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Full Length Research Paper

The choices of capital structure

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This study intends to examine the choices of capital structure from Taiwanese electronic firms. Empirical results here provide the evidence that Taiwanese electronic firms follow the different financing behavior depending on the level of profitability. This study adopts two separated processes: First, we adopt Panel Unit Root Tests and find that under the different profitability the firms have different financing behaviors. Second, we adopt the model of Watson and Wilson (2002) to determine the order of the capital. We find out that the firms with a high level of profitability support the pecking order theory but the firms with a low profitability turn to support the static trade-off theory. However, the firms with the medium profitability cannot have any significant results.

Key words: Capital structure, Trade-off theory, pecking order theory.

INTRODUCTION

How to maximize firm value?

Managers intend to maximize firm value by lowering the weighted average cost of capital. In general, the source of capital can be separated into two kinds of funds: internal funds from retained earnings and external funds by issuing debt and equity. In general version of Modigliani and Miller (1958), they show that the cost of capital is independent of leverage when the costs of bankruptcy are included. However, the Modigliani and Miller (1958) proposition is with strong assumptions in a frictionless world of complete markets. Relaxing from the Modigliani and Miller (1958) assumptions (such as taxes, costs of financial distress, transaction costs, and asymmetric information) leads to heavy studies on discussing their impacts on the determinates of capital structure. For example relaxing the assumption of information asymmetry, a pecking order (PO) theory proposes that the firm prefers internal funds to external funds under the situation of cash deficit due to signaling effects. When external financing is needed, the firm has a priority by issuing debts first and then equity (Myers and Majluf, 1984). However, a trade-off (TO) theory states that each firm has its optimal debt-to-equity ratio, determined by balancing the present value of expected marginal benefits against the tax present value of expected marginal bankruptcy cost of leverage (Harris and Raviv, 1991). Dang (2005) for British quoted companies, conclude that the capital structure decisions are closer to what is predicted by TO Theory. Surprisingly the results of studies focusing upon companies of other countries with similar financial systems are not convergent concerning the relative importance of the PO Theory and the TO Theory in the explanation of capital structure decisions.

By reviewing the literature, the financing behavior or capital structure theory might be followed by managers which cannot have consistent conclusions in the empirical studies. The brief summary of literature is as follows: Belt and Klein (1993) examine whether a firm's choice of capital structure follows the PO theory and they find out that the high-growth firms need more external funds, especially for the firms with lower asymmetric information and support the PO theory. Frank and Goyal (2003) test the PO theory on the publicly traded firms and

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did not find any evidence to support PO theory. Javier and Juan (2005) examine the determinants of capital structure in Spanish firms, and by dividing the firms into several sub-categories (small and medium-sized, high-growth, and highly leverage) they provide the evidence of PO theory. Kayhan and Titman (2007) examine the impact of cash flows, investment expenditures, and stock price histories on debt ratio which support the TO theory. Maria and Roberto (2001) use unit root tests to examine the Italian firms' financing behavior and they find out that more than 80% of firms can support the PO theory but the significant result in their study might not be robust, depending on the cultural heterogeneity. Fama and French (2002) use structural equation that regress leverage and dividend payout as dependent variables on several explanatory variables from the PO and TO theory. They find no conclusive evidence in support of one specific theory. Hovakimian et al. (2001) examine the determinants of capital structure and conclude that a firm's profitability and stock price changes make the difference. However, a dynamic approach of capital structure decisions involves the possibility that companies adjust their level of debt towards a target debt ratio (Frank and Goyal, 2007). The relationship between size and debt as well as the relationship between profitability and debt found in the current study corroborate the conclusions of several studies (Rajan and Zingales, 1995; Shyam-Sunder and Myers, 1999; Miguel and Pindado, 2001; Ozkan, 2001; Frank and Goyal, 2003; Panno, 2003; Bevan and Danbolt, 2004; Dang, 2005; Gaud et al., 2005; Ojah and Manrique, 2005; Tong and Green, 2005).

The main purpose in this study is to find out which capital structure (PO or TO theory) do the high-tech firms in Taiwan follow, first, by testing the stationarity of debt ratio series (panel unit root tests), the financing behavior of high-tech firms can be examined. A stationary debt ratio means that these high-tech firms follow the static TO theory; otherwise, it turns out to support the PO theory. Second, by adopting the PO model of Watson and Wilson (2002), we can examine the priority of financing (internal funds, debt issuance, and equity issuance) for the firms under the different profitability level.

MODELS AND METHODOLOGY

Trade-off model

The static trade-off (TO) theory stated that each firm has its own optimal or target debt-ratio which can maximize firm value. Therefore, we can formulate the changes of debt ratio as target adjustment mechanism. The model developed by Maria and Roberto (2001) in the following is adopted here to examine firm's financing behavior:

$$\Delta D_{it} = \alpha_i \left(D_{it}^{*} - D_{it-1} \right) + \nu_{it} \quad (1)$$

where D_{it-1} is actual debt-ratio, D_{it}^{*} is target debt-ratio, ν_{it} is stochastic error. α_i is larger than zero, indicating that a firm's debt usage adjustment is toward the target ratio, although they might deviate from the optimal one in the short run. The target debt-ratio is defined as follows:

$$D_{it}^{*} = D_{i}^{*} + \Omega_{it} \quad (2)$$

where D_{i}^{*} is the optimal debt-ratio, constant over time and determined by trading off between the cost and benefits of borrowing; Ω_{it} is zero mean stochastic component of optimal leverage, which is stationary when the target is stable over time.
By substituting (2) to (1), we can obtain:

$$\Delta D_{it} = \gamma_i + \beta_i D_{it-1} + \mu_{it} \quad (3)$$

where $\gamma_i = \alpha_i D_t^{*}$, representing a constant term, and $\mu_{it} = \Omega_{it} + \nu_{it}$, depending on both the error of equation (1) and the stochastic component of equation (2). The general formulation of equation (3) is as follows:

$$\Delta D_{it} = \gamma_i + \theta_i D_{it-1} + \sum_{j=1}^{b} a_{ij} \Delta D_{it-j} + \varepsilon_{it} \quad (4)$$

If we assume that both ν_{it} and Ω_{it} are under the white noise processes, then $b = 0$ and equation (4) can be reduced to DF unit root test model for i^{th} firm shown on equation (3). However, in the case with more complex dynamic processes of ν_{it} and Ω_{it}, we have to set $b > 0$ until ε_{it} is a white noise process.

Here we adopt panel unit root tests to examine the financing behavior in the different types of firms. If the empirical results provide the evidence of stationarity, a mean-reversed relationship, it demonstrates that the firms follow the TO theory, adjusting toward the target debt-ratio. Otherwise, if the result is not a mean-reversed one, it can imply that firm's financial behavior based on the PO theory.

In this study, we use the panel unit root test to examine the firm's financial behavior. If the result has mean-reversion, it means that the firm has a target debt-ratio and the firm's financial behavior according with the TO theory. On the contrary, if the result does not have mean-reversion, it implies that the firm's financial behavior accord with the PO theory.

Watson and Wilson model

Watson and Wilson (2002) examine how firms obtain the funds for the required growth in business operations or firm's assets. The definition of total assets as follows:

$$Total\ Asset\ (TA_{it}) = Equity\ (E_{it}) + Debt\ (D_{it}) + Other\ Liabilities\ (OL_{it}) \quad (5)$$

If the changes in other liabilities (OL_{it}) for each firm over the period of time are assumed to fluctuate randomly with its average growth

rate, then the following empirical model developed by Watson and Wilson (2002):

$$(TA_{it} - TA_{it-1})/TA_{it-1} = \sum \alpha + \alpha_1 (E_{it} - E_{it-1})/TA_{it-1} + \alpha_2 (D_{it} - D_{it-1})/TA_{it-1} + \upsilon_{it} \quad (6)$$

where $\sum \alpha$ is a fixed effect vector representing firm's average growth of $(OL_{it} - OL_{it-1})/TA_{it-1}$.

When the firm maintains the optimal debt level, we then expect that $\alpha_1 = \alpha_2$. It means that the proportionate change in its financing behavior for supporting the operating activities is exactly matched by adjusting the same proportionate changes in equity and debt.

According to the PO theory, assuming that retained earnings (RE) is preferred to debt issuance, then to new equity issuance. When the PO theory is hold, the growth rate in RE should be higher than that in equity. For including new equity issuance into the model, Watson and Wilson (2002) have the change in the equities represented as follow:

$$Equity_{it} - Equity_{it-1} = P_{it} - Div_{it} + EI_{it} \quad (7)$$

where P_{it} represents profits available for distribution to common shareholders, Div_{it} represents dividend payments, EI_{it} represents net changes in new equity issuance over the period, and $P_{it} - Div_{it}$ represents the retained profits staying in the firms for the period. By substituting the equation (7) into (6), the new equation (8) is shown as follows:

$$(TA_{it} - TA_{it-1})/TA_{it-1} = \sum \beta + \beta_1 (P_{it} - Div_{it})/TA_{it-1} + \beta_2 (EI_{it})/TA_{it-1} + \beta_3 (D_{it} - D_{it-1})/TA_{it-1} + \upsilon_{it} \quad (8)$$

If the PO theory holds, we should observe the following relationship for β, which is $\beta_1 > \beta_3 > \beta_2$. This relationship might imply that the source of financing has a priority: first from a firm's retained earnings, then debt issuance, and equity issuance falling at the bottom, Watson and Wilson (2002) provide the evidence to support the PO theory due to the asymmetric information problem for external financing. These high-tech firms included in this study has the industry characteristics of heavy expenditures in R&D and more uncertainty or difficulty for evaluating a firm's value (Carpenter and Petersen, 2002). Therefore, in this study, by dividing the sample firms based on the level of profitability allows us to see whether a firm might take differential financing behavior according to the condition of its profitability.

Empirical analysis

The quarterly firm level data of Taiwanese Electronics Firms from the period of 1996: Q4 to 2007: Q3 were provided by the Taiwan Economic Journal (TEJ). Since a firm's financing behavior might be conditional on its profitability, we then divided the sample firms into high, medium, and low profitability subgroups, based on the ratio of return on equity (ROE)[1]. If the firms need more funds, the first source of capital is from internal funds and then by issuing debts.

[1] We separated each firms into three subcategories based on its profitability (ROE) of top 25%, medium 50%, and the last 25%.

EMPIRICAL RESULTS FROM PANEL UNIT ROOT TESTS

Panel unit root tests are used to examine the stationarity of debt ratios. By examining the stationarity of a firm's debt ratio, it allows us to examine whether the debt ratio follows a mean-reverting process. A stationary debt ratio series implies that the firms follow the static TO theory, financing behavior adjusting toward the optimal debt ratio. The empirical results here for overall, high-, and medium- profits firms show that the panel unit root tests for debt ratios fail to reject the null hypothesis with a unit root (Levin, Lin and Chu, 2002; Im, Pesaran and Shin 2003; and Maddala and Wu, 1999) and the results also supported by the stationarity test of Hadri (2001) with the null hypothesis of stationarity (Shown in Table 1). However, the firms with low profitability obtain the significant results and support the static TO theory.

Empirical results from Watson and Wilson (2002) model

Table 2 shows the results from Equation (8) for the firms under the different levels of profitability. We find significant results to support the PO theory. First, the slope coefficient of retained profits (RP) is larger than the slope coefficients of debt issuance and new equity issuance. In Table 2, all slope coefficients have statistically significant results at the 1% significant level. For the firms with high profitability level, we also find out that the slope coefficient of RP is 2.405 and is larger than the slope coefficients of debt issuance (1.718) and new equity issuance (1.138). The results of high-profits firms strongly support the PO theory. To further examine the statistically significant difference among these slope coefficients, we adopted the Wald test and obtained the statistically significant difference between these slope coefficients. For the firms with low profitability level, the slope coefficient of debt issuance is 1.001 and close to the slope coefficients of new equity issuance (1.003) and retained profits (0.903). We only cannot reject the null hypothesis ($H_0 : \beta_2 = \beta_3$) by the Wald test.

The results here cannot support the PO theory and it might infer that the firms with low profitability are unwilling to use internal funds when shortages of funds. For the firms with medium profitability, the slope coefficients of retained profits, new equity issuance and debt issuance are 0.989, 0.983 and 0.977. The Wald test also demonstrates that there are no significant differences for financing from these sources of capital. It might imply that the firms with medium profitability do not prefer to any specific financing behavior and it also can be explained by Market Timing Theory (Baker and Wurgler, 2002). The Market Time Theory states that market value is an important factor for determining firms' financing behavior. When the market value of firm is higher than its true value, it prefers to issuing new equities not debts. Besides,

Table 1. Empirical panel unit root test.

	All firms	High profits	Medium profits	Low profits
Levin, Lin and Chu	-14.710	-7.737	-11.760	-15.700***
Im, Pesaran and Shin	0.877	0.336	1.430	15.272***
Maddla and Wu	231.814	59.329	116.885	241.784***
Hadri (homoscedasticity)	15.034***	5.959***	8.076***	-2.66
Hadri (heteroscedasticity)	11.454***	5.526***	6.801***	-2.812

Note: 1. *** indicates significance at the 0.01 levels. 2. Critical values are based on Monte Carlo Simulations using 20,000 replications.

Table 2. Results from Watson and Wilson model.

Panel A Watson and Wilson model

Variable	High profits		Medium profits		Low profits	
	Coefficient	*t*-statistic	Coefficient	*t*-statistic	Coefficient	*t*-statistic
Constant	-0.073***	-8.866	-0.001	-0.826	0.001	0.712
RP	2.405***	13.529	0.989***	44.734	0.903***	46.396
EI	1.138***	10.162	0.983***	99.88	1.003***	77.387
△D	1.718***	40.515	0.977***	88.75	1.001***	85.366
Adjusted R^2	0.733		0.928		0.953	

Panel B Wald test

$\beta_1 = \beta_2$	34.979***	0.054	17.547***
$\beta_2 = \beta_3$	24.995***	0.179	0.028
$\beta_1 = \beta_3$	12.769***	0.23	18.142***

Note: 1. The Watson and Wilson model i

$$(TA_{it} - TA_{it-1})/TA_{it-1} = \sum \beta + \beta_1 (P_{it} - Div_{it})/TA_{it-1} + \beta_2 (EI_{it})/TA_{it-1} + \beta_3 (D_{it} - D_{it-1})/TA_{it-1} + \upsilon_{it}$$

This is for the different subsamples based on the profitability. 2. *** indicates significance at the 0.01 levels.

Titman and Wessels (1988) and Wald (1999) state that after financing with the external funds, if the funds are still not enough, the debt ratio should be negative correlation with profitability.

Conclusions

This study examines the financing behavior of high-tech firms in Taiwan. We adopted Panel Unit Root tests and the Watson and Wilson (2002) model and found out that the firms with the different levels of profitability have the different choices of capital structure (the PO theory versus the static TO theory). Therefore, a firm's financing behavior depends on its profitability. We provide the evidence that the low-profits firms follow the TO theory but the high-profits firms can support the PO theory. However, the empirical results of medium-profits firms can neither support the TO theory nor the PO theory, which means they do not have any specific financing preferences. The medium-profits firms can choose to issue new equities or debts depending on their current market values, which can reduce the cost of external financing. In brief, the empirical results here find out the evidence that Taiwanese electronic firms follow the different financial behavior depending on the condition of profitability.

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