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COGNITIVE BIAS AND CAPITAL STRUCTURE IN EMERGING MARKETS: EVIDENCE FROM CHINESE LISTED COMPANIES

ABSTRACT

We study the influence of managerial cognitive bias on corporate debt policy in China. We develop a theoretical model of capital structure that incorporates tax benefits of debt and predicts how managerial cognitive bias can lead to suboptimal capital structure choices. We find that when managerial cognitive bias is severe, the firm tends to choose overly-conservative or overly-aggressive debt levels, and the debt level is unrelated to the tax rate. In contrast, when managerial cognitive bias is mild, the firm responds to the tax benefit of debt and tends to choose a debt level that is positively related to the tax rate. We contribute to the literature by introducing managerial cognitive bias into the decision making process. We study how cognitive bias can affect capital structure decisions by incorporating the prospect theory in developing a capital structure model.

Key Words: cognitive bias, capital structure, tax, emerging markets

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INTRODUCTION

Company's capital structure not only affects corporate value, but it is also closely related to corporate governance and financial risks. Capital structure is one of the enterprise's core decisions. Various factors affect firm's capital structure decisions and these factors are unequally significant, *i.e.*, how reliably important they are in explaining capital structure decision is of great importance to investigate. Frank and Goyal (2009) mention some of the most reliable factors which explain market leverage as; tangibility, market-to-book assets ratio, expected inflation, as well as median industry leverage, on their study of capital structure decision of publicly traded American firms in the period of 1950-2003.

The manager-shareholder conflicts is vital in examining capital structure decision. Morellec, Nikolov, and Schürhoff (2012) use dynamic trade-off model to examine the conflicts where they reveal that agency cost varies significantly across firms and correlates with commonly used proxies for corporate governance. In addition, institutional factors are known to impact the speed of firm's capital structure adjustment (Öztekin and Flannery, 2012). The study compares firm's capital structure adjustments across countries and attempts to examine whether the variance in estimated adjustment speeds can be explained by the institutional differences among the countries. The results show that both legal and financial traditions significantly correlate with firm adjustment speeds. Similarly, Fan, Titman, and Twite (2012) investigate how institutional environment influences capital structure and debt maturity choices of firms in developed and developing countries. Their results point that more debt, particularly short term debt, is used in more corrupt countries and countries with weaker laws due to greater tax gains from leverage. Furthermore, Andres, Cumming, and Karabiber (2014) show that market participants can form expectations on target capital structure of listed firms based on available fundamental data and the firm's informational environment.

Moreover, large investment projects seem to impact capital structure of a company (Dudley, 2012). The study shows that lumpy investment projects undertaken by a firm provide the particular firm with an opportunity to adjust leverage at low marginal cost. Furthermore, Xu (2012) examines the relation between profitability and capital structure with respect to import competition and finds that, as firms experience an increase in import competition, they significantly cut down on their leverage ratios through issuance of equity as well as selling assets to repay debts. In addition, on the determinants of firm's capital structure, Rampini and Viswanathan (2013) investigate collateral and capital structure where they argue that collateral determines the capital structure. They also argue that the portion

of tangible assets required is a key determinant of leverage and the dynamics of firm financing. In this paper, we offer a combination of both model derivation and empirical evidence using data compiled from various Chinese firms listed in Shenzhen and Shanghai stock exchanges. The study attempts to shed light on the various factors, particularly the cognitive bias, which affects capital structure decisions in a firm.

The rest of the paper is structured as follows: Section 2 presents a review of the related studies while Section 3 presents an analysis of tax effect of capital structure where related theories are discussed and hypotheses are proposed. Section 4 presents research design and Section 5 discusses empirical results. Concluding remarks and major study implications are presented in Section 6.

RELATED LITERATURE REVIEW AND THEORIES

Currently, there is a number of studies that attempt to shed some light on the problem of the determinants of enterprises' capital structure decision. These studies are often focused on various perspectives, for instance, tax benefits from debt is one of the important factors that can be vital in deciding the ideal capital structure of a particular firm. Looking at the existing studies, there is a great number of studies about capital structure. Myers (2003) as well as Harris and Raviv (1991) are the most notable studies in the area that review main traditional theories and empirical studies on the subject and provide a wide range of valuable inputs to the research on the factors which are considered relevant in explaining the determinants of firm's capital structure. This section discusses arguments and theories from various studies to build this case. The presented arguments and discussions can be useful in motivating other studies as this study is increasingly receiving attention from the academic spheres. Thus, as it was shown above, various factors affect corporate capital structure decision. These are detailed below.

From the trade-off theory (TOT), corporate income tax is an important factor affecting the capital structure. Graham and Harvey (2001), and Brounen, Jong, and Koedijk (2004), separately, through a survey of CFOs of Britain, United States, France, Germany, and other countries, find that tax benefit has a major impact on corporate financing decisions. In addition, Buettner, Overesch, and Schreiber (2012) analyze the role of Thin-Capitalization rules for capital structure choice and investment decisions of multinationals and find that thin-capitalization rules effectively reduce the incentive to use internal loans for tax planning but result in higher external debt. However, what has been puzzling in the literature is that empirical studies don't seem to find consistent evidence that tax benefit

affects capital structure. Numerous studies, for instance, Gordon and Lee (2001), show that there is no significant relationship between tax rates and capital structure. Graham (2000) finds that many U.S. companies' use for tax benefit is very limited, and a huge number of tax benefits are not properly utilized. Thus, these study results entice many researchers to find the answers for the following questions: do income tax and tax benefits impact a company's capital structure? Why do many companies seem to be overly conservative in utilizing tax benefits? And, how should a company choose the optimal capital structures?

The research on how tax affects capital structure can be traced back to the study by Modigliani and Miller (1963). They point out that interest on debt can be deducted before income tax, while dividends are distributed after tax. Hence, through more liabilities, a company can realize additional tax benefits and thus create additional value to the shareholders. But this implies that the optimal debt level is 100% which is clearly inconsistent with the real world observation. To explain inconsistency, scholars from different perspectives, relax restrictions of the Modigliani-Miller (MM) theorem: Miller (1977) introduces personal income tax, while Robichek and Honge (1967), and Myers (1984) introduce bankruptcy costs and proposed the trade-off theory. DeAngelo and Masulis (1980) extend the cost of debt into the financial distress cost and the agency cost. Furthermore, Feld, Heckemeyer, and Overesch (2013) investigate the tax impact on corporate debt financing and conclude that capital structure choices are indeed positively affected by taxes, an effect which is also quantitatively important. Moreover, how powerful CEOs view leverage is well explored in Chintrakarn, Jiraporn, and Singh (2014) where the study shows that CEOs hold a negative view on leverage, hence they may adopt sub-optimal leverage levels that promote their own private benefits at the expense of shareholders.

Corporate income tax is an important factor that encourages debt financing (Garry, 2001). A number of scholars have carried out voluminous research on the relationship between capital structure and tax rates, but their conclusions differ from one another and with less to no consensus. For instance, Barclay and Smith (1995) investigate the impact of marginal tax rate (MTR) on capital structure and find that tax rate and debt ratio are negatively correlated, the opposite of what the trade-off theory predicts. Graham (1996, 2006) point out that, the above inconsistency is caused by the endogenous relation between the marginal tax rate and the debt ratio, and therefore the two variables may appear significantly correlated or uncorrelated depending on the research design. Also, after properly controlling for the endogeneity problem, high marginal tax rate may encourage the enterprise into more debt (Makie-Mason, 1990; Givoly et al., 1992; Graham, 1996). This is

supported by Gordon and Lee (2001) and, Pittman and Klassen (2001). However, Richardson and Lanis (2007) test tax reform data of listed companies in Australia and find a significantly negative correlation between tax rate and debt level, while Baker and Wurgler (2002) find no correlation between tax rate and capital structure. Overall, although scholars have made significant progress on understanding the relationship between tax rate and capital structure, a consistent set of empirical evidence is yet to emerge. As it can be seen from the above analysis, the concept of cognitive bias is broad with numerous connotations, which includes, but not limited to: overconfidence, attribution bias, framing effect, sunk cost, loss aversion, regret aversion, confirmation preference, hindsight as well as cognitive dissonance. Therefore, this paper combines all the above into a single term, cognitive bias.

Behavioral finance, by combining cognitive psychology and modern financial science, has enriched the tool box of theoretical and empirical financial research. Although various studies apply cognitive bias to explain financial behaviors, the research works on how cognitive bias affects capital structure are relatively sparse. Overconfident decision-makers tend to choose higher debt levels (Hackbarth, 2008; Frank and Goyal, 2007), however, Hackbarth disagrees on sorting financing preference according to the increment of costs and risks. In addition, Ben-David, Graham, and Harvey (2007), through empirical analysis of survey data, point out that overconfident decision-makers tend to choose higher debt ratio, especially with long-term debt.

The above literature on the relationship between capital structure and tax rates has so far produced a great number of studies. However, taken together, the existing studies are mainly motivated by the MM theory or the trade-off theory with a relatively large number of anomalies yet to be fully explained. Moreover, research methodologies are mainly theoretical analyses or empirical tests, while studies that combine both model derivation and empirical tests are relatively scarce. Managerial decisions in Chinese firms are likely to be less rational as managers of most of the firms (similarly to most emerging markets) either have lower education level or lower managerial skills compared to those of developed countries, which is likely to cause bias in the capital structure decision process. This calls for more studies on the subject, particularly, since at present, the related studies on cognitive bias and corporate capital structure decisions in emerging markets are relatively scarce. In this study, we contribute to the literature by examining how cognitive bias can affect capital structure decisions. Specifically, we incorporate the prospect theory to develop a capital structure model, in which a manager's cognitive bias can distort the perceived value of the tax benefit of debt and lead to suboptimal capital structure decisions. We then empirically

confirm our theoretical predictions by studying a significantly large data-set of Chinese listed companies. Our study not only provides a theoretical and empirical contribution to the research on capital structure, but also has important value implications to corporate managers and shareholders on the firm's capital structure decisions particularly in emerging markets.

ANALYSIS OF TAX EFFECT OF CAPITAL STRUCTURE

Trade-off theory's optimal capital structure decision

In this section, we set up an optimal capital structure decision model based on trade-off theory as a basis for further analysis. First, we assume the following conditions:

1)A company's tax rate is *T*, interest rate is *r* and discount rate is *d*, all interests are paid on a predetermined schedule, the sum of equity financing and debt financing is *A* (*A* is constant), ϱ is debt ratio ($0 \le \varrho \le 1$).

2) The *EBIT* of year *t* is *K*, the *EBIT* of the remaining years is *Ey* (*Ey*>0); moreover, *K* and *D* are the losses incurred by the enterprise and enterprise's debt, respectively. Furthermore;

$$\sum_{y=t+1}^{t+n-1} E_y - nDr < K < \sum_{y=t+1}^{t+n+1} E_y - (n+1)Dr \tag{1}$$

t, *n*, are positive integers, and, $t \ge 1$, $n \le 5$. The economic significance of this condition is: the corporate earnings for each year can be predicted, and, for the losses in the year *t*, *n* years are required to compensate for the losses. In particular, if $t \to \infty$ means that, in the foreseeable period of time the company will not suffer losses. According to Chinese tax laws, the year the enterprise incurs losses, year *t*, it does not need to pay income tax in the next 5 years to allow taxable income to compensate for the losses of year *t*, hence $n \le 5$.

3) Financial distress costs equal to $C(\varrho)$, tax benefits equal to $B(\varrho)$; and,

$C(0) = 0, C'(0) = 0, C'(1) > B'(1), C(1) > B(1)$. And, when $\varrho \neq 0$, $C'(\rho) > 0, C''(\rho) > 0$

This condition is based on the trade-off theory, and its economic significance is: when the debt ratio is zero, financial distress cost is also zero; with 100% liabilities, the financial distress costs and marginal increase in distress costs from the debt is greater than tax

benefits; in addition, the increase in debt is expected to accelerate the increase in financial distress costs.

4) Corporate debt ratio is fixed, and it will choose the optimal debt ratio so as to realize a maximum corporate value

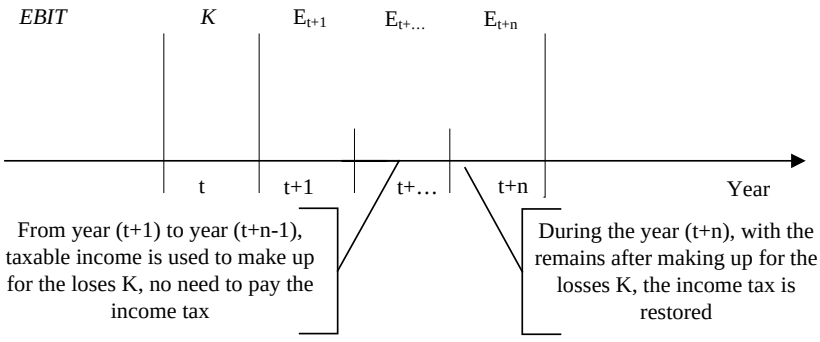
Table 1: Calculation of tax benefits

Year	1	a	t	b	t+n	c
EBIT	E_1	Ea	K	E_b	E_{t+n}	E_c
Interest	AQr	AQr	AQr	AQr	AQr	AQr
Taxable income	E_1- AQr	E_a- AQr	0	E_b- AQr	E_{t+n}- AQr	E_c -AQr
Income tax expenses	$(E_1$- $AQr)T$	$(E_a$- $AQr)$	0	0	ZT	$(E_c$ –$AQr)T$
Tax benefits	$AQrT$	$AQrT$	0	0	$(n+1)AQrT$	$AQrT$

Notes:a= 2, 3, ..., t-1; b=(t+1), (t+2), …, (t+n-1); c=(t+n+1), (t+n+2), …+∞; $Z = \sum_{y=t+1}^{t+n} E_y + K - (n+1)A\rho r$

First, tax benefit is calculated. The results are as shown above in Table 1. According to the Chinese tax law, the year the company suffers losses (year *t*) is not subject to income tax. The company can use taxable income in the next 5 years to compensate for the losses suffered in the year *t* ($K+Dr$). From condition (2) we can see that, from year (t+1) to year ($t+n$-1), the corporate taxable income is insufficient to cover for the accumulated losses. Thus, the company is exempted from paying income tax until the year ($t+n$). This is shown below on figure 1.

Figure 1: Income tax of an enterprise that sustained losses



Assuming that when there is no liability the corporate value is V_N, then the enterprise value (V) is:

$$V = V_N + B(\rho) - C(\rho)$$

$$V = V_N + \sum_{i=1}^{t-1} \frac{A\rho rT}{(1+r)^i} + \frac{(n+1)A\rho rT}{(1+r)^{t+n}} + \sum_{i=t+n+1}^{+\infty} \frac{A\rho rT}{(1+r)^i} - C(\rho)$$

$$V = V_N + A\rho rT\left[\sum_{i=1}^{t-1} \frac{1}{(1+d)^i} + \frac{n+1}{(1+d)^{t+n}} + \frac{1}{d(1+d)^{t+n}}\right] - C(\rho)$$

$$V = V_N + w\rho T - C(\rho) \tag{2}$$

In which:

$$w = Ar\left[\sum_{i=1}^{t-1} \frac{1}{(1+d)^i} + \frac{n+1}{(1+d)^{t+n}} + \frac{1}{d(1+d)^{t+n}}\right] \tag{3}$$

It can be concluded that, when $\varrho=\varrho^*$, V is maximum. ϱ^* is obtained from equation (4), and equation (4) has a unique solution. ϱ^* is the optimal debt ratio, and, ϱ^* is positively correlated with tax rate T. A detailed derivation of the optimal capital structure based on the trade-off theory is as follows:

$$\frac{\partial V}{\partial \rho} = wT - C'(\rho), \quad \frac{\partial^2 V}{\partial \rho^2} = -C''(\rho)$$

If $wT - C'(\rho) = 0$, from condition 3), it can be seen that $C'(0) = 0, C'(1) > B'(1) = KT$ .Also, since $C''(0) > 0$, thus $C'(\rho)$ is an increasing function. Therefore, function $wT - C'(\rho) = 0$ has a unique solution ϱ^*, and $0 \leq \varrho^* \leq 1$.

At the same time, because $C'(\rho)$ is an increasing function, and $C'(\rho^*) = wT$, thus ϱ^* and T are positively correlated. Therefore:

$$wT - C'(\rho^*) = 0 \tag{4}$$

It can be seen that, according to the trade-off theory, tax rate is an important determining factor inthe capital structure, and the debt levels are positively correlated with the tax rate.

Cognitive bias in prospect theory

According to the prospect theory proposed by Kahneman and Tversky (1979), individuals, when faced with uncertainty gains, it is risk averse, while when facing uncertainty losses, it is risk seeking. The essence of this psychological phenomenon is valued when decision-makers gain or lose in the cognitive uncertainty. Following the value-function, there is a certain degree of cognitive bias that makes the decision-maker's perceived gains or losses differ from the actual values. When the gain or loss is small, the difference between the perceived and the actual value is relatively large. But with an increase in the gains or losses, the unit loss or gain to the decision-maker will cause the perceived value change to have a diminishing marginal value.

From equations (2) and (3), it can be seen that, tax-benefit, B(ϱ), is determined by the debt ratio, ϱ, and the time when the losses occur, t, and the time required to recoup the losses, n, are jointly determined. Considering that most listed companies need about 1-5 years to make up for the incurred losses, as in Table 1, the losses will actually be delayed for 1-5 years before being recognized due to the tax benefits, while, the difference between discount factor in that 1-5 years period and 1 is not much, that is, equation (3) can be approximated to 1. Therefore, losses and compensations to losses have little impact on tax benefit. Tax benefit can be regarded as a kind of de facto income. That is, when cognitive tax benefits have value to the enterprise, there is no cognitive bias.

From the prevention point of view, financial distress causes an enterprise to operate under insufficient cash flow and is unable to offset the existing maturing debts, that is, technical bankruptcy. Financial distress cost equals to the product of the expected losses the company expects to incur when the financial distress actually happens and the probability of the financial distress happening. Thus, financial distress cost is a kind of uncertainty loss. There is a huge possibility that an enterprise's awareness of the financial distress cost leads to described cognitive biases. Using a value function to describe it, when the amount of financial distress cost is small, the policy-maker becomes very sensitive to the particular changes. But with the amount getting increasingly large, this kind of sensitivity gradually decreases.

The impact of cognitive bias on the capital structure decision and tax effects

This section discusses the relationship between tax rate and capital structure under the influence of cognitive bias. To ease the analysis of the problem, we propose the following assumptions;

1) ϱ is the debt ratio ($0 \leq \varrho \leq 1$), A is total financing, tax benefit $B(\varrho) = \varrho AT$. This assumption follows equations (2) and (3). Its economic significance is that, tax benefit is proportional to the debt ratio, and the impact of tax benefits on both losses and compensation for losses is negligible ($w=1$).

2) R is the loss incurred at the time when the company actually faces financial distress; financial distress cost equals debt ratio (ϱ) function, that is:

$$C(\rho) = R\rho^{\lambda}, \lambda > 1, R > AT > 1$$

This condition is based on the trade-off theory. Its economic significance is that, the financial distress cost is decided by both R and the debt ratio. The higher the debt ratio, the higher the probability of financial distress occurring, which leads to a speeding-up in the increase of financial distress cost. Also, when an enterprise completely adopt debt financing, financial distress cost is greater than tax benefit, and both are greater than 1.

3) When the decision-maker realizes the losses caused by the financial distress costs, the value function is;

$$P(x) = -(-x)^{\frac{1}{m}}, \quad x \leq 0, \quad m \geq 1 \tag{5}$$

Where, m stands for the severity of the financial distress cognitive bias.

This condition is based on the discussion of the value function in Kahneman and Tversky (1979). Its economic significance is that, when the financial distress cost is relatively small, the decision-maker is very sensitive to the losses caused by the particular costs. But, with the increasing financial distress cost, this sensitivity gradually decreases. The bigger m gets, the more severe the cognitive bias becomes. The value function's marginal diminishing trend will be more obvious, as well as a larger deviation between the subjective value and the actual value.

4) In selecting the optimal capital structure, the corporation chooses in accordance to the tax benefits and the perceived estimate of the financial distress costs. Under the perceived opinion of the decision-maker, the corporate value is;

$$V = V_N + B(\rho) - P\left[-C(\rho)\right]$$

$$V = V_N + \rho AT - R^{\frac{1}{m}}\rho^{\frac{\lambda}{m}} \tag{6}$$

Taking a closer look at the figures below, (Fig. 2 and 3), which show the choice of optimal capital structure under the influence of cognitive bias.

Figure 2: Optimal capital structure choice under the influence of cognitive bias (m<λ)

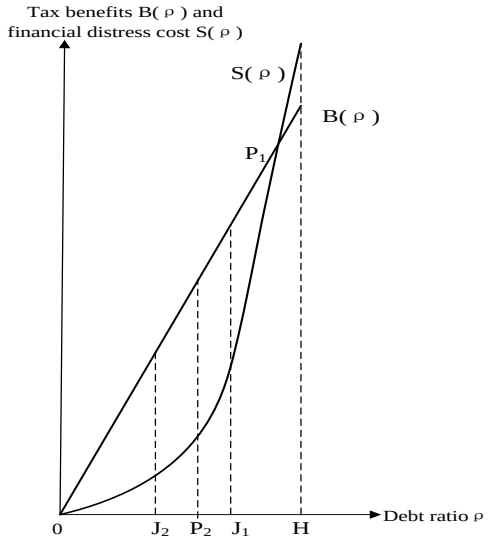
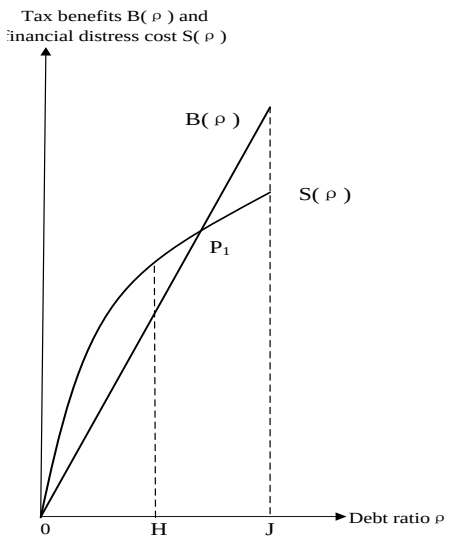


Figure 3: Optimal capital structure choice under the influence of cognitive bias (m>λ)



When $m<\lambda$ or $m>\lambda$, the decision-maker can use Figure 2 and equation (4) to represent the optimal capital structure. From the two figures (Fig. 2 and 3), S(ϱ) is the decision-maker's perceived financial distress cost, i.e., equation (7), B(ϱ)= ϱAT is tax benefit, and the difference of the two curves, Δ(ϱ)=[ϱAT- S(ϱ)], represents liabilities which increase the enterprise's net value ($0\leq\varrho\leq1$). When Δ(ϱ) is at the maximum, the enterprise's value is at the maximum, the corresponding value of ϱ is the optimal debt ratio ϱ*. P_1 is the point of

intersection of S(ϱ) and B(ϱ), while, at P_2 , the derivatives of the two curves are equal. Dotted lines H, J, J_1, and J_2 are the possible locations of the straight line ϱ=1. The optimal debt ratio and the relationship between tax ratio and the optimal debt ratio can be calculated as shown on figure 3. Detailed derivation of the optimal capital structure based on the prospect theory is as follows:

$$\frac{\partial V}{\partial \rho} = AT - \frac{\lambda}{m} R^{\frac{1}{m}} \rho^{\frac{\lambda}{m}-1} \tag{7}$$

$$\frac{\partial^2 V}{\partial \rho^2} = -\frac{\lambda}{m}(\frac{\lambda}{m}-1) R^{\frac{1}{m}} \rho^{\frac{\lambda}{m}-2} \tag{8}$$

The following can easily be obtained:

(1) Concavity and Convexity of S(ϱ): When, *m*=1, there is no cognitive bias, and S(ϱ) is convex. As *m* increases (*m*≤λ), S(ϱ) gradually changes from a convex function to a straight line. When *m*=λ, S(ϱ) completely becomes a straight line. As *m* further increases (*m*>λ), S(ϱ) becomes a concave function.

(2) The point of intersection of B(ϱ) and S(ϱ): when *m*≠λ, setting equation (6) equal to V_N, then the abscissa of the point of intersection of B(ϱ) and S(ϱ) can be calculated as:

$$\rho_1 = \left(\frac{AT}{R^{\frac{1}{m}}} \right)^{\frac{m}{\lambda - m}} \tag{9}$$

When *m*<λ, solving for $\varrho_1 \leq 1$, we obtain $AT \leq R^{\frac{1}{m}}$, that is *m*≤γ. Solving when $\varrho_1 > 1$, we obtain $AT > R^{\frac{1}{m}}$, that is, *m*>γ, in which $\gamma = \frac{\ln R}{\ln(AT)}$.

When *m*>λ, solving $\varrho_1 < 1$ we obtain *m*>γ. Solving $\varrho_1 > 1$, we obtain *m*<γ.

(3) The derivative of S(ϱ): When *m*=λ, S(ϱ) is a straight line, and its derivative is always equal to $R^{\frac{1}{m}}$. When *m*<λ, with an increase on ϱ (0≤ϱ≤1), the derivative of S(ϱ) decreases from infinity to *β*. In which, $\beta = \frac{\lambda}{m} R^{\frac{1}{m}}$.

Suppose equation (7) equals zero, we can solve for the abscissa of the stationary point of $V(\varrho)$.

$$\rho_2 = \left(\frac{mAT}{R^{\frac{1}{m}} \lambda} \right)^{\frac{m}{\lambda - m}} \tag{10}$$

When $m<\lambda$, solving for $\varrho_2 \leq 1$, that is $mAT \leq \lambda R^{\frac{1}{m}}$, we get $m \leq m^*$. Solving for $\varrho_2 > 1$, that is $mAT > \lambda R^{\frac{1}{m}}$, we get $m > m^*$, in which m^* is the solution of $mAT = \lambda R^{\frac{1}{m}}$.

From the analysis above;

(1) From diagram 3, when $m<\lambda$, $S(\varrho)$ is convex. ① If $\varrho_1<1$, that is, $m<\gamma$, then A is at the point where $\varrho=1$. ② If $\varrho_1>1$, and $\varrho_2<1$, that is, $m>\gamma$ and $m<m^*$, then B_1 is at the point where $\varrho=1$. ③ If $\varrho_1>1$and $\varrho_2>1$, that is $m>\gamma$ and $m>m^*$, then J_2 is at the point where $\varrho=1$. As, when $\varrho<\varrho_2$, $S(\varrho)$ increases faster than $B(\varrho)$, and when $\varrho>\varrho_2$, $S(\varrho)$ increases slower than $B(\varrho)$. Therefore, from the above three cases, when ϱ equals to; ϱ_2, ϱ_2, and 1, respectively, $\Delta(\varrho)$ is maximum.

(2) When $m>\lambda$, as shown on diagram 4, $S(\varrho)$ is concave. When $\varrho_1<1$ and $\varrho_1>1$, that is, when $m>\gamma$ and $m<\gamma$, J and H are respectively at $\varrho=1$. Under the mentioned two cases, $\Delta(\varrho)$ is maximum when $\varrho=1$ and $\varrho=0$, respectively.

(3) Similarly, we can deduce the optimal debt ratio when $m=\lambda$ and the optimum debt ratio when $m\neq\lambda$ but $m=\gamma$. This will not be discussed again here.

In addition, according to equation (11), we can deduce that when $m<\lambda$, ϱ_2 and T are positively correlated. And, when the target debt ratio is 0 or 1, the optimum capital structure choice is uncorrelated to the tax rate. The final result is as follows below:

$$\frac{\partial \rho_2}{\partial T} = \frac{mT^{\frac{2m-\lambda}{\lambda-m}}}{\lambda - m} \left(\frac{mA}{R^{\frac{1}{m}} \lambda} \right)^{\frac{m}{\lambda-m}} > 0 \tag{11}$$

Thus:

$$S(\rho) = \left| P[-C(\rho)] \right| = R^{\frac{1}{m}} \rho^{\frac{\lambda}{m}} \tag{12}$$

Due to the fact that companies cannot afford 100% debt financing or 100% equity when choosing capital structure, they always take into consideration various constraints behind the occurrence. Therefore, when the target capital structure is either 0 or 100%liability, the more viable financing options are to make liability as little as possible or as much as possible, that is, over-restrained liabilities or excessive liabilities.

It can be seen that, under the influence of cognitive bias, the enterprise's judgment on the optimal capital structure and the relationship between tax rate and capital structure will differ from the description of the classic trade-off theory. But when the cognitive bias is small (first two cases on Table 2), the enterprise's subjective judgment on optimal capital structure (debt ratio = ϱ_2) and the actual optimal capital structure (debt ratio ϱ_2, and m=1) are not necessarily the same, but still related to tax rate, and, debt ratio and tax ratio are positively correlated. When cognitive bias is large (last seven cases in Table 2) the enterprise will adopt overly-restrained or excessive debt policy. The capital structure choice at this point is not related to the tax rate.

Table 2: The optimal capital structure decision under various degrees of cognitive biases

Decision condition			Decision outcome	
Mathematical description		**Graphical description**	**Optimal debt Ratio ϱ^***	**The relationship between ϱ^* and T**
$m<\lambda$	$m\leq\gamma$	Figure 2 (position H on straight line ϱ=1 or through P_1)	ϱ_2	Positively Correlated
	$m>\gamma$, $m\leq m^*$	Figure. 2 (position J_1 on straight line ϱ=1 or through P_2)	ϱ_2	
	$m>\gamma$, $m>m^*$	Figure 2 (position J_2 on the straight line ϱ=1)	1	
$m=\lambda$	$\lambda<\gamma$	S(ϱ) is linear, and above B(ϱ)	0	Uncorrelated
	$\lambda=\gamma$	S(ϱ) is linear, and overlaps B(ϱ)	Any (debt ratio)	
	$\lambda>\gamma$	S(ϱ) is linear, and is below B(ϱ)	1	
$m>\lambda$	$m<\gamma$	Figure 3 (position H on the line ϱ=1)	0	
	$m>\gamma$	Figure 3 (position J on the line ϱ=1)	1	
	$m=\gamma$	Figure 3 (line ϱ=1 through P_1)	1 or 0	

Notes: m^* is the solution of the equation $mAT = \bar{R}^{\frac{1}{m}}\lambda; \gamma = lnR / ln(AT)$

Hypothesis development

When the operating cash flow is stable, an enterprise can more accurately estimate its ability to repay future debts. Thus, financial distress cost is a *de facto* loss. According to the above analysis it can be seen that, the optimal amount of debt is positively correlated to the tax ratio. Hence we propose the following hypothesis:

Hypothesis 1: When there is a stable operating cash flow, debt ratio is positively correlated with tax rate.

The manager's perception of financial distress cost can directly affect firm's capital structure. When operating cash flow is unstable, financial distress cost is uncertainty loss. At this point, the level of manager's cognitive bias will have a significant impact on the tax effect of capital structure. If the financial distress cognitive bias is low, from the above analysis it can be seen that: in the enterprise, from the manager's subjective opinion, the optimal debt amount is positively correlated with tax ratio. At this point, the manager will adjust debt level according to the changes in tax rates.

If the financial distress cognitive bias is in the middle, from the enterprise's subjective opinion, any amount of liabilities is detrimental to the enterprise (see Table 2). Therefore, the enterprise's optimal capital structure is zero liability, and independent of the tax rate. The change of tax rate at this point will not cause changes in the firm's capital structure. Moreover, if the financial distress cognitive bias is high, from enterprise's subjective view, the optimal capital structure is 100% liability, and independent of the tax ratio (see Table 2). From this, we propose the following hypotheses:

Hypothesis 2a: When enterprises with low financial distress cognitive bias are faced with unstable operating cash flow, debt ratio and tax rate are positively correlated

Hypothesis 2b: When enterprises with moderate or high financial distress cost cognitive bias are faced with unstable operating cash flow, debt ratio and tax rate are uncorrelated

RESEARCH DESIGN

Data selection

We use data from A-share Chinese companies listed in Shanghai and Shenzhen stock exchanges in the period 2000-2010 as our study sample. We apply a specific data selection

procedure as follows: (1) We exclude ST (Special Treatment firms: a firm is labeled as an ST firm by the stock exchanges in accordance to certain guidelines put forward by China's securities regulatory authority when the firm falls into serious financial problems) and PT (Particular Transfer firms: firms downgraded from ST status due to the continuous losses in the next year. This entails a virtual suspension of the downgraded firm's shares from trading and a significant danger of de-listing) companies and companies with incomplete data. (2) We exclude companies that made equity agreement transfer during 2000-2010, mainly after considering that; the main business, capital structure, asset size, even the implementation of tax rates, *etc.,* of these companies usually change substantially after the equity agreement transfer, hence may affect the accuracy of regression results. (3) We exclude companies that make use of tax effect accounting methods, mainly to avoid the possible impact of the use of different methods of calculating income tax. Also, there is a relatively small number of listed companies using tax effect accounting methods. Through the above selection procedures, we obtained 11 years of data comprising 337 companies, with a total of 3707 valid observations. The financial data are obtained from GTA database. The listed companies' actual implemented income tax rate data are obtained from RESSET and annual financial reports of the listed companies.

Model and variables

Since tax benefits of liabilities are mainly derived from the pre-tax interest, we use *ADRI* as the dependent variable. At the same time, if statutory tax rate is used as the explanatory variable, then it will inevitably lead to self-selection problem, thus causing its estimator, β_0, in the model to be biased. To avoid the self-selection bias, we use Effective Tax Rate (*ETR*) as the explanatory variable.

As cognitive bias cannot be directly measured, scholars generally make use of psychological experiments and surveys to examine decision-makers' cognitive biases. The representativeness of the selected samples in the two methods is not high, which causes cognitive bias measurement to have certain limitations. From the above model analysis, according to Table 2, it can be deduced that: during times of unstable operational cash-flow, enterprises with low, medium and high financial distress cognitive bias are expected to choose moderate, prudent, and radical debt policies, respectively. Thus, we divide enterprises with unstable operational cash-flow into 3 groups according to debt ratio levels as, low, medium and high, representing enterprises with, high, moderate, and low cognitive biases, respectively.

Similar to the above hypotheses, we apply strict preconditions in building the study's model by controlling for growth, internal financing and enterprise scale. We control growth because of the assumption that annual enterprise's *EBIT* is stable (excluding years of losses) and there is no new investment. Also, since the enterprise is actually growing, it often needs more liabilities (Robichek and Honge, 1967; Richardson and Lanis, 2007). Controlling internal financing capacity is from Myers (1984). Myers proposes that in order to minimize losses caused by information asymmetry, managers prefer internal financing, *i.e.*, internal financing capacity and liabilities are negatively correlated. Controlling for enterprise size is from Marsh (1982). The study shows that larger enterprises are often more capable of using the scale advantage of debt financing, and have an enhanced bargaining power with their creditors. Therefore, enterprise size is positively correlated with liabilities. Due to the implementation of the new accounting standards, corporate financial statements no longer disclose information on accumulated depreciation, thus this model does not include "non-debt tax shield". Based on the above analysis, the regression equation is as follows:

$$ADRI = \alpha_0 + \beta_0 ETR + \beta_1 GROW + \beta_2 CF + \beta_4 SIZE + \beta_5 INDU + \beta_6 YEAR + \varepsilon \qquad (13)$$

In which; α_0 and βj are regression coefficients (j=0-6), ε the error term, and α_0 is constant. Calculation for each variable is as shown on Table 3 below:

Table 3: Proxy setting and calculation

Variable name	Notation	Calculation method
Interest-bearing debt ratio	ADRI	(short-term borrowings + long-term borrowings due within1 year + long-term liabilities)/final total assets
Effective tax rate	ETR	Actual Implemented income tax rate
Growth	GROW	Income growth rate of the main business
Internal financing capacity	CF	Net-Cash flows generated from business activities/Total final assets
Enterprise size	SIZE	Natural log of final total assets
Seller's discretionary cash flow	SDCF	Std deviation of CF for 2006-2009
Industry dummy variable	INDU	In accordance with SFC industry standards, 11 industry dummy variables are set
Year dummy variable	YEAR	Controlling the annual macroeconomic effect, 5 Year dummy variables are set
Interest-bearing debt ratio	ADRI	(short-term borrowings + long-term borrowings due within1 year + long-term liabilities)/final total assets

Sample grouping

For the ease of empirical testing, samples were grouped according to the following steps: First, according to the level of operating cash flow volatility - here, the sample is divided into low-SDCF and high-SDCF, representing enterprises with stable operating cash-flow and enterprises with unstable operating cash-flow, respectively. Next, based on the average level of interest-bearing debt ratio for each enterprise in the period of 2000-2010. Here, we take the sample from high-SDCF group and divide it into the average interest-bearing debt ratio, namely, low, medium, and high, representing medium cognitive bias, low cognitive bias, and high cognitive bias, respectively. Specific sample grouping is shown in Table 4.

Table 4: Sample grouping

Group	SDCF	Mean of ADRI	Number	Total
G1	[0.009,0.058]		1848	3707
G21		[0.000,0.197]	616	
G22	[0.059,0.346]	[0.198,0.332]	627	
G23		[0.333,0.809]	616	

Notes: Group G1 represents stable operational cash flow group; G21、G22、G23 represent enterprises with; low, medium, and high average ADRI, respectively.

EMPIRICAL RESULTS

Descriptive statistics

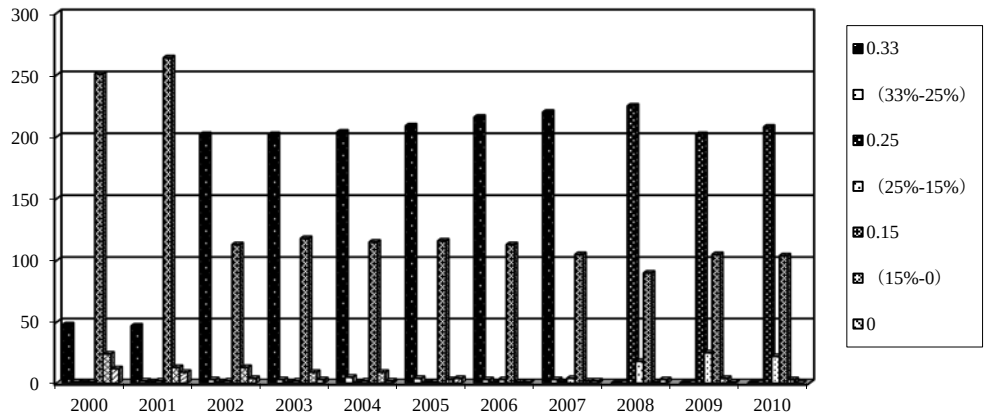
Table 5 displays descriptive statistics of the regression model showing characteristics of each variable. From the table, the maximum value of *ADRI* is 0.877, while its minimum value is only 0.001.Thisexplains the existence of large capital structure differences among various Chinese companies. Also, the maximum value of *ETR* is 0.33, while its minimum value is 0, and suggests that the income tax rate applied by various Chinese companies largely differ. Furthermore, there are some differences in corporate capital structure and ways of sorting out income tax rate among various companies. But in the end, the relationship between capital structure and income tax rate calls for further testing.

Table 5: Descriptive statistics of the main variables

Variables	ADRI	ETR	GROW	CF	SIZE	ROE
Mean	0.277	0.232	0.304	0.054	21.497	0.122
Median	0.272	0.250	0.154	0.053	21.413	0.114
Std. D	0.144	0.085	2.203	0.084	1.019	0.216
Min	0.001	0.000	-1.000	-0.544	18.979	-0.381
Max	0.877	0.330	86.381	1.019	26.099	0.680

Figure 4 shows distribution of the effective tax rate of the 337 listed companies from 2000 to 2010. It can be seen that, during 2000-2001, the number of listed companies that implemented a 15% tax rate is far greater than listed companies that implemented other tax rates. The reason behind this occurrence, *i.e.*, tax competition, is mainly due to the need for local governments to compete for the limited available resources. Therefore, the local government set up "refund-after-collection" preferential tax for the local firms, which caused the statutory tax rate for these firms to fall from 33% to 15%. During the period 2000-2007, the number of listed companies that implemented the 33% tax rate was larger than those which implemented the 15% and other tax rates. However, during 2008-2010, 25% tax rate became the most common tax rate for listed companies, in which, not a single listed company opted for the 33% tax rate. This was mainly caused by the implementation of the "enterprise income tax law" of January 2008. This provision would cause the income tax rate for both domestic and foreign enterprises to stand at 25%.

Figure 4: Effective tax rate distribution of the sample companies for each year



To reflect the capital structure and income tax rate of the listed companies, this paper uses *ADRI* to divide capital structures of listed companies in the following operational ranges; (0-20%) as prudent liability, (20%-40%) as low liability, (40%-60%) as medium liability, (60%-80%) as excessive liability, and (80%-100%) as risky liability. Table 6 shows that, the number of listed companies in the "prudent" region is about 110 companies a year, accounting for 32.56% of the total sample. The number of listed companies in "low liability" region is relatively large (an average of 157 companies per year), accounting for about 46.75% of the total sample. From above it can be seen that 79.31% of enterprises did not take full advantage of the liabilities' tax benefits. This, to a certain extent, also verifies assertion by Graham (1996) that it exists objectively in China. The number of enterprises in the "medium" region is roughly 66 companies per year, just about 21.47% of the total sample, while the number of listed companies lying in "excessive" and "risky" region is relatively low. Through comparison it can be seen that the income tax rate of the listed companies in the "prudent" region is lower than the rates in other regions.

Table 6: Different capital structure intervals with their corresponding sample sizes and mean tax rate

Year	0%-20%		20%-40%		40%-60%		60%-80%		80%-100%	
	n	Tax rate (%)	n	Tax rate (%)	n	Tax rate (%)	n	Tax rate (%)	n	Tax rate (%)
2000	142	16.390	150	16.950	44	17.100	1	33.000	0	0.000
2001	129	16.470	158	16.570	50	19.870	0	0.000	0	0.000
2002	115	24.710	156	25.670	63	27.080	3	33.000	0	0.000
2003	94	24.250	164	26.010	77	29.890	2	33.000	0	0.000
2004	93	24.330	168	26.730	74	26.460	2	24.000	0	0.000
2005	83	23.920	182	27.070	71	26.480	1	15.000	0	0.000
2006	96	25.100	169	27.020	69	28.260	3	21.000	0	0.000
2007	104	26.810	162	26.700	68	27.750	3	21.000	0	0.000
2008	98	21.440	157	22.040	74	21.420	8	21.630	0	0.000
2009	121	20.820	138	21.800	72	20.970	6	20.420	0	0.000
2010	132	21.590	129	21.120	63	22.060	12	21.460	1	20.000

Correlation test

Table 7 lists Pearson's correlation coefficients matrix for each variable in the regression equation and Spearman's correlation coefficient matrix. It is worth noting that, none of the

paired correlation coefficients between variables exceeded 0.8. This means that there is no existence of multicollinearity among variables in the regression equation.

Table 7: The correlation coefficient matrix of the variables

Variables	ADRI	ETR	GROW	CF	SIZE	ROE
ADRI	1.000	0.110***	-0.017	-0.141***	0.111***	-0.101***
ETR	0.112***	1.000	0.035**	0.033**	0.026	0.010
GROW	-0.008	0.026	1.000	0.030*	-0.022	0.016
CF	-0.114***	0.049***	0.114***	1.000	0.048***	0.007
SIZE	0.116***	0.027*	0.125***	0.072***	1.000	0.123***
ROE	-0.095***	-0.010	0.146***	0.191***	0.375***	1.000

Notes: Above the main diagonal are the Pearson correlation coefficients, and below are the Spearman correlation coefficients.***,**and* represent two-tailed test significance level of 1%,5%,10%, respectively.

Regression analysis

From Table 8, it can be seen that, effective tax rate and interest-bearing debt ratio of the companies in group G1 are positively correlated at the 0.05 significance level. This conclusion verifies hypothesis 1. It shows that, with stable operating cash flow, an enterprise will indeed choose the capital structure based on tax rate. In group G22, effective tax rate and interest-bearing debt ratio at the 0.01 significance level are positively correlated, while the relationship between effective tax rate and interest-bearing debt ratio is insignificant in G21 and G23, which proves hypothesis 2a and 2b. This means that, when the operating cash flow is unstable, there exist differences on the impact of income tax on the capital structure.

Considering the two hypotheses, the above premises have been proven. It can be established that, the optimal capital structure decision-making model based on the trade-off theory and prospect theory under the influence of cognitive bias can explain the impact of income tax on the capital structure decisions of the Chinese listed companies. Specifically: first, when the operating cash flow is stable, the company's awareness of the financial distress costs is unbiased, hence, the company will choose capital structure based on tax rates and other factors as described in trade-off theory. Second, when the operating cash flow is unstable, the company's awareness of the financial distress costs will be biased. When the amount of liabilities is small, the company will overestimate the financial distress cost changes caused by the liabilities changes. When the amount of liabilities is relatively large, the company will underestimate the financial distress cost changes caused by the

liabilities changes. Last, if the cognitive bias is not serious, there exists a subjective optimal capital structure, and this particular optimal capital structure is related to tax rate. If cognitive bias exceeds to a certain extent, from an enterprise's point of view, the optimal capital structure is 0 (zero) liability or 100% liability. The capital structure at this point is unrelated to tax rate.

Table 8: Regression analysis results

Variables	G1	G21	G22	G23
Constant	-0.259***	-0.147	-0.188	-0.393***
	(-2.885)	(-1.172)	(1.421)	(-3.015)
ETR	0.085**	0.085	0.321***	0.104
	(1.961)	(1.106)	(4.575)	(1.062)
GROW	0.013**	-0.003	0.001	0.001
	(2.144)	(-0.486)	(0.690)	(0.810)
CF	-0.136**	-0.387***	-0.332***	-0.235***
	(-2.043)	(-4.833)	(-5.758)	(-5.786)
SIZE	0.026***	0.020***	0.001	0.025***
	(6.376)	(3.639)	(0.257)	(4.480)
ROE	-0.002***	-0.002***	-0.001**	-0.001***
	(-5.416)	(-4.059)	(-2.307)	(-4.548)
INDU	Control	Control	Control	Control
YEAR	Control	Control	Control	Control
F	7.702***	4.114***	7.702***	5.272***
Adj-R2	0.083	0.108	0.176	0.158
N	1848	616	627	616

Notes: The maximum value for regression variables' "Variance Inflation Factor" (VIF) for each group is 1.402, far less than 10. This further indicates that, there is no serious multicollinearity in the regression equation. However due to limited space, they are not repeated in the table. ***, ** and * represent two-tailed test significance level of 1%, 5%, 10%, respectively.

CONCLUSION AND IMPLICATIONS

At present, there is a big debate among scholars in the academic spheres about the relationship between capital structure and tax rate. This paper, from a behavioral finance perspective, attempts to shed more light on this debate. It has established an optimal capital-

structure decision model for maximizing subjective value of the enterprise's decision-maker based on trade-off theory and prospect theory, and, examined the relationship between capital structure and income tax in Chinese listed companies. This study uses a sample of data collected from 337 Chinese listed companies in the period 2000-2010 and constructs a multiple regression model that considers; cognitive bias, corporate growth, corporate size, and other related factors. We find that: First, Chinese listed companies prefer to choose prudent debt policy, which supports Graham (2000) assertion. Second, tax benefit is an important factor affecting capital structure of Chinese listed companies. Moreover, when the operating cash flow is stable, debt ratio and tax rate become positively correlated. Last but not least, when operating cash flow is unstable, the financial distress costs awareness of the decision-maker is biased, causing the optimal capital structure to be determined in a biased manner as well. Therefore, the relationship between income tax and capital structure differ from the description of the classic trade-off theory. Specifically, when the financial distress cost is; low, medium, or high, enterprises tend to take moderate, prudent, or aggressive debt policies and the relationship between tax rate and debt rate is; positively correlated, no correlation, and no correlation, respectively.

This paper incorporates cognitive bias into the study of capital structure and tax rates. It analyzes the relationship between capital structure and income tax through model derivation and empirical tests, hence has certain theoretical value and practical significance. Combining the research findings, the following implications can be obtained: financial distress cognitive bias is likely to be an important reason for the Chinese listed companies to adopt excessively prudent or exceedingly aggressive debt financing. The sensitivity of capital structure is insignificant towards tax rate due to managers' cognitive bias towards financial distress cost. Listed companies should do more objective assessment of; tax revenues, financial distress costs, and capital structure, and timely adjust excessively prudent or exceedingly aggressive debt policies so as to better utilize tax benefits and thus maximize enterprise value. Listed companies with high operating cash flow volatility are more vulnerable to the impact of financial distress cognitive bias when choosing capital structure. These companies should adopt improved financing decision-making mechanisms and other mechanisms to minimize such cognitive bias. Listed companies' capital structure decision-makers should re-examine their decision-making procedures in order to discover and correct the irrational behaviors. Banks and other creditors should also pay more attention in identifying and preventing loan companies from exercising exceedingly aggressive debt policies.

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