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Competition, Debt Maturity, and Adjustment Speed in China: A Dynamic Fractional Estimation Approach

Sultan Sikandar Mirza [1,*], Tanveer Ahsan [2], Raheel Safdar [3] and Ajid Ur Rehman [4]

1. Waikato Management School, University of Waikato, Zhejiang University City College, Hangzhou 310015, China
2. Rennes School of Business, 35065 Rennes, France; tanveer.ashan@rennes-sb.com
3. UVAS Business School, University of Veterinary and Animal Sciences, Lahore 54000, Pakistan; raheelchattha@hotmail.com
4. Faculty of Management Science, Riphah International University, Islamabad 44000, Pakistan; ajid.rehman@gmail.com

* Correspondence: Sultan.mirza@waikato.ac.nz

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Abstract: The purpose of this study was to investigate the capital structure adjustment rate in different levels of product market competitions. We classified Chinese non-financial listed firms into highly, moderately, and less competitive firms and applied an unbiased dynamic panel fractional estimator on unbalanced panel data of 10,941 firm-year observations during the period of 1998 to 2015. We find that the adjustment rate of highly and less competitive firms towards long-term target capital structure is higher (28.2–29.1%) as compared to the adjustment rate towards short-term target capital structure (18.8–18.9%). On the other hand, the adjustment rate of moderately competitive firms towards long-term target capital structure is slower (22.3%) as compared to the adjustment rate towards short-term target capital structure (25.3%). Further, the adjustment rate of highly and less competitive firms differs significantly between long-term and short-term target capital structure, while the adjustment rate of moderately competitive firms remains steady. Highly competitive large firms follow the limited liability model to adjust their target capital structure and support trade-off theory, while both small and large firms follow the limited liability and predation models in moderately and less competitive environments, respectively.

Keywords: adjustment rate; product market competition; dynamic panel fractional estimator; China

JEL Classification: C23; G30; G32

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1. Introduction

Since the seminal works of Modigliani and Miller (1963), in opposition to their theorem of capital structure irrelevancy, there grew a consensus among scholars that capital structure matters in the real world. Subsequently, alternate theories were formulated to explain firms' choice of financing, among which the most prominent are the trade-off theory (Kraus and Litzenberger 1973), pecking-order theory (Myers 1984), agency theory (Jensen and Meckling 1976; Jensen 1986), and market timing theory (Baker and Wurgler 2002; Graham and Harvey 2001). These theories mainly state that firms aim to maintain a target capital structure that best meets their needs. However, these theories treat firms in isolation and as independent of their operating environment. Particularly, the role of product market conditions in firms' capital structure choices remains undetermined. Nonetheless, there has been increased scholarly attention towards this issue, and various studies argue that a firm's leverage choice can affect its rival's behavior subject to competitive conditions in its product market (Titman 1984; Brander and Lewis 1986; Kovenock and Phillips 1995).

Researchers have developed various approaches to explain the relationship between product market competition with financial leverage choices e.g., the limited liability model, predation model, and investment effect model. The limited liability model predicts that leverage ratio is positively associated with product market competition as the equity finance-based firms may use debt financing to strategically affect their market share. As a result, firms in an oligopoly market structure may increase their debt levels more often than firms in competitive markets as this strategic increase in debt level may either soften Bertrand price competition (Showalter 1995) or toughen Cournot quantity competition (Bolton and Scharfstein 1990; Brander and Lewis 1986).

The predation model argues that low leverage firms threaten high leverage firms, especially new entrants as they have a more vulnerable financial structure (Brander and Lewis 1986; Bolton and Scharfstein 1990; Opler and Titman 1994). Therefore, low leverage firms can engage themselves in predatory behaviors like price wars or increased output so that new entrants can be forced to leave the market. Therefore, firms can use the low leverage ratio as an incentive in a competitive market structure. Predation models predict a negative relationship between the relative use of debt and product market competition (Chevalier 1995; Jiang et al. 2015; Rajan and Zingales 1995, Titman and Wessels 1988; He and Kyaw 2018).

The investment effect model follows the pecking order and asymmetric information theory and predicts that leverage is negatively associated with market power. As internal financing is a cheaper mode of financing than debt or equity, an increase in debt ratio indicates under-investment due to the asset substitution effect (Myers and Majluf 1984; Kovenock and Phillips 1995).

The Chinese capital market is still in its development stage. Its growing importance in the world has made the Chinese economy a promising environment for investment opportunities. Unique market and ownership structures with a weak legal environment differentiate the Chinese economy from other developed and developing economies. Such attributes may suggest severe agency costs of equity and the product market concentration (Fosu 2013). Therefore, this study focused on the Chinese economy because of its unique cultural and institutional factors. Despite the introduction of split share reforms in 2005–2006, in which firms received more equity financing rights, state-ownership is more common and its debt financing ratio is higher than equity financing. As the Chinese capital market is underdeveloped, creditors' rights are still not fully protected (Jiang et al. 2015; Mirza et al. 2016; Mai et al. 2017).

Very few studies have investigated the relationship between the leverage ratio and product market competition, and different results have been found for Chinese firms. Zhu et al. (2002) find that Chinese firms follow the predation model, while Liu et al. (2003) favor the limited liability effect model. Guney et al. (2011) also favor the predation effect model for Chinese listed firms. Jiang et al. (2015) also argue that firms invest more when facing high competition in a growing economy. They also suggest that industry-leading firms with high predation risk are more likely to invest. Most of the studies exhibit a linear relationship between capital structure and market power. However, Panday (2004) finds a positive non-linear (cubic) relationship between leverage and market power in Malaysian listed firms.

This study used an unbalanced panel dataset of non-financial firms listed on the Chinese stock market over the period of 1998 to 2015 to analyze the relationship between leverage adjustment and product market competition. This study contributes to the existing literature in at least two ways. First, prior studies (e.g., Guney et al. 2011; Ghose and Kabra 2020) used GMM estimation to control endogeneity problems and to determine the adjustment speed towards target capital structure in Chinese firms. However, GMM estimation does not control the unobserved heterogeneity in unbalanced panel data. Unlike other studies, we used an unbiased estimator, i.e., the dynamic panel fractional (DPF) model, which incorporates the fractional nature of debt ratio, i.e., it is bounded between 0 and 1. This model controls for unobserved heterogeneity and unbalanced panel bias (Elsas and Florysiak 2015). Second, most of the studies used firm-level variables while studying the relationship between competition and capital structure (see, for example, Pandey 2004; Fosu 2013; Mitani 2014;

Chang et al. 2015). In contrast, this study also considers country-level factors, which are also important factors that can affect the capital structure of the firms. Our results show some interesting findings. This study finds that the adjustment rate of highly and less competitive firms differs significantly between long-term and short-term target capital structure, while adjustment behavior of smaller, moderately competitive firms follows the predation model.

This paper is constructed as follows. Section 2 presents a theoretical framework. Section 3 discusses data, variables, and methodology. Section 4 illustrates the empirical results and discussions, while Section 5 concludes this study.

2. Literature Review and Hypothesis Development

The capital structure irrelevancy theorem of Modigliani and Miller (1963), which postulates that capital structure is irrelevant to firm value, is based on a set of assumptions (i.e., the absence of taxes, bankruptcy costs, agency costs, asymmetric information, and market inefficiency), which are invariably violated in the real world. Therefore, the MM theorem inherently implies that in the real world, capital structure does matter, and there is a consensus among scholars that firms decide on a strategic capital structure that best matches their needs. Hence, there exists a target or "optimal" capital structure that firms aim to achieve and maintain (Bradley et al. 1984; Kraus and Litzenberger 1973; Scott 1976). Consequently, a number of theories (trade-off theory, pecking-order theory, agency theory, and market timing theory) have emerged over time to rationalize firms' choice of optimal capital structure and their preferred financing modes.

The target or optimal capital structure differs among firms as each firm attempts to best match its leverage choice with its specific needs. The extant literature identifies a number of firm-specific factors affecting a firm's degree of leverage including profitability, tangibility, non-debt tax shields, growth opportunities, firm size, volatility, bankruptcy probability, and uniqueness of the product, etc. (Frank and Goyal 2009; Harris and Raviv 1991; Titman and Wessels 1988; Titman 1984). Moreover, a recent stream of literature suggests that, apart from firm-specific factors of leverage, a firm's leverage choice is also influenced by its industry dynamics, particularly the state of rivalry among firms. The work of Opler and Titman (1994) is among the earliest empirical studies presenting evidence of interaction between leverage and firms' competitive environment. They show that in periods of industry downturn in a competitive market, the highly leveraged firms concede their market shares to conservatively leveraged firms and also experience a decline in their equity value. The existing theoretic literature has identified several models (e.g., limited liability model, predation model, and investment effect model) that rationalize how a firm may employ leverage as a tool to improve its standing in a competitive market or how the market competitiveness may affect a firm's capital structure choices.

The limited liability model of debt financing (Brander and Lewis 1986) links firms' financing decisions with their output decision in an oligarchic market. The model proposes that the limited liability provisions of debt financing provide highly leveraged firms with incentives to adopt more aggressive output strategies. Equity holders value the chances of raised returns under good states higher than the chances of reduced returns under bad states as the debtors are the residual claimants in case of bankruptcy. Therefore, the limited liability model suggests that a firm may strategically use its capital structure to increase its power in the product market and, hence, suggests a positive relationship between leverage and product market competition. Conversely, the predation model proposes that in competitive markets, financially strong firms with "deep pockets" may pick upon a highly leveraged firm (or a financially fragile new entrant) by pursuing aggressive strategies (price war or increased output) aimed at reducing targeted firm's cash flows leading to its eventual bankruptcy or market exit (Bolton and Scharfstein 1990; Brander and Lewis 1986; Opler and Titman 1994; Telser 1966). The predation model, as opposed to the limited liability model, suggests a negative relationship between leverage and market power as it suggests that a firm would want to maintain low leverage to survive in a competitive market. The empirical literature on the subject also offers mixed results. Some studies suggest a negative relationship (Barclay and Smith 2005; Chevalier 1995; Rajan and

Zingales 1995; Titman and Wessels 1988), while others find a positive relationship (Michaelas et al. 1999; Kovenock and Phillips 1995; Rathinasamy et al. 2000) between firms' leverage and their market power. However, the limited liability model and predatory model complement each other in that both predict further intensified competition and increase in leverage. The former suggests that highly leveraged firms increase output, and the latter suggests that less leveraged firms may employ more leverage to pursue predatory strategies. Therefore, we developed the following testable hypothesis.

Hypothesis 1a. *High product market competition is associated with high leverage.*

Hypothesis 1b. *High product market competition is not associated with high leverage.*

Next, continuing with the earlier presented postulation that firms choose and maintain a target capital structure, we sought to investigate if product market competition may affect how effectively firms maintain their targeted capital structure. There exists sufficient empirical evidence that firms' capital structures are stable over time (Lemmon and Zender 2019), indicating that firms keep adjusting their capital structure towards a target (Hovakimian et al. 2004; Antoniou et al. 2008). Though rapid adjustments towards a targeted capital structure are desirable to maximize the associated benefits, firms' timing and speed of adjustment in capital structure are conditioned by the costs associated with such an adjustment. Moreover, the adjustment speed may be less than optimal due to managerial slack in firms with high agency conflict. However, product market competition can effectively force managers to reduce their managerial slack (Chang et al. 2015; He and Kyaw 2018). Jagannathan and Srinivasan (2000) suggest that product market competition reduces the agency cost of managerial slack. Even the firms with high agency conflict are forced by market competition to provide incentives to managers aimed at reducing managerial slack (Chang et al. 2015). Thus, product market competition eventually results in increased managerial vigilance in performing value-enhancing activities. Resultantly, a more optimal speed of adjustment towards a target capital structure is realized as market competition eliminates the delay caused by managerial slack. Accordingly, we developed the following hypothesis.

Hypothesis 2a. *High product market competition is associated with a high speed of adjustment towards firms' target capital structure.*

Hypothesis 2b. *High product market competition is not associated with a high speed of adjustment towards firms' target capital structure.*

3. Methodology

3.1. Data

This study used an extensive dataset for the period of 1998 to 2015 of all Chinese non-financial firms listed on the Shenzhen and Shanghai Stock Exchanges. The firm-level data were obtained from the international database COMPUSTAT IQ, while country-level data (inflation, economic growth, banking development, stock market development) were obtained from the World Bank database[1]. After excluding financial firms and institutions (because of their regulatory environment), we obtained 10,941 firm-year observations of 732 Chinese non-financial listed firms. We considered both active and inactive publicly traded non-financial firms to avoid survivorship bias. The dataset was winsorized at one percent from both sides of the distribution for all firm-level variables to minimize the impact of potential outliers. Further, to investigate the impact of product market competition on the adjustment

1 www.worldbank.org.

rate of Chinese listed non-financial firms, the dataset was classified into 3 parts: highly competitive firms, moderately competitive firms, and less competitive firms.

3.2. Variables

We used 3 proxies to measure capital structure: $STDR_{it}$, measured as the ratio of short-term debt to total assets; $LTDR_{it,}$ measured as the ratio of long-term debt to total assets; and TDR_{it}, measured as the ratio of total debt (short-term loan + long-term loan) to total assets following previous relevant studies (Ahsan et al. 2016, 2017; Bayrakdaroğlu et al. 2013). We used firm and country level explanatory variables consistent with the existing literature (Titman and Wessels 1988; Rajan and Zingales 1995; Booth et al. 2001; de Jong et al. 2008; Ahsan et al. 2016; Cook and Tang 2010; Alves and Francisco 2015) and capital structure theories such as trade-off theory, pecking order theory, agency theory, and market timing theory (Modigliani and Miller 1963; Myers and Majluf 1984; Baker and Wurgler 2002). Specifically, we used the firm-level variables tax shield (TX_{it}), measured as the ratio of tax payments to gross profit; non-debt tax shield (NTS_{it}), measured as the ratio of depreciation and amortization to total assets; volatility (VL_{it}), measured as the percentage change in the ratio of earnings before interest and taxes to total assets; agency cost (AC_{it}), measured as the ratio of operating expenses to net sales; growth potential (GP_{it}), measured as the ratio of percentage change in total assets; profitability (PRF_{it}), measured as the ratio of earnings before interest and taxes to total assets; liquidity (LIQ_{it}), measured as the ratio of current assets to current liabilities; and firm size (SZ_{it}), measured as the natural logarithm of total assets. We also used the country level variables inflation (INF_t), measured as the annual percentage of consumer prices; economic growth (EG_t), measured as annual percentage growth in GDP; banking development (BD_t), measured as domestic credit to private sector by banks as a percentage of GDP; and stock market development (SMD_t), measured as total value of stock traded as a percentage of GDP. We present all the explanatory variables used in this study in Table 1 along with their proxies.

Table 1. Dependent and independent variables, their model names, and proxies.

Variable Level	Variable Name	Model Name	Proxy	Source
Dependent	Short-term debt ratio	$STDR_{it}$	Short-term debt/total assets	COMPUSTAT
	Long-term debt ratio	$LTDR_{it}$	Long-term debt/total assets	COMPUSTAT
	Total debt ratio	TDR_{it}	(Short-term debt + Long-term debt)/total assets	COMPUSTAT
Independent Firm level	Tax shield	TX_{it}	Tax payments/gross profit	COMPUSTAT
	Non-debt tax shield	NTS_{it}	Depreciation and amortization/total assets	COMPUSTAT
	Volatility	VL_{it}	% Change in (earnings before interest and taxes/total assets)	COMPUSTAT
	Agency cost	AC_{it}	Operating expenses/sales	COMPUSTAT
	Growth potential	GP_{it}	% Change in total assets	COMPUSTAT
	Profitability	PRF_{it}	Earnings before interest and taxes/total assets	COMPUSTAT
	Liquidity	LIQ_{it}	Current assets/current liabilities	COMPUSTAT
	Tangibility	TNG_{it}	Property, plant and equipment/total assets	COMPUSTAT
	Firm size	SZ_{it}	ln (total assets)	
Country level	Inflation	INF_t	Inflation, consumer prices (annual %)	World Bank
	Economic growth	EG_t	GDP growth (annual %)	World Bank
	Banking development	BD_t	Domestic credit to private sector by banks (% of GDP)	World Bank
	Stock market development	SMD_t	Stocks traded, total value (% of GDP)	World Bank
Dummy		D_i	Dummy 1 for highly competitive industries; 2 for moderately competitive industries; 3 for less competitive industries.	

3.3. Methodology

3.3.1. Classification of Firms

We used the Herfindahl–Hirschman index (HHI) to measure product market competition. We calculated HHI for each industry categorized according to second level industry classification codes. The HHI is defined as the sum of the square of the market shares of all the firms in that industry. The mathematical description of HHI can be written as follows

$$\mathrm{HHI}_i = \sum_{j=1}^{j} s_{ij}^2$$

where S_{ij} represents the market share of the firm j in the industry i. Further, we created three tertiles of all the firm-year observations based on the mean values of the HHI. We termed the three tertiles as highly competitive firms; moderately competitive firms; and less competitive firms. Table 2 presents the number of firm-year observations and the value of HHI for each tertile.

Table 2. Classification of firm-year observations based on Herfindahl–Hirschman index (HHI).

Quantile	Observations	Mean	SD	Minimum	Maximum
1	3653	0.131	0.042	0.053	0.208
2	3643	0.306	0.062	0.208	0.433
3	3645	0.722	0.217	0.434	1.000

Note: Quantile 1 was classified as highly competitive firms; quantile 2 as moderately competitive, and quantile 3 as less competitive firms.

3.3.2. Partial Adjustment Model

Empirical studies show a number of factors that influence adjustment speed of capital structure, and researchers have classified these factors as firm-specific variables and operating environment of the firms (Ameer 2013; Getzmann et al. 2014; Cook and Tang 2010). Therefore, it can be assumed that the target capital structure function comprises firm and country level factors. As these factors have great importance, managers keep these factors under serious consideration for financing decisions. Therefore, the target capital structure model can be postulated as follows:

$$CS_{it}^{*} = \alpha X_{i,t-1} + \mu_{it} \tag{1}$$

where CS_{it}^{*} is the target capital structure or target debt ratio for the firm i at time t, $\alpha X_{i,t-1}$ is the vector of the firm and country level lagged variables, and μ_{it} is the error component for firm i at time t.

It is considered that firms should operate at their target capital structure. However, a number of endogenous and exogenous factors affect the determinants of target capital structure due to the dynamic nature of their operating environment and the trade-offs between cost and benefits, altogether forcing the firms to delay their adjustment process (Fischer et al. 1989; Myers 1984). Consequently, it can be assumed that firms partially adjust their target capital structure, so our partial adjustment model can be shown as:

$$CS_{it} - CS_{i,t-1} = \delta\left(CS_{it}^{*} - CS_{i,t-1}\right),\ 0 < \delta \le 1 \tag{2}$$

From Equation (2), we can calculate the actual capital structure as:

$$CS_{it} = (1-\delta)CS_{i,t-1} + \delta CS_{it}^{*} \tag{3}$$

where CS_{it} is the actual capital structure for the firm i at time t, δ is the adjustment parameter, and $\delta = 1$ means full adjustment achieved by the firm within one accounting period.

As the adjustment cost depends upon the determinants of target capital structure of a firm, the target adjustment rate of Chinese firms can be found by combining Equations (1) and (3) to get the following partial adjustment model:

$$CS_{it} = (1-\delta)CS_{i,t-1} + \delta\alpha X_{i,t-1} + \mu_{it} \tag{4}$$

After classifying firm-year observations according to competition level, the following can be obtained:

$$CS_{it} = (1-\delta)CS_{i,t-1} + \delta\alpha X_{i,t-1} + D_i + \mu_{it} \tag{5}$$

where CS_{it} is one of the three measures of capital structure (i.e., $STDR_{it}$, $LTDR_{it}$, TDR_{it}) for the firm i at time t, δ is the partial adjustment parameter, $1-\delta$ is adjustment rate, $X_{i,t-1}$ is the vector of firm and country level lagged variables for firm i at time $t-1$, α is the impact of firm and country level variables on target capital structure, D_i is the dummy variable for classification of firm-year observations according to competition level, and μ_{it} is the error component for the firm i at time t.

A number of similar studies have used dynamic panel modeling techniques like fixed effects, random effects, generalized method of moments, etc. (Drobetza and Wanzenried 2006; Tongkong 2012; Getzmann et al. 2014; Venkiteshwaran 2011; Guney et al. 2011). These methods do not incorporate the fractional nature of the dependent variable and may yield biased results (Hovakimian and Li 2011; Elsas and Florysiak 2011). To avoid such problems, we did not consider the aforementioned techniques to estimate Equation (4). In order to control the biased fractional nature of capital structure ratios, we used the dynamic panel fractional (DPF) estimator proposed by Elsas and Florysiak (2015) for this study. This technique has an advantage over other techniques because it controls for unobserved heterogeneity in unbalanced panel data (Elsas and Florysiak 2015). The observable dependent variable CS_{it} (bounded between 0 and 1) is denoted as follows:

$$CS_{it} = \begin{bmatrix} 0 & if & CS^*_{it} \le 0 \\ CS^*_{it} & if & 0 < CS^*_{it} < 1 \\ 1 & if & CS^*_{it} \ge 1 \end{bmatrix} \tag{6}$$

where CS^*_{it} is a latent variable that is unobserved; the value of this latent variable is set equal to one when it is higher than one and equal to zero when it is below zero.

4. Empirical Results

4.1. Descriptive Statistics

Table 3 provides the descriptive statistics for all variables. The results show that highly competitive firms rely more on long-term debt financing as compared to moderately and less competitive firms, which supports Hypothesis 1a. On the other hand, less competitive firms rely more on short-term debt financing as compared to moderately and highly competitive firms.

Among firm-level variables, we observe that the firms facing a high level of competition make greater use of tax shield benefits (mean = 0.065) as compared to the firms in medium (mean TX_{it} 0.056) and low-level competition (mean = 0.057). Further, we observe lowest income volatility (mean = −0.188) for moderately competitive firms and highest (mean = −0.272) for less competitive firms. Furthermore, we observe that agency cost increases with a decrease in competition, which demonstrates that firms facing low competition suffer more from agency conflicts. We find that highly competitive firms are able to generate more profitability than moderately and less competitive firms. However, highly competitive firms use fewer liquid assets as compared to moderately and less competitive firms. The results also show that highly competitive firms have more tangible assets than moderately and less competitive firms.

Table 3. Descriptive statistics of sample firms.

	$STDR_{it}$	$LTDR_{it}$	TDR_{it}	TX_{it}	NTS_{it}	VL_{it}	AC_{it}	GP_{it}	PRF_{it}	LIQ_{it}	TNG_{it}	SZ_{it}	INF_t	EG_t	BD_t	SMD_t
Highly Competitive Firms (330 firms; 3653 firm-year observations)																
Mean	0.173	0.094	0.268	0.065	0.206	−0.203	0.850	0.174	0.047	1.382	0.441	8.216	1.869	9.432	120.397	81.915
SD	0.132	0.109	0.168	0.065	0.154	2.130	0.212	0.352	0.066	1.042	0.205	1.297	2.067	1.882	13.204	81.417
Median	0.150	0.055	0.256	0.051	0.167	−0.100	0.871	0.096	0.047	1.126	0.449	8.133	1.463	9.234	118.023	59.412
Min.	0.000	0.000	0.000	−0.133	0.004	−13.223	0.282	−0.425	−0.266	0.183	0.008	4.977	−1.408	6.900	102.792	17.296
Max.	0.778	0.459	0.825	0.349	0.725	10.712	2.445	3.188	0.242	10.157	0.855	11.984	5.864	14.195	155.324	361.903
Moderately Competitive Firms (412 firms; 3643 firm-year observations)																
	$STDR_{it}$	$LTDR_{it}$	TDR_{it}	TX_{it}	NTS_{it}	VL_{it}	AC_{it}	GP_{it}	PRF_{it}	LIQ_{it}	TNG_{it}	SZ_{it}	INF_t	EG_t	BD_t	SMD_t
Mean	0.183	0.082	0.265	0.056	0.172	−0.188	0.885	0.176	0.036	1.430	0.367	8.051	1.905	9.404	120.854	85.769
SD	0.144	0.111	0.181	0.060	0.143	2.463	0.229	0.355	0.070	1.004	0.217	1.290	2.114	1.898	13.458	82.066
Median	0.161	0.031	0.245	0.045	0.128	−0.124	0.892	0.101	0.039	1.211	0.325	7.912	1.822	9.234	119.382	59.412
Min.	0.000	0.000	0.000	−0.133	0.004	−13.223	0.282	−0.425	−0.266	0.183	0.008	4.977	−1.408	6.900	102.792	17.296
Max.	0.778	0.459	0.825	0.349	0.725	10.712	2.445	3.188	0.242	10.157	0.855	11.984	5.864	14.195	155.324	361.903
Less Competitive Firms (363 firms; 3645 firm-year observations)																
	$STDR_{it}$	$LTDR_{it}$	TDR_{it}	TX_{it}	NTS_{it}	VL_{it}	AC_{it}	GP_{it}	PRF_{it}	LIQ_{it}	TNG_{it}	SZ_{it}	INF_t	EG_t	BD_t	SMD_t
Mean	0.189	0.066	0.257	0.057	0.156	−0.272	0.905	0.176	0.033	1.451	0.340	7.959	2.089	9.354	121.858	91.709
SD	0.146	0.092	0.168	0.065	0.139	2.502	0.221	0.388	0.070	1.115	0.202	1.390	2.109	1.894	13.839	84.632
Median	0.165	0.024	0.245	0.046	0.115	−0.135	0.909	0.096	0.035	1.202	0.310	7.784	1.822	9.234	119.382	62.442
Min.	0.000	0.000	0.000	−0.133	0.004	−13.223	0.282	−0.425	−0.266	0.183	0.008	4.977	−1.408	6.900	102.792	17.296
Max.	0.778	0.459	0.825	0.349	0.725	10.712	2.445	3.188	0.242	10.157	0.855	11.984	5.864	14.195	155.324	361.903

4.2. Robustness and Sensitivity Analysis

Tables 4–6 report the correlation matrixes for highly, moderately, and less competitive firms, respectively. This study used 13 variables (9 firm-level and four country-level variables). Therefore, multicollinearity may be an issue in dealing with such a large database consisting of 10,941 firm-year observations of 732 Chinese non-financial listed firms. The results explain that sample data do not suffer from the multicollinearity problem as the variation inflation factor (VIF) is less than 10 for all of the sample periods (1998–2006, 2007–2015, 1998–2015) (Ott and Longnecker 2015). Further, in order to control unobserved heterogeneity and unbalanced panel data bias, we applied an unbiased estimator (DPF) that incorporated fractional nature of debt ratio, i.e., bounded between 0 and 1 (Elsas and Florysiak 2015). Furthermore, the Wald Chi-squared test rejected (prob > chi^2 = 0.000) the null hypothesis (H_0: All coefficients of the explanatory variables are jointly equal to zero), which validates the joint significance of all the explanatory variables.

Table 4. Pair-wise Correlation (Highly Competitive Firms).

	$STDR_{it}$	$LTDR_{it}$	TDR_{it}	$TX_{i,t-1}$	$NTS_{i,t-1}$	$VL_{i,t-1}$	$AC_{i,t-1}$	$GP_{i,t-1}$	$PRF_{i,t-1}$	$LIQ_{i,t-1}$	$TNG_{i,t-1}$	$SZ_{i,t-1}$	INF_{t-1}	EG_{t-1}	BD_{t-1}	SMD_{t-1}
$STDR_{it}$	1.000															
$LTDR_{it}$	−0.080	1.000														
TDR_{it}	0.742	0.605	1.000													
$TX_{i,t-1}$	−0.215	0.072	−0.127	1.000												
$NTS_{i,t-1}$	−0.028	0.086	0.040	−0.090	1.000											
$VL_{i,t-1}$	−0.090	0.045	−0.041	0.089	0.024	1.000										
$AC_{i,t-1}$	0.306	−0.240	0.086	−0.372	0.078	−0.097	1.000									
$GP_{i,t-1}$	−0.106	0.109	−0.013	0.147	−0.161	0.004	−0.198	1.000								
$PRF_{i,t-1}$	−0.383	0.047	−0.281	0.383	−0.033	0.157	−0.641	0.251	1.000							
$LIQ_{i,t-1}$	−0.364	−0.197	−0.422	0.102	−0.179	−0.018	−0.059	0.163	0.129	1.000						
$TNG_{i,t-1}$	0.029	0.369	0.273	0.003	0.433	0.020	−0.222	−0.024	0.101	−0.370	1.000					
$SZ_{i,t-1}$	−0.028	0.447	0.274	0.073	0.169	0.016	−0.207	0.045	0.104	−0.267	0.286	1.000				
INF_{t-1}	0.013	0.095	0.076	−0.068	0.100	0.009	0.061	−0.063	−0.078	−0.142	0.041	0.265	1.000			
EG_{t-1}	0.057	−0.040	0.019	0.039	0.045	−0.016	0.009	−0.042	0.022	−0.111	0.128	0.020	0.391	1.000		
BD_{t-1}	−0.019	0.129	0.072	−0.050	0.063	0.040	0.037	−0.035	−0.125	−0.038	−0.086	0.301	0.054	−0.388	1.000	
SMD_{t-1}	−0.039	0.116	0.049	−0.019	0.130	0.023	0.035	−0.039	−0.079	−0.120	0.028	0.285	0.391	0.248	0.254	1.000

Table 5. Pair-wise Correlation (Moderately Competitive Firms).

	$STDR_{it}$	$LTDR_{it}$	TDR_{it}	$TX_{i,t-1}$	$NTS_{i,t-1}$	$VL_{i,t-1}$	$AC_{i,t-1}$	$GP_{i,t-1}$	$PRF_{i,t-1}$	$LIQ_{i,t-1}$	$TNG_{i,t-1}$	$SZ_{i,t-1}$	INF_{t-1}	EG_{t-1}	BD_{t-1}	SMD_{t-1}
$STDR_{it}$	1.000															
$LTDR_{it}$	0.005	1.000														
TDR_{it}	0.780	0.615	1.000													
$TX_{i,t-1}$	−0.209	0.016	−0.153	1.000												
$NTS_{i,t-1}$	0.104	0.125	0.161	−0.141	1.000											
$VL_{i,t-1}$	−0.024	0.034	−0.008	0.022	−0.013	1.000										
$AC_{i,t-1}$	0.319	−0.121	0.162	−0.303	−0.005	0.021	1.000									
$GP_{i,t-1}$	−0.094	0.036	−0.048	0.163	−0.227	−0.045	−0.201	1.000								
$PRF_{i,t-1}$	−0.358	−0.013	−0.285	0.390	−0.178	0.065	−0.708	0.294	1.000							
$LIQ_{i,t-1}$	−0.405	−0.209	−0.449	0.145	−0.165	−0.014	−0.126	0.094	0.184	1.000						
$TNG_{i,t-1}$	0.060	0.483	0.352	−0.017	0.481	0.009	−0.294	−0.089	0.062	−0.315	1.000					
$SZ_{i,t-1}$	−0.131	0.351	0.123	0.021	−0.064	0.006	−0.179	0.076	0.110	−0.160	0.112	1.000				
INF_{t-1}	−0.010	0.092	0.053	−0.106	0.089	0.017	0.072	−0.058	−0.119	−0.117	0.041	0.281	1.000			
EG_{t-1}	0.047	−0.017	0.029	−0.084	0.058	−0.002	0.028	−0.008	−0.024	−0.112	0.107	−0.025	0.368	1.000		
BD_{t-1}	−0.038	0.108	0.037	0.008	0.032	0.005	0.028	−0.048	−0.090	−0.004	−0.079	0.342	0.036	−0.410	1.000	
SMD_{t-1}	−0.056	0.128	0.046	−0.044	0.056	0.004	0.037	0.037	−0.078	−0.095	−0.014	0.333	0.399	0.255	0.264	1.000

Table 6. Pair-wise Correlation (Less Competitive Firms).

	$STDR_{it}$	$LTDR_{it}$	TDR_{it}	$TX_{i,t-1}$	$NTS_{i,t-1}$	$VL_{i,t-1}$	$AC_{i,t-1}$	$GP_{i,t-1}$	$PRF_{i,t-1}$	$LIQ_{i,t-1}$	$TNG_{i,t-1}$	$SZ_{i,t-1}$	INF_{t-1}	EG_{t-1}	BD_{t-1}	SMD_{t-1}
$STDR_{it}$	1.000															
$LTDR_{it}$	−0.100	1.000														
TDR_{it}	0.835	0.460	1.000													
$TX_{i,t-1}$	−0.167	0.072	−0.110	1.000												
$NTS_{i,t-1}$	−0.035	0.029	−0.008	−0.165	1.000											
$VL_{i,t-1}$	−0.062	0.014	−0.049	0.059	0.019	1.000										
$AC_{i,t-1}$	0.232	−0.180	0.115	−0.263	0.035	−0.132	1.000									
$GP_{i,t-1}$	−0.098	0.102	−0.033	0.168	−0.193	0.029	−0.208	1.000								
$PRF_{i,t-1}$	−0.272	0.050	−0.222	0.328	−0.115	0.174	−0.686	0.288	1.000							
$LIQ_{i,t-1}$	−0.353	−0.083	−0.359	0.137	−0.161	−0.029	−0.152	0.104	0.115	1.000						
$TNG_{i,t-1}$	−0.020	0.333	0.167	−0.070	0.492	0.014	−0.192	−0.072	0.076	−0.271	1.000					
$SZ_{i,t-1}$	−0.181	0.310	0.007	0.055	0.084	0.011	−0.147	0.115	0.162	−0.137	0.119	1.000				
INF_{t-1}	−0.042	0.076	0.010	−0.043	0.083	−0.017	0.101	−0.048	−0.085	−0.058	−0.001	0.227	1.000			
EG_{t-1}	0.035	−0.050	0.007	0.013	0.038	0.035	0.036	−0.002	0.021	−0.072	0.055	−0.056	0.364	1.000		
BD_{t-1}	−0.067	0.117	0.005	−0.026	0.059	−0.018	0.085	−0.032	−0.103	−0.003	−0.046	0.321	0.007	−0.448	1.000	
SMD_{t-1}	−0.110	0.090	−0.041	0.024	0.054	0.009	0.074	0.033	−0.070	−0.016	−0.055	0.238	0.365	0.282	0.245	1.000

4.3. Target Capital Structure and Adjustment Rate

Table 7 reports the results obtained from the DPF estimator. The empirical results of the DPF estimator show that the estimated coefficients of the lagged debt ratios (STDRit, LTDRit, TDRit) are significant at the 1% level for all three classifications of competition level, which contradicts the study by Jiang et al. (2015) and favours the results by Guney et al. (2011) as these results signify the existence of target capital structure for Chinese listed non-financial firms, irrespective of the competition level these firms are operating in. Further, the results of 3653[2] firm-year observations of Chinese non-financial listed firms operating in a highly competitive environment explain partial adjustment towards short-term (STDRit) target capital structure at the rate of 18.8%, towards long-term (LTDRit) target capital structure at the rate of 28.2%, and towards total (TDRit) target capital structure at the rate of 15.3%. Generally, bigger firms have more controlling power in the market to access external finance and can afford higher transaction costs induced by capital structure adjustment. In addition, bigger firms are more transparent in information disclosure. All these factors make it easier for bigger firms to issue new bonds or borrow new debts. The results (see Table 7) support the studies (Jiang et al. 2015; Guney et al. 2011; Ahsan et al. 2016; Mirza et al. 2016) in that there is a positive relationship between firm size and capital structure deviation and adjustment speed, which supports the trade-off theory. After applying $1/(1-\delta)$ to determine the period required to reach the target capital structure, we find that highly competitive Chinese listed non-financial firms take 5.32, 3.55, and 6.54 years to adjust their target capital structure towards STDRit, LTDRit, and TDRit, respectively. These results suggest that bigger firms in a highly competitive environment have more access to internal and external financing to adjust their target capital structure and faster to achieve their target capital structure which supports the limited liability model. Furthermore, the results of 3643 firm-year observations of Chinese non-financial listed firms, operating in moderately competitive environment partially adjust towards short-term (STDRit) target capital structure at the rate of 25.3%, towards long-term (LTDRit) target capital structure at the rate of 22.3%, and towards total (TDRit) target capital structure at the rate of 15.7%. These results suggest that moderately competitive firms mainly rely on short-term debt financing to adjust and achieve their target capital structure. After applying $1/(1-\delta)$ to determine the period to reach the target capital structure, we find that moderately competitive Chinese listed non-financial firms take 3.95, 4.48, and 6.37 years to adjust their target capital structure towards STDRit, LTDRit, and TDRit, respectively. Moreover, the results of 3645 firm-year observations of Chinese non-financial listed firms, operating in less competitive environment explain that these partially adjust towards short-term (STDRit) target capital structure at the rate of 18.9%, towards long-term (LTDRit) target capital structure at the rate of 29.1%, and towards total (TDRit) target capital structure at the rate of 14.5%. These results suggest that compared with small firms, the big firms are likely to follow the pecking order theory, as they might prefer internal financing to external debt financing in order to adjust their target capital structure in a less competitive environment. After applying $1/(1-\delta)$ to determine the period to reach the target capital structure, we find that less competitive Chinese listed non-financial firms take 5.29, 3.44, and 6.89 years to adjust their target capital structure towards STDRit, LTDRit, and TDRit, respectively. Therefore, bigger Chinese firms achieve their target capital structure faster than the smaller firms. These results also show that less competitive Chinese firms follow the predation model, which supports the prior studies (e.g., Guney et al. 2011) on Chinese firms. Overall, however, these results show that is no single theory that can generalize the adjustment behavior of Chinese firms in different competitive environments.

[2] Dynamic panel fractional (DPF) estimation reduces the number of firm-year observations from 3653 to 3198 for high competitive firms, from 3643 to 2980 for moderately competitive firms, and from 3645 to 3091 for less competitive firms because it includes one year lag of dependent variables ($STDR_{it}$, $LTDR_{it}$, TDR_{it}) as explanatory variables.

Table 7. Adjustment rate towards target capital structure and product market competition.

Time Period	**Highly Competitive Firms**						**Moderately Competitive Firms**						**Less competitive Firms**					
Debt Ratio	$STDR_{it}$		$LTDR_{it}$		TDR_{it}		$STDR_{it}$		$LTDR_{it}$		TDR_{it}		$STDR_{it}$		$LTDR_{it}$		TDR_{it}	
Variables	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**	**Coef.**	**Prob.**
Adjustment Rate	18.8%		28.2%		15.3%		25.3%		22.3%		15.7%		18.9%		29.1%		14.5%	
$Debt_{t-1}$	0.812	0.000	0.718	0.000	0.847	0.000	0.747	0.000	0.777	0.000	0.843	0.000	0.811	0.000	0.709	0.000	0.855	0.000
$TX_{i,t-1}$	−0.022	0.420	0.096	0.000	0.053	0.077	−0.012	0.744	−0.050	0.140	−0.049	0.206	−0.036	0.224	0.053	0.045	0.017	0.579
$NTS_{i,t-1}$	−0.050	0.003	−0.014	0.396	−0.035	0.057	−0.074	0.001	−0.029	0.154	−0.061	0.008	−0.092	0.000	−0.101	0.000	−0.111	0.000
$VL_{i,t-1}$	0.000	0.958	0.000	0.807	0.000	0.659	−0.002	0.011	0.001	0.025	−0.001	0.084	−0.001	0.332	0.000	0.986	−0.001	0.118
$AC_{i,t-1}$	−0.025	0.080	0.019	0.193	−0.009	0.572	0.042	0.003	0.009	0.479	0.040	0.006	−0.050	0.000	−0.008	0.546	−0.049	0.001
$GP_{i,t-1}$	−0.001	0.780	0.010	0.015	0.005	0.292	0.005	0.302	−0.002	0.632	0.005	0.312	0.000	0.979	0.018	0.000	0.013	0.007
$PRF_{i,t-1}$	−0.132	0.001	0.068	0.082	−0.069	0.116	−0.018	0.699	−0.010	0.821	0.030	0.535	−0.122	0.007	−0.024	0.557	−0.099	0.037
$LIQ_{i,t-1}$	0.011	0.000	−0.002	0.332	0.013	0.000	0.009	0.002	−0.010	0.000	0.005	0.074	0.005	0.013	−0.006	0.001	0.002	0.359
$TNG_{i,t-1}$	0.033	0.014	−0.005	0.726	0.013	0.384	0.037	0.050	−0.017	0.350	−0.007	0.732	0.045	0.005	0.031	0.033	0.035	0.039
$SZ_{i,t-1}$	0.013	0.000	0.013	0.000	0.014	0.000	0.003	0.383	0.015	0.000	0.007	0.041	0.001	0.821	0.014	0.000	0.003	0.293
INF_{t-1}	−0.001	0.135	0.001	0.380	0.000	0.634	−0.001	0.153	−0.001	0.207	−0.001	0.149	0.000	0.988	0.001	0.491	0.001	0.201
EG_{t-1}	0.002	0.045	−0.001	0.117	0.001	0.226	0.004	0.000	−0.001	0.221	0.004	0.000	0.002	0.049	−0.003	0.002	0.001	0.319
BD_{t-1}	0.000	0.969	0.000	0.854	0.000	0.523	0.000	0.023	−0.001	0.001	0.000	0.362	0.000	0.130	0.000	0.035	0.000	0.438
SMD_{t-1}	0.000	0.004	0.000	0.830	0.000	0.090	0.000	0.271	0.000	0.327	0.000	0.695	0.000	0.634	0.000	0.587	0.000	0.948
Constant	0.403	0.016	−0.002	0.992	0.311	0.088	0.246	0.015	−0.056	0.565	0.196	0.050	0.065	0.593	−0.335	0.014	−0.119	0.351
Wald-Chi^2	7523	0.000	3648	0.000	10862	0.000	3830	0.000	3302	0.000	6604	0.000	7050	0.000	2603	0.000	8951	0.000
No. of obs.	3198						2980						3091					
No. of firms	286						290						337					

Note: The table presents the separate results of dynamic panel fractional estimation for total highly, moderately, and less competitive industries. Wald-Chi^2 is a test to analyze the joint significance of all the explanatory variables included in the model.

5. Conclusions

This study analyzed 10,941 firm-year observations of 732 Chinese listed non-financial firms over a period of 17 years (1998–2015) and was the first to do so by classifying them into different competition levels to determine the impact of competition level on adjustment rate towards target capital structure. We classified Chinese non-financial listed firms into highly, moderately, and less competitive firms and applied an unbiased dynamic panel fractional estimator to unbalanced panel data of 10,941 firm-year observations during the period of 1998 to 2015. We find that the adjustment rate of highly and less competitive firms towards long-term target capital structure is higher (28.2%–29.1%) as compared to the adjustment rate towards short-term target capital structure (18.8%–18.9%). On the other hand, the adjustment rate of moderately competitive firms towards long-term target capital structure is slower (22.3%) as compared to the adjustment rate towards short-term target capital structure (25.3%).

Further, the adjustment rate of highly and less competitive firms differs significantly between long-term and short-term target capital structure, while the adjustment rate of moderately competitive firms remains steady. Smaller and bigger firms follow the limited liability and predation model in moderately and less competitive environments, respectively, while highly competitive bigger firms follow the limited liability model to adjust their target capital structure and support trade-off theory. Overall, these results show that is no single theory that can generalize the adjustment behavior of Chinese firms in different competitive environments.

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