

Ferrarini, Benno; Hinojales, Marthe; Scaramozzino, Pasquale

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## Leverage and capital structure determinants of Chinese listed companies

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# LEVERAGE AND CAPITAL STRUCTURE DETERMINANTS OF CHINESE LISTED COMPANIES

*Benno Ferrarini, Marthe Hinojales, and Pasquale Scaramozzino*

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Benno Ferrarini, Marthe Hinojales,  
and Pasquale Scaramozzino

No. 509 | January 2017

Benno Ferrarini ([bferrarini@adb.org](mailto:bferrarini@adb.org)) is a senior economist and Marthe Hinojales ([mhinojales@adb.org](mailto:mhinojales@adb.org)) is an economics officer at the Economic Research and Regional Cooperation Department, Asian Development Bank. Pasquale Scaramozzino ([ps6@soas.ac.uk](mailto:ps6@soas.ac.uk)) is professor of Economics, School of Finance and Management at SOAS, University of London and Dipartimento di Economia e Finanza, Università di Roma Tor Vergata.



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Tel +63 2 632 4444; Fax +63 2 636 2444  
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## ABSTRACT

Total debt in the People's Republic of China has increased significantly in recent years, mostly on account of nonfinancial corporate debt. Earning and the financial performance of corporate firms have weakened, and so has the asset quality of the financial sector. This paper assesses the financial fragility of the Chinese economy by looking at risk factors in the nonfinancial sector. We apply quantile regressions to a rich dataset of Chinese listed companies contained in Standard & Poor's IQ Capital database. We find higher sensitivity over time of corporate leverage to some of its key determinants, particularly for firms at the upper margin of the distribution. In particular, profitability increasingly acts as a curb on corporate leverage. At a time of falling profitability across the Chinese nonfinancial corporate sector, this eases the brake on leverage and may contribute to its continuing increase.

*Keywords:* corporate debt, debt sustainability, panel quantile regression, People's Republic of China

*JEL codes:* G01, G21, H30, H60

## I. INTRODUCTION

Corporate leverage in the People's Republic of China (PRC) accelerated in the aftermath of the global financial crisis, accentuating industrial overcapacity in traditional sectors and fueling asset bubbles in the property, stock, and bond markets. Earnings and financial performance of companies have deteriorated, and with them the asset quality of the Chinese financial sector holding the bulk of the corporate debt. Warnings about the dangers of excessive corporate leverage and financial sector vulnerability have been a staple of the international press since at least 2015, and also the Chinese authorities have recognized the problem.

Much of the debate on debt and financial sustainability in the PRC has centered on aggregate data and indicators, which suggest a marked rise in corporate debt and nonperforming loans held by the domestic banking system. However, a macro focus tends to overlook heterogeneity and vulnerabilities at the micro level, which are relevant to policy formulation (Bernanke and Campbell 1988). For example, recent market analysis associates the energy sector with the lowest return on capital and the largest increase in nonperforming loan ratios among Chinese industries, suggesting that it should be a prime focus of authorities' monitoring efforts (S&P Global Market Intelligence 2016).

Additional and more systematic insights can be gained from regression analysis of corporate balance sheet data. Early attempts, predating the recent credit surge, can be found in the literature assessing the determinants of capital structure in the PRC (e.g. Chen 2004, Huang and Song 2006). It shows that the insights from modern finance theory of capital structure are borne out in the Chinese corporate data, notwithstanding institutional differences compared to the United States (US) and European markets and the presence of financial constraints in the Chinese banking sector.<sup>1</sup>

This paper builds on this strain of literature to determine the drivers of nonfinancial corporate debt in the PRC during the credit surge since 2009. Focus is on the margins of the corporate distribution and on variations in the determinants of corporate leverage that could signal rising risk of financial distress particularly in these segments of the Chinese corporate landscape. This is accomplished through the use of panel and simultaneous quantile analysis, beyond the mean-based ordinary least squares regression analysis of previous approaches. The empirical investigation relies on Standard & Poor's (S&P) IQ Capital database, which contains richly detailed historical balance sheet data and key financial indicators of Chinese companies up until 2015 at this time of writing. The dataset is summarized in Appendix Tables A1, A2.1, and A2.2.

We find that, over time, corporate leverage has become more sensitive to changes in some of its key determinants, particularly for firms at the upper margin of the distribution. In particular, profitability appears to have increased over time its impact as a curb on corporate leverage. Among the underlying reasons is the government-induced massive stimulus to stem the global financial crisis, which caused a significant decline in lending rates and incentivizes companies to borrow instead of relying on retained earnings as a source of funding. This eases the brake on leverage at a time when corporate profitability is falling, and likely contributes to further rises of corporate debt.

The paper is structured to provide a brief overview of rising leverage and financial risk in the PRC's corporate sector, in section II. This is followed, in section III, by a presentation of the empirical

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<sup>1</sup> In particular, the state exerts vast control over the state-owned enterprises and the financial system, which reduces the likelihood and costs of financial distress compared to those facing the private corporate sector (Chen 2004, Borst and Lardy 2015).

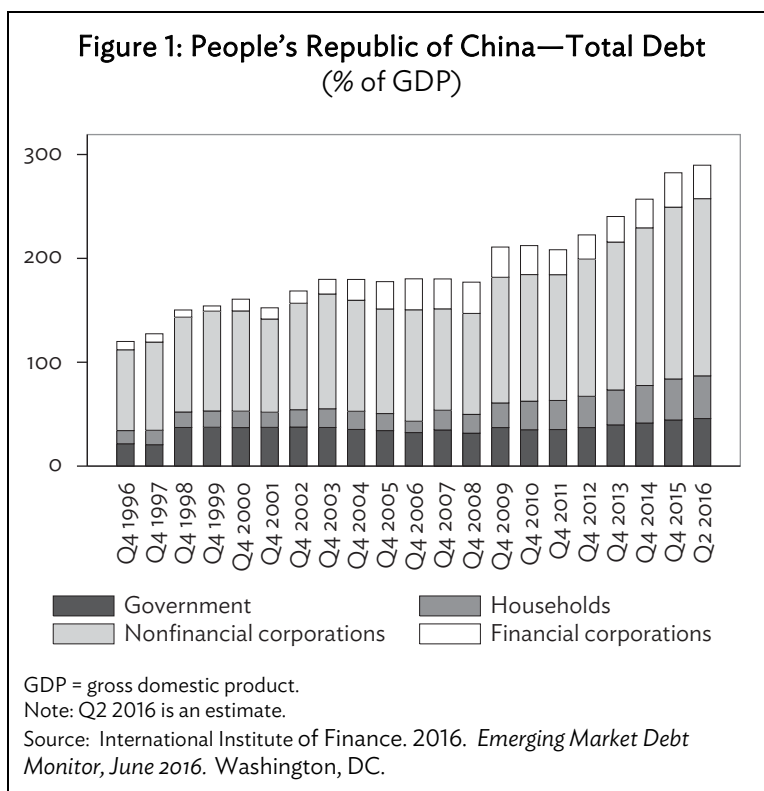


framework and the data used, and a discussion of the results achieved. The paper closes with lessons for policy and broader conclusions, in section IV.

## II. CORPORATE LEVERAGE AND GROWING FINANCIAL RISK

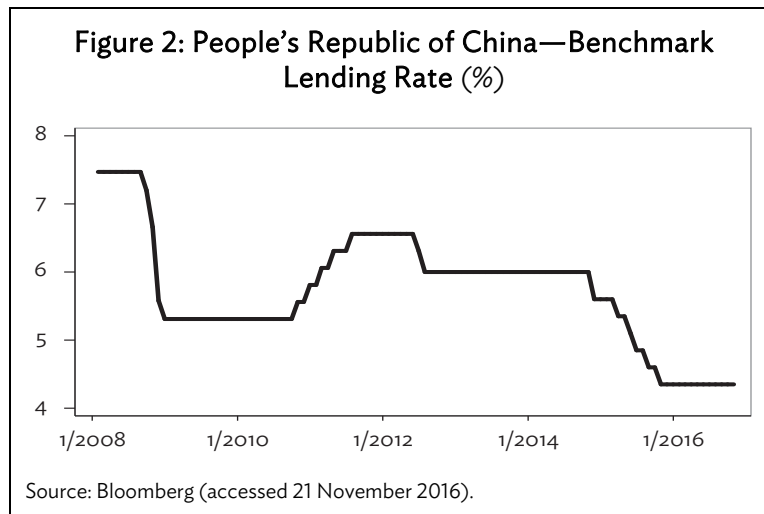
Stable at roughly 40% of gross domestic product (GDP) in 2015, general government debt in the PRC is not particularly large compared to other emerging economies.<sup>2</sup> However, total debt across all sectors ballooned to nearly 290% by the second quarter of 2016 (Figure 1). The massive buildup of debt—mostly domestic—accelerated from the end of 2008 onward, when the government enacted unprecedented monetary and fiscal stimulus to stem the impact of the global financial crisis.<sup>3</sup> Fiscal stimulus alone amounted to nearly CNY6 trillion—or 18.5% of GDP—between 2008 and 2010 (Ferrarini, Jha, and Ramayandi 2012).

Stimulus often was directed to the state-owned enterprises (SOEs) whose liabilities grew to 115% of GDP in 2015, or funneled through the policy and state-controlled commercial banks. The net effect of intervention was a significant though discontinuous fall in the benchmark lending rate, from nearly 7.5% in January 2008 to 5.3% by 2010, and 4.3% by the end of 2015 (Figure 2). The decline in the lending rate is likely to have altered the relative opportunity cost of the alternative funding sources for firms, and in particular between retained earnings and external debt.



<sup>2</sup> Accounting for both explicit and contingent off-budget liabilities incurred by local governments through their financing platforms, the International Monetary Fund estimates that the PRC's public debt ratio is substantially higher, at 56% in 2015, and will rise to nearly 74% of GDP by 2021 (IMF 2016b).

<sup>3</sup> And grow it did: the PRC's real GDP expanded on average by nearly 9.2% each year between 2009 and 2013, while the US, Japan, and the euro area were struggling with 0.3% growth on average (ADB 2011, 2013).

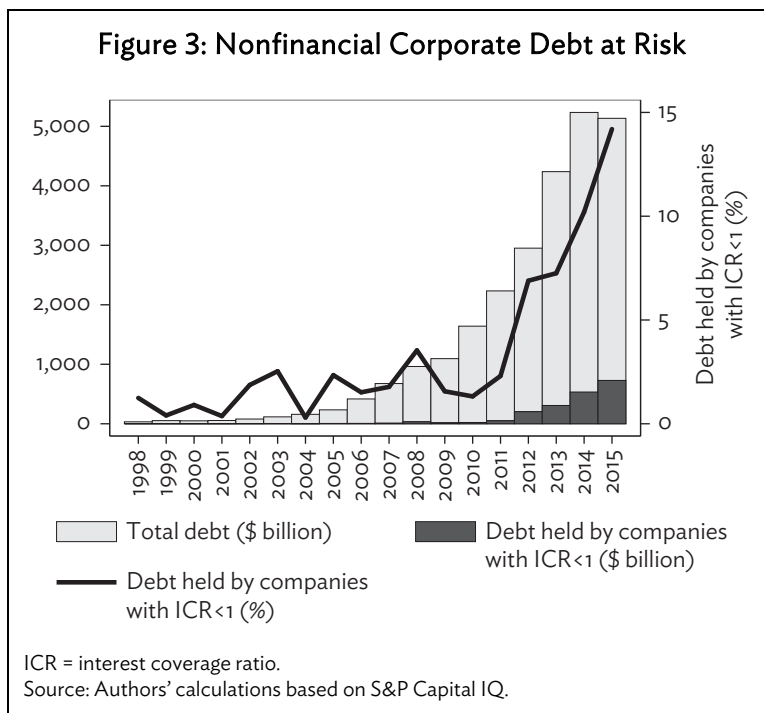


The PRC's credit to GDP gap—measuring banking risk and defined as the difference between the credit-to-GDP ratio and its long-term trend—reached 30.1 in the first quarter of 2016 (BIS 2016). The Bank for International Settlements warns that this exceeds the gap of any other country it has been tracking, as well as that of the East Asian economies involved in the 1998 crisis and the US' prior to the Lehman crisis. Moreover, the PRC's credit has expanded against the backdrop of a sharply slower economic growth in recent years, reflecting weaker external demand as well as authorities' steering efforts toward a more balanced, sustainable growth model.

The credit surge since 2009 worsened industrial overcapacity—hence profitability—in traditional sectors, such as steel, cement, and energy, while feeding asset bubbles in the property, equity, and bond markets. At the Chinese corporate level, this has translated into weakened fundamentals and a sharp fall in industrial profits, particularly of SOEs. As debtors struggle to service interest payments, nonperforming loans (NPLs) have been on the rise. Chinese official figures show NPLs continuously rising during the past 4 years, to 1.8% of total loans in the first quarter of 2016. However, the PRC does not follow standard international practice in recording NPLs, which tend to be understated as a result. Most analysts estimate that the NPL ratio exceeds 15% of total loans outstanding (CLSA 2016; Fitch Ratings 2016). This ratio does not include bad debt in the country's shadow banking system, which itself is estimated to have grown more than threefold between the end of 2012 and the first quarter of 2016, to about 10% of bank assets (S&P Global Ratings 2016a).

Data limitations notwithstanding, rising pressure in the Chinese corporate sector is best gauged at the firm level, as the share of total debt held by companies whose earnings before interest, tax, depreciation, and amortization (EBITDA) are insufficient to cover interest expenses. This ratio is seen spiking from 3.5% or less throughout the period from 1998 to 2011, to nearly 7% in 2012, and to more than 14% in 2015 (Figure 3. See Appendix Table A3 for detailed results).<sup>4</sup>

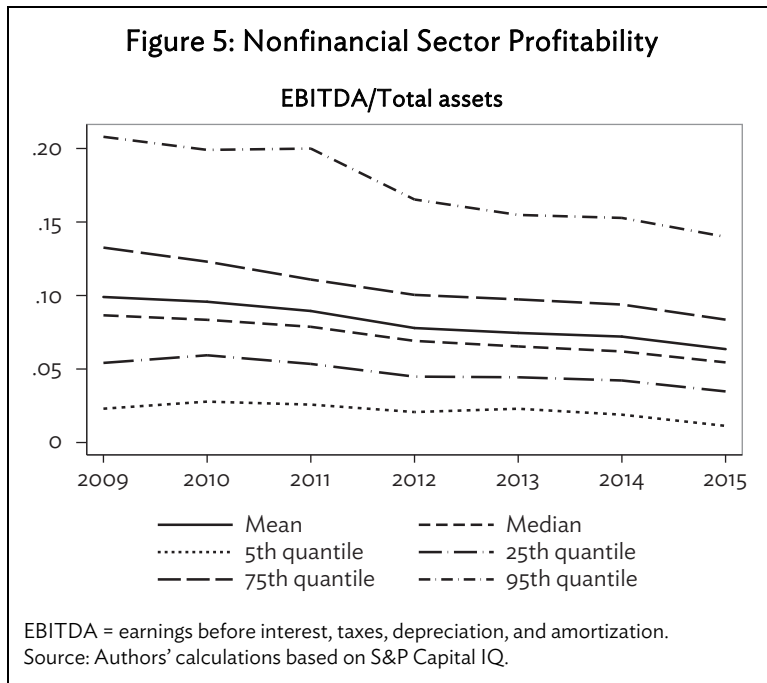
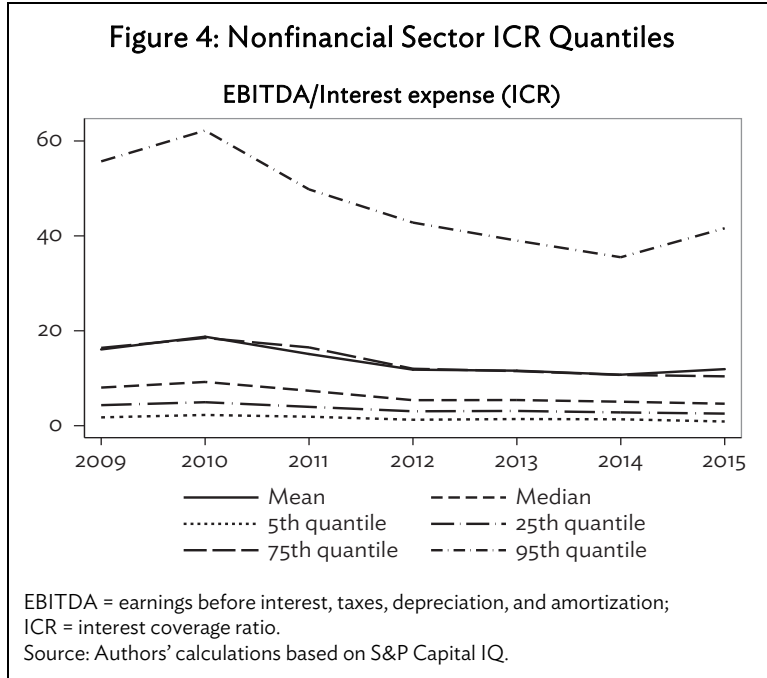
<sup>4</sup> Specifically, we derive this measure from the S&P Capital IQ database, described in Appendix Table A1. The S&P data extract accounts for all Chinese listed companies for the years between 1990 and 2015. Isolating nonfinancial companies with accounting data available, we are able to identify a sample of expanding size over time, from 52 companies in 1998 to 3,377 in 2015. Companies' interest coverage ratio (ICR) is defined as the ratio of EBITDA to interest expense. A company is considered to be at risk when EBITDA is insufficient to cover its interest expense in any given year, or  $ICR < 1$  (IMF 2016a.) This threshold is arbitrary. Less conservative approaches have been to define at risk all debt owed by firms with  $ICR < 2$  (such as in IMF 2016a). The US dollar amount of debt at risk in the Chinese nonfinancial corporate sector is then computed as the ratio of aggregate debt owed by companies with  $ICR < 1$  to total debt.



Breaking down the nonfinancial corporate distribution, the interest coverage ratio (ICR) can be seen deteriorating across corporate layers delineated by its 5th, 25th, 50th, 75th, and 95th quantiles (Figure 4). Similarly, profitability declined repeatedly between 2009 and 2015 at all five quantiles (Figure 5). However, deterioration of these financial ratios is considerably stronger at the upper 95th quantile of Chinese nonfinancial corporate distribution, compared to the mean and lower quantiles, which suggests that regression analysis is to allow for heterogeneity in the PRC's corporate landscape.

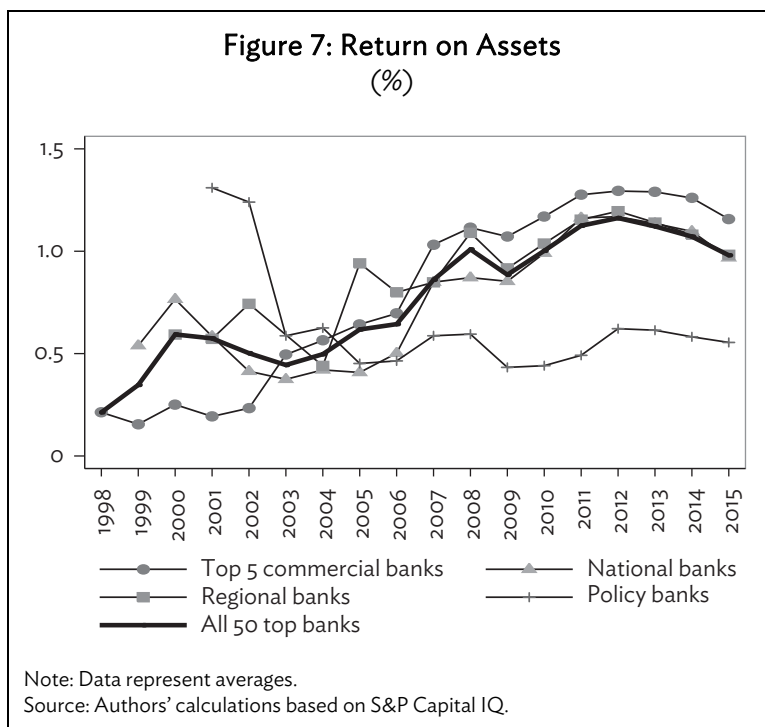
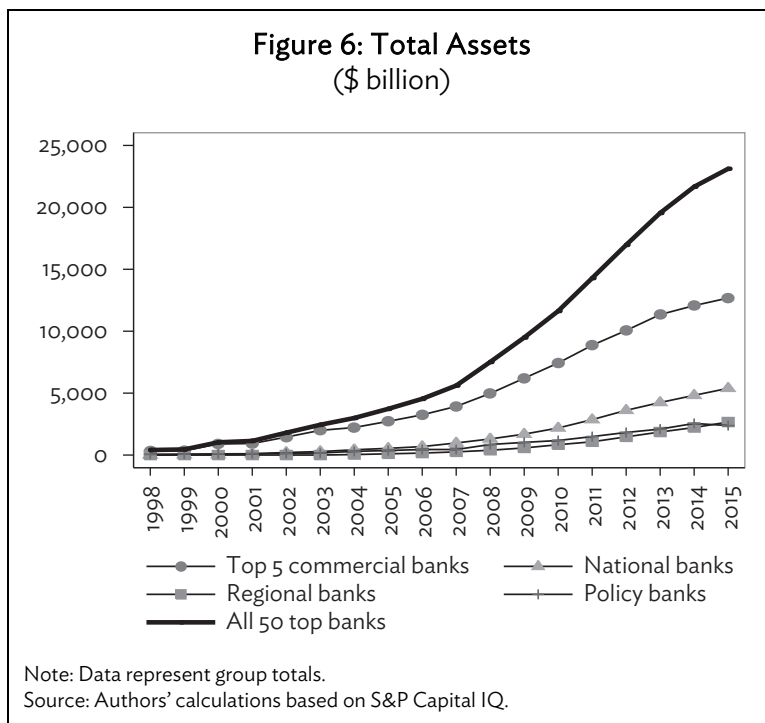
As a result of growing financial pressures in vast segments of the nonfinancial corporate landscape, the Chinese banking system now holds an unprecedented pile of loans that constitutes a large contingent burden and is fueling concerns about the growing risks of a disruptive adjustment to the Chinese economy, with international repercussions (ADB 2016, Moody's 2016). Based on current market reports, it is unclear to what extent the nation's banking system will be able to absorb weakening borrower credit quality without requiring a larger bailout operation by the state. Some evidence on banking sector performance can be evinced from the S&P data. We rank the top 50 banks according to their total asset holdings in 2015, and group them into four policy and commercial bank categories.<sup>5</sup>

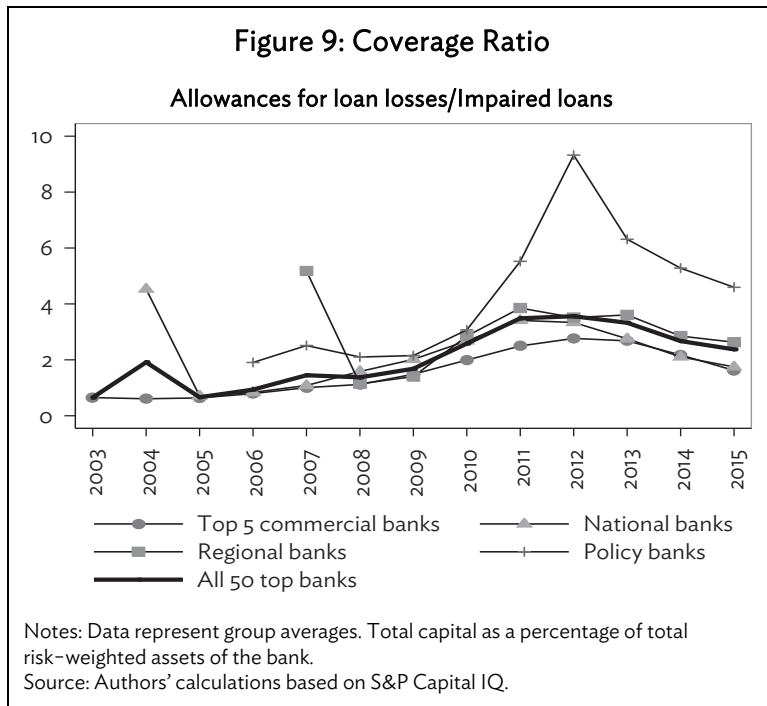
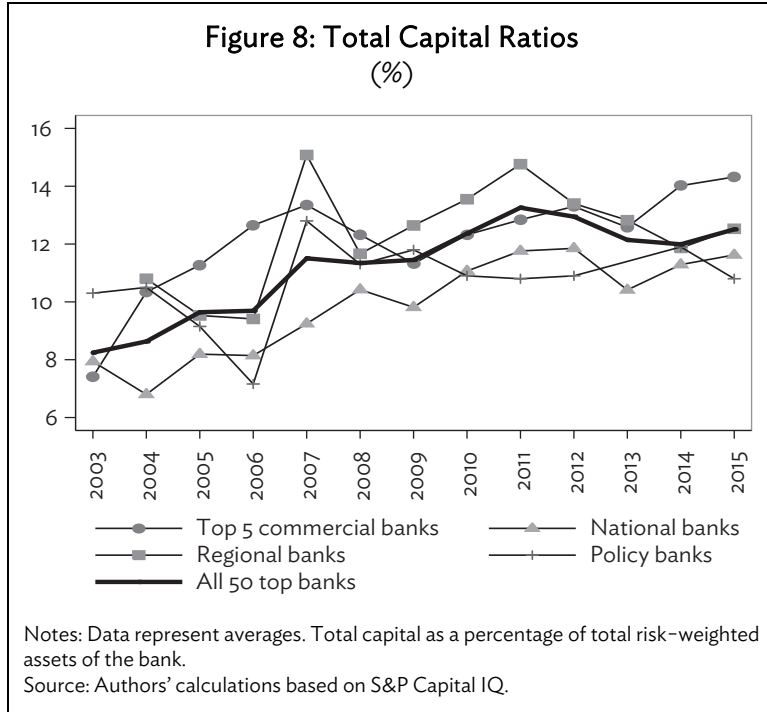
<sup>5</sup> Following S&P Global Ratings (2016b), we divide banks into the following categories: (i) Top five commercial banks: the top five largest banks by far in terms of asset size and with the broadest branch network across the country; (ii) National banks: large joint-stock commercial banks with a nationwide network; (iii) Regional banks: smaller joint-stock commercial banks and the leading city or rural commercial banks; and (iv) Policy banks: Agricultural Development Bank of China, China Development Bank Corporation, and the Export-Import Bank of China, which are used by the Chinese authorities to direct financing to certain economic sectors.



Financial indicator charts along this breakdown provide evidence of incipient vulnerability in the banking sector. Total assets surged across the sector, although at a progressively slowing rate since about 2010 (Figure 6). The top five commercial banks hold the bulk of assets, but credit growth involved all segments of the banking sector, including the regional banks. However, growth in revenues and net income did not keep up with that of assets, causing returns on assets to drop significantly in the 3 years to 2015 (Figure 7). In the meantime, the banking sector failed to raise capital at the same pace as it was issuing credits, causing capital ratios to shrink between 2011 and 2014 (Figure 8). This is true in relation to average ratios for the 50 top banks taken together, not for the policy banks, which raised capital and saw their ratios

increase over the same period. Lately, since 2015, the top five and other commercial banks have been raising capital in response to higher loan impairments. Nevertheless, the banking sector's efforts have been insufficient so far to stem against the continuing fall since 2012 of the ratio of loan losses allowance to impaired loans (Figure 9). Averaging 2.4 in 2015 across the top 50 banks, coverage appears to be adequate still, although the underestimation of impaired loans may grossly overstate this statistic.





In sum, S&P company data provides evidence of rising leverage in the Chinese nonfinancial corporate sector against the backdrop of falling returns and interest coverage ratios. The impact of deteriorating asset quality does not yet seem fully reflected in banks' balance sheets. However, weakening capital ratios since the 2009 credit surge and a sharp drop in returns on assets more recently appear to signal financial sector vulnerabilities, which are likely to sharpen against the trend of rising financial pressure in large segments of the PRC's corporate sector.

### III. DETERMINANTS OF CORPORATE DEBT

Focus turns now to the determinants of corporate leverage in the PRC. Heterogeneity across the nonfinancial corporate sector implies that an aggregate, mean-based approach would be ill suited to identifying vulnerabilities, particularly those affecting firms at the margins of the corporate distribution. Our empirical approach thus entails quantile regression analysis, which we apply within the framework developed by the theoretical literature on corporate debt. This literature has identified a number of possible explanations for the capital structure of firms (Titman and Wessels 1988; Harris and Raviv 1991). According to models based on agency costs, firms choose their debt–equity ratio with a view to mitigate the possible conflicts of interest between equity holders and managers, and between equity holders and debt holders. An important implication of these theories is that firms with limited scope for asset substitution are likely to have higher debt levels, because they face lower agency costs of debt. Corporation tax rules could also act as an incentive to issue debt to reduce tax liabilities. In general, firms might trade off the increasing agency and bankruptcy costs associated with high debt with the tax benefits of increased leverage.

An alternative explanation of capital structure is based on asymmetric information between investors and firm’s insiders. Managers may choose a high debt–equity ratio in order to signal the good financial health of the firm. A high leverage would credibly convey the signal that the firm faces a low risk of bankruptcy. Finally, the pecking order theory of financing argues that firms will seek to avoid the higher cost of external debt and the dilution of equity capital associated with new equity issue. Firms will finance new investment internally in the first instance; once internal sources of finance are exhausted they will issue low-risk debt, and only as a last resort will they choose to issue new equity.

The empirical literature on corporate finance has identified a number of potential determinants of the capital structure choice. These determinants include profitability, size, growth opportunities, asset tangibility, nondebt tax shields, and volatility or business risk (see Titman and Wessels 1988, Harris and Raviv 1991). Profitability should have a negative effect on leverage according to the pecking order theory of capital structure. Bigger firms could face a lower risk of default than smaller firms because of the greater diversification of their investment. Furthermore, larger firms could have easier access to capital markets, and could borrow under better conditions than small firms. We would therefore expect a positive effect of firm size on debt. Growth opportunities can be seen as noncollateralizable assets: firms with sizable growth opportunities may find it more difficult to borrow externally because of the asset substitution effect (Titman and Wessels 1988). By contrast, a greater share of tangible assets should have an unambiguously positive effect on leverage because the assets can be used as a collateral for loans. Nondebt tax shields, such as depreciation allowances, should have a negative influence on leverage because they reduce the incentive to issue external debt (DeAngelo and Masulis 1980). Finally, volatility or business risk could be associated with the potential cost of financial distress, and should have a negative effect on leverage.

In our empirical analysis, we examine the determinants of the debt–equity ratio of firms, the ICR defined as the ratio between EBITDA and interest expense, the debt–earnings ratio (DTE), and Altman’s Z-score (ZALT). The regression variables are computed from the S&P Capital IQ database and include Chinese company panel data from 2009 to 2015.<sup>6</sup>

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<sup>6</sup> The database and variables are described and summarized in Appendix Tables A1, A2.1 and A2.2.

## A. Panel Fixed Effects

Table 1 presents the results of estimating the model by panel fixed effects.<sup>7</sup> The first three columns report estimates for total leverage, defined as the ratio of total debt to total assets, and for both long-term leverage and short-term leverage where we consider long-term debt and short-term debt only respectively. Profitability has a negative and significant coefficient, which is consistent with the pecking order theory of capital structure. Size has a positive and significant coefficient for total leverage LEV and for long-term leverage only. Neither asset growth nor earnings volatility is significant for any of the measures of leverage. Asset tangibility is positive and significant for all definitions of leverage, consistent with both the agency theory and the pecking order theory. Finally, nondebt tax shields—calculated as the ratio of total depreciation to total assets—are statistically significant but are only negative for long-term leverage. That is, nondebt tax shields seem to shorten debt maturity.

**Table 1: Capital Structure of Nonfinancial Firms, Panel Fixed Effects**

Variable	Total Leverage (1) LEV	Long-term Leverage (2) LLEV	Short-term Leverage (3) SLEV	1/ Interest Coverage Ratio (4) (ICR) <sup>-1</sup>	Debt/Earnings Ratio (5) DTE	1/ Altman Z-score (6) (ZALT) <sup>-1</sup>
PROF (lagged) PROF	-0.208***	-0.092*	-0.094*	-1.548***	-30.720***	0.010
SIZE (lagged) SIZE	0.023***	0.016***	-0.004	0.060**	1.558***	0.104**
GROWTA (lagged) GROWTA	0.000	0.000	0.000	0.000	0.001	-0.001
TANG (lagged) TANG	0.210***	0.083***	0.096***	-0.130	4.222	0.212
EVOL (lagged) EVOL	0.000	0.000	0.000	0.003	0.071	0.001*
NDTS (lagged) NDTS	0.545*	-0.365*	0.686**	2.374*	-42.104	-4.042
Constant	0.011	-0.041	0.116***	-0.009	-3.173	-0.199
<i>Number of observations</i>	6,881	6,881	6,881	6,751	6,751	6,747
<i>Number of groups</i>	983	983	983	983	983	983
<i>R-squared</i>	0.186	0.21	0.029	0.053	0.085	0.007
<i>F-statistic</i>	29.652	14.219	9.694	17.105	14.534	8.083
<i>Hausman</i>	36.37***	43.94***	52.38***	64.41***	57.83***	14.48*

DTE = debt-to-earnings, EVOL = earnings volatility, GROWTA = growth opportunities, ICR = interest coverage ratio, LEV = total leverage, LLEV = long-term leverage, NDTS = nondebt tax shields, PROF = profitability, SIZE = size, SLEV = short-term leverage, TANG = tangibility, ZALT = Altman Z-score.

Notes: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001. Standard errors are robust and allow for intergroup correlation. Regression variables are computed from S&P Capital IQ data, described in Appendix A1, and include Chinese company data from 2009 to 2015, summarized in Appendixes A2.1 and A2.2.

Source: Authors' calculations.

<sup>7</sup> Hausman tests reject the random effects specification for all the estimated equations.



Our findings so far are broadly supportive of the agency and the pecking order theory of capital structure, and weakly also of the signaling theory, although they would not be able to discriminate conclusively between these alternative theories.

Columns (4) to (6) of Table 1 examine potential determinants of key indicators of financial fragility of firms. Column (4) reports the results of estimating the equation for the inverse of the ICR ( $ICR^{-1}$ ). Values of ICR less than one indicate that current earnings fall short of the interest expenses which are due, and therefore low values of ICR (or high values of its inverse) are an indicator of financial distress. Profitability and earnings volatility have been lagged to avoid potential endogeneity with the dependent variable. The fixed-effects estimates show that lagged profitability has a negative effect and nondebt tax shield a positive effect as expected. Size has a positive effect, which is consistent with its positive influence on leverage.

Column (5) of Table 1 looks at the DTE as the dependent variable. This ratio too is used as an indicator of the potential financial distress of companies. Profitability and earning volatility have again been lagged to avoid endogeneity. The only significant variables are profitability and size, with a negative and a positive coefficient, respectively, as expected.

Finally, column (6) gives the results of estimating the determinants of the inverse Altman's Z-score, ( $ZALT^{-1}$ ). The Z-score is a weighted average of five ratios: (i) working capital/total assets; (ii) retained earnings/total assets; (iii) earnings before interest and taxes/total assets; (iv) the market value of equity/the book value of total liabilities; and (v) sales/total assets (Altman 1968). It is usually interpreted as a predictor of the probability that the company will go into bankruptcy within 2 years. High values of the inverse Z-score can thus be read as indicating low bankruptcy risk. All the regressors are lagged one period in the fixed effect regressions to avoid simultaneity bias. Among the statistically significant variables, size has a large and positive coefficient, which indicates that size is associated with a lower probability of bankruptcy. Earnings volatility also has a positive and significant coefficient, but its effect is relatively modest in absolute value.

## B. Quantile Regression Panel Data

The estimates in Table 1 allow for firm-specific, time-invariant fixed effects  $\alpha_i$  to capture the unobserved heterogeneity across firms in the response of the dependent variable to the conditioning variables. A potential shortcoming of this approach is that it assumes a common response of the dependent variable to the explanatory variables for all firms. This can be a strong assumption, since the response of the dependent variable could be different across the distribution of firms. For example, variables such as the size of the firm or the share of tangible assets could play a different role depending on whether the firm is already highly leveraged or not. In this case, a more suitable approach to estimating the response of the dependent variables to the conditioning variables across the whole distribution of firms is to estimate the model by quantile regression (Koenker and Basset 1978). Quantile regression estimation allows for different values of the regression coefficients across the different quantiles of the distribution of firms, and is therefore able to capture nonlinearities in the response of the dependent variable to its determinants.<sup>8</sup>

Quantile regressions with fixed effects for panel data presents however the difficulty that quantile estimators with additive fixed effects may not have the same interpretation as cross-sectional

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<sup>8</sup> Fattouh, Harris, and Scaramozzino (2005, 2008) use quantile regression to study capital structure in the Republic of Korea and in the United Kingdom, respectively.

regressions. The reason for this is that, using conventional notation, the distribution of  $(Y_{it} - \alpha_i)|X_{it}$  is not order-isomorphic to the distribution of  $Y_{it}|X_{it}$ : an observation which lies in one of the low quantiles of the distribution with respect to  $Y_{it}$  may lie in one of the top quantiles of the distribution with respect to  $(Y_{it} - \alpha_i)$ , and vice versa. This creates difficulties for the interpretation of panel quantile regressions with additive fixed effects, since the results cannot be understood in the same manner as cross-sectional regressions.

The estimator developed by Powell (2014) is able to address this concern, and to yield estimation results which can be interpreted in the same manner as cross-sectional regressions. The regression outcomes are modeled as:

$$Y_{it} = X'_{it}\beta(U_{it}^*) \quad (1)$$

where  $U_{it}^* \sim U(0,1)$  and where  $X'_{it}\beta(\tau)$  is strictly increasing in  $\tau \in (0,1)$ . The outcomes in (1) can be compared with other quantile estimators by setting  $U_{it}^* = f(\alpha_i, U_{it})$ . The causal effect of a change in the conditioning variable from  $x_1$  to  $x_2$  for a given  $\tau$  is:

$$x'_2\beta(\tau) - x'_1\beta(\tau) \quad (2)$$

where  $\tau$  denotes the quantile of the distribution. Using (2), we can define the structural quantile function (SQF) for equation (1) as:

$$S_Y(\tau|x) = x'\beta(\tau) \quad (3)$$

The identifying assumption for additive fixed effects models is the following:

$$U_{it}|(X_{it}, \alpha_i) \sim U(0,1) \quad (4)$$

Powell's (2014) Quantile Regression Panel Data (QRPD) estimator relaxes (4), and only requires the weaker identification assumption:

$$U_{it}^*|X_i \sim U_{is}^*|X_i \quad t, s = 1, 2, \dots, T \quad (5)$$

The SQF for the additive fixed effect model is  $\alpha_i - x'\beta(\tau)$ , whereas the SQF for the QRPD model is  $x'\beta(\tau)$ . As a result, the interpretation of the  $\tau$ -th quantile for the QRPD is the same as for the cross-sectional distribution (or equivalently for the pooled quantile regression).

Table 2 reports the results of quantile regression panel data estimation for our sample of nonfinancial companies. The findings reveal that the fixed-effects assumption of constant regression coefficients across the distribution of firms is not generally confirmed by the data. The estimated coefficients often vary across quantiles, although it is difficult to discern a clear pattern in the data across all the financial variables. Regarding capital structure, some of the strongest results are obtained for long-term leverage. Both size and the share of tangible assets are positive and statistically significant over the central quantiles of the distribution, with the first result consistent with the signaling theory of capital structure and the second with collateralizable assets ceasing to be relevant for firms with a very low or a very high leverage.

Table 2: Capital Structure of Nonfinancial Firms, Quantile Regression Panel Data

Total Leverage						1/ Interest Coverage Ratio					
Variable	5th	25th	50th	75th	95th	Variable	5th	25th	50th	75th	95th
PROF	-0.105	-0.241	-0.232	-0.283**	-0.335	(lagged) PROF	-0.038	-0.179***	-0.641***	-0.904***	-0.043
SIZE	0.162***	6.189	0.057	0.023*	0.040	SIZE	0.001	0.024***	0.021	0.021	0.040
GROWTA	0.000	0.000	0.000	0.000	0.000	GROWTA	0.000	0.000	0.000	0.000	0.000
TANG	0.100	1.433	0.250	0.186***	0.091	TANG	0.008	0.016	0.038	0.021	-0.046
EVOL	0.000	-0.001	0.000	0.000	0.000	(lagged) EVOL	0.000	0.000	0.001	0.002	8.185***
NDTS	0.496	2.488	0.784	0.526	0.427	NDTS	0.334	0.442*	0.116	-0.096	-0.448
<i>Number of observations</i>	6,881					<i>Number of observations</i>	6,751				
<i>No. of groups</i>	983					<i>No. of groups</i>	983				

Long-term Leverage						Debt/Earnings Ratio					
Variable	5th	25th	50th	75th	95th	Variable	5th	25th	50th	75th	95th
PROF	0.000	-0.006	-0.005	-0.009	-0.160	(lagged) PROF	-0.332	-6.904*	-11.654***	-17.648***	-24.964***
SIZE	0.247	0.012*	0.029***	0.044***	0.037	SIZE	7.527***	0.736	1.044***	1.256	1.061
GROWTA	0.000	0.000	-0.000***	0.000	-0.000***	GROWTA	-0.001	-0.001	-0.001	0.008	-0.005
TANG	0.002	0.037**	0.082***	0.111**	0.177	TANG	1.768	1.955*	2.368***	2.532**	10.328
EVOL	-0.001	0.000	0.000	0.000	0.029	(lagged) EVOL	0.002	0.007	0.016	0.019	0.368
NDTS	0.066	-0.057	-0.223	-0.251	-0.047	NDTS	-1.324	-9.140	-14.305	-24.029	-41.029
<i>Number of observations</i>	6,881					<i>Number of observations</i>	6,751				
<i>No. of groups</i>	983					<i>No. of groups</i>	983				

Short-term Leverage						1/ Altman Z-score					
Variable	5th	25th	50th	75th	95th	Variable	5th	25th	50th	75th	95th
PROF	-0.028	-0.140	-0.108	-0.255**	-0.343	(lagged) PROF	-0.210	-0.622***	-0.780***	-0.864***	-0.810
SIZE	0.229	5.029	0.035*	-0.008	-0.008	(lagged) SIZE	9.591	0.053***	0.076	0.091***	0.081
GROWTA	0.000	-0.001	0.000	0.000	0.000	(lagged) GROWTA	0.000	0.000	0.000	0.000***	0.001
TANG	0.011	0.025	0.019	0.044	0.042	(lagged) TANG	0.072	0.126***	0.186***	0.216**	0.273
EVOL	0.000	-0.002	0.000	0.000	0.001	(lagged) EVOL	0.010	0.000***	0.000	0.001	0.156
NDTS	0.111	0.319	0.896	1.987***	0.789	(lagged) NDTS	-0.010	0.222	0.151	0.753	3.379
<i>Number of observations</i>	6,881					<i>Number of observations</i>	6,747				
<i>No. of groups</i>	983					<i>No. of groups</i>	983				

EVOL = earnings volatility, GROWTA = growth opportunities, NDTS = nondebt tax shields, PROF = profitability, SIZE = size, TANG = tangibility.

Note: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001.

Source: Authors' calculations.

Lagged profits exert a strong and significant influence on financial ratios. The estimated coefficients are negative and significant for the inverse of ICR and for DTE, and increase in size for the upper quantiles of the distribution: higher profits therefore reduce the financial fragility of firms. They however increase the overall risk of bankruptcy as measured by the Z-score, which may also be consistent with signaling theory. Size tends to be associated with high debt–earnings ratios for firms in the left tail of the distribution and with lower Z-scores for firms in the central quantiles of the distribution. A higher share of tangible assets tends to be associated with larger debt–earnings ratios but with lower Z-scores.

The QRPD estimations illustrate that the assumption that regression coefficients are constant across the distributions of firms may not be valid. The effects of the regressors on the debt–equity ratios or on financial ratios can be different in the middle ranges of the distributions of firms and on the tails. The findings from QRPD tend to be more supportive of signaling theories of capital structure than the fixed-effects estimates would suggest.

### C. Simultaneous Panel Quantile Regressions

The Quantile Regression Panel Data approach of section III.B has the advantage of being directly comparable to cross-sectional quantile regression estimations in the interpretation of the regression coefficients, because of the weaker identifying assumption (5). Estimation by QRPD however still requires that the coefficients remain constant over time. DeAngelo and Roll (2015) recently found evidence that firm leverage exhibits significant variability over time. It is important therefore to investigate whether the responses of the dependent variables to their determinants vary along the economic cycle or over time. If this proves to be the case, then the assumption of constant coefficients would not be valid.

Table 3 shows the results of simultaneous panel regressions on total leverage for selected years from 2009 to 2015. Compared to QRPD, these estimations reveal that the effects of the explanatory variables on the response variables tend to vary over time, as well as across quantiles. For each year, the null hypothesis that the coefficients are constant across the distribution is often rejected by *F* tests. Profitability attracts a negative and significant coefficient which becomes larger in absolute value over time. Size is only significant for the more recent periods, whereas the effects of tangibility tend to be positive and significant across all time periods.

Similar results hold for long-term debt (Appendix Table A4.1), where however profitability tends to play a less significant role, and for short-term debt (Appendix Table A4.2). Lagged profitability also tends to exert an increasingly important role for the inverse of the ICR (Appendix Table A4.3) and for the DTE (Appendix Table A4.4). The influence of the share of tangible assets too becomes more significant in the more recent period. A strong cyclical effect appears to be present in the coefficients on the inverse Z-scores (Appendix Table A4.5), with the coefficients for profitability and tangible assets increasing during the middle years of the sample for the central quantiles and then declining towards the end of the sample period.

**Table 3: Capital Structure of Nonfinancial Corporations: Simultaneous Panel Quantile Regressions**

Quantile	Variable	2009	2011	2013	2015
5th	PROF	0.014	-0.178*	-0.285	-0.428***
	SIZE	0.002	0.012**	0.013***	0.014***
	GROWTA	0.000	0.000	0.000	0.000
	TANG	0.161***	0.168***	0.185***	0.141***
	EVOL	0.000	0.001	0.001	0.000
	NDTS	0.088	-0.099	0.481	0.294
	Constant	-0.039	-0.082**	-0.099***	-0.090**
25th	PROF	-0.281**	-0.461***	-0.620**	-0.722***
	SIZE	0.000	0.021**	0.021***	0.026***
	GROWTA	0.000	-0.001	0.000	0.000
	TANG	0.329***	0.282***	0.269***	0.282***
	EVOL	0.000	0.000	0.000	-0.001
	NDTS	0.404	0.164	0.100	-0.135
	Constant	0.020	-0.075*	-0.060	-0.103*
50th	PROF	-0.391***	-0.546***	-0.506***	-0.868***
	SIZE	0.002	0.035***	0.036***	0.039***
	GROWTA	0.000	0.000	-0.001*	0.000
	TANG	0.372***	0.294***	0.295***	0.279***
	EVOL	0.000	0.000	0.000	0.000
	NDTS	0.394	0.858	0.229	0.159
	Constant	0.088*	-0.094***	-0.093**	-0.104*
75th	PROF	-0.429**	-0.578***	-0.829***	-0.781***
	SIZE	0.003	0.026***	0.035***	0.050***
	GROWTA	0.000	-0.001	-0.002*	0.000
	TANG	0.339***	0.272***	0.244***	0.260***
	EVOL	0.001	0.000	0.000	-0.001
	NDTS	0.978	1.248**	1.102	0.710
	Constant	0.173***	0.055	0.033	-0.100*
95th	PROF	-0.678***	-0.731***	-1.117**	-1.051***
	SIZE	0.006	0.029***	0.033***	0.041***
	GROWTA	0.000	0.000	0.001	0.000
	TANG	0.229*	0.097	0.150***	0.062
	EVOL	0.001	-0.001	0.000	-0.001
	NDTS	0.447	1.733***	1.154***	0.462
	Constant	0.386***	0.272***	0.246***	0.233**
<i>F-test on equality of coefficients</i>					
	PROF	7.119***	4.598**	2.874*	2.711*
	SIZE	0.247	4.537**	17.779***	13.064***
	GROWTA	0.628	0.495	1.883	0.331
	TANG	5.971***	6.174***	2.546*	4.168
	EVOL	0.850	7.059***	3.223*	0.104
	NDTS	0.918	3.030*	1.675	0.358
	<i>Number of observations</i>	983	983	983	983

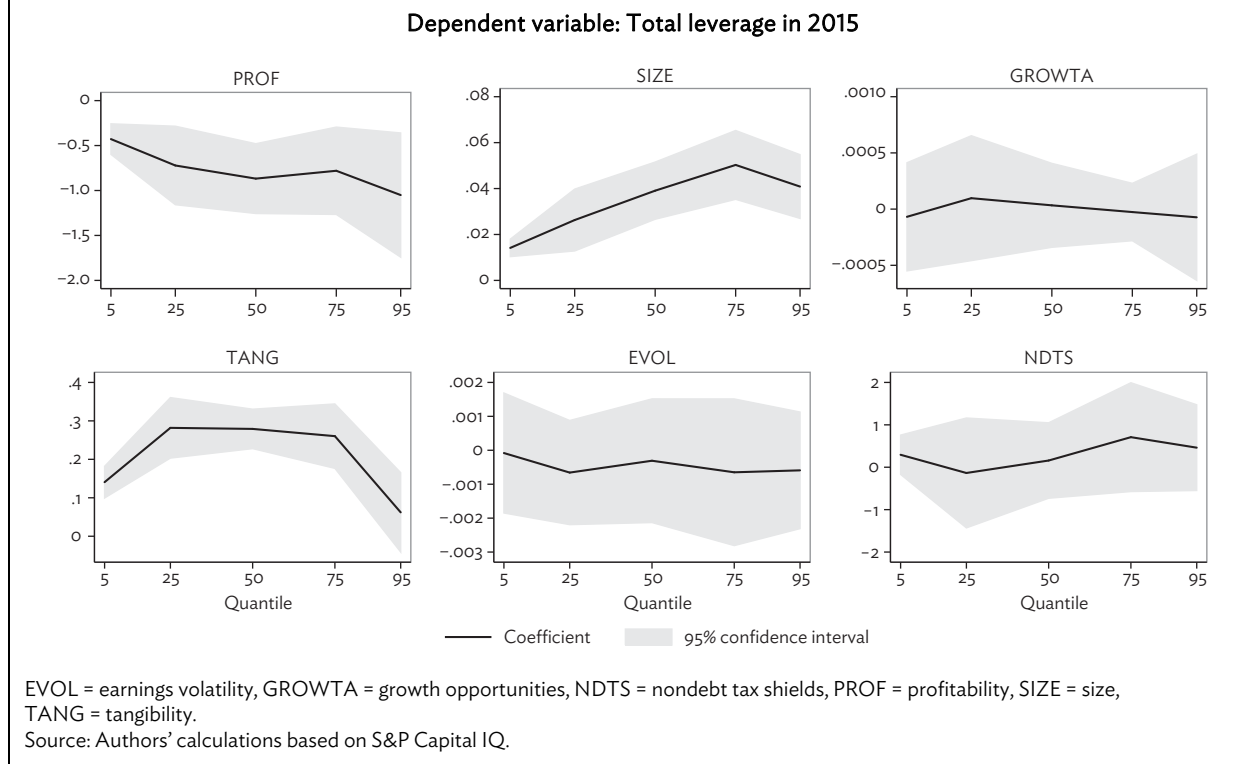
EVOL = earnings volatility, GROWTA = growth opportunities, NDTS = nondebt tax shields, PROF = profitability, SIZE = size, TANG = tangibility.

Note: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Source: Authors' calculations.

Figure 10 illustrates the changing values of the regressions coefficients for total leverage across quantiles of the distribution in 2015, the last year of the sample. In particular, the influence of profitability tends to increase in absolute value for the top quantiles of the distribution and the influence of size tends to increase, whereas tangibility displays an inverted U-shaped pattern.

Figure 10: Simultaneous Panel Quantile Regressions



The combined results from QRPD and simultaneous panel regressions indicate that the assumptions of constant coefficients across firms and over time may not be valid for Chinese nonfinancial firms. A number of coefficients increase in size over time pointing to increased sensitivity of debt ratios to some of their determinants in recent years. This can be a potential cause for concern, since a deterioration in the variables which act as a restraining influence on debt ratios could see even greater increases in the leverage of Chinese corporations.

In particular, the simultaneous panel quantile regressions show that the role of profitability in reducing debt levels has grown in importance in the more recent period. At the same time, nonfinancial corporations have experienced a decline in their profitability in the more recent years. A reason for this finding can be traced to the aggressive intervention by Chinese policy authorities in the aftermath of the global financial crisis. The significant decline in the lending rate since 2008 has reduced the opportunity cost of external debt relative to retained earnings as sources of funding, thereby increasing firms' incentive to borrow in preference to internal sources of finance. Together with the decline in profitability over the same period, the decline in the opportunity cost of debt resulted in a heightened sensitivity of the firm capital structure to earnings.

The joint effect of the increased role of profitability for leverage and of the decline in profitability itself is thus likely to lead to larger debt ratios in the coming years. This result is of relevance for the future financial sustainability of Chinese firms. It is important to note that this conclusion could not have been obtained from an aggregate analysis of financial variables nor from a conventional fixed effects analysis, since it only emerges from a simultaneous quantile analysis where the regression coefficients are allowed to change over time.

#### IV. CONCLUSIONS

Ever since the Government of the PRC chose to implement a large stimulus to support the economy in the wake of the financial crisis of 2008/2009, corporate leverage has experienced a steep and sustained increase. The ratios of total debt and of credit to GDP have increased at the same time as corporate returns and interest coverage ratios have been weakening, raising concerns about growing systemic vulnerability within the Chinese financial system.

Based on the analysis of aggregate data, there is no clear evidence yet of weakening corporate performance onto the Chinese financial sector. To an extent, this reflects the predominance of SOEs in the Chinese corporate landscape, and authorities' control over the financial system and its major players and institutions. Such a controlled environment has the ability to contain or delay the spillover of financial distress from the corporate to the financial sector for some period of time, but not indefinitely. Ultimately, growing systemic pressure constitutes a contingent liability to the state, and its realization would come to bear heavily on the public budget and debt ratios.

This paper assessed corporate sector fragility through panel regressions that relate leverage and other financial indicators to the determinants of capital structure, such as companies' size and profitability. The rationale for quantile regression analysis—of which we implement also the panel approach developed recently—is that it picks up vulnerabilities not just at the mean or median of the distribution, but also for the more marginal firms, which are those most exposed to negative shocks. Indeed, our analysis confirms that the sensitivity of leverage to its determinants varies across quantiles, with some areas of the distribution being affected much more strongly than others. We also find that some of the estimated coefficients have increased substantially in absolute size over time.

In particular, we find that profitability has a restraining effect on corporate leverage, the intensity of which has risen sharply over recent years. Possibly, this can be explained by a significant decline in lending rates in the wake of the massive stimulus program, which increased Chinese firms' incentive to borrow instead of relying on retained earnings as a source of finance. Against the backdrop of deteriorating profitability, this resulted in firms' heightened sensitivity of the capital structure to earnings. Ultimately, this finding raises some concern about the recent downward trend in corporate firms' profitability, because it implies that firms could react by taking on even larger levels of debt in the future. An uptick in corporate profitability in 2016—reflected in the latest data release but not in the above analysis—provides some relief in this regard.

In sum, the findings in this paper seem to confirm our hypothesis that financial sector based on aggregate indicators tend to overlook the increased vulnerability of the marginal nonfinancial firms in the Chinese corporate sector. The fragility of the system tends to be underestimated as a result, and may provide a sense of complacency about the stability of the Chinese financial system which is unwarranted in view of continuing weakness in the corporate system.

## APPENDIX

**Table A1: The S&P Capital IQ Database and Regression Variables**

Variable	Description	Measurement
LEV	Total leverage	Ratio of total debt to total assets
LLEV	Long-term leverage	Ratio of long-term debt to total assets
SLEV	Short-term leverage	Ratio of short-term debt to total assets
ICR	Interest coverage ratio	Ratio of EBITDA (earnings before interest, taxes, depreciation, and amortization) to interest expense
DTE	Debt-to-earnings	Ratio of total debt to EBITDA
ZALT	Altman Z-score	The Z-score is a weighted average of five ratios: (i) working capital/total assets, (ii) retained earnings/total assets, (iii) earnings before interest and taxes/total assets, (iv) the market value of equity/the book value of total liabilities, and (v) sales/total assets.
PROF	Profitability	Ratio of EBITDA to total assets
SIZE	Size	Natural logarithm of total assets
GROWTA	Growth opportunities	Ratio of revenue growth to total asset growth
TANG	Tangibility	Ratio of net property, plant, equipment, and inventory to total assets
EVOL	Earnings volatility	Change of operating income (absolute value of first differences)
NDS	Nondebt tax shields	Ratio of depreciation and amortization (EBITDA-EBIT) to total assets

Notes:

1. As of November 2016, the S&P Capital IQ database covers more than 45,000 active companies—spanning 130 countries and several currencies. It also provides financial statement data for more than 800,000 private companies. Data on fundamentals cover equities, fixed income, capital structure, credit ratings, transactions, private equity firm profiles, ownership, and business relationships. It is accessible with a subscription: <https://www.capitaliq.com/>
  2. For this study, we downloaded data for all private and public firms geographically located in the People's Republic of China that are considered operating as of September 2016. This includes 36 financial ratios, 24 standardized balance sheet and income statement items, as well as 10 indicators specific to banks. The data run from 1990 to 2015 and are expressed in US dollar millions, based on the platform's historical exchange rates.
  3. For regression analysis, we retained data from 2009 to 2015 only and computed variables as described in the above table.
- Sources: S&P Capital IQ Fundamentals. [http://marketintelligence.spglobal.com/documents/products/SPCIQ\\_Fundamentals\\_v2.pdf](http://marketintelligence.spglobal.com/documents/products/SPCIQ_Fundamentals_v2.pdf) and the S&P Capital IQ® Platform. [http://marketintelligence.spglobal.com/documents/products/SPCIQ\\_Platform\\_v2.pdf](http://marketintelligence.spglobal.com/documents/products/SPCIQ_Platform_v2.pdf)



Table A2.1: Regression Variables—Summary by Years

Variable	Year = 2009–2015					Year = 2012						
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max		
LEV	6,881	0.26	0.15	0.00	0.86	983	0.27	0.14	0.00	0.72		
LLEV	6,881	0.09	0.10	0.00	0.62	983	0.09	0.10	0.00	0.60		
SLEV	6,881	0.15	0.11	0.00	0.86	983	0.15	0.11	0.00	0.65		
ICR <sup>-1</sup>	6,881	0.26	0.53	0.00	15.38	983	0.31	0.77	0.00	14.08		
DTE	6,881	5.81	11.88	0.00	275.80	983	6.33	15.26	0.02	254.80		
ZALT <sup>-1</sup>	6,881	0.49	2.25	-71.43	166.67	983	0.52	0.42	0.06	4.76		
PROF	6,881	0.08	0.05	0.00	0.51	983	0.08	0.05	0.00	0.32		
SIZE	6,881	6.74	1.37	3.18	12.87	983	6.81	1.32	4.20	12.76		
GROWTA	6,881	0.95	32.34	-520.90	1,985.81	983	1.06	26.18	-207.56	751.67		
TANG	6,881	0.48	0.18	0.01	0.95	983	0.49	0.18	0.02	0.94		
EVOL	6,881	1.97	13.70	0.00	506.66	983	1.94	13.12	0.00	300.20		
NDTS	6,881	0.02	0.02	0.00	0.22	983	0.02	0.02	0.00	0.15		
		<b>Year = 2009</b>						<b>Year = 2013</b>				
LEV	983	0.26	0.15	0.00	0.86	983	0.27	0.14	0.00	0.73		
LLEV	983	0.09	0.10	0.00	0.62	983	0.10	0.10	0.00	0.55		
SLEV	983	0.15	0.11	0.00	0.86	983	0.15	0.11	0.00	0.54		
ICR <sup>-1</sup>	983	0.20	0.40	0.00	8.06	983	0.26	0.29	0.00	3.46		
DTE	983	4.86	11.67	0.01	261.20	983	5.67	8.31	0.03	191.50		
ZALT <sup>-1</sup>	983	0.40	2.39	-71.43	13.70	983	0.54	0.50	0.06	10.64		
PROF	983	0.10	0.06	0.00	0.39	983	0.07	0.04	0.00	0.33		
SIZE	983	6.09	1.38	3.18	12.27	983	6.97	1.31	4.39	12.87		
GROWTA	983	0.40	28.05	-520.90	385.43	983	1.08	8.07	-85.55	127.70		
TANG	983	0.49	0.18	0.03	0.95	983	0.49	0.17	0.01	0.94		
EVOL	983	2.73	20.91	0.00	506.66	983	2.15	15.74	0.00	315.34		
NDTS	983	0.03	0.02	0.00	0.22	983	0.02	0.02	0.00	0.13		
		<b>Year = 2010</b>						<b>Year = 2014</b>				
LEV	983	0.25	0.15	0.00	0.69	983	0.27	0.15	0.00	0.73		
LLEV	983	0.09	0.10	0.00	0.58	983	0.10	0.10	0.00	0.56		
SLEV	983	0.14	0.11	0.00	0.69	983	0.14	0.11	0.00	0.63		
ICR <sup>-1</sup>	983	0.16	0.29	0.00	6.17	983	0.30	0.49	0.00	9.52		
DTE	983	4.16	8.75	0.00	193.40	983	6.31	9.97	0.02	182.30		
ZALT <sup>-1</sup>	983	0.41	0.62	0.02	17.24	983	0.53	0.46	-5.41	5.10		
PROF	983	0.10	0.05	0.00	0.47	983	0.07	0.04	0.00	0.30		
SIZE	983	6.41	1.33	3.73	12.43	983	7.08	1.31	4.46	12.87		
GROWTA	983	2.02	22.45	-84.49	616.75	983	-0.58	26.98	-513.95	493.65		
TANG	983	0.48	0.18	0.03	0.94	983	0.48	0.18	0.02	0.92		
EVOL	983	1.60	10.47	0.00	274.23	983	1.78	12.11	0.00	318.52		
NDTS	983	0.02	0.02	0.00	0.16	983	0.02	0.02	0.00	0.13		
		<b>Year = 2011</b>						<b>Year = 2015</b>				
LEV	983	0.26	0.15	0.00	0.74	983	0.26	0.15	0.00	0.70		
LLEV	983	0.08	0.10	0.00	0.52	983	0.10	0.10	0.00	0.48		
SLEV	983	0.15	0.11	0.00	0.69	983	0.14	0.10	0.00	0.59		
ICR <sup>-1</sup>	983	0.21	0.40	0.00	7.19	983	0.38	0.77	0.00	15.38		
DTE	983	4.69	8.04	0.00	166.10	983	8.65	17.24	0.01	275.80		
ZALT <sup>-1</sup>	983	0.41	0.40	0.04	8.13	983	0.64	5.32	-2.17	166.67		
PROF	983	0.09	0.05	0.00	0.51	983	0.06	0.04	0.00	0.26		
SIZE	983	6.65	1.31	3.98	12.63	983	7.16	1.30	4.40	12.82		
GROWTA	983	1.14	7.08	-101.91	75.76	983	1.53	67.10	-428.02	1,985.81		
TANG	983	0.49	0.18	0.03	0.94	983	0.46	0.18	0.01	0.90		
EVOL	983	1.40	11.12	0.00	272.49	983	2.16	8.80	0.00	143.68		
NDTS	983	0.02	0.02	0.00	0.15	983	0.02	0.02	0.00	0.11		

DTE = debt-to-earnings, EVOL = earnings volatility, GROWTA = growth opportunities, ICR = interest coverage ratio, LEV = total leverage, LLEV = long-term leverage, NDTS = nondebt tax shields, PROF = profitability, SIZE = size, SLEV = short-term leverage, TANG = tangibility, ZALT = Altman Z-score.

Source: Authors' calculations.

Table A2.2: Regression Variables—Summary by Leverage Quantiles

Variable	Quantile interval = 0–5					Quantile interval = 50–75						
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max		
LEV	344	0.02	0.01	0.00	0.04	1,720	0.31	0.03	0.25	0.36		
PROF	344	0.09	0.06	0.01	0.42	1,720	0.08	0.05	0.00	0.47		
SIZE	344	6.26	1.23	3.96	11.11	1,720	6.91	1.37	3.27	11.79		
GROWTA	344	0.92	15.77	-142.96	197.71	1,720	0.07	19.28	-428.02	262.49		
TANG	344	0.35	0.15	0.01	0.94	1,720	0.50	0.17	0.02	0.91		
EVOL	344	1.46	6.10	0.00	59.34	1,720	2.46	18.54	0.00	506.66		
NDTS	344	0.02	0.01	0.00	0.09	1,720	0.02	0.02	0.00	0.22		
		Quantile interval = 5–25						Quantile interval = 75–95				
LEV	1,377	0.10	0.03	0.04	0.15	1,376	0.43	0.04	0.36	0.52		
PROF	1,377	0.09	0.06	0.00	0.39	1,376	0.07	0.04	0.00	0.27		
SIZE	1,377	6.32	1.24	3.21	12.43	1,376	7.08	1.24	3.47	10.87		
GROWTA	1,377	0.63	21.45	-520.90	385.43	1,376	1.72	60.27	-513.95	1,985.81		
TANG	1,377	0.41	0.16	0.03	0.94	1,376	0.56	0.17	0.01	0.94		
EVOL	1,377	1.21	5.31	0.00	94.96	1,376	2.00	12.23	0.00	318.52		
NDTS	1,377	0.02	0.01	0.00	0.12	1,376	0.03	0.02	0.00	0.15		
		Quantile interval = 25–50						Quantile interval = 95–100				
LEV	1,720	0.20	0.03	0.15	0.25	344	0.58	0.05	0.52	0.86		
PROF	1,720	0.09	0.05	0.00	0.51	344	0.06	0.03	0.00	0.20		
SIZE	1,720	6.53	1.40	3.18	12.87	344	7.72	1.35	3.87	10.84		
GROWTA	1,720	1.44	21.65	-269.20	616.75	344	1.14	9.85	-74.75	86.21		
TANG	1,720	0.47	0.16	0.01	0.92	344	0.60	0.20	0.04	0.95		
EVOL	1,720	1.75	12.03	0.00	300.20	344	3.94	23.67	0.00	315.34		
NDTS	1,720	0.03	0.02	0.00	0.16	344	0.03	0.02	0.00	0.12		

EVOL = earnings volatility, GROWTA = growth opportunities, LEV = total leverage, NDTS = nondebt tax shields, PROF = profitability, SIZE = size, TANG = tangibility.

Source: Authors' calculations.

Table A3: Interest Coverage Ratio and Nonfinancial Corporate Sector Leverage

Year	Number of Companies			Corporate Debt (\$ billion)		
	ICR<1	Total	Ratio (%)	ICR<1	Total	Ratio (%)
1998	2	52	3.8	0.4	33	1.2
1999	5	107	4.7	0.2	53	0.4
2000	7	144	4.9	0.5	50	0.9
2001	2	189	1.1	0.2	55	0.4
2002	8	219	3.7	1.5	80	1.9
2003	9	295	3.1	2.9	116	2.5
2004	8	412	1.9	0.5	159	0.3
2005	23	594	3.9	5.5	234	2.3
2006	52	1,580	3.3	6.3	417	1.5
2007	71	1,944	3.7	12.0	676	1.8
2008	82	2,142	3.8	34.1	963	3.5
2009	87	2,412	3.6	17.1	1,095	1.6
2010	61	2,525	2.4	21.6	1,641	1.3
2011	78	2,750	2.8	51.4	2,233	2.3
2012	146	2,955	4.9	203.4	2,952	6.9
2013	206	3,423	6.0	307.4	4,238	7.3
2014	272	3,565	7.6	533.7	5,234	10.2
2015	303	3,377	9.0	728.9	5,135	14.2

ICR = interest coverage ratio.

Source: Authors' calculations based on S&P Capital IQ.

Table A4.1: Capital Structure of Nonfinancial Corporations—SQR for Long-term Leverage

Quantile	Variable	2009	2011	2013	2015
5th	PROF	0.000	0.000	-0.002	-0.007
	SIZE	0.000	0.001	0.001	0.002
	GROWTA	0.000	0.000	0.000	0.000
	TANG	0.000	0.001	0.003	0.004
	EVOL	0.000	0.000	0.000	0.000
	NDTS	0.000	0.003	0.000	-0.005
	Constant	0.000	-0.004	-0.008	-0.011
25th	PROF	0.003	-0.040	-0.068	-0.076***
	SIZE	0.011***	0.012***	0.016***	0.018***
	GROWTA	0.000	0.000	0.000	0.000
	TANG	0.083***	0.059***	0.085***	0.107***
	EVOL	0.000	0.000	0.000	0.000
	NDTS	-0.137*	-0.071	-0.121	-0.344*
	Constant	-0.085***	-0.087***	-0.120***	-0.134***
50th	PROF	-0.026	-0.064	0.020	-0.073
	SIZE	0.020***	0.026***	0.032***	0.031***
	GROWTA	0.000	0.000	0.000	0.000
	TANG	0.169***	0.130***	0.184***	0.168***
	EVOL	0.000	0.000	0.000	0.000
	NDTS	-0.513*	-0.303	-0.458	-0.645*
	Constant	-0.124***	-0.164***	-0.220***	-0.201***
75th	PROF	-0.039	-0.188*	-0.069	-0.271***
	SIZE	0.030***	0.037***	0.040***	0.041***
	GROWTA	0.000	-0.001	0.000	0.000
	TANG	0.247***	0.207***	0.215***	0.196***
	EVOL	0.000	0.000	0.000	0.000
	NDTS	-0.345	-0.033	-0.492	-0.608
	Constant	-0.166***	-0.207***	-0.223***	-0.209***
95th	PROF	-0.250	-0.275	0.051	0.075
	SIZE	0.031**	0.037***	0.027***	0.044***
	GROWTA	0.001	-0.001	-0.002***	0.000
	TANG	0.209**	0.198*	0.130	0.143*
	EVOL	0.000	0.000	-0.000**	0.000
	NDTS	0.313	0.043	-0.731	-1.038
	Constant	-0.009	-0.061	0.029	-0.094
<i>F-test on equality of coefficients</i>					
	PROF	1.048	2.411*	1.758	3.614**
	SIZE	100.924***	24.201***	33.270***	33.056***
	GROWTA	0.408	0.418	2.157	2.358
	TANG	42.578***	11.711***	24.552***	20.804***
	EVOL	0.333	1.453	0.813	1.094
	NDTS	1.707	0.770	0.979	2.348
	<i>Number of observations</i>	983	983	983	983

EVOL = earnings volatility, GROWTA = growth opportunities, NDTS = nondebt tax shields, PROF = profitability, SIZE = size, SQR = simultaneous quantile regression, TANG = tangibility.

Note: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001.

Source: Authors' calculations.

Table A4.2: Capital Structure of Nonfinancial Corporations—SQR for Short-term Leverage

Quantile	Variable	2009	2011	2013	2015
5th	PROF	-0.085**	-0.068***	-0.072	-0.146**
	SIZE	-0.004*	-0.002*	-0.001	0.001
	GROWTA	0.000	-0.000*	0.000	0.000
	TANG	0.018	0.015*	0.008	0.003
	EVOL	0.000	0.000	0.001	0.000
	NDTS	0.341**	0.241***	0.370***	0.206
	Constant	0.030**	0.019*	0.013	0.005
25th	PROF	-0.106*	-0.254***	-0.321***	-0.377***
	SIZE	-0.015***	-0.010***	-0.009***	-0.005**
	GROWTA	0.000	0.000	-0.001*	0.000
	TANG	0.059*	0.045	0.053***	0.012
	EVOL	0.000	0.000	0.000	-0.001
	NDTS	0.869**	0.874**	0.453	0.651*
	Constant	0.119***	0.112***	0.117***	0.095***
50th	PROF	-0.317**	-0.404**	-0.536***	-0.599***
	SIZE	-0.023***	-0.012**	-0.016***	-0.007*
	GROWTA	0.000	0.000	-0.001	0.000
	TANG	0.093**	0.064	0.086**	0.034
	EVOL	0.000	0.001	0.000	0.000
	NDTS	1.055**	0.842	1.144**	1.005*
	Constant	0.235***	0.195***	0.205***	0.166***
75th	PROF	-0.240*	-0.503***	-0.679***	-0.782***
	SIZE	-0.029***	-0.013***	-0.008	-0.010*
	GROWTA	0.000	0.000	-0.001	0.000
	TANG	0.107*	0.050	0.031	0.080*
	EVOL	0.001	0.000	0.000	0.000
	NDTS	0.731	0.858**	1.108***	0.729
	Constant	0.346***	0.300***	0.279***	0.264***
95th	PROF	-0.707***	-0.473***	-0.836***	-1.041**
	SIZE	-0.043***	-0.023*	-0.016	0.003
	GROWTA	0.000	0.002*	-0.002	0.000
	TANG	0.093	0.060	0.062	0.099
	EVOL	0.002	-0.001	-0.001	0.000
	NDTS	0.674	0.423	0.769	0.926
	Constant	0.616***	0.500***	0.490***	0.304***
<i>F-test on equality of coefficients</i>					
	PROF	5.805***	6.648***	10.091***	6.215***
	SIZE	22.949***	5.530***	8.819***	2.912*
	GROWTA	0.564	1.270	1.127	0.230
	TANG	2.759*	0.507	1.387	2.919*
	EVOL	0.714	0.492	0.836	0.071
	NDTS	1.729	3.679	1.377	2.311
	<i>Number of observations</i>	983	983	983	983

EVOL = earnings volatility, GROWTA = growth opportunities, NDTS = nondebt tax shields, PROF = profitability, SIZE = size, SQR = simultaneous quantile regression, TANG = tangibility.

Note: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001.

Source: Authors' calculations.

Table A4.3: Capital Structure of Nonfinancial Corporations—SQR for the Inverse of ICR

Quantile	Variable	2009	2011	2013	2015
5th	(lagged) PROF	-0.113**	-0.152***	-0.229***	-0.428***
	SIZE	-0.001	-0.001	0.000	0.004*
	GROWTA	0.000	0.000	0.000	0.000
	TANG	0.030*	0.023**	0.014	0.041*
	(lagged) EVOL	0.000	0.001	0.002***	0.000
	ndts	0.218	0.255**	0.273	0.037
	Constant	0.015	0.027**	0.038*	0.022
25th	(lagged) PROF	-0.462***	-0.545***	-1.068***	-1.444***
	SIZE	-0.005**	-0.003	-0.002	0.005
	GROWTA	0.000	0.000	-0.001	0.001
	TANG	0.050	0.044	0.087	0.081
	(lagged) EVOL	0.000	0.001	0.001	0.002*
	NDTS	0.430*	0.661***	0.416	0.572
	Constant	0.117***	0.111***	0.156***	0.147***
50th	(lagged) PROF	-0.826***	-1.034***	-1.692***	-2.411***
	SIZE	-0.009***	-0.002	0.003	0.015*
	GROWTA	0.000	-0.001	-0.001	0.001
	TANG	0.069***	0.078**	0.084*	0.083*
	(lagged) EVOL	0.001	0.002	0.002	0.002
	NDTS	0.126	0.603*	0.357	0.807
	Constant	0.238***	0.209***	0.262***	0.247***
75th	(lagged) PROF	-1.241***	-1.487***	-2.376***	-3.310***
	SIZE	-0.007	0.004	0.011	0.012
	GROWTA	0.000	-0.002	-0.002***	0.001
	TANG	0.054	0.080*	0.022	-0.010
	(lagged) EVOL	0.003	0.001	0.002	0.009
	NDTS	-0.258	0.010	0.161	0.269
	Constant	0.380***	0.333***	0.419***	0.526***
95th	(lagged) PROF	-1.815***	-2.125***	-3.813***	-7.916***
	SIZE	-0.022	-0.014	-0.015	-0.032
	GROWTA	0.001	-0.005**	-0.005	0.002
	TANG	0.001	-0.076	0.171	-1.044*
	(lagged) EVOL	0.009***	0.000	0.000	0.028*
	NDTS	0.211	-1.768**	1.082	15.614
	Constant	0.826***	0.872***	0.959***	1.996**
<i>F-test on equality of coefficients</i>					
	(lagged) PROF	82.137***	60.277***	32.786***	93.567***
	SIZE	2.217	1.468	0.796	1.498
	GROWTA	1.184	2.994*	1.049	1.318
	TANG	1.982	2.032	1.545	2.590*
	(lagged) EVOL	3.647**	0.054	0.137	3.090*
	NDTS	1.275	4.530**	0.089	0.885
	Number of observations	853	983	983	983

EVOL = earnings volatility, GROWTA = growth opportunities, ICR = interest coverage ratio, NDTS = nondebt tax shields, PROF = profitability, SIZE = size, SQR = simultaneous quantile regression, TANG = tangibility.

Note: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001.

Source: Authors' calculations.

Table A4.4: Capital Structure of Nonfinancial Corporations—SQR for Debt-earnings Ratio

Quantile	Variable	2009	2011	2013	2015
5th	(lagged) PROF	-2.214	-4.303***	-9.662***	-9.442***
	SIZE	0.058	0.059	0.158**	0.228***
	GROWTA	0.000	-0.006	-0.011	0.000
	TANG	1.695***	1.473***	3.362***	2.269***
	(lagged) EVOL	0.006	0.041***	0.027***	0.026
	NDTS	-5.392	-1.601	-16.048**	-6.723
	Constant	-0.301	-0.008	-0.583	-0.956**
25th	(lagged) PROF	-9.283***	-15.608***	-22.160***	-34.735***
	SIZE	0.084	0.260***	0.250**	0.516***
	GROWTA	-0.001	-0.015	-0.014***	0.009
	TANG	3.092***	3.236***	4.073***	5.030***
	(lagged) EVOL	0.003	0.027*	0.014	0.014
	NDTS	-14.115**	-2.192	-22.746***	-23.437***
	Constant	1.031*	0.364	1.246*	0.139
50th	(lagged) PROF	-16.996***	-21.270***	-34.544***	-49.510***
	SIZE	0.275***	0.370***	0.514***	0.790***
	GROWTA	0.001	-0.028	-0.028***	0.011
	TANG	4.316***	3.506***	4.437***	5.557***
	(lagged) EVOL	0.022	0.038*	0.031	0.021
	NDTS	-27.796***	-14.349*	-28.794***	-35.772***
	Constant	1.842*	1.606**	2.013***	1.414
75th	(lagged) PROF	-23.817***	-30.528***	-48.645***	-67.840***
	SIZE	0.575**	0.565***	0.798***	1.218***
	GROWTA	0.006	-0.057	-0.039*	0.009
	TANG	3.329***	3.600***	5.216***	6.780***
	(lagged) EVOL	0.109	0.028	0.042*	0.186
	NDTS	-40.231**	-23.806**	-46.853***	-55.336**
	Constant	3.552**	3.322***	3.636*	2.555
95th	(lagged) PROF	-33.863***	-50.388***	-68.702***	-130.159***
	SIZE	1.310	0.709*	1.126	1.069
	GROWTA	-0.025	-0.131	-0.094*	0.033
	TANG	6.713	4.456	12.822*	12.229
	(lagged) EVOL	0.545*	0.071	0.003	0.415
	NDTS	-86.400*	-75.970***	-57.822	-109.338
	Constant	5.582	10.621***	6.346	23.464
<i>F-test on equality of coefficients</i>					
	(lagged) PROF	9.991***	29.828***	25.762***	33.299***
	SIZE	5.295***	4.928***	4.355**	12.914***
	GROWTA	2.349	1.577	2.205	0.700
	TANG	3.090*	5.063***	1.636	5.286***
	(lagged) EVOL	2.192	0.938	0.518	0.577
	NDTS	4.057**	5.082***	3.354**	2.363
	Number of observations	853	983	983	983

EVOL = earnings volatility, GROWTA = growth opportunities, NDTS = nondebt tax shields, PROF = profitability, SIZE = size, SQR = simultaneous quantile regression, TANG = tangibility.

Note: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001.

Source: Authors' calculations.

**Table A4.5: Capital Structure of Nonfinancial Corporations—SQR for the Inverse of Altman Z-score**

Quantile	Variable	2009	2011	2013	2015
5th	(lagged) PROF	-0.243	-0.639***	-1.307***	-0.705***
	(lagged) SIZE	0.029**	0.042***	0.050***	0.056***
	(lagged) GROWTA	-0.001	0.000	0.000	-0.001
	(lagged) TANG	0.224***	0.118*	0.171**	0.123*
	(lagged) EVOL	0.001	0.000	0.001	0.001
	(lagged) NDTs	-2.729	-0.095	-0.067	-0.873
	Constant	-0.049	-0.107***	-0.099*	-0.225***
25th	(lagged) PROF	-0.842***	-1.241***	-1.851***	-1.437***
	(lagged) SIZE	0.050***	0.062***	0.077***	0.097***
	(lagged) GROWTA	0.001	0.000	0.000	-0.000*
	(lagged) TANG	0.189***	0.231***	0.303***	0.220***
	(lagged) EVOL	0.000	0.001	0.000	0.002
	(lagged) NDTs	-0.206	0.251	0.721	0.394
	Constant	-0.047	-0.143***	-0.201***	-0.421***
50th	(lagged) PROF	-1.118***	-1.462***	-2.402***	-1.847***
	(lagged) SIZE	0.058***	0.081***	0.099***	0.130***
	(lagged) GROWTA	0.000	0.000	0.000	0.000
	(lagged) TANG	0.236***	0.376***	0.402***	0.331***
	(lagged) EVOL	0.000	0.000	-0.001	0.003*
	(lagged) NDTs	0.283	-0.055	2.032***	1.179*
	Constant	-0.012	-0.199***	-0.268***	-0.588***
75th	(lagged) PROF	-1.088***	-1.509***	-2.741***	-2.176***
	(lagged) SIZE	0.043**	0.107***	0.136***	0.173***
	(lagged) GROWTA	0.002	0.000	0.000	0.000
	(lagged) TANG	0.340***	0.432***	0.423***	0.298***
	(lagged) EVOL	0.002	0.002	0.002	0.003*
	(lagged) NDTs	1.629	-0.161	2.427***	2.355
	Constant	0.175	-0.256***	-0.353**	-0.732***
95th	(lagged) PROF	-1.675**	-1.783***	-2.784***	-1.967**
	(lagged) SIZE	0.082	0.135***	0.265***	0.303***
	(lagged) GROWTA	0.010	-0.001	-0.001	-0.001
	(lagged) TANG	0.697***	0.190	0.501**	0.410
	(lagged) EVOL	0.001	-0.001	-0.001	0.001
	(lagged) NDTs	1.091	4.524	7.272***	8.242*
	Constant	0.264	-0.028	-0.978***	-1.442***
<i>F-test on equality of coefficients</i>					
	(lagged) PROF	1.802	9.793***	7.457***	7.829***
	(lagged) SIZE	2.805*	13.657***	14.727***	11.046***
	(lagged) GROWTA	0.794	0.121	0.180	0.569
	(lagged) TANG	2.664*	5.766***	4.453**	1.724
	(lagged) EVOL	0.511	0.728	1.495	0.437
	(lagged) NDTs	1.256	2.108	7.504***	1.782
	Number of observations	849	983	983	983

EVOL = earnings volatility, GROWTA = growth opportunities, NDTs = nondebt tax shields, PROF = profitability, SIZE = size, SQR = simultaneous quantile regression, TANG = tangibility.

Note: \* p<0.05, \*\* p<0.01, \*\*\* p<0.001.

Source: Authors' calculations.

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## Leverage and Capital Structure Determinants of Chinese Listed Companies

We assess the financial fragility of the Chinese economy by looking at risk factors in the nonfinancial sector. Quantile regressions applied to financial data of Chinese listed companies find increasing sensitivity over time of corporate leverage to some of its key determinants. In particular, profitability increasingly acts as a curb on corporate leverage during recent years. At this time of low profitability across the Chinese nonfinancial corporate sector, this may contribute to further increases in corporate leverage over time.

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