

Does information asymmetry lead to higher debt financing? Evidence from China during the NTS Reform period

NTS Reform
period

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Abstract

Purpose – The purpose of this paper is to test an implication of the pecking order theory to explain capital structure decisions among Chinese listed companies during the 2005-2007 NTS Reform transition period.

Design/methodology/approach – The authors utilize direct proxies for information asymmetry based on microstructure models including Probability of the arrival of informed trades (PIN), Adverse selection component of the bid-ask spread (λ), Illiquidity ratio (ILLIQ) and liquidity ratio, and Information asymmetry index (InfoAsy) to examine their relation with firms' debt financing.

Findings – Consistent with the prediction of Pecking Order Theory, the authors find that companies for which stock investors are challenged with more severe informational disadvantages are associated with higher degree of leverage use.

Originality/value – The study provides a more direct test on the positive relation between information asymmetry and financial leverage of Chinese firms. In contrast to previous findings by Chen (2004), the results suggest that capital structure choices among Chinese firms progressively conform to conventional finance theories (e.g. Pecking Order Theory) with the decline of non-tradable shares.

Keywords Pecking order, Capital structure, Asymmetric information, Chinese market NTS Reform

Paper type Research paper

1. Introduction

The choice between debt vs equity is one of the major corporate finance decisions, as it directly impacts on a corporation's cost of capital and, therefore, its value. While generally providing the lower cost of capital, the benefit of debt financing is also linked to its ability to reduce the adverse impact of equity issuances. According to the pecking order theory,

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Myers (1984) and Myers and Majluf (1984) assert that, since management are presumably equipped with better information about the firm's prospects, they face difficulty in convincing outside investors that they will not be paying for overpriced stocks. This forces firms to issue equity at a price lower than its intrinsic value. Firms with higher degrees of information asymmetry (e.g. lower corporate governance quality) will be more harshly penalized through deeper discounting of their equity issuances. Thus, the pecking order theory predicts that firms with a higher degree of information asymmetry are associated with higher levels of debt usage, all other things being equal.

While the pecking order theory has proven to explain capital structure choices among corporations worldwide, it is at odds with the findings of Chen (2004). The author reports the new pecking order of which firms prefer the use of retained earnings, new equity issuances, and long-term debt accordingly. We conjecture that the unconventional preference of equity issuance over long-term debt may stem from the fact that Chen (2004) study period is during the time when non-tradable shares (NTS) (predominantly owned by the state). Since these NTS investors are less subject to information asymmetry problem, firms are generally less adversely impacted by new equity issuances. This gives rise to the finding that information asymmetry may not lead to higher debt financing in China (and thus less needs to use debt financing to reduce the adverse selection problem faced by equity investors).

Our paper aims to empirically investigate whether Chinese corporations conform to the pecking order theory once NTS are revoked during the 2005-2007 NTS Reform period. With the NTS Reform, NTS (which contribute to a big proportion in Chinese capital market) are converted into tradable shares and become subject to information asymmetry problem. In this new environment, the role of information asymmetry on debt financing choices should become more prominent. In other words, we should detect a positive relation between information asymmetry and net debt issuances, as predicted by the traditional pecking order theory. Having mentioned that, directly testing the information aspect of a firm's capital structure decisions is challenging due to the lack of a direct measure on information asymmetry. Recent developments in microstructure research have, however, provided new tools for researchers to detect the degree of information asymmetry faced by stock investors. Bharath *et al.* (2009) are the first to apply such techniques to test the pecking order theory. In their study, the positive relation between asymmetric information and leverage use is confirmed among US firms.

We apply Bharath *et al.* (2009) techniques to investigate how information asymmetry affects the new debt issuances of Chinese listed firms in the years 2005 to 2007 NTS Reform transition period[1]. The ability of the pecking order theory to explain firms' financing choices depends heavily on the stock market's ability or incentive to produce information. The latter should be systematically promoted with the lifting of NTS. There is another reason why a study in the Chinese market is particularly interesting. First, it has been argued that share manipulation and insider trading are rampant in Chinese capital markets, while investor protection rights are not legally codified (see, e.g. Chakravarty *et al.*, 1998; Chan *et al.*, 2008). In such a highly opaque informational environment, one should expect to find stronger (not weaker as documented by Chen, 2004) evidence in support of the pecking order theory. We study if this is the case when the capital market becomes more conventional (e.g. the disappearances of NTS).

Using a rigorous measure of information asymmetry based on microstructure models, it is proven in this paper that Chinese firms, for which stock investors are more adversely affected by informational disadvantages, are associated with higher debt usage. This is now consistent with the pecking order theory and in contrast to the findings of previous studies. In the model, which addresses the endogeneity issue between leverage

and information asymmetry, about 75 percent of the cross-sectional variation in debt usage among Chinese firms during the 2005 to 2007 period (the NTS Reform period) can be explained.

The results stress the significant role of financial markets on real economic activity. Chen *et al.* (2007) and Bakke and Whited (2010) find that firm managers learn about their firms' fundamentals from the private information in stock prices and incorporate this information into corporate investment decisions. These findings add support to the argument that the effect of financial markets on the real economy is not merely a sideshow (Morck *et al.*, 1990; Stein, 1996). Overall, our findings also point to the success of Chinese NTS Reform in making its capital market more efficient.

The paper is organized as follows. The next section provides a brief background on previous studies that empirically test the pecking order theory. Section 3 describes the data and information asymmetry measures. Section 4 presents the empirical analyses and findings, while Section 5 concludes the paper.

2. Existing empirical studies on the pecking order theory

There are two groups of studies with respect to the empirical testing of the pecking order theory. The first group focuses on the key prediction of the model: The order of companies' financing choices. Current supportive evidence is mixed. In a simple regression of a firm's net debt issued on the financing deficit, the slope coefficient captures the effect of a one dollar increase in deficits on the proportional increase in debt financing. The pecking order theory implies that this coefficient is close to unity. Shyam-Sunder and Myers (1999) find the pecking order β to be 0.75 in a sample of 157 large US firms and conclude that the pecking order is an excellent first-order descriptor of corporate financing behavior. Using a more comprehensive sample of US firms, Frank and Goyal (2003) find that the slope coefficient is significantly less than one and that the pecking order model has lost its explanatory power over the years (0.28 for the period 1971 to 1989, but 0.15 for the period 1990 to 1998). They also find that the pecking order behavior appears to be a better approximation for larger firms. This is counterintuitive to asymmetric information being the driver of the pecking order, as in Myers and Majluf's (1984) model, because information asymmetry is likely to be more severe among smaller firms. Whether the pecking order theory explains capital structure behaviors among firms is still an on-going debate. Agca and Mozumdar (2007) and Lemmon and Zender (2010) find evidence in favor of the pecking order theory when they control for firms' debt capacities. On the other hand, Leary and Roberts (2010) find evidence that, even when controlling for debt capacity, the pecking order theory is unable to characterize even half of firms' financing decisions.

In most capital structure studies, the test of pecking order theory relies on the negative relation between "leverage" and "firms" profitability usually measured by return on equity and return on assets that is shown in a regression model. This is potentially flawed for several reasons. For example, studying the Chinese corporations during the 1995 to 2000 period (several years prior to the NTS Reform), Chen (2004) reports the negative relation between leverage and profitability among Chinese firms but importantly notes that it does not necessarily support the pecking order theory. Mispricing of the new projects or avoidance of underinvestment problems can also lead to the negative relation between the two variables[2]. This is consistent with more recent literature that attempts to directly test the core assumption of the pecking order theory altogether. Specifically, the tests should directly tackle whether information asymmetry is a determinant of capital structure decisions for firms. Bharath *et al.* (2009) construct an information asymmetry index based on several microstructure measures of adverse selection and test the relation between information asymmetry and firms' capital structure decisions. They find that a

firm-specific level of information asymmetry affects a firm's debt issuances to finance its deficits. In the USA, firms in the highest adverse selection decile issue 30 cents more debt than firms in the lowest decile, corresponding to a one dollar increase in the financing deficit.

3. Data and variable measurement

3.1 Data

This study examines all listed companies on the Shenzhen Stock Exchange from 2005 to 2007. To arrive at the final sample of 428 companies, the following data are eliminated: financial companies; companies that fell into the category special treatment[3]; and companies with missing data required for empirical analyses. The annual financial information and daily trading information is retrieved from the China Stock Market & Accounting Research Database, which is compiled according to the format of CRSP and Compustat by GTA Information Technology Company Limited. The Chinese microstructure data, including intraday trades and quote data, which are essential for constructing an information asymmetry index, are drawn from the China Center for Economic Research database.

3.2 Measuring information asymmetry

Following Bharath *et al.* (2009), the study here measures cross-sectional variation in asymmetric information based on the microstructure literature, which focuses on the adverse selection component of market liquidity provision. These microstructure variables capture the extent to which potential losses will be incurred by liquidity providers when transacting with better-informed traders. There are four different adverse selection variables used in the analysis. The first variable draws inferences about adverse selection, based on the estimation of structural models of the arrival of informed trades in the market. The second variable focuses on the temporary price effect as a source of the extent of adverse information. The fourth and the fifth variables belong to the same group, which estimates adverse selection based on the interaction between trading volume and stock returns. More detailed information regarding these variables will be provided in the following sections, which are about the construction of various information asymmetry measures and an information asymmetry index based on the first principle component approach.

3.2.1 Probability of the arrival of informed trades (PIN). The first variable, PIN, was developed by Easley *et al.* (1996) to measure (*ex post*) the probability that transactions occur based on private information. The basic idea behind the measure is that, on each trading day, trades can come from noisy (uninformed) traders, or from informed traders. The daily arrival rate of uninformed buys and sells is denoted by ε_b and ε_s , respectively. The probability that an information event occurs is α , in which case the probability of bad news is δ and the probability of good news is $(1-\delta)$. If an information event occurs, the arrival rate of informed traders is μ . Let $\theta = \{\varepsilon_b, \varepsilon_s, \alpha, \delta, \mu\}$. The likelihood function for a single trading day is given by:

$$\begin{aligned} L(\theta|B, S) = & (1-\alpha)e^{-\varepsilon_b} \frac{\varepsilon_b^B}{B!} e^{-\varepsilon_s} \frac{\varepsilon_s^S}{S!} + \alpha\delta e^{-\varepsilon_b} \frac{\varepsilon_b^B}{B!} e^{-(\mu+\varepsilon_s)} \frac{(\mu+\varepsilon_s)^S}{S!} \\ & + \alpha(1-\delta)e^{-(\mu+\varepsilon_b)} \frac{(\mu+\varepsilon_b)^B}{B!} e^{-\varepsilon_s} \frac{\varepsilon_s^S}{S!}, \end{aligned} \quad (1)$$

where B is the number of buy orders and S is the number of sell orders in a single trading day. Assuming independence across trading days, and estimating trade data over i days,

the parameters of the model (ε_b , ε_s , α , δ , μ) can be obtained by maximizing the following likelihood function:

$$V = L(\theta|M) = \prod_{i=1}^I L(\theta|B_i, S_i). \quad (2)$$

Then, the probability of informed trading in a given stock for a given period, which determines the PIN measure, is:

$$\text{PIN} = \frac{\alpha\mu}{\alpha\mu + \varepsilon_s + \varepsilon_b}, \quad (3)$$

where $\alpha\mu + \varepsilon_s + \varepsilon_b$ is the daily arrival rate of all orders and $\alpha\mu$ is the arrival rate of information-based trades. The PIN measure for each firm is estimated on an annual basis. The larger the estimated $\text{PIN}_{i,t}$, the greater the intensity of information asymmetry about firm i in year t .

3.2.2 Adverse selection component of the bid-ask spread (λ). Lin *et al.* (1995) develop empirical estimates of the temporary price effect in response to a trade. The magnitude of the temporary price effect depends on three variables: the extent of adverse information (λ); the pattern of order arrivals (θ); and the size of the effective spread (z). The decomposition is in line with other studies (e.g. Glosten and Harris, 1988) that decompose the bid-ask spread into its adverse information component (λ) and dealer gross profit component ($1-\lambda-\theta$). λ , measuring the extent of the adverse selection cost component, or the bid-ask spread, is the focus here and can be estimated using the following regression:

$$Q_{t+1} - Q_t = \lambda z_t + \varepsilon_{t+1}, \quad (4)$$

where Q_t is the quote midpoint at time t , $Q_t = \text{LN}[(\text{Bid}_t + \text{Ask}_t)/2]$, and z_t is one-half the signed effective spread with $z_t > 0$ for a buy order and $z_t < 0$ for a sell order. $z_t = \text{LN}(P_t) - Q_t$, where P_t is the transaction price at time t . λ is also aggregated to an annual basis. The larger the $\lambda_{i,t}$, the greater is the intensity of information asymmetry for firm i in year t .

3.2.3 Illiquidity ratio (ILLIQ) and liquidity ratio (LR). Amihud's (2002) illiquidity measure (ILLIQ) follows Kyle's (1985) price impact definition of liquidity (Kyle's λ). This measure is intuitively appealing in the sense that it measures the daily price impact of the order flow; this being the concept of illiquidity, it quantifies the price/return response to a given size of trade. The annual ILLIQ here is calculated as the average daily ratio of the daily absolute return to the (dollar) trading volume on that day:

$$\text{ILLIQ}_{i,t} = \frac{1}{D_{i,t}} \sum_{d=1}^{D_{i,t}} \sqrt{\frac{|R_{itd}|}{\text{VOLD}_{itd}}}, \quad (5)$$

where R_{itd} is the return on stock i on day d of year t and VOLD_{itd} is the respective daily volume in dollars (in millions). $D_{i,t}$ is the number of days for which data are available for stock i in year t .

Cooper *et al.* (1985) and Amihud *et al.* (1997) use the LR, also called the Amivest measure of liquidity, to measure the trading volume associated with a unit change in the stock price. To measure illiquidity, we use negative LR. The annual LR measure is thus defined as:

$$\text{LR}_{i,t} = -\frac{1}{D_{i,t}} \sum_{d=1}^{D_{i,t}} \sqrt{\frac{\text{VOLD}_{itd}}{|R_{itd}|}}. \quad (6)$$

This illiquidity measure is strongly related to the LR. Holding all other factors equal, as the $ILLIQ_{i,t}$ and $LR_{i,t}$ increase for firm i in year t , the extent of adverse selection increases and stock liquidity declines.

3.2.4 Information asymmetry index (InfoAsy). Finally, Hasbrouck (2005) argues that there is no single measure that captures all dimensions of liquidity. The four information asymmetry proxies capture different dimensions of market liquidity that are determined by the adverse selection. Each proxy is likely to include an information-asymmetry component as well as idiosyncratic, non-information-related components. To construct a variable that is able to capture much of the common variation among the four measures, we follow Bharath *et al.*'s (2009) principal component approach to estimate the first principal component of the correlation matrix of the four measures mentioned previously. The first principal component explains, on average, more than 40 percent of the cross-sectional sample variance, which will be utilized as the key explanatory variable in the following analysis. In this study the first principal component is denoted as the information asymmetry index (InfoAsy).

Panel A of Table I provides summary statistics of the four measures conceptually related to the extent of information asymmetry about firm i in year t . The means are of the expected sign (positive for $PIN_{i,t}$, $\lambda_{i,t}$, and $ILLIQ_{i,t}$ and negative for $LR_{i,t}$) indicating the presence of information asymmetry in the Chinese market for the covered sample period. Panel B provides the correlation coefficient matrix of the four information asymmetry measures and the information asymmetry index estimated from the four measures using a principal component approach. The results indicate positive correlations between the four proxies for firm-level information asymmetry, with the exception of $PIN_{i,t}$ and $\lambda_{i,t}$, and $ILLIQ_{i,t}$ and $\lambda_{i,t}$. This suggests that $\lambda_{i,t}$ shares the least common properties with other measures. More importantly, the information asymmetry index InfoAsy is positively correlated to all of the individual information asymmetry measures. The highest correlation appears in the measure of $ILLIQ_{i,t}$.

4. Empirical analyses

4.1 A direct test of the pecking order theory

To test the pecking order theory, Shyam-Sunder and Myers (1999) test the relation between net debt issuance for firm i in year t (ΔD_{it}) and the firm's financing deficit (DEF_{it}). A simple regression model is presented as follows:

$$\Delta D_{it} = \alpha + \beta DEF_{it} + \varepsilon_{it}, \tag{7}$$

Table I.
Summary statistics
and correlation matrix
on asymmetric
information measures

Panel A: Summary statistics

Variable	Obs.	Mean	SD	Median
PIN_{it}	1,044	0.1	0.08	0.1
$ILLIQ_{it}$	1,044	0.1	0.09	0.1
LR_{it}	1,044	-16.1	8.5	-14.0
λ_{it}	1,044	0.02	0.02	0.01
InfoAsy _{it}	1,044	0.0	1.00	0.03

Panel B: Correlation matrix

	InfoAsy _{it}	PIN_{it}	λ_{it}	$ILLIQ_{it}$	LR_{it}
InfoAsy _{it}	1.00				
PIN_{it}	0.03***	1.00			
λ_{it}	0.24***	-0.06	1.00		
$ILLIQ_{it}$	0.43***	0.09***	0.03	1.00	
LR_{it}	0.32***	0.07*	0.22***	0.51***	1.00

Notes:

*** ** *Statistical significance at the 10, 5 and 1 percent levels, respectively

where ΔD_{it} is defined as the difference between long-term debt and long-term debt reduction, while DEF_{it} is given by the following equation:

$$DEF_{it} = \beta_1 DIV_{it} + \beta_2 CAPINV_{it} - \beta_3 CF_{it} \quad (8)$$

where DIV_{it} is the dividend payments, $CAPINV_{it} = CAPEX_{it} + \Delta WC_{it}$, $CAPEX_{it}$ is capital expenditure, ΔWC_{it} is the net increase in working capital, and CF_{it} is operating cash flows after interest and taxes.

If the pecking order theory is true, it is expected that $\alpha = 0$ and $\beta = 1$. The pecking order coefficient is β . Note that the pecking orders predictions do not depend on the sign of DEF_{it} (Shyam-Sunder and Myers, 1999).

Since the pecking order prediction is driven by asymmetric information, it is expected that there will be a cross-sectional variation in pecking order coefficients across stocks or companies, with different levels of information asymmetry. In other words, the absolute value of the pecking order coefficient ($|\beta|$) should increase with the degree of information asymmetry.

To empirically test the above expectation, the sample firms are sorted into three groups (of equal numbers) based on their information asymmetry index (InfoAsy) during the entire study period (2005 to 2007). Regressions (7) and (8) are then applied to obtain estimated pecking order coefficients, β for each group. If the pecking order theory provides an accurate description of a firm's financing behavior (i.e. the level of information asymmetry is the driving force of the firm's capital structure decisions), then it is expected that there will be an increasing and monotonic ordering of the pecking order coefficient β across groups. Furthermore, the difference in the β between the high and low groups should be positive and significant. The results, reported in Tables II and III, are consistent with this hypothesis.

With the exception of the InfoAsy group (as reported in Table III), all estimates of β in Equation (7) for the three InfoAsy-sorted groups (as reported in Table II), and estimates of β_1 , β_2 , and β_3 in Equation (8), are positive, smaller than one, and statistically significant at the 1 percent level. This result is consistent with the predictions of the pecking order theory. More importantly, Tables II and III indicate that the β coefficients are nearly monotonically increasing in the severity of firms' information asymmetry. For instance, the estimate of β in Table II is 0.06 for the low information asymmetry group, 0.23 for the medium information asymmetry group, and 0.36 for the high information asymmetry group.

Further, Table II shows that the difference between the β coefficients for the two extreme groups of firms (the high-low β column) is large (0.1) and strongly statistically significant (t -statistic = 4.1). The test of the difference in β between the high InfoAsy group and the low InfoAsy group follows two steps. First, all observations of firms in the two groups in Equation (7) are pooled. An interaction term is then added between DEF_{it} and a dummy

	Firms sorted by InfoAsy			High-low	F-stat
	Low	Med	High		
β	0.06**	0.23***	0.36***	0.1***	12.94***
$t(\beta)$	2.75	9.27	16.88	4.11	(0.00)
R^2	2%	20%	45%		

Notes: This table reports the regression coefficients from regression in Equation (7). Net debt issuance for firm i in year t is denoted as ΔD_{it} , while the firm's financing deficit is represented as DEF_{it} . We sort firms into three groups (of equal numbers) based on their level of information asymmetry index (InfoAsy) during the entire study period (2005 to 2007). The information asymmetry index (InfoAsy) is the first principal component of four microstructure proxies described in Section 3. *, **, ***Statistical significance at the 10, 5 and 1 percent levels, respectively

Table II.
The relation between
net debt issuance
and the firm's
financing deficit: a
sub-group analysis

Table III.
Firms' financing
deficit regression

	Firms sorted by InfoAsy				<i>F</i> -stat
	Low	Med	High	High-low	
β_1	-0.06	0.45***	0.48***	0.46***	46.44
<i>t</i> (β)	-0.02	3.08	4.38	4.66	(0.00)
β_2	0.24	0.24***	0.39***	0.27***	72.04
<i>t</i> (β)	0.09	7.26	13.61	11.76	(0.00)
β_3	0.39***	-0.22***	-0.37***	-0.25***	65.13
<i>t</i> (β)	6.61	-5.67	-12.08	-9.45	(0.00)
R^2	22%	20%	51%		

Notes: This table reports the regression coefficients on the firm's financing deficit DEF_{it} in Equation (8). Where DIV_{it} is the dividend payments, $CAPINV_{it} = CAPEX_{it} + \Delta WC_{it}$, $CAPEX_{it}$ is the capital expenditure, ΔWC_{it} is the net increase in working capital, and CF_{it} is operating cash flows after interest and taxes. Firm categorization is in the same pattern as described in Table II. *, **, ***Statistical significance at the 10, 5 and 1 percent levels, respectively

variable, which takes the value of 1 if a firm-year observation belongs to the high InfoAsy group, and 0 otherwise. The coefficient of the interaction term captures the incremental effect of DEF_{it} from the high InfoAsy group on ΔD_{it} . The high-low β is not necessarily equal to the difference between high β and low β . To interpret the economic significance, on average, for every Yuan of financing deficit to be covered, firms in the high InfoAsy group issue 0.1 Yuan more debt than do firms in the low InfoAsy group. These results clearly indicate that the financing needs of a firm that are satisfied by the issuance of debt are an increasing function of the level of a firm's information asymmetry, which is consistent with the pecking order theory.

4.2 Does information asymmetry matter as a determinant of capital structure?

The above analysis is based on the variation in coefficient estimates of pecking order regressions across firms, when sorted by their information asymmetry proxies. In this section, a more conventional specification is employed to test the determinants of a firm's capital structure. The dependent variable is LEV_{it} , which includes book total debt ratio (DA); defined as total debt (short-term plus long-term) divided by total debt plus book value of equity; and market total debt ratio (DMA); defined as total debt (short-term plus long-term) divided by total debt plus market value of equity.

To ascertain the effect of information asymmetry on a firm's capital structure, it is useful to distinguish between information asymmetry variables and other attributes that are suspected of being correlated with managerial financial decisions. Theoretical and empirical studies have suggested a series of potential attributes, including a firm's profitability, tangibility, growth opportunities, size, and ownership structure (institutional ownership and stated ownership).

The pecking order theory suggests that firms prefer to finance new investments from retained earnings and raise debt, or equity capital, only if internal resources are insufficient. As the ability to retain earnings depends on profitability, it is expected that there will be an inverse relation between leverage and profitability (Rajan and Zingales, 1995).

A negative relation is also expected between growth opportunities and leverage for two reasons. In the case of bankruptcy, tangible assets are more likely to have a higher value than intangible assets. Furthermore, tangible assets can be used as collateral, reducing agency costs of debt and the cost of borrowing (Stulz and Johnson, 1985). This suggests a positive relation between leverage and the tangibility of assets.

It is widely accepted that firm size is inversely correlated with the probability of bankruptcy, and larger firms have greater capability for debt financing. Larger firms are

likely to have less information asymmetry. Hence, larger firms will have greater access to debt markets with lower costs of borrowing. Therefore, a positive relation is anticipated between firm size and leverage.

An ownership structure that allows for active influence by large institutional shareholders will reduce agency problems between managers and shareholders, but will also increase potential agency conflicts between debtholders and shareholders. This agency problem increases the return required by debtholders and, thus, reduces the firm's "optimal" leverage ratio. Pushner (1995) observe a strong negative relation between institutional ownership and the leverage ratio of Japanese firms.

In China, prior to the 2005 to 2007 NTS Reform, the majority of listed firms are ultimately controlled by state-owned enterprises (SOEs), or other government agencies. At the end of 2003, 72 percent of Chinese listed firms were SOEs, with the largest shareholder being a government entity that owns more than 20 percent of the firm's stock (Wang *et al.*, 2008). SOEs are more likely to receive government backing in their external debt financing and preferential treatment from state banks through the granting of loans based on political, social, or tax-motivated factors (Brandt and Li, 2003). Furthermore, like unlisted SOEs, listed SOEs have relatively higher leverage than do non-state firms. A positive relation is expected between state ownership and leverage. However, NTS Reform that started in 2005 has drastically changed these. It is the interesting aspect of the NTS Reform transition period that has motivated our study.

Table IV summarizes the main determinants of capital structure used in this analysis, their definitions, and the predicted signs. The dependent variable LEV_{it} is then regressed on the information asymmetry index InfoAsy and a set of control variables:

$$\begin{aligned} LEV_{it} = & a + b_1InfoAsy_{it} + b_2Tangibility_{it} + b_3GrowthOpportunities_{it} \\ & + b_4LogSize_{it} + b_5profitability_{it} \\ & + b_7InstituionalOwnership + b_6StateOwnership + \varepsilon_{it}. \end{aligned} \quad (9)$$

Table V indicates that extrinsic information asymmetry influences the capital structure choice of a firm. The parameter estimate of InfoAsy, the measure of information asymmetry, is found to be positive and strongly significant. Based on a parameter estimate of 0.10 (0.06) for the DMA (DA) regression and the standard deviation of the InfoAsy estimates of 1, it is estimated that a one standard deviation change in InfoAsy will lead to a change in leverage of about 10.1 percent (5.9 percent). These numbers suggest that the results are both economically significant and robust to the choice of leverage measures (market value or book value). Other variables produce coefficients expected in previous capital structure theories (the trade-off model, the bankruptcy cost, and the agency cost model), with an exception only for state ownership. It is also worth noting

Table IV.
Determinants of
capital structure,
definitions, and
predicted signs

Proxy (Abbreviation)	Definitions	Predicted signs
Information asymmetry index (InfoAsy)	The first principal component of PIN, λ , ILLIQ and LR	+
Tangibility	(Fixed assets + inventories)/total assets	+
Growth opportunities	Tobin's Q	-
Size	Natural logarithm of market capitalization	+
Profitability	Earnings before interest and tax/total assets	-
Institutional ownership	Percentage of institutional shareholding	-
State ownership	Percentage of state shareholding	+

Table V.
Determinants of
Chinese capital
structure:
2005 to 2007

	DMA (Market value)	DA (Book value)
InfoAsy	0.10***	0.06***
	13.46	7.31
Tangibility	0.09***	0.11***
	3.22	3.47
Growth opportunities	-0.03***	0.01***
	-16.55	3.92
Size	0.13***	0.11***
	20.41	15.96
Profitability	-0.24***	-0.34***
	-9.38	-12.08
Intuitional ownership	-0.34***	-0.07
	-7.96	-1.53
State ownership	-0.07***	-0.09***
	-3.20	-3.93
Obs.	1,044	1,044
Overall R ²	61%	38%

Notes: This table reports estimates for the b_n coefficients from firm fixed-effects regressions in Equation (9). The dependent variable is LEV_{it} and includes the book total debt ratio (DA); defined as total debt (short-term plus long-term) divided by total debt plus book value of equity; and the market total debt ratio (DMA); defined as total debt (short-term plus long-term) divided by total debt plus market value of equity. All other variables are described in Table IV. We do not report the coefficient for the intercept. *, **, ***Statistical significant at 10, 5 and 1 percent levels, respectively, assessed with robust standard errors adjusted for firm-level clustering

that, unlike the findings of previous studies (e.g. Chen, 2004), the growth opportunity coefficient displays a negative sign, as expected in the pecking order theory. Overall, the results suggest that capital structure choices among Chinese companies have become, over time, more in line with conventional finance theories.

4.3 Endogeneity issue

It is arguable that the relation between capital structure and information asymmetry may be bi-directional. As a result, the regression model in Section 4.2 could suffer from a simultaneity issue. For example, small firms are more likely to suffer financial constraints, because small firms tend to be young, and young firms tend to face frictions in obtaining external capital. The financial decisions are endogenously determined by firm characteristics. In the meantime, trading stocks of small firms generally incur higher transaction costs. This increases the cost of capitalizing private information and, therefore, renders informed trading in the firms' shares (Grossman and Stiglitz, 1980). For a robustness check, leverage and extrinsic information asymmetry are allowed to be jointly determined, and potential endogeneity is controlled for in the relation.

The endogeneity test uses a simultaneous equation framework to test the relation between leverage and InfoAsy. The following specification is used for this purpose:

$$LEV_{it} = \alpha_0 + \alpha_1 LEV_{it-1} + \alpha_2 LEV_{it-2} + \alpha_3 InfoAsy_{it-1} + \alpha_4 controls_{it} + \varepsilon_{it}, \quad (10)$$

$$InfoAsy_{it-1} = \beta_0 + \beta_1 LEV_{it-1} + \beta_2 LEV_{it-2} + \beta_3 InfoAsy_{it-2} + v_{it}, \quad (11)$$

where the lagged value of InfoAsy is used as an instrument, and the controlled variables (controls) include all control variables used in Equation (9). The results in Table VI show that an increase in extrinsic information asymmetry is associated with an increase in leverage, after taking into account the bi-directional relation between leverage and extrinsic

	Lev(<i>t</i>)	InfoAsy(<i>t</i> −1)	NTS Reform period
Lev(<i>t</i> −1)	0.46*** 10.06	−0.04 −0.12	119
Lev(<i>t</i> −2)	−0.04 −1.03	−0.34 −1.20	
ASY(<i>t</i> −1)	0.05*** 3.89		
ASY(<i>t</i> −2)		0.40*** 15.98	
Tangibility	0.00 −0.01		
Growth opportunities	−0.01*** −4.93		
Size	0.05*** 5.75		
Profitability	−0.08*** −3.47		
Intuitiional ownership	−0.12** −2.62		
State ownership	−0.03 −1.55		
<i>R</i> ²	75%	46%	
Notes: This table reports estimates for the b_n coefficients from the following simultaneous in Equations (10)–(11). The dependent variable is LEV_{it} and includes the book total debt ratio (DA); defined as total debt (short-term plus long-term) divided by total debt plus book value of equity; and the market total debt ratio (DMA); defined as total debt (short-term plus long-term) divided by total debt plus market value of equity. All other variables are described in Table IV. We do not report the coefficient for the intercept. *, **, ***Statistical significant at 10, 5 and 1 percent levels, respectively, assessed with robust standard errors adjusted for firm-level clustering			Table VI. Simultaneous equations: determinants of Chinese capital structure: 2005 to 2007

information asymmetry. After controlling for the endogenous relation between InfoAsy and leverage, strong evidence is found that extrinsic information asymmetry is positively related to leverage.

5. Conclusion

This paper sheds further light on how firms operating in a situation of informational opacity and with less favorable debt-financing determine their capital structure. Specifically, we revisit the explanatory power of the pecking order theory on Chinese companies during the 2005–2007 NTS Reform transition period. While an influential study by Chen (2004) points to the weaker explanatory power of the pecking order theory in China during the 1995 to 2000 period, the positive relation between information asymmetry and new debt issuances reported in our study provides a strong support on the direct prediction of the pecking order theory in the Chinese stock market during the NTS Reform period. Our study is also consistent with Feng *et al.* (2007) that the debt level of Chinese companies generally increases with higher information asymmetry. However, the authors note that new debt financing in China is still low in the pre-NTS Reform period. This warrants a further investigation during the NTS Reform period (2005 and onwards) and we intend to fill this gap. Our results are both statistically and “economically” significant. The results are also robust to the inclusion of other controlled variables, simultaneity, and other issues. Importantly, the fact that asymmetric information issues in the capital market are not ignored by corporate managers and are more consistent with theoretical models implies an important shift in the interaction between Chinese corporations and capital markets promoted by the NTS Reform.

Notes

1. Our microstructure-based study involves a rather large data set as it deals with transaction-by-transaction trading activities. Thus, we limit our study to the span of three years during which researchers consider as the NTS Reform transition period.
2. Chen (2004) ultimately concludes that pecking order theory does not work in China during 1995–2000 study period.
3. Special treatment companies refer to those listed on either the Shenzhen or Shanghai Stock Exchanges that experience abnormal financial conditions. The ST system was implemented on April 22, 1998.

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Further reading

- Huang, G. and Song, F.M. (2006), "The determinants of capital structure: evidence from China", *Chinese Economy Review*, Vol. 17 No. 1, pp. 14-36.

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