Online Appendix
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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Appendix 1: Real Capital Stock

A real capital stock series is constructed using the perpetual inventory method as described in Brandt et al (2012). We have the book value of firms' fixed capital stock at the original purchase prices. Since these book values are the sum of nominal values for different years, they cannot be used directly. Thus, we construct a real capital stock series using the following formula:

$$K_{it} = (1-\delta)\, K_{i,t-1} + (BK_{it} - BK_{i,t-1})/P_t \tag{1}$$

where BK_{it} is the book value of the capital stock for firm i in year t; and P_t is the investment deflator as constructed by Brandt and Rawski (2008). To construct the real capital stock series, we then need to know the initial nominal value of the capital stock, which is projected as

$$BK_{i,t_0} = BK_{i,t_1} / \left(1 + g_{ps}\right)^{t_1 - t_0}$$

where BK_{i,t_1} is the book value of capital stock when firm i first appears in the data set in year t_1,and, g_{ps} is the average growth rate of capital, calculated using province-sector level capital growth rate between the earliest available survey (1995) and the first year that the firm enters the data.[1] For firms founded later than 1998, the initial book value of capital stock is taken directly from the data set.

Using information on the age of firm i, we could get the projected book value of the capital stock for the beginning year t_0 (BK_{i,t_0}), which can be thought of as the initial nominal value of capital. In this case, the real capital stock is $K_{i,t_0} = BK_{i,t_0}/P_{t_0}$. We could also compute the real capital stock in each year, assuming an annual depreciation rate as 0.09 and using the perpetual inventory method as in equation (1).[2] Our estimated real capital series is highly correlated with the original value of nominal capital as well as the net value of nominal capital.

[1] To be more concrete, we use 1995 industrial census and calculate the province-sector level growth rate for the book value of capital. Note that Brandt et al (2012) use the province-sector level aggregate capital stock growth, which ignores entry and exit. We instead use the province-sector level average capital stock growth.

[2] We also use an alternative depreciation rate of 0.05 and find that our results are qualitatively similar.

Appendix 2: Summary Statistics

Table A.1 contains summary statistics for our entire and balanced samples of firms aggregated by ownership. We keep a firm-year observations if all the data for gross output, intermediate inputs, real capital, employees, and labor shares (wage divided by value added) are available. To eliminate outliers, we drop the firms in the bottom and the top 0.25% of the distribution of values for labor shares and capital intensities and in the bottom and the top 0.1% of the distribution of values for intermediate input spending divided by gross output. As a result, we have 1,704,372 observations, which is an unbalanced panel of 457,610 manufacturing firms over ten years (1998 to 2007). We have excluded SOEs in the service sector. Tang et al (2014) document that SOEs tend to dominate upstream service sectors such as banking, insurance and telecommunications as well as mining (which we have also excluded); moreover, Li et al (2015) argue that this industrial structure has enabled upstream SOEs to extract high markups from competitive downstream firms and be profitable. If we were to include these upstream we might observe that markups are increasing for SOEs. Thus, because we have excluded mining and services, our analysis might underestimate the contribution of markups to the overall growth of SOE profitability.

Table A.2 reports several key aggregate production and income variables for top central SOEs and all other SOEs, and also for all SOEs. Table A.2 shows that the overall number of SOEs declines from 35,793 in 1998 to 11,787 in 2007. This decline is driven by all other SOEs because there is an increase in the number of top central SOEs. Employment in top central and other SOEs fell by 21.5% and 66.5%, respectively. During 1998-2007, the growth rate of capital intensity for other SOEs is much more rapid than the rate within top central SOEs although there was a persistent difference in their capital intensities even in 2007 (i.e., 3.0 for top central SOEs versus 1.8 for other SOEs). Table A.2 also reports the profit share of value added. During 1998-2007, the share of profits increased by 15.7% for top central SOEs and 19.8% for other SOEs. These results are robust when we use the balanced sample.

Appendix 3: Robustness Checks for Production Functions

The traditional micro-econometric methods for estimating the capital-labor elasticity of substitution production include Kmenta (1967), non-linear least squares (e.g., Henningsen and Henningsen,

2012) and Chirinko et al (2011). While the approach of Kmenta (1967) uses the polynomial approximation of Taylor's theorem, Chirinko et al (2011) use the first order condition of a CES production function in order to estimate the long-run capital-labor elasticity of substitution. The Chirinko et al method is not suitable for the case of Chinese manufacturing during 1998-2007: this is a period of rapid structural change and the Chirinko et al method requires a stable (stationary) time series of firm-level production variables. Moreover, the Chirinko et al method requires rich firm-level data on the cost of capital that we do not have.

Before we introduce the method that we have adapted from De Loecker and Warzynski (2012), we will discuss two traditional micro-econometric approaches for estimating the elasticity of substitution between labor and capital.

Kmenta's Approach

Kmenta (1967) uses the polynomial approximation of Taylor's theorem around the Cobb-Douglas production function ($\sigma_s = 1$):

$$\begin{aligned} q_{it} &= \ln(\omega_{it}) + \beta_s^n n_{it} + \beta_s^k k_{it} + \beta_s^{kn} n_{it}^2 + \beta_s^{kn} k_{it}^2 \\ &\quad -2\beta_s^{kn} n_{it} k_{it} + (1 - \beta_s^n - \beta_s^k) m_{it}. \end{aligned} \tag{2}$$

where lower-case letters denote logged values: $q_{it} = \ln(Q_{it})$, $n_{it} = \ln(N_{it})$, $k_{it} = \ln(K_{it})$, and $m_{it} = \ln(M_{it})$.

Here, we can obtain the capital-labor elasticity of substitution from

$$\sigma_s = \left[1 + \beta_s^{kn}(\beta_s^n + \beta_s^k)/(\beta_s^n \beta_s^k)\right]^{-1}. \tag{3}$$

A standard method for estimating equation (2) is to assume there is no systematic productivity innovation: ($\ln(\omega_{it}) = \ln(\omega_i)$), and estimate it with firm-fixed effects using the within-firm transformation:

$$
\begin{aligned}
d(q_{it}) &= \beta_s^n d(n_{it}) + \beta_s^k d(k_{it}) + \beta_s^{kn} d(n_{it}^2) + \beta_s^{kn} d(k_{it}^2) \\
&\quad -2\beta_s^{kn} d(n_{it}k_{it}) + (1-\beta_s^n-\beta_s^k) d(m_{it}) + \sum_t \theta^t D_{it}^t + \varepsilon_{it}
\end{aligned} \tag{4}
$$

where $d(x_{it}) = x_{it} - (1/T_i)\sum_t x_{it}$ and T_i is the number of observations available for firm i.

Olley and Pakes (1996) and Ackerberg et al (2015) criticize the within-transformation models, and that is why we use the De Loecker and Warzynski (2012) approach in the main body of our paper. Regarding the estimation of the capital-labor elasticity of substitution, Thursby and Lowell (1978) also show that the Kmenta (1967) approach becomes increasingly inaccurate as the absolute value of the actual elasticity of substitution gets larger. Nevertheless, as a robustness check the first and second panels in Table A.3 summarize the estimated parameters for the production function in equation (4) for each of 28 2-digit and 132 3-digit sectors[3] using the data from the entire sample. The capital-labor elasticity of substitution obtained from equation (3) exceeds unity in 92.9% of the 2-digit sectors and 82.6% of the 3-digit sectors.

Non-Linear Least Squares

The parameters of the production function could be estimated by non-linear least squares. However, a challenging issue with this method is to achieve convergence (Henningsen and Henningsen, 2012). Thus, it is important to obtain good initial parameter values and to impose reasonable constraints on parameters so that the CES production function is as close to long-linear as possible. Regarding initial parameter values, we use the following values $(\bar{a}_s, \bar{\sigma}_s, \bar{\alpha}_s) = (0.5, 1.25, 0.2)$, which are close to the average values estimated from equation (4). Regarding the constraints on parameters in the production function specification, we make the most of enforcing the unit elasticity of substitution between the factor inputs and intermediate inputs and constant returns to scale in production. By assuming $\ln(\omega_{it}) = \ln(\omega_i)$, we can also estimate using non-linear least squares with the within-firm transformation:

[3] The estimations do not converge to the reasonable ranges for four of the 3-digit sectors.

$$\begin{aligned} d(q_{it}) &= \alpha_s \frac{\sigma_s}{\sigma_s - 1} \ln\left(a_s (N_{it})^{\frac{\sigma_s-1}{\sigma_s}} + (1-a_s)(K_{it})^{\frac{\sigma_s-1}{\sigma_s}}\right) \\ &\quad -\alpha_s \frac{\sigma_s}{\sigma_s - 1} \ln\left(a_s (\tilde{N}_{it})^{\frac{\sigma_s-1}{\sigma_s}} + (1-a_s)(\tilde{K}_{it})^{\frac{\sigma_s-1}{\sigma_s}}\right) \\ &\quad +(1-\alpha_s) d(m_{it}) + \sum_t \theta^t D_{it}^t + \varepsilon_{it} \end{aligned} \tag{5}$$

where $\tilde{X}_i = (1/T_i)\sum_t X_{it}$.

The third and fourth panels in Table A.3 report the estimated parameters in equation (5) for each of the 27 2-digit and each of the 114 3-digit sectors.[4] The elasticity of substitution between labor and capital (σ_s) exceeds unity in 96.3% of 2-digit sectors and 94.7% of 3-digit sectors, indicating that labor and capital are strong substitutes in Chinese manufacturing during 1998-2007.

Robustness Checks

Human Capital Adjustments

Assuming that an individual's wage depends on her/his labor productivity, our measure of labor reflects the regional differences in human capital accumulation. We also adjust the national-level growth of human capital over the period using the Penn World Table 8.1. (Feenstra et al, 2015). Instead of using the reported number of head-count employee (L_{it}), in this paper we develop the measure of labor from the following equation:

$$N_{it} = L_{it} \times \left(100 \times \frac{w_{rt}}{w_t} \times \frac{hc_t}{hc_0}\right) \tag{6}$$

where w_{rt} is the average wage at year t for one of the four regions[5] in China (r),[6] w_t is the average wage at year t in China, and hc_t is the measure of human capital for year t (and $t = 0$ for the initial year of 1998) from the Penn World Table 8.1.

[4] The estimations do not converge to the reasonable ranges for one of the 2-digit sectors and 22 of the 3-digit sectors.

[5] Each region includes the following provinces or province-equivalent municipal cities: the North includes Beijing, Tianjin, Hebei, Shanxi, Neimenggu, Liaoning, Jilin and Heilongjiang; the East includes Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi and Shandong; the South includes Henan, Hubei, Hunan, Guangdong, Guangxi and Hainan; and, the West includes Chongqing, Sichuan, Guizhou, Yunnan, Xizang, Shan'xi, Gansu, Qinghai, Ningxia and Xinjiang.

[6] See Cheng et al (2013) for the regional differences in factor markets within China.

This adjustment is important in estimating the elasticity of substitution since we do not include labor- and capital-augmenting productivities in our production function. Alternatively, we obtain the second measure of labor from the firm-level wage (w_{it}) divided by province-level average wage for each year (w_t^p):

$$\tilde{N}_{it} = L_{it} \times \left(100 \times \frac{w_{it}}{w_t^p}\right). \tag{7}$$

The second and third panels of Table A.4 report the robustness checks for the measurement of labor. The estimation results are similar to our baseline results in the first panel of Table A.4. On average the elasticity of substitution between labor and capital is 1.545 with the unadjusted head-count number of employee (Table A.4 Panel 2) and 1.498 with the human-capital adjusted labor developed from equation (7) (Table A.4 Panel 3).

Large SOEs

As shown in the paper, large SOEs behave differently because they have preferential access to capital and are more capital intensive. To check whether the high elasticity of substitution between labor and capital is caused from large SOEs, we exclude SOEs that held SOE status throughout the period (the SOE continuers), which are largest firms in the sample. The results suggest that the estimates of capital-labor elasticity of substitution are not sensitive to exclusion of the large SOEs-the SOE continuers (Table A.4 Panel 4).

Constant Returns and Cobb-Douglas Weight on Factors and Intermediates

In order to obtain to obtain sharp theoretical predictions using a flexible production function, we assume that there constant returns to scale in production and Cobb-Douglas weight (unitary substitution elasticity) between factors and intermediate inputs. In what follows we provide empirical validation for these two assumptions.

First, we relax the assumption of constant returns to scale by introducing α_s^* in the following equation:

$$Q_{it} = \omega_{it} \left[a_s (N_{it})^{\frac{\sigma_s - 1}{\sigma_s}} + (1 - a_s)(K_{it})^{\frac{\sigma_s - 1}{\sigma_s}}\right]^{\frac{\alpha_s \sigma_s}{\sigma_s - 1}} (M_{it})^{\alpha_s^*}. \tag{8}$$

In Table A.4 Panel 5, we report the results when we relax the assumption of constant returns to scale by using the independent weight on intermediate input ($\bar{\alpha}_s^*$ where $\bar{\alpha}_s + \bar{\alpha}_s^*$ may not sum to unity). Relaxing the assumption of constant returns to scale implies that that our value of moment ($m_s(\Omega)$), becomes smaller than the baseline estimates (that assumes constant returns to scale) for 82.3% of the sectors. And, the estimated returns to scale are less than one for 72.1% of the industries, and the average value is 0.982, which is a small departure from constant returns to scale. The small difference constant and decreasing returns is consistent with the discussion in Gorodnichenko (2007) where a firm-specific market price index is not available and firms face imperfect competition. We will have an additional robustness check in the following section.

Finally, we provide validation for the assumption of a Cobb-Douglas weight between the factors and intermediate inputs. Our measure of intermediate inputs is the aggregate of all intermediate expenditures, which includes materials, parts and components, electricity, and services. Therefore, we are unable to assume, for example, that capital and electricity usages are complements, and labor and business services are substitutes due to outsourcing. Nonetheless, we introduce the following double CES form for a robustness check:

$$Q_{it} = \omega_{it} \left\{ a_s^* \left[a_s (N_{it})^{\frac{\sigma_s - 1}{\sigma_s}} + (1 - a_s) (K_{it})^{\frac{\sigma_s - 1}{\sigma_s}} \right]^{\frac{\sigma_s}{\sigma_s - 1} \cdot \frac{\sigma_s^* - 1}{\sigma_s^*}} + (1 - a_s^*)(M_{it})^{\frac{\sigma_s^* - 1}{\sigma_s^*}} \right\}^{\frac{\sigma_s^*}{\sigma_s^* - 1}} \tag{9}$$

where the elasticity of substitution between the factor inputs, $a_s(N_{it})^{\frac{\sigma_s-1}{\sigma_s}} + (1-a_s)\,(K_{it})^{\frac{\sigma_s-1}{\sigma_s}\frac{\sigma_s}{\sigma_s-1}}$, and intermediate inputs is σ_s^*, and the weight on factor inputs is a_s^*.

Since all the inputs are non-linear in production process, we use the following moment condition:

$$m_s^*(\Omega) \equiv E\left[\zeta_{it}(\Omega)\begin{pmatrix} \ln(K_{it}) \\ \ln(N_{i,t-1}) \\ \ln(M_{i,t-1}) \\ [\ln(K_{it})]^2 \\ [\ln(N_{i,t-1})]^2 \\ [\ln(M_{i,t-1})]^2 \\ \ln(K_{it})\ln(N_{i,t-1}) \\ \ln(K_{it})\ln(M_{i,t-1}) \\ \ln(N_{i,t-1})\ln(M_{i,t-1}) \end{pmatrix}\right] = 0 \tag{10}$$

and search for the optimal combination of $\hat{a}_s$, $\hat{\sigma}_s$, $\hat{a}_s^*$ and $\hat{\sigma}_s^*$ by minimizing the sum of the moments using the weighting procedure proposed by Hansen (1982) for the plausible values of Ω. Here, we use equation (5) to obtain the approximate values of $\tilde{\Omega} = (\tilde{\alpha}_s, \tilde{\sigma}_s, \tilde{a}_s)$. Note that $\tilde{a}_s^*$ is approximated from $\tilde{\alpha}_s$ since $\tilde{a}_s^*$ equals to $\tilde{\alpha}_s$ under the Cobb-Douglas assumption between factors and intermediate inputs.

Table A.4 Panel 6 shows that the average value of the estimated value of $\hat{\sigma}_s^*$ is 1.022, and $\hat{\sigma}_s^*$ is greater than unity for 55.1% of the industries. In this panel, we find that the obtained value of $m_s^*(\Omega)$ from equation (10) is much larger than that of $m_s(\Omega)$ from the baseline specification: the average value of $m_s(\Omega)$ is 0.00065 and that of $m_s^*(\Omega)$ is 0.00101; and $m_s(\Omega)$ is smaller than $m_s^*(\Omega)$ for 96.3% of the industries. Our results indicate that allowing the elasticity of substitution between factors and intermediate inputs to depart from unity does not necessarily improve the results, and this is strong empirical validation for the Cobb-Douglas weight. As shown in Table A.1, the share of spending on intermediate inputs in revenue is relatively stable over the period, which is also suggesting the unitary elasticity of substitution. This constant materials share contrasts with the declining share of paid to labor over the same period.

Appendix 4: Constant Returns and Competitive Factor Markets

We use Proposition 1 in Gorodnichenko (2007) and verify two critical assumptions underlying our theory: constant returns to scale in production and competitive factor markets. Note that in this section we do not use the baseline CES production function, but use the simplest form (i.e., Cobb-Douglas) and validate our empirical estimates using an alternative method. Gorodnichenko (2007) obtains the following equation under the assumptions that firms minimize costs, factor and intermediate inputs are flexible, and cost is separable in each input:

$$\frac{\gamma}{\mu} = (1 - s_\pi)\rho \tag{11}$$

where γ is returns to scale in production, μ is markups, s_π is profit shares in revenues, and $\rho = \sum_{j=1}^{n} \rho_j s_j$ where ρ_j is the elasticity of cost with respect to input j and s_j is the cost share of input j. Moreover, if we add an assumption that firms maximize profits, we also have:

$$\eta = \frac{\gamma}{\mu} \tag{12}$$

where η is returns to scale in the revenue production function.

To show that our assumption of constant returns to scale production function is consistent with our markup measures, we first obtain returns to scale in revenue function by regressing the log of nominal revenue (r_{it}) with the logs of three real inputs (n_{it}, k_{it}, and m_{it}) as well as firm- and year-fixed effects:

$$d(r_{it}) = \beta^n d(n_{it}) + \beta^k d(k_{it}) + \beta^m d(m_{it}) + \sum_t \theta^t D_{it}^t + \varepsilon_{it}. \tag{13}$$

The obtained returns to scale in revenue is $\eta = 0.921$ ($\beta^n = 0.094; \beta^n = 0.04; \beta^m = 0.787$). Since the median and mean values of the estimated markups are both $\mu = 1.11$, equation (12) implies that the expected returns to scale in production is $\gamma = 1.02$, and this validates our assumption of constant returns to scale in the production function.

Next, we validate the assumption of perfectly competitive factor markets using equation (11). Since the estimated returns to scale in revenue is 0.921 and the empirical aggregate value of profit shares in revenue is around 4% in private and foreign firms,[7] we expect that $\rho = 0.97$. Thus, equation (11) validates the assumption that input markets are perfectly competitive, excluding the possibility such as labor market monopsony that results in an upward-sloping labor supply curve.

Finally, we estimate the elasticity of input cost with respect to each input and verify if $\rho = \sum_{j=1}^{n} \rho_j s_j$ holds. We can obtain, for example, the elasticity of labor cost with respect to labor from the following equation:

$$\rho_N = \frac{d \ln\left[C(w_{it}, N_{it})\right]}{d \ln(N_{it})} \tag{14}$$

where $C(w_{it}, N_{it})$ is the cost function of labor, which is labor compensation in the data.

We can obtain ρ_N by regressing $\ln\left[C(w_{it}, N_{it})\right]$ with $\ln(N_{it})$ and find that the estimated elasticity for labor across three types of labor are right around 1. The results suggest another validation for perfectly competitive labor market. Not surprisingly, we obtain the similar results of the elasticity of unity for intermediate input. Although we do not have a direct measure of capital payments, if we use the sum of interest paid and capital depreciation, we obtain that the elasticity is around 0.9. Overall, the expected value ($\rho = 0.97$) from equation (11) is consistent with the sum of the elasticity of cost with respect to inputs ($\sum_{j=1}^{n} \rho_j s_j = 0.98$) estimated from equation (14).

Appendix 5: Capital Intensity

In this section, the change in capital intensity at the aggregate level is decomposed into its between and within effects. The equation used for this decomposition exercise is

$$\triangle CI = \sum \triangle S_i ACI_i + \sum \triangle CI_i AS_i. \tag{15}$$

In equation (15), the change in capital intensity during 1998 to 2007 (i.e., 0.421 from 0.876 in 1998 to 1.297 in 2007; see the second panel in Table A.1) is $\triangle CI = CI_{2007} - CI_{1998}$ where CI_{1998} and CI_{2007} are capital intensities from the balanced sample in manufacturing in 1998 and 2007. We also define the following four variables: (1) the change in capital intensity of firm i is $\triangle CI_i = CI_{i,2007} - CI_{i,1998}$ where $CI_{i,1998}$ and $CI_{i,2007}$ are capital intensities for firm i in 1998 and 2007, (2) the change in the share in employment for firm i is $\triangle S_i = S_{i,2007} - S_{i,1998}$ where

[7] We have argued throughout the main paper that profit maximization was not the sole objective of SOEs.

$S_{i,1998}$ and $S_{i,2007}$ are the shares of firm i in employment in 1998 and 2007, (3) the average capital intensity for firm i at 1998 and 2007 is $ACI_i = 0.5(CI_{i,1998} + CI_{i,2007})$, and (4) firm i's average share in employment is $AS_i = 0.5(S_{i,1998} + S_{i,2007})$. In equation (15), the first term in the right-hand side is the between effect, which captures the change associated with the share of each firm in employment. The second term is the within effect because it measures the change in capital intensity within each firm i.

We find that almost all the increase in capital intensity at the aggregate level (0.421) stems from the within effect (0.458), and the between effect does not contribute to the increase in capital intensity (-0.037). Our results indicate that the composition change in firms, as well as the composition changes in industries and ownerships, is not responsible for the increase in aggregate capital intensity in Chinese manufacturing during the period of 1998-2007.

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Tables and Figures

Table A.1: Summary statistics for the entire and balanced data

1. Entire sample

	SOE			private			foreign			total		
	1998	2007	change	1998	2007	change	1998	2007	change	1998	2007	change
The number of firms	35,793	11,787	-67.1%	17,868	190,580	966.6%	20,925	54,519	160.5%	119,185	270,368	126.8%
Real output (billion RMB)	1,907	4,014	110.5%	506	11,387	2149.2%	1,351	8,552	532.8%	5,090	25,159	394.3%
Employee (1,000)	21,538	7,988	-62.9%	3,912	29,119	644.3%	6,214	18,790	202.4%	42,324	58,831	39.0%
Real capital (billion RMB)	1,899	1,786	-5.9%	190	2,595	1264.7%	626	1,928	207.7%	3,195	6,575	105.8%
Profits/value added (%)	2.8%	21.6%	18.8%	17.4%	19.6%	2.2%	13.9%	22.5%	8.7%	9.5%	20.9%	11.4%
Wage bill/value added (%)	31.5%	17.4%	-14.1%	22.6%	15.9%	-6.7%	23.3%	23.5%	0.2%	26.4%	18.4%	-7.9%
Intermediate inputs/revenue (%)	75.5%	75.5%	0.0%	77.4%	75.3%	-2.1%	77.8%	77.1%	-0.7%	76.9%	75.9%	-1.0%
Share of unprofitable firms (%)	42.7%	21.7%	-21.0%	15.5%	9.5%	-6.0%	31.7%	20.3%	-11.4%	27.2%	12.4%	-14.8%
Real wage rate (RMB)	8,136	26,671	227.8%	7,563	17,880	136.4%	12,727	27,230	114.0%	8,469	22,177	161.9%
Capital intensity	0.892	2.029	127.4%	0.483	0.813	68.4%	0.987	0.920	-6.7%	0.754	1.013	34.3%

2. Balanced sample

	SOE			private			foreign			total		
	1998	2007	change	1998	2007	change	1998	2007	change	1998	2007	change
The number of firms	5,989	3,537	-40.9%	5,684	14,391	153.2%	6,910	7,292	5.5%	28,360	28,360	0.0%
Real output (billion RMB)	827	2,162	161.4%	212	2,651	1149.2%	636	2,241	252.2%	2,101	7,635	263.5%
Employee (1,000)	8,257	4,231	-48.8%	1,506	5,830	287.0%	2,727	4,454	63.3%	15,659	15,688	0.2%
Real capital (billion RMB)	839	944	12.5%	76	643	749.4%	306	518	69.2%	1,375	2,237	62.8%
Profits/value added (%)	8.8%	23.6%	14.8%	19.1%	21.9%	2.8%	18.1%	23.9%	5.8%	13.8%	23.0%	9.2%
Wage bill/value added (%)	31.0%	17.6%	-13.4%	21.5%	15.2%	-6.3%	22.9%	22.8%	-0.1%	26.3%	18.1%	-8.2%
Intermediate inputs/revenue (%)	74.5%	74.1%	-0.4%	77.6%	76.5%	-1.1%	77.4%	76.3%	-1.1%	76.4%	75.7%	-0.6%
Share of unprofitable firms (%)	26.2%	22.0%	-4.3%	11.1%	12.0%	0.8%	26.8%	19.2%	-7.5%	19.3%	15.6%	-3.7%
Real wage rate (RMB)	9,505	28,599	200.9%	7,822	19,039	143.4%	13,837	30,561	120.9%	9,737	25,301	159.8%
Capital intensity	1.027	2.023	96.9%	0.497	1.015	104.1%	1.096	1.043	-4.9%	0.876	1.297	48.1%

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) The column denoted "change" reports a percentage-point change from 1998 to 2007 for the variables with (%). The same column reports a percentage change from 1998 to 2007 for the other variables. (4) Capital intensity is real capital divided by augmented labor (See online appendices 1 and 3).

Table A.2: Summary statistics for SOEs

1. Entire sample

	Top central SOEs			Other SOEs			All SOEs		
	1998	2007	change	1998	2007	change	1998	2007	change
The number of firms	120	230	91.7%	35,673	11,557	-67.6%	35,793	11,787	-67.1%
Real output (billion RMB)	370	1,053	184.9%	1,538	2,961	92.3%	1,907	4,014	110.5%
Employee (1,000)	1,819	1,428	-21.5%	19,719	6,560	-66.5%	21,538	7,988	-62.9%
Real capital (billion RMB)	387	476	22.9%	1,512	1,311	-13.6%	1,899	1,786	-5.9%
Profits/value added (%)	6.0%	21.7%	15.7%	1.9%	21.6%	19.8%	2.8%	21.6%	18.8%
Wage bill/value added (%)	18.6%	14.4%	-4.2%	35.3%	18.7%	-16.6%	31.5%	17.4%	-14.1%
Intermediate inputs/revenue (%)	71.4%	73.0%	1.6%	76.4%	76.4%	0.0%	75.5%	75.5%	0.0%
Share of unprofitable firms (%)	20.8%	12.2%	-8.7%	42.8%	21.9%	-20.8%	42.7%	21.7%	-21.0%
Real wage rate (RMB)	13,000	37,200	186.1%	7,687	24,378	214.9%	8,136	26,671	227.8%
Capital intensity	2.197	3.009	37.0%	0.775	1.814	157.9%	0.892	2.029	127.4%

2. Balanced sample

	Top central SOEs			Other SOEs			All SOEs		
	1998	2007	change	1998	2007	change	1998	2007	change
The number of firms	66	124	87.9%	5,923	3,413	-42.4%	5,989	3,537	-40.9%
Real output (billion RMB)	184	590	219.9%	643	1,572	144.7%	827	2,162	161.4%
Employee (1,000)	1,137	858	-24.5%	7,119	3,373	-52.5%	8,257	4,231	-48.8%
Real capital (billion RMB)	178	241	35.3%	661	703	6.3%	839	944	12.5%
Profits/value added (%)	11.4%	26.9%	15.5%	7.9%	21.9%	14.1%	8.8%	23.6%	14.8%
Wage bill/value added (%)	19.5%	14.5%	-5.0%	35.2%	19.2%	-16.0%	31.0%	17.6%	-13.4%
Intermediate inputs/revenue (%)	69.2%	67.6%	-1.6%	76.0%	76.6%	0.6%	74.5%	74.1%	-0.4%
Share of unprofitable firms (%)	22.7%	5.6%	-17.1%	26.3%	22.6%	-3.7%	26.2%	22.0%	-4.3%
Real wage rate (RMB)	11,582	40,268	247.7%	9,173	25,630	178.4%	9,505	28,599	200.9%
Capital intensity	1.622	2.521	55.4%	0.935	1.894	123.5%	1.027	2.023	96.9%

Notes: See Table A.1.

Table A.3: Robustness checks for the CES production function estimates

1. Translog with Kmenta (1967)

1.1 2-digit sectors (σ_s>1 for 92.9% of the 2-digit sectors)

	Estimated parameters				5%
	Mean	St.dev	Min	Max	significant
σ_s (implied elasticity of substitution)	1.229	0.165	0.828	1.685	-
ln(labor)	0.105	0.025	0.067	0.167	100.0%
ln(capital)	0.079	0.021	0.029	0.120	100.0%
ln(labor)ln(capital)	-0.007	0.005	-0.012	0.011	85.7%

1.2 3-digit sectors (σ_s>1 for 81.2% of the 3-digit sectors)

	Estimated parameters				5%
	Mean	St.dev	Min	Max	significant
σ_s (implied elasticity of substitution)	1.246	0.323	0.358	2.404	-
ln(labor)	0.104	0.037	0.035	0.253	100.0%
ln(capital)	0.078	0.027	-0.015	0.154	97.7%
ln(labor)ln(capital)	-0.005	0.012	-0.025	0.093	42.1%

2. NLS with fixed effects

2.1 2-digit sectors (σ_s>1 for 96.3% of the 2-digit sectors)

	Estimated parameters				5%
	Mean	St.dev	Min	Max	significant
σ_s (elasticity of substitution)	1.547	0.216	0.932	1.954	92.6%
α_s (weight on factor inputs)	0.177	0.033	0.126	0.251	100.0%
a_s (weight on labor)	0.534	0.083	0.404	0.816	100.0%

2.2 3-digit sectors (σ_s>1 for 95.0% of the 3-digit sectors)

	Estimated parameters				5%
	Mean	St.dev	Min	Max	significant
σ_s (elasticity of substitution)	1.529	0.398	0.389	2.490	71.7%
α_s (weight on factor inputs)	0.179	0.045	0.085	0.310	100.0%
a_s (weight on labor)	0.551	0.117	0.305	1.065	100.0%

Table A.4: Robustness checks for GMM estimates for 136 3-digit sectors

1. Baseline specification (σ_s>1 for 95.6%)

	Mean	St.dev	Min	Max
Parameters				
σ_s (elasticity of substitution)	1.553	0.366	0.624	2.436
α_s (weight on factor inputs)	0.169	0.059	0.060	0.343
a_s (weight on labor)	0.548	0.108	0.261	0.900
m_s (minimum value of $m_s(\Omega)$)	6.5E-04	1.4E-03	1.0E-06	1.0E-02

2. Unadjusted employee (σ_s>1 for 94.9%)

	Mean	St.dev	Min	Max
Parameters				
σ_s (elasticity of substitution)	1.545	0.379	0.624	2.436
α_s (weight on factor inputs)	0.168	0.058	0.060	0.343
a_s (weight on labor)	0.548	0.109	0.261	0.900
m_s (minimum value of $m_s(\Omega)$)	6.6E-04	1.4E-03	5.4E-07	1.1E-02

3. Alternative human-capital adjustment (σ_s>1 for 94.1%)

	Mean	St.dev	Min	Max
Parameters				
σ_s (elasticity of substitution)	1.498	0.343	0.624	2.371
α_s (weight on factor inputs)	0.155	0.056	0.040	0.313
a_s (weight on labor)	0.558	0.110	0.261	0.835
m_s (minimum value of $m_s(\Omega)$)	1.0E-03	1.9E-03	9.6E-06	1.7E-02

4. Without SOE continuers (σ_s>1 for 94.9%)

	Mean	St.dev	Min	Max
Parameters				
σ_s (elasticity of substitution)	1.539	0.356	0.624	2.436
α_s (weight on factor inputs)	0.168	0.061	0.060	0.343
a_s (weight on labor)	0.550	0.108	0.261	0.900
m_s (minimum value of $m_s(\Omega)$)	6.6E-04	1.4E-03	2.5E-06	1.2E-02

5. Without the CRS Restriction (σ_s>1 for 94.9%)

	Mean	St.dev	Min	Max
Parameters				
σ_s (elasticity of substitution)	1.533	0.356	0.624	2.296
α_s (weight on factor inputs)	0.172	0.052	0.060	0.345
α_s* (weight on intermediate inputs)	0.547	0.123	0.256	0.865
a_s (weight on labor)	0.810	0.053	0.672	0.945
m_s (minimum value of $m_s(\Omega)$)	1.2E-04	3.8E-04	1.0E-06	4.2E-03
Implied returns to scale	0.982	0.037	0.900	1.080

6. Without the Cobb-Douglas Restriction (σ_s>1 for 96.3%)

	Mean	St.dev	Min	Max
Parameters				
σ_s (substitution between capital and labor)	1.530	0.346	0.624	2.378
a_s (weight on labor)	0.542	0.107	0.256	0.895
σ_s* (substitution between factor/intermediate inputs)	1.022	0.082	0.917	1.099
a_s* (weight on factor input)	0.178	0.056	0.060	0.338
m_s* (minimum value of $m_s(\Omega)$)	1.0E-03	2.0E-03	1.7E-06	1.5E-02