, at which point exists an optimal capital structure. Warner(1977) and Altman(1984) explored the bankruptcy costs and financing decision, they proposed that direct and indirect bankruptcy costs are incurred when debt financing is used, therefore, Bankruptcy costs may be one of the constraints affecting the amount of financing decision. Furthermore, Branch(2002) examined 91 bankruptcy firms and finds out holders of interests in a bankruptcy firm might, on average, recover only about 56% of the firm's pre-distress value(PDV). Warner(1977) and Kim(1978) explored the leverage level and bankruptcy probabilities. They found that when increase the level of debt usage, the probability that a financial distress occurs is also expected to increase. In other words, their bankruptcy probabilities are certainly higher. Haugen and Lemma(1988) incorporated bankruptcy and liquidation decisions into their model, they discovered that their model can better explain financial problems if bankruptcy and liquidation decision are considered at the same time, they suggested that inclusion of more parameters into the model can help explain complicated financial issues.

Based on the analysis mentioned above, We can recognize that bankruptcy costs reduce not only firm but creditor value. Thus, a firm's debt value has a negative relationship with its bankruptcy probability. Firms with a higher bankruptcy probability will be demanded to pay higher interest on debt and comply with more constrains in debt covenants. The demands may further increase the firm's bankruptcy probability and bankruptcy costs. Thus, These relationship can be expressed as suggested by Leland(1994) as following equation:

$$P_B = \left( \frac{V}{V_B} \right)^{-\left(\frac{2r}{\sigma^2}\right)} \tag{11}$$

Where, $P_B$ is bankruptcy probability, $V$ is the value of the unlevered firm, $V_B$ is the value of a levered firm upon bankruptcy and also the bankruptcy threshold, $r$ is the riskless interest rate, $\sigma^2$ is the variance of firm assets. The bankruptcy probability is negative relationship with firm value and riskless interest rate, and positive relationship with bankruptcy threshold and variance of firm assets.

$$BC(V) = bD_L = \alpha V_B \times P_B \tag{12}$$

Where, $BC(V)$ is the bankruptcy cost of the firm. $\alpha$ , the cost of liquidation, is in a proportion of $V_B$. The bankruptcy costs is positive relationship with $\alpha$ , $V_B$ and $P_B$.

From above analysis, we can confirm that the bankruptcy probability is positively related to the bankruptcy costs, and the bankruptcy costs are negatively related to firm values. Thus, we can predict that: **H2** : The positive influence of leverage to firm value tends to be stronger when bankruptcy probability is lower.

In this study, We will use Altman's Z-Score[ii] (Altman, 1968, 1984) as proxy for the bankruptcy probability.. Altman (1993) demonstrated that his model is quite accurate in predicting bankruptcy. In addition, Begley et al (1996) showed that the Altman model still retained their predictive abilities for COMPUSTAT firm in the 1980s. If we further consider the bankruptcy costs and incorporate it into equation (2), then it become the following expression:

$$V_L = \overline{X}(1-\tau_C)/\rho + \lambda D_L - bD_L \tag{13}$$

$$V_L = V_U + \lambda D_L - bD_L \tag{14}$$

Where, $\lambda = \{1-[(1-\tau_c)(1-\tau_g)/(1-\tau_d)]\}$, and *b* is the present value of the bankruptcy cost per dollar of debt. Based on Stiglitz(1972) and Kim(1978)argument, The optimal capital structure will occur by maximizing the firm value at the point where the present value of the marginal tax shield (benefit) on interest payments equals the present value of the marginal expected bankruptcy costs of debt e.g., the following condition holds:

$$\partial V_L / \partial D_L = \partial(\lambda D_L)/\partial D_L - \partial(bD_L)/\partial D_L = 0 \tag{15}$$

Or $$\partial(\lambda D_L)/\partial D_L = \partial(bD_L)/\partial D_L \tag{16}$$

In this trade-off model, the optimal capital structure for a firm can be obtained without resorting to Miller's personal taxes, in which a higher tax advantage of debt, $\tau_c D_L$ is traded-off against the present value of bankruptcy cost of debt, $bD_L$.

### 2.2.2 Agency Cost

Jensen and Meckling (1976) used the agency relationship and agency costs to explain the existence of optimal capital structure at the firm level. They argue that separation of firm's control (management) from its ownership may create conflicts of interest between agents and costs to the firm, defined as *agency costs of equity*, since managers may be engaged in value non-maximizing activities and/or transferring firm resources for personal benefits. In a related paper, Parrino and Weisbach (1999) empirically estimate that the agency costs of debt are too small to offset the tax benefits. However, Debt not only can mitigates the manager-shareholder conflict, but also can reduce the agency costs of equity by means of the following methods, Firstly, It can reduce the agency costs of equity by raising the manager's share of ownership in the firm, Secondly, It can achieve the same goal by reducing the amount of 'free' cash available to managers to engage in the pursuits (Jensen, 1986) since debt commits the firm to pay out cash.

But, Debt can create "asset substitution effect", Which is described as" The equity holder let management invest the more risk projects than debt holders anticipated without their agreement. If this high risk projects are done well, the debt holders may only gain regular returns, Hence, All the other extra benefits are distributed to equity holders. On the contrary, If this projects are break down, the debt holders must share the losses jointly with the equity holders. With a view to protecting themselves, debt holders must monitor the firm (imposing monitoring costs) and impose covenants (covenant costs).(Jensen &Meckling,1976 ; Long &Malitz, 1985 ; Barnea, Haugen and Senbet 1985 ; Skinner, 1993). Besides, Debt can cause "under-investment problems" as well, Which is described as" After the debt holders lend funds to the firm, If management find out that all the benefits derived from investment projects will be distributed to debt holders only, they will give up all the investment projects profitable to the firm.(Myers, 1997 ; Barnea et al.1985 ; Titman &Wessels,1988 ;Skinner,1993). Both of mentioned above can be described as agency costs of debt , Which may be resulted in reducing the value of his firm.

Due to the agency costs attached to both debt and equity, an optimal capital structure is obtained in the agency approach by trading-off the agency costs of equity (the benefit of debt) against the agency costs of debt and by minimizing the total agency costs involved in issuing debt and equity. If a dollar of debt reduces the present value of the agency costs of equity by $c_e$ and increases the present value of the agency costs incurred by $c_d$ (which is assumed to be generally lower than $c_e$), the total benefit of debt used by the firm, $D_L$, would be $(c_e - c_d)\, D_L$..

If we further consider the agency costs and incorporate it into equation (13), After rearranging it, it become the following expression:

$$V_L = \overline{X}(1-\tau_C)/\rho + (\lambda - b)D_L + (C_e - C_d)D_L \qquad (17)$$

or

$$V_L = \overline{X}(1-\tau_C)/\rho + (\lambda + C_e)D_L - (b + C_d)D_L \qquad (18)$$

In equilibrium, $(\lambda + c_e) = (b + c_d)$, and an optimal capital structure for individual firms is obtained at the margin.

In this study, the reason why we use the free cash flow as the proxy of agency costs as follows: Firstly, Jensen (1986) asserted that firm need motivate managers to use the free cash flow efficiently. Secondly, Yang (2009) argued that the free cash flow and overinvestment are main two agency problem, who found they have significantly positive impact on the cost of capital. Thirdly, Richardson (2006) found that overinvestment usually occurs in firms with high free cash flows.

### 2.3The Relationship between Firm Values and Leverage is Non-Monotonic

According to the trade-off theory, there exists an optimal capital structure, despite leverage-related costs may trade off some advantages of debt financing , when the advantages of debt financing ( such as interests tax shields , reducing agency cost of equity) are greater than the various leverage-related costs ( such as debt-issuing costs, bankruptcy costs, agency costs of debt and loss of non-debt tax shields), One can always increase firm values by increasing leverage until the marginal gain from leverage equal to the marginal expected loss from the bankruptcy costs. As the marginal tax shield effect equals the marginal bankruptcy costs, the firm's value reaches its maximum level. Later, with the continuous use of debt financing, the firm's value declines gradually due to leverage-related costs are greater than advantages from leverage. From the analysis mentioned above, firm values varies with different level of debt usages. Firm values increase with increase of debt until the marginal benefits from leverage equal to the marginal bankruptcy costs, at this point, the firm's value reaches its maximum level, if we further increase the level of debt usages, firm values not only does not increase ,but also decrease. The variation and relationship between the advantages of debt financing, the leverage-related costs and firm values can be displayed by following expressions:

Let $(\frac{D}{TA})_i$, $(\frac{D}{TA})_{op}$, $V_L$, $[(\lambda + C_e)D_L]$, $[(b + C_d)D_L]$, be denoted as the random debt to total assets ratio, the optimal capital structure, the firm values, the advantages of debt financing and the leverage-related costs respectively,

As $[(\lambda + C_e)D_L] > [(b + C_d)D_L]$, $V_L$ increase with $(\frac{D}{TA})_i$ increase, only if only

$$(\frac{D}{TA})_i < (\frac{D}{TA})_{op} \tag{19}$$

As $[(\lambda + C_e)D_L] < [(b + C_d)D_L]$, $V_L$ decrease with $(\frac{D}{TA})_i$ increase, only if only

$$(\frac{D}{TA})_i > (\frac{D}{TA})_{op} \tag{20}$$

As $[(\lambda + C_e)D_L] = [(b + C_d)D_L]$, $V_L$ reach its maximum level, , only if only

$$(\frac{D}{TA})_i = (\frac{D}{TA})_{op} \tag{21}$$

The variation of firm values with increasing the level of debt usages is presented in increasing until reaching its maximum level, and declining gradually. In other word, the relationship between firm values and leverage level is displayed in a inversed U-shape, i.e., it is non-monotonic.

Based on the modified M&M theory, the firm value is an increasing function of financial leverage due to the tax shield effect. However, in Miller model, Given that $(1-\tau_c)(1-\tau_{pe}) < (1-\tau_{pd})$, The effect of debt tax shield is not fully offset by individual income tax, and decisions on capital structure are likely to affect firm value. Specifically, If we add the Trade-off theory to equation (8) to analyze the relationship between firm value and leverage level, the model become following equation:

$$V_L = \overline{X}(1-\tau_C)/\rho + \Psi D_L \tag{22}$$

Where, $\Psi = (\lambda + c_e) - (b + c_d)$, which includes both the tax and non-tax effect of debt, Moreover, the total benefit of debt are the sum of the tax shield effect and the reducing agency cost of equity through leverage, similarly, the total costs of debt equals the bankruptcy costs and the increasing agency costs of debt through leverage. When the debt to total assets ratio is smaller(greater) than the optimal capital structure, the total benefits of debt are greater(smaller) than the total costs of debt, As the debt to total assets ratio equals the optimal capital structure, firm value reach its maximum level. The variation and relationship between the debt to total assets ratio, the optimal capital structure and firm values can be displayed by following expressions:

Let $(\frac{D}{TA})_i$, $(\frac{D}{TA})_{op}$, $V_L$, be denoted as a random debt level to total assets ratio, the optimal capital structure and firm values respectively,

As $(\frac{D}{TA})_i < (\frac{D}{TA})_{op}$, $V_L$ increase with $(\frac{D}{TA})_i$ increase, only if only

$$[(\lambda + C_e)D_L] > [(b + C_d)D_L] \tag{23}$$

As $(\frac{D}{TA})_i > (\frac{D}{TA})_{op}$, $V_L$ decrease with $(\frac{D}{TA})_i$ increase, only if only

$$[(\lambda + C_e)D_L] < [(b + C_d)D_L] \tag{24}$$

As $(\frac{D}{TA})_i = (\frac{D}{TA})_{op}$, $V_L$ reach its maximum level , only if only

$$[(\lambda + C_e)D_L] = [(b + C_d)D_L] \tag{25}$$

Therefore, we can infer that the maximizing-value firm will not use its debt to equity ratio in excess of the optimal capital structure, In this situation, firm value can also increase with increasing the level of debt usages. Based on above analysis we can predict that: **H3:** Leverage positively influence firm value before reaching the firm's optimal capital structure.

### 2.4 Firm Quality

Firm quality are composed of the following ratios, Working Capital to Total Assets(WC/TA), Retained earnings to Total Assets(RE/TA), Earnings Before Interest and Taxes to Total Assets(EBIT/TA), Market Value of Equity to Book Value of Total Liabilities(MVE/TL) and Sales to Total Assets(S/TA) respectively. WC/TA ratio is a measure of the net liquid assets of the firm relative to the total capitalization. It may

reflect the characteristics of liquidity of assets and size of firm, the larger the working capital, the lower the risk of insolvency. RE/TA ratio is a measure of the cumulative profitability over time, the age of a firm is implicitly considered in this ratio. For example, a relatively young firm will probably show a low RE/TA ratio because it has not had enough time to build up its cumulative profits. Therefore, it may argued that young firm more probably being classified as bankrupt than that of another older firm. In addition, the RE/TA ratio may measure the leverage of a firm. Those firms with high RE relative to TA, have financed their assets through retention of profit and have not utilized as much debt. The EBIT/TA ratio is a measure of the true productivity of the firm's assets, independent of any tax or leverage factors. Since a firm's ultimate existence is based on the earnings power of its assets. Furthermore, insolvency in a bankrupt sense occurs when the total liabilities exceed a fair valuation of the firm's assets with value determined by the earning power of the assets. It may also be viewed as the indicator of earnings gained from the total funds through debts and equities financing, the larger this ratio, the more effect on assets turnover and operation management. The MVE/TL ratio measure shows how much the firm's assets can decline in value (measured by market value of equity plus debt) before the liability exceed the assets and the firm becomes insolvent. This ratio may show the relative relationship between funds financing from debt holders and equity holders, the level of stability of fundamental finance structure and the level of protection to funds financing from debt holder by funds financing from equity holder respectively. It also appears to be a more effective predictor of bankruptcy than a similar, more commonly used ratio; net worth/total debt ( book values). the S/TA ratio is a standard financial ratio illustrating the sales generating ability of the firm' assets. It is one measure of management's capacity in dealing with competitive conditions. the larger this ratio, the more the effect on assets turnover.

Altman's Z-Score ( Altman, 1984) is used as a proxy for measuring firm quality. The higher the score, the lower the probability of bankruptcy, and thus the higher the firm's quality. the higher firm's quality may improve firm' credit rationing by debt holders and equity holders. the better the firm' credit rationing, the lower required rate of return by debt holders and equity holders. which resulted in reducing the costs of capital and increasing firm's value. Based on this argument we can predict that :**H4**: the positive influence of leverage to firm value tends to be stronger when firm financial quality is better

**Table 1: The definition of independent variables and expected sign with hypothesis**

| Variables | Definition | To test the capital structure theory | Hypothesis | Expected sign |
|---|---|---|---|---|
| $D_L$ | Which denotes the leverage, we measure it as the ratio of total liabilities to the net fixed assets | Modified M&M theory(The tax shield effect) | The values of a leveraged firm are greater than that of the unleveraged firm.(H1) | Positive |
| Z-score for bankruptcy probability | Which is used as the proxy of the bankruptcy probability of leveraged firm , it proposed by Altman (1968, 1984) | The static trade-off theory ( bankruptcy cost) | The Z-score is positively related to the values of leveraged firm (H2) | Positive |
| FCFPS | Which denotes the free cash flow of per share, we measure it as the ratio of free cash flow to every year weighted average common stock outstanding, it is used as the proxy of agency costs of leveraged firm | The dynamic trade-off theory (agency costs) | The FCFPS is negatively related to the values of leveraged firm | Negative |
| Z-score for financial quality | Which is used as the proxy of firm financial quality of leveraged firm, it proposed by Altman (1968, 1984) | The theory proposed by this paper | The positive influence of leverage to firm value tends to be stronger when firm financial quality is better (H4) | Positive |
| $D_LZ$ | Equals the product of $D_L$ and Z-score, Which is used to measure the interaction of $D_L$ and Z-score. The theory proposed by this paper | | The positive influence of leverage to firm value tends to be stronger when firm financial quality is better(H4) | Positive |

**Table 1: The definition of independent variables and expected sign with hypothesis(Continued)**

| | | | | |
|---|---|---|---|---|
| $D_L F$ | Equals the product of $D_L$ and FCFPS, Which is used to measure the interaction of $D_L$ and FCFPS. | The theory proposed by this paper | The positive influence of leverage on firm value tends to be weaker when free cash flow of per share (FCFPS) is larger | Negative |
| $D_L ZF$ | Equals the product of $D_L$, Z-score and FCFPS, Which is used to measure the interaction of $D_L$, Z-score and FCFPS. | The theory proposed by this paper | Leverage positively influence on firm value before reaching the firm's optimal capital structure (H3).<br><br>The positive influence of leverage to firm value tends to be stronger when firm financial quality(Z-score) is better and free cash flow of per share (FCFPS) is larger | Positive |

# 3. Research Design

## 3.1Sample

The sample in this study consisted of 645 companies listed in Taiwan Securities Exchange (TSE) that provide annual report from 2000-2009 consecutively. The data were collected from audited annual reports that were published at TSE that can be found at Taiwan Economic Journal (TEJ). For the purpose of accurate analysis, we trimmed the sample through the following ways, firstly, we deleted all the firms that did not have a complete and since some variables are scaled by total fixed assets period , secondly , we must delete a few of observations that included negative values for one of those variables. Owing to some variables are scaled by total fixed assets. Thirdly, we dropped the sample firms with exceeding 90% in leverage ratio in order to overcome the presence of outlier, As a result, we deleted 2529 observations from 6450 observations, and the remainder is 3921 observations in this study.

## 3.2 The Statistical Model

In this study, we use pane data to estimate the estimator and test the above hypothesis using pooled cross-section and time-series data. However, which statistical model is fit for this research. We use the following criterion to decide which statistical model to be employed. Firstly, if the expected values of the residuals are not equal zero, the OLS is improper. Secondly, in the pane data model, no matter it contains the time-invariant variable or not, OLS is also not fit for this case, in this situation, Generalized Least square(GLS) is more proper than OLS. Thirdly, if it

involves the endogeneity bias when the hypothesis, in this case, Generalized method of moment(GMM) is more proper for testing than OLS and GLS. Therefore, we decide to employ the GMM model to estimate the estimator and test the above hypothesis eventually.

Before regression, we examine whether the observations exist the autocorrelation and homoskedasticity, According to Li\jung-Box Q-statistic and $Q^2$ statistic, it indicates that it don't exist autocorrelation and homoskedasticity significantly.

### 3.3 Empirical Model

The data were analyzed by moderating regression analysis model. The measurement for variables are displayed in section 3.4, The empirical models were as follow:

#### 3.3.1 Model to Describe the Effect of Leverage on Firm Values (H1)

This model is used to test the tax shield effect on firm values when use debt financing

$$V_L = \alpha_1 + \alpha_2 \theta_{it} + \alpha_3 D_{L\,it} + \varepsilon \text{.....} \text{.....} \text{.....} \text{.....} \text{.....} \text{.....} \text{.....} \text{..} (26)$$

#### 3.3.2 Model to Describe the Effect of Leverage on Firm Value Moderated by Bankruptcy Probability (H2)

This model is used to test the effect of bankruptcy costs on firm values when use different level of debt financing, in this model, we use Z-score as the proxy of bankruptcy probability

$$V_{L11} = \alpha_1 + \alpha_2 D_{L\,it} + \alpha_3 Zscore_{it} + \alpha_4 D_L Z_{it} + \alpha_5 EPS_{it} + \varepsilon \text{.....} \text{.....} \text{.....} \text{.....} \text{..} (27)$$

#### 3.3.3 Model to Describe the Effect of Leverage Level on Firm Value Moderated by Bankruptcy Probability and the Free Cash Flow of Per Share (H3)

This model is used to test the effect of bankruptcy costs and agency costs on firm values when use different level of debt financing, In this model, we use Z-score and the free cash flow of per share as the proxy of bankruptcy probability and agency costs respectively.

$$V_{L21} = \alpha_1 + \alpha_2 D_{L\,it} + \alpha_3 Zscore + \alpha_4 FCFPS + \alpha_5 D_L Z + \alpha_6 D_L F + \alpha_7 D_L ZF$$
$$+ \alpha_8 EPS_{it} + \varepsilon \text{.....} \text{.....} \text{.....} \text{.....} \text{.....} \text{.....} \text{.....} \text{.....} \text{.....} \text{.....} (28)$$

#### 3.3.4 Model to Describe the Effect of Leverage on Firm Value Moderated By Firm Quality (H4)

This model is used to test the effect of firm financial quality on firm values when use different level of debt financing, In this model, we use Z-score as the proxy of the firm financial quality.

$$V_{L31} = \alpha_1 + \alpha_2\theta_L + \alpha_3 D_{Lit} + \alpha_4 Zscore_{it} + \alpha_5 D_L Z_{it} + \alpha_6 EPS_{it} + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots (29)$$

### 3.4 Variables and Measurement

#### 3.4.1 Dependent Variable

$V_L$=(V/FA), V denotes the value of a firm, which equals the market value of equity and the sum of the book value of long-term debt and total short-term or current liabilities. FA denotes the net fixed assets.

#### 3.4.2 Independent Variable

$D_L$ = (D/FA),D denotes the total liabilities of a firm, which equals the book value of long-term debt and total short-term or current liabilities. FA denotes the net fixed assets.

#### 3.4.3 Control Variables

(1)$\theta_L$=(($X^T$-τR/FA)),$X^T$[=X(1-τ)+τR] is the expected earnings after taxes and before interest, X is earnings before interest and taxes, τis the corporate tax rate, R is the total interest on outstanding debt. FA is the net fixed assets.
(2)EPS=(NI/$P_C$), EPS is the earnings per share, NI is net income, $P_C$ is the closing price at the end of every year during sample period.

#### 3.4.4 Moderated Variables

(1)Z-score, Z-score Model (Altman,1968) were composed of the following discriminant function:

Z=0.012X1-0.014X2+0.033X3+0.006X4+0.999X5, Where X1=Working capital/Total Assets), X2=(Retained Earnings/Total Assets), X3=(EBIT/Total Assets), X4=(market Value of Equity /Book value of Total Liabilities), X5=(Sales /Total Assets).

(2)FCFPS=(FCF/SH), FCFPS is the free cash flow per share, FCF is the free cash flow , SH is the every year weighted-average common shares outstanding during sample period , we use it as the proxy of agency costs of the sample firm in this study.

(3)$D_L$F, equals the product of $D_L$ and FCFPS, Which is used to measure the interaction of $D_L$ and FFPS.

(4)$D_L$Z, equals the product of $D_L$ and Z-score, Which is used to measure the interaction of $D_L$ and Z-score.

(5)$D_L$ZF, equals the product of $D_L$, Z-score and FCFPS, Which is used to measure the interaction of $D_L$, Z-score and FCFPS.

# 4. Results and Discussion

## 4.1Descriptive Statistics

**Table 2: The statistics of independent variables**

| Statistic / Variable | Average | Maximum | Minimum | STD |
|---|---|---|---|---|
| $\theta_L$ | 1.00 | 39.51 | 0.01 | 2.64 |
| $D_L$ | 0.32 | 0.84 | 0.02 | 0.15 |
| Z-score | 3.01 | 22.01 | 0.41 | 1.21 |
| FCFPS | 4.97 | 71.49 | 0.00 | 5.37 |
| EPS | 3.62 | 57.85 | 0.01 | 3.82 |

Note;1. The values of the table are computed by our research based on TEJ data
2. The measurements for variable : see section 3.4

Table 2.display the following information, the ratio of EATBI to fixed assets($\theta_L$ ) is one in average, it indicates that all firms may earn one time to fixed assets in average, but the variation range of$\theta_L$ is greater for the whole industry. The ratio of total liabilities to fixed assets ( $D_L$ ) is 32% in average, it displays that all firm hold the 32 percent liabilities to fixed assets in average, however, this ratio of total liabilities to fixed assets is somewhat low in general, moreover, the variation scope of $D_L$ is lower for the whole industry., The Z-score is 3.01 in average, it indicates that all firm have the better financial quality and the zero bankruptcy probability when using debt finance. The FCFPS is 4.97 in average, it indicates that all firms have the higher free cash flow for per share, however, the variation range of FCFPS is on the high side. The EPS is 3.62 in average. It shows that all firms earns 3.62 NT. dollar per
share.

**Table 3: Pearson correlation matrix**

| | $V_L$ | $\theta_L$ | $D_L$ | Z-score | FCFPS | EPS |
|---|---|---|---|---|---|---|
| $V_L$ | 1 | .828** | .034* | .140** | .120** | .272** |
| | | .000 | .046 | .000 | .000 | .000 |
| $\theta_L$ | .828** | 1 | -.004 | .179** | .154** | .356** |
| | .000 | | .416 | .000 | .000 | .000 |
| $D_L$ | .034* | -.004 | 1 | -.552** | .070** | .010 |
| | .046 | .416 | | .000 | .000 | .308 |
| Z-score | .140** | .179** | -.552** | 1 | .039* | .169** |
| | .000 | .000 | .000 | | .025 | .000 |
| FCFPS | .120** | .154** | .070** | .039* | 1 | .700** |
| | .000 | .000 | .000 | .025 | | .000 |
| EPS | .272** | .356** | .010 | .169** | .700** | 1 |
| | .000 | .000 | .308 | .000 | .000 | |

**, At the 1% significant level( one tail) , Significant correlated。
*. At the 5% significant level( one tail) , Significant correlated。

Table 3 indicates clearly that all independent variables are significantly positively related to dependent variable. Regarding the relationship between the independent variable, $\theta_L$ is significantly positively related to Z-score, FCFPS and EPS, but insignificantly negatively related to $D_L$ , $D_L$ is significantly negatively related to Z-score, but significantly positively related to FCFPS and insignificantly positively related to EPS. Z-score is significantly positively related to FCFPS and EPS. FCFPS is significantly positively related to EPS.

### 4.2 The Effect of Leverage on Firm Values (H1)

**Table 4: The results of $V_L$ regression on $\theta_L$ and $D_L$**
**Dependent variable: $V_L$**

| | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| Cons | 0.969859 | 1.415587 | 0.685128 | 0.4933 |
| $\theta_L$ | 10.95518 | 1.521629 | 7.1996*** | 0.0000 |
| $D_L$ | 8.620825 | 3.962100 | 2.1758** | 0.0297 |

| | | | |
|---|---|---|---|
| R-squared | 0.685477 | Mean dependent var | 14.79702 |
| Adjusted R-squared | 0.685226 | S.D. dependent var | 36.03789 |
| S.E. of regression | 20.21895 | Sum squared resid | 1024468. |
| Durbin-Watson stat | 1.777935 | J-statistic | 0.000155 |

*** , ** ,* denoted at 1%, 5% and 10% significant level respectively

The regression coefficient for the tax adjusted income/earnings variable is 10.955, which is equal to the verse of the cost of capital or marginal capitalization factor, $1/\rho$, to an all equity firm. Therefore, the estimated expected cost of equity capital of the sampled firms, $\rho$, is approximately 0.091.

Table 4 clearly shows that coefficient is positive and significant for the leverage variable at 1% significant level, According to M&M theory (1963), if bankruptcy costs are not considered, tax shield benefit (TB) is generated during debt financing. Which indicates that values of a leveraged firm are greater than that of a unleveraged firm, the results are consistent with M&M (1963), Myers (1974), Miller (1977), Miles and Ezzell (1980), Harris and Pringle (1985), Damodaran (1994), Ruback (2002), Fernandez [2004] and supporting the H1 we proposed.

### 4.3 The Effect of Leverage on Firm Values Moderated by the Bankruptcy Probability (H2) or Firm Financial Quality (H4)

**Table 5: The results of $V_L$ regression on $D_L$, Z-score and their product**
**Dependent variable: $V_L$**

| | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| Cons | -16.18890 | 9.266902 | -1.7469* | 0.0808 |
| $D_L$ | 25.11336 | 20.30163 | 1.2370 | 0.2162 |
| Z-score | 4.974813 | 2.785111 | 1.78621* | 0.0742 |
| $D_LZ$ | 3.360246 | 7.068967 | 0.47535 | 0.6346 |
| EPS | 1.360800 | 0.610679 | 2.2283** | 0.0259 |

| | | | |
|---|---|---|---|
| R-squared | 0.084507 | Mean dependent var | 14.79702 |
| Adjusted R-squared | 0.083044 | S.D. dependent var | 36.03789 |
| S.E. of regression | 34.50909 | Sum squared resid | 2981957. |
| Durbin-Watson stat | 0.856598 | J-statistic | 6.05E-29 |

*** , ** ,* denoted at 1%, 5% and 10% significant level respectively

Table 5 clearly shows that coefficients are positive and significant for the $D_L$ and Z-score variable at 10% significant level, According to Altman (1968,1993), the better the firm financial quality, the lower bankruptcy probability. Based on Leland (1994,1998) model, the bankruptcy probability is a negative relationship with firm values. Thus, the firm value is an increasing function with the firm financial quality, but is a decreasing function with the bankruptcy probability through debt financing. The results are in harmony with Altman (1968,1993) and Leland (1994,1998) and supporting H2 we put forward. Besides, the interaction coefficient of $D_L$ and Z-score is positive but statistically insignificant, which indicates that the positive influence of leverage to firm value tends to be stronger when firm financial quality is better. The results are in line with Altman (1968,1993), Begley et al (1996),Leland(1994,1998), and supporting the H4 we proposed.

### 4.4 The Effect of the Leverage on firm Values Moderated by Bankruptcy Probability and the Free Cash Flow of Per Share (H3)

**Table 6: The results of $V_L$ regression on $D_L$, Z-score, FCFPS and their interaction Dependent variable: $V_L$**

| | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| Cons | 8.286323 | 8.894666 | 0.931606 | 0.3516 |
| $D_L$ | -20.07044 | 23.13641 | -0.867483 | 0.3858 |
| Z-score | -1.139631 | 2.234618 | -0.509989 | 0.6101 |
| FCFPS | -2.065147 | 0.831381 | -2.48400** | 0.0131 |
| $D_L$Z | 18.72885 | 6.862334 | 2.72923*** | 0.0064 |
| $D_L$F | 4.358719 | 2.098734 | 2.076832* | 0.0379 |
| $D_L$ZF, | -0.167442 | 0.682364 | -0.245385 | 0.8062 |

| | | | |
|---|---|---|---|
| R-squared | -0.067881 | Mean dependent var | 14.79702 |
| Adjusted R-squared | -0.070442 | S.D. dependent var | 36.03789 |
| S.E. of regression | 37.28558 | Sum squared resid | 3478316. |
| Durbin-Watson stat | 0.782723 | J-statistic | 0.005940 |

*** , ** ,* denoted at 1%, 5% and 10% significant level respectively

Table 6 clearly exhibits that the coefficients are negative and significant for FCFPS variable at 5% significant level, while the coefficient of interaction of Z-score and $D_L$, and the coefficient of interaction of FCFPS and $D_L$ are positively related to firm value at 1% and 10% significant level respectively. which indicates that the free cash flow is negatively related to firm value. however, the positive effect of leverage on firm value tend to be stronger when the free cash flow are higher. It implies that the agency problem of the free cash flow can be solved through debt financing. Moreover, the positive effects of leverage on firm value also tend to be stronger when bankruptcy probability is lower. According to the trade-off theory, there exists an optimal capital structure, If firms consider the total benefits and the total costs of debt simultaneously when debt financing, they will use debt financing until the debt to equity ratio equals the optimal capital structure. We can infer that the maximizing-value firm will not use its debt to equity ratio in excess of the optimal capital structure, which indicates that firm value can also increase with the level of debt usages. The results are in harmony with trade-off theory, Stiglitz(1972), Kim(1978) and supporting H3 we proposed.

## 5. Conclusion

In capital structure theories, only the trade-off theory maximizes the firm value and don't face the information asymmetry, this is why we explore the effect of leverage on firm values , Moreover, with a view to understanding which factors affect this effect, we further add the contextual variables to our regression model to explore their influence on this effect.

In static trade-off theory, no matter what the M&M(1963) model or Miller(1973) model, if we don't consider bankruptcy costs, there exist the tax shield effect only if the present value of the tax shields is positive during debt financing. The results support the M&M(1963), Miller(1977), Myers (1974), Miles and Ezzell (1980), Harris and Pringle (1985), Damodaran (1994), Ruback (2002), Fernandez(2004) and **H1** we proposed. If we further consider bankruptcy costs, It wouldn't change the empirical result only the estimated coefficient of leverage becomes smaller, which indicates that bankruptcy costs influence the effect of leverage on firm values substantially, and support **H2** we put forward.

In dynamic trade-off theory, if we consider the bankruptcy costs and the agency costs simultaneously before the firm reaches it's optimal capital structure during debt financing, the results show that leverage is positively related to the firm values, which support Stiglitz(1972), Kim(1978) and **H3** we proposed.

In the analysis of the contextual variables which influence the effect of leverage on firm values. In regarding individual variable analysis, the results show that he positive influence of leverage to firm value tends to be stronger when firm financial quality is better, which support **H4** we proposed.

Specifically, based on the average ratio of total liabilities to fixed assets (32%), we conclude that the sample firm in Taiwan in research period have not make the most use of debt finance to create the maximum-value, Firstly, the estimated expected cost of equity capital (9.1%) is greater than the average interest rate level (3.88%), Secondly, the tax shield effect is 8.62, it imply that firm value may increase 8.62 NT. Dollars with 1 NT. Dollars debt , Thirdly, the average Z-score is 3.1, it imply that the firm has better financial quality and near zero bankruptcy probability when increase debt finance. As a result, firms can capture the better credit rating and borrow the loans at the lower interest rate from banks. Fourthly, the average free cash flow of per share is 4.97, it imply that firms have sufficient free cash enough to commit to interest payment, which may overcome the agency costs with a superabundance of free cash flow to manager.

### 5.1 Major Findings and Implication

Through the analysis of the interaction effect of contextual variables and leverage, we can find the following results: Firstly, the positive influence of leverage to firm value tends to be stronger when the firm quality is better, which support H4. Secondly, although the free cash flow of per share is negatively related to the firm values, however, if we increase the leverage with the free cash flow of per share, the positive influence of leverage to firm value don't change, which indicates that the positive influence of leverage to firm values tends to be stronger when the free cash flow of per share is higher, which support H2.

In the implication for management, we can come to the following conclusion: Firstly, why the better firm quality can intensify the positive influence of leverage to firm value, the reason may be generalized in two respective, the better firm quality, the less bankruptcy probability and bankruptcy costs on the one hand, the better firm quality can capture the better credit rating and borrow the loans at the lower interest rate from banks on the other hand, which resulted in lowering the capital costs and

increasing firm value. Secondly, why the free cash flow can strengthen the positive influence of leverage to firm value, the reason may be summed up in two aspects, debt can alleviate the agency problem of free cash flow through committing to the interest payment. Besides, in order to avoid of overinvesting due to the excessive free cash flow, the firm can design the attractive executive compensation to motivate the manager to use the free cash flow efficiently.

From the above analysis, we can also come to the following conclusion: If firm decide to finance through debt financing to meet the funds necessary to future growth opportunity, they must consider all the contextual variable which influence the effect of leverage to the firm vale.

### 5.2 Limitation and Future Study

As we know, the average interest rate level varied violently from 1991 to 2009, in other word, drop from 8.74% in 1991-2000 to 3.88% in sample period. However, Taiwan Stock Exchange Capitalization Weighted Stock Index varied slightly at the same time, to say explicitly, rise from 6076 in 1991-2000 to 6412 in sample period. Under this circumstance, the debt financing is more incentive for firm than equity financing. However, we have not explore the settings where contrary to that, Besides, we explore the contextual variable influencing the effect of leverage to the firm vale just only on the whole industries.

In order to explore the inverse relationship, we plan to explore the settings where the equity financing is more favorable for firm than the debt financing. Moreover, we plan to examine this relationship and effect on the individual industry.

## Endnotes

[i] The average interest rate of loan is 8.74% from 1991-2000 and 3.88% from 2001-2009. Data from the statistical report of Central Bank of the Republic China(Taiwan)

[ii] The Z-score discriminant model developed by Altman(1968,1993) which is: $Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$ where $X_1$=Working Capital/Total Assets, $X_2$=Retained Earnings/Total Assets, $X_3$=Earnings Before Interest and Taxes/Total Assets, $X_4$=Market Value Equity/Book Values of Total Liabilities, $X_5$=Sales/Total Assets, If Z<1.81, then the company has a high probability of default, If Z>2.99, the company has near zero probability of default, If 1.81<Z<2.99, this range is named as “grey area” ,the company has 95% probability of default in one year, and has 70% probability of default in two year,, as a result, the higher the Z-score, the less probability of bankruptcy.

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