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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Traditional focuses and explanations:


- **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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- **internal incentivization/ effect of privatization:**

- **roles of labor and capital inputs:**
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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 $\implies$ Procurement corruption $\implies$ Higher input prices

$\downarrow$

Managerial shirking $\implies$ Lower productivity $\implies$ 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; \( \rightarrow \) higher material input prices and lower productivity; \( \rightarrow \) 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.
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SOE Reform and External Monitoring

Waves of SOE reform:


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) →

- higher material prices, due to managers’
  - corruption and kickbacks in material procurement (Cheng, 2004);
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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


- 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:

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

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

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

Input price menu:

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

Material expenditure:

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

Profit maximization:

\[ \max_{Q_{jt}, L_{jt}, M_{jt}, H_{jt}} \quad P_{jt} Q_{jt} - \tilde{P}_{Mjt} M_{jt} - P_{Ljt} L_{jt}. \]
Setup of the Empirical Model

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

\[
\omega_{jt+1} = f_0 + f_{\text{soe}} \text{SOE}_{jt} + f_{\text{SASAC}} \text{SASAC}_t + f_1 \omega_{jt} + \epsilon_{\omega_{jt+1}},
\]

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

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p_{Mjt+1} = g_0 + g_{\text{soe}} \text{SOE}_{jt} + g_{\text{SASAC}} \text{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:

$$M_{jt} = \left[ \frac{\alpha_L E_{Mjt}}{\alpha_M E_{Ljt}} \right]^{\frac{1}{\gamma}} L_{jt}$$

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

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

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

  \[
  \omega_{jt} = \tilde{\omega}_{jt} + \frac{1}{\theta} \ln(1 - \sigma_{Mjt}),
  \quad p_{Mjt} = \tilde{p}_{Mjt} - \tilde{\omega}_{jt} - \frac{1}{\theta} \ln(\sigma_{Mjt}),
  \]

- Estimate \(\theta\), with \(\sigma_{Mjt}, \tilde{\omega}_{jt}\), 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:

\[ Y_{jt} = \beta_0 + \beta_{soe}SOE_{jt} + \beta_zZ_{jt} + \lambda_{ind} + \lambda_{prov} + \lambda_t + \varepsilon_{jt}, \]

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

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<thead>
<tr>
<th></th>
<th>(1) input price</th>
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<tbody>
<tr>
<td>SOE</td>
<td>0.067***</td>
<td>0.064***</td>
<td>-0.226***</td>
<td>-0.199***</td>
<td>-0.170***</td>
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<tr>
<td>Adjusted $R^2$</td>
<td>0.943</td>
<td>0.967</td>
<td>0.928</td>
<td>0.966</td>
<td>0.685</td>
<td>0.725</td>
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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:

\[ Y_{jt} = \beta_0 + \beta_{soe} SOE_{jt} + \beta_{soe*SASAC} (SOE_{jt} \times SASAC_t) + \beta_z Z_{jt} + \lambda_{ind} + \lambda_{prov} + \lambda_t + \epsilon_{jt}. \]
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Dynamic Effect of SASAC and Test for Pre-trend

\[ Y_{jt} = \beta_0 + \beta_{soe} SOE_{jt} + \sum_{t=2001}^{2007} \beta_{soe \times t} (SOE_{jt} \times D_t) + \beta_z Z_{jt} + \lambda_{ind} + \lambda_{prov} + \lambda_t + \varepsilon_{jt} \]

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Monitoring Costs and SOE Performance

Larger monitoring costs $\rightarrow$ lower strength of monitoring $\rightarrow$ higher level of shirking/managerial expropriation $\rightarrow$ 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:

\[ Y_{jt} = \beta_0 + \beta_{soe} SOE_{jt} + \beta_{soe*dist} (SOE_{jt} \times Dist_{jt}) + \beta_{dist} Dist_{jt} + \beta_z Z_{jt} \]
\[ + \lambda_{ind} + \lambda_{prov} + \lambda_t + \epsilon_{jt}. \]
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:

\[ Y_{jt} = \beta_0 + \beta_{soe} SOE_{jt} + \beta_{soe*dist} (SOE_{jt} \times Dist_{jt}) + \beta_{dist} Dist_{jt} + \beta_z Z_{jt} + \lambda_{ind} + \lambda_{prov} + \lambda_t + \varepsilon_{jt}. \]
## Monitoring Costs and SOE Performance

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Li and Zhang
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:

\[ Y_{jt} = \beta_0 + \beta_{soe} SOE_{jt} + \beta_{soe*dist} (SOE_{jt} \times Dist_{jt}) + \beta_{soe*sasac} (SOE_{jt} \times SASAC_t) + \beta_{soe*dist*sasac} (SOE_{jt} \times Dist_{jt} \times SASAC_t) + \beta_{dist*sasac} (Dist_{jt} \times SASAC_t) + \beta_{dist} Dist_{jt} + \beta_Z Z_{jt} + \lambda_{ind} + \lambda_{prov} + \lambda_t + \epsilon_{jt}. \]
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Li and Zhang
## Monitoring Costs, SASAC, and Performance

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| 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.