The Impact of Firm Productivity on External Finance

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Abstract

Capital market imperfections prevent good quality firms from accessing external finance. Consequently, firms' capital structure is largely shaped by such disadvantages. Competing theories suggest very different firm financing behaviour with different incentives. Surprisingly little is known on how firms may prove their true quality to external lenders in order to obtain funds. Using a panel of 1536 Chinese listed firms over the period 1999-2010 we establish firm leverage models augmented with firm's total factor productivity. We show that firms' TFP is a good indicator of true quality and enables firms to raise external finance, though such effect mainly works for firms' short term external finance, but not much for long term finance. Large and/or old firms and more productive firms are able to make better use of their TFP to gain external finance than their respective counterparties. Financially dependent firms, which have to rely on external finance for their capital expenditure, find their TFP is particularly more helpful in raising leverage relative to financially independent firms.

Key words: capital structure, leverage, productivity, firm quality, financial dependence
JEL: D22, D24, G32

1. Introduction

Financial market imperfections result in good quality firms being unable to raise external funds for their profitable projects. Having been aware of such a fact, a profit maximising firm subsequently allocates its financial as well as other recourses to minimise cost and enable possible investment opportunities, which is suboptimal at best. There has been an enormous body of literature studying firms' capital structure under the assumption that firms are adversely affected by market imperfections. Scholars have also substantially studied on how legal and institutional advancement may improve the market imperfection situation and consequently benefit all firms in the market (e.g. Rajan and Zingales, 1995; Booth *et al.*, 2001; Bancel and Mittoo, 2004; Öztekin and Flannery, 2012). However, little is known about how heterogeneous firms can better distinguish themselves from others and prove to external lenders about their true worthiness[1], and therefore suffer less from the imperfect market under given institutional environment.

Our paper aims to fill in this gap. We argue that firms' total factor productivity (TFP), which is largely free from the possibility of window-dressing activities, can be a good indicator of firms' true value. The least productive firms will exit the market. More productive firms are able to survive, but only to rely on their internal finance as external lenders and investors find

[1] Our argument is related but very different from the signalling theory (Ross, 1977), which suggests issuing debt is firms' signal of high quality to the markets. We discuss this in more details below.

them too risky to generate sufficient profits. Finally, the most productive firms not only are able to perform well but also raise external finance for their operations, as they are regarded as trustworthy by outsiders.

Using a panel of 1536 Chinese listed firms' data between year 1999 and 2010 we find that more productive firms are able to raise more external funds relative to their firm size than less productive firms, i.e. high productivity enables firms to keep higher leverage. Such positive productivity effects are found to be particularly pronounced for firms' short-term external finance. Such effects of firm productivity on leverage also hold for state owned and private firms in the sample separately, and are generally more obvious for the former. When the sample firms are distinguished by their size and age together, levels of productivity and external finance dependence respectively, we find that these three criteria make a difference for the productivity effects on firm leverage. They indicate firms' perceived quality, productivity quality and financial quality respectively. Generally, larger and/or older firms and high TFP firms have stronger positive TFP effects on their leverage than their respective counterparties, i.e. small young firms and low TFP firms. External finance dependent firms, which have insufficient internal finance to cover their capital expenditure, benefit more from their TFP on their leverage. Again the positive TFP effects are only significant for total leverage ad current leverage, but not non-current leverage.

Our focus is to identify a good indicator of firms' quality, which can help to overcome information asymmetries problem in the financial markets and channel external finance into good quality firms. Our research effectually also contributes to the firm capital structure literature, which often argues between the pecking order hypothesis and the static trade-off theory. We offer an alternative view on firms' leverage. Rather than being a choice of firms due to cost minimisation as suggested by the two theories, our research would imply that firms' leverage is also determined by their ability of raising such external finance from outsiders. The results would be more compatible with the pecking order hypothesis.

The rest of the paper is organised as follows: section 2 reviews the relevant theories and describes our theoretical idea. Section 3 presents the equations for empirical tests and empirical method. Section 4 describes our data. Section 5 discusses the empirical regression results, and finally section 6 concludes.

2. The theories

The popular theories that predict the observed firms' behaviour of utilising external finance include the Myers and Majluf (1984)'s pecking order theory and the static trade-off theory. Both theories try to suggest how a value-maximising firm may adjust its financing towards an optimum. The former predicts that external financing is only driven by firm's internal financing deficit due to differentiated financing costs, which is caused by information asymmetries problems in the financial markets. According to the pecking order hypothesis, a firm will issue debt until its debt capacity is reached, if its finance needs exceed its debt capacity. The latter suggests that a trade-off between the advantage of tax shield of debt and the costs of financial distress when the firm's debt ratio is too high, which brings in the agency costs too, drives firms' financing adjustment. The trade-off theory predicts that a firm adjust its leverage towards its target debt ratio. The implications of both pecking order theory and trade-off theory have received empirical support, but the former seems to be more favoured by scholars (e.g. Fama and French, 2002; Sarkar and Zapatero, 2003). However,

empirical tests of the two theories have not been very conclusive, which is possibly attributable to statistical testing difficulties and the practical interpretation of the pecking order hypothesis (Leary and Roberts, 2010), and seems to depend on the particular stochastic process assumed for the firm's earnings, i.e. internal source of finance (Sarkar and Zapatero, 2003).

It would be important to emphasise that our objective here is not to join the debate of the pecking order versus trade-off theories theoretically or empirically. Instead, we would like to show that besides those factors, which these two theories suggest, affecting firms' leverage level, firms' total factor productivity can demonstrate firms' true value and therefore help firms to raise external finance. We argue that conventional accounting information is subject to manipulation and often cannot convince external lenders about the true worthiness of the firm, whereas productivity is a better indicator of firms' true value and may help firms to suffer less from information asymmetries problem in the financial markets. To our knowledge, the existing research in the areas of firms' capital structure mainly focuses on testing firms' financing behaviour given the disadvantages of information asymmetries and agency problems etc., but surprisingly not much on whether and how firms can relieve such disadvantage themselves so that they can optimise their financing and production strategy. A stream of research finds that legal and institutional improvement in a country can benefit the country's financial development overall (e.g. Beck *et al.*, 2003), but the focus is not on individual firms. Our paper aims to fill this gap in the literature.

Productivity improvement is believed to be the essential drive of economic growth. It is the ability of a producer to generate the maximum amount of output using a fixed amount of input. In a production function it is the residual from the output after all the measurable input factors being accounted for. Productivity fundamentally defines heterogeneity across firms (e.g. Melitz, 2003). Our key novel idea is that in a competitive market where firms maximise profits and lenders are risk neutral or averse, firms with very low productivity would have to exit the market. Firms with intermediate level of productivity are able to survive in the market, but can only rely on their own internal finance, because they are rationed by external lenders who disbelieve their ability in generating sufficient profits and find them too risky to lend to. Firms with high level of productivity not only grow in the market, but also have access to external financial markets, where lenders find them trustworthy. Such a model shows that the exposure to financial markets induces only the most productive firms to access external finance while simultaneously forcing the least productive firms to exit. Both the exit of the least productive firms and the additional investment that the most productive firms are able to profit from using the external finance that they raise reallocate the market shares towards the more productive firms, and eventually promote an aggregate productivity increase.

This model is also consistent with the findings in the finance and growth literature at both aggregate (e.g. Beck, *et al.* 2000; Carlin and Mayer, 2003) and firm levels (e.g. Brown, *et al.* 2009; Guariglia *et al.*, 2011), where a sound financial system or good accessibility of financial resources is found to enable growth (e.g. King and Levine, 1993; Ayyagari, *et al.*, 2011). Besides a direct effect of productivity, such as effort, on growth, our model would propose that productivity could also drive growth indirectly through enabling finance.

The signalling theory developed by Ross (1977) may also offer a useful support for our model. Ross (1977) suggests that to maximise personal returns a firm's manager has the

incentive to signal the market of the firm's quality by choosing particular leverage. High quality firms would choose higher leverage, as issuing debt can expose the firm to costly financial distress (Ovtchinnikov, 2010), so that only the high quality firms are able to sustain the high leverage level. Though Ross' model and our model suggest similar relationship between firms' quality and leverage, Ross models leverage as a choice of firms whereas we consider that firms are eager to demonstrate their qualities in order to compete for external finance. In this theory the incentive for signalling is primarily managers' personal gains, whereas we consider that the incentive for firms to prove their true quality is to obtain external finance for the firm. Yet in this signalling theory, quality is not defined in terms of observable variables (Smith and Watts, 1992), whereas we specify quality as firms' TFP.

Another interesting finding by Gonzalez and James (2007) from a panel of US listed firms shows that technology firms have easier access to bank lending, and current earnings and cash flows were significantly less important in determining such finance for technology firms than for nontechnology firms. Typically technology firms would be more productive than nontechnology firms. It is not unreasonable to interpret these authors' results as that technology, a possible proxy for productivity, makes a positive difference for firms' access to bank landing, and it possibly substitutes some effects which may be played by firms' current financial position on such external finance.

Our model has the empirical implication that firms' productivity should have a positive effect on their ability in raising external funds. Accordingly, if firms have demand of external finance for their investment opportunities, we should observe that higher productivity helps firms to keep higher leverage.

Our foremost contribution is that we are the first to test the effects of firm productivity on its ability of raising external finance. To our knowledge, there has been little research looking at the possible correlation between productivity and finance. Besides Gonzalez and James (2007) mentioned above, Gatti and Love (2008), Moreno-Badia and Slootmaekers (2009), Chen and Guariglia (2011) among a handful of others find that the availability of finance helps firms to improve productivity, as finance may enable firms to optimise operations and carry out productivity enhancing activities. We test whether the reverse link also works. If our findings are positive, it may suggest that there might be a virtuous cycle between firms' finance and productivity. Our second contribution is that we show that firms' productivity is another important factor which restricts firms' capital structure. Neither the pecking order theory nor the static trade-off theory so far includes a role of firms' productivity in determining capital structure. However, our model would be consistent with the pecking order theory, i.e. we confirm that more productive firms are able to utilise finance of higher pecking order or more expensive finance. Third, our use of Chinese listed firm data should provide a good test environment. Chinese firms have experienced an enormous productivity growth and the country has transformed from a virtually closed economy to a world manufacturing centre in just three decades. Yet its financial sector is largely underdeveloped compared to the industrialised countries'. The Chinese stock market just started in 1990, and only became more regulated from 1999, when the *China Securities Acts* was put into effect. Firms in China are known to face difficulty in raising finance (e.g. Allen *et al.*, 2005; Poncet *et al.*, 2010; Guariglia *et al.*, 2011). Hence, it is interesting to test whether higher productivity brings higher leverage to the listed firms in China, which have relatively better quality than others and already have the access to equity finance. The implications found from listed firms

can be easily extended to other non-listed firms, as the latter would typically suffer more from capital market imperfections.

3. The model and estimation methods

The model

The regression model takes the following form

$$leverage_{it} = a + b_1 leverage_{i,t-1} + b_2 sales_{it} + b_3 assetsgrowth_{it} + b_4 tagibility_{it} + b_5 age_{it} + b_6 roe_{it} + b_7 dep_{it} + b_8 tfp_{it} + v_j + v_t + v_p + v_o + e_{it} \quad (1)$$

where *leverage* is firm *i*'s ratio of total liability to total assets at time *t*; *sales* is the logarithm of firm's real sales; *assets growth* is growth of firm's net fixed assets from time *t-1* to time *t*; *tangibility* is firm's ratio of total tangible assets to total assets; *age* is firm's age at the end of the year; *roe* is firm's return on equity; *dep* is firm's depreciation to total assets ratio; *tfp* is firm's total factor productivity calculated by the Levinsohn and Petrin (2003) method.[2] v_j, v_t, v_p and v_o are 2-digit industry dummies, year dummies, province dummies, which indicate firms' location, and firms' ownership dummies[3] respectively. *e* is an idiosyncratic error term.

Except firms' TFP, these variables have been well documented in the capital structure literature to play a role in determining firms' leverage. Much literature has suggested that firm size has a positive effect on its leverage ratio for a number of reasons. First of all, the direct bankruptcy costs decrease as firm size increases (Warner, 1977). Large firms are also believed to suffer less from information asymmetries in the financial markets and are thus able to diversify and gain easier access to capital markets, and perhaps borrow at lower interest rates reflecting lower risk premium than small firms (Titman and Wessels, 1988; Ferri and Jones, 1979). We use firms' real sales to proxy firm size and expect it to have a positive coefficient.

The inclusion of firms' net fixed assets growth is to capture firms' growth opportunities. The relationship between firms' growth opportunities and leverage may vary. According to trade-off theory, higher growth opportunities may lead to worse shareholder-bondholder conflict (Myers, 1977), and assets substitution and dilution (Jensen and Meckling, 1976). Therefore, firms will reduce leverage as a response to control the costs associated with these problems. Titman and Wessels (1988) argue that expected future growth should be negatively related to long-term debt level due to agency cost. However, the agency problem is mitigated if firms issue short-term debt (Myers, 1977), and hence growth opportunities might be positively linked to firms' short-term leverage. Under the pecking order theory, if firms' priority is current period investment, firms' leverage will increase with higher growth opportunities, as firms would finance the current investment projects with increased debt (Ovtchinnikov, 2010). However, if firms are more concerned with future investment, firms would prefer to keep leverage low as they may worry about their debt capacity in anticipation of future finance for

[2] See more detailed variable definitions in the appendix.

[3] There are 7 types of ownership in our dataset, i.e. state owned, private, foreign, collective, civil organisation, employee and others. Ownership is defined according to the ultimate controlling shareholder of the firm.

investment (Ovtchinnikov, 2010). Thus, the sign of the assets growth variable in our model may have to depend on our specific sample.

Tangible assets can provide some protection to the lender in case of bankruptcy. Further tangible assets can be used as collateral to the lender and thus firms' opportunity to engage in asset substitution is reduced (Stulz and Johnson, 1985), which eases the agency problem. This suggests a likely positive effect of assets tangibility on leverage. However, when firms' leverage is not too high, managers may be able and tend to consume more than the optimal level of perquisites, which may produce a negative relation between collateralisable capital and debt levels (Titman and Wessels, 1988). Hence, the sign of tangibility variable may be also uncertain.

Firm age is expected to have a positive relation with leverage, as older firms have longer track records in the market and may suffer less from asymmetric information problem in raising external funds.

Return on equity (ROE) is used to measure firms' profitability[4]. The pecking order of finance behaviour is partially due to the transaction costs (Myers, 1984; Myers and Majluf, 1984). The profitability of a firm and hence the amount of retained earnings is a cheap source of finance. More profitable firms would have less need to finance investment projects with more expensive external finance, and thus have lower leverage. On the other hand, under the trade-off theory more profitable firms have lower potential costs of financial distress, and also can utilise more debt to shield against income tax and control the agency cost of free cash flow (Jensen, 1986). Thus, debt is more attractive and affordable for more profitable firms, i.e. leverage is higher. The overall effect certainly depends on which incentive dominates. In our case, since the Chinese financial market still lags behind and most firms find difficulty in raising external finance. Therefore, we expect the pecking order prediction to rule, i.e. a negative effect of ROE on leverage.

DeAngelo and Masulis (1980) suggest that firms' depreciation is a corporate tax shield substitute for debt. If firms utilise their accounting depreciation deductions to shield corporate tax, firms may not try to use debt for the same purpose given concerns of financial distress risk. This follows the logic of the trade-off theory. Therefore, we may expect a negative relationship between depreciation and leverage. Huang and Song (2006) find a negative relation between such tax shield and the leverage of Chinese listed firms. We also standardise the depreciation variable by firms' total assets to control for the size effects.

Industry and time dummies are common in the literature to control for industry specific characteristics and time effects. The province dummies are to control the fixed effects associated with firm location. The Chinese economy has a strong location dimension, where typically the coastal provinces have more advanced economies than others. Provincial authorities have numerous local policies which shape the economic and legal environment for firms. Ownership dummies account for various managerial incentives which may affect firms' leverage. For example, it is often believed that state firms have easier access to external finance due to the fact that in the event of bankruptcy state firms are more likely to be bailed out by the public finance. Foreign firms often have access to finance abroad such as funds

[4] Since our dataset is for listed firms and to avoid colinearity with sales and assets growth variables in the equation to some extent, we pick roe over return on sales or return on assets measures.

from foreign financial institutions and their parent firms, whereas private firms in China are discriminated in financial markets (Allen *et al.*, 2005).

$$leverage_{it} = a + b_1 leverage_{i,t-1} + b_2 sales_{it} + b_3 assetsgrowth_{it} + b_4 tagibility_{it} + b_5 age_{it} + b_6 roe_{it} + b_7 dep_{it} + b_{81} tfp_{it} \times Type1 + b_{82} tfp_{it} \times (1 - Type1) + v_j + v_t + v_p + v_o + e_{it} \quad (2)$$

We then further split the full sample of firm-years by their size and age together, their level of TFP and their external finance dependence by estimating eq. (2). First, firms which are both small and young should be more vulnerable to information disadvantage in the financial market and consequently have more difficulties in getting external finance. Thus we would like to find out whether TFP is more helpful for small young firms or for larger and/or older firms. Second, to compare the TFP effect across high and low TFP firms can somehow test whether the TFP effect is linear, accelerating or decelerating. Third, the financial dependence measure enables us to distinguish between firms with essential needs of external finance and those without. It also shows firms' strength of internal financial position. We are particularly interested to know whether productivity can help when a firm has no other choice but to desperately obtain some external finance. All these three dimensions somewhat indicate firms' perceived or true quality. We are interested to find out how firms' TFP interact with these measures and exert any effect on their ability of raising leverage. In eq. (2) *Type1* is a dummy variable indicating firms being small and young, with low level of TFP and being external finance dependent respectively.

Estimation methodology

All of our equations are estimated using the system generalised method of moments (GMM) developed by Arellano and Bond (1991) and Blundell and Bond (1998), by which we may control for the possible simultaneity and endogeneity problems in our models. We treat all the regressors in our equations except age as endogenous and instrument them using their own lagged variables[5]. Year dummies, two-digit industry dummies, province dummies and ownership dummies are included in all the regressions and instrument sets.

The validity of the dynamic model specification relies on the absence of serial correlation in the first-differenced residuals. The presence of the n^{th}-order serial correlation requires the $n+1^{th}$ or deeper lags of the instruments to be used (Brown and Petersen, 2009; Roodman, 2009). We use the *m(n)* test to identify n^{th}-order serial correlation in the differenced residuals. It is asymptotically distributed as a standard normal under the null of no n^{th}-order serial correlation of the differenced residuals. The validity of the instruments is tested using the Hansen/Sargan statistics (or *J* statistics).

We use the same model to analyse firms' total, non-current and current leverage separately. In our dataset every firm has some current liabilities, while quite a number of firms do not have any non-current liabilities. This suggests that when we apply the model to non-current leverage, our sample is left censored at zero, i.e. we do not know whether those firms with zero non-current liability chose not to borrow long-term debt or were unable to borrow. Therefore, to adjust for such bias we also report the results of random-effects Tobit method

[5] We use the lagged level variables of the endogenous regressors in the differenced equations and the lagged difference variables in the level equations as the instruments.

using 12 quadrature points for the non-current leverage regressions. To ensure the appropriateness of the models we perform likelihood-ratio test to compare against pooled Tobit model and check the sensitivity of quadrature approximation, i.e. we check the results against the estimations using 8 and 16 quadrature points.

Finally to make our results comparable, we also report fixed-effects estimations for the leverage models and current leverage models.

4. Data and descriptive statistics

4.1 Data

Our data is from the China Stock Market Financial Statements Database (CSMAR) ranging from 1990-2010. It contains financial statement information for all firms listed in China's stock market. Due to accounting standards, stock market regulation and etc. changes, some of our key variables only became available from 1998. These firms operate in a variety of industries and locate in 30 provinces or province-equivalent municipal cities of China.

To control for the bias caused by outliers we removed the one percent tails of the distribution of all variables included in our regressions except only the top one percent for the non-current leverage in the non-current leverage regression, as firms' non-current liabilities are likely to be left censored at 0. We left out firms with less than three-year consecutive observations, which is a common practice for dynamic models, as well as firms that did not have complete information on our regression variables. Finally, our unbalanced panel covers 1536 listed firms with 11,371 firm-year observations. Our dynamic model equation leaves our sample only ranging from 1999-2010. Observations in each year range from a minimum of 636 in 1999 to a maximum of 1152 in 2009.[6]

4.2 Descriptive statistics

Column 1 to 3 of table 1a show the descriptive statistics of the total, state owned (SOEs) and private firm-years[7] respectively, and column 4 reports the significance of the mean difference between SOEs and private firms. Almost 70% of the total firm-years are SOEs and about 24% are private. This could imply that features of state ownership may play a role in influencing firms' behaviours among China's listed firms. On average both SOEs and private firm-years have a little higher leverage than the total average, though the difference is not significant. However, SOEs have higher non-current leverage and lower current leverage than the total average and the private firms, and the differences with private firms are highly significant. SOEs have much higher TFP than private firms as well as the overall average. They are much larger in terms of real sales and younger. Their tangibility and depreciation to total assets ratio are also higher. Fixed assets growth rates are similar across SOEs, private and total firm-years. Private firms have higher return on equity than SOEs. These statistics suggest that with similar level of total leverage, SOEs rely more on non-current leverage whereas private firms use more current leverage. Overall firms only have a small proportion of non-current leverage (14.4%) out of their total leverage. The figure is a little higher for SOEs (15.4%) and

[6] See the Appendix for more information on the structure of our panel.
[7] SOEs and private firms are defined by the nature of their ultimate controlling shareholder, which is reported in our dataset.

lower for private firms (12.2%). Table 1a also suggests that listed SOEs in our sample seem to have better quality, particularly measured by TFP, than listed private firms. This is consistent with the pecking order theory, which suggests that under information asymmetries due to the higher financing costs and uncertainty of long term finance, only the high quality firms may be able to obtain long term finance from external lenders, i.e. to have higher non-current leverage. The statistics are weakly in line with Barclay and Smith's (1995) empirical finding that higher-growth firms prefer to use shorter term debt.

Table 1b presents the statistics when the full sample is split into small and young versus other firm-years (column 1 to 3), high and low TFP firm-years (column 4 to 6), and financially dependent and independent firm-years (column 7 to 9). Firm-years that are both small in size and young[8] take up about 22.7% of all firm-years. Small young firms are lower in all three types of leverage, less productive, and less profitable. Their depreciation ratio is lower but their fixed assets growth is much higher than the rest of firms. Tangibility is almost identical between small young firms and the rest. Small young firms, which may suffer more from information asymmetries problem in financial markets, may be less able to raise external fund. The statistics, showing an important observation that in our sample small young firms have lower leverage, non-current leverage and current leverage than other firms, may suggest that the information problem may be well at work among China's listed firms. We would like to explore whether conventional proxies for information asymmetries, i.e. firm size and age, would make a difference for the effects of firm productivity in helping raising external finance.

Firms with higher TFP have significantly higher total and current leverage than low TFP firms, but the non-current leverage is very close across the two groups. Since leverage is the sum of current and non-current leverage, it seems that more productive firms in our sample simply have higher current leverage than less productive firms. More productive firms are also much larger, a little older and much more profitable than less productive firms, but their tangibility and depreciation ratio are lower, and their growth is only very weakly higher. Overall, more productive firms appear to be better than their counterparties in our sample.

Finally, following Rajan and Zingales (1998) we define firm-years as financially dependent and independent. A financially independent firm in our sample would have sufficient internal funds (cash flow) to cover their capital expenditure, and a financially dependent firm would not have such privilege. However, the summary statistics show that financially independent firm-years, which are about 14.8% of the total firm-years, have higher total leverage and current leverage ratios than their counterparties, though their non-current leverage is lower. The differences are all significant. They are much more productive and a little older, but their size, fixed assets growth, profitability and depreciation ratio are much lower. Tangibility is almost identical between the two groups. It is interesting that with better internal financial position financially independent firms even have higher leverage, especially current leverage, which may be inconsistent with the prediction of the pecking order theory. The rationale of raising external funds for financially dependent and independent firms might be very different. While the former may be driven by their demand of finance in excess of their internal resources, the latter could have incentives of using external funds for other purposes, such as tax shields. It is very interesting to discover whether firm productivity would play the

[8] A firm is defined as small and young if its real sales is ranked in the bottom 50 percentile of the real sales distribution of all firms in the same 2-digit industry and in the same year, and if its age is ranked in the bottom 50 percentile of the age distribution of all firms in the same 2-digit industry.

same role in helping raising external finance for firms with such important distinction in their internal financial position.
Overall, the descriptive statistics provide some preliminary evidence that higher TFP is generally associated with higher leverage, i.e. external finance, and that the characteristics of firm ownership, size and age, level of productivity, and external finance dependence all play a role in influencing firms' leverage. Especially, we observe that though state and private firms have similar total leverage, state firms which are much more productive have much higher long-term leverage, while the less productive private firms rely more on short-term leverage. The less productive small young firms are lower in all three kinds of leverages than their more productive larger and/or older counterparties. High TFP firms, however, only have higher total leverage and current leverage, and their non-current leverage is very similar to that of low TFP firms'. The more productive financially independent firms have higher total leverage and non-current leverage, but lower current leverage than their less productive counterparties. In the following section, we provide a more detailed analysis of the link between productivity and external finance, and the extent to which the characteristics of firm ownership, size and age, level of productivity, and external finance dependence, which all somewhat indicate firms' quality, affect the sensitivity of leverage to TFP.

5. Results

Total leverage

The system GMM regressions in table 2a column 1 show that in the full sample firms' TFP has a significant positive effect on their total leverage, which suggests that overall productivity helps firms to raise external finance. On average, every 1% increase in a firm's TFP would lead its total leverage ratio to increase by about 0.051. Other variables are all reasonable. The lagged leverage variable has a large positive and significant coefficient suggesting an obvious dynamic behaviour. Large firms, measured by real sales, are able to keep higher leverage as they may suffer less from information problems. Fixed assets growth has positive significant effects on leverage, which is consistent with a prediction by pecking order theory. Tangibility also plays a significant positive role in determining leverage, as tangible assets could serve as collateral for external finance. Firm age has virtually no effect on leverage. Profitability has a negative effect, which seems to suggest that more profitable firms tend to use less external finance. It is likely that these firms find it cheaper to use their internal finance from their retained earnings. Depreciation ratio, to control the possibility that firms may depreciate their assets to shield off some tax instead of using debt for the same purpose, also reduces leverage as expected. The fixed effect regression produces largely consistent results except that the age variable is positive significant.

It is not surprising that the results in column 3 for SOEs are quite similar to those in column 1 for all firms, since about 70% of the sample firms are state controlled. TFP is also positive significant for SOEs. However, tangibility has no effect and age becomes negative significant for SOEs' leverage. Fixed effect estimation in column 4 is also similar to those in column 2, and confirms positive significant TFP effect on leverage. For private firms GMM estimator shows that TFP does not help to increase leverage, though fixed effect estimator still suggests the opposite.

Table 2b column 1 shows that when the sample firms are split by their size and age together, both small young and other firms have positive significant TFP effects, but other firms' TFP

effect is significantly larger (χ^2 at 10%) than that of small young firms'. It seems that larger and/or more established firms in the sample find TFP more helpful for raising external finance. Both more and less productive firms attract positive significant TFP coefficients in column 3 and 4, and both GMM and FE results show that TFP effects are significantly higher (χ^2 at 10% and 0% respectively) for more productive firms than less productive ones. These results might indicate that it is the better quality firms which can benefit more from their true quality, i.e. TFP, in obtaining external finance.

Finally in column 5 it is interesting to note that financially dependent firms have a positive significant TFP effect but financially independent firms do not. In column 6, though both groups have a positive significant TFP effect, the effect of dependent firms is significantly stronger (χ^2 at 5%). It is understandable that financially independent firms do not have to rely on external finance, and therefore they do not find it important to prove their true quality to external lenders, whereas dependent firms do not have enough internal finance for their needs and are more desperate to do so. Indeed financially independent firms in our sample have much higher TFP than their counterparty as shown in table 1b (13.1 vs. 9.4).

Non-current leverage

In table 3a the GMM regressions in column 1, 3 and 5 show that TFP makes no effect on firms' non-current leverage. Firm size, tangibility and age are not important for non-current leverage. Assets growth, profitability and depreciation still have similar effect as for total leverage. The random effect (RE) tobit estimators in column 2, 4 and 6 show very small though significant negative effects of TFP for the full (χ^2 at 10%) and SOE samples (χ^2 at 5%), and no effect for the private sample. It is possible that the TFP effect in the full sample is mainly driven by the SOEs, given their weight. The m(n) tests and J tests suggest appropriate model specifications and instrument sets for the GMM regressions, and the log likelihood tests suggest the appropriateness of the choice of 12 quadrature points for the RE tobit models.

In table 3b, we find again that TFP are all insignificant for firms classified by size and age, level of productivity and financial dependence in the GMM models. In the RE tobit models in column 2, 4 and 6, small young firms and other firms have a very similar small negative TFP effect on their non-current leverage. More productive firms have a small negative TFP effect and less productive firms do not have. Financially dependent and independent firms have very similar small negative TFP effects. Again all the regressions pass relevant tests and are therefore appropriate.

It seems that productivity is not helpful for firms to raise long term external finance. This result is robust when we replace the dependent variable in table 3a and 3b with firms' long term debt to total assets ratio or total long term liability to total assets ratio.[9]

Current leverage

Firms' TFP has a positive significant effect on their current leverage in all the regressions in table 4a, which means productivity of all the sample firms, SOEs and private firms positively contribute to their current leverage. In table 4b TFP is positive significant for all firm groups

[9] The results using these alternative measures of long-term external finance are not reported, but available upon request.

except for small young firms. We find that larger and/or older firms can utilise their TFP to raise current leverage, while small young firms cannot in column 1. More productive firms have a significantly higher TFP effect than their less productive counterparties in column 3 and 4 (χ^2 at 10% and 0% respectively). Financially dependent firms' TFP effect is significantly higher than financially independent firms' (χ^2 at 5% in column 5). All other control variables in both table 4a and 4b are sensible and various tests suggest that all the models are fine. The pattern of TFP effects in table 4b is a little similar to the total leverage models in table 2b. Given that TFP generally has little effect on firms' non-current leverage, which also only takes a small proportion of firms' total leverage, we may consider that the TFP effect on total leverage is probably largely dominated by its effect on current leverage.

6. Summary and conclusion

Due to the information asymmetries problem in financial markets good firms often find it difficult to prove to external lenders about their true quality and to distinguish themselves from bad quality firms. We argue that instead of sending indirect signals to external lenders good quality firms can use their true quality of productivity to obtain external finance. It also makes sense for the external lenders. Besides relying directly on firms' accounting information, which is often subject to manipulation, using firms' TFP information, which can hardly be manipulated, would give a reliable indication of firms' quality and risk.

Overall, using a panel of 1536 Chinese listed firms with 11,371 observations between year 1999-2010 we find that TFP is statistically and economically important and positive in determining firms' total and current leverage, but not non-current leverage. Such pattern also holds for state and private firms separately. It seems that better quality firms, i.e. large and/or old or more productive firms, are able to make better use of their TFP to gain external finance, though mainly short-term finance. Financially dependent firms, which have to rely on external finance for their capital expenditure, find their TFP is particularly more helpful in raising leverage relative to financially independent firms. The latter does not necessarily need external finance for their capital expenditure, and are consequently not desperate to convince external lenders. Thus, it is reasonable to find that their TFP effect on leverage is statistically weaker or even insignificant. Again the TFP effect for these two groups is primarily on total and current leverage. Non-current leverage is generally affected by neither groups of firms' TFP. We may conclude from our results that firm productivity can help firms to raise external finance, mainly for short-term external finance, and particularly for those good quality firms with essential demand of external finance.

Our research suggests that firms could use their productivity to prove and financial institutions could use firms' productivity to verify firms' quality in the financial markets. This would reduce the information asymmetries problem to some extent. In addition if government policies and regulations may encourage such system in the financial sector, it could ensure financial resources are channelled into productive firms and shifted away from unproductive firms. This will help to improve aggregate productivity and is certainly beneficial to an economy's sustainable growth in the long term.

We have also made an important contribution to the capital structure literature by detecting the positive effect of productivity on external finance at firm level. Further research is needed to formally prove the connection between the two.

Appendix

Panel data structure

Year	Number of observations	Percent	Cumulative
1999	636	5.59	5.59
2000	702	6.17	11.77
2001	834	7.33	19.10
2002	954	8.39	27.49
2003	998	8.78	36.27
2004	1,026	9.02	45.29
2005	1,081	9.51	54.80
2006	1,046	9.20	64.00
2007	1,054	9.27	73.27
2008	1,120	9.85	83.11
2009	1,152	10.13	93.25
2010	768	6.75	100.00
Total	11,371	100.00	

Number of years per firm	Number of observations	Percent	Cumulative
3	110	0.97	0.97
4	274	2.41	3.38
5	331	2.91	6.29
6	213	1.87	8.16
7	667	5.87	14.03
8	577	5.07	19.10
9	789	6.94	26.04
10	875	7.70	33.73
11	1,749	15.38	49.12
12	1,783	15.68	64.80
13	4,003	35.20	100.00
Total	11,371	100.00	

Variable definitions

TFP: estimated using the Levinsohn and Petrin (2003) method, applied separately to different industrial groups. The *levpet* Stata command was used in estimation. Also see Chen and Guariglia (2011).
Sales: operational revenue
Age: current year – firms' year of establishment + 1
Roe: net profit / average shareholder's equity
Depreciation: depreciation of fixed assets, oil and gas assets and bearer biological assets
Deflators: taken from the *China Statistical Yearbook* (various issues), which are published by the National Bureau of Statistics of China. The provincial capital goods deflator was used to deflate the capital stock, and the provincial producer price indices (PPI) for manufactured goods to deflate other variables, e.g. sales.

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Table 1a: summary statistics

	All firm-years (1)	SOE (2)	private (3)	diff. (p-value) (4)
leverage	0.480 (0.173)	0.481 (0.171)	0.485 (0.175)	0.304
non-current leverage	0.069 (0.087)	0.074 (0.090)	0.059 (0.081)	0.000
current leverage	0.411 (0.166)	0.406 (0.164)	0.425 (0.165)	0.000
tfp	9.913 (22.783)	11.019 (24.502)	7.650 (18.788)	0.000
sales	1.86e+07 (3.26e+07)	2.11e+07 (3.62e+07)	1.21e+07 (1.98e+07)	0.000
fixed assets growth	0.088 (0.329)	0.088 (0.313)	0.094 (0.374)	0.393
tangibility	0.964 (0.043)	0.966 (0.042)	0.958 (0.045)	0.000
age	10.661 (4.314)	10.431 (4.283)	11.378 (4.369)	0.000
return on equity	0.055 (0.143)	0.053 (0.136)	0.060 (0.158)	0.028
Depreciation	0.024 (0.015)	0.025 (0.015)	0.021 (0.014)	0.000
number of observations	11371	7893 (69.4%)	2743 (24.1%)	

Notes: This table reports sample means. Standard deviations are presented in parentheses. Leverage is firms' total liability to total assets ratio; non-current leverage, firms' total non-current liability to total assets ratio; current leverage, firms' total current liability to total assets ratio; tfp represents total factor productivity; tangibility, total tangible assets / total assets; return on equity (roe), net profit/average shareholder's equity; depreciation, depreciation / total assets. The currency unit is thousands of RMB *yuan* (the exchange rate is approximately of USD: RMB = 1:6.3). See the Appendix for precise definitions of all variables. Diff. is the *p*-value of the test statistic for the equality of means.

Table 1b: summary statistics

	small &young	others	diff. (p-value)	high tfp	low tfp	diff. (p-value)	financially dependent	financially independent	diff. (p-value)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
leverage	0.413 (0.165)	0.500 (0.171)	0.000	0.535 (0.177)	0.458 (0.166)	0.000	0.478 (0.173)	0.491 (0.172)	0.005
non-current leverage	0.055 (0.076)	0.074 (0.090)	0.000	0.069 (0.088)	0.070 (0.087)	0.899	0.071 (0.088)	0.061 (0.083)	0.000
current leverage	0.358 (0.153)	0.426 (0.166)	0.000	0.466 (0.174)	0.388 (0.157)	0.000	0.407 (0.165)	0.430 (0.168)	0.000
tfp	6.843 (15.198)	10.813 (24.494)	0.000	13.299 (29.209)	8.505 (19.325)	0.000	9.370 (21.940)	13.061 (27.154)	0.000
sales	4.06e+6 (2.58e+6)	2.29e+7 (3.60e+7)	0.000	3.33e+7 (4.76e+7)	1.25e+7 (2.09e+7)	0.000	1.93e+7 (3.32e+7)	1.48e+7 (2.79e+7)	0.000
fixed assets growth	0.126 (0.346)	0.078 (0.324)	0.000	0.092 (0.321)	0.087 (0.333)	0.416	0.096 (0.326)	0.046 (0.345)	0.000
tangibility	0.964 (0.043)	0.964 (0.043)	0.423	0.959 (0.050)	0.966 (0.040)	0.000	0.964 (0.042)	0.964 (0.048)	0.858
age	6.853 (2.046)	11.777 (4.164)	0.000	11.352 (4.289)	10.374 (4.292)	0.000	10.536 (4.266)	11.490 (4.479)	0.000
return on equity	0.038 (0.138)	0.060 (0.144)	0.000	0.088 (0.156)	0.041 (0.135)	0.000	0.058 (0.140)	0.040 (0.154)	0.000
depreciation	0.022 (0.013)	0.025 (0.015)	0.000	0.022 (0.015)	0.025 (0.015)	0.000	0.025 (0.015)	0.020 (0.014)	0.000
number of observations	2577 (22.7%)	8794 (77.3%)		3340 (25%)	8031 (75%)		9614 (85.2%)	1671 (14.8%)	

Notes: A firm is defined as small and young if its real sales is ranked in the bottom 50 percentile of the real sales distribution of all firms in the same 2-digit industry and in the same year, and if its age is ranked in the bottom 50 percentile of the age distribution of all firms in the same 2-digit industry. A firm is defined as with high tfp if its tfp is ranked in the top 25 percentile of the tfp distribution all firms in the same 2-digit industry and in the same year, and is defined as with low tfp otherwise. A firm is defined as financially dependent if its average ratio of (cash expenditure – cash flow)/cash expenditure is larger than 0, and is defined as financially independent otherwise. Also see *Notes* to Table 1a.

Table 2a: total leverage

dependent variable: $leverage_{it}$	All		SOE		private	
	GMM (1)	FE (2)	GMM (3)	FE (4)	GMM (5)	FE (6)
dependent $variable_{i,t-1}$	0.790*** (0.019)	0.598*** (0.007)	0.780*** (0.023)	0.585*** (0.008)	0.798*** (0.033)	0.510*** (0.018)
$logS_{it}$	0.014*** (0.004)	0.010*** (0.002)	0.018*** (0.004)	0.009*** (0.002)	0.012* (0.006)	0.010*** (0.004)
assets $growth_{it}$	0.044*** (0.010)	0.030*** (0.002)	0.040*** (0.011)	0.034*** (0.003)	0.040* (0.020)	0.019*** (0.005)
$tangibility_{it}$	0.118** (0.054)	0.106*** (0.024)	0.074 (0.061)	0.141*** (0.028)	-0.084 (0.126)	0.063 (0.061)
age_{it}	0.000 (0.001)	0.002*** (0.000)	-0.003** (0.002)	0.002*** (0.000)	1.69e-3 (1.93e-3)	0.004*** (0.001)
roe_{it}	-0.267*** (0.020)	-0.264*** (0.006)	-0.268*** (0.025)	-0.268*** (0.007)	-0.236*** (0.033)	-0.236*** (0.012)
dep_{it}	-0.617*** (0.216)	-1.685*** (0.092)	-0.941*** (0.248)	-1.790*** (0.106)	-0.500 (0.452)	-1.513*** (0.252)
$logtfp_{it}$	0.051*** (0.016)	0.104*** (0.005)	0.052*** (0.019)	0.122*** (0.007)	0.003 (0.026)	0.105*** (0.012)
m2(p-value)	0.824		0.540		0.831	
J (Hansen)	0.031		0.121		0.225	
IVs(lags)	*t-2,… Δt-1…*		*t-2,… Δt-1…*		*t-2,… Δt-1…*	
ρ		0.877		0.919		0.889
number of observations	11454	11454	8129	8129	2766	2766

Notes: All specifications were estimated using a system GMM estimator as well as a fixed effect estimator for comparison. *i* indexes firms; and *t*, time. *logS* is the logarithm of firm's real sales; *dep*, firms' depreciation to total assets ratio; *logtfp*, the logarithm of tfp. The figures reported in parentheses are asymptotic standard errors. Standard errors and test statistics are asymptotically robust to heteroskedasticity. State owned firms (SOEs) and private firms are defined according to firms' ultimate controlling shareholders. In column 1, year dummies, 2-digit industry dummies, province dummies and ownership dummies are included in both the equation and the instrument set. In column 3 and 5, year dummies, 2-digit industry dummies and province dummies are included in both the equations and the instrument sets. In column 2, 4 and 6, year dummies, province dummies and ownership dummies are included in the equations. *m2* is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation. ρ is the total proportion of error variance accounted for by unobserved heterogeneity. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level. Also see Notes to Table 1a.

Table 2b: total leverage

dependent variable: $leverage_{it}$	small&young /others		low/high productivity		financially dependent/independent	
	GMM	FE	GMM	FE	GMM	FE
	(1)	(2)	(3)	(4)	(5)	(6)
dependent $variable_{i,t-1}$	0.793*** (0.018)	0.598*** (0.007)	0.804*** (0.018)	0.598*** (0.007)	0.822*** (0.021)	0.598*** (0.007)
$logS_{it}$	0.011*** (0.003)	0.010*** (0.002)	0.013*** (0.004)	0.010*** (0.002)	0.015*** (0.004)	0.010*** (0.002)
assets $growth_{it}$	0.046*** (0.010)	0.030*** (0.002)	0.055*** (0.012)	0.031*** (0.002)	0.066*** (0.015)	0.031*** (0.002)
$tangibility_{it}$	0.109** (0.052)	0.106*** (0.024)	0.086 (0.055)	0.106*** (0.024)	0.072 (0.058)	0.105*** (0.024)
age_{it}	0.000 (0.001)	0. 002*** (0.000)	0.000 (0.001)	0.002*** (0.000)	0.001 (0.001)	0.002*** (0.000)
roe_{it}	-0.258*** (0.019)	-0.264*** (0.006)	-0.251*** (0.021)	-0.264*** (0.006)	-0.257*** (0.025)	-0.264*** (0.006)
dep_{it}	-0.585*** (0.208)	-1.686*** (0.092)	-0.441** (0.221)	-1.685*** (0.092)	-0.401 (0.267)	-1.687*** (0.092)
$logtfp_{it}$×*type1*	0.037** (0.017)	0.102*** (0.005)	0.029 (0.018)	0.098*** (0.005)	0.029* (0.017)	0.109*** (0.006)
$logtfp_{it}$×*(1-type1)*	0.044*** (0.016)	0.104*** (0.005)	0.034** (0.017)	0.103*** (0.005)	0.022 (0.017)	0.085*** (0.010)
m2(p-value)	0.772		0.744		0.694	
J (Hansen)	0.059		0.026		0.003	
IVs(lags)	*t-2,… Δt-1…*		*t-2,… Δt-1…*		*t-2,… Δt-1…*	
ρ		0.876		0.871		0.876
χ^2	0.054	0.335	0.059	0.000	0.220	0.019
number of observations	11454	11454	11454	11454	11429	11429

Notes: All specifications were estimated using a system GMM estimator as well as a fixed effect estimator for comparison. *Type1* indicates old firm-years in columns 1 and 2, low productivity firm-years in columns 3 and 4, and financially dependent firm-years in column 5 and 6, respectively. χ^2 tests the null hypothesis H_0: $logtfp_{it}$ ×*Type1*= $logtfp_{it}$ ×*(1-Type1)*. In column 1, 3 and 5, year dummies, 2-digit industry dummies, province dummies and ownership dummies are included in both the equations and the instrument sets. In column 2, 4 and 6, year dummies, province dummies and ownership dummies are included in the equations. Also see *Notes* to Table 1b and 2a.

Table 3a: non-current leverage

dependent variable: non-current leverage$_{it}$	All		SOE		private	
	GMM (1)	RE-Tobit (2)	GMM (3)	RE-Tobit (4)	GMM (5)	RE-Tobit (6)
dependent variable$_{i,t-1}$	0.641***	0.777***	0.660***	0.785***	0.555***	0.725***
	(0.024)	(0.010)	(0.026)	(0.012)	(0.060)	(0.017)
logS$_{it}$	0.003	0.007***	0.005	0.007***	0.004	0.008***
	(0.003)	(0.001)	(0.004)	(0.001)	(0.005)	(0.001)
assets growth$_{it}$	0.018**	0.021***	0.024**	0.023***	-0.006	0.015***
	(0.009)	(0.002)	(0.011)	(0.002)	(0.017)	(0.003)
tangibility$_{it}$	0.005	0.032**	0.048	0.041**	-0.067	-0.011
	(0.050)	(0.015)	(0.055)	(0.018)	(0.101)	(0.031)
age$_{it}$	0.000	3.82e-4***	-0.002	1.88e-4	-0.001	5.68e-4*
	(0.001)	(1.96e-4)	(0.002)	(2.54e-4)	(0.002)	(3.31e-4)
roe$_{it}$	-0.029	-0.038***	-0.062**	-0.040***	-0.055*	-0.044***
	(0.018)	(0.004)	(0.025)	(0.005)	(0.032)	(0.009)
dep$_{it}$	-0.823***	-0.199***	-0.612***	-0.249***	-1.121***	-0.099
	(0.197)	(0.050)	(0.223)	(0.059)	(0.382)	(0.103)
logtfp$_{it}$	0.003	-0.005*	0.018	-0.008**	-0.022	-0.001
	(0.013)	(0.003)	(0.015)	(0.004)	(0.026)	(0.006)
m2(p-value)	0.242		0.137			
m3(p-value)					0.719	
J (Hansen)	0.117		0.398		0.688	
IVs(lags)	*t-2,… Δt-1…*		*t-2,… Δt-1…*		*t-2,… Δt-1…*	
log likelihood diff. with 8 quadrature points		-4.364e-9		-3.456e-11		7.276e-12
log likelihood diff. with 16 quadrature points		-4.364e-9		-1.819e-12		9.095e-13
number of observations	11353	11353	8043	8043	2763	2763
number of left-censored (at 0) observations		1368		870		381

Notes: All specifications were estimated using a system GMM estimator as well as a random effect tobit estimator for comparison. In column 1, year dummies, 2-digit industry dummies, province dummies and ownership dummies are included in both the equation and the instrument set. In column 3 and 5, year dummies, 2-digit industry dummies and province dummies are included in both the equations and the instrument sets. In column 2, 4 and 6, year dummies, 2-digit industry dummies, province dummies and ownership dummies are included in the equations. The random effects tobit models use 12 quadrature points. *log likelihood diff.* reports the quadrature checks of the difference between fitted quadrature 12 points and comparison 8 points, and the difference between fitted quadrature 12 points and comparison 16 points.

Table 3b: non-current leverage

dependent variable: non-current leverage$_{it}$	small&young /others		low/high productivity		financially dependent/independent	
	GMM	RE-Tobit	GMM	RE-Tobit	GMM	RE-Tobit
	(1)	(2)	(3)	(4)	(5)	(6)
dependent variable$_{i,t-1}$	0.710***	0.777***	0.643***	0.806***	0.646***	0.777***
	(0.036)	(0.010)	(0.024)	(0.007)	(0.024)	(0.010)
logS$_{it}$	0.007**	0.007***	0.003	0.006***	0.003	0.007***
	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)
assets growth$_{it}$	0.004	0.021***	0.016*	0.022***	0.015*	0.021***
	(0.011)	(0.002)	(0.009)	(0.002)	(0.009)	(0.002)
tangibility$_{it}$	0.018	0.032**	-0.011	0.032**	0.027	0.032**
	(0.059)	(0.015)	(0.049)	(0.014)	(0.051)	(0.015)
age$_{it}$	-0.001	3.86e-4*	0.000	3.31e-4*	-0.001	3.78e-4*
	(0.001)	(1.99e-4)	(0.001)	(1.78e-4)	(0.001)	(1.97e-4)
roe$_{it}$	-0.047*	-0.038***	-0.016	-0.037***	-0.047**	-0.038***
	(0.024)	(0.004)	(0.019)	(0.004)	(0.021)	(0.004)
dep$_{it}$	-0.394	-0.198***	-0.767***	-0.163***	-0.823***	-0.200***
	(0.263)	(0.050)	(0.205)	(0.046)	(0.210)	(0.050)
logtfp$_{it}$×type1	-0.004	-5.32e-3*	-0.015	-4.16e-3	0.008	-5.42e-3*
	(0.016)	(3.21e-3)	(0.014)	(3.13e-3)	(0.014)	(2.99e-3)
logtfp$_{it}$×(1-type1)	0.003	-5.42e-3*	-0.008	-5.02e-3*	0.015	-5.75e-3*
	(0.015)	(2.99e-3)	(0.013)	(2.87e-3)	(0.014)	(3.11e-3)
m2(p-value)			0.250		0.254	
m3(p-value)	0.960					
J (Hansen)	0.453		0.136		0.351	
IVs(lags)	*t-3,…* *Δt-2…*		*t-2,…* *Δt-1…*		*t-2,…* *Δt-1…*	
log likelihood diff. with 8 quadrature points		-3.391e-9		-5.602e-9		-5.452e-9
log likelihood diff. with 16 quadrature points		-3.392e-9		-5.577e-9		-5.444e-9
χ^2	0.011	0. 918	0.009	0.282	0.154	0.724
number of observations	11353	11353	11353	11353	11328	11328
number of left-censored (at 0) observations		1368		1368		1366

Notes: All specifications were estimated using a system GMM estimator as well as a random effect tobit estimator for comparison. In column 1, 3 and 5, year dummies, 2-digit industry dummies, province dummies and ownership dummies are included in both the equations and the instrument sets. In column 2, 4 and 6, year dummies, 2-digit industry dummies, province dummies and ownership dummies are included in the equations. Also see notes to table 3a.

Table 4a: current leverage

dependent variable: current leverage$_{it}$	All		SOE		private	
	GMM (1)	FE (2)	GMM (3)	FE (4)	GMM (5)	FE (6)
dependent variable$_{i,t-1}$	0.812***	0.542***	0.746***	0.529***	0.603***	0.448***
	(0.027)	(0.008)	(0.040)	(0.009)	(0.036)	(0.019)
logS$_{it}$	0.006	0.012***	0.005	0.010***	0.008	0.016***
	(0.004)	(0.002)	(0.006)	(0.002)	(0.006)	(0.004)
assets growth$_{it}$	0.036**	0.014***	-0.039	0.018***	0.013	0.006
	(0.016)	(0.002)	(0.024)	(0.003)	(0.014)	(0.005)
tangibility$_{it}$	0.024	0.108***	-0.045	0.110***	0.093	0.200***
	(0.082)	(0.026)	(0.107)	(0.030)	(0.148)	(0.066)
age$_{it}$	0.002	3.95e-4	0.001	5.31e-4	0.007***	2.35e-3
	(0.002)	(4.35e-4)	(0.003)	(4.97e-4)	(0.002)	(1.47e-3)
roe$_{it}$	-0.207***	-0.225***	-0.150***	-0.225***	-0.187***	-0.203***
	(0.036)	(0.006)	(0.052)	(0.008)	(0.030)	(0.014)
dep$_{it}$	-0.352	-0.881***	0.025	-0.828***	0.586	-0.735***
	(0.334)	(0.100)	(0.454)	(0.114)	(0.450)	(0.274)
logtfp$_{it}$	0.045**	0.098***	0.063**	0.117***	0.063**	0.072***
	(0.020)	(0.006)	(0.028)	(0.007)	(0.028)	(0.013)
m2(p-value)					0.998	
m3(p-value)	0.950					
m4(p-value)			0.586			
J (Hansen)	0.168		0.300		0. 214	
IVs(lags)	*t-3,…* *Δt-2…*		*t-4,…* *Δt-3…*		*t-2,…* *Δt-1…*	
ρ		0.844		0.898		0.846
number of observations	11567	11567	8216	8216	2787	2787

Notes: All specifications were estimated using a system GMM estimator as well as a fixed effect estimator for comparison. In column 1, year dummies, 2-digit industry dummies, province dummies and ownership dummies are included in both the equation and the instrument set. In column 3 and 5, year dummies, 2-digit industry dummies and province dummies are included in both the equations and the instrument sets. In column 2, 4 and 6, year dummies, province dummies and ownership dummies are included in the equations.

Table 4b: current leverage

dependent variable: current leverage$_{it}$	small&young /others		low/high productivity		financially dependent/independent	
	GMM	FE	GMM	FE	GMM	FE
	(1)	(2)	(3)	(4)	(5)	(6)
dependent variable$_{i,t-1}$	0.762***	0.542***	0.708***	0.541***	0.714***	0.542***
	(0.028)	(0.008)	(0.027)	(0.008)	(0.028)	(0.008)
logS$_{it}$	0.009**	0.012***	0.011**	0.012***	0.011**	0.012***
	(0.004)	(0.002)	(0.005)	(0.002)	(0.005)	(0.002)
assets growth$_{it}$	-0.004	0.014***	-0.011	0.014***	-0.015	0.014***
	(0.018)	(0.002)	(0.015)	(0.002)	(0.015)	(0.002)
tangibility$_{it}$	0.066	0.108***	0.040	0.108***	0.043	0.108***
	(0.103)	(0.026)	(0.097)	(0.026)	(0.098)	(0.026)
age$_{it}$	3.35e-3**	3.97e-4	0.002	5.02e-4	0.002	3.88e-4
	(1.66e-3)	(4.39e-4)	(0.002)	(4.37e-4)	(0.002)	(4.36e-4)
roe$_{it}$	-0.184***	-0.225***	-0.218***	-0.224***	-0.208***	-0.225***
	(0.033)	(0.006)	(0.031)	(0.006)	(0.032)	(0.006)
dep$_{it}$	-0.287	-0.880***	-0.545***	-0.880***	-0.583*	-0.882***
	(0.338)	(0.100)	(0.312)	(0.100)	(0.317)	(0.100)
logtfp$_{it}$×type1	0.039	0.098***	0.060***	0.092***	0.064***	0.101***
	(0.026)	(0.006)	(0.023)	(0.006)	(0.023)	(0.006)
logtfp$_{it}$×(1-type1)	0.040*	0.098***	0.070***	0.097***	0.047**	0.087***
	(0.024)	(0.006)	(0.022)	(0.006)	(0.022)	(0.010)
m4(p-value)	0.849		0.776		0.874	
J (Hansen)	0.118		0.072		0.126	
IVs(lags)	*t-4,…* *Δt-3…*		*t-4,…* *Δt-3…*		*t-4,…* *Δt-3…*	
ρ		0.844		0.836		0.842
χ^2	0.841	0.959	0.059	0.002	0.016	0.200
number of observations	11567	11567	11567	11567	11542	11542

Notes: All specifications were estimated using a system GMM estimator as well as a fixed effect estimator for comparison. In column 1, 3 and 5, year dummies, 2-digit industry dummies, province dummies and ownership dummies are included in both the equations and the instrument sets. In column 2, 4 and 6, year dummies, province dummies and ownership dummies are included in the equations.