Is Working Capital Management Value-Enhancing? Evidence from Non-Listed Chinese Firms' Performance and Financial Constraints

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ABSTRACT

Financial factors have been found to influence firms' real activities and promote aggregate growth. However, the linkage between net working capital and firm performance (e.g., firm-level total factor productivity and profitability) has been overlooked in the literature. In this study, we bridge this gap, using data on 147,310 non-listed Chinese firms over 1999–2007 to estimate a firm performance model augmented with net working capital. We find that productivity and profitability are strongly and significantly associated with net working capital for private and foreign firms, but not for state-owned enterprises. More specifically, an increase in net working capital has a negative (positive) effect on productivity and profitability in firms with positive (negative) net working capital. Furthermore, highly external financially constrained, highly internal financially constrained, and small private and foreign-owned firms are more sensitive to net working capital.

Keywords: productivity, profitability, net working capital, financial constraints, non-listed Chinese firms

JEL classifications: D24, G32

1 Introduction

Working capital management is particularly important in the Chinese context, where firms have limited access to long-term capital markets (Ding et al., 2013) or face financial constraints and therefore must rely on internally generated funds, short-term bank loans, and trade credit to finance their activities. In line with this argument, effective net working capital management played an important role in alleviating the effects of the recent financial crisis in China (KPMG China, 2011) and improving investment behavior (Ding et al., 2013).

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In addition, the presence of financial constraints and their effects on firms' investment decisions and performance have received intense interest in the corporate finance literature. There is considerable evidence that financial constraints are an impediment to the investment and growth of firms in developing economies (Hubbard, 1998; Stein, 2003). For such firms, net working capital may serve as an additional source of finance. However, little is known about whether and how net working capital works and how much economic activity it supports in China, especially under the country's financial constraints.

To bridge this gap in the literature, we focus on firm performance (productivity and profitability), which is significantly associated with growth (Chen and Guariglia, 2013). Specifically, we explore the role played by net working capital management in explaining why Chinese firms are able to grow at high rates despite the presence of significant financial constraints. By using an extensive, nationally representative database of non-listed Chinese firms (i.e., the GUOTAIAN database), we examine the extension of working capital management, one of the mechanisms suggested by Aktas et al. (2015), Ding et al. (2013), and Hale and Long (2011a) as being an important financial intermediation for Chinese firms' growth, investment, and profitability.

We contribute to the literature in the following ways. First, we introduce a new mechanism to understand the relationship between net working capital and firm performance. For the first time, we test how financial constraints affect Chinese firms' use of net working capital from the perspective of both firm productivity and profitability. Second, we extend studies of financial constraints. In particular, we use several methods to measure financial constraints, including internal and external financial constraints. We demonstrate that net working capital is an efficient financial tool to alleviate the financial constraints of Chinese firms. To the best of our knowledge, no other study has thus far analyzed the links between firm performance, especially total factor productivity (TFP), net working capital management, and financial constraints by making use of firm-level sensitivities. Third, we enrich the heterogeneity of this study on ownership. We test the link between net working capital and firm performance among state-owned enterprises (SOEs) as well as private and foreign-owned firms and provide a comparative analysis regarding ownership. Fourth, our Chinese non-listed firm-level data supply a good test environment. We use larger and more up-to-date data samples for our estimations than those used in previous studies. Our dataset contains 147,310 non-listed Chinese manufacturing firms over 1999–2007 taken from the GTA database, which provides up to 757,423 firm-level observations. Since China is the largest developing and transitional economy, our data provide a good test environment within which to understand the link between working capital and firm performance. Thus, this study can extend research on developed economies and offer insights for other developing economies.

We initially run TFP and return on sales (ROS) regressions as a function of net working capital and other financial variables, separately for state-owned,

private, and foreign firms.[1] We find that SOEs always exhibit an insignificant relation between TFP/ROS and working capital, suggesting that the performance of SOEs is not determined by net working capital. This can be explained by these firms' needs to fulfill political and social objectives as well as economic objectives (Bai et al., 2006) and the priorities that central and local governments as well as the (dominant) state-owned banks accord to them (Ding et al., 2013). On the contrary, private and foreign firms exhibit a strong and significant relation between firm performance and working capital, indicating that firms tend to adjust working capital to improve performance. To take into account the heterogeneity characterizing the firms in our sample, we thus construct five firm-level financial constraints proxies (SA index, investment cash flow sensitivity (ICFS), marketization level, size, and ownership) and analyze the extent to which they influence the relation between working capital management and firm performance. We find that more financially constrained firms, as measured by the SA index and ICFS, are particularly active in adjusting working capital. Furthermore, firms in underdeveloped marketization regions are more financially constrained and adjust working capital more actively. In addition, compared with large firms, small firms' financial constraints are higher, and these firms are particularly active in maintaining their TFP or ROS level by adjusting working capital. In addition to the ability to accumulate high cash flow highlighted in Chen and Guariglia (2013) and Guariglia et al. (2011),[2] active net working capital management may thus help explain the Chinese growth puzzle.

The remainder of this paper is organized as follows. Section 2 provides a literature review and hypothesis development. Section 3 describes our data and presents the descriptive statistics. Section 4 illustrates our baseline specification and estimation methodology. Section 5 discusses our main empirical results and robustness tests. Section 6 concludes.

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[1] This study adds to the classical yet growing literature on ownership and control (e.g., Claessens et al., 2000; Gompers et al., 2010; La Porta et al., 1999; Lin et al., 2011a, 2011b) by linking working capital management to external financial constraints.

[2] Several dimensions of our study are different from that by Chen and Guariglia (2013). First, we fully analyze firm performance from two perspectives, whereas Chen and Guariglia (2013) emphasize TFP more than ROS. We believe that in China, as productivity and profitability are different approaches to measure firm performance, they should be discussed carefully. Second, they use the contribution brought about by cash flow to test the relationship between financial constraints and TFP. By contrast, while cash flow is a control variable in our model, we focus on the smoothing effect of net working capital management. This is the core difference between the two papers, as our research motivations are quite different. Third, we use several methods to directly and indirectly measure financial constraints and explore the relationship between firm performance and net working capital. Our measurements of financial constraints are more reliable and diverse. Fourth, we adopt non-listed Chinese firms (the NBS database including both listed and non-listed firms) to test net working capital's smoothing effect when firms cannot access the stock market.

2 Literature Review and Hypothesis Development

2.1 Literature review

Net working capital, defined as the difference between firms' current assets (which include accounts receivable, inventories, and cash) and current liabilities (which include accounts payable and short-term debt), represents the source and use of short-term capital. It is often used to measure a firm's liquidity, which ensures that firms are able to meet their short-term obligations. Insufficient liquidity can lead to bankruptcy (Dunn and Cheatham, 1993). Yet, too much liquidity can be detrimental to firms' profitability (Bhattacharya, 2001). The good management of working capital therefore requires striking a balance between liquidity and firm performance to maximize the value of the firm. The advantages of holding inventories and extending trade credit to customers are outlined below. Yet, the higher inventories and accounts receivable, the less money is available to the firm for profitable investment. This fact suggests that finding the optimal level of working capital may be a difficult task for firm managers (Deloof, 2003).

The literature proposes several theoretical arguments to understand the relation between working capital and firm performance. On the one hand, additional investment in working capital is expected to have positive effects, particularly for firms with low working capital, which allows firms to grow by increasing sales and earnings. Larger inventories are known, among other issues, to reduce supply cost, provide hedges against input price fluctuations, and minimize the loss of sales due to potential stock-outs (Blinder and Maccini, 1991; Corsten and Gruen, 2004; Fazzari and Petersen, 1993). Supplying credit to customers may also affect positively firm sales because it allows for price discrimination, serves as a warranty for product quality, and fosters long-term relationships with customers (Brennan et al., 1988; Long et al., 1993; Summers and Wilson, 2002). On the other hand, overinvestment in working capital may generate adverse effects and lead to value destruction for shareholders. Like any investment, increases in working capital require additional financing, which in turn involves financing and opportunity costs (Kieschnick et al., 2013). Therefore, ceteris paribus, firms that hold high working capital on their balance sheet may also face high interest expenses and bankruptcy risk. Moreover, too much cash tied up in net working capital might impede firms from implementing value-enhancing investment projects in the short run (Ek and Guerin, 2011). The existence of potential benefits and costs implies therefore a non-linear relation between working capital and firm performance, with the expected relation being negative for firms with a high level of working capital (i.e., overinvestment in net working capital) and positive for firms with a low level of working capital (i.e., underinvestment in net working capital) (Aktas et al., 2015; Baños-Caballero et al., 2014; Mun and Jang, 2015).

In particular, for firms with excessive net working capital (or positive liquidity), corporate investment can be seen as a possible channel through which the

decrease in unnecessary working capital from one period to the next translates into higher firm performance. If a firm cuts working capital to redeploy underutilized resources to higher valued uses, working capital reductions should be associated with an increase in firm performance (Atanassov and Han Kim, 2009). As working capital could be considered to be a source of internal funds (Fazzari and Petersen, 1993) or a cash substitute (Bates et al., 2009), in this study we argue that corporate investment is a potential channel through which improvement in net working capital management should affect firm performance. "Indeed, the decrease in unnecessary net working capital through time increases [a] firm's financial flexibility in the short run thanks to the release of unnecessary cash invested in working capital, and also in the long run thanks to relatively less financing needs to fund day-to-day operating activities" (Aktas et al., 2015). Additionally, financially flexible firms have better ability to create investment opportunities (Denis and Sibilkov, 2010; Duchin et al., 2010). For firms with unnecessary net working capital, we therefore expect a negative relation between net working capital and corporate investment (i.e., a positive relation between a decrease in unnecessary net working capital over time and corporate investment).

For firms with an already low level of net working capital (or negative liquidity), corporate investment sourced by working capital reductions is different. Fazzari and Petersen (1993) suggest that investment in working capital is more sensitive to financing constraints than investments in fixed capital. Firms with negative net working capital are generally more financially constrained and they are able to overcome their deficiency in working capital to increase their investment in fixed assets. Indeed, firms with negative net working capital are relatively small with volatile sales and higher R&D and growth opportunities (Aktas et al., 2015). Net working capital can thus increase firm performance by increasing inventories or cash to avoid sale and investment risks. In this vein, empirical evidence demonstrates that investment in working capital depends on a firm's financing conditions. Specifically, Hill et al. (2010) show that firms with greater internal financing capacity and capital market access hold more working capital.

In China, firms have limited access to long-term capital markets, and thus working capital management is particularly important. However, related studies are scarce. It has been shown that effective working capital management played a particularly important role in alleviating the effects of the recent financial crisis in China (KPMG China, 2011). In addition, Hale and Long (2011a, 2011b) argue that the spectacular recent growth characterizing Chinese private firms has been driven by, among other things, their ability to manage their working capital in general, and their accounts receivable in particular, more efficiently than other firms. Moreover, firms characterized by high working capital display high ICFS in working capital and low ICFS in fixed capital. The active management of working capital may help firms alleviate the effects of financing constraints on fixed investment (Ding et al., 2013). These findings suggest

that working capital is an important financial resource for Chinese firms. Given the limited research on this topic, our analysis aims to bridge the gap in the literature on net working capital management and Chinese firm performance from the perspective of financial constraints. We next discuss the five distinct hypotheses in turn.

2.2 Hypothesis Development

2.2.1 Basic hypothesis

For firms with excessive net working capital (net working capital over 0), we propose corporate investment as a possible channel through which to decrease unnecessary working capital and thus raise firm performance. Because firms cut working capital to redeploy underutilized resources to higher valued uses, working capital reductions can improve firm performance (Atanassov and Kim, 2009). In addition, in the short run, a decrease in unnecessary net working capital increases a firm's financial flexibility by releasing unnecessary cash invested in working capital as well as lower financing needs to fund day-to-day operating activities in the long run (Aktas et al., 2015).

For firms with negative excess working capital (net working capital below 0), the relation between net working capital and change in investment is positive. Firms are able to overcome their deficiency in working capital by increasing liquid assets and decreasing liquidity debt. Firms with negative net working capital are relatively small with volatile sales and higher R&D and growth opportunities (Aktas et al., 2015). Firms can thus adjust net working capital in the short-term to improve firm performance. Thus, we raise our hypothesis as follows:

Hypothesis 1. *There is an inverted U-shaped relationship between net working capital and TFP/ROS. Specifically, if a firm's net working capital is positive (negative), its net working capital has a negative (positive) influence on TFP and ROS.*

2.2.2 Ownership

We first differentiate the linkages between cash flow and performance across groups of firms based on ownership. Our sample is divided into SOEs, private firms, and foreign firms. A lending bias has long existed in China because of the state-dominated financial system. SOEs typically benefit from soft budget constraints and do not suffer from financing constraints (Bai et al., 2006); therefore, we expect the productivity and profitability of SOEs not to be significantly affected by the availability of working capital. By contrast, we expect the productivity and profitability of private firms in China to be significantly affected by working capital, as they face high financing constraints (Allen et al., 2005; Chen and Guariglia, 2013; Guariglia et al., 2011; Poncet et al., 2010).

As for foreign firms, the extent to which they are subject to financing constraints is unclear in the literature. World Bank (2006) documents that fully foreign-owned firms operating in China have limited direct access to domestic finance and have to finance much of their investment from aboard. Ding et al. (2013) and Guariglia et al. (2011) also show that they suffer from significant financing constraints. Yet, Manova et al. (2011) and Poncet et al. (2010) claim that these firms are less financially constrained than private firms, as they can access finance from their parent company. Analyzing the linkages between their TFP/ROS and working capital may thus shed further light on the extent of the financing constraints faced by these firms. Therefore, we formulate our hypothesis as follows:

Hypothesis 2. *Net working capital is significantly associated with TFP and ROS in private firms, while not significantly associated with TFP and ROS in SOEs. For foreign-owned firms, there are two possibilities and it is necessary to test both perspectives.*

2.2.3 External financial constraints

Financial constraints have been demonstrated to influence firm investment behavior, the financing environment, and TFP/ROS. As TFP is highly correlated with the level of financial constraints, high TFP benefits the financial health of firms (Silva, 2011). Previous studies show that internal financing plays a more important role in TFP or investment than the external financing of financially constrained firms among Chinese firms facing financial constraints (Chen and Guariglia, 2013; Ding et al., 2013; Guariglia et al., 2011; Héricourt and Poncet, 2009; Poncet et al., 2010). Ding et al. (2013) and Fazzari and Petersen (1993) find that firms with high working capital exhibit lower sensitivities of fixed investment to cash flow than their counterparts with low working capital for US and Chinese firms, respectively. Similarly, Chen and Guariglia (2013) find that having high working capital can alleviate firms' dependence on internal finance, enhancing their TFP. Furthermore, as high financially constrained firms lack sufficient financing channels, the availability of working capital increases their ability to raise cash at short notice. As highly financially constrained firms can quickly liquidize some of their working capital assets in case they need extra funds to finance uncertain productivity-enhancing activities, working capital is more sensitive to TFP/ROS. By contrast, low financially constrained firms may be unable to do the same and are hence likely to be less dependent on their working capital for productivity- and profitability-enhancing activities. Thus, we raise the hypothesis as follows:

Hypothesis 3. *Net working capital is more sensitive to TFP/ROS in highly external financially constrained firms than low external financially constrained firms.*

2.2.4 Internal financial constraints

A firm with greater internal cash flow may find it easier to obtain external finance, as it will be perceived as less risky by lenders. A high internal cash flow

can be seen as evidence of the firm's managers' commitment to their investment projects (Brealey et al., 1977) and can decrease the risk of default and liquidation (Cleary et al., 2007). Conversely, firms that are internally financially constrained find it more difficult to obtain external finance.

Further, internal finance shocks have different effects on constrained and unconstrained firms. Since working capital can smooth the cash flow of internal financially constrained firms (Chen and Guariglia, 2013; Ding et al., 2013; Fazzari and Peterson, 1993), it can ease internal financial constraints in order to improve firm performance. Therefore, we formulate our hypothesis as follows:

Hypothesis 4. *Net working capital is more sensitive to TFP/ROS in highly internal financially constrained firms than low internal financially constrained firms.*

2.2.5 Financial constraints and firm size

Many studies have used firm size to measure financial constraints (Guariglia, 2008). In the literature, small firms are presumed to have less access to finance because they lack collateral and credit histories, making it difficult for banks to assess their creditworthiness (Beck et al., 2011; Berger and Udell, 2006). Large firms are usually considered to have better access to external financial markets than small firms (Kusnadi and Wei, 2011). In China, weaker connections with government could put small firms in an even more disadvantageous situation when obtaining external funds. Further, the financing of small firms is significantly constrained by accessibility to external finance because they are particularly susceptible to information asymmetry effects. Small firms are also disadvantaged as they cannot exploit scale economies and have fewer overall physical assets that could serve as collateral compared with large capital-intensive companies. Thus, they are more reliant on internal finance. In addition, managing their net working capital is an efficient way for them to ease financial constraints. Thus, we raise the following hypothesis:

Hypothesis 5. *Net working capital is more sensitive to TFP/ROS in small firms than in large firms.*

3 Empirical Specification and Estimation Methodology

3.1 Baseline specification

As one of the most important measurements of efficiency, TFP reveals differences in economic growth and income levels across countries and regions (Caselli and Gennaioli, 2005; Hsieh and Klenow, 2010). Based on Chen and Guariglia's (2013) empirical model of cash flow and firm performance, we establish a model to find the determinants of TFP and understand whether

financial factors exert any effect. Specifically, we estimate the following models:

$$TFP_{it} = \alpha_0 + \alpha_1 TFP_{i,t-1} + \alpha_2 NWK_{it} * D + \alpha_3 NWK_{it} * (1-D) + \alpha_4 X_{it} + v_i + v_j + v_t + v_{jt} + \varepsilon_{it}, \quad (1)$$

$$ROS_{it} = \alpha_0 + \alpha_1 ROS_{i,t-1} + \alpha_2 NWK_{it} * D + \alpha_3 NWK_{it} * (1-D) + \alpha_4 X_{it} + v_i + v_j + v_t + v_{jt} + \varepsilon_{it}, \quad (2)$$

where TFP_{it} indicates the productivity[3] of firm i at time t; the estimation of TFP is explained in Appendix 2. ROS_{it} is used to measure the profitability[4] of firm i at time t. X_{it} is a vector of a firm's characteristics, including firm size, firm age, cash flow, leverage, and sales growth.[5] Net working capital is our key explanatory variable. Current assets minus current liabilities scaled by total assets is used to evaluate net working capital.[6] All data in this study have been deflated by deflators.[7] D and 1-D are dummy variables: if net working capital is negative, D equals 1 and 0 otherwise. If net working capital is positive, 1-D equals 1 and 0 otherwise.

v_i is a firm-specific effect, which we control for by regressing Eqs. (1) and (2) at first differences, and v_j is an industry-specific effect measured by an industry dummy. There are 37 industries, the basic industry being textile manufacturing (Brandt et al., 2012). v_t is a time-specific effect, which we control for by using a time dummy. Finally, ε_{it} is an idiosyncratic error term. This specification enables us to test how working capital influences the productivity of Chinese firms.

3.2 Endogeneity problem and methodology

Following Chen and Guariglia (2013) and Guariglia et al. (2011), we use the system generalized method of moments (GMM) estimator to estimate this specification. To examine the relation between working capital and firm performance, one issue is the potential endogeneity of the explanatory variables with respect to TFP/ROS. For example, unobservable corporate-specific fixed effects may affect the ownership and financial constraints, while simultaneous causality for financial constraints (Shailer and Wang, 2015) and dynamic panel bias (Arellano and Bond, 1991; Bond, 2002; Nickell, 1981) may exist.

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[3] Owing to the serial correlation of TFP, which follows a first-order Markov process (Levinsohn and Petrin, 2003), lagged TFP should be included to control for this problem.

[4] Several studies use ROS to measure firm profitability. For example, Chen and Guariglia (2013) and Firth et al. (2009) use ROS to measure the profitability of Chinese firms.

[5] All the variables are defined in Appendix 1.

[6] Consistent with previous studies (Ding et al., 2013; Fazzari and Petersen, 1993), the working capital variable is scaled by total assets.

[7] Our data have been deflated by the deflators taken from the China Statistical Yearbook (various issues) published by the National Bureau of Statistics of China. We use the provincial capital goods deflator to deflate the capital variable and the gross domestic product (GDP) deflator to deflate the other variables.

Specifically, the reverse causality problem exists between firm performance and its financial constraint level, in which less efficient (low-growth) firms may be subject to higher financial constraints as they shift the blame for their underinvestment to the credit market. In addition, firms anticipate shocks to productivity or profitability and accordingly adjust inputs throughout the production process (Coricelli et al., 2012). Moreover, the nature of panel data raises questions about omitted variable bias: for example, unobserved growth opportunities or managerial ability may be the main driving force behind the scale of the firm's on-the-job training program (Popov, 2014). We thus adopt the system GMM estimator to address endogeneity in the panel estimation and the weak instrument problem[8] (Arellano and Bond, 1991; Blundell and Bond, 1998).

In addition, we use two criteria to test that our estimations are reasonable. First, we access the presence of *n*th-order serial correlation in the different residuals, which is denoted as the $m(n)$ test. The estimations that we regress may be reasonable if these specifications are exempted from detailed correlation in the first-differenced residuals. In the presence of serial correlation of order n, lags n+1 and deeper are strictly required in the instrument set (Brown and Petersen, 2009; Roodman, 2009). The $m(n)$ test is asymptotically distributed as a standard normal distribution under the null hypothesis of no n-order serial correlation of the differenced residuals. Second, to evaluate whether our instruments are legitimate and our model is correctly specified, we assess whether the variables in the instrument set are uncorrelated with the error term in the relevant equations. We use the Hansen test (J test) to test the overidentifying restrictions. The result of this test for instrumental validity is asymptotically distributed as a chi-square with degrees of freedom equal to the number of instruments less the number of parameters.

3.3 Accounting for firm heterogeneity

In addition to the baseline analysis discussed in Section 3.1, we introduce firm heterogeneity to analyze the relationship between net working capital and firm performance. ICFS, the SA index, internal financial constraints, and firm size are discussed in this part.

3.3.1 ICFS

To account for the heterogeneity of ICFS, we follow the methodology introduced by Hovakimian and Hovakimian (2009) to calculate the firm-level ICFS in fixed capital as follows:

[8]To solve the endogeneity problem of large panel data on Chinese firms, Chen and Guariglia (2013), Ding et al. (2013), Guariglia and Poncet (2008), and Guariglia et al., (2011) discuss the system GMM method from theoretical and empirical perspectives.

$$ICFS_{it} = \sum_{t=1}^{n} \left(\frac{(cashflow / K)_{it}}{\sum_{t=1}^{n} (cashflow / K)_{it}} * \left(\frac{I}{K} \right)_{it} \right) - \frac{1}{n} \sum_{t=1}^{n} \left(\frac{I}{K} \right)_{it}, \quad (3)$$

where n is the number of annual observations for firm i and t indicates time. This sensitivity is given by the difference between the cash flow-weighted time-series average investment in fixed capital to the fixed capital ratio of a firm and its simple arithmetic time-series average ratio.

Therefore, we separate firms according to their level of financial constraints, measured by ICFS, and consider firms with an ICFS above (below) the sample median to be more (less) likely to be financially constrained.

3.3.2 External financial constraints

The firm-level external financial constraints are calculated as follows (Hadlock and Pierce, 2010):

$$SA_{it} = 0.737 * Size_{it} + 0.043 * Size_{it}^2 - 0.040 * Age_{it} \quad (4)$$

Therefore, we separate firms according to their level of financial constraints, measured by the SA index, and consider firms with an SA index above (below) the sample median to be less (more) likely to be financially constrained.

3.3.3 Internal financial constraints

We separate firms according to their internal level of financial constraints, measured by cash flow, and consider firms with a cash flow above (below) the sample median to be less (more) likely to be financially constrained.

3.3.4 Firm size

We separate firms according to their size, measured by the natural logarithm of total assets, and consider firms with a size above (below) the sample median to be less (more) likely to be financially constrained.

4 Data and Descriptive Statistics

4.1 Data

We use data drawn from the annual financial accounts filed by non-listed industrial firms from the GTA (GUOTAIAN) database via CSMAR (China Securities Market & Accounting Research) during 1999–2007. We choose 2007 as our sample end year to avoid the confounding effects of significant changes in China's financing environment on firms' cost of debt and financial constraints

following the global financial crisis (Levinger, 2014; Shailer and Wang, 2015).[9] Our data cover 41 industries and includes enterprises with annual sales of at least five million yuan (about US$ 650,000). Our sample consists of all non-listed Chinese enterprises with debt financing and available data.

Owing to data restrictions, following Guariglia et al. (2011), we omitted observations with negative sales, negative total assets minus total fixed assets, negative total assets minus liquid assets, and negative accumulated depreciation minus current depreciation. We also omitted firms with incomplete records on our main regression variables. To control for the potential influence of outliers, observations in the 1% tails of each of the regression variables were also excluded. We also omitted all firms with fewer than five years of consecutive observations. In addition, we further matched the address, telephone number, and industry code of firms and omitted observations for firms with fewer than eight employees (Brandt et al., 2012).

Finally, our unbalanced panel covers 118,356 non-listed firms, corresponding to 625,618 firm-year observations.[10] Specifically, firm survival (entry or exit) has been demonstrated to be influenced by financial constraints and productivity (Liu and Li, 2015). These decisions may not be random and could bias our results. Following Guariglia et al. (2011), our unbalanced panel thus contains about 45.7% five-year continuous samples from the original dataset, which has more valid data than those used in Chen and Guariglia (2013) and Guariglia et al. (2011).

4.2 Descriptive statistics

Table 1 displays the descriptive statistics of our key variables by year. With respect to firm performance, there is a steady increase in TFP (3.588–4.795) and ROS (1.5%–3.1%). Turning to the financial variables, net working capital increases steadily (3.6%–8.4%), with positive (negative) net working capital increasing (decreasing) (3.6%–8.4%/–8.8%–7.3%). Cash flow increases from 8.0% to 11.9%, while leverage decreases from 61.6% to 56.6%.

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[9]Our period selection is also influenced by that some main variables (e.g., input intermediation to calculate TFP by using the *LP* method) are not available in our database after 2007.

[10]In fact, our original panels cover 134,768 non-listed firms, corresponding to 935,623 firm-year observations during 1999–2007. We identify five types of firm ownerships: state, collective, legal person, domestic private, and foreign. Indeed, "[c]ollective firms are distinct from state-owned in that they are either owned by township-villages governments or collectively by the employees. Legal-person share is a mixture of ownership by state legal persons and private legal persons" (Cull et al., 2009). By the end of the 1990s, nearly two-thirds of all town and village enterprises had been privatized in the provinces, although considerable differences exist across townships (Brandt and Li, 2003; Brandt et al., 2003). Therefore, we discuss three typical ownerships (state, private, and foreign), as the ownerships of collective and legal person are unclear and ambiguous.

Table 1. Summary Statistics by Year.

Variable	2000	2001	2002	2003	2004	2005	2006	2007
TFP^{LP}	3.588 (100)	3.602 (100)	3.719 (104)	3.846 (107)	4.057 (113)	4.296 (120)	4.525 (126)	4.795 (134)
TFP^{OP}	1.677 (100)	1.693 (101)	1.722 (103)	1.766 (105)	1.797 (107)	1.826 (109)	1.854 (111)	1.881 (112)
ROS (%)	1.5	1.5	1.7	2.0	2.1	2.3	2.6	3.1
ROA (%)	4.2	4.4	4.7	5.0	5.0	5.6	6.0	6.7
Net working capital (%)	3.6	4.5	4.9	5.2	5.4	6.4	7.5	8.4
Net working capital (positive) (%)	12.6	13.4	13.7	14.0	14.0	14.6	15.4	15.8
Net working capital (negative) (%)	–8.8	–8.8	–8.6	–8.6	–8.4	–8.1	–7.7	–7.3
Cash flow (%)	8.0	8.3	8.7	9.1	9.3	10.4	11.0	11.9
Leverage (%)	61.6	60.2	59.5	58.7	59.1	57.8	57.1	56.6
Sales growth (%)	1.8	0.3	5.4	4.7	1.8	3.3	2.6	4.1
Size	9.939	9.870	9.860	9.861	9.984	10.094	10.204	10.331
Age	2.268	2.168	2.170	2.115	2.160	2.265	2.360	2.440
Real age	9.660	8.741	8.758	8.290	8.671	9.631	10.591	11.473
SA	–3.095	–3.100	–3.102	–3.099	–3.087	–3.078	–3.067	–3.051
Observations	77,519	95,677	111,564	134,786	119,761	115,811	109,806	102,757

Note: See Appendix 1 for the definitions of all variables. This table reports the summary statistics for the sample firms by year during 2000–2007. The unit of assets is thousand RMB. The unit of real age is year.

Table 2. Summary Statistics by Ownership.

Variable	Full Sample	State	Private	Foreign	Diff. (S/P)	Diff. (F/P)	Diff. (F/S)
TFP^{LP}	4.026	3.653	3.952	4.304	–0.295***	0.352***	–1.117***
TFP^{OP}	1.772	1.700	1.776	1.806	–0.075***	0.030***	–0.154***
ROS	0.020	0.002	0.027	0.023	–0.025***	–0.005***	–0.020***
ROA	0.051	0.033	0.059	0.053	–0.025***	–0.006***	–0.016***
Net working capital	0.056	0.013	0.048	0.110	–0.034***	0.062***	–0.129***
Net working capital (positive)	0.141	0.121	0.133	0.175	–0.012***	0.043***	–0.075***
Net working capital (negative)	–0.083	–0.104	–0.084	–0.064	–0.020***	0.020***	–0.052***
Cash flow	0.095	0.071	0.104	0.098	–0.033***	–0.006***	–0.024***
Leverage	0.590	0.647	0.594	0.544	0.052***	–0.050***	0.151***
Sales growth	0.031	–0.024	0.052	0.031	–0.076***	–0.029***	–0.058***
Size	10.011	10.407	9.847	10.190	0.210***	0.344***	–0.456***
Age	2.239	2.707	2.108	2.251	0.599***	0.143***	0.638***
SA	–3.085	–3.038	–3.105	–3.063	0.010***	0.042***	–0.090***
Observations	890,987	106,038	554,669	170,280			

Note: See Appendix 1 for the definitions of all variables. This table reports the summary statistics for the sample firms during 1999–2007 and tests comparing state-owned and private firms, private and foreign-owned firms, and state- and foreign-owned firms. The significance of the test statistic for the equality of variables' mean is shown by ***, **, and *. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3. Correlation Matrix Between the Independent Variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Net working capital (positive)	1						
Net working capital (negative)	0.438	1					
Cash flow	0.205	0.149	1				
Leverage	–0.578	–0.519	–0.304				
Sales growth	0.002	0.049	0.177	–0.033	1		
Size	–0.089	–0.002	–0.129	0.021	0.042	1	
Age	–0.033	–0.054	–0.106	0.101	–0.086	0.124	1

Note: See Appendix 1 for the definitions of all variables. This table reports the correlation matrix between the independent variables of the sample firms during 1999–2007.

Table 2 displays the descriptive statistics of our key variables by ownership. Following Chen and Guariglia (2013), "ownership is defined on the basis of the average paid-in-capital over the data period. For instance, a firm is classified as state-owned if at least 50% of its average paid-in capital over its data period is owned by the state." With respect to productivity, the average value for firms with different ownership types generally fluctuates around 4.0; the foreign group has the highest TFP (4.304), while the SOE group has the lowest (3.653). Regarding profitability, the ROS of the private group is the highest (2.7%), while that of SOEs is as low as 0.2%. This result echoes the fact that Chinese SOEs generally have lower efficiency and profitability compared with firms of other types of ownership.[11] The net working capital of the foreign group is the highest (11.0%), while that of SOEs is the lowest (1.3%). In addition, we find that positive net working capital fluctuates around 14.1%, whereas negative net working capital accounts for about –8.3%. Consistent with the previous results, in terms of both positive and negative working capital, the SOE group is the lowest (12.1% and –10.4%, respectively), while the foreign group is the highest (17.5% and –6.4%, respectively). The leverage of the foreign group is the lowest (54.4%), while that of SOEs is the highest (64.7%). This finding is highly consistent with the reality that Chinese SOEs have easy access to loans and other

[11]Our results are consistent with those of previous studies (e.g., Chen and Guariglia, 2013) by showing that foreign and private firms have higher TFP and profitability.

debts from banks and financial institutions, while foreign firms may rely more on their own country's capital market rather than debt financing. Additionally, turning to the financial constraints proxies of cash flow, firm size, and the SA index, the SOE group shows the weakest financial constraints (0.07.1, 10.407, and –3.085), while the private group shows the strongest (0.104, 9.847, and –3.105). These three proxies are thus consistent with each other.

Table 3 shows the correlation coefficients of the key independent variables. All the correlation coefficients are smaller than 0.6 and most are very small, which can alleviate the concern about multicollinearity problems when they are used simultaneously in the same regression.

5 Regression Results

5.1 Baseline results and ownership

Table 4 presents the results of the system GMM regression analyses to investigate the relationship between net working capital and TFP/ROS, using Eqs. (1) and (2). Each column with net working capital^2 tests the effect of the squared term of net working capital on TFP/ROS to investigate the curvilinear relationship between net working capital and TFP/ROS, as presented in Hypothesis 1. The results for private and foreign-owned firms from the net working capital^2 model show a significant inverted U-shaped relationship between net working capital and TFP/ROS (the coefficients of net working capital^2 are –0.206, –0.223, –0.007, and –0.028 (columns 2, 3, 5, and 6)), while SOEs do not (columns 1 and 4), which supports Hypothesis 1.

Further, the positive and negative net working capital groups are also examined separately to identify the unique relationship between the two groups. As presented in Table 5, for the positive net working capital group, the coefficients of TFP/ROS on net working capital for private and foreign firms are significantly negative; by contrast, the coefficients of TFP/ROS on net working capital for private and foreign firms are significantly positive for the negative net working capital group, while those for SOEs are not significant. These findings further support Hypothesis 1.

Tables 4 and 5 indicate that the relationship between net working capital and TFP/ROS is inverted U-shaped with optimal working capital levels in private and foreign-owned firms, but not in SOEs. In particular, positive (negative) net working capital plays a significantly negative (positive) role on TFP/ROS in private and foreign-owned firms (the coefficients are –0.772 and 0.563, –0.529 and 0.241, –0.052 and 0.032, –0.035 and 0.054), but not in SOEs. Hypothesis 2 is also proven here. These findings indicate that firms can boost their productivity and profitability by increasing working capital efficiency for private and foreign-owned firms (i.e., minimizing accounts receivable and inventories or maximizing accounts payable when net working capital is positive; maximizing accounts receivable and inventories or

Table 4. Baseline Results-I.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: TFP			Dependent variable: ROS		
Variable	**SOEs**	**Private**	**Foreign**	**SOEs**	**Private**	**Foreign**
Lag dependent$_{i,t-1}$	0.902*** (0.064)	0.958*** (0.017)	0.920*** (0.063)	0.467*** (0.047)	0.702*** (0.095)	0.425*** (0.075)
Net working capital	0.059 (0.382)	0.061*** (0.022)	0.238*** (0.074)	0.027 (0.086)	0.004*** (0.001)	0.015*** (0.002)
Net working capital^2	–0.135 (0.137)	–0.206*** (0.058)	–0.223*** (0.082)	–0.045 (0.031)	–0.007*** (0.002)	–0.028*** (0.009)
Cash flow	0.575 (0.893)	1.215*** (0.092)	2.480*** (0.316)	0.445*** (0.064)	0.060** (0.030)	0.387*** (0.010)
Leverage	0.037 (0.232)	0.290*** (0.111)	0.452*** (0.074)	0.042 (0.027)	–0.012*** (0.002)	–0.023 (0.018)
Sales growth	0.288* (0.153)	0.501*** (0.083)	0.142 (0.291)	0.042*** (0.002)	0.019*** (0.002)	0.025*** (0.002)
Size	0.135 (0.109)	0.111*** (0.026)	0.131 (0.124)	0.009** (0.004)	0.003** (0.002)	0.003 (0.004)
Age	–0.038*** (0.013)	–0.041*** (0.005)	–0.118*** (0.026)	–0.002*** (0.001)	–0.001*** (0.000)	–0.002** (0.001)
Constant	–0.830 (0.915)	–0.934*** (0.199)	–0.990 (1.057)	–0.128*** (0.041)	–0.018 (0.015)	–0.055 (0.036)
Year dummy	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES
M(2)				0.101		
M(3)	0.433	0.074	0.332		0.551	0.972
Hansen (*J*) test	0.169	0.120	0.084	0.260	0.277	0.359
Observations	64,249	438,282	130,778	63,919	435,617	129,467

Note: See Appendix 1 for the definitions of all variables. This table presents the results from the regressions using the two-step GMM model. ***M(n)*** is a test for n-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Hansen (*J*) statistics provide a test of overidentifying restrictions, distributed under the null of instrument validity. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5. Baseline Results-II.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: TFP			Dependent variable: ROS		
Variable	**SOEs**	**Private**	**Foreign**	**SOEs**	**Private**	**Foreign**
Lag dependent$_{i,t-1}$	0.916*** (0.065)	0.951*** (0.018)	0.898*** (0.063)	0.213** (0.098)	0.704*** (0.090)	0.427*** (0.063)
Net working capital × D	–0.405 (0.361)	–0.772*** (0.098)	–0.529** (0.263)	–0.114 (0.106)	–0.052*** (0.016)	–0.035** (0.017)
Net working capital × (1-D)	0.221 (0.138)	0.563*** (0.038)	0.241*** (0.046)	0.094 (0.068)	0.032*** (0.005)	0.054*** (0.007)
Cash flow	0.347 (0.916)	1.403*** (0.096)	1.285*** (0.182)	0.427 (0.317)	0.065** (0.027)	0.395*** (0.007)
Leverage	–0.077 (0.258)	0.154*** (0.037)	0.037 (0.128)	–0.056 (0.039)	–0.015 (0.009)	–0.005 (0.011)
Sales growth	0.278* (0.160)	0.355*** (0.093)	1.505*** (0.065)	0.037*** (0.007)	0.019*** (0.002)	0.025*** (0.002)
Size	0.109 (0.109)	0.106*** (0.028)	0.165 (0.125)	0.020*** (0.005)	0.002 (0.002)	0.002 (0.004)
Age	–0.043*** (0.012)	–0.041*** (0.005)	–0.021 (0.017)	–0.006** (0.003)	–0.001** (0.000)	–0.001 (0.001)
Constant	–0.329 (0.963)	–0.633*** (0.225)	–1.074 (1.095)	–0.134** (0.061)	0.002 (0.020)	–0.041 (0.039)
Year dummy	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES
M(2)				0.868		
M(3)	0.404	0.080	0.365		0.645	0.967
Hansen (*J*) test	0.221	0.106	0.278	0.158	0.601	0.131
Wald test	0.069	0.000	0.003	0.141	0.000	0.000
Observations	63,659	432,579	129,380	63,919	432,358	128,138

Note: See Appendix 1 for the definitions of all variables. This table presents the results from the regressions using the two-step GMM model. *M(η)* is a test for n-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Hansen (*J*) statistics provide a test of overidentifying restrictions, distributed under the null of instrument validity. The numbers in the rows of the Wald test testing whether the impact of net working capital on TFP or ROS is the same across positive (D) and negative (1-D) net working capital firm-years are the p-values associated with the F-test for general restrictions. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

minimizing accounts payable when net working capital is negative). In addition, net working capital is more efficient for private firms than for foreign-owned firms, indicating that it helps smooth the financing needs of the former. However, net working capital is an inefficient tool to enhance firm performance in SOEs.

Additionally, the coefficients of private and foreign firms' cash flow are also positive and significant for firm performance (1.403, 1.285, 0.065, and 0.395), which suggests that firm performance suffers from internal financial constraints, even though internal financing remains an important resource. Moreover, growth opportunities, measured by sales growth, are statistically significant for firm performance, indicating that firms with higher growth perform better. Finally, young firms perform better in terms of both productivity and profitability.

5.2 ICFS

To test whether firms' ICFS plays a moderating role on the relation between net working capital and TFP/ROS, we divide ownership into two groups according to the ICFS index, as evaluated by Eq. (3). Table 6 shows that net working capital does not significantly affect TFP/ROS for SOEs, neither in the high ICFS group nor in the low ICFS group. We also find that high ICFS firms' working capital is more sensitive to TFP/ROS, which indicates that when firms' investment behavior strongly relies on internal financing and their external financing channels are tighter, they can boost their performance by managing working capital more efficiently. These results imply that when ICFS is high and net working capital is positive, firms can use trade credit as an alternative financial intermediation in the production process (enhancing TFP) as well as reduce inventory and raise sales to supplement cash flow (enhancing ROS). On the contrary, when net working capital is negative, firms can raise inventory to avoid the risk of out-of-stocks and decrease supply cost. Further, we also find that when firms' ICFS is higher, the coefficients of cash flow on both TFP and ROS are larger. This means that when ICFS is high, cash flow is more important for firm performance. This result enriches the findings of Chen and Guariglia (2013) and Ding et al. (2013).

5.3 External financial constraints index (SA index)

Table 7 examines the influence of direct external financial constraints on the relation between working capital and TFP/ROS. We divide each ownership type into two groups according to the SA index, as evaluated by Eq. (6). Consistent with the previous results, working capital does not significantly affect the firm performance of SOEs, while financially constrained private and foreign-owned firms' net working capital is more sensitive than that of less financially constrained firms. This relation exists in the relation between positive and negative net working capital and firm performance. Furthermore, we find that cash

Table 6. Regressions by ICFS Level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: TFP					
	ICFS^{High}	**ICFS^{Low}**	**ICFS^{High}**	**ICFS^{Low}**	**ICFS^{High}**	**ICFS^{Low}**
Variable	**SOEs**	**SOEs**	**Private**	**Private**	**Foreign**	**Foreign**
Lag dependent$_{i,t-1}$	0.808*** (0.048)	0.889*** (0.060)	0.974*** (0.027)	0.929*** (0.025)	0.889*** (0.085)	0.891*** (0.056)
Net working capital × D	0.010 (0.424)	0.284 (0.440)	–1.046*** (0.156)	–0.520*** (0.132)	–1.283*** (0.482)	–0.789*** (0.211)
Net working capital × (1-D)	0.134 (0.084)	0.145 (0.100)	0.645*** (0.066)	0.500*** (0.046)	0.925*** (0.132)	0.610*** (0.223)
Cash flow	0.897 (0.596)	0.045 (0.833)	1.537*** (0.147)	1.393*** (0.138)	3.684*** (0.451)	2.146*** (0.641)
Leverage	0.083 (0.129)	0.229* (0.130)	0.140*** (0.054)	0.180*** (0.053)	0.338 (0.227)	0.035 (0.124)
Sales growth	1.169*** (0.045)	1.276*** (0.052)	0.261* (0.142)	0.399*** (0.132)	–0.663 (0.404)	0.134 (0.918)
Size	0.295*** (0.093)	0.173* (0.100)	0.021 (0.043)	0.182*** (0.039)	0.093 (0.168)	0.202** (0.088)
Age	–0.043*** (0.014)	–0.036** (0.016)	–0.036*** (0.007)	–0.046*** (0.008)	–0.106*** (0.029)	–0.074 (0.068)
Constant	–1.909** (0.756)	–1.278 (0.835)	0.147 (0.348)	–1.362*** (0.315)	–0.240 (1.563)	–1.335** (0.631)
Year dummy	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES
M(2)						
M(3)	0.760	0.949	0.122	0.056	0.408	0.672
Hansen (*J*) test	0.435	0.087	0.257	0.425	0.266	0.242
Wald test	0.794	0.786	0.000	0.000	0.000	0.000
Observations	35,053	28,717	205,029	227,550	68,860	59,967

Note: See Appendix 1 for the definitions of all variables. This table presents the results from the regressions using the two-step GMM model. ***M(n)*** is a test for n-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Hansen (*J*) statistics provide a test of overidentifying restrictions, distributed under the null of instrument validity. The numbers in the rows of the Wald test testing whether

(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable: ROS					
ICFS^{High}	**ICFS^{Low}**	**ICFS^{High}**	**ICFS^{Low}**	**ICFS^{High}**	**ICFS^{Low}**
SOEs	**SOEs**	**Private**	**Private**	**Foreign**	**Foreign**
0.530***	0.239**	0.617***	0.632***	0.452***	0.468***
(0.131)	(0.120)	(0.056)	(0.074)	(0.077)	(0.063)
–0.031	0.049	–0.059***	–0.029*	–0.057**	–0.041**
(0.056)	(0.032)	(0.015)	(0.017)	(0.028)	(0.018)
0.017	0.073	0.047***	0.032***	0.095***	0.036***
(0.018)	(0.109)	(0.010)	(0.005)	(0.016)	(0.005)
0.234	0.284	0.231***	0.203***	0.404***	0.325***
(0.185)	(0.340)	(0.006)	(0.008)	(0.011)	(0.012)
–0.048	–0.002	–0.002	0.013	–0.003	–0.017***
(0.037)	(0.035)	(0.014)	(0.011)	(0.006)	(0.006)
0.057***	0.029***	0.018***	0.007***	0.031***	0.058***
(0.007)	(0.007)	(0.001)	(0.001)	(0.003)	(0.014)
0.003	0.029***	0.007***	0.003**	–0.003	0.002**
(0.008)	(0.008)	(0.001)	(0.001)	(0.006)	(0.001)
–0.004*	–0.006*	–0.001**	–0.000	0.002	–0.006
(0.002)	(0.003)	(0.000)	(0.000)	(0.003)	(0.006)
0.013	–0.265***	–0.068***	–0.048***	0.019	–0.016
(0.079)	(0.065)	(0.016)	(0.016)	(0.064)	(0.013)
YES	YES	YES	YES	YES	YES
YES	YES	YES	YES	YES	YES
	0.879			0.062	
0.443		0.461	0.847		0.433
0.097	0.431	0.214	0.860	0.757	0.232
0.426	0.860	0.000	0.001	0.000	0.000
34,981	29,209	171,584	228,099	57,320	59,760

the impact of net working capital on TFP or ROS is the same across positive (D) and negative (1-D) net working capital firm-years are the p-values associated with the F-test for general restrictions. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7. Regressions by Financial Constraints Level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: TFP					
	SA^{High}	**SA^{Low}**	**SA^{High}**	**SA^{Low}**	**SA^{High}**	**SA^{Low}**
Variable	**SOEs**	**SOEs**	**Private**	**Private**	**Foreign**	**Foreign**
Lag dependent$_{i,t-1}$	0.715*** (0.117)	0.832*** (0.054)	0.875*** (0.087)	0.920*** (0.019)	0.718*** (0.148)	0.869*** (0.049)
Net working capital × D	0.597 (0.462)	–0.329 (0.744)	–0.998*** (0.261)	–0.356** (0.154)	–0.553** (0.257)	–0.326* (0.181)
Net working capital × (1-D)	0.047 (0.200)	0.183 (0.179)	0.713*** (0.145)	0.375** (0.155)	0.599*** (0.158)	0.452*** (0.085)
Cash flow	0.467 (1.046)	0.291 (0.765)	2.396*** (0.806)	1.736*** (0.108)	2.172*** (0.607)	1.721*** (0.204)
Leverage	0.168 (0.270)	0.114 (0.150)	0.223 (0.192)	0.311*** (0.056)	0.107 (0.151)	0.388*** (0.082)
Sales growth	0.853*** (0.072)	1.450*** (0.057)	0.566 (0.540)	0.984*** (0.140)	0.575 (0.587)	1.670*** (0.062)
Size	0.107* (0.058)	0.540*** (0.174)	–0.043 (0.104)	0.217*** (0.046)	0.126 (0.214)	0.133 (0.157)
Age	–0.040** (0.018)	–0.113*** (0.032)	–0.012 (0.020)	–0.045*** (0.009)	–0.066 (0.074)	–0.031 (0.055)
Constant	0.103 (0.349)	–4.654*** (1.664)	0.790 (0.838)	–1.907*** (0.433)	–0.138 (1.556)	–0.713 (1.489)
Year dummy	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES
M(2)						
M(3)	0.379	0.833	0.451	0.084	0.858	0.131
Hansen (*J*) test	0.131	0.144	0.609	0.315	0.466	0.090
Wald test	0.326	0.561	0.000	0.008	0.001	0.000
Observations	26,046	38,009	226,767	205,812	41,576	88,404

Note: See Appendix 1 for the definitions of all variables. This table presents the results from the regressions using the two-step GMM model. ***M(n)*** is a test for n-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Hansen (*J*) statistics provide a test of overidentifying restrictions, distributed under the null of instrument validity. The numbers in the rows of the Wald test testing whether

(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable: ROS					
SA^{High}	**SA^{Low}**	**SA^{High}**	**SA^{Low}**	**SA^{High}**	**SA^{Low}**
SOEs	**SOEs**	**Private**	**Private**	**Foreign**	**Foreign**
0.245***	0.307***	0.690***	0.725***	0.423***	0.435***
(0.072)	(0.089)	(0.161)	(0.090)	(0.063)	(0.041)
–0.005	–0.045	–0.069***	–0.054**	–0.045***	–0.028**
(0.092)	(0.065)	(0.024)	(0.021)	(0.014)	(0.011)
0.127	0.070	0.039***	0.033***	0.107***	0.048***
(0.221)	(0.078)	(0.006)	(0.009)	(0.021)	(0.012)
0.002	0.248	0.161***	0.134***	0.309***	0.122***
(0.203)	(0.319)	(0.016)	(0.036)	(0.007)	(0.041)
–0.080	–0.020	–0.014***	–0.011**	0.005	–0.038**
(0.092)	(0.053)	(0.003)	(0.005)	(0.004)	(0.018)
0.036***	0.051***	0.008***	0.026***	0.015***	0.075***
(0.005)	(0.008)	(0.001)	(0.002)	(0.001)	(0.022)
0.102**	0.040***	0.000	0.005	0.001***	0.003***
(0.043)	(0.009)	(0.005)	(0.005)	(0.000)	(0.001)
–0.027***	–0.012***	–0.001	–0.002	0.003***	–0.001
(0.009)	(0.003)	(0.002)	(0.001)	(0.001)	(0.002)
–0.770**	–0.393***	0.005	–0.038	0.000	–0.004
(0.341)	(0.102)	(0.050)	(0.053)	(0.000)	(0.016)
YES	YES	YES	YES	YES	YES
YES	YES	YES	YES	YES	YES
0.745	0.538				
		0.847	0.930	0.376	0.873
0.500	0.274	0.829	0.145	0.079	0.074
0.634	0.284	0.000	0.001	0.000	0.000
27,143	36,776	185,832	204,102	33,974	86,704

the impact of net working capital on TFP or ROS is the same across positive (D) and negative (1-D) net working capital firm-years are the p-values associated with the F-test for general restrictions. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8. Regressions by Cash Flow Level.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: TFP					
	CF^{Low}	**CF^{High}**	**CF^{Low}**	**CF^{High}**	**CF^{Low}**	**CF^{High}**
Variable	**SOEs**	**SOEs**	**Private**	**Private**	**Foreign**	**Foreign**
Lag dependent$_{i,t-1}$	0.812*** (0.043)	0.891*** (0.062)	0.973*** (0.026)	0.949*** (0.022)	0.871*** (0.062)	0.866*** (0.036)
Net working capital × D	0.394 (0.494)	–0.056 (0.558)	–0.696*** (0.170)	–0.157*** (0.055)	–0.818*** (0.310)	–0.310*** (0.111)
Net working capital × (1-D)	0.016 (0.081)	0.966 (1.065)	0.351*** (0.092)	0.182* (0.105)	0.806** (0.346)	0.281*** (0.051)
Cash flow	0.956 (3.211)	1.060*** (0.188)	1.700* (0.939)	0.681*** (0.087)	1.887** (0.828)	1.162*** (0.135)
Leverage	0.105 (0.085)	0.585 (0.432)	0.041 (0.079)	0.121*** (0.038)	0.086 (0.197)	0.081 (0.075)
Sales growth	1.101*** (0.061)	1.599*** (0.072)	0.574 (0.479)	1.331*** (0.047)	0.304 (0.740)	1.644*** (0.052)
Size	0.223*** (0.074)	0.155** (0.068)	–0.011 (0.041)	0.128*** (0.032)	0.181** (0.078)	0.198** (0.077)
Age	–0.033*** (0.012)	–0.012 (0.011)	–0.019 (0.017)	–0.011** (0.004)	–0.060 (0.097)	–0.046 (0.046)
Constant	–1.298* (0.745)	–1.244** (0.487)	0.472 (0.359)	–0.975*** (0.248)	–0.940 (0.591)	–1.213* (0.717)
Year dummy	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES
M(2)						
M(3)	0.330	0.941	0.105	0.106	0.081	0.549
Hansen (*J*) test	0.733	0.078	0.125	0.136	0.800	0.251
Wald test	0.493	0.410	0.000	0.011	0.002	0.000
Observations	27,777	28,440	185,826	203,242	45,550	83,830

Note: See Appendix 1 for the definitions of all variables. This table presents the results from the regressions using the two-step GMM model. ***M(n)*** is a test for n-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Hansen (*J*) statistics provide a test of overidentifying restrictions, distributed under the null of instrument validity. The numbers in the rows of the Wald test testing whether

(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable: ROS					
CF^{Low}	**CF^{High}**	**CF^{Low}**	**CF^{High}**	**CF^{Low}**	**CF^{High}**
SOEs	**SOEs**	**Private**	**Private**	**Foreign**	**Foreign**
0.485***	0.264**	0.521***	0.580***	0.323***	0.500***
(0.110)	(0.123)	(0.115)	(0.052)	(0.044)	(0.089)
–0.033	–0.069	–0.130***	–0.040**	–0.091***	–0.071**
(0.060)	(0.059)	(0.046)	(0.018)	(0.021)	(0.028)
0.031	–0.010	0.046***	0.027**	0.101***	0.045*
(0.019)	(0.024)	(0.011)	(0.011)	(0.013)	(0.027)
0.439	0.239***	0.601***	0.163***	0.590***	0.262***
(0.343)	(0.017)	(0.101)	(0.020)	(0.066)	(0.006)
–0.019	–0.090*	–0.037*	–0.006	–0.026	–0.028***
(0.029)	(0.050)	(0.021)	(0.016)	(0.018)	(0.005)
0.051***	0.009***	0.050	–0.012	0.019***	0.015***
(0.006)	(0.003)	(0.047)	(0.037)	(0.005)	(0.002)
–0.002	0.017**	0.021*	0.008***	0.009***	–0.003
(0.010)	(0.007)	(0.011)	(0.001)	(0.003)	(0.004)
–0.001	–0.002*	–0.053**	–0.002	0.002	0.002
(0.001)	(0.001)	(0.021)	(0.008)	(0.001)	(0.002)
0.042	–0.092	0.348**	–0.072**	–0.092***	0.050
(0.093)	(0.060)	(0.164)	(0.030)	(0.035)	(0.047)
YES	YES	YES	YES	YES	YES
YES	YES	YES	YES	YES	YES
	0.270				
0.424		0.944	0.253	0.552	0.534
0.244	0.972	0.069	0.300	0.062	0.165
0.358	0.327	0.001	0.003	0.000	0.028
28,968	34,951	184,187	201,359	36,880	71,313

the impact of net working capital on TFP or ROS is the same across positive (D) and negative (1-D) net working capital firm-years are the p-values associated with the F-test for general restrictions. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

flow influences TFP/ROS more strongly when firms are facing severe external financial constraints. In addition, leverage plays a positive and significant role on TFP in less external financially constrained firms. These findings suggest that firms can increase their productivity and profitability through net working capital management, especially when their external financial constraints are high. Further, cash flow is a more important financial intermediation for highly financially constrained firms. Firms can thus use more trade credit or reduce inventory in the production process or during sales activities.

5.4 Internal financial constraints

Sections 5.2 and 5.3 discussed the external financial constraints faced by firms, showing that cash flow is important when firms are financially constrained. However, cash flow is also considered to be a proxy of internal financial constraints. Table 8 presents the results when we divide each ownership type by the internal levels of financial constraints. We find that internal financially constrained private and foreign-owned firms' net working capital is more sensitive than that of less internal financially constrained firms. These findings suggest that when firms' cash level is low, they can increase their productivity and profitability through net working capital management, because such capital can be converted into cash flow quickly and efficiently (Chen and Guariglia, 2013; Mun and Jang, 2015).

5.5 Firm size

Similarly, this part estimates the regression for the separate samples of small and large firms. The results in Table 9 illustrate that the effect of net working capital on TFP/ROS is more pronounced for small firms than for large firms. Net working capital management is more efficient for small firms to maintain their productivity and profitability. This result corroborates the findings that small firms are more financially constrained and that net working capital is more sensitive for small firms.

5.6 Robustness tests[12]

5.6.1 Alternative productivity and profitability measures

TFP estimated by using the *OP* method (Olley and Pakes, 1996) is one alternative measurement of firm productivity, while return on assets (ROA) can also

[12]Owing to space limitations, the regression results of our robustness tests are omitted. Detailed information is available from the author on request.

be used to measure firm profitability. The relation between net working capital (positive and negative) and TFP^{OP}/ROA is consistent with TFP^{LP}/ROS, indicating that the measurement of productivity and profitability does not change our results.

5.6.2 Alternative financial constraint measures

The literature provides alternative ways in which to measure a firm's financial constraints, which include the financial constraints index developed by Whited and Wu (2006). We also find that in the highly financially constrained group of private and foreign-owned firms, both positive and negative net working capital are more sensitive to TFP/ROS, and working capital management is more efficient for firm performance in this group. This fact illustrates that our results are unchanged by using different measures of financial constraints.

6 Conclusions

We used data on Chinese non-listed firms over 1999–2007 to study the relationship between working capital and firm performance. Moving beyond the existing literature, we considered a wide range of firm performance measures, both firm productivity (TFP) and firm profitability (ROS), and investigated how working capital management affects firm performance.

We found an inverted U-shaped relationship between net working capital and TFP/ROS. If a firm's net working capital is positive (negative), its net working capital has a negative (positive) influence on TFP and ROS. Net working capital is also significantly associated with TFP and ROS in privately and foreign-owned firms, while not significantly associated with TFP and ROS in SOEs. This finding suggests that net working capital management is an efficient tool that enhances the performance of non-SOEs.

Furthermore, we focused on the fact that net working capital has a different effect on firm performance under different financial constraints. First, we found that high ICFS firms' working capital is more sensitive to TFP/ROS, which indicates that when firms' investment behavior in production and management processes strongly relies on internal financing and their external financing channels are tighter, firms can boost performance by managing working capital more efficiently. Second, external financially constrained private and foreign-owned firms' net working capital is more sensitive than that of less financially constrained firms, whose external levels of financial constraints are evaluated by the SA index. Third, internal financially constrained private and foreign-owned firms' net working capital is more sensitive than that of less internal financially constrained firms. Finally, the effect of working capital on TFP/ROS is more pronounced for small firms than for large firms. This fact corroborates the findings that small firms are more financially constrained and that working capital is more sensitive for small firms.

Table 9. Regressions by Firm Size.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: TFP					
	Small	**Large**	**Small**	**Large**	**Small**	**Large**
Variable	**SOEs**	**SOEs**	**Private**	**Private**	**Foreign**	**Foreign**
Lag dependent$_{i,t-1}$	0.609*** (0.099)	0.863*** (0.032)	0.853*** (0.085)	0.921*** (0.019)	0.732*** (0.102)	0.950*** (0.032)
Net working capital × D	–0.386 (0.411)	–0.158 (0.666)	–0.916** (0.420)	–0.356** (0.151)	–0.821*** (0.224)	–0.430* (0.237)
Net working capital × (1-D)	0.709 (0.706)	0.181 (0.352)	0.570*** (0.149)	0.375** (0.147)	0.529*** (0.128)	0.478* (0.244)
Cash flow	1.054 (0.935)	1.577*** (0.231)	2.314*** (0.711)	1.694*** (0.112)	1.832*** (0.408)	1.520*** (0.148)
Leverage	0.156 (0.271)	0.231 (0.205)	0.064 (0.402)	0.313*** (0.054)	0.048 (0.120)	0.389 (0.288)
Sales growth	0.784*** (0.065)	1.415*** (0.032)	0.335 (0.487)	0.979*** (0.156)	0.022 (0.397)	1.811*** (0.041)
Size	0.134*** (0.044)	0.184*** (0.041)	0.172* (0.094)	0.211*** (0.044)	0.133* (0.071)	0.114** (0.052)
Age	–0.070*** (0.018)	–0.021*** (0.008)	–0.048*** (0.016)	–0.029*** (0.005)	–0.564*** (0.189)	–0.059*** (0.013)
Constant	0.522** (0.259)	–1.255*** (0.363)	–0.917 (0.722)	–1.889*** (0.427)	–1.250*** (0.375)	–1.212** (0.486)
Year dummy	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES
M(2)						
M(3)	0.791	0.761	0.096	0.097	0.782	0.592
Hansen (*J*) test	0.464	0.173	0.321	0.410	0.142	0.116
Wald test	0.240	0.675	0.000	0.006	0.000	0.001
Observations	0.791	0.761	0.096	0.097	0.782	0.592

Note: See Appendix 1 for the definitions of all variables. This table presents the results from the regressions using the two-step GMM model. ***M(n)*** is a test for n-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. The Hansen (*J*) statistics provide a test of overidentifying restrictions, distributed under the null of instrument validity. The numbers in the rows of the Wald test testing whether

(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable: ROS					
Small	**Large**	**Small**	**Large**	**Small**	**Large**
SOEs	**SOEs**	**Private**	**Private**	**Foreign**	**Foreign**
0.148***	0.262***	0.567***	0.648***	0.399***	0.465***
(0.042)	(0.093)	(0.095)	(0.095)	(0.067)	(0.068)
–0.006	–0.059	–0.105***	–0.039*	–0.043***	–0.038**
(0.037)	(0.055)	(0.032)	(0.023)	(0.015)	(0.015)
0.107	0.125	0.057***	0.039***	0.103***	0.034***
(0.075)	(0.081)	(0.012)	(0.007)	(0.022)	(0.010)
0.469***	0.319	0.227***	0.118***	0.302***	0.252***
(0.109)	(0.346)	(0.031)	(0.037)	(0.007)	(0.069)
0.012	–0.020	–0.022***	–0.004	0.004	–0.031***
(0.028)	(0.032)	(0.007)	(0.013)	(0.004)	(0.010)
0.026***	0.048***	0.080	0.027***	0.014***	0.111***
(0.003)	(0.008)	(0.056)	(0.002)	(0.001)	(0.038)
0.051***	0.035***	–0.003	0.008*	–0.001*	0.000
(0.010)	(0.010)	(0.006)	(0.004)	(0.000)	(0.002)
–0.004*	–0.006**	–0.002*	–0.002**	0.001	–0.006
(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.005)
–0.462***	–0.338***	0.056	–0.066	0.000	0.000
(0.095)	(0.096)	(0.062)	(0.050)	(0.000)	(0.020)
YES	YES	YES	YES	YES	YES
YES	YES	YES	YES	YES	YES
0.355	0.934				
		0.240	0.847	0.712	0.851
0.074	0.285	0.088	0.148	0.087	0.675
0.213	0.084	0.000	0.003	0.000	0.000
23,383	40,453	182,130	203,951	32,211	87,599

the impact of Working Capital on TFP or ROS is the same across positive (D) and negative (1-D) working capital firm-years are the p-values associated with the F-test for general restrictions. Robust standard errors are in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Compared with previous research, this study discusses net working capital's smoothing effect as an alternative financial resource by introducing the financial constraints mechanism into our analysis. The presented findings suggest several implications for the relationship between net working capital management and firm performance in China. First, net working capital is an alternative financing resource that can alleviate the financial constraints of non-state-owned Chinese firms and net working capital management is an efficient tool that enhances the performance of non-SOEs. Second, firms with positive (negative) net working capital can influence firm performance by adjusting liquid assets and debt structure. Third, net working capital is more efficient at enhancing performance when firms are more financially constrained. Indeed, for strongly financially constrained firms, net working capital is important to smooth financial constraints.

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Appendix 1

Variable Definition.	
TFP^{LP}	Total factor productivity, measured by Levinsohn and Petrin (2003)
TFP^{OP}	Total factor productivity, measured by Olley and Pakes (1996)
ROS	Return on sales, measured by net profit divided by total sales
ROA	Return on assets, measured by net profit divided by total assets
Net working capital	Current assets minus current liabilities divided by total assets
Cash Flow	Net income and depreciation divided by total assets
Leverage	Current liabilities and non-current liabilities divided by total assets
Sales Growth	Difference between sales in period *t* and *t–1* over sales in period *t–1*
Firm Size	Natural logarithm of total assets
Firm Age	Natural logarithm of the number of years since the open year
SA Index	$-0.737*size + 0.043*size^2 - 0.040*age$
WW Index	–0.091*cf–0.062*divpos + 0.021*tltd – 0.044*lnta + 0.102*isg – 0.035*sg
Fixed Investment	Difference between the book value of fixed assets at the end of year t and that at the end of year t–1 after depreciation
Fixed Capital Stock	Book value of fixed assets

Appendix 2

Estimating a TFP Equation

There are various methods to estimate TFP. The simplest model is Solow's (1957) residual method estimated by OLS. However, econometric issues arise because firm productivity can affect input choices. This fact implies that the coefficient estimates obtained with OLS might be biased. A number of solutions have been proposed in the literature to overcome this problem, including the firm-level fixed effects method of Jefferson et al. (2008), the Olley and Pakes method (*OP* method, 1996), and the Levinsohn and Petrin method (*LP* method, 2003).

To better cope with the simultaneity and sample selected problem, we regress our TFP by using the *LP* method and use TFP regressed by the *OP* method as part of our robustness tests.

Specifically, we assume that the production function of China's manufacturing firms takes the following Cobb–Douglas form:

$$Y_{it} = A_{it} L_{it}^{\beta_l} K_{it}^{\beta_k} M_{it}^{\beta_m}, \tag{1}$$

where Y_{it} represents the physical output of firm i in period t; L_{it}, K_{it}, and M_{it}[13] are labor, capital, and intermediate inputs, respectively and A_{it} is the Hicks neutral efficiency level of firm i in period t. Taking the natural logs and differentiating the equation yields a linear production function as follows:

$$y_{it} = lnA_{it} + \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it}, \tag{2}$$

$$TFP_{it} = y_{it} - \beta_l l_{it} - \beta_k k_{it} - \beta_m m_{it}, \tag{3}$$

where β_l, β_k, and β_m are estimated by using the *LP* method, *OP* method, and OLS method, respectively.

[13] Y_{it} is measured by the logarithm of sales, L_{it} is measured by the logarithm of the number of employees, and K_{it} is measured by the logarithm of net fixed assets. To better cope with the simultaneity and sample selected problem, the LP method and OP method use intermediate inputs to solve this problem. To account for the characteristics of the intermediate inputs M_{it}, we control for the firm-level intermediate input variable from the balance sheet to measure LP method TFP, while we use the capital input calculated by using the perpetual inventory method as the proxy of intermediate inputs to measure OP method TFP. The equation of the capital input is $I_t = K_t - (1 - \rho)^* K_{t-1}$, where I_t is the capital input, K_t is the fixed capital, and ρ is the depreciation rate, and we choose the rate of depreciation as 0.15 in our regression.