Firm Entry and Regional Growth Disparities: the Effect of SOEs in China

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Motivation

- 1992: Take-off for non-state firms in industry in China
- But huge initial dispersion in NSOE output per worker across localities
  - 334 prefectures (geographical administrative units)
  - Chinese Industrial Census Data
  - Output per worker in the Non-state sector, 1992
  - variance of logs is 0.35; 90/10 ratio is 4.2

![Output per Worker, 1992 NSOEs](image)
Motivation

- Solow model: low Y/N could be driven by either low initial capital stock or low TFP

- Low initial capital yields clear prediction: Prefectures with low output per worker should experience
  - investment should increase (mechanism: capital inflow or high savings)
  - new firms should be created
  - inflow of workers (increased employment)
There is no (negative) relationship between
  - creation of new NSOE firms (1994-1995), as a fraction of all 1992 firms
  - output per worker in 1992 for NSOE
There is no (negative) relationship between
- increased investment (flow of capital through new 1994-1995 NSOE firms), as a fraction of all capital in 1995
- output per worker in 1992 for NSOEs
1992-1995: No Convergence in Output per Worker

- There is little convergence in NSOE output per worker between 1992 and 1995
- slope: -0.12
1995 Cross Section
Chinese Industrial Census (CIC)


• Covers most of the manufacturing sector

• Large

• Data work (issues)
  - make prefectures consistent across years
  - define the SOE sector (especially in 2004 and 2008)
  - construct measures of real capital
1995 NSOE Ypw vs. TFP, Wages, and Kpw

- 1995 NSOE output per worker is positively correlated with 1995 NSOE
  - wages
  - TFP
  - capital per worker
The Importance of the SOE Share of Output

- The SOE share of output, $s$, is negatively correlated with NSOE
  - output per worker; $s$ accounts for 39% of the variation
  - wages; $s$ accounts for 12% of the variation
The Importance of the SOE Share of Output

- The SOE share of output, $s$, is negatively correlated with NSOE
  - capital per worker; $s$ accounts for 9% of the variation
  - TFP (defined as Solow residual); $s$ accounts for 40% of the variation
1995-2004 Convergence in the NSOE Sector
There is a 1995-2004 convergence in the NSOE sector in
- output per worker; rate of convergence is 8.5%
- wages; rate of convergence is 8.3%
There is a 1995-2004 convergence in the NSOE sector in
- capital per worker; rate of convergence is 13.5%
- TFP (calculated as Solow resid.); rate of convergence is 4.4%
There is a 1995-2004 divergence in total GDP

1995-2004 prefecture GDP growth is

- higher in prefectures with high 1995 NSOE $Y/N$

- higher in prefectures with lower SOE share of output
Fact 1: 1995 – large initial dispersion across prefectures in $Y/N$ for NSOE:

- Low $Y/N$ prefectures have low $TFP$, low wages, little capital
- ... nevertheless, low investment and few firms established

Fact 2: Low $TFP$ is highly associated with high share of SOE firms

Fact 3: Strong convergence in $Y/N$, $TFP$, and wages in 1995-2004
Paper in a Nutshell

Claim 1: Standard capital and output wedges cannot explain this pattern

Model: Build Hopenhayn firm entry model with heterogeneous “entry wedges”

Claim 2: Initial dispersion and eventual convergence is driven by the entry wedge

Claim 3: Implied entry wedges are highly correlated with SOE share
    : Both in 1995 cross-section and in 1995-2004 changes
Framework for Wedges

\[ y_i = z_i^{1-\eta} \left( k_i^{1-\alpha} n_i^\alpha \right)^\eta, \]

- Firms have a common production function
- \( 0 < \eta < 1 \): decreasing returns to scale
- common rental rate of capital \((r + \delta)\)
- prefecture-specific wage rate \(w_i\)
- Distortions: output tax \(\tau_i^y\) and capital tax \(\tau_i^k\). Assume no labor wedge
Framework for Wedges

- The firm’s objective is

\[ \max_{k_i, n_i} \left\{ (1 - \tau_i^y) y_i - w_i n_i - \left( 1 + \tau_i^k \right) (r + \delta) k_i \right\}. \]

- Using the firm’s first-order conditions for \( k \) and \( n \) we obtain

\[
\begin{align*}
(1 - \tau_i^y) &= \frac{1}{\alpha \eta} \frac{w_i n_i}{y_i} \\
(1 + \tau_i^k) &= \frac{1 - \alpha}{\alpha} \cdot \frac{w_i n_i}{(r + \delta) k_i}
\end{align*}
\]
Framework for Wedges

- Gross output wedge, $\Delta_i^y$  
  \[
  \Delta_i^y = (1 - \tau_i^y) = \frac{1}{\alpha \eta} \frac{w_i n_i}{y_i}
  \]

- Gross capital wedge, $\Delta_i^k$
  \[
  \Delta_i^k = (1 + \tau_i^k)(r + \delta) = \frac{1 - \alpha}{\alpha} \cdot \frac{w_i n_i}{k_i}
  \]

- Compute $\Delta_i^y$ and $\Delta_i^k$ for each prefecture in the dataset

- Use the 1995 Chinese Industrial Census
  - value added: $y_i$
  - wage bill: $w_i n_i$
  - impute real capital: $k_i$

- Labor share, $\alpha \eta$: Hsieh and Klenow (2009)

- Decreasing returns, $\eta$
  - Restuccia and Rogerson (2008): $\eta = 0.85$
Gross Capital Wedge: $\Delta^k$

- Higher capital taxes in high $s$ pref. for non-SOE firms
- No relationship between capital taxes and $s$ for SOE firms
Lower output taxes (higher subsidies) in high \( s \) prefectures

For both non-SOE and SOE firms

output wedges negatively correlated with TFP (large output taxes associated with large TFP)
Needed: Entry Wedges

Fact 1 \((1 - \tau^y)\) increases sharply with \(s\)

Fact 2 \((1 + \tau^k)\) increases slightly with \(s\)

- If \(\tau^y\) dominates, then one should expect to see …
  - ↑ entry with \(s\)
  - ↑ wages \(w\) with \(s\)
  - ↑ output per worker \(\frac{Y}{N}\) with \(s\)

- Consider Hopenhayn model with heterogeneity in “entry wedges” \(\psi\)
  - only a fraction \((1 - \psi)\) of potential entrants can get a licence
  - randomly chosen
A Model of Heterogeneous Entrepreneurs with an Entry Wedge
Model

- There are two sectors in a prefecture: SOE and NSOE
- Large number of potential entrants in both sectors
- Only a fraction \((1 - \psi)\) of NSOE potential entrants do enter
- Firms heterogeneous in productivity \(z\)
- Capital freely mobile across prefectures
- Prefecture-sector specific \(\tau_i^y\) and \(\tau_i^k\)
- Same economy-wide wage rate \(\hat{w}\) in the SOE sectors
- Prefecture-specific wage rate \(w_i\) in NSOE sector
- Per-period sector-specific operating fixed cost \(\nu\)
Private firms, NSOE Sector

\[ y_i = z_i^{1-\eta} \left( k_i^{1-\alpha} n_i^\alpha \right)^\eta, \]

- common production function: \( 0 < \alpha < 1 \)
- heterogeneous productivity: \( z \)
- \( 0 < \eta < 1 \): decreasing returns to scale
- common rental rate of capital \((r + \delta)\)
- prefecture-specific wage rate \( w_i \), output tax \( \tau_i^y \), capital tax \( \tau_i^k \)
NSOE Sector

- $f(z)$ is Pareto distributed

$$f(z) = z^{\xi} \xi z^{-\xi - 1},$$

: $\xi > 1$
: $z \geq 1, z \in [z, \infty)$

- The firm problem implies:

$$y = z ((1 - \tau^y) \eta)^{\frac{n}{1-\eta}} \left( \frac{1 - \alpha}{(1 + \tau^k)(r + \delta)} \right)^{\frac{(1-\alpha)\eta}{1-\eta}} \left( \frac{\alpha}{w} \right)^{\frac{\alpha\eta}{1-\eta}}$$

$$n = z \cdot \alpha \eta \left( \frac{1 - \tau^y}{w} \right) \cdot \bar{y}$$

$$k = z \cdot (1 - \alpha) \eta \frac{1 - \tau^y}{(1 + \tau^k)(r + \delta)} \cdot \bar{y}$$

$$\Pi = z \cdot (1 - \tau^y)(1 - \eta) \cdot \bar{y}.$$
NSOE Sector

- Only entrepreneurs with \( z \geq z^* \) will operate, where

\[
z^* = \frac{\nu}{(1 - \tau^y)(1 - \eta) \cdot \bar{y}}
\]

- The measure \( \Gamma \) of all operating entrepreneurs is

\[
\Gamma (z \geq z^*) = M(1 - \psi) \int_{z^*}^{\infty} z^\xi \xi z^{-\xi-1} \, dz = M(1 - \psi) z^\xi (z^*)^{-\xi}
\]

- The equilibrium wage \( w \) clears the labor market

\[
M(1 - \psi) \int_{z^*}^{\infty} n(z) f(z) \, dz = N
\]

- Normalize by the size of the labor force in the prefecture
Equilibrium mechanism

- Suppose \((1 - \psi)\) is small

- Low \((1 - \psi)\) implies that few firms enter

- Low entry implies low wages required to clear the labor market (since little competition for workers)

- Low wages implies low \(z^*\) (since labor is cheap)

- Low \(z^*\) implies low TFP and low \(Y/N\)
Equilibrium Wage: $w$

\[
\ln w = \frac{1 - \eta}{1 - \eta + \xi \alpha \eta} \ln \left( \frac{(1 - \psi)Z^\xi}{N} \right) - \frac{(1 - \eta)(\xi - 1)}{1 - \eta + \xi \alpha \eta} \ln(v)
\]

\[
+ \frac{\xi}{1 - \eta + \xi \alpha \eta} \ln(1 - \tau^Y)
\]

\[- \frac{(1 - \alpha) \xi \eta}{1 - \eta + \xi \alpha \eta} \ln \left( (1 + \tau^k)(r + \delta) \right)
\]

\[+ \Omega(\alpha, \eta, \xi)\]

\[
\frac{\partial \ln w}{\partial \ln (1 + \tau^k)} = \frac{\partial \ln w}{\partial \ln (r + \delta)} = - \frac{(1 - \alpha) \xi \eta}{1 - \eta + \xi \alpha \eta} < 0
\]

\[
\frac{\partial \ln w}{\partial \ln (1 - \tau^Y)} = \frac{\xi}{1 - \eta + \xi \alpha \eta} > 0
\]

\[
\frac{\partial \ln w}{\partial \ln (1 - \psi)} = - \frac{\partial \ln w}{\partial \ln N} = \frac{1 - \eta}{1 - \eta + \xi \alpha \eta} > 0
\]
Equilibrium: Output per Worker

\[ \ln \frac{Y}{N} = \ln w - \ln (1 - \tau^y) - \ln (\alpha \eta) \]

\[
\frac{\partial \ln \frac{Y}{N}}{\partial \ln (1 + \tau^k)} = \frac{\partial \ln \frac{w}{(r + \delta)}}{\partial \ln (r + \delta)} = -\frac{(1 - \alpha) \xi \eta}{1 - \eta + \xi \alpha \eta} < 0
\]

\[
\frac{\partial \ln \frac{Y}{N}}{\partial \ln (1 - \tau^y)} = \frac{\xi \eta (1 - \alpha) + (\xi - 1)(1 - \eta)}{1 - \eta + \xi \alpha \eta} > 0
\]

\[
\frac{\partial \ln \frac{Y}{N}}{\partial \ln (1 - \psi)} = -\frac{\partial \ln \frac{w}{N}}{\partial \ln N} = \frac{1 - \eta}{1 - \eta + \xi \alpha \eta} > 0
\]
Equilibrium: Entrants

\[ \Gamma (z \geq z^*) = (1 - \psi)z^\left(\frac{(1 - \tau^y)(1 - \eta) \cdot \bar{y}}{v}\right)^\xi \]

\[
\frac{\partial \ln \Gamma}{\partial \ln (1 + \tau^k)} < 0 \\
\frac{\partial \ln \Gamma}{\partial \ln (1 - \tau^y)} > 0 \\
\frac{\partial \ln \Gamma}{\partial \ln (1 - \psi)} > 0
\]
Equilibrium: TFP $Z$

\[
\ln Z = \frac{\alpha \eta (1 - \eta)}{1 - \eta + \xi \alpha \eta} \ln \left( \frac{(1 - \psi)Z^\xi}{N} \right) - \frac{\alpha \eta (1 - \eta)(\xi - 1)}{1 - \eta + \xi \alpha \eta} \ln (\nu)
\]

\[
-\frac{1 - \eta}{1 - \eta + \xi \alpha \eta} \ln (1 - \tau^y)
\]

\[
+ \frac{(1 - \eta)(1 + (\xi - 1)\alpha \eta)}{1 - \eta + \xi \alpha \eta} \ln \left( \frac{(1 + \tau^k)(r + \delta)}{1 - \eta + \xi \alpha \eta} \right)
\]

\[+ \Omega(\alpha, \eta, \xi)\]

\[
\frac{\partial \ln Z}{\partial \ln (1 + \tau^k)} = \frac{\partial \ln Z}{\partial \ln (r + \delta)} = \frac{(1 - \eta)(1 + (\xi - 1)\alpha \eta)}{1 - \eta + \xi \alpha \eta} > 0
\]

\[
\frac{\partial \ln Z}{\partial \ln (1 - \tau^y)} = -\frac{1 - \eta}{1 - \eta + \xi \alpha \eta} < 0
\]

\[
\frac{\partial \ln Z}{\partial \ln (1 - \psi)} = -\frac{\partial \ln Z}{\partial \ln N} = \frac{\alpha \eta (1 - \eta)}{1 - \eta + \xi \alpha \eta} > 0
\]
**SOE Sector**

- Same production function as NSOE firms;
  \[ \hat{y}_i = \hat{z}_i^{1-\eta} \left( \hat{k}_i^{1-\alpha} \hat{n}_i^\alpha \right)^{\eta}, \]
- measure one of potential SOE firms
- per-period operating fixed cost \( \hat{\nu} \)
- \( \hat{z} \) is Pareto distributed with parameter \( \hat{\xi} \) (\( \hat{\xi} > \xi \))
- common (exogenous) wage rate \( \hat{w} \) across prefectures
SOE Sector in Equilibrium: Output per Worker

\[
\ln \frac{\hat{Y}}{\hat{N}} = \ln \hat{w} - \ln (1 - \hat{\tau}^y) - \ln (\alpha \eta)
\]

\[
\frac{\partial \ln \frac{\hat{Y}}{\hat{N}}}{\partial \ln (1 + \hat{\tau}^k)} = 0
\]

\[
\frac{\partial \ln \frac{\hat{Y}}{\hat{N}}}{\partial \ln (1 - \hat{\tau}^y)} = -1
\]
SOE Sector in Equilibrium: TFP $\hat{Z}$

\[
\ln \hat{Z} = (1 - \alpha \eta) \ln \left[ \left(1 + \hat{\tau}^k \right) (r + \delta) \right] \\
\ln \left(1 - \hat{\tau}^y \right) \\
+ \alpha \eta \ln \hat{w} \\
+ \Omega(\alpha, \eta)
\]

\[
\frac{\partial \ln \hat{Z}}{\partial \ln \left(1 + \hat{\tau}^k \right)} = 1 - \alpha \eta \\
\frac{\partial \ln \hat{Z}}{\partial \ln \left(1 - \hat{\tau}^y \right)} = -1
\]

- Note that \( \frac{\partial \ln Z}{\partial \ln (1 - \tau^y)} = -\frac{1-\eta}{1-\eta+\xi \alpha \eta} \in (-1, 0) \)

- The effect is stronger in the SOE sectors because $\hat{w}$ does not change
Estimating the Gross Entry Wedge: \((1 - \psi)\)

- Calibrate some key parameters
  - labor share, \(\alpha \eta\): Hsieh and Klenow (2009)
  - \(\eta = 0.85\), Restuccia and Rogerson (2008): \(\xi = 1.05\), use 30% of the most productive firms

\[
E(z|z \geq z^*) = \frac{\xi}{\xi - 1}
\]

- calibrate \(\nu\) such that \(n^*(z^*) = 1\) in the lowest \(s\) prefectures
- calibrate \(z\) such that \(\psi = 0\) in the lowest \(s\) prefectures
Estimating the Gross Entry Wedge: \((1 - \psi)\)

- Estimate \(\psi_j\) in prefecture \(j\) from the equilibrium condition

\[
\ln(1 - \psi_j) = \ln N + \frac{1 - \eta + \xi \alpha \eta}{1 - \eta} \ln w_j \\
- \frac{\xi}{1 - \eta} \ln(1 - \tau_j^y) \\
+ \frac{\xi \eta (1 - \alpha)}{1 - \eta} \ln \left[ (1 + \tau_j^k)(r + \delta) \right] \\
+ (\xi - 1) \ln \nu + \Omega(\alpha, \eta, \xi, \zeta)
\]
1995 Gross Entry Wedge in the NSOE Sector

- log gross entry wedge \( \ln(1 - \hat{\psi}) \)

- SOE share accounts for 52% of the variation in the entry wedge
Entry Wedges in the NSOE Sector

- Log gross entry wedge $\ln(1 - \psi)$
2008 Costs of Starting a Business in China

  - Provides various measures of the cost of starting a business in main provincial cities

- Measures
  - Rank: from easy (1) to hard (30) to start a business
  - Days it takes to start a business
  - Cost of starting a business: as a % of provincial GDP per capita
“Doing Business in China” and Entry Wedges, 2008
Neighborhood Social Economy (NSOE) firms in a prefecture have access to two technologies:

1. inefficient low $z$ technology with a high labor share (labor intensive)
2. efficient high $z$ technology with a low labor share

A larger fraction of the NSOE firms in the high $s$ prefectures will use technology 1 \( \Rightarrow \) higher labor share.

Predictions of the theory:
- within prefectures: smaller firms have higher labor share
- across prefectures: conditional on size, firms have the same labor share
Alternative Theory I

- Predictions of the theory are not consistent with the data
- Within prefectures:
  - firms with different sizes have the same labor share
- Across prefectures:
  - conditional on size, firms have increasing in $s$ labor share
Alternative Theory II

• The pool of potential entrants is worse in the high $s$ prefectures:
  - lower TFP of entrants
  - less heavy right Pareto tail

• Predictions of the theory
  - consider a productivity cutoff $z_0$
  - consider the right tail of the Pareto distribution for firms with $z > z_0$
  - $\xi$ should be higher in high $s$ prefectures

• Predictions of the theory are not consistent with the data
  - pick $z_0$ as the 90th or 95th percentile of the overall TFP distrib.
  - in each case, $\xi$ is the same in high and low $s$ prefectures
  - for the 90th perc: $\xi_{s,low} = 1.044$, $\xi_{s,high} = 1.048$
Alternative Theory III

- The cost of operation, $v$, is higher in high $s$ prefectures

- Predictions of the theory
  - less entry
  - lower wages

- Predictions of the theory that are not consistent with the data
  - entrants are positively selected on productivity
  - high TFP
Understanding Changes over Time
Wages in the NSOE sector have equalized by 2004.

Study the importance of the change in four margins in the NSOE sector:

- the employment share: $n$
- the gross output wedge: $(1 - \tau^Y)$
- the gross capital wedge: $(1 + \tau^k)$
- the gross entry wedge: $(1 - \psi)$
- Employment in the NSOE sector increased at approx. same rate
  - no effect on $w$ (no convergence in $w$)
- The gross output wedge declined for the high $s$ prefectures
  - decline in $w$ in the high $s$ prefectures (divergence in $w$)
Decomposition, 1995-2004: \( w \)

- **Blue line (dots):** 1995 log wages \( \text{-- slope -0.67} \)
- **Red line (dots):** log wages with 1995 parameters
  - 2004 employment shares (left panel) \( \text{-- slope -0.67} \)
  - 2004 gross output wedge (right panel) \( \text{-- slope -1.78} \)
- **Black line:** 2004 log wages \( \text{-- slope 0.00} \)
The gross capital wedge was equalized in the NSOE sectors:
- decline (increase) in \( w \) in the low (high) \( s \) pref. (converg. in \( w \))

The gross entry wedge declined for the high \( s \) prefectures:
- increase in \( w \) in the high \( s \) prefectures (convergence in \( w \))
Decomposition, 1995-2004: \( w \)

- Blue line (dots): 1995 log wages – slope -0.67
- Red line (dots): log wages with 1995 parameters
  - 2004 gross capital wedge (left panel) – slope -0.24
  - 2004 gross entry wedge (right panel) – slope 0.38
- Black line: 2004 log wages – slope 0.00
Decomposition, 1995-2004: NSOE $\frac{Y}{N}$

\[
\ln \frac{Y}{N} = \ln w - \ln(1 - \tau^Y) + \Omega(\alpha, \eta)
\]

- Margins affecting converg. in $w$: same effect on $\frac{Y}{N}$
- $\ln(1 - \tau^Y)$ still different by $s \Rightarrow$ no full converg. in $\frac{Y}{N}$
\[
\ln Y = \ln w - \ln(\alpha \eta) - \ln(1 - \tau^Y) - \ln N
\]

- Margins affecting converg. in \( w \): same effect on \( Y \)
- \( \ln(1 - \tau^Y) \) still different by \( s \) ⇒ no full converg. in \( Y \)
\[ \ln Z = \alpha \eta \ln w + (1 - \alpha \eta) \ln [(1 + \tau^k)(r + \delta)] - \ln (1 - \tau^y) + \Omega(\alpha, \eta) \]

- Margins affecting converg. in \( w \): same effect on \( Z \)
- \( \ln [(1 + \tau^k)(r + \delta)] \) equalized by \( s \)
- \( \ln (1 - \tau^y) \) still different by \( s \) \( \Rightarrow \) no full converg. in \( Z \)
**Experiment: SOE Reform**

- **The SOE sector**
  - $\uparrow \hat{\nu}$: the worst SOEs exit
  - $\frac{\partial \ln \hat{Y}}{\partial \ln \hat{\nu}} = \frac{\partial \ln \hat{K}}{\partial \ln \hat{\nu}} = \frac{\partial \ln \hat{N}}{\partial \ln \hat{\nu}} = 1 - \hat{\xi} < 0$
  - $\frac{\partial \ln \left( \frac{\hat{Y}}{\hat{N}} \right)}{\partial \ln \hat{\nu}} = \frac{\partial \ln \hat{Z}}{\partial \ln \hat{\nu}} = 0$, but $\uparrow \hat{Z}$

- **NSOE sector**
  - suppose the change in $s$ does not directly affect $(1 - \psi)$
  - $\uparrow N \Rightarrow \downarrow w, \downarrow z^*, \uparrow M, \uparrow Y, \downarrow (Y/N), \downarrow Z$
    - $(1 - \psi)$ remains a key wedge
    - Policy advice: eliminate the entry wedge
Conclusion

- Aim to understand the heterogeneous growth patterns across localities in China

- A snapshot of manufacturing in 1995 shows that
  - non-SOE firm entry is substantially smaller in high $s$ prefectures
  - non-SOE firm entrants in high $s$ prefectures pay lower wages and have lower $TFP$, value added per worker, and capital

- Output wedges are declining with $s$ while the capital wedges are slightly increasing with $s$

- Output and capital wedges cannot account for 1995 NSOE patterns
Conclusion

• Build a two-sector model of heterogeneous firms
  - SOE and NSOE sectors
  - model entrants and incorporate entry wedges
  - infer the entry wedges in 1995
  - infer the entry wedges in 2004 and 2008
  - study the effect of capital, output, and entry wedges and labor mobility on changes at the prefecture level from 1995 to 2004

• Work in progress
  - study the effect of SOE reforms on changes at the prefecture level from 1995 to 2004
  - analyze the partial reversal observed in the 2004-2008 period
  - calibrate full dynamic model
Additional Slides
Introduction Wedges Model Experiments Conclusion

Provincial Economic Growth and SOE Share

- Negative relationship at the provincial level between
  - 1978-1995 output (annual) growth rate
  - 1978 output share of SOEs
Employment Growth: 1995-2004

- Negative relationship between
  - 1995-2004 employment growth rate
  - 1995 output share of SOEs
Framework for Wedges: The Labor Wedge

- Incorporating the gross labor wedge: \((1 + \tau^w)\)

- Gross output wedge, \(\Delta^y_i\)

\[
\Delta^y_i = \frac{(1 - \tau^y_i)}{(1 + \tau^w)} = \frac{1}{\alpha \eta} \frac{w_i n_i}{y_i}
\]

- Gross capital wedge, \(\Delta^k_i\)

\[
\Delta^k_i = \frac{(1 + \tau^k_i)(r + \delta)}{(1 + \tau^w)} = \frac{1 - \alpha}{\alpha} \cdot \frac{w_i n_i}{k_i}
\]

- If the labor wedge increases with \(s\), then in the NSOE sectors:
  - the output subsidies need to be even higher in the high \(s\) prefectures, and
  - the capital tax wedges need to be lower in the high \(s\) prefectures
Gross Output Wedge, Entrants: $\Delta y$

- Lower output taxes (higher subsidies) in high $s$ prefectures
- For both non-SOE and SOE firms
Higher capital taxes in high $s$ prefectures for non-SOE firms

No relationship between capital taxes and $s$ for SOE firms
SOE and NSOE Wages in s Prefectures

- SOEs pay the same wage in all s prefectures
- SOE and NSOE wages are similar in low s prefectures
- SOE wages are higher than NSOE wages in high s prefectures