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Recasting the Iron Rice Bowl: The Reform of China's State Owned Enterprises

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Abstract

Following the enactment of reforms in the mid-1990s China's state owned enterprises (SOEs) became more profitable. Using theoretical insights from Azmat, Manning and Van Reenen (2012) and Karabarbounis and Neiman (2014) and econometric methods in De Loecker and Warzynski (2012) this paper finds that SOE restructuring was nevertheless limited. This is because SOE profitability gains in part reflect that they were under less political pressure to hire excess labor and also their cost of capital fell and their capital-labor elasticity of substitution generally exceeded unity. Moreover, SOE productivity lagged foreign and private firms.

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1 Introduction

When China had a planned economy, state owned enterprises (SOEs) were pervasive and provided job security and stable wages and were popularly known as the "iron rice bowl." Naughton (1996, p.44) notes that most workers in SOEs "not only stayed in a single enterprise for life: they could often pass their jobs on to their children when they retired." It was legally and practically impossible for SOEs "to fire workers, and quits were almost unknown." SOE managers were expected to produce outputs in order to fulfill planned targets; and, they were also under pressure to sustain the iron rice bowl.

Following the enactment of market reforms in 1978, SOE managers were allowed to sell outputs at market prices and keep a share of the profits once they had fulfilled targets negotiated with their superiors in the bureaucracy.[1] SOE managers were also give some more power to hire and fire workers. Nevertheless, by 1989 labor turnover in SOEs remained very low and only 0.5% of state workers were either fired, quit or were on contacts that were not renewed (Naughton, 1996, p.212).

[1]This overview of reforms draws on Gordon and Li (1991), Groves et al (1994, 1995), Jefferson et al (1996), Li (1997), Liu and Zhao (2011) and Putterman and Dong (2000).

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Several influential studies document that the SOEs were productive and profitable during the 1980s (Groves et al, 1995; Jefferson et al, 1996; Li, 1997). However, by the early 1990s SOEs had become unprofitable and were draining local government budgets. Thus, in 1992 the "iron rice bowl" was criticized in the official press and there were massive layoffs of SOE workers starting in the mid-1990s. The Company Law of July 1994 was designed to improve SOE performance and contained a set of reforms for "corporatizing" SOEs. Following the Fourteenth Party Congress in 1995, large and medium sized SOEs were corporatized, and small SOEs were privatized or shutdown, and this basic strategy of "grasping the big" SOEs and "letting go of the small" ones has subsequently remained in force.[2]

The Chinese Annual Surveys of Industrial Production (ASIP) provides a rich description of SOEs as well as private, foreign and hybrid firms (for herein, denoted hybrids) in the manufacturing sector during 1998-2007. Evidence from the ASIP indicates that there was a massive shakeout where roughly two-thirds of the operating manufacturing SOEs in 1998 were either privatized or shut down as of 2007 and employment in SOEs fell by 62.9% between 1998 and 2007. Using the ASIP data, Figure 1 illustrates that SOE profitability[3] rapidly grew from 2.8% to 21.6% during 1998-2007. While aggregate profitability in SOEs lagged all other firms by roughly 13% in 1998, SOE profitability was marginally higher than in all other firms as of 2007.

Figure 1 is also useful for comparing the profitability of SOEs with the subset of SOEs that were in operation throughout 1998-2007 and operated as SOEs for at least one year during 1998-2007. We denote this subset of SOEs the "SOEs-balanced sample." In any year the SOEs-balanced sample excludes SOEs that subsequently exited before 2007, and excludes SOEs that entered after 1998. Thus, reformers might select the SOEs-balanced sample for treatment because on average they were subject to a higher dosage of reform than entire

[2]See Chen et al (2006), Deng et al (2011), Fan et al (2011), Hsieh and Song (2015), Kato and Long (2006), Liao et al (2014) and Sun and Tong (2003).

[3]Profitability is profits as a share of value added. Throughout this paper profitability and profit shares are synonymous.

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sample of SOEs. Figure 1 illustrates that while the SOEs-balanced sample exhibit higher profitability than the entire sample of SOEs, both SOE groups exhibit a qualitatively similar growth in profitability throughout 1998-2007.

Does the rapid growth in SOE profitability indicate that SOEs restructured? While profitability growth can indicate that SOEs restructured, it could also indicate that the state used its standard tools including product market protections, input subsidies and financial bailouts for SOEs that enable SOEs to avoid restructuring (Kornai, 1991 and 1992).

In order to evaluate the performance of China's SOEs, this paper develops a theory of SOE profitability and also measures SOE productivity. Regarding profitability, it is often the case that the state in China (and around the world) puts political pressure on its SOEs to pursue non-economic objectives such as hiring excess labor. In this vein, Azmat, Manning and Van Reenen (2012) build a model that makes predictions about the impact of product market competition and political pressure to hire excess labor on firm behavior. We extend this model and find that an SOE's profitability increases when it has more product market power and when it is under less political pressure to hire excess labor.

Another issue related to SOE profitability is that the Chinese state enables its SOEs to obtain capital goods more easily and cheaply than private firms (see Tsai, 2004; Firth et al, 2009). There is a well known theoretical link between the cost of capital relative to labor, the elasticity of substitution between capital and labor, and labor's share (see, for example, Karabarbounis and Neiman, 2014). We explore the theoretical link between the cost of capital, the elasticity of substitution and profitability for SOEs that are under political pressure to hire excess labor. When the cost of capital relative to labor is falling, then an SOE will increase the capital intensity of its production processes. We show that this increase in capital intensity causes an SOE's profitability to increase (decrease) when the elasticity of substitution between capital and labor exceeds (is less than) unity, and has no impact when the elasticity of substitution is unity.

Using this theoretical framework to guide our empirical work, we find that there are several important reasons why SOE profitability grew. First, we estimate the capital-labor

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elasticity of substitution in 136 3-digit manufacturing sectors and find that in general it is greater than unity: thus, as the cost of capital for SOEs fell, SOEs dramatically increased their capital intensity. Second, we estimate the political pressures for SOEs to hire excess labor and find that it fell from 55.2% of a unit of profits in 1998 to 26.1% in 2007. These results indicate that SOEs' access to increasingly cheap capital inputs and the declining political pressure on SOEs to hire excess labor contributed to their profitability growth.

In order to directly measure whether SOEs restructured, we estimate the firm-level productivity measure from our theory. Syverson (2011, p.327) argues that productivity is a critical indicator of a firm's long term prospects in a market economy simply because "higher productivity producers are more likely to survive than their less efficient industry competitors." We find the productivity of most SOEs was lower than the productivity of firms in the private and foreign sectors. An exception to this finding is SOEs that have strong connections to the central government were as productive as foreign and private firms. However, these centrally connected SOEs accounted for only 19% and 26% of SOE output in 1998 and 2007, respectively. Thus, our results indicate that SOE restructuring overall was limited.

Our finding that SOEs were profitable because they had access to cheap capital and not because they were productive is related to the findings in Song et al (2011) that China's SOEs are relatively unproductive but survive because they have preferential access to cheap loans from state banks for financing investment. Boyreau-Debray and Wei (2005), Bai et al (2006) and Riedel et al (2007) also carefully document that SOEs have preferential access to investment finance from banks.

Our finding that SOEs were under political pressure to hire excess labor is consistent with the finding in Cooper et al (2015) that even after the enactment of reforms SOEs continued to take actions to preserve jobs and faced higher costs of workforce adjustment than private firms. Our finding that political pressure on SOEs to hire excess labor fell during 1998-2007 is related to the argument in Fu et al (2008) that the goal of the reform was to reduce operating losses in SOEs by allowing them to massively lay-off workers.

Our paper contributes to the debate about the effectiveness of corporatizing SOEs with-

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out privatizing them. Our finding that SOEs did not exhibit robust productivity gains is consistent with Shleifer and Vishny's (1994) prediction that corporatization without privatization can generate inefficiencies. Qian (1996) warns that the corporatization without privatization might encourage SOE insiders to preserve their rents by choosing diffuse outside investors and weak corporate boards. A discussion of corporate governance within SOEs is contained in the conclusion.

The next section describes the data; section 3 builds a model that makes predictions about an SOE's profitability; section 4 discusses how the model is estimated; sections 5 and 6 reports estimation results; and, section 7 concludes.

2 Overview of Data

We use the data from the Chinese Annual Surveys of Industrial Production (ASIP), which covers all SOEs and all non-state enterprises with total sales exceeding 5 million RMB in the industrial sector (including manufacturing, mining and utilities) during 1998-2007.[4] The analysis is limited to manufacturing firms, and we discuss the shortcoming that services are excluded in the online appendix.[5] We follow Brandt et al (2012) and use a firm's registration type to determine its ownership which can include: state owned enterprises (SOEs), domestically owned firms (private firms), private foreign firms (foreign firms), and hybrid firms. When the ownership structure is unavailable, we use a firm's major contributor to paid-in capital to determine its ownership type.

In subsequent analysis we also account for SOEs that have exceptionally strong political connections with the central government and may thus behave differently. In 2003, there were 196 SOEs directly supervised by the State-owned Assets Supervision and Administration

[4] As noted by Cai and Liu (2009), this dataset should be reliable because it is designed for computing Chinese GDP.

[5] We follow Brandt et al (2012) and use each firm's ID, name, industry, address and other information to track it over time. We do this becuase one sixth of all firms that are observed for more than one year change their official ID over the sample period.

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Commission of the State Council (SASAC) that are denoted "central SOEs." Over time, central SOEs have also gone through mergers and consolidations: and, as of 2014 there were 113 central SOEs. Central SOEs are all big conglomerates and each owns many second-tier and third-tier SOEs.[6] They also have subsidiaries listed in the Shanghai Stock Exchange or in the Shenzhen Stock Exchange, or even listed in the Hong Kong Stock Exchange. Within these central SOEs there are 53 SOEs located at even a higher political position that are denoted "top central SOEs."[7] The chief executives of top central SOEs are often directly appointed by the Central Organization Department of the Chinese Communist Party, and these SOE leaders have the political rank of vice minister.

It is not possible to directly identify top central SOEs in the data set. Although we could obtain the names for the top central SOEs[8], in the ASIP data, it only records firms according to legal entity. A top central SOE usually own many such legal entities around the country and each of them has an independent firm code. Thus, we identify a top central SOE using extra information in the dataset on whether a SOE is a subsidiary of a top central SOE. Furthermore, it is likely that many second tier or third tier state firms are competitive and market oriented, so we further restrict our sample to state firms that in any year employed more than 10,000 workers and had gross output volume exceeding one billion RMB. This is a conservative measure since many third-tier and even second-tier SOEs that are in this group may be excluded. However, this measure is consistent with the fact that top central SOEs are large and have a major impact on the local economies.

Table 1 describes ownership transitions of SOEs between the period 1998-2002 and 2003-2007. The top row highlights the importance of net exits during 1998-2002 for the evolution of SOEs between these two periods. Of the 41,783 SOEs in operation in 1998-2002, more

[6] A second-tier SOE is a subsidiary of the subidiary to the parent company. A third-tier SOE is a subsidary of the second-tier SOE.

[7] See U.S. Chamber of Commerce (2012), p.60, footnote 192.

[8] Those names of these central SOEs can be found on the website: http://www.sasac.gov.cn/

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than half (24,421) were net exiters. Of the 17,362 SOEs remaining in operation after 1998-2002, one-fifth (3,574) were privatized and 6% (1,033) became either foreign or hybrid firms. Thus, out of the 41,783 SOEs in operation in 1998-2002, about 31% (12,755) were "SOE-continuers." The first column in Table 1 underscores the primary importance of the "SOE-continuers" and the secondary relevance of net entry during 2003-2007 for the evolution of SOEs. Out of the 20,015 SOEs in operation in 2003-2007, 64% (12,755) were "SOE-continuers" and 32.5% (6,491) were net entrants, and only 3.8% were private, foreign and hybrid firms during 1998-2002.

Table 2 contains summary statistics for our sample of firms aggregated by ownership. In this table and in several subsequent tables and figures, for ease of exposition, the hybrid firm category is excluded because they constitute a small share of output, value added and employment. The table describes the entire data set and shows the overall number of firms expands from 119,185 in 1998 to 270,368 in 2007.[9] Underlying this expansion was an almost eleven-fold increase in the number of private firms and a roughly two-and-a-half fold increase in foreign firms that was offset by a roughly two-thirds decline in the number of SOEs. During this period SOEs became relatively less important than private and foreign firms: the output share of SOEs fell from 37.5% to 16%, while the overall output share of private and foreign firms increased from 36.5% to 79%.

As previously argued, China's SOEs traditionally have been an important source of jobs. It is thus striking that overall employment in SOEs during 1998-2007 fell by 62.9%, while employment within private and foreign firms grew by 644% and 202%, respectively. It is also striking that SOEs increased the capital intensity of their production processes more aggressively than private and foreign firms.[10] During 1998-2007, the aggregate capital intensity grew by 34%; however, the 127% growth within SOEs was much more rapid than the 68%

[9] See our online appendix Table A.1 for summary statistics for the balanced sample and Table A.2 for summary statistics for the top central SOEs and the other SOEs.

[10] Capital intensity is real capital divided by human capital adjusted employees. For more details, see our online appendix for data development.

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growth within private firms and the negligible (-6.7%) growth within foreign firms. While the capital intensity for SOEs in 1998 was 0.89 and comparable to the foreign firms (0.99) and higher than private firms (0.48), by 2007 the SOEs' aggregate capital intensity of 2.03 was roughly 2.5 times and 2.2 times higher than in the private and foreign sectors.

There are two other noteworthy patterns for labor and wages. First, the overall real wage in manufacturing grew by 162%, and these gains were most pronounced within SOEs (228%), then within private firms (136%) and, lastly, within foreign firms (114%). State-sector real wages in 1998 were close to private-sector real wages and roughly one-third lower than foreign-sector wages. By 2007, state-sector wages were roughly equivalent to foreign-sector wages and almost 50% higher than private-sector wages. Second, labor's share of value added fell by 7.9 percentage points. This change was most pronounced for SOEs (a 14.1 percentage point decline) and then private firms (a 6.7 percentage point drop), and negligible within the foreign sector.[11] Thus, labor's share within SOEs fell because the declining rate of employment exceeded the increasing rate of wage growth. A potential reason for this sharp decline of employment is that SOEs drastically released labor and replaced it with capital.

Table 2 also reports aggregate profits/value added (profitability) and the share of profitable firms by ownership category. During 1998-2007, profitability increased by 11.4 percentage points; and, this gain was most pronounced for SOEs (an 18.8 percentage point increase) and then foreign firms (an 8.7 percentage point increase), and negligible within private firms (a 2.2 percentage point increase).

In the next section we develop a theoretical model for understanding whether the observed increase in SOE profit shares is indicative of restructuring. In order to check if the SOEs have restructured, in a subsequent section we derive and analyze the productivity of SOEs.

[11] This result and the results in the rest of the paper are robust when we follow the approach in Hsieh and Klenow (2009) and Brandt et al (2012) and inflate wage payments so that aggregate firm-level shares are comparable with the labor share values from the national accounts.

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3 Profitability: Theoretical Considerations

We consider an economy inhabited by firms that are differentiated by sectors, denoted s, and that operate in various time periods, denoted t. A firm i in period t has a sector-specific time-invariant production function that converts augmented labor (N_{it}), capital (K_{it}) and materials (M_{it}) into real output (Q_{it}). Firms within a sector are differentiated in each period by its firm-specific productivity. We use a flexible production function that assumes constant returns to scale in labor, capital and materials, and also a flexible constant elasticity of substitution between labor and capital and a unitary (Cobb-Douglas) elasticity of substitution between materials and factor inputs (labor and capital):

$$Q_{it} = \omega_{it} \left[a_s (N_{it})^{\frac{\sigma_s - 1}{\sigma_s}} + (1 - a_s) (K_{it})^{\frac{\sigma_s - 1}{\sigma_s}} \right]^{\frac{\alpha_s \sigma_s}{\sigma_s - 1}} (M_{it})^{1-\alpha_s} \tag{1}$$

where we denote $Q_{it} = \omega_{it} F(N_{it}, K_{it}, M_{it})$.

In this specification, Q_{it} is real output for a firm i at time t[12]; ω_{it} is firm-specific productivity; a_s is the sector-specific weight on labor versus capital in factor inputs ($0 < a_s < 1$); σ_s is the sector-specific elasticity of substitution between capital and labor ($0 \leq \sigma_s < +\infty$); α_s is the sector-specific Cobb-Douglas weight between the factor inputs (i.e., labor and capital) and intermediate inputs ($0 < \alpha_s < 1$). This flexible production function enables us to build a model that has clear theoretical predictions. And, as will be described subsequently, we can empirically identify all the production function parameters and thus assess the model's theoretical predictions. Moreover, in the online appendices 3 and 4, we show that the underlying parameters of this production function are sensible.

Input markets are competitive and a firm can hire its labor, capital and materials at input prices that are denoted w_{it}, r_{it}, and $\tilde{p}_{it}$, respectively. Product markets are imperfectly

[12] Basu and Fernald (1995 and 1997) show that the structural parameters estimated from a value-added production function could be biased if firms operate in imperfectly competitive product markets. We thus use an ouptut production function because, as documented subsequently, most Chinese manufacturing firms exercise market power in product markets.

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competitive and each firm faces an inverse demand function:

$$p_{it} = B_{it}(Q_{it})^{-\frac{1}{\eta_{it}}} \tag{2}$$

where η_{it} denotes the price elasticity of demand: $\eta_{it} \geq 1$.

In each period, private firms choose inputs in order to maximize profits, Π_{it}:

$$\Pi_{it} = p_{it}Q_{it} - w_{it}N_{it} - r_{it}K_{it} - \tilde{p}_{it}M_{it}.$$

SOEs are also under political pressure to hire excess labor and have a political benefit for hiring an additional employee equal to $(1 - 1/\phi_t)w_{it}$, where $\phi_t \geq 1$ for SOEs and $\phi_t = 1$ for private, hybrid and foreign firms. Thus, the degree to which the state pressures SOEs to hire excess labor is increasing in ϕ_t.

Firms are assumed to choose labor, capital and materials in order to maximize the objective function:

$$U_{it} = \Pi_{it} + \left(1 - \frac{1}{\phi_t}\right) w_{it}N_{it}. \tag{3}$$

The first order conditions for maximizing the objective function in equation (3) with respect to labor and capital are:

$$\phi_t \left(1 - \frac{1}{\eta_{it}}\right) \frac{\partial Q_{it}/Q_{it}}{\partial N_{it}/N_{it}} = \frac{w_{it}N_{it}}{p_{it}Q_{it}} \tag{4}$$

$$\left(1 - \frac{1}{\eta_{it}}\right) \frac{\partial Q_{it}/Q_{it}}{\partial K_{it}/K_{it}} = \frac{r_{it}K_{it}}{p_{it}Q_{it}}. \tag{5}$$

Because there are constant returns to scale in production and α_s is the Cobb-Douglas weight for factor inputs, then $\frac{\partial Q_{it}/Q_{it}}{\partial K_{it}/K_{it}} = \alpha_s - \frac{\partial Q_{it}/Q_{it}}{\partial N_{it}/N_{it}}$ and equation (5) is simplified:

$$\left(1 - \frac{1}{\eta_{it}}\right) \left[\alpha_s - \frac{\partial Q_{it}/Q_{it}}{\partial N_{it}/N_{it}}\right] = \frac{r_{it}K_{it}}{p_{it}Q_{it}}. \tag{6}$$

Combining equations (4) and (5), the firm-level capital intensity can be expressed as a function of the sectoral production function parameters, firm-level costs and the political

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weight on labor:

$$\frac{K_{it}}{N_{it}} = \left(\phi_t \frac{r_{it}}{w_{it}} \frac{a_s}{1-a_s}\right)^{-\sigma_s}. \tag{7}$$

Thus, when $0 < \sigma_s$, capital intensity is decreasing in the political weight on labor (ϕ_t), decreasing in nominal cost of capital (r_{it}), increasing in wage rate (w_{it}), and decreasing in the weight on labor versus capital in factor inputs (a_s).

Finally, the first order condition for materials is:

$$\left(1 - \frac{1}{\eta_{it}}\right) \frac{\partial Q_{it}/Q_{it}}{\partial M_{it}/M_{it}} = \frac{\tilde{p}_{it} M_{it}}{p_{it} Q_{it}}. \tag{8}$$

Using the first order condition for materials in (8) and $(\partial Q_{it}/Q_{it})/(\partial M_{it}/M_{it}) = 1 - \alpha_s$, it is straightforward to compute a firm's markup, μ_{it}:[13]

$$\mu_{it} = \frac{1}{1 - 1/\eta_{it}} = \frac{p_{it} Q (1-\alpha_s)}{\tilde{p}_{it} M_{it}}. \tag{9}$$

Value added for a firm is its revenues minus materials costs. Thus, using the markup equation (9), value added can be expressed as:

$$VA_{it} = p_{it} Q_{it} - \tilde{p}_{it} M_{it} = p_{it} Q_{it} \left(1 - \frac{1-\alpha_s}{\mu_{it}}\right). \tag{10}$$

Since $1 > 1 - \frac{1-\alpha_s}{\mu_{it}} > 0$, a firm always generates positive value added when $Q_{it} > 0$.

Our goal is to derive an expression for profitability (profit shares of value added). Since $\Pi_{it} = p_{it} Q_{it} - w_{it} N_{it} - r_{it} K_{it} - \tilde{p}_{it} M_{it} = VA_{it} - w_{it} N_{it} - r_{it} K_{it}$, a firm's profit share is

$$\frac{\Pi_{it}}{VA_{it}} = 1 - \left(\frac{w_{it} N_{it}}{VA_{it}} + \frac{r_{it} K_{it}}{VA_{it}}\right). \tag{11}$$

[13] De Loecker and Warzynski (2012) obtain the markup by assuming that firms employ labor flexibly. In our model, SOEs are under political pressure to hire labor and do not flexibly employ labor. Thus, we follow the approach in Lu et al (2012) and use intermediate inputs as the flexible input.

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A simple interpretation of equation (11) is that profitability equals one minus the total factor share. Using the first order conditions in (4) and (6), and the relationship between revenue and value added in (10), a firm's labor share and capital share are:

$$\frac{w_{it}N_{it}}{VA_{it}} = \frac{\phi_t}{\mu_{it} - 1 + \alpha_s}\left[\frac{\partial Q_{it}/Q_{it}}{\partial N_{it}/N_{it}}\right] \tag{12}$$

$$\frac{r_{it}K_{it}}{VA_{it}} = \frac{1}{\mu_{it} - 1 + \alpha_s}\left[\alpha_s - \frac{\partial Q_{it}/Q_{it}}{\partial N_{it}/N_{it}}\right]. \tag{13}$$

Combining equations (11), (12) and (13), profitability is

$$\frac{\Pi_{it}}{VA_{it}} = \frac{\mu_{it} - 1}{\mu_{it} - 1 + \alpha_s} - \frac{\phi_t - 1}{\mu_{it} - 1 + \alpha_s}\left[\frac{\partial Q_{it}/Q_{it}}{\partial N_{it}/N_{it}}\right] \tag{14}$$

where the output elasticity of labor is

$$\frac{\partial Q_{it}/Q_{it}}{\partial N_{it}/N_{it}} = \alpha_s\left[1 + \left(\frac{1 - a_s}{a_s}\right)\left(\frac{K_{it}}{N_{it}}\right)^{\frac{\sigma_s - 1}{\sigma_s}}\right]^{-1}. \tag{15}$$

We use the system of equations (14) and (15) for making predictions about the impact of μ_{it} (markups), ϕ_t (political weight on excess employment) and K_{it}/N_{it} (capital intensity) on profitability. In the Cobb-Douglas case ($\sigma_s = 1$), the output elasticity of labor is constant and capital intensity has no effect on profitability. Thus, in general we study situations where $\sigma_s \neq 1$ and capital intensity (K_{it}/N_{it}) impacts firm-level profitability exclusively through the firm's output elasticity of labor.

When $\phi_t = 1$ and SOE is under no pressure to hire excess labor, the second term on the right hand side of equation (14) vanishes: $\frac{\Pi_{it}}{VA_{it}} = \frac{\mu_{it}-1}{\mu_{it}-1+\alpha_s}$. In this case profitability is increasing in μ_{it} and is unaffected by K_{it}/N_{it}.

Next, consider the situation where an SOE is under political pressure to hire excess labor: $\phi_t > 1$. By inspection of the second term on the right hand side of equation (14), profitability increases as ϕ_t decreases. The impact of K_{it}/N_{it} on profitability, however,

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depends on σ_s (the elasticity of substitution between labor and capital). Profitability is increasing in K_{it}/N_{it} when $\sigma_s > 1$ and decreasing in K_{it}/N_{it} when $\sigma_s < 1$. As already noted, when $\sigma_s = 1$, the output elasticity of labor is constant. In the next section we will show that $\sigma_s > 1$ is the empirically relevant case.

Equation (7) indicates that an increase in w_{it} or a decrease in r_{it}, or a decrease in ϕ_t lowers capital intensity (K_{it}/N_{it}) which, in turn, can influence profitability, as described above. Thus, a decrease in the political pressure to hire excess labor (ϕ_t) has a direct positive effect on profitability and also an indirect positive effect through output elasticity of labor on profitability when $\sigma_s > 1$.

Finally, firm-level productivity (ω_{it}) does not enter into our system of equations (14) and (15) because profits (the numerator of profitability) and value added (the denominator) are both homogenous of degree one in productivity. Because productivity is a direct measure of restructuring, it is estimated later in this paper.

4 Estimation

The system of equations (14) and (15) enables us to estimate how markups, political pressure and capital intensity shape SOE profitability. If we can derive estimates for the structural parameters in each of 136 3-digit sectoral production functions and use observed firm-level capital intensity, we can estimate the output elasticity of labor for each firm in equation (15). We can then use this estimated output elasticity of labor along with estimates for markups, the political weight on hiring excess labor and parameters from the sectoral production functions to estimate a predicted measure of time-varying firm-level profitability using equation (14). Finally, in order to evaluate whether SOE profitability is indicative of restructuring, it will be useful to estimate productivity.

In this paper, we follow a recent approach proposed by De Loecker and Warzynski (2012)[14] and estimate the production function parameters $(\hat{\sigma}_s, \hat{\alpha}_s, \hat{a}_s)$ for the 136 3-digit sectors and

[14]See their online appendix for the application to a CES production function.

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the time-varying firm-level markups ($\hat{\mu}_{it}$) and time-varying firm-level productivity ($\hat{\omega}_{it}$). De Loecker and Warzynski (2012) follow the tradition of Olley and Pakes (1996), Levinsohn and Petrin (2003) and Ackerberg et al (2015) of overcoming the potential simultaneity bias when the firm observes productivity shocks (ω_{it}) but the econometrician does not.

The production function in equation (1) is estimated in two stages. In the first stage, we use the timing assumption in Ackerberg et al (2015) that firms need more time to optimally hire labor and install capital than purchase intermediate inputs. It follows from this timing assumption that a firm's demand for intermediate inputs depends on its productivity and the predetermined amounts of labor and the current stock of capital. We also follow De Loecker and Warzynski (2012) and assume that the status of export, which is approximated by an exporter dummy (D^e_{it}), is essential for the choice of intermediate inputs:

$$\ln(M_{it}) = h_t\left[\ln(\omega_{it}), \ln(N_{it}), \ln(K_{it}), D^e_{it}\right].$$

Following Ackerberg et al (2015), we assume the above equation can be inverted:

$$\ln(\omega_{it}) = h_t^{-1}\left[\ln(N_{it}), \ln(K_{it}), \ln(M_{it}), D^e_{it}\right].$$

We then approximate $\ln(Q_{it})$ with the second-order polynomial function of the three inputs and that interacted with an exporter dummy in the first stage:

$$\begin{aligned} \ln(Q_{it}) &= h_t^{-1}\left[\ln(N_{it}), \ln(K_{it}), \ln(M_{it}), D^e_{it}\right] + \ln F(N_{it}, K_{it}, M_{it}) \\ &\approx \Phi_t\left[\ln(N_{it}), \ln(K_{it}), \ln(M_{it}), D^e_{it}\right] + \epsilon_{it} \end{aligned} \tag{16}$$

where the variables Q_{it} and M_{it} are deflated with industry-level output and input deflators from Brandt et al (2012) and, the real capital stock series is constructed using the perpetual inventory method.

As argued in Gorodnichenko (2007), the industry-level output deflator does not necessarily provide a perfect measure of the output price since firms in the same industry often

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charge very different prices and enjoy different markups. Thus, ideally real output would be obtained by deflating revenues with a firm-level deflator. However, because firm-level deflators are not available, we follow what is common practice in the literature and use industry-level deflators.[15]

After the first stage equation is estimated, we obtain the fitted value of equation (16), $\hat{\Phi}_t$, and compute the corresponding value of productivity for any combination of parameters $\Omega = (\bar{\alpha}_s, \bar{\sigma}_s, \bar{a}_s)$. This enables us to express the log of productivity $\ln(\bar{\omega}_{it}(\Omega))$ as the fitted log output from equation (17) minus the logged contribution of factors (labor and capital) and the logged contribution of materials:

$$\ln(\bar{\omega}_{it}(\Omega)) = \hat{\Phi}_t - \frac{\bar{\alpha}_s \bar{\sigma}_s}{\bar{\sigma}_s - 1} \ln\left[\bar{a}_s (N_{it})^{\frac{\bar{\sigma}_s - 1}{\bar{\sigma}_s}} + (1 - \bar{a}_s)(K_{it})^{\frac{\bar{\sigma}_s - 1}{\bar{\sigma}_s}}\right] - (1 - \bar{\alpha}_s)\ln(M_{it}). \tag{17}$$

Our generalized method of moments (GMM) procedure assumes that firm-level innovations to productivity, $\zeta_{it}(\Omega)$, do not correlate with the predetermined choices of inputs. To recover $\zeta_{it}(\Omega)$, we assume that productivity for any set of parameters, $\bar{\omega}_{it}(\Omega)$, follows a non-parametric first order Markov process, and then we can approximate the productivity process with the third order polynomial:

$$\ln(\bar{\omega}_{it}(\Omega)) = \gamma_0 + \gamma_1 \ln(\bar{\omega}_{i,t-1}(\Omega)) + \gamma_2 \left[\ln(\bar{\omega}_{i,t-1}(\Omega))\right]^2 + \gamma_3 \left[\ln(\bar{\omega}_{i,t-1}(\Omega))\right]^3 + \zeta_{it}(\Omega).$$

From this third order polynomial, we can recover the innovation to productivity, $\zeta_{it}(\Omega)$, for a given set of the parameters. Since the productivity term, $\ln(\bar{\omega}_{it}(\Omega))$, can be correlated with the current choices of flexible inputs, $\ln(N_{it})$ and $\ln(M_{it})$, but it is not correlated with the predetermined variable, $\ln(K_{it})$, the innovation to productivity, $\zeta_{it}(\Omega)$, will not be correlated with $\ln(K_{it})$, $\ln(N_{i,t-1})$, and $\ln(M_{i,t-1})$. Thus, we use the moment condition similar to De

[15] In our online appendix 4, we use the theoretical connection among our estimates of firm-level markups, profit shares, and the returns to scale in the revenue production function from Gorodnichenko (2007, Proposition 1) and show that our theoretical assumptions for output production function and for the use of industry-level deflators are sensible.

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Loecker and Warzynski (2012):

$$m_s(\Omega) \equiv E\left[\zeta_{it}(\Omega)\begin{pmatrix} \ln(K_{it}) \\ \ln(N_{i,t-1}) \\ \ln(K_{it})\ln(N_{i,t-1}) \\ [\ln(K_{it})]^2 \\ [\ln(N_{i,t-1})]^2 \\ \ln(M_{i,t-1}) \end{pmatrix}\right] = 0 \tag{18}$$

and search for the optimal combination of $\hat{\alpha}_s$, $\hat{\sigma}_s$, and $\hat{a}_s$ by minimizing the sum of the moments (and driving it as close as possible to zero) using the weighting procedure proposed by Hansen (1982) for plausible values of Ω.

We estimate the three parameters of equation (1) for each of 136 3-digit CIC industries using the moment condition in equation (18). On average the weight on factor inputs ($\hat{\alpha}_s$) is 0.169, the weight on labor relative to capital ($\hat{a}_s$) is 0.548 and, the elasticity of substitution between labor and capital ($\hat{\sigma}_s$) on average is 1.553: moreover, the elasticity of substitution is greater than unity in 130 out of 136 sectors. These findings are somewhat surprising because in firm-level studies of the United Stated that use different estimation methods, the elasticity of substitution was found to less than one (see León-Ledesma et al, 2010; Chirinko et al, 2011; Oberfield and Raval, 2014). However, at the cross-country level, Duffy and Papageorgiou (2000) and Karabarbounis and Neiman (2014) find that some countries have elasticities of substitution exceeding unity. In our online appendix 3, we show that this result is robust to several estimation procedures, alternative measures of labor, when SOEs are dropped from the sample, when we relax the constant returns to scale assumption, and when we relax the restriction that materials are Cobb-Douglas in the production function.

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5 Profit Shares

5.1 Capital Intensity

Because the elasticity of substitution between labor and capital in the Chinese manufacturing sector generally exceeds unity, our theory predicts that an increase in SOE capital intensity will cause SOE profitability to increase. Our theory and in particular equation (7) imply that the relatively profound fall in the costs of capital relative to labor for SOEs, ($\phi_t \frac{r_{it}}{w_{it}}$), drove their relatively rapid growth in capital intensity. However, there could be other reasons for this pattern. For example, Ma et al (2014) argue that China's accession to the WTO and the associated policy changes encouraged SOEs (which generally supply the domestic market and are in general capital intensive) to export and grow. However, the between and within decomposition that is reported in our online appendix 5 indicates that within effects and not composition (between) effects drive the growth in aggregate capital intensity.

In order to check whether this growth of capital intensity within SOEs is robust to provincial-, sectoral- and year-fixed effects, we estimate the following equation:

$$\ln(K_{it}/N_{it}) = \sum_o \theta^o D^o_{it} + \sum_p \theta^p D^p_{it} + \sum_s \theta^s D^s_{it} + \sum_t \theta^t D^t_{it} + \varepsilon_{it} \tag{19}$$

where ε_{it} is an independent and identically distributed random variable. In equation (19), the dependent variable is the log of capital intensity of firm i in year t and D^o_{it}, D^p_{it}, D^s_{it} and D^t_{it} are ownership-, province-, sector-, and year-dummy variables, respectively. Foreign firms are the reference group because, as previously described, their capital intensity was stable during 1998-2007. Thus, equation (19) estimates how SOEs and private firms differ from foreign firms after controlling for province-, sectoral- and year-fixed effects. Since the outcomes are reported in logs, these differences are in percentage terms.

Table 3 contains results for three cases: 1) the entire sample, 2) the entire sample accounting for differences within SOEs (top central and all other SOEs), and 3) the balanced sample accounting for differences within SOEs. In each case, the model is estimated for the entire period 1998-2007, for 1998-2002 and then for 2003-2007. The first set of estimates for

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the entire sample shows that the relative capital intensity of SOEs increased by 28.7% (from -0.402 log points in 1998-2002 to -0.116 log points in 2003-2007). The results indicate that throughout 1998-2007 SOEs on average were less capital intensive than foreign firms and more capital intensive than private firms.

The second set of estimates shows that capital intensity grew by 18.9% in top central SOEs (from 0.829 log points in 1998-2002 to 1.018 log points in 2003-2007) and by 27.8% in the other SOEs (from -0.406 log points in 1998-2002 to -0.128 log points in 2003-2007). These estimates also show that throughout 1998-2007 the top central SOEs were more capital intensive than foreign firms, which were more capital intensive than the other SOEs; and, private firms were least capital intensive.

Comparing the second and third set of estimates (the entire and balanced samples accounting for differences within SOEs) enables us to check for the impact of exit and entry on the capital intensity of SOEs. Qualitatively, the results in the balanced panel and full sample are similar. However, the capital intensity of the top central SOEs is smaller in the balanced sample, while the capital intensity of the other SOEs is larger in the balanced sample. Between 1998 and 2007 the number of top-central SOEs increased by 91.7% (from 120 firms in 1998 to 230 firms in 2007) while the number of other SOEs decreased by -67.6% (from 35,673 firms in 1997 to 11,557 firms in 2007).[16] These differences between the entire and balanced samples indicate that in the case of the top central SOEs there was a net entry and nationalization of relatively large and capital intensive firms, and in the case of the other SOEs there was a net exit and privatization of relatively small and labor intensive SOEs. Thus, consistent with the narrative in Hsieh and Song (2015) the rapid growth of capital intensity of SOEs is due to the privatization and shutting down ("letting go") of the small and relatively labor intensive SOEs and the entry and nationalization ("grasping") of the relatively large and capital intensive SOEs.

[16] See our online appendix Table A.2.

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5.2 Markups

Using the production function parameters that we have estimated for each of the 136 3-digit sectors, we can compute the value of the markup using equation (9):

$$\hat{\mu}_{it} = \frac{(1 - \hat{\alpha}_s)}{\tilde{p}_{it} M_{it} / p_{it} Q_{it}}$$

where we use the actual values of nominal gross output ($p_{it}Q_{it}$) and intermediate input spending ($\tilde{p}_{it}M_{it}$) to compute expenditures on materials as a share of total revenue ($\tilde{p}_{it}M_{it}/p_{it}Q_{it}$) in the denominator of the markup equation.

The denominator in equation (9) would be biased if SOEs had preferential access to materials inputs that private and firms do not have. To determine if this is a problem, we check if there are differences between SOEs and private firms, and SOEs and foreign firms in terms of material expenditures as a share of revenues in the fifth, tenth, fiftieth (median), ninetieth and ninety-fifth percentiles of their distributions. In each case we fail to reject the null hypothesis that these differences are statistically significant. On average, materials expenditures as a share of revenues in SOEs are 2.5 percentage points lower than in private firms, and 2.9 percentage points lower than foreign firms. While these differences are statistically significant, they are both less than 1/10th of a sample standard deviation and thus quantitatively small. Moreover, if SOEs over-used materials because they have preferential access, we would expect that on average their spending on materials as a share of revenues would be higher than in the private and foreign firms. Thus, these patterns give us some assurance that the above markup equation is reasonably accurate.

Our theory predicts that an increase in markups causes profitability to increase.[17] However, in our analysis of the data we find that the distribution of log markup for SOEs is stable in 1998 and 2007, suggesting that changes in markups is not an important reason

[17] Roughly 20-25% of the sample have markups less than one and the average markup is roughly 1.11. Thus, while firms may be losing profits in some periods, on average they are profitable.

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for the increasing profitability of SOEs. This impression is confirmed when we estimate equation (19) using the log of markups as a dependent variable. Results are reported in Table 4. In the entire sample, SOEs have higher markups than foreign firms in 1998-2002, and this difference vanishes in 2003-2007. Accounting for differences within SOEs, there is no difference between top central SOEs and foreign firms. However, the other SOEs have higher markups than foreign firms in 1998-2002 (this difference disappears in 2003-2007). In the balanced sample estimates that account for differences in SOEs, there is no statistical difference between foreign firms and top central SOEs and also between foreign firms and other SOEs during 1998-2002 and 2003-2007. This difference between the entire sample and balanced sample indicates that within the group of other SOEs, the SOEs that exited and were privatized had relatively high markups.

5.3 Political Pressure to Hire Excess Labor

Using our estimates for the sectoral production parameters ($\hat{\sigma}_s$, $\hat{\alpha}_s$, $\hat{a}_s$) and for the time-varying firm-level markups, $\hat{\mu}_{it}$, we can use our theoretical model to estimate an SOE's time varying political benefit of hiring excess labor, $1-1/\phi_t$. Because ϕ_t is log-linearly associated with labor's share while it is not log-linearly associated with profit's share, our strategy is to develop an equation for labor's share from which we can estimate $\ln(\phi_t)$ and then calculate $1-1/\phi_t$. Combining the labor share equation (12) with the output elasticity of labor equation (15), then we can first calculate $\ln(\hat{\phi}_t)$ using our observed and reasonably well measured data for labor's share $(w_{it}N_{it}/VA_{it})$[18] and capital intensity (K_{it}/N_{it}), our calculated markup, $\hat{\mu}_{it}$, and estimated production function parameters:

[18]Labor's share is labor compensation divided by value added, where labor compensation includes payable wages and employment benefits. A potential caveat is that the aggregate labor share computed from our manufacturing data is lower than the figure in the NBS statistical yearbooks. However, our results are robust to the adjustments used in Hsieh and Klenow (2009) and Brandt et al (2012).

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$$\ln(\hat{\phi}_t) = \ln\left(\frac{w_{it}N_{it}}{VA_{it}}\right) + \ln\left(\hat{\mu}_{it} - 1 + \hat{\alpha}_s\right) - \ln\left(\hat{\alpha}_s\right) + \ln\left[1 + \left(\frac{1-\hat{a}_s}{\hat{a}_s}\right)\left(\frac{K_{it}}{N_{it}}\right)^{\frac{\hat{\sigma}_s - 1}{\hat{\sigma}_s}}\right]. \quad (20)$$

Because the data and estimated parameters on the right hand side of equation (20) can have measurement errors, we regress the calculated political weight parameter, $\hat{\phi}_t$:

$$\ln(\hat{\phi}_t) = \sum_t \pi_t D_{it}^{SOE} D_{it}^t + e_{it} \quad (21)$$

where D_{it}^{SOE} is the SOE dummy variable, and the error term consists of year-, province-, and sector-specific components: $e_{it} = \sum_t \theta^t D_{it}^t + \sum_p \theta^p D_{it}^p + \sum_s \theta^s D_{it}^s + \varepsilon_{it}$ and ε_{it} is a random variable that is independently and identically distributed. Thus, our estimated political weight for excess employment is $1 - 1/\phi_t^* = 1 - 1/\exp(\tilde{\pi}_t)$.

If the reforms first announced in 1995 in the Fourteenth Party Congress were de facto enacted, then it should be observed that the political benefit for SOEs of hiring excess labor, $1 - 1/\phi_t^*$, fell over time. If this pattern emerges, then this would provide another explanation (along with capital intensity effects) for the rapid increase in profitability of SOEs.

Table 5 Panel 1 reports SOEs' estimated political benefits of hiring excess labor from the entire sample. The subsequent columns (North, East, South and West) contain the results for China's four regions. Although the coefficients are estimated for each year, for ease of exposition, we only report the results for the years 1998 and 2007. The estimated coefficient $\tilde{\pi}_t$ associated with political pressure in equation (21) is 0.802 in year 1998, and 0.303 in 2007. This means that the estimated benefit to an SOE of hiring excess labor, $1 - 1/\phi_t^* = 1 - 1/\exp(\tilde{\pi}_t)$, fell from 55.2% in 1998 of profits to 26.1% of profits in 2007. These estimates are statistically significant at the 1 percent confidence level in both years and indicate that over time SOEs could pay more attention to making profits. The declines in an SOEs political benefits of hiring excess are slightly different across the regions and are more pronounced in reformist regions such as the East and South, and less pronounced for the North and West regions (Table 5 Panel 1).

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Table 5 Panel 2 and Figure 2 highlight the importance of entry and exit. We report estimates of the SOEs' benefit of hiring excess labor using only the balanced panel. Moreover, we only choose the firms that operated without the ownership changes over the entire period. In this case, the estimated benefit to an SOE of hiring excess labor fell from 49.9% in 1998 of profits to 37.7% of profits in 2007. As shown for the entire sample in the first panel, the SOEs' political benefit of hiring excess labor falls. However, in contrast to full sample, reform is not more pronounced in the East and South, suggesting that it is the dynamics of entry and exit that are critical to the more pronounced fall in political pressure in the East and South regions.

5.4 Predictions for Profit Shares

As shown in the previous sections, the capital deepening and the declining pressure to employ excess labor are two fundamental reasons why SOE profitability increased during 1998-2007. Figure 3 illustrates the goodness of fit of our theory. In order to obtain predicted aggregate SOE profitability, we insert the estimated production parameters, the average value of the markup, the estimated political pressure variable (the column "All" in Table 5 Panel 2), and the observed capital intensity into equations (14) and (15). The dashed line in Figure 3 illustrates the aggregate predicted profit shares for SOEs for each year during 1998-2007, which is close to the aggregate observed profitability.

Figure 4 plots the capital intensity and profitability schedules for SOEs in 1998 and 2007. In this figure the capital intensity in each year exhibits enormous heterogeneity and spans roughly six log points (a ratio of $400 \cong \exp(2)/\exp(-4)$). As predicted by our theory for the case in which the elasticity of substitution between capital and labor exceeds unity, the capital intensity-profitability schedules for SOEs are upward sloping in both years. Figure 4 also illustrates that between 1998 and 2007 the capital intensity-profitability schedule shifts upward. Thus, for any level of capital intensity, predicted profitability for an SOE was higher in 2007 than in 1998. For example, consider the predicted value for 1998 when SOEs faced significant pressure to hire excess employment. In this year, SOEs with log capital intensities

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roughly less than -2 on average were predicted to have negative profits. However, by 2007, all SOEs, including the relatively small ones with log capital intensity less than -2, were predicted to have positive profits.

Fixing capital intensity, our theory predicts that higher markups and/or declining political pressure to hire excess labor would cause this upward shift. However, since SOE markups were relatively stable during 1998-2007, we conclude that declining political pressure on SOEs to hire excess labor drove the upward shift in the capital intensity-profitability schedule. Moreover, the increase in capital intensity for SOEs drove their gains in aggregate profitability.

6 Productivity

Finally, we analyze whether the gains in SOE profitability were accompanied by gains in their productivity. If SOEs had successfully restructured, then their productivity should have been similar to levels in private and foreign firms. Table 6 reports estimation results using the log of productivity as a dependent variable in equation (19), where log productivity for SOEs and private firms is relative to productivity in foreign firms. The first set of estimates from the entire sample shows that private and foreign firms have comparable productivity levels, and the productivity of SOEs is 12.1% lower than foreign firms during 1998-2007. While the productivity gap between SOEs and foreign firms shrinks by 4.7% (from -0.137 log points in 1998-2003 to -0.09 log points in 2003-2007), the SOEs still fail to catch up.

The second set of estimates from the entire sample shows that the other SOEs are laggards in terms of productivity, and the top central SOEs have productivity levels that are similar to foreign and private firms throughout 1998-2007. Thus, the finding in Hsieh and Song (2015) that China's SOEs had an impressive productivity performance applies to the top central large SOEs. However, it is important to note that the top central SOEs account for roughly 26% of SOE output and 18% of SOE employment in 2007 even after the "grasp the big and let go of the small" policy. Thus, in general SOE productivity growth was not impressive, indicating that SOE restructuring, especially in the case of other SOEs,

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was limited. These results are similar and somewhat stronger for the balanced sample in Table 6. Figure 5 illustrates that in the balanced sample the productivity of SOEs failed to catch up to the private and foreign sectors. Our productivity results differ from Hsieh and Song (2015) because they use value added production functions while we use output-based production functions. As previously noted, we use output production function because there is imperfect competition in product markets (see Basu and Fernald, 1995).

If SOEs had restructured during 1998-2007, then we would observe that the performance of continuing SOEs during 2003-2007 would be no worse than SOEs that had become private during 2003-2007. We use firms that operated as SOEs in 1998-2002 and then became private firms as of 2003-2007 as the reference group and estimate an specification similar to equation (19) using the log of productivity as the dependent variable. We report the results in Table 7. The first column indicates that in 1998-2002 the SOE-continuers were 4.2% less productive than the SOEs that were privatized in 2003-2007. Moreover, the SOEs that subsequently exited were the least productive SOEs (by 9.7%) in 1998-2002. Thus, there may have been some selection on SOE privatization, liquidation and corporatization by productivity. However, comparing columns 1 and 2, it is clear that the productivity advantage of SOEs that were privatized in 2003-2007 over the SOE-continuers grew from 4.2% in 1998-2002 to 6.0% in 2003-2007 and the productivity gap between SOE-continuers and SOEs that were privatized grew.

The second set of columns in Table 7, where we account for differences within SOEs (top central and all other SOEs), shows that this basic pattern is robust. However, in this case it is the other SOEs that continue to operate as SOEs that are 4.3% less productive than the SOEs that were privatized in 2003-2007 and 6.1% less productive in 2003-2007. The top central SOEs-continuers are marginally more productive than the SOEs that privatize as of 2003-2007 although the large standard errors do not enable us to reject the null hypothesis that there is no difference between SOE-continuers and the SOEs that were privatized.

The third set of columns reports estimates for the balanced sample. The qualitative pattern from the second set of columns is robust. However, the difference between the

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productivity of the other SOEs that continue versus those that were privatized in 2003-2007 is attenuated (the continuers are now 2.2% less productive in 1998-2002 and 4% less productive in 2003-2007). This again indicates that the net exit of SOEs promoted productivity growth.

7 Conclusions

If we were simply to examine profitability, it appears that SOEs in China successfully restructured during 1998-2007. In this paper we have developed a comprehensive method for evaluating the drivers of SOE profitability including product market competition, political pressures to hire excess labor, and the ability to substitute labor for capital. We also document the evolution of SOE productivity in a setup that allows for flexible substitution between capital and labor and imperfect competition in product markets. We find that SOEs profitability increased primarily for two reasons: first, because the elasticity of substitution between capital and labor exceeds unity and SOEs had preferential access to capital, SOEs could become profitable by increasing their capital intensity: And, second, the state placed its SOEs under less political pressure to hire excess labor. We also find that, with the exception of the top central SOEs, in general SOEs became profitable without having impressive productivity gains.

Our findings provide an important counter-example to the Chong et al (2011) study of privatization of SOEs around the world. Using privatization prices, Chong et al (2011) argue that releasing excess labor in SOEs that are privatizing is more important for restructuring than labor retrenchment policies. However, in the case of China, we document that while SOEs massively released labor, the large group of other SOEs did not restructure. This suggests that simply firing labor without weakening political connections between SOEs and the state is problematic.

The results in this study are consistent with other studies that highlight the problems with state interference in firms and the benefits of weakening state influence. Chen et al (2006) document that Chinese firms that have more outsiders on their boards are less likely to engage in fraud. And, the studies of Fan et al (2011) and Deng et al (2011) document

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that outside board members are often ignored in corporatized SOEs. In well functioning corporations, there should be more turnover of CEOs when firms are performing poorly, and less turnover when they are performing well. However, Kato and Long (2002) document that this expected inverse relationship between firm performance and CEO turnover is weak in SOEs during 1998-2002, and significant and stronger in private owned firms. As part of the reform, medium and large-sized Chinese SOEs sold stock to some private investors while the state typically retained the block of controlling shares. Sun and Tong (2003) show that returns on sales and earning actually decrease after this partial privatization (or corporatization) of SOEs during 1994-1998; while SOE leverage increased. Moreover, this split share structure led to a whole series of well-known rent-seeking activities among the large shareholders who held the non-traded blocs such as guaranteed loans to the large shareholders and other related party transactions. However, in 2005 with the split share reform private agents could start to buy up the large blocs on non-tradable shares that had been controlled by the state. Liao et al (2014) argue that the SOEs who effectively dismantled this split share structure weakened the power of the state to influence their activities. This reform was effectively a privatization and led to gains in output, profits and employment levels of SOEs who implemented them.

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Tables and Figures

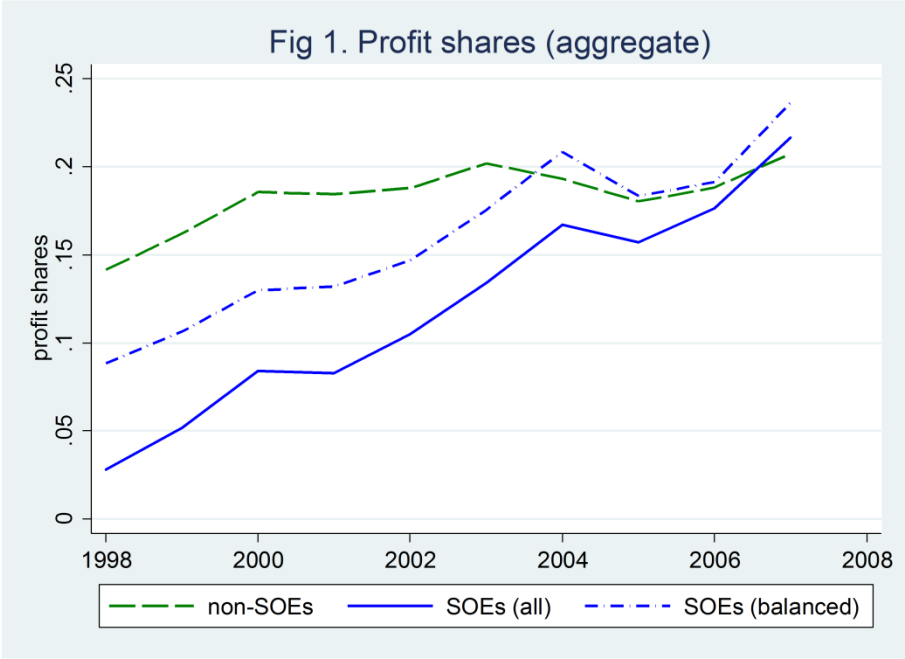

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Table 1: Changes in ownership during 1998-2002 and 2003-2007

	Ownerships in 03-07				Net exit	Total
	SOE	Private	Foreign	Hybrid	during 98-02	(98-02)
Ownerships in 98-02						
SOE	12755	3574	291	742	24421	41783
Private	301	45648	1543	1997	19785	69274
Foreign	81	628	26910	218	11655	39492
Hybrid	387	13162	1167	20879	34636	70231
Net entry during 03-07	6491	172954	43188	14197		236830
Total (03-07)	20015	235966	73099	38033	90497	457610

Notes: A simple majority rule is used to determine the ownership classification for the first and second five year periods of 1998-2002 and 2003-2007. For example, if the state owns a firm for at least three years during 1998-2002 and a private party owns the same firm for at least three years during 2003-2007, then the firm is categorized as an SOE and then private during 1998-2002 and 2003-2007, respectively. For 5% (7%) of the observations during the 2003-2007 (1998-2002), the two ownership classifications have the same years or there are three ownership types in each period. Thus, in these cases we choose the most conservative measure of SOEs and the classification is based on the priority ordering of hybrid, foreign, private, and then SOEs.

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Table 2: Summary statistics aggregated by ownership

	SOE		Private		Foreign		Total	
	1998	2007	1998	2007	1998	2007	1998	2007
The number of firms	35,793	11,787	17,868	190,580	20,925	54,519	119,185	270,368
Real output (billion RMB)	1,907	4,014	506	11,387	1,351	8,552	5,090	25,159
Employee (1,000)	21,538	7,988	3,912	29,119	6,214	18,790	42,324	58,831
Real capital (billion RMB)	1,899	1,786	190	2,595	626	1,928	3,195	6,575
Profits/value added (%)	2.8%	21.6%	17.4%	19.6%	13.9%	22.5%	9.5%	20.9%
Wage bill/value added (%)	31.5%	17.4%	22.6%	15.9%	23.3%	23.5%	26.4%	18.4%
Intermediate inputs/revenue (%)	75.5%	75.5%	77.4%	75.3%	77.8%	77.1%	76.9%	75.9%
Share of unprofitable firms (%)	42.7%	21.7%	15.5%	9.5%	31.7%	20.3%	27.2%	12.4%
Real wage rate (RMB)	8,136	26,671	7,563	17,880	12,727	27,230	8,469	22,177
Capital intensity	0.892	2.029	0.483	0.813	0.987	0.920	0.754	1.013

Notes: (1) The ratios are calculated from the aggregates by ownership. For example, profits/value added for SOE in 1998 is profits from all SOEs divided by value added from all SOEs. (2) The industry-level output deflator (1998 prices) is used to deflate gross output and wage rate. (3) Capital intensity is real capital divided by augmented labor (See our online appendices 1 and 3).

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Table 3: Differences in the log capital intensity

	Entire sample			Entire sample			Balanced sample		
	98-07	98-02	03-07	98-07	98-02	03-07	98-07	98-02	03-07
SOEs	-0.275***	-0.402***	-0.116**						
	(0.046)	(0.050)	(0.051)						
Top central SOEs				0.941***	0.829***	1.018***	0.680***	0.509***	0.837***
				(0.126)	(0.162)	(0.105)	(0.098)	(0.126)	(0.087)
Other SOEs				-0.282***	-0.406***	-0.128**	-0.196***	-0.297***	-0.086*
				(0.046)	(0.049)	(0.050)	(0.045)	(0.048)	(0.045)
Private firms	-0.522***	-0.699***	-0.451***	-0.522***	-0.699***	-0.451***	-0.482***	-0.669***	-0.339***
	(0.041)	(0.045)	(0.041)	(0.041)	(0.045)	(0.041)	(0.043)	(0.047)	(0.040)
Observations	1,704,372	621,195	1,083,177	1,704,372	621,195	1,083,177	283,600	141,800	141,800
R-squared	0.166	0.173	0.178	0.167	0.174	0.179	0.248	0.266	0.234

Notes: (1) Standard errors that are clustered at the 3-digit sectoral level are in parentheses. (2) All specifications include sector-, province-, and year-fixed effects. (3) ***, ** and * indicate significance at the 1%, 5% and 10% confidence levels, respectively. (4) The estimated coefficients are relative to foreign firms.

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Table 4: Differences in the log markup

	Entire sample			Entire sample			Balanced sample		
	98-07	98-02	03-07	98-07	98-02	03-07	98-07	98-02	03-07
SOEs	0.007	0.018***	-0.004						
	(0.004)	(0.004)	(0.005)						
Top central SOEs				-0.024	0.014	-0.052	-0.006	0.006	-0.012
				(0.086)	(0.096)	(0.074)	(0.087)	(0.093)	(0.081)
Other SOEs				0.007	0.018***	-0.003	-0.006	-0.006	-0.007
				(0.004)	(0.004)	(0.005)	(0.007)	(0.007)	(0.007)
Private firms	-0.022***	-0.015***	-0.026***	-0.022***	-0.015***	-0.026***	-0.023***	-0.026***	-0.020***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Observations	1,704,372	621,195	1,083,177	1,704,372	621,195	1,083,177	283,600	141,800	141,800
R-squared	0.087	0.081	0.096	0.087	0.081	0.096	0.112	0.114	0.119

Notes: See Table 3.

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Table 5: Estimates for the SOEs' political benefit of excess employment

1. Entire sample

	All	North	East	South	West
Implied political weight in 98 ($1-1/\phi_{98}$)	0.552	0.564	0.538	0.529	0.517
Estimated coefficient (π_{98}) in eq (21)	0.802 (0.033)	0.830 (0.035)	0.773 (0.032)	0.752 (0.037)	0.728 (0.055)
Implied political weight in 07 ($1-1/\phi_{07}$)	0.261	0.307	0.232	0.238	0.304
Estimated coefficient (π_{07}) in eq (21)	0.303 (0.028)	0.367 (0.030)	0.264 (0.030)	0.272 (0.037)	0.363 (0.036)
Observations	1,673,371	264,660	869,569	401,612	137,530
R-squared	0.296	0.284	0.293	0.286	0.389

2. Balanced sample (continuers w/o ownership changes)

	All	North	East	South	West
Implied political weight in 98 ($1-1/\phi_{98}$)	0.499	0.465	0.476	0.510	0.470
Estimated coefficient (π_{98}) in eq (21)	0.691 (0.047)	0.625 (0.058)	0.647 (0.060)	0.714 (0.059)	0.635 (0.086)
Implied political weight in 07 ($1-1/\phi_{07}$)	0.314	0.348	0.295	0.317	0.288
Estimated coefficient (π_{07}) in eq (21)	0.377 (0.045)	0.427 (0.060)	0.350 (0.062)	0.381 (0.051)	0.340 (0.064)
Observations	149,252	21,302	79,290	35,603	13,057
R-squared	0.343	0.341	0.336	0.346	0.473

Notes: (1) Standard errors that are clustered at the 3-digit sectoral level are in parentheses. (2) All coefficients are statistically significant at the 1% confidence level. (3) All specifications include sector-, province-, and year-fixed effects.

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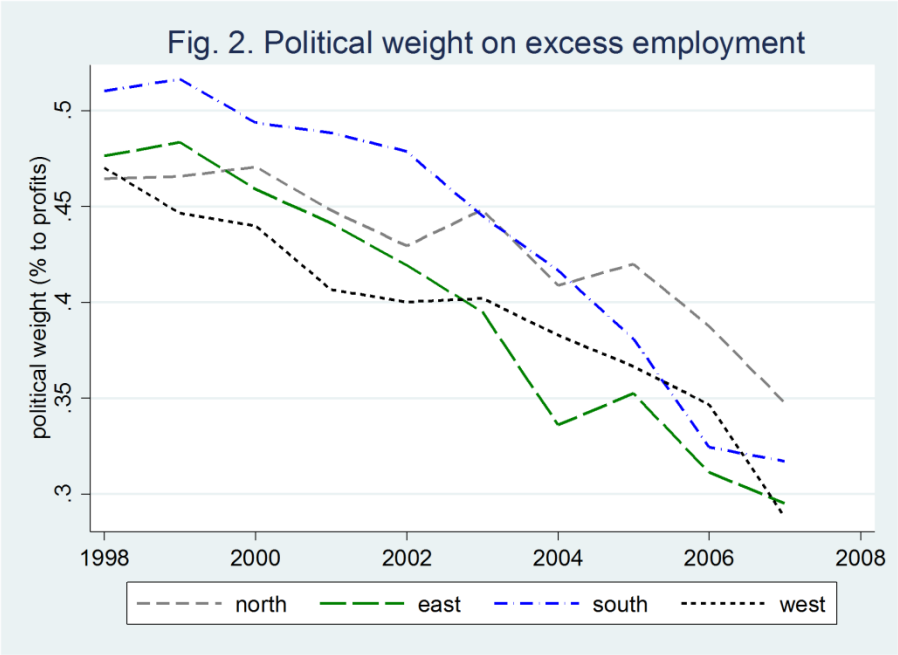

Notes: This figure uses the balanced sample of firms that do not change their ownership (see Table 5.2).

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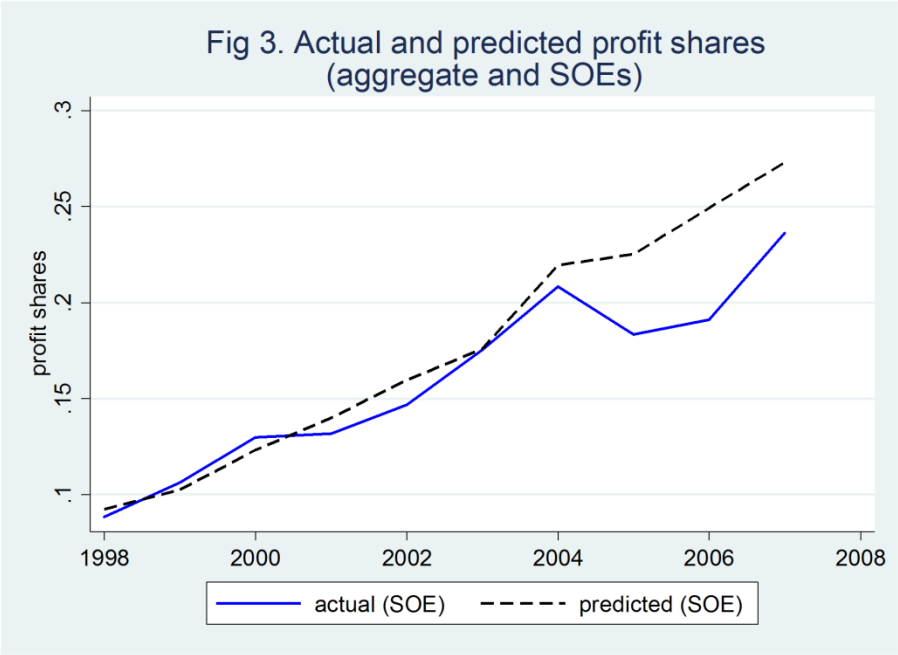

Notes: Predicted profit shares are obtained using the estimated production parameters, the actual capital intensity, and the average markup value (1.11) for the balanced sample.

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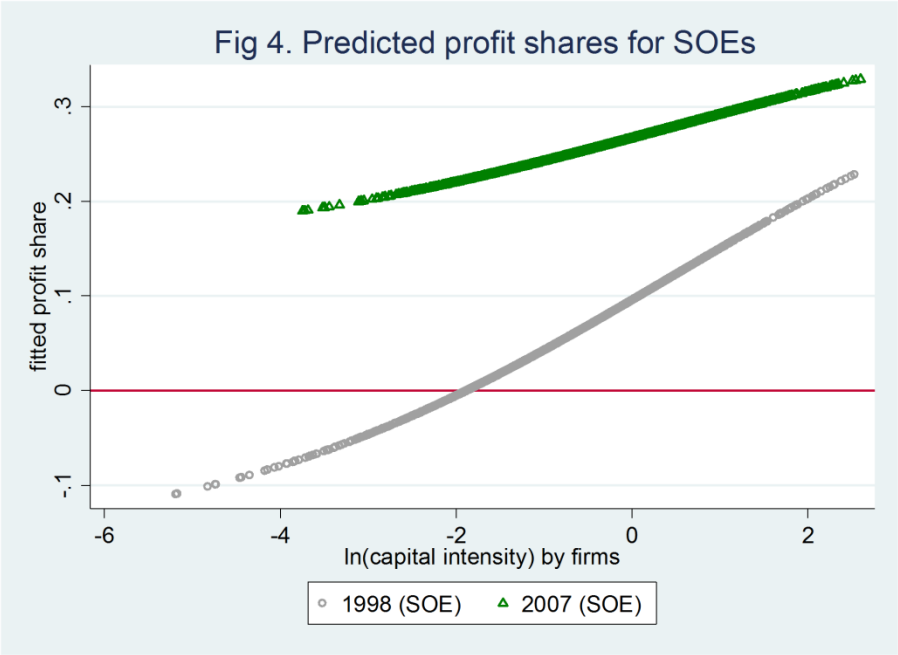

Notes: Predicted profit shares are obtained using the average values of the estimated production parameters, the actual capital intensity, and the average markup value (1.11) for the balanced sample.

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Table 6: Differences in log productivity

	Entire sample			Entire sample			Balanced sample		
	98-07	98-02	03-07	98-07	98-02	03-07	98-07	98-02	03-07
SOEs	-0.121***	-0.137***	-0.090***						
	(0.008)	(0.007)	(0.008)						
Top central SOEs				0.005	0.000	0.004	-0.001	-0.026	0.018
				(0.057)	(0.082)	(0.050)	(0.070)	(0.092)	(0.060)
Other SOEs				-0.121***	-0.137***	-0.091***	-0.104***	-0.117***	-0.090***
				(0.008)	(0.007)	(0.008)	(0.006)	(0.007)	(0.007)
Private firms	-0.008***	-0.007**	-0.008***	-0.008***	-0.007**	-0.008***	-0.036***	-0.037***	-0.035***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Observations	1,704,372	621,195	1,083,177	1,704,372	621,195	1,083,177	283,600	141,800	141,800
R-squared	0.243	0.086	0.302	0.243	0.087	0.302	0.206	0.096	0.262

Notes: See Table 3.

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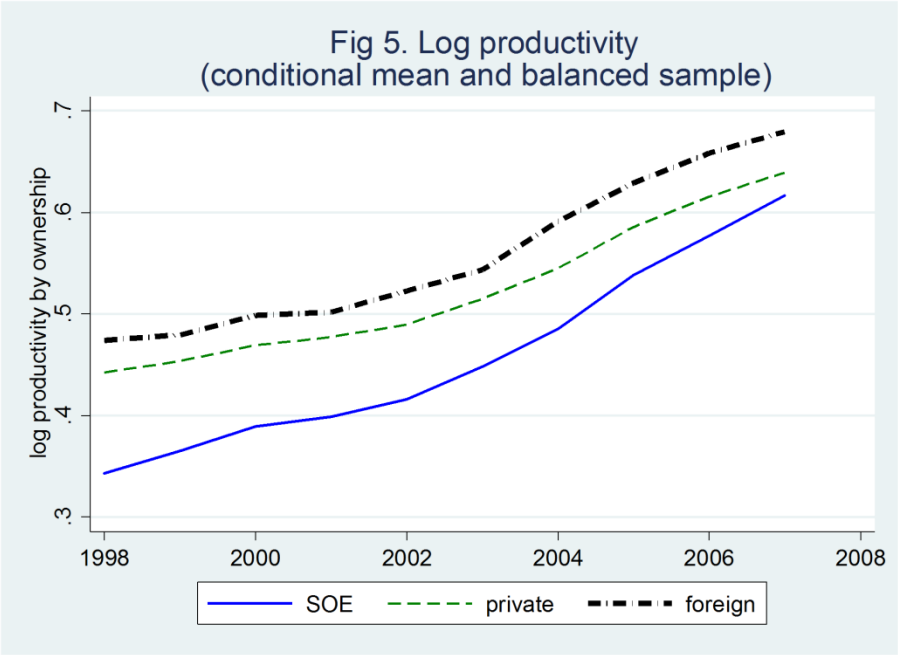

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Table 7: Differences in log productivity for SOEs

	Entire sample		Entire sample		Balanced sample	
	98-02	03-07	98-02	03-07	98-02	03-07
SOEs (98-07)	-0.042***	-0.060***				
	(0.008)	(0.008)				
Top central SOEs (98-07)			0.072	0.046	0.054	0.061
			(0.086)	(0.048)	(0.071)	(0.045)
Other SOEs (98-07)			-0.043***	-0.061***	-0.022*	-0.040***
			(0.008)	(0.008)	(0.012)	(0.015)
SOEs (98-02) to foreign (03-07)	-0.018**	-0.018**	-0.018**	-0.018*	-0.012	-0.021
	(0.009)	(0.009)	(0.009)	(0.009)	(0.013)	(0.016)
Exiters	-0.097***		-0.097***			
	(0.010)		(0.010)			
Observations	124,516	55,556	124,516	55,556	21,765	21,765
R-squared	0.076	0.187	0.076	0.188	0.117	0.248

Notes: (1) Standard errors that are clustered at the 3-digit sectoral level are in parentheses. (2) All specifications include sector-, province-, and year-fixed effects. (3) ***, ** and * indicate significance at the 1%, 5% and 10% confidence levels, respectively. (4) The estimated coefficients are relative to the firms that changed the ownerships from SOEs (98-02) to private (03-07).