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Does China overinvest? Evidence from a panel of Chinese firms

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ABSTRACT

This paper uses a dataset of more than 100,000 firms over the period of 2000–2007 to assess whether and why Chinese firms overinvest. We find that corporate investment is more efficient in the non-state sector. Within all ownership categories, we uncover evidence indicating a degree of overinvestment among firms that invest more than their industry median or more than their predicted optimal investment. The free cash flow hypothesis provides a good explanation for China's overinvestment in the non-state sectors, whereas in the state sector, overinvestment is attributable to the poor screening and monitoring of enterprises by banks.

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1. Introduction

China has experienced an investment boom throughout the period of its economic reform. Gross fixed capital formation has averaged 34% of GDP since 1978, and 40% over the last decade (*World Development Indicators*, July 2015). A wide range of arguments has been offered by way of explanation. For instance, Gong and Lin (2008) argue that the vast surplus of labour in rural areas, and the easy and cheap credit provided by the government via its state banking system, are the preconditions for the high investment rate. According to Aziz and Dunaway (2007), it is the attractive returns on investment that provide Chinese firms with strong incentives to invest. They point out that low bank lending rates and abundant retained earnings have kept the cost of investing low. Barnett and Brooks (2006) provide evidence that the non-state sector has been the driver in the recent investment surge, and that it has been funded mainly by 'self-raised' funds emanating from the growth of company profits. Knight and Ding (2010) stress the high growth expectations and investment confidence that flow from China's 'developmental state'.

Nevertheless, whether or not China overinvests is a matter of controversy. Although investment and investment-generated improvements in productivity are important drivers of China's rapid economic growth, the high investment rate may also be an important source of macroeconomic imbalances. Concern has been expressed that too much investment may create industrial overcapacity, generate inefficiency, and threaten profits and thus future investment and employment. The danger of overcapacity has become increasingly worrying as a result of China's recent economic slowdown.

Overinvestment in China has mainly been investigated with aggregate data at a country or province level. Contrasting results have been found as to whether China overinvests (see Rawski 2002; Bai, Hsieh, and Qian 2006; Qin and Song 2009). There is a recent literature addressing this question using micro-level data (see, Chen et al. 2011; Liu and Siu 2012). However, these papers have either looked at overinvestment only indirectly, focusing on investment efficiency, or are based on a small sample of listed firms, thereby casting doubt on the representativeness of the study. To the best of our knowledge, more direct measures of overinvestment have not been devised for firms in China. An analysis of the possible determinants of overinvestment in China is therefore needed. Our main contribution is to fill this gap in the literature. We use a firm-level dataset of more

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than 100,000 firms over the period 2000–2007. This dataset is much more comprehensive than those previously used in the literature to analyse overinvestment in China. Its use enables us to move the literature forward, by taking into account the vast heterogeneity characterizing Chinese firms in analysing their investment behaviour. This represents our second contribution.

Following the literature, we first present some stylized facts on firm-level investment efficiency in China. We subsequently devise more direct tests for overinvestment by analysing cases of investment above the industry median, and above the predicted optimal level. We examine whether such 'candidates' for overinvestment can be explained by the free cash flow hypothesis (Jensen 1986) or the absence of a disciplinary role of debt (Stulz 1990).

We find that state-owned enterprises (SOEs) invest much less efficiently than non-state firms. Evidence of overinvestment is found within all types of firms. In the state sector, this is attributable to the poor screening and monitoring of SOEs by banks, and in the non-state domestic sectors (collective and private firms), to abundant cash flow generated from high profits. We also find that debt limits the overinvestment bias only for firms with limited or no political affiliation: banks are unlikely to impose restrictions on firms affiliated with central or provincial governments, irrespective of their ownership. In other words, banks' incentives and efforts to monitor their lending are likely to be compromised when the borrowing firms have state ownership or high political affiliation.

The remainder of the paper is organized as follows. Section 2 discusses China's institutional background and relevant theoretical and empirical literature. Section 3 describes the data and sample. Section 4 provides some stylized facts on the investment efficiency of Chinese firms in order to better motivate the subsequent direct tests for overinvestment. Section 5 describes the methodology for identifying the subsample of cases in which overinvestment is likely and various tests for it using variables that are predicted to cause overinvestment. The results are reported in Section 6. Section 7 draws conclusions and policy implications.

2. Background and relevant literature

2.1. China's institutional background: ownership reform, the financial system and incentive structures

Our hypotheses must take into account the Chinese context. China had a centrally planned economy until economic reform began in 1978. The reform process was incremental but hardly slow: China has moved towards a market economy in less than three decades.

A distinguishing feature of China's institutional reform is the emergence of new forms of ownership. The Chinese industrial sector was initially dominated by SOEs, whose directive was to fulfil production quotas, to transfer profits to government, and to provide life-long employment. Collective and private firms began to grow rapidly in the 1980s and 1990s and played a catalytic role in pushing China towards a market economy. Unlike SOEs, collective and private firms faced relatively hard budget constraints, so generating profit incentives. Deng Xiaoping's 'Southern Tour' in the spring of 1992 unleashed a surge of inward FDI to China, and foreign firms have been allowed steadily greater freedom to operate in the Chinese market. The Company Law adopted in 1994 provided a uniform legal framework into which all of the ownership forms fit, signalling the introduction of more clearly defined property rights and the start of the dramatic institutional change involved in the rapid downsizing of the state sector. Many SOEs and collective firms were shut down, privatized or turned into shareholding entities that are increasingly dominated by private owners. However, SOEs remain dominant in energy, natural resources and a few strategic or monopolistic sectors that are controlled and protected by central and local governments. Despite some evidence that the profitability of the state sector improved after 1998, SOEs are generally still less efficient than comparable non-state firms (Ding, Guariglia, and Knight 2012).

Another important dimension of China's institutional context is its financial system, which is inefficient and 'repressed'. The government has intervened, and continues to intervene, in bank lending to favour the state sector in order to keep unprofitable SOEs afloat during the reform process (Riedel, Jin, and Gao 2007). Despite the gradual reform of the banking sector, bank loans constitute a major share of investment financing only for SOEs. These loans are made at rates well below what would have been the competitive rate of interest for borrowers, and are made without close monitoring. By contrast, private firms, the driving force

of the economy, are generally discriminated against by the formal financial system and have to pay high interest rates on rationed loans or rely predominantly on internal funds for investment (Allen, Qian, and Qian 2005; Knight and Ding 2010; Guariglia, Liu, and Song 2011). Although these problems have become less severe since 2000 (Guariglia and Poncet 2008), private investment has remained at a borrowing disadvantage (Haggard and Huang 2008).

In China, political control is centralised and economic management is decentralised. This gives rise to a classic principal-agent problem. China's 'developmental state' is based on a successful solution to the principal-agent problem. Incentives are created at all levels of government and bureaucracy to pursue central government objectives. These objectives have primarily been the achievement of rapid economic growth (Knight 2014). The incentives are created partly by the system of state appointments, promotions and demotions at every level of government and officialdom. Performance targets have generally been set by criteria such as the pace of economic growth and the rate of investment in the relevant jurisdiction (Xu 2011). Thus, the incentive structures facing bureaucrats and SOE managers place more emphasis on investment and growth than on profitability and market viability. The abundant supply of loans at low interest rates from the state-owned banks to the state-owned sector, and poor bank screening and monitoring of loans, has to be understood in this institutional context.

All these institutional arrangements suggest that SOEs are likely to overinvest, whereas private firms are likely to underinvest, by comparison with a free market outcome.

2.2. *Theoretical framework*

In a world of perfect and complete capital markets, firms' investment decisions should depend only on their investment opportunities (Modigliani and Miller 1958). However, various real-world frictions – capital markets being either imperfect or incomplete – may prevent firms from investing at the optimal level. For instance, Fazzari, Hubbard, and Petersen (1988) claim that financial constraints matter, so making investment expenditures more sensitive to cash flow than to Tobin's Q. Using real options theory, Dixit and Pindyck (1994) focus on the role of irreversibility and claim that increases in uncertainty boost the threshold that triggers investment, thereby reducing investment. Thus, both financial constraints and uncertainty arguments predict underinvestment, that is, firms will invest below the optimal level.

Jensen (1986) develops the 'free cash flow hypothesis' according to which managers have incentives to overinvest, that is, to expand their firms beyond the optimal size. The underlying reason is that growth strengthens managers' power by increasing the resources under their control: as a firm becomes larger, more opportunities exist for managers to indulge their desires for pecuniary and non-pecuniary (power and prestige) benefits. Accordingly, there exist conflicts of interest between shareholders and managers. The conflict is especially severe when firms have 'free cash flow', that is, cash flow in excess of that required to fund all projects that have positive net present value (NPV) when discounted at the relevant cost of capital. Managers have to be monitored in order to prevent them from investing their free cash flow at below the cost of capital or wasting it on organizational inefficiencies. Jensen (1986) argues that, by serving this monitoring role, external capital markets in general, and debt in particular, could and should discipline managerial use of funds and prevent overinvestment.

Stulz (1990) develops a theoretical model that focuses on the role of debt financing in alleviating overinvestment bias. Given poor investment opportunities, the likelihood that management invests in negative NPV projects increases in the level of managerial discretion over investment funds. Debt is found to reduce such overinvestment by forcing managers to pay out cash flow when it accrues. Thus, firms with poor investment opportunities benefit from higher leverage because increased capital market monitoring and discipline reduce the overinvestment problem. In other words, debt financing pre-commits managers to pay out free cash flow rather than to waste it when positive NPV investment opportunities are exhausted. Similarly, Aghion, Dewatripont, and Rey (1999) argue that debt instruments reduce the agency costs of free cash flow by reducing the cash available for spending at the discretion of managers. In their theoretical model, this not only mitigates managerial slack but also accelerates the rate at which managers adopt new technologies, thus fostering growth.

2.3. Empirical literature: cross-country and China-specific evidence

The free cash flow hypothesis of overinvestment has been well supported by cross-country evidence. For instance, Richardson (2006) adopts an accounting-based framework to measure overinvestment and free cash flow and finds for a sample of US firms that overinvestment is concentrated in firms with the highest levels of free cash flow. Using US data of 400 sales of subsidiaries in the 1990s, Bates (2005) relates the use of proceeds from asset sales to overinvestment. He shows that retaining firms systematically overinvest relative to an industry benchmark. On the effect of debt, Lang, Ofek, and Stulz (1996), Aivazian, Ge, and Qiu (2005), and Ahn, Denis, and Denis (2006), using either US or Canadian data, find a negative relationship between investment and leverage. The correlation is much stronger for firms with low growth. This is consistent with Stulz's (1990) hypothesis that leverage prevents managers of low-growth firms from investing in non-profitable capital expenditures. D'Mello and Miranda (2010) investigate the impact of long-term debt on the overinvestment decisions of firms. By employing a sample of 366 debt issues in the US over the period 1968–2001, they find that managers of unleveraged firms retain excessive liquidity, and that the issue of debt leads to a dramatic reduction in cash ratios and in abnormal capital expenditures. These results generally provide support for the hypothesis that debt reduces overinvestment.

Despite lack of direct evidence on overinvestment, both macro- and micro-level studies have been conducted to examine China's investment performance. Research based on aggregate data obtains contradictory results. For instance, Zhang (2003) calculates incremental capital-output ratios over the period 1978–2000, and finds an improvement of investment efficiency at the aggregate level. Bai, Hsieh, and Qian (2006) derive estimates of the real rate of return on capital in the economy as a whole over the reform period and find that the return to capital in China has been remarkably high despite the high investment rate, owing to the rapid growth in total factor productivity (TFP) and a trend towards more capital-intensive industries. Other studies hold a negative view of China's investment performance. Among these, Rawski (2002) suggests that there were low investment returns and widespread excess capacity across many industries throughout the 1990s. There is, in fact, direct evidence of underutilization of capital in certain industries, particularly heavy industries dominated by the state (European Chamber of Commerce in China 2009). Barnett and Brooks (2006) claim that the increase in investment over the period 1990–2005 led to a rise in the capital–output ratio and a fall in the marginal product of capital, suggesting declining capital efficiency and by implication overinvestment. Using provincial data for the period 1989–2004, Qin and Song (2009) find that despite increasing allocative efficiency and improving technical efficiency associated with aggregate investment, the tendency of overinvestment remains in China, which is defined as the difference between actual and profit-maximizing investment.

The recent literature based on micro data also provides inconclusive evidence on Chinese firms' investment efficiency. For instance, Liang (2006) shows that the return on listed firms' investment has been high and rising since late 1990s, as a result of the declining share of investment undertaken by listed SOEs. Lian and Chung (2008) take into account the effects of both financial constraints and agency costs, and discover underinvestment rather than overinvestment for Chinese listed firms.

Less optimistic views are also held. Firth, Lin, and Wong (2008) find a negative relationship between leverage and investment among 1200 listed firms over the period 1991–2004. They argue that the political obligations of the state-owned banks to support inefficient SOEs with low-growth opportunities prevent them from monitoring these firms properly, so increasing the risk of overinvestment. Chen et al. (2011) argue that government intervention through majority state ownership or the appointment of politically connected managers distorts SOEs' investment behaviour and harms investment efficiency of Chinese listed firms. Liu and Siu (2012) use a large sample of unlisted firms and find that, compared to SOEs, non-state firms use higher rates to discount future investment payoffs. They claim that, owing to soft budget constraints, managers of SOEs perceive a cost of capital that is inefficiently low, and therefore tend to overinvest. By contrast, non-state firms are less likely to overinvest because they are generally more cautious and less willing to embark in new and risky projects. Dollar and Wei (2007) echo these findings by using a sample of over 12,000 firms over the period 2002–2004, and conclude that the immature financial system has imposed costs on the economy, in the form of investment misallocation towards inefficient SOEs, equal to about 5% of GDP. Along similar lines, Hsieh and Klenow (2009) find evidence of greater distortions in resource allocation in China than in the US, and show that if capital and labour

were hypothetically reallocated to equalize marginal products to the extent observed in the US, manufacturing, TFP would rise by 30–50% in China.

Although the literature on China contains some intuitively appealing results, the datasets used in most studies cover either a fairly small number of firms or a relatively short time period, putting into question the representativeness of their findings. Moreover, none of these studies proposes direct measures of overinvestment, and each particular method of indirectly measuring overinvestment or measuring investment efficiency inevitably involves strong assumptions. We contribute to the literature by adopting several approaches to address investment efficiency and to measure overinvestment, some of which are new to the Chinese context, and by using a more comprehensive dataset which enables us to take full account of the wide heterogeneity among firms, and with the objective of understanding the extent, nature and causes of overinvestment in China.

3. Data and sample

We use data drawn from the annual accounting reports filed with the National Bureau of Statistics (NBS) by industrial firms over the period 2000–2007. The dataset includes all SOEs and other types of enterprises with annual sales above five million yuan (about $750,000). These firms operate in the manufacturing and mining sectors and are located in all 31 Chinese provinces or province-equivalent municipal cities. This dataset is the most comprehensive firm-level dataset in China, having great accuracy[1] and representativeness, that is, it represents approximately 90% of gross output in manufacturing and mining sectors in China. The firms are mainly unlisted.[2] Following the literature, we deleted observations with negative sales, as well as observations with negative total assets minus total fixed assets, total assets minus liquid assets and accumulated depreciation minus current depreciation. Firms that lacked complete records on our main regression variables were also dropped. To control for the potential influence of outliers, we excluded observations in the 1% tails of each of the regression variables. Finally, we removed all firms with less than five years of consecutive observations.

Our final dataset covers 100,112 firms, which corresponds to 639,382 firm-year observations. Our sample is unbalanced: the number of observations ranges from a minimum of 49,639 in 2000 to a maximum of 93,330 in 2003 (see Table A1 in the Appendix for the detailed structure of the dataset). There is entry and exit of firms during our sample period: less than 30% of firms have the full eight-year accounting information. The active entry and exit of firms is the consequence of enterprise restructuring, which began in earnest in the mid-1990s. It can be viewed as a source of dynamism in this sector (Brandt, Biesebroeck, and Zhang 2012).

The NBS data contain a continuous measure of ownership, which is based on the fraction of paid-in-capital contributed by the following six different types of investors: the state; foreign investors (excluding those from Hong Kong, Macao and Taiwan); investors from Hong Kong, Macao and Taiwan;[3] legal entities;[4] individuals and collective investors.[5] We group all foreign firms (from Hong Kong, Macao, Taiwan and other parts of the world) into a single foreign category and all firms owned by legal entities and individuals into a single private category. Thus, our firms fall into four broad ownership groups – state-owned, collective, private and foreign – based on the shares of paid-in-capital contributed by the four types of investors each year.

We then adopt two methods to classify firms by ownership. First, as in Ding, Guariglia, and Knight (2012, 2013) and Guariglia, Liu, and Song (2011), we group firms according to the majority average ownership shares. For instance, if the average share of capital paid-in by private investors over the period 2000–2007 is greater than 50%, then the firm is classified as privately owned. One potential problem with this method is that the size of the private ownership group is likely to be exaggerated. According to Haggard and Huang (2008), defining China's private sector is difficult, as genuinely private domestic firms are different from government-controlled firms. They argue that the former group has remained relatively small and subject to many controls and permissions, for instance, with regard to the provision of finance and the requirement of official approval of investment projects above a certain size. To take account of this phenomenon, our second approach to classification is based on a 100% rule. For instance, a firm is classified as privately owned when all the paid-in-capital in each year is contributed by private investors. This method allows us to focus on the *de jure* private firms which are more likely to represent the true private sector. However, the second approach has a big disadvantage, that is, a large

number of firms are left in a residual category (referred to as the mixed ownership group), where firms do not have a single-type investor.[6] Therefore, in this paper, we rely mainly on the majority classification rule and use the 100% rule as a robustness test.

Table A2 in the Appendix shows that our sample is dominated by private firms: 62% of firms are classified as privately owned by the majority rule. There is also an interesting pattern of the evolution of ownership over the eight-year period. We find that the proportion of SOEs in our sample declined dramatically, from 12% in 2000 to 5% in 2007. A similar pattern holds for collective firms, whose share declines from 11% to 7%. In contrast, the share of private firms climbed from 52% to 66%. The share of foreign firms remained roughly stable at between 17% and 19%. Privatization of small SOEs and rural collective firms became significant after 1998 (Haggard and Huang 2008). Our dataset reflects the restructuring process involved in the shrinkage of the state and collective sectors and the expansion of the private sector.

4. Stylised facts on investment efficiency of Chinese firms

4.1. Investment-investment opportunity sensitivity

The firms that overinvest are likely to exhibit lower levels of investment efficiency. However, there are several possible reasons for low investment efficiency and overinvestment is just one of them. Low efficiency of investment is consistent with overinvestment but not evidence of it. We first present some stylised facts about the investment efficiency of different types of Chinese firms, not as indirect tests of overinvestment but as pointers that are consistent with overinvestment.

In the absence of a perfect capital market, a variety of frictions (such as information asymmetries, agency problems and measurement errors) have been identified in the empirical literature which make firms' investment expenditure less sensitive to investment opportunities (see, Fazzari, Hubbard, and Petersen 1988; Erickson and Whited 2000). Thus, high sensitivity of investment to investment opportunity is regarded as a signal of high investment efficiency, that is, higher explanatory power of investment opportunity in the investment equation suggests that investment is less affected by frictions and therefore more efficient (see Chen et al. 2011). We first regress investment on investment opportunities (as proxies by sales growth[7]) for different ownership groups after controlling for a number of firm-specific features such as cash flow, age and size (see Appendix 2 for detailed discussions on model specification and variable definitions). The results are presented in Table 1. Panel A shows that sales growth is not statistically significant for the investment of SOEs, but is significantly positive for the investment of all non-state firms, with the highest effect being found for private firms. The results suggest that investment by non-state firms in general and by private firms in particular is more efficient than investment by SOEs. The much lower coefficient of sales growth of foreign firms, compared with that of private firms, confirms the finding of Greenaway, Guariglia, and Yu (2014) that there is an inverted U-shaped relationship between foreign ownership and firm performance, that is, some domestic ownership is necessary to ensure optimal performance.

In Panel B, we further interact the investment opportunity variable with dummy variables indicating firms with high or low leverage ratio (see Appendix 2 for detailed model specification and new variable definitions). We find that among non-state firms, firms with high leverage are sensitive to investment opportunities, whereas there is no such effect for firms with low leverage. By contrast, the investment in SOEs is not sensitive to investment opportunities regardless of their leverage status. This provides some initial evidence for the monitoring role of debt in the non-state sector in China, that is, debt financing helps non-state firms to better utilize investment opportunities when making investment decisions, thus improving the investment efficiency of these firms, whereas this mechanism does not work for SOEs.

4.2. Marginal and average revenue product of capital (MRPK & ARPK)

We adopt the method proposed by Dollar and Wei (2007) to compute the marginal revenue product of capital (MRPK) and the average revenue product of capital (ARPK) as alternative measures for investment efficiency of Chinese firms (see Appendix 3 for details of this approach). Table 2 presents descriptive statistics for these

Table 1. Investment-investment opportunity sensitivity.

Dependent variable: $I/K_{i,t}$	(1) SOEs	(2) Collective firms	(3) Private firms	(4) Foreign firms
Panel A. Baseline estimation				
$I/K_{i,t-1}$	−0.0899***	−0.110***	0.0512	0.0701
	(0.0114)	(0.0118)	(0.0428)	(0.0623)
cash flow$_{i,t-1}$	0.0788***	0.155***	0.0727**	0.0975***
	(0.0259)	(0.0244)	(0.0337)	(0.0351)
sales growth$_{i,t-1}$	0.0852	0.313***	0.337***	0.105*
	(0.0714)	(0.0776)	(0.0389)	(0.0599)
firm age$_{i,t}$	−0.0165***	0.00439	−0.0110***	−0.0261***
	(0.00493)	(0.00744)	(0.00375)	(0.00992)
firm size$_{i,t-1}$	0.0412***	−0.0256	0.0246***	0.0176
	(0.00988)	(0.0228)	(0.00615)	(0.0127)
*m*3 test (*p*-value)	0.185	0.796	0.202	0.708
Hansen *J* test (*p*-value)	0.0749	0.143	0	0
Observations	23,714	21,695	163,032	65,762
Panel B. The role of debt				
$I/K_{i,t-1}$	−0.0855***	−0.105***	0.0336	−0.101***
	(0.0103)	(0.0124)	(0.0445)	(0.00796)
cash flow$_{i,t-1}$	0.111***	0.161***	0.0915***	0.127***
	(0.0158)	(0.0254)	(0.0341)	(0.0161)
sales growth$_{i,t-1}$ * high leverage	0.00843	0.591***	0.741***	0.251***
	(0.0112)	(0.145)	(0.138)	(0.0966)
sales growth$_{i,t-1}$ * low leverage	−0.0150	−0.118	−0.132	0.0131
	(0.0149)	(0.166)	(0.145)	(0.0731)
firm age$_{i,t}$	−0.0210***	0.00339	−0.0109***	−0.101***
	(0.00430)	(0.00729)	(0.00407)	(0.0192)
firm size$_{i,t-1}$	0.0492***	−0.0313	0.0205***	0.0192*
	(0.00832)	(0.0242)	(0.00653)	(0.0114)
*m*3 test (*p*-value)	0.0459	0.551	0.204	0.551
Hansen *J* test (*p*-value)	0.103	0.550	4.04e−06	0.550
Observations	23,714	21,695	163,032	65,762

Notes: *high (low) leverage* is a dummy variable if the firm's leverage ratio is higher (lower) than the median value of the leverage ratio in the sample; robust standard errors in parentheses; the ownership classification is based on the majority rule; all equations are estimated using a System GMM estimator.

***$p < .01$.

**$p < .05$.

*$p < .1$.

Table 2. Investment efficiency: ARPK and MRPK.

	SOEs	Collective firms	Private firms	Foreign firms
Average revenue product of capital (ARPK)	0.553	1.106	1.011	1.188
	(0.307)	(0.684)	(0.629)	(0.699)
Marginal revenue product of capital (MRPK)	0.196	0.528	0.476	0.473
	(0.104)	(0.292)	(0.291)	(0.279)
Observations	23,739	21,709	163,095	65,815

Notes: Mean and median (in parentheses) values of each variable are reported; the ownership classification is based on the majority rule.

investment efficiency proxies. Both means and medians are provided, as the latter are less influenced by outliers, but we focus our discussion on means. We find that SOEs have the lowest investment efficiency as measured by both ARPK (55.3%) and MRPK (19.6%). By contrast, all types of non-state firm have much higher investment efficiency. For instance, foreign firms have the highest ARPK (118.8%) followed by collective (110.6%) and private firms (101.1%), collective firms have the highest MRPK (52.8%) followed by private (47.6%) and foreign firms (47.3%). This again confirms the view that SOEs are the least efficient sector in their use of capital.

In brief, our initial evidence from both methods shows that corporate investment is more efficient in the non-state sector, suggesting that SOEs are more prone to overinvest due to the lack of monitoring from the banking sector.

5. Overinvestment and its determinants: empirical methodology

5.1. Definitions of above-median and above-predicted investment and free cash flow

The stylised facts on investment efficiency provide pointers to overinvestment. In this section, we test Jensen's (1986) free cash flow hypothesis of overinvestment, and make an assessment of the extent to which debt plays a disciplinary role in curbing managerial discretion (Jensen 1986; Stulz 1990).

We first follow the approach developed by Bates (2005), which determines whether firms overinvest by comparing the capital expenditure ratios of each firm operating in a given industry in a given year with the median ratio of all firms operating in the same industry during that year. If the difference is positive (negative), then Bates assumes the firm to overinvest (underinvest). Similarly, free cash flow (FCF_1) is defined by Bates as the cash flow of a sample firm in a given industry and year in excess of the median cash flow of all firms operating in the same industry in that year. Bates' method of constructing overinvestment has been widely accepted and applied in the literature (see, for instance, Servaes 1994; Hendershott 1996, who study the investment behaviour of takeover targets; and D'Mello and Miranda 2010, who analyse the links between overinvestment and short-term debt). To the best of our knowledge, we are the first to examine the determinants of above-median investment in the Chinese case.

A limitation of Bates' approach is that investment opportunities are not captured when modelling overinvestment, that is, some high-investing firms may simply have better profit opportunities than others. Moreover, by definition half of the observations in the sample display above-median investment. It is therefore inappropriate to refer to these firms as overinvesting firms. Rather, we use the above-median investment to look for evidence of overinvestment.

We next devise a second approach in which an investment equation is estimated to predict the optimal level of investment, and investment above this predicted optimal level is subsequently analysed. This method is in line with that used by Harford (1999) and Opler et al. (1999) when determining the optimal cash holdings of firms. We first estimate a standard investment equation, which is that used in Section 4.1 (see Equation (A1) in Appendix 2 for the model specification and Table 1(a) for the results). The investment of each firm predicted by Equation (A1) can be considered as optimal in the sense that it is our best measure of the amount that the firm would invest in the absence of those factors – free cash flow and lack of restraining influence of debt – which are expected to cause overinvestment. Our interest lies in investment above the predicted optimal level ($I/K^*_{i,t}$) obtained from Equation (A1), as indicated by a positive $\epsilon_{i,t}$, suggesting possible overinvestment.

Within this approach, our second free cash flow measure (FCF_2) is the cash flow beyond what is required to maintain assets (i.e. depreciation) and to finance the optimal investment. Specifically:

$$\mathrm{FCF}_2 = \text{cash flow}_{i,t} - \mathrm{Dep}_{i.t} - I/K^*_{i,t}, \tag{1}$$

where $\text{cash flow}_{i,t}$ represents the cash flow to assets ratio, $\mathrm{Dep}_{i,t}$ is depreciation and $I/K^*_{i,t}$ is predicted optimal investment.

It is important to stress that we do not define overinvestment as above-median or above-optimal investment. Instead, we use these two sub-samples as providing possible 'candidates' for overinvestment, that is, cases in which evidence of overinvestment – based on its hypothesized causes – is likely to be found. The advantage of concentrating on both the above-median or above-predicted investment is that issues of structural transformation and divestment, which might otherwise mask overinvestment, can be set aside. This will enable us to test for evidence of overinvestment by means of the variables which are predicted to cause it. In so doing, we use as dependent variables, the investment above the median (ABOVEMED) in a first exercise, and the investment above the predicted level (ABOVEPRED, i.e. $I/K_{i,t} - I/K^*_{i,t}$) in a second. In both cases, the investment variable is expressed as a proportion of capital stock.

5.2. Hypothesis testing

First, in order to test for the free cash flow hypothesis of overinvestment (Jensen 1986), we estimate the following regression:

$$\text{ABOVEMED}_{i,t} \text{ or } \text{ABOVEPRED}_{i,t} = \beta_0 + \beta_1 \text{FCF}_{i,t-1} + \beta_2 \text{ ownership dummies}_i + v_i + v_t + v_j + v_r + \varepsilon_{i,t}, \quad (2)$$

where $\text{ABOVEMED}_{i,t}$ and $\text{ABOVEPRED}_{i,t}$ are the two proxies for overinvestment; $\text{FCF}_{i,t-1}$ is the lagged free cash flow taking the forms of either FCF_1 or FCF_2; ownership dummies_i include three dummy variables equal to 1 if the firm is owned respectively by the state (SOE), collective (COL) or foreign (FOR) agents, and 0 otherwise. The private ownership group (PRIV) is the omitted category.

The error term in Equation (2) comprises five components. v_i is a firm-specific time-invariant component, encompassing all time-invariant firm characteristics likely to influence overinvestment, as well as the time-invariant component of the measurement error affecting any of the regression variables; v_t is a time-specific component accounting for possible business cycles; v_j is an industry-specific component reflecting industrial features associated with firm-level overinvestment; v_r is a region-specific component which captures geographic factors that influence firms' overinvestment, and $\epsilon_{i,t}$ is an idiosyncratic component. We control for v_i by estimating our equations in first-differences, and for v_t, v_j and v_r by including year, industry and regional dummies in all our specifications.

The System GMM estimator (Blundell and Bond 1998) is used to estimate Equation (2) and its variants in order to take into account unobserved firm heterogeneity and the possible endogeneity and mismeasurement problems of the regressors. In assessing whether our instruments are legitimate and our models are correctly specified, the Hansen *J* test of over-identifying restrictions is employed to evaluate the overall validity of the set of instruments. In addition, we assess the presence of n^{th}-order serial correlation in the differenced residuals using the $m(n)$ test, which is asymptotically distributed as a standard normal under the null of no n^{th}-order serial correlation of the differenced residuals. In the presence of serial correlation of order n in the differenced residuals, the instrument set needs to be restricted to lags $n+1$ and further for the first-differenced equation and lag n for the level equation (Roodman 2009). We initially used two lags of all regressors as instruments in the differenced equation. However, since all our models generally fail the test for second-order autocorrelation of the differenced residuals, levels of all regressors lagged three times and longer are used as instruments in the first-differenced equations. First-differenced variables lagged twice are used as additional instruments in the level equations. Our method of restricting the number of instruments used in each first-differenced equation can help alleviate the potential instrument proliferation problem (Bowsher 2002; Roodman 2009).

The free cash flow hypothesis (Jensen 1986) predicts a positive β_1 coefficient. We control for various types of firm heterogeneity. Specifically, we hypothesize that the impact of free cash flow on overinvestment may be different for firms with different levels of free cash flow, firms owned by different agents, and firms with different degrees of political affiliation. We test these hypotheses by interacting the free cash flow term with relevant dummies variables.

We examine the role of debt in alleviating the overinvestment bias (Stulz 1990) by estimating the following equation:

$$\text{ABOVEMED}_{i,t} \text{ or } \text{ABOVEPRED}_{i,t} = \gamma_0 + \gamma_1 \text{FCF}_{i,t-1} + \gamma_2 \text{leverage}_{i,t-1} + \gamma_3 \text{ ownership dummies}_i + v_i + v_t + v_j + v_r + \varepsilon_{i,t}, \quad (3)$$

where $\text{leverage}_{i,t-1}$ is the lagged ratio of total debt to total assets. All other variables including the error terms and the estimating approach are the same as those used in Equation (2). A negative coefficient of γ_2 is predicted if the hypothesis that debt has a disciplinary role on firm investment holds.

Given China's institutional background, we expect the role of debt in alleviating the overinvestment bias may be different for firms owned by different agents and for firms with different degrees of political affiliation. We test such hypotheses by interacting the leverage term with relevant dummies variables.

6. Empirical results

6.1. Descriptive statistics

The descriptive statistics of the above-median and above-predicted investment and free cash flow variables together with the leverage ratio are presented in Table 3 for each ownership group. The first set of variables is constructed according to the above-median approach. The above-median investment, expressed as a proportion of tangible fixed assets ($ABOVEMED_{i,t}$), is 24.9% in the full sample. It is highest for private firms (26.1%) and lowest for SOEs (19.9%). The ratio of free cash flow to tangible fixed assets (FCF_1) is 18.7% for the full sample, being lowest for SOEs (2.8%) and highest for collective firms (27.6%). The co-existence of high above-median investment and high free cash flow in the non-state sectors provides suggestive evidence of Jensen's (1986) free cash flow hypothesis. The leverage ratio, also presented in Table 3, is 57.6% for the full sample: it is lowest for foreign firms (48.9%) and highest for SOEs (61.3%), providing some initial evidence of lax lending to the state sector.

The second set of variables is constructed according to the above-predicted approach. The actual and predicted optimal investment for firms owned by different agents is reported in Tables A3 in the Appendix. The pattern of the predicted optimal investment ($I/K^*_{i,t}$) is very similar to that of the actual investment rate ($I/K_{i,t}$): it is highest for private firms, followed by foreign and collective firms, and lowest for SOEs. The discrepancy between actual and optimal levels of investment is very small. However, the aggregation of a large number of firms might conceal the fact that some firms overinvest and others divest, so that the small discrepancy between actual and optimal levels of investment simply result from the two opposing effects.

Interestingly, Table 3 shows that once firms investing less than their predicted level are removed from the sample, the above-predicted approach yields summary statistics very similar to the above-median approach for both above-predicted investment ($ABOVEPRED_{i,t}$) and free cash flow (FCF_2).

6.2. The free cash flow hypothesis

6.2.1. Baseline results

Our hypothesis is that managers of firms with funds in excess of those required to finance positive NPV projects are likely to overinvest. We test the hypothesis using Equation (2) and report the results in Table 4. The free cash flow term is found to be positive and significant in both equations: the elasticity calculated at sample means

Table 3. Descriptive statistics of above-median and above-predicted investment and free cash flow measures.

	Full sample	SOEs	Collective firms	Private firms	Foreign firms
Above-median approach					
ABOVEMED	0.249	0.199	0.238	0.261	0.229
	(0.185)	(0.131)	(0.171)	(0.199)	(0.163)
FCF_1	0.187	0.028	0.276	0.170	0.249
	(0.026)	(−0.062)	(0.079)	(0.020)	(0.066)
Leverage	0.576	0.613	0.579	0.597	0.489
	(0.590)	(0.623)	(0.591)	(0.615)	(0.488)
Observations	254,142	14,069	19,244	167,305	44,296
Above-predicted approach					
ABOVEPRED	0.240	0.188	0.237	0.254	0.223
	(0.154)	(0.110)	(0.145)	(0.170)	(0.141)
FCF_2	0.170	0.072	0.218	0.177	0.166
	(0.069)	(0.034)	(0.097)	(0.072)	(0.066)
Leverage	0.580	0.631	0.598	0.605	0.487
	(0.593)	(0.641)	(0.607)	(0.625)	(0.484)
Observations	108,830	9,248	8,646	62,666	23,689

Notes: ABOVEMED and FCF_1 are above-median investment and free cash flow. ABOVEPRED represents the above-predicted investment, and FCF_2 is the cash flow net of depreciation and predicted investment. Mean and median (in parentheses) values of each variable are reported. The ownership classification is based on the majority rule. See Appendix 5 for definitions of all variables. The relatively smaller sample when using the above-predicted approach is due to missing observations of regressors when estimating predicted investment.

Table 4. The free cash flow hypothesis of overinvestment: baseline equation.

Dependent variable: $ABOVEMED_{i,t}$ or $ABOVEPRED_{i,t}$	Above-median approach (1)	Above-predicted approach (2)
$FCF_{i,t-1}$	0.059**	0.102**
	(0.005)	(0.052)
SOE_i	−0.050**	−0.050**
	(0.002)	(0.006)
COL_i	−0.028**	−0.021**
	(0.002)	(0.005)
FOR_i	−0.035**	−0.026**
	(0.001)	(0.003)
*m*3 test (*p*-value)	0.763	0.359
Hansen *J* test (*p*-value)	0.000	0.197
Observations	254,142	108,830

Notes: Robust standard errors in parentheses; the ownership classification is based on the majority rule; all equations are estimated using a System GMM estimator.
***$p < .01$.
**$p < .05$.
*$p < .1$.

suggests that a 10% increase in free cash flow is associated with a 0.4% rise in the above-median investment and with a 0.6% rise in the above-predicted investment.[8] This positive relationship constitutes evidence in favour of the free cash flow hypothesis. Compared with the benchmark group of private firms, all other ownership groups (SOEs, collective firms and foreign firms) exhibit lower above-median or above-predicted investment: the coefficients on the ownership dummies are, in fact, all negative and precisely determined. They are largest in absolute value for SOEs, followed by foreign firms. By contrast with conventional thinking and contrary to the finding in Dollar and Wei (2007) and Liu and Siu (2012), it is the private sector rather than the state sector that appears to have overinvested most in recent years.[9] One possible explanation is that the rising profitability in the non-state sectors generates abundant free cash flow, which leads to excessive investment. SOEs do not have much free cash flow at hand because they are less profitable, and this curbs their proclivity to overinvest.[10] Another possibility is that SOEs have divested to get rid of obsolete capital in the face of increasing competition, and that this restructuring has curbed their tendency to overinvest (Ding, Guariglia, and Knight 2012). The lower above-median and above-predicted investment in the foreign sector compared to the private sector may be due to better corporate governance mechanisms.

The validity of the instrument sets is confirmed by the *m*3 test. The *p*-values of the Hansen *J* test are significant, which may result from the large size of our panel. The Monte Carlo evidence of Blundell, Bond, and Windmeijer (2000) show, in fact, that, when using System GMM on a large panel data to estimate a production function, the Hansen *J* test tends to over-reject the null hypothesis of instrument validity. Consistent with this, Nickell and Nicolitsas (1999) report significant *J* test statistics for all of their estimation results on UK firms, and Benito (2005), Benito and Hernando (2007) and Becker and Sivadasan (2010), for several of theirs. We are therefore inclined to pay little attention to the *J* test, as long as the test for third-order autocorrelation of the differenced residuals is satisfactory.

6.2.2. Possible channels

Table 5 reports the results of possible channels through which free cash flow may affect firms' above-median and above-predicted investment. Panel A differentiates firms by whether they have positive or negative free cash flow. According to the free cash flow hypothesis, only firms with positive free cash flow should overinvest. This is confirmed by our results, that is, the positive and significant effect of free cash flow on above-median or above-predicted investment is only found for firms with positive free cash flow, but not for those with negative free cash flow.[11] A χ^2 test suggests that the difference between the coefficients associated with the positive and negative free cash flow interactions is statistically significant, according to the above-median approach.

Panel B differentiates firms on the basis of ownership. We expect all the coefficients of the interaction terms to be significantly positive if the free cash flow hypothesis holds, but keep an open view on their magnitudes. For

Table 5. The free cash flow hypothesis of overinvestment: possible channels.

Dependent variable: $ABOVEMED_{i,t}$ or $ABOVEPRED_{i,t}$	Above-median approach (1)	Above-predicted approach (2)
Panel A. Channel 1: positive or negative free cash flow		
$FCF_{i,t-1} * POSFCF_{i,t-1}$	0.066**	0.063**
	(0.002)	(0.011)
$FCF_{i,t-1} * NEGFCF_{i,t-1}$	0.005	0.116
	(0.009)	(0.085)
SOE_i	−0.053**	−0.054**
	(0.002)	(0.003)
COL_i	−0.029**	−0.019**
	(0.002)	(0.003)
FOR_i	−0.035**	−0.025**
	(0.001)	(0.003)
H_0: impact of $FCF_{i,t-1}$ on $ABOVEMED_{i,t}$ or $ABOVEPRED_{i,t}$ is the same across firms with positive and negative free cash flow (*p*-value)	0.000**	0.576
*m*3 test (*p*-value)	0.783	0.290
Hansen *J* test (*p*-value)	0.000	0.000
Observations	254,142	108,830
Panel B. Channel 2: ownership		
$FCF_{i,t-1} * SOE_i$	0.070**	0.035**
	(0.029)	(0.017)
$FCF_{i,t-1} * COL_i$	0.072**	0.079**
	(0.014)	(0.017)
$FCF_{i,t-1} * PRIV_i$	0.090**	0.051**
	(0.007)	(0.007)
$FCF_{i,t-1} * FOR_i$	0.043**	0.007
	(0.010)	(0.008)
SOE_i	−0.047**	−0.055**
	(0.003)	(0.003)
COL_i	−0.028**	−0.023**
	(0.005)	(0.004)
FOR_i	−0.023**	−0.023**
	(0.003)	(0.002)
H_0: impact of $FCF_{i,t-1}$ on $ABOVEMED_{i,t}$ or $ABOVEPRED_{i,t}$ is the same across all ownership groups (*p*-value)	0.003**	0.000**
*m*3 test (*p*-value)	0.811	0.298
Hansen *J* test (*p*-value)	0.412	0.036
Observations	254,142	108,830
Panel C. Channel 3: political affiliation		
$FCF_{i,t-1} * HIGHPA_i$	0.071**	0.023**
	(0.019)	(0.011)
$FCF_{i,t-1} * MEDIUMPA_i$	0.045**	0.042**
	(0.009)	(0.004)
$FCF_{i,t-1} * NOPA_i$	0.058**	0.044**
	(0.008)	(0.003)
SOE_i	−0.053**	−0.056**
	(0.002)	(0.002)
COL_i	−0.026**	−0.017**
	(0.002)	(0.002)
FOR_i	−0.033**	−0.027**
	(0.001)	(0.002)
H_0: impact of $FCF_{i,t-1}$ on $ABOVEMED_{i,t}$ or $ABOVEPRED_{i,t}$ is the same across firms with high, medium, and no political affiliation (*p*-value)	0.329	0.222
*m*3 test (*p*-value)	0.694	0.375
Hansen *J* test (*p*-value)	0.308	0.077
Observations	254,142	108,830

Notes: Robust standard errors in parentheses; the ownership classification is based on the majority rule; all equations are estimated using a System GMM estimator.
***$p < .01$.
**$p < .05$.
*$p < .1$.

instance, being much less profitable than their non-state counterparts, SOEs typically have less free cash flow at hand, which may lead to a low coefficient of the interaction term for SOEs. Yet, SOEs are also less subject to external monitoring than non-state firms. The absence of control on their use of free cash flow may lead to a high coefficient of SOEs' interaction term. Looking at the results, according to the above-median approach, the coefficient on free cash flow is positive and significant for all types of ownership groups. It is highest for private and collective firms, which being the most profitable sectors, have abundant free cash flow. The coefficient is lowest for foreign firms, perhaps because of sound corporate governance in this sector: despite the presence of high profits and free cash flow, foreign firms might have better internal control of their use of free cash flow. The coefficient for SOEs lies in between owing to the joint effects of low free cash flow and poor control of its use. A χ^2 test rejects the null hypothesis that the magnitude of the free cash flow coefficient is the same across all ownership groups. The above-predicted approach yields similar results, except for the insignificant coefficient of free cash flow for foreign firms. This confirms the inference that free cash flow is a main reason for overinvestment in domestic firms rather than in foreign firms. Yet, given that, as documented in Table 3, free cash flow is typically much lower for SOEs compared to private and collective firms, we argue that even though the coefficient associated with free cash flow is of a similar magnitude for SOEs and private firms, the free cash flow hypothesis cannot be put forward as a convincing explanation of overinvestment for SOEs.

Panel C differentiates firms on the basis of political affiliation. Political affiliation refers to the fact that firms are affiliated (have a *lishu* relationship) with the central, provincial, prefecture, county or township governments (Li 2004; Tan, Li, and Xia 2007; Xia, Li, and Long 2009). Our dataset contains a measure of firms' political affiliation, which distinguishes high political affiliation (i.e. affiliation with central or provincial governments), medium political affiliation (i.e. affiliation with local governments such as city-, district-, county-, township- and village-level governments) and no political affiliation.[12] On the one hand, government intervention may distort firms' investment behaviour, reduce investment efficiency and lead to overinvestment. In particular, firms with high political affiliation are more likely to use their free cash flow to engage in investment that aims not to maximize firm value but to achieve objectives favoured by government, so generating more investment. Using a sample of state-owned listed firms, Chen et al. (2011) find evidence in favour of this argument. On the other hand, a *lishu* relationship is associated with government support and subsidies, that is, governments may grant firms affiliated with them benefits such as bank loans at better conditions, waivers of import tariffs, tax reductions and so on. Guariglia and Mateut (2016) confirm this view and find that politically affiliated firms benefit from easier access to short-term finance than their non-affiliated counterparts in China. Our results show that free cash flow has a significantly positive effect on the overinvestment of firms with high, medium and no political affiliations. A χ^2 test suggests that the difference in the magnitude of the interacted coefficients is not statistically significant. The sensitivity of overinvestment to free cash flow thus appears to be similar across firms characterized by different levels of political affiliation.

Our results were robust to the inclusion of additional control variables (such as firm size and age) in the above-median and above-predicted investment equations, to the use of a balanced sample of firms with complete eight-year accounting information, to the use of the 100% rule of ownership classification, to taking into account the ownership changes, to consider the development status of firms' location, to various ways of constructing optimal investment (e.g. by including industry-level value added growth or forward-looking sales growth as alternative measures of investment opportunities) and to the use of alternative definitions of free cash flow (such as the accounting definition according to which free cash flow is calculated as the sum of net profit, interest expenses and non-cash charges minus the sum of working capital and capital expenditure). Estimates related to these robustness tests are not reported for brevity, but available upon request. In summary, our results support the free cash flow hypothesis, which offers a plausible explanation for overinvestment, especially by domestic firms.

6.3. The disciplinary role of debt

We hypothesize that high leverage discourages managers from undertaking non-profitable investments: debt pre-commits firms to pay cash as interest and principal, and such commitments reduce managerial discretion over free cash flow that might otherwise be allocated to negative NPV projects. Table 6 tests this hypothesis.

Table 6. The role of debt in alleviating overinvestment bias: baseline model.

Dependent variable: $ABOVEMED_{i,t}$ or $ABOVEPRED_{i,t}$	Above-median approach (1)	Above-predicted approach (2)
$FCF_{i,t-1}$	0.065***	0.115***
	(0.010)	(0.027)
$leverage_{i,t-1}$	0.013	−0.010
	(0.025)	(0.040)
SOE_i	−0.050***	−0.049***
	(0.003)	(0.004)
COL_i	−0.029***	−0.021***
	(0.002)	(0.004)
FOR_i	−0.032***	−0.027***
	(0.003)	(0.006)
*m*3 test (*p*-value)	0.775	0.392
Hansen *J* test (*p*-value)	0.0926	0.005
Observations	254,142	108,830

Notes: Robust standard errors in parentheses; the ownership classification is based on the majority rule; all equations are estimated using a System GMM estimator.
***$p < .01$.
**$p < .05$.
*$p < .1$.

Surprisingly, although the free cash flow hypothesis is supported by the data, the leverage ratio does not have a significant effect on firms' above-median and above-predicted investment. One possible explanation is that the vast heterogeneity among Chinese firms may prevent such effects from being found in the full sample.

We examine some possible channels in Table 7. Panel A focuses on the effect of ownership. We find that free cash flow contributes positively and significantly to positive differences in investment according to both methods. Leverage is found to reduce the investment term for collective firms (based on the above-median approach) and for both collective and private firms (based on the above-predicted approach). Interestingly, a positive and significant coefficient of debt is found for SOEs based on the above-median approach. No significant debt effects are found for foreign firms. Hence, the disciplinary pressures from banks help to curb any tendency to overinvestment for collective firms and for private firms (when the above-predicted approach is used), but not in the state and foreign sectors. The positive association between leverage and overinvestment for SOEs can be explained in the light of the fact that these companies, which have enjoyed relatively easy access to formal finance (reflected by their high leverage ratio), are unlikely to face strict screening and monitoring pressures from banks. This is consistent with Firth, Lin, and Wong's (2008) argument according to which Chinese banks impose fewer restrictions on capital expenditures of firms with greater state ownership, thus creating an overinvestment bias. In the case of foreign firms, the absence of a disciplinary role of debt can be explained by their relatively low leverage ratio.

Panel B compares the effects of debt on above-median and above-predicted investment among firms with different degrees of political affiliation. The free cash flow hypothesis is once again supported. In addition, we observe that, according to either approach, leverage has no impact on above-median or above-predicted investment for firms with high political affiliation, but has a significantly negative effect for firms with medium or no political affiliation. A χ^2 test suggests that the difference between the debt coefficients of firms with different degrees of political affiliation is statistically significant at the 10% level. These findings can be explained as follows: when firms have high political affiliation, banks' ability and incentive to exert disciplinary pressures on them are likely to be compromised by state policies in pursuit of non-profit objectives. Without sound monitoring by financiers, external funds are unlikely to exert any control on overinvestment in firms with high political affiliation. In contrast, debt exerts a disciplinary role in reducing overinvestment for firms with medium or no political affiliation, this role being largest for the former. The lower debt effect for firms with no political affiliation compared to firms with medium affiliation may appear because the former are less able to obtain bank loans than the latter. In summary, a certain degree of political connection may be beneficial for Chinese firms in order to gain access to external finance and other opportunities, but too much government intervention may distort incentives and reduce investment efficiency.

Table 7. The role of debt in alleviating overinvestment bias: possible channels.

Dependent variable: $ABOVEMED_{i,t}$ or $ABOVEPRED_{i,t}$	Above-median approach (1)	Above-predicted approach (2)
Panel A. Channel 1: ownership		
$FCF_{i,t-1}$	0.072**	0.089**
	(0.004)	(0.019)
$leverage_{i,t-1} * SOE_i$	0.138*	−0.006
	(0.087)	(0.046)
$leverage_{i,t-1} * COL_i$	−0.123*	−0.142**
	(0.079)	(0.163)
$leverage_{i,t-1} * PRIV_i$	0.004	−0.062**
	(0.003)	(0.024)
$leverage_{i,t-1} * FOR_i$	0.044	−0.046
	(0.048)	(0.036)
SOE_i	−0.283**	−0.082**
	(0.109)	(0.031)
COL_i	−0.067*	0.031
	(0.039)	(0.039)
FOR_i	−0.111**	−0.039*
	(0.036)	(0.021)
H_0: impact of $leverage_{i,t-1}$ on $ABOVEMED_{i,t}$ or $ABOVEPRED_{i,t}$ is the same across all ownership groups (*p*-value)	0.139	0.355
*m*3 test (*p*-value)	0.839	0.442
Hansen *J* test (*p*-value)	0.000	0.039
Observations	254,142	108,830
Panel B. Channel 2: political affiliation		
Dependent variable: $ABOVEMED_{i,t}$ or $ABOVEPRED_{i,t}$	Above-median approach (1)	Above-predicted approach (2)
$FCF_{i,t-1}$	0.047**	0.092**
	(0.009)	(0.023)
$leverage_{i,t-1} * HIGHPA_i$	−0.004	−0.069
	(0.067)	(0.057)
$leverage_{i,t-1} * MEDIUMPA_i$	−0.174**	−0.073**
	(0.071)	(0.029)
$leverage_{i,t-1} * NOPA_i$	−0.164**	−0.042*
	(0.049)	(0.024)
SOE_i	−0.026*	−0.041**
	(0.017)	(0.011)
COL_i	−0.031**	−0.013**
	(0.006)	(0.006)
FOR_i	−0.085**	−0.034**
	(0.013)	(0.004)
H_0: impact of $leverage_{i,t-1}$ on $ABOVEMED_{i,t}$ or $ABOVEPRED_{i,t}$ is the same across firms with high, medium, and no political affiliation (*p*-value)	0.004**	0.079*
*m*3 test (*p*-value)	0.922	0.361
Hansen *J* test (*p*-value)	0.086	0.003
Observations	254,142	108,830

Notes: Robust standard errors in parentheses; the ownership classification is based on the majority rule; all equations are estimated using a System GMM estimator.
***$p < .01$.
**$p < .05$.
*$p < .1$.

7. Conclusion

China has achieved a remarkably high level of industrial investment in recent years. There was a danger that such rapid capital accumulation would cause diminishing returns to set in and would create underutilized capacity. Has the efficiency of industrial investment in the SOEs remained lower than in private firms? Is there evidence of overinvestment and, if so, what drives it? These are the questions that were posed in this paper.

We find significant heterogeneity on Chinese firms' investment efficiency and uncover evidence of overinvestment for all types of firms. For collective and private firms, their rising profitability in recent years has generated

significant free cash flow that has induced overinvestment, consistent with the prediction of the free cash flow hypothesis. The disciplinary role of debt on overinvestment was found to hold for collective and private firms, but not for SOEs. This result helps to explain overinvestment in the state sector: despite the gradual financial sector reforms, banks still impose fewer restrictions on SOEs' borrowing and investment decisions, which creates a bias towards overinvestment. We also found that debt curbs the overinvestment bias for firms with no or limited, but not high, political affiliation: banks are unlikely to impose restrictions on firms affiliated with central or provincial governments, irrespective of their ownership.

The European Union Chamber of Commerce in China (2016) examined overcapacity in China – its extent, causes and consequences – concentrating on eight key industries dominated by SOEs. It noted that overcapacity in these industries, as measured by its inverse, the capital utilisation rate, had deteriorated over the previous five years despite central government's recognition of the problem and its efforts to reduce it. This failure was attributed to, among others, local government and SOE management growth objectives moulded by the centrally imposed incentive structures, weak regulatory enforcement, and China's vast monetary and fiscal stimulus package in the wake of the global financial crisis of 2008.

Overinvestment, as defined and analysed in this paper, carries with it the danger that it will generate overcapacity. Overcapacity and its rise have potentially serious implications for the Chinese economy. The underutilisation of capital increases average fixed costs. Insofar as the response to overcapacity is instead to increase production, the effect is likely to be an increase in exports at low prices and diminishing marginal revenue. In either case the result is falling profitability and probably rising non-performing loans, so increasing the risk of a financial crisis. The primary victim is China's economy. However, the substantial role that China now plays in world trade means that there are significant implications for the global economy. The result is growing trade tensions, for instance in the market for steel.

The danger of overcapacity has become more worrying on account of China's recent economic slowdown. In 2016 the Chinese government showed a new determination to tackle the problem of unproductive investment in the state-owned sector – announcing massive firm closures and worker layoffs in the most affected industries, including steel, coal, cement, and shipbuilding.[13] The European Chamber of Commerce in China (2016) listed 13 policy recommendations to reduce overcapacity. The main policy recommendation against overinvestment that our paper leads us to emphasise is to deepen financial sector reform and in that way to ensure that commercial lending criteria would be applied to SOEs and to strengthen corporate governance by improving scrutiny on managerial decisions on the use of free cash flow among collective and private firms.

Our study has some limitations. For instance, the normal explanation for excessive investment in market economies relies on the separation of ownership from control, combined with the absence of strong market competition. However, because our dataset largely contains unlisted firms, it does not permit good tests of various hypotheses relating to corporate governance issues such as the role of conflict of interests between managers and shareholders or between small and large shareholders, and their effect on overinvestment. This can be done using the listed firm data in future studies.

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Notes

1. The NBS endeavours to guarantee consistency in data collection across industries and regions. It also audits selected companies to ensure that financial data are accurate (Tan and Peng 2003).
2. Publicly listed companies cannot be separately identified in our dataset: it is difficult to track these companies as their legal identification numbers were changed as they went public. There are slightly more than 1000 listed companies operating in the manufacturing and mining sectors over the period considered, which amount to less than 0.3% of the total number of firms in our sample.
3. The rationale for dividing foreign investors into those from Hong Kong, Macao and Taiwan, and those from other parts of the world is that the former capture the so-called round-tripping foreign direct investment, whereby domestic firms may register as foreign invested firms from nearby regions to take advantage of the benefits (such as tax and legal benefits) granted to foreign invested firms (Huang 2003).
4. Legal entities represent a mix of various domestic institutions, such as industrial enterprises, construction and real estate development companies, transportation and power companies, security companies, trust and investment companies, foundations and funds, banks, technology and research institutions, etc.
5. Collective firms are typically owned collectively by communities in urban or rural areas.
6. See Panel II of Table A2 in the Appendix.
7. Because most firms in our sample are not listed, we cannot compute forward-looking variables such as Tobin's Q, which are typically used to capture investment opportunities. Instead, we use the growth of real sales. This approach has been widely used in the investment literature (Konings, Rizov, and Vandenbussche 2003; Guariglia, 2008). Our results are robust to using other proxies for investment opportunities such as the industry-level value added growth and future sales growth, in order to emphasize the fundamentally forward-looking nature of firms' investment decisions.
8. The elasticity is calculated using the following formula: (coefficient on free cash flow*mean value of free cash flow)/mean value of overinvestment, that is, (0.059*0.150)/0.241 based on the above-median approach and (0.102*0.146)/0.244 based on the above-predicted approach.
9. This finding is consistent with Chen et al. (2011), who also find that overinvestment is positively related to free cash flow. Yet, by contrast with us, these authors focus on listed companies.
10. In support of this argument, it is interesting to note that, as shown in Table 3, free cash flow is always significantly higher for private firms than for SOEs. Specifically, the free cash flow to capital ratio calculated using the above-median (above-predicted) approach is 2.8% (7.2%) for SOEs, and 17% (17.7%) for private firms. The differences between these values are statistically significant at conventional levels.
11. About 20% of the total firm-year observations in our sample have negative free cash flow.
12. In our sample, 6.4% of the firms have high political affiliation, 39.8% have medium affiliation and 53.8% have no affiliation.
13. See 'China to Shed 1.8 Million Coal and Steel Jobs', *The Financial Times*, February 28, 2016.

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