

# Privatization and Productivity in China

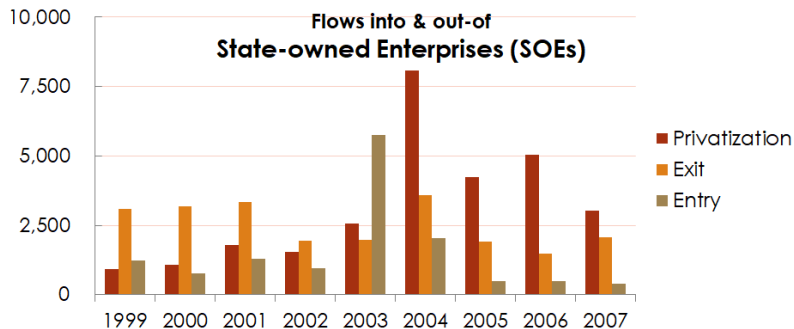
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# Privatization and Productivity

- Effects of ownership change on productivity
  - **Brown, Earle, & Telegdy** ('06 JPE): Eastern Europe; panel regressions
  - **Dinc & Gupta** ('11 J of Finance): India; local elections as IV
  - **Branguinsky, Okazaki, Oyama, & Syverson** ('15 AER): M&A in Meiji Japan
- This paper
  - 1 Exploits **timeline** of privatization
  - 2 Extends ACF/GNR framework (production-function estimation)
    - Firms know their own productivity
    - Selection into "**ownership types**"

# Privatization in China



# Privatization in China: Still a Big Issue

- Reversal of trends
  - “The state advances, the private retreats” (Guó jìn mín tuì)
- The Economist (December 8th, 2018)
  - “Rumors abound on the **state** wanting to take small stakes in [the tech industry’s] big thriving firms.”
  - “Some have been told to expect **party ‘observers’** on their boards from next year.”
  - “The founder of Bytedance, a tech giant founded in 2012, has said publicly that ‘technology must be led by **socialist core values**.’”
  - “When **Jack Ma** of Alibaba was revealed (...) to be a **party member**, (...) some took it to mean that no one now works outside the party-state nexus.”
- Is “the TFP of SOEs  $\approx$  the TFP of private firms” now?
  - **Hsieh & Song** ('15): Yes!
  - **Brandt** ('15): Really?

# Institutional Background

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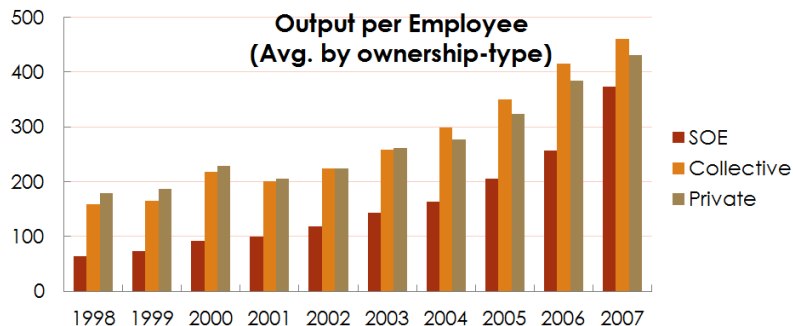
Year	Event
1949	Communist Party took power.
1950s	<b>State took control</b> of productive assets. <ul style="list-style-type: none"><li>- Big businesses: Bureaucrats on board</li><li>- Small businesses: Bundled into collectives</li></ul>
1970s	SOEs earned <b>90% of government revenues</b> .
1980s	Some economic liberalization
1990s	SOEs made <b>net losses</b> .
1998	“Grasp the large, let go of the small” ( <i>Zhuā dà fàng xiǎo</i> )

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# Privatization Program

- Main purpose
  - Get rid of non-performing SOEs (small & medium, regional)
- Government's choice
  - Keep as SOE, or
  - Let go:
    - Shut down, or
    - Allow privatization (mostly by Management Buy-Outs)
- Process takes about 12 months.
  - Petition → Asset inspection → Approval

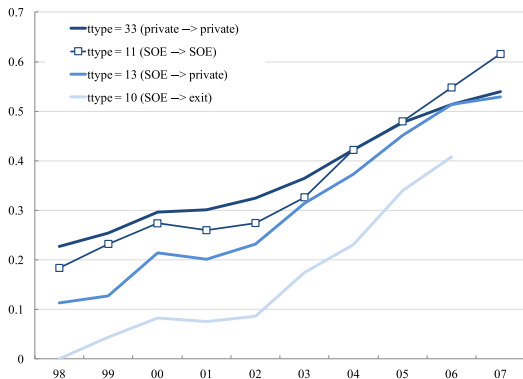
# Data: Survey of Manufacturers



- Labor productivity: Private firms >>> SOEs

# Selection: Suggestive Evidence

- OLS of  $y_{it}$  on  $(k_{it}, l_{it}, m_{it})$  & “ownership-type transition” dummies



- Suggestive, but ignores all endogeneity problems
- Let's use **more flexible model** & incorporate **choice of ownership type**.



# Production Function

- GNR's nonparametric approach (Gandhi, Navarro, & Rivers '17)

$$y_{it} = f(k_{it}, l_{it}, m_{it}, d_{it}) + \omega_{it} + \varepsilon_{it} \quad (1)$$

- We augment: Different  $f(\cdot)$  by “ownership type”  $d_{it}$ 
  - “State-owned”, “private”, or “collective”
  - Systematic gaps in productivity = Different conditional-mean outputs
- Unobserved:
  - Persistent, firm-specific TFP (1st-order Markov),  $\omega_{it}$
  - Pure noise (i.i.d.),  $\varepsilon_{it}$

# Timing Assumption

- 1 Firm knows its own TFP

$$\omega_{it} = h(\omega_{i,t-1}, \text{collectivized}_{it}, \text{privatized}_{it}) + \xi_{it} + \delta_t \quad (2)$$

- Distinguishing “just privatized” from “already private”

- 2 Firm's choice

- $m_{it}$ ,  $k_{i,t+1}$ ,  $l_{i,t+1}$ , &  $d_{i,t+1}$ 
  - One of ACF's two setups (Akerberg, Caves, & Frazer '15)
- **Idea:** Ownership type as “just another input choice” by the firm...
  - ...based on its knowledge of TFP, & implemented with a time lag

- 3 Production

$$y_{it} = f(k_{it}, l_{it}, m_{it}, d_{it}) + \omega_{it} + \varepsilon_{it}$$

# GNR Approach

- 1 Estimate the “slope” of  $f(\cdot)$  w.r.t.  $m_{it}$ .

$$s_{it} \equiv \log \frac{p_{it} M_{it}}{P_{it} Y_{it}} = \underbrace{\log E[e^{\varepsilon_{it}}] + \log \frac{\partial}{\partial m_{it}} f(k_{it}, l_{it}, m_{it}, d_{it})}_{\equiv \log D^{\varepsilon}(k_{it}, l_{it}, m_{it}, d_{it})} - \varepsilon_{it} \quad (3)$$

- 2 Integrate the “slope” to recover  $f(\cdot)$  up to  $C$ .

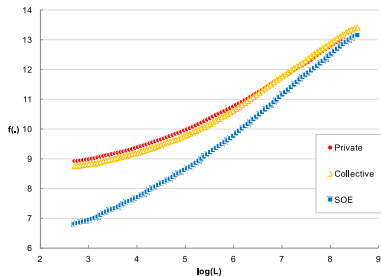
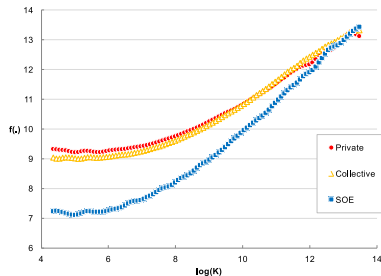
$$f(k_{it}, l_{it}, m_{it}, d_{it}) + C(k_{it}, l_{it}, d_{it}) = \int \frac{D^{\varepsilon}(k_{it}, l_{it}, m_{it}, d_{it})}{E[e^{D^{\varepsilon}(k_{it}, l_{it}, m_{it}, d_{it}; \theta_d)} - s_{it}]} dm_{it} \\ \equiv \mathcal{D}^{\varepsilon}(k_{it}, l_{it}, m_{it}, d_{it}) \quad (4)$$

- 3 Nonlinear GMM to estimate  $C$ ,  $f(\cdot)$ , and  $h(\cdot)$  with moment conditions:

$$E \left[ \hat{\xi}_{it} k_{it}^{a_k} l_{it}^{a_l} \right] = 0 \text{ and} \quad (5)$$

$$E \left[ \hat{\xi}_{it} k_{it}^{a_k} l_{it}^{a_l} d_{it}^{\tau} \right] = 0 \quad (6)$$

# GNR Estimates of Production Functions



- Differences in conditional-mean outputs = Private-SOE gaps in productivity
  - Changes in both level & shape

# Linear Approximation (for Comparison)

- Let's compare GNR estimates with (preliminary) OLS...
- ...by projecting them onto **linear** & **common**  $\tilde{f}(k_{it}, l_{it}, m_{it})$ :

$$\hat{E}[f|k_{it}, l_{it}, m_{it}, d_{it}] \approx \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \beta_{col} d_{it}^{col} + \beta_{pri} d_{it}^{pri} \quad (7)$$

$$\hat{E}[h|\omega_{i,t-1}, coll' d_{it}, priv' d_{it}] \approx \gamma_0 + \rho \omega_{i,t-1} + \gamma_{col} coll' d_{it} + \gamma_{pri} priv' d_{it} \quad (8)$$

- Summarizing the “changes in **level** & **shape**” by different **intercepts** (only)

# OLS vs GNR

Method:	OLS (1)	GNR (linear summary) (2)
Capital ( $\beta_k$ )	0.027 (0.002)	0.193 (0.029)
Labor ( $\beta_l$ )	0.092 (0.003)	0.460 (0.067)
Materials ( $\beta_m$ )	0.876 (0.003)	0.281 (0.099)
Collective ( $\beta_{col}$ )	0.140 (0.006)	0.747 (0.109)
Collectivization initial gap ( $\gamma_{col}$ )	-0.053 (0.008)	-0.709 (0.102)
Private ( $\beta_{pri}$ )	0.147 (0.006)	0.850 (0.147)
Privatization initial gap ( $\gamma_{pri}$ )	-0.005 (0.004)	-0.170 (0.074)
Autocorrelation ( $\rho$ )	- -	0.744 (0.030)
Year dummy	Yes	Yes
2-digit CIC dummy	Yes	Yes
Number of observations	195,980	195,980
Number of privatization/collectivization	10,910	10,910

Note: This table focuses on the year-1998 cohort. CIC is Chinese industry classification code.

- Output **doubles** after privatization:  $\exp(.850) = 2.340$ ;  $\exp(.680) = 1.974$

# Likely Sources of TFP Gaps

- No clear (quantitative) evidence related to:
  - “Mass lay-off”
  - Indicators of innovation (“new product” revenues & Chinese patents)
- Qualitative case studies suggest
  - **Bureaucracy & political interventions** at SOEs: negative TFP “shocks”
  - **Short-run gains**: Managerial freedom w.r.t. demand & organization
  - **Longer-run gains**: Managerial freedom w.r.t. process & product

# More Results

- Time
  - The private-SOE gap **widened** within old cohort, but
  - ...the gap is **narrower** within new cohort.
- Region
  - The gap is also **narrower** in more “economically liberal” regions.
- Sector
  - The gap is **wider** in consumer-facing, final-good, & high-tech industries.
  - The gap is **narrower** in industrials, materials.
  - Unreliable estimates in “strategic” (i.e., regulated) industries



## More (1 of 4): Alternative Definitions of “SOE”

- Baseline definition: Registration type
- Alternative definition: Shareholding percentage

Definition: Method:	50% shareholding threshold		20% shareholding threshold	
	OLS (1)	GNR (2)	OLS (3)	GNR (4)
Collective ( $\beta_{col}$ )	0.076 (0.009)	0.184 (0.034)	0.072 (0.010)	0.230 (0.058)
Initial gap ( $\gamma_{col}$ )	0.011 (0.013)	-0.471 (0.028)	0.014 (0.016)	-0.444 (0.032)
Private ( $\beta_{pri}$ )	0.090 (0.009)	0.378 (0.026)	0.063 (0.006)	0.362 (0.026)
Initial gap ( $\gamma_{pri}$ )	-0.071 (0.007)	-0.123 (0.032)	-0.074 (0.007)	-0.215 (0.101)
Number of observations	195,182	195,182	195,182	195,182
Number of priv'n/collect'n	10,230	10,230	10,014	10,014

- Many SOEs (in the baseline definition) are re-labeled as “private.”
- The “private-SOE gap” **shrinks** almost mechanically (but it’s still wide).
  - $\exp(0.378) = 1.459$ ;  $\exp(0.378 - 0.123) = 1.290$

## More (2 of 4): By Period & Cohort

- Baseline: The 1998 cohort, all years (1998–2007)
- Alternative: Split the sample period into 1998–2002 & 2003–2007

Cohort:	1998 cohort		2003 cohort
	1998-2002	2003-2007	2003-2007
Period:			
Method:	GNR	GNR	GNR
	(1)	(2)	(3)
Collective ( $\beta_{col}$ )	0.644 (0.180)	0.791 (0.153)	0.494 (0.061)
Initial gap ( $\gamma_{col}$ )	-0.597 (0.157)	-0.604 (0.145)	-0.524 (0.066)
Private ( $\beta_{pri}$ )	0.804 (0.224)	<b>1.008</b> (0.210)	<b>0.478</b> (0.067)
Initial gap ( $\gamma_{pri}$ )	-0.184 (0.068)	-0.325 (0.119)	-0.021 (0.025)
Number of observations	123,707	72,273	426,642
Number of priv'n/collect'n	6,113	4,797	16,470

- The private-SOE gap **widened** within the 1998 cohort.
- The private-SOE gap is **narrower** within the 2003 cohort.

## More (3 of 4): By Region

- Baseline: All regions
- Alternative: Split North-South or Inland-Coast

Geographical split: Region: Method:	North vs. South		Inland vs. Coast	
	North GNR (1)	South GNR (2)	Inland GNR (3)	East Coast GNR (4)
Collective ( $\beta_{col}$ )	0.845 (0.389)	0.484 (0.331)	0.819 (0.171)	0.517 (0.385)
Initial gap ( $\gamma_{col}$ )	-0.788 (0.329)	-0.419 (0.360)	-0.758 (0.188)	-0.517 (0.290)
Private ( $\beta_{pri}$ )	1.140 (0.500)	0.499 (0.379)	1.116 (0.219)	0.526 (0.485)
Initial gap ( $\gamma_{pri}$ )	-0.344 (0.158)	-0.080 (0.140)	-0.408 (0.113)	-0.054 (0.156)
Number of observations	81,339	114,464	90,674	105,129
Number of priv'n/collect'n	3,927	6,976	4,458	6,445

- The private-SOE gap is **narrower** in more economically liberal regions.

## More (4 of 4): By Industry Type

- Baseline: All manufacturing industries
- Alternative: By sector

Industry type:	Final goods	Materials	High tech	"Strategic"
Method:	GNR	GNR	GNR	GNR
	(1)	(2)	(3)	(4)
Collective ( $\beta_{col}$ )	0.895 (0.222)	0.436 (0.276)	0.914 (0.387)	-0.058 (0.380)
Initial gap ( $\gamma_{col}$ )	-0.749 (0.191)	-0.510 (0.295)	-0.908 (0.400)	-0.179 (0.387)
Private ( $\beta_{pri}$ )	1.003 (0.295)	0.445 (0.304)	1.057 (0.477)	-0.236 (0.451)
Initial gap ( $\gamma_{pri}$ )	-0.206 (0.135)	-0.017 (0.104)	-0.199 (0.323)	0.192 (0.182)
Number of observations	79,044	59,481	56,161	18,694
Number of priv'n/collect'n	4,269	3,445	3,171	1,071

- **Final-goods:** CIC 13, 14, 15, 17, 18, 19, 20, 21, 23, 24, 31, & 34.
- **Materials:** CIC 22, 25, 26, 28, 29, 30, 32, & 33.
- **High-tech:** CIC 27, 35, 36, 37, 39, 40, 41, & 42.
- "Strategic" (or highly regulated): CIC 24, 25, 27, & 37.

# Summary

- Productivity: Private firms >>> SOEs
  - Most of eventual gains realized immediately
- Mechanism
  - Managerial flexibility (or less bureaucracy/politics)
- SOEs' performance closer to private
  - among new cohorts, in economically liberal regions
- SOEs' performance far behind private
  - in final-good & high-tech sectors
- Privatization & productivity
  - Important driver of modern China's transformation
  - Too important to be left outside IO