Does External Monitoring Improve the Performance of State-Owned Enterprises?

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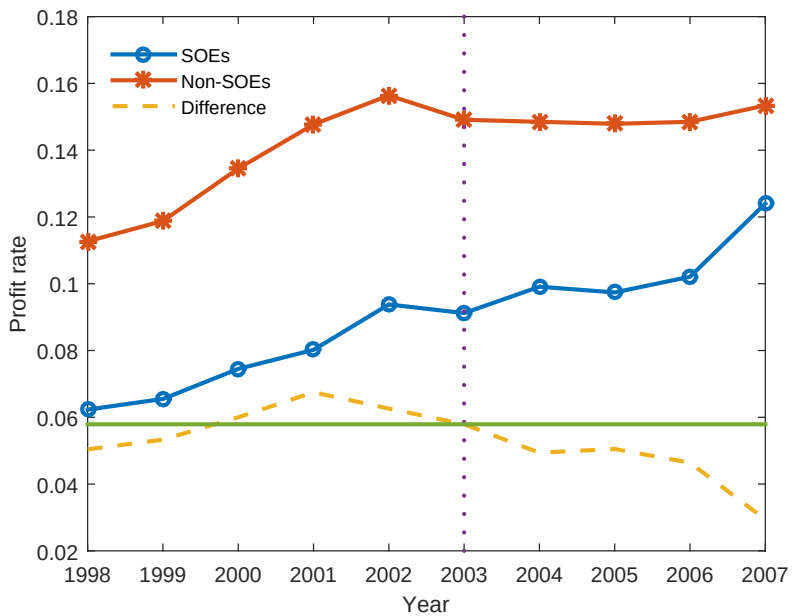
Motivation

Like in many countries, Chinese state-owned enterprises (SOEs), compared with private firms in manufacturing industries, are:

- larger – more capital stock and advantages in technology;
- underperforming – lower profitability and productivity (Jefferson and Rawski, 1994; Xu, 2011; Brandt, et al., 2012);

Nonetheless, the gap has narrowed down over time, especially after 2003 (Hsieh and Song, 2015; Berkowitz et al., 2018).



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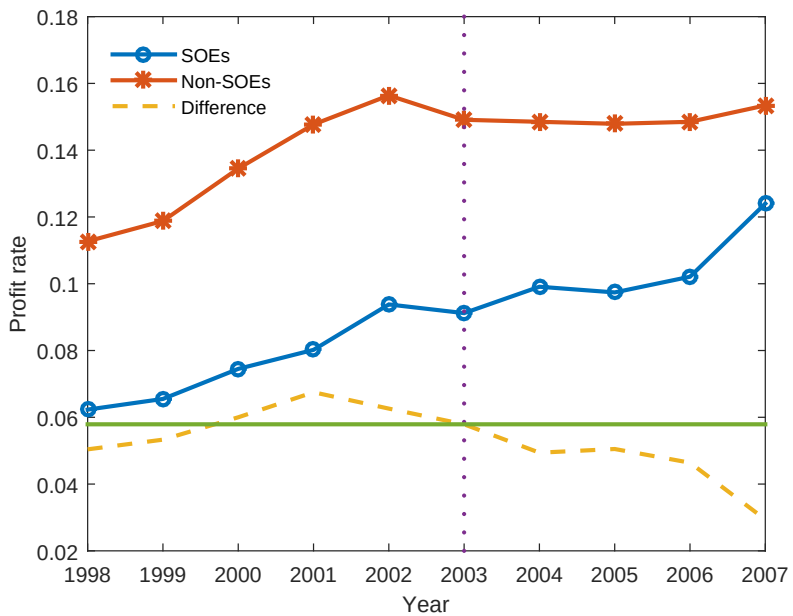

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Traditional focuses and explanations:

- internal incentivization/ effect of privatization:
  Groves, et al, 1994; Li, 1997; Estrin, et al, 2009; Chen, et al, 2017;
- roles of labor and capital inputs:
  Firth et al., 2009; Song et al., 2011; Berkowitz et al., 2018.

But an important perspective from corporate governance is much less explored:

- SOEs face ineffective external monitoring on their management, due to:
  - unclear property rights ("owned by all the people");
  - weak legal enforcement arising from strong political connections.
- This may lead to higher prices of intermediate material inputs *and* lower productivity of SOEs.

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Research Question

How does external monitoring from government influence SOE performance, by affecting managerial expropriation in procurement (material input prices) and shirking in production management (productivity)?

Weak monitoring $\Longrightarrow$ Procurement corruption $\Longrightarrow$ Higher input prices

$\Downarrow$ $\Downarrow$

Managerial shirking $\Longrightarrow$ Lower productivity $\Longrightarrow$ Weaker performance

Why Focus on External Monitoring?

- An indispensable component in corporate governance to reduce managerial expropriation and shirking (Becker, 1968; Allingham and Sandmo, 1972).
- Weak external monitoring leads to SOE managers' opportunistic behaviors: corruption in material procurement and shirking in production management;
  $\Longrightarrow$ higher material input prices and lower productivity;
  $\Longrightarrow$ lower profitability.

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Why Care Material Input Prices?

1. Large heterogeneity across firms (Ornaghi, 2006; Atalay, 2014);
2. Biased productivity estimate if material prices heterogeneity is ignored;
3. A direct channel through which external monitoring has an impact;
4. Large potential gains: material input accounts for a significant part of total variable costs (80-90%).

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Challenges

- Need to identify the mechanism from many firm performance drivers/policies involved;
- Our data—like most manufacturing survey datasets—does not include firm-level data on material input prices.
- Even if input prices are observed, they are usually not readily comparable, because firms choose input quality which vary by firm and is unobserved.

What's New in This Paper

- Study the impacts of external monitoring on SOE performance directly.
- ...through two distinct channels: material input prices and productivity.
- Document the gaps between SOEs and non-SOEs in terms of both material input prices and productivity.
- Investigate the causality between external monitoring and SOE performance, using variations of monitoring strength in both time and spatial dimensions.
- We show that monitoring enhancement can be an alternative policy tool to improve SOE performance.

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SOE Reform and External Monitoring

Waves of SOE reform:

1. 1978-1984: management reform – greater autonomy and retaining profits.
2. 1985-1992: market-orientated reform – increased competition.
3. 1993-: ownership reform – privatization.

Fundamental problems of external monitoring remain:

- individuals do not have incentive to monitor.
- weak monitoring from government:
  - multiple departments jointly supervise, shirking responsibility.

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Implications of Weak Monitoring

SOE managers had the ultimate control (insider control problem) $\rightarrow$

- higher material prices, due to managers'
  - corruption and kickbacks in material procurement (Cheng, 2004);
  - conduct self-dealing and relational transactions;
  - shirk in bargaining for better material prices in the input market.
- lower productivity, due to managers'
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A Nationwide Policy Shock: SASAC

To strengthen monitoring and management of SOEs, the State Council of China announced the establishment of State-owned Assets Supervision and Administration Commission (SASAC):

- established in March 2003;
- single powerful department with full responsibility for SOE performance;
- hierarchy: central, provincial, and prefecture-level SASAC offices;
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Preview of Empirical Results

Findings:

- Gaps: SOEs' productivity is lower by 20% and they pay 6.4% higher input prices compared with non-SOEs;
- Evidence of causality:
  - Time dimension: SASAC narrowed down the gaps in input prices and productivity by one-half;
  - Spatial dimension: SOEs far away to their oversight governments have lower productivity and pay higher input prices.
- Catch-up: Strengthened external monitoring significantly contributed to the catch-up of SOEs to non-SOEs.

Implication:

- Monitoring enhancement as an alternative way of privatization.

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Data: Chinese Manufacturing Industries

Firm-level survey from National Bureau of Statistics in China (1998-2007)

- all SOEs and non-SOEs with annual sales above 600,000 USD;
- 326,294 firms in total across 19 two-digit (SIC) manufacturing industries;
- 35,551 SOEs: state ownership over 30%, following Huang et al. (AER, 2018);
- firm-level total sales, number of workers, wage expenditure, material expenditure, capital stock, ownership, location, industry, etc.

Construction of Key Measures

Three key measures at the firm-level:

- input price and productivity using Grieco, Li, and Zhang (2016, 2018).
  - Grieco, Li, and Zhang (IER, 2016):
    - biased production estimation if input prices heterogeneity ignored;
    - estimate production functions with unobserved input prices heterogeneity.
  - Grieco, Li, and Zhang (2018):
    - take firms endogenous choices of material quality into account;
    - produce quality-adjusted measures of input prices and productivity.
- total factor productivity (TFP) using Levinsohn and Petrin (2003), without controlling for input price heterogeneity, a safeguard of our analysis.

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Setup of the Empirical Model

Demand function:

$$P_{jt} = (Q_{jt})^{1/\eta}.$$

Production function:

$$Q_{jt} = \tilde{\Omega}_{jt}\left[\alpha_L L_{jt}^{\gamma} + \alpha_M M_{jt}^{\gamma} + \alpha_K K_{jt}^{\gamma}\right]^{\frac{1}{\gamma}}.$$

Firm capability following Kugler and Verhoogen (2009, 2012):

$$\tilde{\Omega}_{jt} = \left[\Omega_{jt}{}^{\theta} + H_{jt}^{\theta}\right]^{\frac{1}{\theta}}.$$

Input price menu:

$$\tilde{P}_{Mjt} = P_{Mjt} H_{jt}.$$

Material expenditure:

$$E_{Mjt} = \tilde{P}_{Mjt} M_{jt}.$$

Profit maximization:

$$\max_{Q_{jt}, L_{jt}, M_{jt}, H_{jt}} \quad P_{jt} Q_{jt} - \tilde{P}_{Mjt} M_{jt} - P_{L_{jt}} L_{jt}.$$

Setup of the Empirical Model

Denote $\omega_{jt} \equiv \ln \Omega_{jt}$, and assume it evolves according to an AR(1) process:

$$\omega_{jt+1} = f_0 + f_{soe} SOE_{jt} + f_{SASAC} SASAC_t + f_1 \omega_{jt} + \epsilon^{\omega}_{jt+1},$$

Denote $p_{Mjt} = \ln P_{Mjt}$, and assume it evolves according to an AR(1) process:

$$p_{Mjt+1} = g_0 + g_{soe} SOE_{jt} + g_{SASAC} SASAC_t + g_1 p_{Mjt} + \epsilon^{p}_{jt+1},$$

Note: no priori assumption on whether SOEs have lower or higher input prices or productivity, compared with non-SOEs.

Preferred Measures of Input Prices and Productivity

Two-stage estimation

Stage 1: quality-inclusive measures $(\tilde{\Omega}_{jt}, \tilde{P}_{Mjt})$, by Grieco, Li, and Zhang (2016)

- Use first order conditions of labor and material to recover:

$$
\begin{aligned}
M_{jt} &= \left[\frac{\alpha_L E_{Mjt}}{\alpha_M E_{Ljt}}\right]^{\frac{1}{\gamma}} L_{jt} \\
\tilde{\Omega}_{jt} &= \frac{1}{\alpha_L}\frac{\eta}{1+\eta} L_{jt}^{-\gamma} E_{L_{jt}} \left[\alpha_L L_{jt}^{\gamma}\left(1+\frac{E_{M_{jt}}}{E_{L_{jt}}}\right) + \alpha_K K_{jt}^{\gamma}\right]^{1-\frac{1}{\gamma}(1+\frac{1}{\eta})}
\end{aligned}
$$

- Substitute into revenue equation to estimate production and demand parameters.

$$
R_{jt} = \frac{\eta}{1+\eta}\left[E_{M_{jt}} + E_{L_{jt}}\left(1+\frac{\alpha_K}{\alpha_L}\left(\frac{K_{jt}}{L_{jt}}\right)^{\gamma}\right)\right] e^{\epsilon_{jt}}.
$$

Preferred Measures of Input Prices and Productivity

Two-stage estimation

Stage 2: quality-adjusted measures (Ω_{jt}, P_{Mjt}), by Grieco, Li, and Zhang (2018)

- First order condition of input quality implies that input quality is a monotone function of productivity (in logs):

$$h_{jt} = \frac{1}{\theta} \ln \frac{\sigma_{Mjt}}{1 - \sigma_{Mjt}} + \omega_{jt}$$

- Use this in capability function and input price menu to recover (in logs),

$$\begin{aligned} \omega_{jt} &= \tilde{\omega}_{jt} + \frac{1}{\theta} \ln(1 - \sigma_{Mjt}), \\ p_{Mjt} &= \tilde{p}_{Mjt} - \tilde{\omega}_{jt} - \frac{1}{\theta} \ln(\sigma_{Mjt}), \end{aligned}$$

- Estimate θ, with σ_{Mjt}, $\tilde{\omega}_{jt}$, and $\tilde{p}_{jt}$ computed from data and stage 1, using Markov assumption *a la* Olley and Pakes (1996).

SOEs v.s. Non-SOEs

Conjecture 1 (SOEs v.s. non-SOEs) SOEs pay higher input price and have lower productivity, compared with non-SOEs.

Regressions:

$$Y_{jt} = \beta_0 + \beta_{soe} SOE_{jt} + \beta_z Z_{jt} + \lambda_{ind} + \lambda_{prov} + \lambda_t + \varepsilon_{jt},$$

where Y_{jt} is input prices, productivity, or TFP (all in logarithm), and Z_{jt} includes firm characteristics (e.g., age, size).

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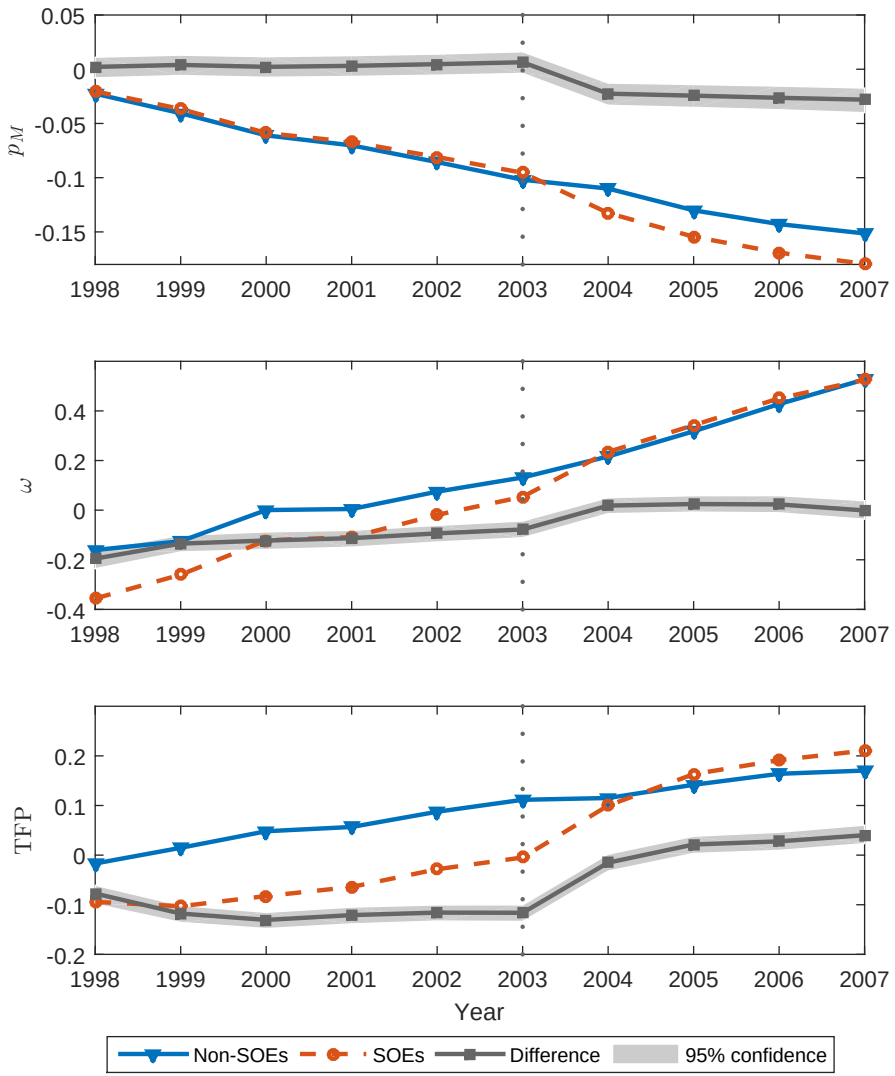
Performance Comparison of SOE and non-SOEs

	(1) input price	(2) input price	(3) productivity	(4) productivity	(5) TFP	(6) TFP
SOE	0.067***	0.064***	-0.226***	-0.199***	-0.170***	-0.161***
	(0.001)	(0.001)	(0.004)	(0.003)	(0.002)	(0.002)
Age, Size	YES	YES	YES	YES	YES	YES
R&D, K-intensity		YES		YES		YES
Observations	1196053	873414	1196053	873414	1196053	873414
Adjusted R^2	0.943	0.967	0.928	0.966	0.685	0.725

Evolution of Key Measures (Mean), SOE vs non-SOE



SASAC and SOE Performance

Conjecture 2 (SASAC Effect) The establishment of SASAC reduces input prices and increases productivity of SOEs.

Regressions:

$$Y_{jt} = \beta_0 + \beta_{soe} SOE_{jt} + \beta_{soe*SASAC} (SOE_{jt} * SASAC_t) + \beta_z Z_{jt} + \lambda_{ind} + \lambda_{prov} + \lambda_t + \varepsilon_{jt}.$$

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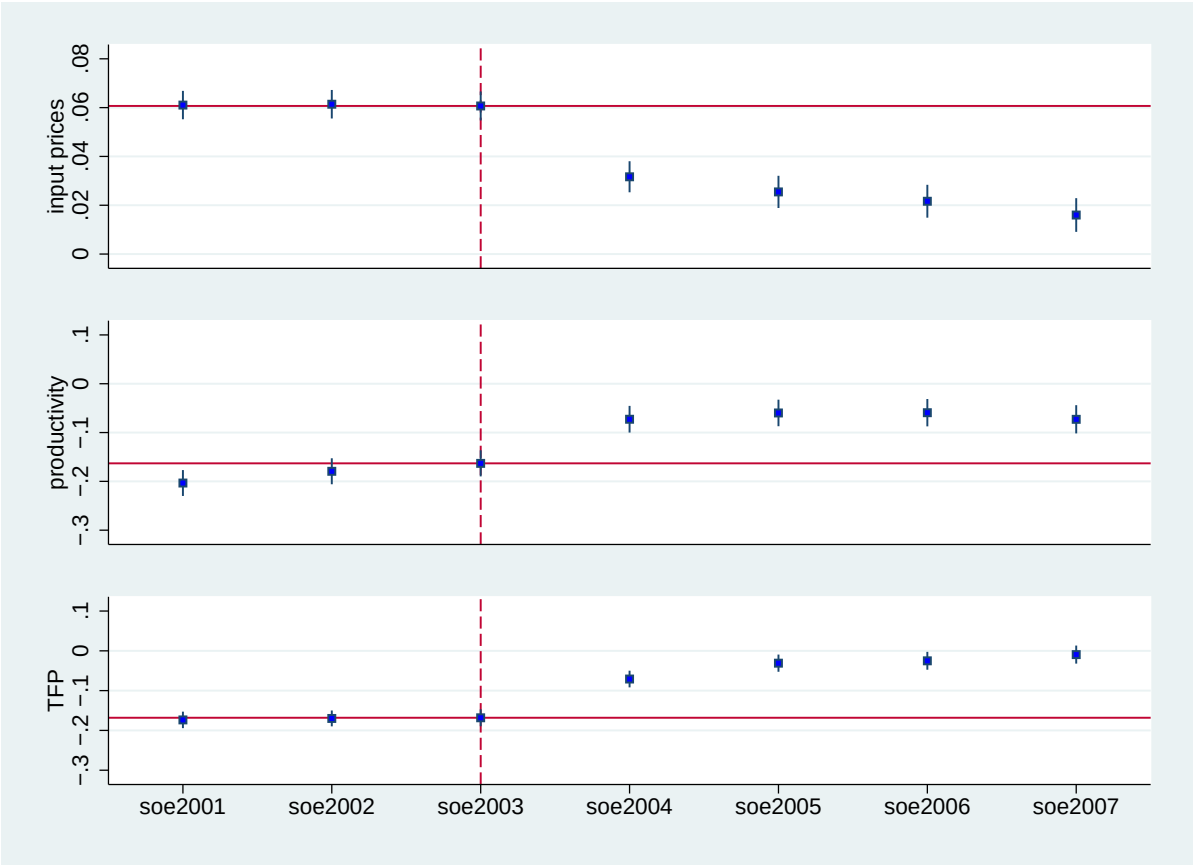
SASAC and SOE Performance

	(1) input price	(2) input price	(3) productivity	(4) productivity	(5) TFP	(6) TFP
SOE	0.082***	0.076***	-0.283***	-0.239***	-0.200***	-0.191***
	(0.001)	(0.001)	(0.005)	(0.003)	(0.002)	(0.003)
SASAC*SOE	-0.056***	-0.039***	0.213***	0.126***	0.113***	0.095***
	(0.001)	(0.001)	(0.006)	(0.004)	(0.004)	(0.004)
Age, Size	YES	YES	YES	YES	YES	YES
R&D, K-intensity		YES		YES		YES
Observations	1196053	873414	1196053	873414	1196053	873414
Adjusted R^2	0.943	0.967	0.929	0.966	0.686	0.726

Dynamic Effect of SASAC and Test for Pre-trend



$$Y_{jt} = \beta_0 + \beta_{soe} SOE_{jt} + \sum_{t=2001}^{2007} \beta_{soe*t} \left(SOE_{jt} * D_t\right) + \beta_z Z_{jt} + \lambda_{ind} + \lambda_{prov} + \lambda_t + \varepsilon_{jt}.$$

Monitoring Costs and SOE Performance

Larger monitoring costs → lower strength of monitoring → higher level of shirking/managerial expropriation → weaker performance.

Proxy monitoring costs as distance of an SOE to its oversight government:

- information asymmetry and monitoring difficulties, following Huang et al. (AER, 2018);
- each SOE has its own oversight government.

Potential concern: distance may contain effect of agglomeration and localization.

Solution:

- same affiliation system for non-SOEs;
- but, non-SOEs' affiliated government bears no responsibility for monitoring.

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Monitoring Costs and SOE Performance

Conjecture 3 (Monitoring Costs and SOE Performance) Higher monitoring costs reduce SOE performance, through the input prices and productivity channels.

Regressions:

$$\begin{aligned} Y_{jt} &= \beta_0 + \beta_{soe} SOE_{jt} + \beta_{soe*dist} \left(SOE_{jt} * Dist_{jt}\right) + \beta_{dist} Dist_{jt} + \beta_z Z_{jt} \\ &+ \lambda_{ind} + \lambda_{prov} + \lambda_t + \varepsilon_{jt}. \end{aligned}$$

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SOE	0.062***	0.060***	-0.189***	-0.169***	-0.165***	-0.157***
	(0.002)	(0.001)	(0.008)	(0.006)	(0.005)	(0.005)
SOE*Dist	0.002***	0.001***	-0.011***	-0.006***	0.001	0.002
	(0.001)	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)
Dist	YES	YES	YES	YES	YES	YES
Age, Size	YES	YES	YES	YES	YES	YES
R&D, K-intensity		YES		YES		YES
Observations	541117	392900	541117	392900	541117	392900
Adjusted R^2	0.946	0.970	0.928	0.966	0.669	0.707

Monitoring Costs, SASAC, and Performance

Combining both the time dimension and spatial dimension, we expect:

SASAC alleviates the negative effects of monitoring costs, because:

- larger potential gains;
- SASAC may spend more monitoring effort on distant firms.

Regressions:

$$\begin{aligned} Y_{jt} = {} & \beta_0 + \beta_{soe} SOE_{jt} + \beta_{soe*dist} (SOE_{jt} * Dist_{jt}) + \beta_{soe*sasac} (SOE_{jt} * SASAC_t) \\ & + \beta_{soe*dist*sasac} (SOE_{jt} * Dist_{jt} * SASAC_t) + \beta_{dist*sasac} (Dist_{jt} * SASAC_t) \\ & + \beta_{dist} Dist_{jt} + \beta_z Z_{jt} + \lambda_{ind} + \lambda_{prov} + \lambda_t + \varepsilon_{jt}. \end{aligned}$$

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Monitoring Costs, SASAC, and Performance

	(1) input price	(2) input price	(3) productivity	(4) productivity	(5) TFP	(6) TFP
SOE	0.067***	0.064***	-0.222***	-0.196***	-0.175***	-0.165***
	(0.002)	(0.001)	(0.009)	(0.007)	(0.005)	(0.005)
SASAC*SOE	-0.026***	-0.019***	0.141***	0.096***	0.051***	0.035***
	(0.003)	(0.002)	(0.013)	(0.010)	(0.008)	(0.008)
SOE*Dist	0.005***	0.003***	-0.014***	-0.007***	-0.004**	-0.004**
	(0.001)	(0.000)	(0.002)	(0.002)	(0.001)	(0.002)
SASAC*SOE*Dist	-0.007***	-0.005***	0.008**	0.003	0.015***	0.015***
	(0.001)	(0.001)	(0.004)	(0.003)	(0.002)	(0.002)
SASAC*Dist	YES	YES	YES	YES	YES	YES
Dist	YES	YES	YES	YES	YES	YES
Age, Size	YES	YES	YES	YES	YES	YES
R&D, K-intensity		YES		YES		YES
Observations	541117	392900	541117	392900	541117	392900
Adjusted R^2	0.946	0.970	0.928	0.966	0.669	0.708

Alternative Explanations?

- Privatization and Internal Monitoring/Incentive
- Market Power/Competition
- Pre-trend
- Balanced panel
- World Trade Organization
- Alternative Definition of SOEs
- Firm-level Import and Export Engagement
- Firm Fixed Effects

Conclusion

- We empirically investigate how external monitoring affects SOE performance through both channels of material input prices and productivity in the context of Chinese manufacturing industries.
- We apply a structural method to separately estimate material input prices and productivity from observable data.
- Time and spatial evidence shows that ineffective external monitoring contributed to the weak SOE performance.
- Results imply that external monitoring enhancement could be an alternative of privatization to improve firm performance.