

CESifo Venice Summer Institute

19 - 24 July 2010



“THE EVOLVING ROLE OF CHINA IN THE GLOBAL ECONOMY”

to be held on **23 - 24 July 2010**
on the island of San Servolo in the Bay of Venice, Italy

If You Try, You'll Get By: Chinese Private Firms' Efficiency Gains from Overcoming Financial Constraints

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June 30, 2010

Abstract

It appears to be common knowledge that external financing in China is mostly limited to state-owned firms and is hard to obtain for smaller private firms. In this paper we first confirm that this is true in our data and then investigate ways in which private firms overcome their financing constraints. We find that private firms reduce their need for external funds through more efficient management of inventory and accounts receivable. We further show that the low levels of inventory and accounts receivable in Chinese private firms are not below efficient levels and are unlikely to be a hindrance to their efficient operations. Instead, these low levels of working capital seem to be correlated with higher financial returns as well as higher productivity. We conclude that while limited access to external financing may limit the growth of private sector in the medium and long run, in the short run the lean operating budget may be contributing to private firms' efficiency.

JEL classification: O12, O16, G31

Keywords: China, external financing, private sector, inventory, account receivable, efficiency

¹ The views expressed in this paper are those of the authors and do not necessarily represent the views of the Federal Reserve Bank of San Francisco or Federal Reserve System. Part of this work was conducted while Hale was visiting the Hong Kong Institute of Monetary Research, for whose hospitality she is most grateful. We thank Hirotaka Miura for excellent research assistance. All errors are ours.

1. Introduction

The importance of finances in economic development has long been advocated and empirically tested in the economic literature. As early as 1911, Schumpeter has linked the importance of financial services to firms' capacity in engaging technological innovation and thus a country's ability in economic development. Based on country-level analyses, King and Levine (1993) provide evidence that multiple indicators of financial development are not only positively correlated with the present levels of multiple economic indicators but also their future values. Using industry level data for a large number of countries, Rajan and Zingales (1998) show that industries with higher external finance requirements tend to grow faster in countries with more developed capital markets.

Thus, one big puzzle in China's rapid economic growth in the past three decades relates to the financial sector. On the one hand, the Chinese economy has experienced one of the fastest growth rates in the world continuously since the late 1970s, partly driven by the rapid development of the private sector, which substantially outpaced the growth rate of the state sector. On the other hand, the vast majority of researchers believe that the formal financial sector in China lacks efficiency by many standards. How did the private sector in China manage to grow so rapidly with limited access to external finance? There are two avenues one could explore: alternative financing to overcome limited supply of external funds from the formal financial sector, and new ways in which firms may reduce their demand for external funds.

Previous studies addressing the puzzle focused mainly on alternative financing sources that include internal funds, informal loans (from family, friends, and acquaintances), foreign direct investment (FDI), and trade credit among private firms themselves and from other types of firms. While there is evidence that the first three alternative sources (internal funds, informal loans, and FDI) have been important in alleviating private firms' financial constraints (Allen, Qian, and Qian, 2005, 2007; Hèricourt and Poncet, 2008; Lardy 1998, 2004; Poncet, Steingress, and Vandenbussche, 2008), trade credit from other sectors (such as state-owned or foreign-invested sector) has been shown to play an insignificant role (Cull, Xu, and Zhu, 2009) or to be non-existent (Hale and Long, 2010).²

² Using a small sample of private firms and SOEs for 1994-1999, Ge and Qiu (2007) provide evidence that private firms use trade credit as a net source of credit (i.e., incur higher accounts payable than accounts receivable), while SOEs on average are a net supplier of trade credit. However, in the more recent years we are focusing on (2000-2006), this channel appears to have dried out.

In this paper we focus on the second avenue by investigating the ways in which Chinese private firms lower their demand for external financing and studying whether these methods lead to increased or decreased efficiency. To the best of our knowledge, only one other paper explores the finances of Chinese private firms from the demand side of finances: Long and Zhang (2010) point out that certain organizational arrangements such as clustering may lead to a lower level of financial needs for Chinese firms. We go further along this path by investigating two other channels, namely, the management of inventory and that of accounts receivable, which allow firms to reduce the demand for operating costs.

Various studies provide evidence that private firms have been discriminated against in the financial market. Brandt and Li (2003) provide direct evidence that between 1994 and 1997 private firms were discriminated against by township branches of the Agricultural Bank of China and the local Rural Credit Cooperatives, compared to township enterprises. Dollar and Wei (2007) show that on average Chinese domestic private firms have significantly higher returns to capital than SOEs, implying more funds going to the SOEs, an inefficient allocation of financial resources. Liu and Siu (2006) similarly show that the “implied” cost of capital derived from their estimated structural parameters is substantially higher for private firms and foreign invested firms than for SOEs in China. More generally, Hsieh and Klenow (2009) estimate that Chinese manufacturing sector could potentially improve its total factor productivity by 30-50% through more efficient capital allocation.

Using balance-sheet data from Chinese Industrial Surveys of Medium-sized and Large Firms for 2000-2006 (the NBS survey) and survey data from the Large-Scale Survey of Private Enterprises in China that was conducted in five waves between 1997 and 2006, we first confirm that, consistent with conventional wisdom, private firms had limited access to external finance during the period of rapid economic growth prior to the global recession. Moreover, we find substantial variations among private firms: While the small private firms face more financial constraints, the more established large private firms seem to have access to finances more equal to their state-owned counterparts.

We then turn to the main analysis of our paper – channels through which private firms reduce their demand for operating funds. Using the NBS survey data as well as Survey of Private Enterprises data we study the relationship between firms’ access to external finance and the ratios of inventories and accounts receivable to sales. As inventories make up a large part of daily working capital, a lower level of inventory implies less funds required for working capital, and thus less need for finances. Likewise,

lower average level of accounts receivable means that firms recover their revenues and use them for working capital financing more quickly, thus relying less on external financing.

First of all, we find that the ratios of inventory to sales and accounts receivable to sales are substantially lower in private firms than in firms of other ownership types, even after controlling for various firm characteristics, industry, and location. Next, we show that these ratios depend on our measures of access to external finance, especially for private firms, both in a cross-section and in the fixed-effects panel. This suggests that not only firms with less access to credit have lower ratios of inventories and accounts receivables to sales (cross-section results), but also that firms make greater adjustments in their inventories and accounts receivable when credit gets tighter (fixed-effects panel results).

An important question is whether the low levels of inventories and accounts receivable induced by limited access to external finance are in fact below the levels that are necessary to guarantee optimal sales. In other words, are the low ratios of inventories and accounts receivable observed in Chinese private firms just another indicator of detrimental effects of limited access to external finances? One warning sign is the fact that these ratios for private firms are even lower than for those in majority foreign-invested firms, which are thought to be the most efficient among Chinese firms. To address this question, we estimate non-linear regressions of various measures of firm profitability on inventory and accounts receivable ratios, and find that firm profitability is monotonically decreasing in these ratios. In other words, there is no evidence that low ratios of inventories and accounts receivable to sales in private firms are associated with lower profitability.

We take a step further and find that lower levels of inventory and accounts receivable are associated with higher productivity as well. The results for inventory are consistent with the findings made by Lieberman and Demeester (1999) for Japanese car manufacturers. Here the argument is that a lower inventory level (especially work in process inventory) makes it easier to expose and subsequently resolve problems throughout the production process, leading to higher productivity. On the other hand, the higher productivity in firms with lower accounts receivable/sales ratios may be explained by the firm's greater ability to fully utilize its production capacity (Fisman 2001) and to finance process, product, or technology development that helps enhance productivity. Thus, lower levels of inventory and accounts receivable increase firms' profitability through both higher productivity and lower financial costs.

Consequently, we argue that financial constraints faced by Chinese private firms lead to an increase in efficiency in terms of inventory and accounts receivable management. We further show that the decline in levels of inventory and accounts receivable is not so extreme as to negatively affect firms' profitability. Alternatively, if there are negative effects of financial constraints on profitability, they are not working through the inventory and accounts receivable channels.

It is important to emphasize that our results do not imply that there are no costs associated with limited access to financing by private firms. A substantial body of literature shows that the restricted access to credit is impeding the development of Chinese private firms by limiting fixed assets investment and growth. We do, however, show that private firms in China have found ways of coping with day-to-day shortage of financing through becoming more cost effective in a way that does not harm their profitability. Such efficiency improvements also make private firms in China more competitive compared to their state-owned counterparts in China and potentially more competitive compared to less constrained firms in other countries.

An important implication of our findings is that as financial markets improve in China, private firms are likely to use their newly-found access to external funds for financing long-term investment rather than working capital. In our opinion, this implies that a more efficient financial sector in China is likely to become the next engine for sustained growth of the Chinese economy.

The rest of the paper is organized as follows. Part 2 describes our data. Part 3 demonstrates that private firms are financially constrained compared to state-owned firms. Part 4 shows that firms respond to the constrained financial access by reducing their levels of inventories and accounts receivable. Part 5 analyzes the effects of such mechanisms on profitability and productivity. Part 6 concludes.

2. Data

Our data come from two main sources. First, we use balance sheet and ownership information from the Chinese Industrial Surveys of Medium-sized and Large Firms for 2000-2006, which includes all state-owned firms and firms of other ownership types that are in excess of a certain scale. This data set is commonly referred to as the National Bureau of Statistics (NBS) manufacturing census, and is an

unbalanced panel with a total of 496,738 firms for 2000-2006.³ For short, we will refer to this data set as the “census” data. We use two versions of these data – the cross-section of firms in the last year of our sample (297,665 firms) and a balanced panel that only includes firms that were in our data in each of the years 2000-2006 (48,382 firms, 338,674 observations).

Second, we use survey data from the Large-Scale Survey of Private Enterprises in China jointly conducted by the All China Federation of Industrial and Commerce (ACFIC) and the United Front of the Chinese Communist Party in 1997, 2000, 2002, 2004, and 2006, often with help from the Bureau of Industry and Commerce. This survey is a repeated cross-section in which firms are not matched across years. A total of 18,527 firms are surveyed over all the years, and only private firms are included. For short, we will refer to this data set as the “survey” data.

The census data covers firms of all ownership types, including those with foreign capital share. We classify firms by ownership types in two ways – by the registration type, and by the type of investor holding the majority share of the paid-up capital. While the first measure may be outdated, as the registration of the firm may not change as soon as the firm’s capital structure changes, it is possible that the registration type, rather than the *de facto* ownership structure determines the access to financing. We will refer to the two classifications as the *de jure* ownership type (by registration) and the *de facto* ownership type (by actual shares).

Using the 2006 cross-section, Table 1 shows that in most cases there is a good match between the two classifications. Note that one exception is the set of firms with the majority share held by “legal person,” which are mostly registered as private firms, but could also be in other categories. In what follows, we will analyze results using both classifications, but to spare the reader from all the details, we will only report results from the *de facto* classification analysis and point to the differences wherever they arise.

[Table 1 about here]

While the census data mainly include medium and large firms, there are small firms in the data set as well, both because all SOE firms are included in these data sets and due to time lags in excluding firms that have fallen below the size threshold. For the purposes of our analysis, we classify all firms into

³ While the raw data includes 622,424 firms, after we drop observations with missing values for year, location, industry code, duplicates or near duplicates, as well as observations with key variables that appear erroneously reported or missing, we are left with 496,738 firms in the unbalanced panel data set.

four groups – small firms with assets less than 40 thousand RMB, medium firms with assets between 40 and 400 thousand RMB, large firms assets between 400 thousand and 4 million RMB, and giant firms with more assets exceeding 4 million RMB. The top panel of Table 2 gives the distribution of firms in 2006 from the NBS census data by these size categories and their *de facto* ownership type, for both our 2006 cross-section and the firms that were in the data set continuously since 2000. The panel shows that small firms are predominantly private, while giant and large firms are mostly state-owned, and that the balanced panel data set includes disproportionately fewer small and private firms. Panel B of the table shows the size distribution of firms in the private firm survey data for both the pooled sample of 2000-2006 and for the 2006 survey. We can see that the private firm surveys almost exclusively cover small firms and as a result include many small private firms that are excluded from the census data.

[Table 2 about here]

3. Do state-owned firms have easier access to external financing?

As discussed previously, a main indicator of how efficiently the financial system operates in China is whether banks treat firms of different ownership types differently when extending loans to them. Thus we first study how SOEs differ in their access to formal loans as compared to private firms.

Using the sample of all firms in the last year of our census data, 2006, we first confirm that state-owned firms, regardless of their size, still have easier access to external financing: they tend to have higher leverage (debt/total assets) and higher share of financial expense in total expense, while they pay half as much expense per unit (RMB) of their external financing compared to private firms (see Table 3).⁴ Repeating the same analysis for the balanced panel of the firms we see that while leverage was more or less unchanged during our sample period for SOEs, it in fact declined for private firms, holding the sample constant. Moreover, for older and larger private firms that were in our sample since 2000, leverage is in fact a bit higher than for SOEs and is declining. If we include new firms, however, in our 2006 sample, the average leverage of the private firms is substantially lower than in the balanced sample, suggesting that new entrants have more restricted access to financing than older

⁴ Note that the per unit cost for external financing computed here is different from average interest rate for at least two reasons: (1) A firm's total debt may include liabilities not bearing interest payments such as various accounts payable, and (2) Even if the firm's total debt comprises only interest-bearing bank loans, the year-end total debt may not correspond to the amount of bank loans that incurred the interest payment in that year. However, this ratio still gives a proxy for the average cost of obtaining finances faced by firms of different types.

private firms and than SOEs. The leverage of smaller private firms, the ones included in our survey data, is less than half of the private firms in the census, indicating that access to finance is particularly hard for young small private firms.

One possibility is, therefore, that differences in access to finance are not due to ownership per se, but rather reflect the fact that private firms are on average younger and smaller and therefore lack credit history and reputation. We address this difficulty in interpretation in two ways: by estimating the effects of ownership controlling for size, liquidity, and profitability in a regression analysis that we discuss later, and by focusing on small firms in the survey data. It is therefore important to emphasize in this regard that the NBS census data that focus on large and medium-sized firms could not be the only information source for studying the financial access of Chinese private firms. And this is particularly the case for the balanced firm panel that disproportionately includes large firms.

Looking at the share of financial expense in total expense, we find that even in the balanced panel that share is a lot lower for private firms than for the SOEs. It becomes even lower once we include all firms in our 2006 cross-section. At the same time, interest expense as a ratio to total debt is almost twice as high for private firms as it is for SOEs, in both cross-section and balanced panel. This indicates that when private firms do access external finance, they pay substantially more for it than SOEs. In addition, we see that total financial expenses and interest expenses have declined on average for SOEs during our sample period, while they remained basically unchanged for private firms.

[Table 3 about here]

While we cannot directly measure informal external financing using our census data, we can use accounts payable and accounts receivable as proxies. For instance, a high share of accounts payable in total debt may suggest that firms have to rely on trade credit to finance their operating expenses when other forms of credit are not available. Table 4 shows, for our full-sample cross-section in 2006, that the share of accounts payable in total debt is much lower for state-owned firms. The pattern is the same in our balanced sample and does not change much since 2003, when these variables were first reported in the census data.⁵ Similarly, lower share of accounts receivable in total assets for state-owned firms also suggests that they tend to engage less in informal financing.

[Table 4 about here]

⁵ We do not present the balanced panel results in the interest of space.

This interpretation of trade credit as a substitute for other forms of credit is further confirmed by the fact that as a ratio of total sales, state-owned firms have higher accounts payable and accounts receivable than private firms. Together with the previous fact, this implies that even though state-owned firms use trade credit more actively in their transactions than private firms, trade credit still comprises a higher portion of all liabilities for private firms than for state-owned. Furthermore, as we will discuss in more detail below, private firms may be trying to reduce their need for financing through better management of their accounts payable and accounts receivable.

As we mentioned earlier, one potential reason for state-owned firms' easier access to finances could be their better creditworthiness rather than prejudice against private firms in the formal financial sector. To see whether this is the case, we test whether the apparent SOE advantage in accessing external credit persists when we control for size and measures of creditworthiness. Table 5 reports the results of the regression analysis that conducts this test for the 2006 cross-section. We do see that at least for leverage size matters as well – once we control for log of assets, the coefficient on the SOE dummy falls by about half, indicating that half of the difference in leverage between private firms and SOEs in the 2006 census cross-section is due to the fact that state firms tend to be larger. Nevertheless, we still find that state-owned firms have significantly higher leverage, larger ratio of financial to total expenses, and lower share of accounts payable in total debt, even after controlling for size, profitability, and liquidity measures. These findings confirm that state-owned firms have easier access to formal external finance and rely less on informal finance than other firms.

[Table 5 about here]

We repeat this analysis for the balanced panel to see what the trends were between 2000 and 2006 (or between 2003 and 2006 in the case of accounts payable over debt). To this end, we interact the indicator for majority state-owned firms with the time trend and estimate a panel regression by GLS with random effects (see Table 6). We find that although in our balanced panel sample the leverage is roughly the same for private firms and SOEs, two other measures indicate that even for this sample, which only includes larger and older private firms, the private firms have more difficult access to credit. While these differences between state-owned and other firms diminish over our sample period, the rate of convergence is very slow for the share of financial and interest expenses.

[Table 6 about here]

The importance of informal finances and trade credit can also be demonstrated by comparing total debt and the total amount of funds needed. In the private firm surveys, firms report two types of

funds needed: every day working capital and funds for expansion. The survey data suggest that the daily working capital requirement is easily fulfilled by bank loans (as the ratio between bank loan amount and the working capital amount is substantially greater than 1), although neither informal loans nor trade credit alone can fully cover it, amounting to 76% and 93% of the daily working capital, respectively. But when expansion funds are included, bank loans alone are not sufficient even when informal loans are added – without informal loans, bank credit covers only 74% of expansion funds, with informal loans, 89%. In fact, only with the addition of accounts payable can the total debt cover the total funds needed, and then barely – the ratio of total debt to total required funds is 1.02.

Therefore, both informal loans and trade credit are essential for the healthy growth of private firms, although they are both relatively small in magnitude. In other words, private firms would be financially constrained without the informal financial mechanisms such as informal loans and trade credit. This pattern is confirmed by the responses from firms to questions on whether they face difficulty in obtaining finances, which were asked in 1995 and 2000. In both years, over 70% of firms gave affirmative answers to the above questions (Table 7)

[Table 7 about here]

One caveat, however, is that the above discussion ignores the compatibility in the time structures of debts and capital required. As both formal and informal loans are mostly short-term ones in China, and so are accounts payable, it may not be feasible to provide expansion funds with the formal and informal credit discussed above. In addition, note that the above calculation does not include the actual investment made in the current year. In contrast, the previous discussion on internal funds suggests that the main source for such longer-term investment in private firms is most likely firms' own retained earnings. Based on the private firm survey data, Table 8 gives the main uses of private firms' after-tax profit, among which about 54% of the profit is allocated to investment.

[Table 8 about here]

4. Reducing financing needs through inventory and accounts receivable

We now turn to the two ways we believe private firms may have used to lower their demand for external financing. Table 9 shows that private firms have much lower inventory/sales ratio than their SOE counterparts: 14% vs. 31%. They also have lower accounts receivable/sales ratio than SOEs: 13%

vs. 16%. In fact, among firms of all ownership types, both of these ratios are the lowest for the subsample of private firms.

As these firms are all industrial firms exceeding a certain size, such huge differences in inventory/sales ratios most likely indicate much more efficient management of inventories and thus lower need for working capital in private firms, as compared to SOEs. In fact, both ratios in private firms are even lower than those in foreign invested firms. If we assume that foreign invested firms are both unconstrained financially and efficient at managing their inventory, this may imply that private firms may in fact be reducing their inventory below the optimal level, an issue we will study in the next part of the paper.

[Table 9 about here]

Our hypothesis is that the low inventories and accounts receivable reflect the attempt of the firms that are financial constrained to reduce their need for working capital funds. To test this hypothesis we regress the inventory and accounts receivable ratios on our measures of credit constraint, namely leverage, financial expense/total expense, and interest expense/debt ratios. The results are presented in Table 10, with panel A reflecting the cross-section results for 2006 and panel B reflecting the fixed effects results for the balanced panel. We find expected correlations that are statistically significant for all three measures of access to external financing in the cross-section with ownership and industry dummies included and in the panel with firm and year fixed effects.

[Table 10 about here]

The cross-section results show that firms with easier access to external financing, reflected by higher leverage, higher ratio of financial to total expenses, or lower ratio of interest expenses to total debt, tend to have higher level of inventories and accounts receivable. Fixed-effect panel results show that when access to external finance gets tighter for an individual firm, as reflected in this firm's lower leverage, lower ratio of financial to total expenses, or higher ratio of interest expenses to total debt, it lowers its inventory and accounts payable ratios. We repeat the analysis with all three measures of access to external finance lagged by one year, and find that the results are qualitatively the same,

suggesting that we cannot reject causal relationship between limited access to external finance and lower levels of inventories and accounts receivable.⁶

In terms of economic importance of the effects, we find in the cross-section sample that firms with access to finance that is the same as an average private firm (55% leverage, 1.6% ratio of financial to total expenses, and 3% ratio of interest expenses to total debt) will have inventory to sales ratio that is 4.3 percentage points lower and the accounts receivable to sales ratio that is 1.6 percentage points lower than a firm with access to finance that is the same as an average state owned firm (56% leverage, 4.7% ratio of financial to total expenses, and 1.6% ratio of interest expenses to total debt). These differences explain a large fraction, 28% and 61% of the differences in the inventory to sales and accounts receivable to sales ratios, respectively, between average private and average state owned firms.

In the panel we find that if access to external finances improves from the average level of private firms (leverage of 60%, financial to total expense of 2.7%, and interest expense to total debt of 3%) to the average level of state owned firms (56%, 5.7%, and 1.9%, respectively), the inventory to sales ratio would increase by 3.6 percentage points, which would explain just over a quarter of the difference in the ratio between private and state owned firms. The same change would lead to an increase in the accounts receivable to sales ratio by 1 percentage point, explaining a third of a difference between private and state-owned firms. These magnitudes are large, given that they are identified by within variation over time of the relevant variables for individual firms, and that private firms in the balanced panel sample are older and larger private firms that tend to be more similar to state owned companies.

We observe the same patterns in the private firm survey data, which provides information on small private firms. Unfortunately, this survey does not provide information on inventory, but we can still analyze the effects of financing constraints on accounts receivable to sales ratio. Moreover, as financial costs are not available in the survey data, we only use leverage and interest rate as measures of credit constraints. Finally, the repeated cross-section nature of the data precludes us from conducting firm fixed effects estimation, but we do control for industry, province, and year fixed effects in the analysis.

⁶ We do not report these results in the interest of space. The only substantial change is that lagged leverage is not a significant predictor for accounts receivable ratio.

As Panel C in Table 10 shows, leverage has positive and significant effects on the accounts receivable to sales ratio. Thus, the results obtained are largely in line with those for the census data, suggesting that the positive correlation between access to external finances and the level of working capital applies to small Chinese firms as well as large and medium-sized firms. Furthermore, the estimated effect of leverage on accounts receivable is larger than what we obtained for the large and medium-sized firms, suggesting greater sensitivity of small private firms' accounts receivable ratio to the availability of external funds.

5. Do low ratios of inventories and accounts receivable harm profitability?

We have demonstrated that firms with more limited access to external finances tend to have lower inventory and accounts receivable ratios. We also showed, in the fixed effects regression, that a given firm lowers these ratios in response to worsening financing conditions. A natural question that arises is whether these effects of limited access to external finance may be harmful to firms because inventory and accounts receivable ratios of financially constrained firms are so low as to prevent them from operating at an optimal level of sales.

As pointed out previously, Chinese private firms in fact have lower inventory levels than foreign invested firms in China, which seems to confirm the suspicion above. Table 11 below shows that this fear may not be justified, as the total and the component inventory days for Chinese private firms are all comparable to the average levels in the OECD firms. In contrast, most other types of Chinese firms have longer inventory days, particularly in raw material and intermediate goods inventories. The Chinese private firms are even closer to firms in Japan and Korea, China's two Asian neighbors. If one uses Korea as a benchmark, the Chinese private firms still have room to further reduce their inventory level. In other words, although much lower than other types of Chinese firms in inventory levels, especially Chinese SOEs, Chinese private firms seem to operate within the normal range of inventory levels by the international standards. The time-span difference between the Chinese firm sample and the OECD sample further strengthens this argument, as improvements in inventory technologies have led to declining inventory levels over time.

[Table 11 about here]

Table 12 compares Chinese firms with U.S. firms in terms of the accounts receivable/sales ratio. For large firms, Chinese firms have slightly lower account receivables ratios than their American counterparts. Given that U.S. data is from late 1980s while the Chinese data is for this century, and that the accounts receivable/sales ratios tend to decrease over time due to more advanced payment methods, it is reasonable to argue that large firms in the two countries have similar RA/sales ratios. For small firms, Chinese firms have higher average AR/sales ratios than the U.S. firms yet lower median ratios, implying much variation among small Chinese private firms in their ability to recoup sales revenue from customers. As seen before, among large and medium-sized firms, Chinese private firms maintain lower levels of accounts receivable than Chinese SOEs. Overall, there is no clear evidence that Chinese private firms have to maintain overly low RA/sales ratios.

[Table 12 about here]

Yet, to further address the possibility of Chinese private firms carrying levels of inventory and accounts payable that are too low, we now study the potential non-linear effects of inventory and accounts receivable ratios on profitability and productivity of the firms.

In Table 13 we show the results of our estimation of the regression of two different profitability measures (pretax and aftertax return on assets) and of our total factor productivity estimate on the ratios of inventory and accounts receivable to sales and the squares of these ratios.⁷ If reducing inventories below certain level has a detrimental effect on profitability, we should see a negative coefficient on the square term and positive coefficient on the linear term. As columns 1, 2, 4, and 5 of Table 13 show, for both inventory and accounts receivable the pattern is reversed – the coefficient is positive on the square term and negative on the linear term. Further, the magnitudes of these coefficients indicate that for the entire range of the values of both ratios, lower ratios are associated with higher profitability – the minimum of both quadratic curves is above the highest value of the ratios in our data.⁸ The findings related to inventory levels are consistent with Lieberman and Demeester (1999) who studied Japanese car manufacturers, while the results on accounts receivable are in line with those in Fisman (2001).

⁷ Total factor productivity (TFP) is measured as a residual from estimation industry-by-industry system GMM model of production function. For the detailed description of how TFP measures are obtained, see Hale, Long, Moran, Miura (2010).

⁸ To be precise, there are 129 observations in the cross-section data and 153 observations in the panel data for which inventory to sales ratio is in the increasing range of the estimated quadratic function. For the accounts receivable there are no observations in the increasing range of the quadratic function.

Columns 3 and 6 of Table 13 show that productivity is associated with inventory and accounts receivable ratios in the same way as profitability – for the range of these ratios in our sample, lower ratios are associated with higher productivity. The theoretical argument in support of the findings on inventory is outlined in Lieberman and Demeester (1999): As firms have lower inventory levels (especially the level of work-in-process inventory), problems related to various steps in the production process are more easily exposed and thus are more likely to be resolved by managers and workers, which then leads to increases in firm productivity. As for trade credit, Fisman (2001) argues that greater supplier credit helps firms more fully utilize their capacity. By reducing working capital requirement, a lower accounts receivable level will have similar effects in helping firms reaching their full capacity and thus enhancing productivity. Additionally, the extra funds available may help make new process and technology more affordable, which further enhances productivity. It is worth noting that such an advantage is in addition to the channel of lower financial costs, which is the usually the focus of research.

Therefore, we find that for large and medium-sized Chinese firms, a) firms with lower inventory and accounts receivable ratios tend to have higher profitability and higher total factor productivity in the cross-section, controlling for industry and ownership type; b) controlling for firm fixed effects, when inventories and accounts receivables fall, firms become more profitable and more productive. To explore the patterns for small private firms, we again turn to the private firm survey data. Panel B presents the corresponding results using the survey data. As before, industry, province, and year dummies are controlled for in the analysis of the repeated cross-sectional data.

Columns 1-3 give estimation results using pretax and after-tax return on assets and a crude measure of total factor productivity as the dependent variable, respectively.⁹ As we can see, just like the results from analyzing the data for the larger firms, the linear term always has negative effects, while the effect of the quadratic term is always positive. For pre-tax return on asset, the coefficient on linear term of accounts receivable to sales ratio is the only that has a significant effect, implying that a monotonically negative correlation between accounts receivable and profitability: the lower the accounts receivable to sales ratio, the higher the profitability. Likewise, the results suggest that the relationship between accounts receivable and TFP is

⁹ Because raw material usage is unknown for firms in the survey data, we construct estimate TFP by running a regression of log sales on log assets and log labor, in addition to variables of interest.

exclusively monotonic: the lower the accounts receivable to sales ratio, the higher the firm's TFP.¹⁰ In addition, the effects of accounts receivable on both profitability and productivity are larger than those obtained for the larger firms. This is suggestive evidence that small private firms benefit more from managing their working capital more efficiently.

As small private Chinese firms are the most constrained in their access to external finances, these findings provide more salient support for the argument that more efficient management of working capital (inventory and accounts receivable) may have led to better firm performance, both through lower financial costs and via real productivity gains.

6. Conclusion

It has long been noted in the literature that private firms in China have harder access to external financing and that such credit constraints are harmful for the development of the private sector in China. Nevertheless, despite limited access to financing, the private sector in China has experienced a long period of miraculous growth prior to the onset of the global recession. While we do not fully reconcile these two apparently conflicting observations, we provide evidence that may help explain some of the puzzle. In particular, we show that Chinese private firms respond to financing constraints by lowering inventory and accounts receivable and thus limiting their need for working capital. We further show that even at the low levels of inventory and accounts receivable, reductions in these ratios are associated with higher productivity and profitability. In other words, facing and overcoming financing constraints may have forced Chinese private firms to become more efficient.

Our findings do not necessarily contradict the argument that limited access to external funding is likely slowing down the development of the private sector in China. In fact because private firms are able to manage working capital very efficiently (by maintaining low levels of inventory and accounts receivable), our results imply that easier access to external finance will likely lead to more expansion and long-term investment projects by private firms. Hence, financial market reforms, through allowing further growth of the private sector through more credit, may well be the next engine of sustained economic growth in China.

¹⁰ There are only 17 firms in our sample of small private firms for which the accounts receivable to sales ratio is in the increasing range of the estimated quadratic function.

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Table 1. Firm distribution by de facto and de jure ownership type in 2006 census cross-section

De facto ownership	De jure ownership						Total
	state	private	collective	frn*	hmt*	other	
state	12,309	37	46	325	262	2,807	15,786
private	104	111,610	862	2,054	1,600	27,843	144,073
collective	100	378	10,556	354	344	4,324	16,056
frn*	2	112	3	21,976	251	173	22,517
hmt*	3	102	9	380	21,220	155	21,869
Legal person	2,754	35,962	2,736	5,898	5,081	23,590	76,021
Other**	55	136	48	304	237	563	1,343
Total	15,327	148,337	14,260	31,291	28,995	59,455	297,665

Number of firms reported in each cell

*frn = owned by foreign company with headquarters outside greater China area; hmt = owned by a company with headquarters in Hong Kong, Taiwan, or Macao

**No group holds more than 50% shares

Table 2. Size distribution (by assets) of firms by ownership type and sample (Number of firms in each cell)

Panel A: NBS census data

2006 full cross-section

De facto ownership	Size distribution by assets				Total
	small	medium	large	giant	
state	8,383	5,681	1,467	255	15,786
private	121,638	21,045	1,347	34	144,064
collective	12,463	3,333	250	10	16,056
frn	12,188	8,716	1,523	90	22,517
hmt	14,100	7,052	691	24	21,867
legal person	55,124	17,877	2,706	310	76,017
Other	597	487	223	36	1,343
Total	224,493	64,191	8,207	759	297,650

Balanced panel sample as of 2006

ownership	size_as				Total
	small	medium	large	giant	
state	3,396	2,708	690	127	6,921
private	7,076	3,920	386	15	11,397
collective	2,353	1,082	81	5	3,521
frn	1,307	1,985	519	33	3,844
hmt	1,879	1,665	214	11	3,769
legal person	4,363	3,678	793	116	8,950
other	114	175	105	21	415
Total	20,488	15,213	2,788	328	38,817

Panel B: Size distribution of firms from private firm survey data

Pooled private firm sample for 2000, 2002, 2004, & 2006

	small	medium	large	giant	Total
Survey data	8,977	733	38	1	9,749

Private firm sample for 2006

	small	medium	large	giant	Total
Survey data	2,253	242	10	0	2,505

Table 3. Mean leverage, financial and interest expense ratios

Mean leverage:

year	other	state	private	ownership collective	frn	hmt	legal person
Census full 2006 cross-section							
2006	0.5270655	0.5599121	0.553948	0.5386975	0.4697204	0.4761098	0.5285534
Balanced panel (census)							
2000	0.5710869	0.5670198	0.6224115	0.5974506	0.4732248	0.4957071	0.5716565
2001	0.5544248	0.5608889	0.6144733	0.5874439	0.4538752	0.4808093	0.5670505
2002	0.5453331	0.560621	0.6097414	0.5812743	0.4499532	0.476328	0.5667261
2003	0.5496885	0.5594965	0.6095757	0.5767031	0.4514101	0.4746216	0.5639201
2004	0.530387	0.5657067	0.6089812	0.5675425	0.4678842	0.4648331	0.5735869
2005	0.5280951	0.5678059	0.5967634	0.56247	0.4527427	0.4704356	0.5616242
2006	0.5404513	0.5653585	0.5895072	0.559625	0.4463859	0.4695703	0.556495

Survey data (private firms only)

year	debt/asset	debt/asset1
2000	0.1711667	.
2002	0.1769443	0.2110109
2004	0.1838394	0.223089
2006	0.2167257	0.24843

Where asset does not include accounts receivable, but asset1 includes AR (which was not available for 2000).

Mean (financial expense/total expense)

year	other	state	private	ownership collective	frn	hmt	legal person
Census full 2006 cross-section							
2006	0.0255374	0.0457006	0.0152922	0.0176842	0.0148726	0.0122669	0.0204316
Balanced panel (census)							
2000	0.0445738	0.0632555	0.0279436	0.0320019	0.0301418	0.0191012	0.0403799
2001	0.0407172	0.0623533	0.0269873	0.0304421	0.0275245	0.0170225	0.0376548
2002	0.041142	0.0593192	0.0243659	0.0286642	0.0235307	0.0144496	0.0370419
2003	0.0341271	0.0572678	0.0225671	0.0263405	0.0215939	0.0138601	0.0324943
2004	0.0340242	0.0550491	0.0230045	0.0223288	0.0175288	0.0125677	0.0315693
2005	0.0287277	0.0504006	0.0217918	0.0226448	0.0155942	0.0132149	0.0297987
2006	0.0300134	0.0496973	0.0216176	0.0204176	0.0159484	0.0151862	0.0273304

Mean (interest expense/total debt)

year	ownership						
	other	state	private	collective	frn	hmt	legal person
Census full 2006 cross-section							
2006	0.0266667	0.0157521	0.0307337	0.0249302	0.0146456	0.0122944	0.0289223
Balanced panel (census)							
2000	0.0316954	0.0220281	0.0330856	0.035588	0.0228914	0.0172136	0.0316134
2001	0.032206	0.0208976	0.0320514	0.033084	0.0202682	0.0162542	0.0296349
2002	0.0271391	0.0197437	0.0298703	0.0319305	0.0173067	0.0154289	0.03086
2003	0.0249439	0.0191362	0.0288501	0.0301492	0.0147266	0.0141237	0.0285463
2004	0.0232134	0.0174312	0.0294332	0.026364	0.0139089	0.0127125	0.0267188
2005	0.0229547	0.0167197	0.0302106	0.027168	0.0151674	0.0137857	0.0273302
2006	0.0263176	0.0158902	0.030519	0.0252377	0.0155676	0.0127305	0.0263805

Table 4. Accounts payable and accounts receivable

De facto ownership	Mean					
	AP/assets	AP/debt	AP/sales	AR/assets	AR/debt	AR/sales
NBS 2006 cross-section						
state	0.1065433	0.1763865	0.1464989	0.1064704	0.1662064	0.1607052
private	0.1454115	0.2619018	0.0995536	0.1907293	0.2964941	0.1313267
collective	0.1501968	0.2653261	0.1196202	0.2064847	0.290433	0.164984
frn	0.1957519	0.4134812	0.1589811	0.1925882	0.3345768	0.1656279
hmt	0.2102893	0.4317049	0.1697322	0.2030218	0.3288149	0.1730874
legal person	0.1451012	0.2721183	0.1144058	0.1684955	0.2742357	0.1335646
other	0.1307289	0.2495824	0.1309284	0.1648499	0.2831569	0.1720792
Survey (2006)	0.071087	0.2034589	0.0748228	0.2069642	0.8242683	0.1583272

Table 5. OLS regressions in the 2006 NBS census cross-section

Dependent variable is leverage					
state	0.027*** (0.0023)	0.015*** (0.0023)	0.027*** (0.0023)	0.024*** (0.0023)	0.015*** (0.0023)
lassets		0.013*** (0.00034)			0.011*** (0.00034)
pretaxROE			-0.000017 (0.00004)		-0.00002 (0.000039)
liquidity				-0.0000040*** (0.0000062)	-0.0000041*** (0.0000062)
_cons	0.53*** (0.0005)	0.40*** (0.0034)	0.53*** (0.0005)	0.54*** (0.00049)	0.44*** (0.0034)
N	286993	286993	286894	279662	279628
r2_a	0.00047	0.0058	0.00049	0.00054	0.004

Dependent variable is financial expenses/total expenses

state	0.029*** (0.00042)	0.024*** (0.00042)	0.029*** (0.00042)	0.029*** (0.00043)	0.024*** (0.00042)
lassets		0.0062*** (0.000062)			0.0062*** (0.000063)
pretaxROE			0.0000032 (0.0000072)		0.0000015 (0.0000071)
liquidity				-0.000000079 (0.00000014)	-0.00000015 (0.00000013)
_cons	0.017*** (0.000091)	-0.043*** (0.00061)	0.017*** (0.000091)	0.017*** (0.000093)	-0.044*** (0.00062)
N	265672	265670	265630	258509	258472
r2_a	0.018	0.052	0.018	0.018	0.053

Dependent variable is interest expense/total debt

state	-0.11*** (0.0024)	-0.11*** (0.0024)	-0.11*** (0.0024)	-0.12*** (0.0024)	-0.11*** (0.0024)
lassets		-0.0099*** (0.00038)			-0.012*** (0.00038)
pretaxROE			0.000015 (0.000045)		0.000017 (0.000044)
liquidity				-0.0000020*** (0.00000070)	-0.0000018*** (0.00000070)
_cons	0.29*** (0.00055)	0.39*** (0.0037)	0.29*** (0.00055)	0.30*** (0.00056)	0.41*** (0.0038)
N	293435	293435	293391	287813	287774
r2_a	0.0077	0.0100	0.0077	0.0082	0.011

Table 6. Balanced panel census GLS RE regressions

Dep.var:	leverage	finexp	ap_debt
state	-0.039*** (0.0019)	0.019*** (0.00060)	-0.061*** (0.0057)
state_t	0.011*** (0.00034)	-0.0011*** (0.00011)	-0.0030*** (0.00097)
lassets	0.018*** (0.00053)	0.0070*** (0.00015)	-0.015*** (0.00066)
pretaxROE	-0.0000026 (0.000019)	0.0000033 (0.0000061)	-0.0000056 (0.000035)
liquidity	-0.00000024 (0.00000019)	4.8e-09 0.000000060	-0.00000044* (0.00000024)
t	-0.0054*** (0.00015)	-0.0025*** (0.000051)	-0.0022*** (0.00041)
N	250261	230893	147867

Table 7. Sources of ongoing financing (percent)

Survey year	bank loan	loan	Bloan/asset	informal inflow/asset	Bloan/asset1	inflow/asset1	accountspayable/debt
2000	0.3813863	0.2746502	0.656618	0.343382	.	.	.
2002	0.4324739	0.2777778	0.6752712	0.3247288	0.509941	0.2345309	0.2555281
2004	0.3897742	0.2333997	0.682294	0.317706	0.5259771	0.23203	0.2419929
2006	0.4347146	0.2301277	0.7332355	0.2667645	0.5909441	0.2019938	0.2070621
Total	0.4114568	0.2530349	0.6878425	0.3121575	0.5421635	0.2226344	0.2352022

Where asset does not include accounts receivable, but asset1 includes AR (which was not available for 2000).

Table 8. Uses of profit (percent)

Survey year	investment	dividend	SpecialAssessment	donation	PublicRelations	other
1995	0.4163436	0.0932845	0.0939559	0.1269798	0.1899265	0.1551914
1997	0.5866943	0.1921225	0.0690326	0.0657159	0.1421804	0.1055952
2000	0.7426211	0.1866239	0.0603343	0.0830994	0.1668536	0.0874556
2002	0.3083546	0.145202	0.0910435	0.1086098	0.2075858	0.0310835
2004	0.4039595	0.239454	0.0981842	0.0988894	0.2031859	0.082699
2006	0.4652271	0.1728487	0.0654249	0.0747586	0.1553567	0.0319072
Total	0.535972	0.1655978	0.0800102	0.0949046	0.1785527	0.0929303

Table 9. Average inventory/sales and ar/sales ratios by ownership in 2006 census cross-section

ownership	mean inventory/sales	AR/sales
state	0.3058309	0.1607052
private	0.1384788	0.1313267
collective	0.1708645	0.164984
frn	0.1947837	0.1656279
hmt	0.2216497	0.1730874
legal person	0.172007	0.1335646
other	0.2210449	0.1720792
Survey (2006)		0.1583272

Table 10. Relationship between inventory/sales and ar/sales ratios and measure of fin.constraints

A. 2006 cross-section. 2-digit industry and ownership dummies included but not reported (39 industries)

Dependent variable: inventory/sales

Dependent variable: inventory/sales				
	est1	est2	est3	est4
	b/se	b/se	b/se	b/se
leverage	0.13*** (0.0023)			0.091*** (0.0025)
finexp_tot~p		1.27*** (0.014)		1.22*** (0.015)
int_rate			-0.29*** (0.0098)	-0.29*** (0.0093)
N	257719	239551	247052	226218
r2_a	0.047	0.068	0.042	0.075

Dependent variable: accounts receivable/sales				
	est1	est2	est3	est4
	b/se	b/se	b/se	b/se
leverage	0.084*** (0.0012)			0.070*** (0.0013)
finexp_tot~p		0.37*** (0.0075)		0.40*** (0.0081)
int_rate			-0.23*** (0.0047)	-0.20*** (0.0048)
N	254494	236546	243788	223612
r2_a	0.094	0.086	0.085	0.11

B. Balanced panel with firm and year Fes

Dependent variable: inventory/sales				
	est1	est2	est3	est4
	b/se	b/se	b/se	b/se
leverage	0.10*** (0.0042)			0.057*** (0.0046)
finexp_tot~p		1.14*** (0.015)		1.16*** (0.016)
int_rate			-0.17*** (0.018)	-0.36*** (0.016)
N	257304	237809	243552	220436
Firms	38315	37989	38298	37180
R^2 within	0.03	0.03	0.004	0.03

Dependent variable: accounts receivable/sales

	est1	est2	est3	est4
	b/se	b/se	b/se	b/se
leverage	0.058*** (0.0019)			0.041*** (0.0021)
finexp_tot~p		0.30*** (0.0068)		0.34*** (0.0077)
int_rate			-0.11*** (0.0070)	-0.14*** (0.0073)
N	251338	231876	237267	215400
Firms	38175	37834	38145	37004
R ² within	0.02	0.02	0.01	0.03

C. Repeated cross-section using survey data. Year, 1-digit industry, and ownership dummies included but not reported (19 industries)

Dependent variable: accounts receivable/sales

	est1	est2	est3
	b/se	b/se	b/se
leverage	0.13*** (0.024)		0.24** (0.10)
int_rate		-0.0036 (0.0037)	-0.0035 (0.0037)
N	6287	727	658
r _{2_a}	0.019	0.082	0.2

Table 11: Comparing Chinese firms with OECD firms in inventory level (days)

Chinese firms	Total inventory days (2000 - 2006)	Finished goods	raw material plus intermediate goods
private	53.3	26.1	27.2
Hmt	92.7	36	56.7
foreign	82.3	31.1	51.2
Soe corporations	189	89.9	99.9
	110.6	54.2	56.5
canada	74	36	38
France	103	61	42
Germany	92	58	34
great Britain	78	41	37
Japan	56	31	25
Korea	42	19	23
switzerland	93	41	52
netherlands	83	51	32
u.s.	82	36	46
Total	63	34	29

Sources: Inventory days for Chinese firms are the authors' own calculations based on the NBS data (2000-2006), (where inventory days = inventory/ sales * 365 days), while those for the OECD country firms are from Table 1 in Roumiantsev and Netessine (2007), which are in turn summary statistics of active companies from 9 OECD countries that are included in the COMPUSTAT Global database and that operate in the manufacturing, wholesale and retail, and minerals and mining sectors excluding construction.

Table 12: Comparing Chinese firms with OECD firms in accounts receivable to sales ratio (percent)

Panel A: large firms

	U.S. firms (1988-1989)		Chinese firms (2006 cross-section)					
	Mean	Median	private		SOE		all	
			mean	median	Mean	median	mean	median
Mining	28.7	21.7	7.7	2.2	12.6	6.1	8.8	2.8
Construction	15.8	16.4						
Manufacturing	19.1	17	13.1	7.6	18	11.1	14.1	8.3
transportation/utilities	16.2	14.1	11.3	5.6	12.2	5.1	12.3	7.8
Wholesale trade	15.5	14						
retail trade	7.3	2.3						
Services	22.4	19.4						
Total	18.5	16.1	12.8	7.2	15.6	8.5	13.8	7.9

Panel B: small firms

	U.S. firms (1988-1989)		Chinese firms (2006 cross-section)	
	Mean	Median	private	
			mean	median
Mining	9.9	6.9	14.8	0.05
Construction	10.4	7.8	19.6	0.09
Manufacturing	11.8	10	16.3	0.07
transportation/utilities	8.1	6.5	16	0.02
Wholesale trade	8.1	7		
retail trade	3	0.4	6.7	0
Services	8	3.5	9	0
Total	4.4	1.8	13.6	0.03

Source: Information on Chinese firms are the authors' own calculations based on the NBS data (2000-2006, for the large firm sample) and the private firm survey data (2002-2006, for the small firm sample), while that on U.S. firms is from Table 1 in Petersen and Rajan (1997), which in turn summarizes data from the National Survey of Small Business Finances in 1988-1989 for small firms and the Compustat for the large firms.

Table 13

A. 2006 cross-section. 2-digit industry and ownership dummies included but not reported (39 industries)

	2006 cross-section. Industry and ownership dummies			Balanced panel Firm and year Fes		
	pretaxROA	aftertaxROA	TFP	pretaxROA	aftertaxROA	TFP
inventory_~s	-0.22*** (0.0029)	-0.19*** (0.0026)	-0.40*** (0.0050)	-0.070*** (0.0020)	-0.062*** (0.0019)	-0.38*** (0.0052)
inv2	0.037*** (0.00077)	0.032*** (0.00070)	0.052*** (0.0014)	0.0094*** (0.00038)	0.0083*** (0.00035)	0.030*** (0.00096)
ar_revenue	-0.56*** (0.0079)	-0.49*** (0.0072)	-0.45*** (0.014)	-0.15*** (0.0058)	-0.13*** (0.0055)	-0.40*** (0.016)
ar2	0.59*** (0.012)	0.52*** (0.011)	0.46*** (0.021)	0.13*** (0.0073)	0.11*** (0.0069)	0.22*** (0.020)
N	263477	263477	152912	263543	263543	134757
Adjusted R ²	0.074	0.068	0.074			
Firms				38670	38670	23225
Within R ²				0.01	0.01	0.081

B. 2repeated cross-section using survey data. Year, 1-digit industry, and ownership dummies included but not reported (19 industries)

	pretaxROA	aftertaxROA	log(sales)
ar_revenue	-0.36* (0.21)	-0.12 (0.098)	-1.10*** (0.05)
ar2	0.033 (0.026)	0.0098 (0.012)	0.078*** (0.006)
employln			0.48*** (0.014)
assetln			0.54*** (0.012)
N	4633	5887	6188
r2_a	0.002	0.0085	0.7