International Scholars Journals

Global Journal of Business Management ISSN 2736-1721 Vol. 14 (3), pp. 001-008, March, 2020. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Capital structure and firm value in China: A panel threshold regression analysis

Yu-Shu Cheng[1]*, Yi-Pei Liu[2] and Chu-Yang Chien[3]

[1]Department of Accounting, Kainan University, No.1 Kainan Rd, Luzhu Shiang, Taoyuan 33857, Taiwan.
[2]Department of Accounting, Providence University, Taichung, Taiwan.
[3]Department of Accounting, National Yunlin University of Science and Technology, Yunlin, Taiwan.

Accepted 14 September, 2019

Since the study of Modigliani and Miller (1958), a large number of studies have contributed to the discussion about the optimal capital structure, which is a fundamental topic of corporate finance. In this study, we investigate whether there is an optimal leverage at which point firm is able to maximize its value. An advanced panel threshold regression model is applied to test the panel threshold effect of debt ratio on firm value among 650 A-shares of Chinese listed firms from 2001 to 2006. The results confirm that a triple-threshold effect does exist and show an inverted-U correlation between leverage and firm value. This study shows that it is possible to identify the definitive level beyond which a further increase in debt financing does not improve proportional firm value. Some important policy implications emerge from the findings.

Key words: Capital structure, firm value, emerging market, panel threshold regression model.

INTRODUCTION

How can a firm optimize its capital structure? The basic objective of optimizing capital structure is to decide on that proportion of various forms of debts and equities that maximizes firm value, while minimizing the average cost of capital. Over the past 50 years, the relationship between capital structure and firm value has been a significant, but controversial issue in finance. Theories of this relationship predict positive, negative, or no statistically significant relationship (Modigliani and Miller, 1958, 1963; Modigliani and Miller, 1963; Jensen and Meckling, 1976; Miller, 1977; Myer, 1977, 1984; Myer and Majluf, 1984; Graham, 2000; Baker and Wurgler, 2002; Welch, 2004). Similarly, empirical studies have also produced mixed results (Friend and Lang, 1988; Barton et al., 1989; Bos and Fetherston, 1993; Michaels et al., 1999; Booth et al., 2001; Abor, 2005; Mollik, 2005; Bonaccorsi di Patti, 2006; Kyerboach-Coleman, 2007), which may be due to two problems - one related to model specification and the other to model estimation.

Thanks to the mixed theoretical and empirical evidence, we apply an advanced panel threshold regression model (PTRM), proposed by Hansen (1999), to empirically examine whether there is an optimal level of debt at which point firms attain their maximum level of firm value, and it clarifies firms finance as much as possible as it can in debt.

As noted by Rajan and Zingales (1995), prior studies of capital structure have often relied on data from United States. How those theories apply to other countries is under-explored. Prasad et al. (2001) have surveyed the empirical studies on company capital structure, and they observed that the most empirical research on company capital structure is concerned with the major industrial countries, and that there has been relatively little study on developing countries or the transition economies. China is of interest for two reasons: (1) China is in transition from a command economy to a market economy. (2) Most Chinese listed companies were formerly owned by the state. In the period covered by this study, the state still maintains its controlling right after the firms becomes public. It is therefore, of a particular, interest to investigate the relationship between capital structure and firm value in a sample of listed Chinese firms.

Using a balance panel of 650 A-shares of Chinese listed firms during 2001 to 2006, our empirical results confirm that three threshold effects exist and that there is an inverted-U relationship between capital structure and

*Corresponding author. E-mail: cyushu@gmail.com. Tel: 886-3-3412500 ext. 7915.

firm value. In the low-debt and high-debt regimes, firms maximize their firm value by increasing and decreasing, respectively, the level of debt.

The current study mainly provides four contributions to this area of research. First, most empirical studies of capital structure have been conducted in developed countries, but, to date, there has been relatively little research on emerging economies. We bridge the gap in the literature by providing novel evidence on how capital structure affects firm value in China, one of the most prominent emerging markets. Second, and probably more importantly, we enlarge our understanding of the relationship between debt ratio and firm value by resolving the methodological problems associated with short-period samples. Cross-sectional data and multiple regression models have been used to address this relation. However, these analyses have not taken time factors into account, which leads to the problem of low statistical power and biased parameter estimates. To improve these statistical disadvantages, we use an advanced PTRM that enables us to determine the threshold effect of debt ratio and identify the four "regimes" that indicate where there are positive and negative debt ratio impacts on firm value. Our empirical results show that there is a "trade-off" relationship between tax advantages and increased disadvantages offered by the debt, which will tend to increase or decrease the firms' value, knowing that these trade -off relationships in the PTRM will provide useful insights for more complex situations. Third, we provide some valuable and practical policy implications to practitioners, regulators and investors for decision-making. As regards industry-level leverage, since the threshold values of debt ratio vary across different industries, managers can decide on an optimal debt level according to the different investment opportunities by comparing the threshold values that are derived from the PTRM.

In other words, managers are able to benefit very much by ascertaining the optimal debt ratio level in their industry. Furthermore, as regards firm- level leverage, PTRM can be applied at the firm level. Managers are able to set a target debt level by calculating their own threshold value of debt ratio using interior data from all businesses in their company, and to gradually move towards it, so as to maximize firm value. Finally, this study's reminds the investor to pay more attention to the trade-off relationship between gains and costs of debts, especially when the firm's debt ratio is at the threshold.

THEORETICAL AND EMPIRICAL ISSUES

With regards to the theoretical studies, there are four widely acknowledged competitive theories of capital structure: Capital structure irrelevance, capital structure relevance, the static trade-off theory and pecking order theory. In a frictionless and perfect markets world, the irrelevant capital structure of Modigliani and Miller (1958) argued that firm value is independent of firm capital structure, and there is no optimal capital structure for a specific firm. However, the assumptions of perfect capital markets with no transaction cost, no taxes, homogenous expectations and symmetric information are unrealistic and not applicable because taxes, friction, agency costs, and differences in information, all exist in reality (Modigliani and Miller, 1963; Jensen and Meckling, 1976; Myer, 1984; Myer and Majluf, 1984).

In their subsequent paper, Modigliani and Miller (1963) relaxed their assumption by incorporating corporate tax benefits as determinants of the capital structure of firms. The key feature of taxation is the recognition of interest as a tax-deductible expense. A firm that pays taxes receives a partially offsetting interest "tax -shield" in the nature of lower taxes paid. In other words, the firm value is increased through the use of debt in the capital structure, due to the tax deductibility of interest payments on debt. This is a tacit admission in which capital structure affects firm value. Consequently, as Modigliani and Miller (1963) propose, firms should use as much debt capital as possible to maximize their value. In analogous to Modigliani and Miller's (1963) propositions, Miller (1977) incorporated both corporate taxes and personal taxes into his model. Miller (1977) indicated that relative level of each tax rate determines firm value, and that the gain from employing debt may be smaller than what was suggested in Modigliani and Miller (1963). In a recent study, Graham (2000) suggested that the capitalized tax benefit of debt is about ten percent of firm value and that personal tax penalty reduces this benefit by approximately two-thirds before the tax Reform Act of 1986 and by slightly less than half after reform.

The static trade-off theory was developed by Myers in 1977. Myers (1977) suggests that the optimal capital structure does exist. A value-maximizing firm will find an optimal capital structure by trading off benefits and costs of debt financing. Firms will borrow up to the point that equates marginal costs and benefits of each additional unit of financing. Benefits of debt refer to tax advantages and the reduced agency costs of free cash flow, whereas, costs of debt refer to bankruptcy costs and the increased agency costs that arise when the firm creditworthiness is in doubt. Therefore, it values the company as the value of the firm is unlevered plus the present value of the tax advantages minus the present value of bankruptcy and agency costs. Among tax-based, agency- cost-based and bankruptcy-cost- based models belong to static trade-off model, including Modigliani and Miller (1963), Jensen and Meckling (1976), Myers (1977), Bradley et al. (1984), Altman (1984), and Stulz (1990).

The pecking order theory proposed by Myers (1984) and Myers and Majluf (1984), suggests that there is a hierarchy of firm preferences with regard to the financing of their investments and that there is no well-defined

target debt ratio. It is so because of the existence of the asymmetric information problem between the firm and likely finance providers. Firms finance their needs, initially by using internally generated funds (that is, undistributed earnings, where there is no existence of information asymmetry), next by less risky debt if additional funds are needed and lastly by risky external equity issue to cover any remaining capital requirements. The order of preferences reflects relative costs of finance to vary between the different sources of finance.

Along related strands of pecking order theory (the market timing theory) first expressed by Baker and Wurgler in 2002, posits equity market-timing attempts have at least a decade long impact on capital structure, and capital structure is the cumulative outcome of past attempts to time equity markets. Baker and Wurgler (2002) used an external finance-weighted average of market-to-book ratio (EFWAMB) in order to capture equity market-timing attempts. They find that EFWAMB is negatively associated with leverage, reflecting the impact of external financing decisions on leverage. This indicates that the adjustment toward target leverage is slow, and that firms do not generally care if they are been finance with debt or equity; they just opt the form of financing which, at that point in time, seems to be more valued by financial markets.

Welch (2004) used inertia theory and further confirmed that firms do little to readjust their leverage caused by stock price movements: Actual debt ratios move nearly as one with stock returns and the effect is highly persistent. Under the pecking order (market-timing and inertia theories), since firms do not perceive that leverage have great impacts on firm value, firms do not actively adjust the capital structure to the target level. In contrast, the trade-off theory argues that there is a closed link between leverage and firm value due to the market imperfections. Firms attempt to keep an optimal target capital structure that balances the costs and benefits associated with varying degrees of leverage, so as to maximize firm value.

Given these opposing theories, it is not surprising that the large empirical literature on leverage and firm value measured by performance has produced mixed results. For example, Kyerboach-Coleman (2007) pointed out that capital structure has a positive impact on performance of microfinance institutions. Berger and Bonaccorsi di Patti (2006) suggested that higher leverage, which is defined as total debts to total assets at book value, reduces the agency cost of outside equity and, therefore, increases firm value. These empirical re-sults are also consistent with Abor (2005), Mollik (2005), Peterson and Rajan (1994) and Bos and Fetherston (1993), who discovered that there is a positive association between leverage and performance. However, several studies found a negative association between leverage and performance (Friend and Lang, 1988; Barton et al., 1989; Michaels et al., 1999; Booth et al., 2001).

DATA

Sample set

Our sample selection starts with the entire population of A-shares of listed Chinese firms on the Shenzhen and Shanghai stock exchanges for 2001 to 2006. The financial institutions, banking, finance, and insurance firms are not included in the study since the balance sheet of those firms has a strikingly different structure from those of nonfinancial firms. We exclude the firms that issue both A- and B-shares and both A- and H-shares since they are different from A-share firms in terms of their information environment, reporting requirements, and information dissemination process. We also exclude the special treatment (ST) and particular transfer (PT) firms because of their different regulatory nature. Finally, we drop the observations with missing values in either dependent variable or independent variables. Table 1 presents the breakdown of 12 industries in the sample. After applying various filters, a total of 650 A-shares of Chinese listed firms with 3,900 firm-year observations were selected, in which 387 firms (59.54 percent) were from the traditional manufacturing industry, while 263 firms (40.46 percent) were from the non-manufacturing industry. We obtained all data from the China Stock Market and Accounting Research (CSMAR) database, developed by the Shenzhen GTA Information Technology Company. Table 2 provides the descriptive statistics of all the variables in our model. The mean of debt ratio and ROE are 39 and 31.67% (Tables 1 and 2).

Variables

There are two categories of explanatory variables in our panel data and threshold regression model. One is the threshold variable (debt-to-asset ratio), which is the key variable used to assess the optimal capital structure of a firm and to capture the threshold effect of debt on firm value. The other is the control variable and it is used to isolate the effects of other factors that have a predictable influence on firm value. Following prior literature, we employ three control variables in our research. The first control variable is used to capture intangibles that relates to the firm size, and is denoted in natural log form of total assets. The second and third control variable is concerned with firm's growth and is denoted as the annual percent change in sales and total assets, respectively.

How should we measure the debt ratio in China? Theoretically, there are three ways to measure debt ratio: Short-term debt to total assets, long-term debt to total assets, and total debt to total assets. Rajan and Zingales (1995) indicated that the most suitable debt-ratio relies on the purpose of the analysis. For publicly-listed Chinese firms, the decomposition of total debts into long-term and short-term debt may not be desirable for the following reason as explained. Diamond (1991, 1993), Rajan (1992) and Demirguc-Kuniand and Maksimovic (1999) indicated that firms in emerging countries rely mainly on short-term debt when the legal system is inefficient or costly to use, short-term debt is likely to be used than long-term debt. Kim et al. (2003) reported that at the end of 2002, banks held 86% of all the loans in China and that the public corporate debt amounted to only 2.8% of all outstanding debt, implying the most popular way of financing is borrowing money from bank. Short-term debt is the majority of total debt for most Chinese firms. In addition, the small amount of long-term debt may also imply that publicly-listed Chinese firms prefer equity financing instead of debt. This is a particular circumstance in China. The aforementioned argument suggests that the suitable debt-ratio should be based on short-term debts. Nonetheless, most companies in China tend to maintain their short-term debt even after the expiration date for another year or so, so that short-term debt can easily become long-term debt over time, although they are still recorded as short-term debt in their balance sheet. For this

Table 1. Sample distribution by industry.

Industry	Number of firms	Percentage of firms (%)
Agriculture, forestry, livestock farming, fishery	15	2.31
Mining	10	1.54
Manufacturing	387	59.54
Electric power, gas and water production and supply	34	5.23
Construction	18	2.77
Transport and storage	31	4.77
Information technology	36	5.54
Wholesale and retail trade	54	8.31
Real estate	18	2.77
Social service	19	2.92
Communication and cultural Industry	3	0.46
Comprehensive	25	3.85
Total	650	100

Notes: This table presents the industry classification of 650 A-shares of listed Chinese firms on the Shenzhen and Shanghai stock exchanges from 2001 to 2006.

Table 2. Descriptive statistics.

Variables	25% quantile	Median	75% quantile	Mean	S.D.	J-B
v_{it}	0.0299	0.0673	0.1101	0.0745	0.0988	244210***
d_{it}	0.2642	0.3921	0.5167	0.3900	0.1714	58.8523***
s_{it}	13.5689	14.0563	14.6398	14.1278	0.8543	288.8694***
g_{it}	0.0077	0.0858	0.1955	0.1534	0.3160	469752.8***
p_{it}	-0.0291	0.1134	0.2869	0.3167	4.9342	3.38E+08***

Notes: SD denotes standard deviation, while J-B denotes the Jarque-Bera test for normality. The variables v_{it}, d_{it}, s_{it}, g_{it}, and p_{it} represent ROE, debt-to-asset ratio, firm size (natural log form of total assets), growth rate of operating sales and growth rate of total assets, respectively. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

reason, we use total debt, rather than short- or long-term debt, to calculate debt ratio.

Which value of debt ratio is appropriate? It should also be noted that we do not use market value of debt to calculate debt ratio. The main reason is that there exist non-circulation shares in Chinese stock markets. Shares of publicly-listed Chinese firms can be divided into circulation shares and non-circulation shares. Non-circulation shares are the majority of whole shares. In the equation of calculating market value of total debt ratio, only market value of circulation shares is used. The biggest part of non-circulation shares is not added to equation. Therefore, market value of total debt ratio that was calculated is higher than what it should be. Accordingly, we do not market the value of debt to calculate debt ratio. That is, we only use book value of debt to calculate debt ratio.

METHODOLOGY

Following Hansen (1999) study's, we constructed the following single threshold model:

$$v_{it} = \begin{cases} \mu_i + \theta' h_{it} + \beta_1 d_{it} + \varepsilon_{it} & if\ d_{it} \le \gamma \\ \mu_i + \theta' h_{it} + \beta_2 d_{it} + \varepsilon_{it} & if\ d_{it} > \gamma \end{cases} \quad (1)$$

$$\theta = (\theta_1, \theta_2, \theta_3)' \text{ ¡A } h_{it} = (s_{it}, g_{it}, p_{it})'$$

where v_{it} represents firm value and return on equity (ROE) is used as the proxy; d_{it} (debt ratio) is the explanatory variable and also the threshold variable; γ is the hypothesized specific threshold value. We incorporate three variables (h_{it}) so as to isolate the effects of other factors that have predictable influences on firm value. The three control variables contains s_{it} : firm size; g_{it} : growth rate of operating sales and p_{it} : growth rate of total assets. θ_1 , θ_2 and θ_3 represent the coefficient estimates of the control variables. μ_i is a given fixed effect used to grasp the heterogeneity of different companies under different operating conditions; β_1 is the threshold coefficient when the threshold value is lower than γ; β_2 is the threshold coefficient when the threshold value is higher than γ; ε_{it} is the process of white noise; i represents different firms and t represents different periods.

From equations (1), the observations are split into two "regimes" depending on whether the threshold variable d_{it} is smaller or larger than the threshold value(γ).The regimes have different regression slopes, β_1 and β_2 . We use the known data of the v_{it} , d_{it} , and h_{it} to estimate the unknown parameters γ , β , σ^2 and θ.

However, we hypothesize that there is a threshold effect (that is, an asymmetric nonlinear relationship) between debt ratio and firm value, it is important to determine whether threshold effect is statistically significant. The null hypothesis and alternative hypothesis are set as: "H_0: $\beta_1 = \beta_2$; H_1: $\beta_1 \neq \beta_2$ ". If the null hypothesis holds, the coefficient $\beta_1 = \beta_2$ represents that the threshold effect between debt ratio and firm value does not exist. On the other hand, if the alternative hypothesis holds, the coefficient $\beta_1 \neq \beta_2$ implies the that threshold effect does exist. Hansen (1999) recommended the *F*-test to examine the existence of the threshold effect and also the use of sup-Wald statistic to test the null hypothesis.

If there exist double thresholds, the model can be modified as:

$$v_{it} = \begin{cases} \mu_i + \theta' h_{it} + \beta_1 d_{it} + \varepsilon_{it} & if\ d_{it} \le \gamma_1 \\ \mu_i + \theta' h_{it} + \beta_2 d_{it} + \varepsilon_{it} & if\ \gamma_1 < d_{it} \le \gamma_2 \\ \mu_i + \theta' h_{it} + \beta_3 d_{it} + \varepsilon_{it} & if\ \gamma_2 < d_{it} \end{cases} \quad (2)$$

where threshold value $\gamma_1 < \gamma_2$. This can be extended to multiple thresholds model (γ_1 ,γ_2 ,γ_3 , γ_n).

EMPIRICAL RESULTS

Panel unit root test results

Before the panel data in the statistical analysis was used, we carried out a test to determine whether the variables in the model are stationary. If this condition is not met, the spurious regression problem might arise and the estimated parameters could be biased. The null hypothesis of non-stationary versus the alternative in which variable is stationary, was tested using the group mean panel unit root test. Thus, we first perform two different panel- based unit root tests, the Levin- Lin- Chu ADF (Levin et al., 2002) and the IPS ADF (Im et al., 2003), to examine the null hypotheses of a unit root of all variables chosen in the models for our sample of 650 A-shares of the listed Chinese firms on the Shenzhen and Shanghai stock exchanges. Table 3 reports both panel unit root test results. As shown in Table 3, the nulls of the unit root are all rejected, which indicates that all the variables are stationary, that is, I(0). Accordingly, we proceed with full analysis.

Tests of threshold effect

In this study, we use the bootstrap method to obtain an approximation of the *F*-statistics and then calculate the *p*-values. The *F* statistics contains F_1, F_2 and F_3 to assess the null hypotheses of none, one and two thresholds, respectively. Table 4 provides the tests for the single-threshold, double-threshold and triple-threshold effects. The single-threshold effect is first tested to see if it exists. By using bootstrap to make 500 times, *F*-statistics of 128.1439 and *p*-value of 0.0000 are respectively yielded. They show significance under 1% significant level and reject the null hypothesis of no threshold effect; then the double threshold effect test is followed to see if it exists. Likewise, bootstrap is used to make 500 times and respectively yields *F*-statistics of 33.4008 and *p*-value of 0.0000; they show significance under a 5% significant level and reject the null hypothesis of one threshold. Finally, triple-threshold effect is tested to see if it exists.

Similarly, bootstrap is used to make 500 times and respective yields *F*-statistics of 18.2737 and *p*-value of 0.0000. The results reject the null hypothesis of two thresholds, suggesting the possibility of three thresholds. In conclusion, the aforementioned statistic analysis articulately shows that an asymmetric relationship of three thresholds in four regimes is significantly formed.

Table 4 also presents the estimated values of three thresholds, which are 53.97, 70.48 and 75.26%, respectively. All observations are objectively and passively split into four regimes depending on whether the threshold variable d_{it} is smaller or larger than the threshold value ($\hat{\gamma}_1$, $\hat{\gamma}_2$, $\hat{\gamma}_3$). Accordingly, we define four regimes formed by three threshold values to be low debt, medium debt, high debt and very high debt if their debt ratio within the ranges 0 - 53.79, 53.79 - 70.48 and 70.48 - 75.26% exceed 75.26%. The wide range of the first regimes indicates that most of firms belong to this regime.

Table 5 reports the regression slope coefficients, conventional OLS standard errors, and White-corrected standard errors for four regimes. The estimated model from the empirical findings can be expressed as

Table 3. Panel unit-root test results.

Variables	LLC		IPS	
	***t*-statistic**	***p*-value**	***t*-statistic**	***p*-value**
v_{it}	-421.4800***	0.0000	-129.4560***	0.0000
d_{it}	-88.6204***	0.0000	-54.4017***	0.0000
s_{it}	-200.7810***	0.0000	-112.4992***	0.0000
g_{it}	-151.9242***	0.0000	-63.9192***	0.0000
p_{it}	-140.6608***	0.0000	-89.9807***	0.0000

Notes: LLC and IPS represent the Levin et al. (2002) and Im et al. (2003) panel unit-root test, respectively. The variables v_{it}, d_{it}, s_{it}, g_{it}, and p_{it} represent ROE, debt-to-asset ratio, firm size (natural log form of total assets), growth rate of operating sales and growth rate of total assets, respectively. ***, ** and * indicate significance at the 1, 5 and 10% level, respectively.

Table 4. Tests for threshold effects between debt ratio and ROE

Threshold value			Critical value of *F*		
	F	***p*-value**	**1%**	**5%**	**10%**
Single threshold effect test					
0.7526	128.1439	0.0000***	25.4302	18.6874	15.2315
Double threshold effect test					
0.7048 0.7526	33.4008	0.0000***	20.5019	15.9807	13.7982
Triple threshold effect test					
0.5397 0.7048 0.7526	18.2737	0.0000***	13.8812	11.2079	10.3062

Notes: *F*-statistics and *p*-values are from repeating bootstrap procedures 500 times for each of the three bootstrap tests. ***, ** and * indicate significance at the 1, 5 and 10% level, respectively.

Table 5. Estimated coefficients of ROE.

Coefficients	Estimated value	OLS SE	t_{OLS}	White SE	t_{White}
β_1	0.0979	0.0252	3.8849***	0.0233	4.2017***
β_2	0.0507	0.0221	2.2941***	0.0251	2.0199***
β_3	-0.0775	0.0323	-2.3994***	0.0568	1.3668
β_4	-0.2734	0.0345	-7.9246***	0.1541	-1.7742*

Notes: $\hat{\beta}_1$, $\hat{\beta}_2$, $\hat{\beta}_3$ and $\hat{\beta}_4$ are the coefficient estimates that are smaller and larger than the threshold value γ. OLS SE and White SE represent conventional OLS SEs (considering homoscedasticity) and White-corrected SEs (considering heteroscedasticity), respectively. ***, ** and * indicate significance at the 1, 5 and 10% level, respectively.

follows:

$$v_{it} = \begin{cases} \mu_i + \theta h_{it} + 0.0979 d_{it} & if\ d_{it} \le 0.5397 \\ \mu_i + \theta h_{it} + 0.0507 d_{it} & if\ 0.5397 < d_{it} \le 0.7048 \\ \mu_i + \theta h_{it} - 0.0775 d_{it} & if\ 0.7048 < d_{it} \le 0.7526 \\ \mu_i + \theta h_{it} - 0.2734 d_{it} & if\ d_{it} > 0.7526 \end{cases} \quad (3)$$

In the first regime (low debt), where the debt ratio is less than 53.97%, the estimated coefficient $\hat{\beta}_1$ is 0.0979 and is significant at the 1% level, indicating that ROE increases by 0.0979% with an increase of 1% in debt ratio. In the second regime (medium debt), where the debt ratio is between 53.97 and 70.48%, the estimated coefficient $\hat{\beta}_2$ is still positive and significant at the 1% level, but the effect of debt on firm value decreases to 0.0507. This means that there is a decreasing trend, and ROE only increases by 0.0507% with an increase of 1% in debt ratio. The negative effects of debt on firm value are found in the third (high debt) and last regime (very high debt), respectively. The estimated coefficients $\hat{\beta}_3$ and $\hat{\beta}_4$ are -0.0775 and -0.2734; both of them are significant at 1% level, which means that ROE decreases by 0.0775 and 0.2734% with an increase of 1% in debt ratio. The negative effects on firm value increase gradually along with the increase of debt ratio. The regression slope coefficients of the panel threshold does not have a fixed value; in the low-debt regime (it is 0.0979), whereas, in the medium- debt, high-debt and very high-debt regimes, the slopes are 0.0507, - 0.0775 and -0.0.2734, respectively. Therefore, the results clearly suggest that the relationship between debt ratio and ROE (that is, the slope value) varies in accordance with different changes in debt structure, and that debt structure has a nonlinear relationship (inverted U-shape)

Table 6. Number (percentage) of firms in each regime by year.

	Regime 1		Regime 2		Regime 3		Regime 4	
	Low		Moderate		High		Very high	
	$d_{it} \le 0.5397$		$0.5397 < d_{it} \le 0.7048$		$0.7048 < d_{it} \le 0.7526$		$d_{it} > 0.7526$	
2001	526	81%	118	(18%)	1	(0%)	5	1%
2002	556	86%	87	(13%)	5	(1%)	2	0%
2003	541	83%	96	(15%)	8	(1%)	5	1%
2004	510	78%	125	(19%)	9	(1%)	6	1%
2005	483	74%	151	(23%)	8	(1%)	8	1%
2006	453	70%	174	(27%)	11	(2%)	12	2%
Total	3069	79%	751	(19%)	42	(1%)	38	1%

Table 7. Estimated coefficients of the control variables.

Coefficients	Estimated value	OLS SE	t_{OLS}	White SE	t_{White}
$\hat{\theta}_1$	-0.0344	0.0077	-4.4675***	0.0137	-2.5109***
$\hat{\theta}_2$	0.0505	0.0062	8.1452***	0.0067	7.5373***
$\hat{\theta}_3$	0.0006	0.0004	1.50000	0.0003	2.0000**

Notes: $\hat{\theta}_1$, $\hat{\theta}_2$ and $\hat{\theta}_3$ represent estimated coefficients of firm size, growth rate on total assets and sales. OLS SE and White SE represent conventional OLS SEs (considering homoscedasticity) and White-corrected SEs (considering heteroscedasticity), respectively. ***, ** and * indicate significance at the 1, 5 and 10% level, respectively.

With firm value.

In conclusion, the empirical findings confirm the nonlinear relation and identify the exact turning point of debt effectiveness by using the powerful panel threshold regression model. The empirical findings show that debt is positively related to firm value when it has not reached the threshold value. But it must be noted that increasing debt beyond its optimal, that is, the threshold value determined in this study, will hurt firm value. The empirical findings are consistent with the trade- off theory, which suggests that increased leverage may generate tax-shield and reduce agency costs, whereas, the opposite effect may occur. When the leverage becomes relatively high, further increases may generate considerable agency costs of outside debt from risk shifting that result in higher expected costs of bankruptcy or liquidation. The advantage of tax shield is offset by the incremental costs through debt financing, which counteracts the positive effect of debt financing on firm value. Therefore, the rational managers have to find a “balance” where the interest tax shield is equal to the incremental cost of debt financing.

Table 6 reports the percentage of firms which fall into the four regimes each year. As shown in Table 6, we found that approximately 79% of the Chinese listed firms fall in low debt ratio regime (that is, about 453 - 556 companies fall in the first regime each year), 19% of companies fall in medium debt ratio regime (that is, about 87-174 companies fall in the second regime each year), 1% of companies fall in high debt ratio regime (that is, about 1- 11 companies fall in the third regime each year), and 1% of companies fall in very high debt ratio regime (that is, about 2 - 12 companies fall in the third regime each year).

Table 7 presents the estimated coefficients of three control variables. As shown in Table 7, the estimated coefficient of firm size (θ_1) is -0.0344 and firm size is significantly negatively related to ROE. Empirical finding is consistent with Mak and Kusnadi (2005) and Dushnitsky and Lenox (2006). The estimated coefficients of growth rate on the total assets and sales (θ_2, θ_3) are 0.0505 and 0.0006, respectively. Firm growth rates have a significantly positive effect on firm value, implying that the greater the growth rate, that a firm have, the higher its firm value (Tables 6 and 7).

CONCLUSIONS AND IMPLICATIONS

It is important for any corporate entities to ensure an optimal capital structure and secure the financing sources

with the least cost of capital. This study uses the advanced panel threshold regression model to examine the panel threshold effect of leverage on firm value among 650 A- shares of Chinese- listed firms from 2001 to 2006. We use ROE as surrogate for firm value and debt-to-asset ratio as the threshold variable. The empirical results strongly indicate that triple-threshold effect exists between debt ratio and firm value. Besides, the coefficient is positive when debt ratio is less than 53.97%, which implies that debt financing can improve firm value. The coefficient is still positive, but starts to decrease when debt ratio is between 53.97 and 70.48%. The coefficient is negative and presents a decreasing trend when the debt ratio is between 70.48 and 75.26% or above 75.26%, implying that, in that regime, a further increase in debt financing, deteriorates firm value. We, therefore, compelled to conclude that the relationship between leverage and firm value represents an inverted U-shape. Debt financing should not be used unlimitedly; however, there is an optimal level beyond which, the increased debt does not have a better proportional firm value. These results are consistent with the static trade-off theory (Myers, 1977), which argues that firms seek debt level that balance the gains and costs of debt financing.

There are some valuable and practical policy implications that emerge from our findings, and firms can considerably benefit from it. First, since debt ratio threshold values vary according to the different industry and the market situation that the company is operating in, managers can apply the models that are developed here in order to set a target level, and then gradually move towards it so as to maximize firm value. Second, the knowledge of these capital structuring concepts that emerge from our study will help the financial manager in the utilization of the market conditions to the firm's advantage. Finally, our study can offer investors a good understanding of optimal capital structure in China.

REFERENCES

Abor J (2005). The effect of capital structure on profitability: An empirical analysis of listed firms in Ghana. J. Risk Fin., 6(5): 438-447.

Altman EI (1984). A further empirical investigation of the bankruptcy cost question. J. Fin., 39(4): 1067-1090.

Baker M, Wurgler J (2002). Market timing and capital structure. J. Fin., 57(1): 1-32.

Barton SL, Ned CH, Sundaram S (1989). An empirical test of stakeholder theory predictions of capital. Fin. Manage., 18(1): 36-44.

Berger AN, Bonaccorsi PE (2006). Capital structure and firm performance: A new approach to testing agency theory and an application to the banking industry. J. Bank. Fin., 30(4): 1065-1102

Booth LV, Aivazian V, Demirguc-Kunt A, Maksimovic V (2001). Capital structure in developing countries. J. Fin., 56(2): 87-130.

Bos T, Fetherston TA (1993). Capital structure practices on the specific firm. Res. Int. Bus. Fin., 10: 53-66.

Bradley M, Jarrell GA, Kim EH (1984). On the existence of an optimal capital structure: Theory and evidence. J. Fin., 39(3): 857- 878.

Diamond DW (1991). Debt maturity structure and liquidity risk. Q. J. Econ., 106(3): 709-738.

Diamond DW (1993). Seniority and maturity of debt contracts. J. Fin. Econ., 33(3): 341-368.

Demirguc-Kunt A, Maksimovic V (1999). Institutions, financial markets and firm debt maturity. J. Fin. Econ., 54(3): 295-336.

Dushnitsky G,Lenox MJ (2006). When does corporate venture capital investment create firm value. J. Bus. Venturing., 21(6): 753-772.

Friend I, Lang HP (1988). An empirical test of the impact of managerial self-interest on corporate capital structure. J. Fin., 43(2): 271-281.

Graham JR (2000). How big are the tax benefits of debt. J. Fin., 55(5): 1901-1941.

Hansen BE (1999). Threshold effects in non-dynamic panels: Estimation, testing and inference. J. Econ., 93(2): 345-368.

ImKS, Pesaran MH, Shin Y (2003). Testing for unit roots in heterogeneous panels. J. Econ., 115(1): 53-74.

Jensen MC, Meckling WH (1976). Theory of the firm: Managerial behavior, agency cost and ownership structure. J. Fin. Econ., 3(4): 305-360.

Kim Y, Ho IS, Giles MS (2003). Developing institutional investors in People's Republic of China. The World Bank Country Study Paper.

Kyerboach-Coleman A (2007). The impact of capital structure on the performance of microfinance institutions. J. Risk Fin., 8(1): 56-71.

Levin A, Lin CF, Chu CS (2002). Unit root in panel data: Asymptotic and finite-sample properties. J. Econ., 108(1): 1-24.

Mak YT, Kusnadi Y (2005). Size really matters: Further evidence on the negative relationship between board Size and firm value. Pacific-Basin Fin. J., 13(3): 301-318.

Miller MH (1977). Debt and taxes. J. Fin., 32(2): 261-275.

Modigliani F, Miller MH (1958). The cost of capital, corporate finance, and the theory of investment. Am. Econ. Rev., 48(3): 261-297.

Modigliani F, Miller MH (1963). Corporate income taxes and the cost of capital: A correction. Am. Econ. Rev., 53(3): 433-443.

Mollik AT (2005). Capital structure choice and the firm value in Australia: A panel data analysis under the imputation tax system. Working Paper, Thirteenth Annual Conference on Pacific Basin Finance, Economics and Accounting, June 10-11, New Brunswick, New Jersey.

Myers SC (1977). Determinants of corporate borrowing. J. Fin. Econ., 5(2): 147-75.

Myers SC (1984). The capital structure puzzle. J. Fin., 39(3): 575-592.

Myers SC, Majluf, NS (1984). Corporate financing and investment decisions when firms have information that investors do not have. J. Fin. Econ., 13(2): 187-222.

Petersen MA, Rajan RG (1994). The benefits of lending relationships: Evidence from small business data. J. Fin., 49(1): 3-37.

Prasad SJ, Green CJ, Murinde V (2001). Company financing, capital structure, and ownership: A survey, and implications for developing economies. SUERF Studies 12.

Rajan RG (1992). Insiders and outsiders: The choice between informed and arm's length debt. J. Fin., 47(4): 1367-1400.

Rajan RG, Zingales L (1995). What do we know about capital structure? Some evidence from international data. J. Fin., 50(5): 1421-1460.

Stulz R (1990). Managerial discretion and optimal financing policies. J. Fin. Econ., 26(1): 3-27.

Welch I (2004). Capital structure and stock returns. J. Polit. Econ., 112(1): 106-131.