Hierarchic Government, Endogenous Policies, and Foreign Direct Investment: Theory and Evidence from China and India

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Motivations: FDI Inflows

Figure 1: China and India Per Capita FDI Inflows: 1987-2005

Governments policies on FDI are very different in India and China
(1) profit tax rate (41% vs 30%) and tariff rate (19.2% vs 9.9%)
(2) institutional barrier:

Table 1: Measures of the Ease of Doing Business in China and India (2005)

<table>
<thead>
<tr>
<th>Country</th>
<th>Overall Ease (Rank$^b$)</th>
<th>Starting a Business</th>
<th>Enforcing Contract</th>
<th>Registering Property</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall Time (Days)</td>
<td>Cost ($^a$) (%)</td>
<td>Procedures (Number)</td>
<td>Time (Days)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>91</td>
<td>48</td>
<td>13.6</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>406</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>116</td>
<td>71</td>
<td>62.0</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>1420</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>62</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: a. as a percentage of Income per capita; b. among all the economies in the world
Preview of Main Results

- FDI polarization: provincial government revenue maximization + decreasing negative pecuniary externality
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- Horizontal interaction between provinces might cause asymmetric FDI allocation but FDI bifurcation still holds.
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- Central government chooses incentive-compatible policies to induce provincial government(s) to implement its favored FDI.
Preview of Main Results

- FDI polarization: provincial government revenue maximization + decreasing negative pecuniary externality
- Horizontal interaction between provinces might cause asymmetric FDI allocation but FDI bifurcation still holds.
- Central government chooses incentive-compatible policies to induce provincial government(s) to implement its favored FDI.
- China and India’s FDI difference CAN be mainly because China’s central government obtained a higher share of total tax revenue.
Road Map

1. Single Province Model
   - 1. Exogenous Profit Tax Rate and Tariff Rate

2. Hierarchic Government (central government + SIG)
   - 1. Regional Competition for FDI
   - 2. Endogenous Profit Tax Rate and Tariff Rate

3. Calibration/Simulation
   - 1. China and India
   - 2. Counterfactual Experiment

4. Conclusion
\( n_h \) domestic firms, differentiated consumption goods, unit cost is \( c_h \)
Single Province Model

Environment

- $n_h$ domestic firms, differentiated consumption goods, unit cost is $c_h$
- $n_f$ potential foreign investors, unit cost is $c_f < c_h$, 
$n_h$ domestic firms, differentiated consumption goods, unit cost is $c_h$

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$n_m$ denotes the total number of investors who makes FDI, so $n_f - n_m$ firms export.
- \( n_h \) domestic firms, differentiated consumption goods, unit cost is \( c_h \)
- \( n_f \) potential foreign investors, unit cost is \( c_f < c_h \),
- \( n_m \) denotes the total number of investors who makes FDI, so \( n_f - n_m \) firms export.
- Unit mass households, endowed with \( L \) units of labor, have identical utility function:

\[
U = x_0 + \frac{\theta}{\theta - 1} \left\{ \left[ n_h x_h^{\frac{\varepsilon - 1}{\varepsilon}} + (n_f - n_m) x_f^{\frac{\varepsilon - 1}{\varepsilon}} + n_m x_m^{\frac{\varepsilon - 1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon - 1}} \right\}^{\frac{\theta - 1}{\theta}}.
\]
Market Structure: competitive labor market and monopolistic competition commodity markets

\[ \pi_h \equiv \frac{1}{\varepsilon} p_h^{1-\varepsilon} q^{\varepsilon-\theta} \]
\[ \pi_m \equiv \frac{1}{\varepsilon} p_m^{1-\varepsilon} q^{\varepsilon-\theta} \]
\[ \pi_f \equiv \frac{1}{\varepsilon^\tau} p_f^{1-\varepsilon} q^{\varepsilon-\theta} \]

\[ q = \left[ n_h p_h^{1-\varepsilon} + n_m p_m^{1-\varepsilon} + (n_f - n_m) p_f^{1-\varepsilon} \right]^{1/(1-\varepsilon)}, \]

\[ p_h \equiv \frac{\varepsilon}{\varepsilon-1} c_h, \]
\[ p_m \equiv \frac{\varepsilon}{\varepsilon-1} c_f, \]
\[ p_f \equiv \frac{\varepsilon}{\varepsilon-1} c_f \tau, \]

Assume \( \varepsilon > \theta > 1 \).

Lemma

Profit \( \pi_i \) decreases with FDI \( n_m \) for any \( i \in \{h, m, f\} \); and both \( \pi_h \) and \( \pi_m \) increase with \( \tau \).
Any investor $j \in N_f$ chooses FDI ($D_j = 1$) rather than export ($D_j = 0$) iff
\[(1 - \lambda) \pi_m - \phi \geq \pi_f.\]
where $\lambda$ is profit tax rate and $\phi$ is institutional entry cost.

When $\phi = 0$, any positive FDI supply requires
\[1 - \lambda - \tau^{-\varepsilon} w^{1-\varepsilon} \geq 0. \tag{1}\]

Aggregate FDI supply is $\int_{j \in N_f} D_j dj$. 
Timing:

1. Given $\lambda$ and $\tau$, the provincial government decides $\phi$
2. All the potential investors make FDI decisions simultaneously
3. Labor market opens, output is produced, commodity market opens, taxation, and consumption.
The government chooses $\phi$ to maximize total tax revenue and its attitude toward FDI is determined by

$$\max_{n_m} \Psi(n_m) \equiv (1 - \gamma) [\lambda n_m \pi_m(n_m) + \overline{\lambda} n_h \pi_h(n_m)]$$

pro-FDI tax base expansion effect versus anti-FDI profit-reduction effect, $\frac{\partial^2 \pi_i}{\partial n_m^2} > 0$ is crucial for the "convexity" of $\Psi(n_m)$

Provincial government’s demand for $n_m$:

$$n_m^d = \begin{cases} 0, & \text{if } \lambda \leq \tilde{\lambda}(\tau) \\ n_f, & \text{if } \lambda > \tilde{\lambda}(\tau) \end{cases}$$

where $\tilde{\lambda}'(\tau) > 0$ and $\tilde{\lambda}(\infty) < \overline{\lambda}$.

$\phi^*$ is determined by $n_m^d$. 
Proposition 1: In the equilibrium with one province, FDI is either null or full:

\[ n_m^* = \begin{cases} 
  n_f, & \text{if } \tilde{\lambda}(\tau) < \lambda \leq 1 - \tau^{-\varepsilon} W^{1-\varepsilon} \\
  0, & \text{otherwise}
\end{cases} \]
two provinces, $k \in \{1, 2\}$, each is a replicate of the single-province economy
Endogenous Policies

Preliminary

• two provinces, \( k \in \{1, 2\} \), each is a replicate of the single-province economy

• two layers of governments
two provinces, $k \in \{1, 2\}$, each is a replicate of the single-province economy

two layers of governments

- central government determines $\tau$ and $\lambda_k$, $k \in \{1, 2\}$
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two layers of governments

- central government determines $\tau$ and $\lambda_k$, $k \in \{1, 2\}$
- government of province $k$ determines $\phi_k$
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two layers of governments
  - central government determines $\tau$ and $\lambda_k$, $k \in \{1, 2\}$
  - government of province $k$ determines $\phi_k$

All the owners of domestic firms form one special interest group (SIG)
The special interest group solves

\[
\max_{C(\lambda_1,\lambda_2,\tau)} \sum_{k=1}^{2} (1 - \bar{\lambda}) n_h \pi_h(k) - C(\lambda_1, \lambda_2, \tau)
\]  

(2)
Timing

- The special interest group solves

\[
\max_{C(\lambda_1, \lambda_2, \tau)} \sum_{k=1}^{2} (1 - \lambda) n_h \pi_h(k) - C(\lambda_1, \lambda_2, \tau) \tag{2}
\]

- Central government solves

\[
\max_{\lambda_1, \lambda_2, \tau} C(\lambda_1, \lambda_2, \tau) + \sum_{k=1}^{2} \gamma [\lambda n_h \pi_h(k) + \lambda_k n_m(k) \pi_m(k)] + \sum_{k=1}^{2} \frac{\tau-1}{\tau} (n_f - n_m(k)) p_f x_f(k) + a \sum_{k=1}^{2} W_k(\tau, n_m(k)). \tag{3}
\]
Timing

- The special interest group solves
  \[
  \max_{C(\lambda_1, \lambda_2, \tau)} \sum_{k=1}^{2} (1 - \bar{\lambda}) n_h \pi_h(k) - C(\lambda_1, \lambda_2, \tau) \tag{2}
  \]

- Central government solves
  \[
  \max_{\lambda_1, \lambda_2, \tau} C(\lambda_1, \lambda_2, \tau) + \sum_{k=1}^{2} \gamma [\bar{\lambda} n_h \pi_h(k) + \lambda_k n_m(k) \pi_m(k)] \tag{3}
  \]
  \[
  + \sum_{k=1}^{2} \frac{\tau-1}{\tau} (n_f - n_m(k)) p_f x_f(k) + a \sum_{k=1}^{2} W_k(\tau, n_m(k)).
  \]

- Government of Province \(k\) solves
  \[
  \max_{\phi_k \geq 0} (1 - \gamma) [\lambda_k \pi_m(k) n_m(k) + \bar{\lambda} n_h \pi_h(k)].
  \]
Timing

- The special interest group solves
  
  $$\max_{C(\lambda_1, \lambda_2, \tau)} \sum_{k=1}^{2} (1 - \bar{\lambda}) n_h \pi_h(k) - C(\lambda_1, \lambda_2, \tau)$$  \hspace{1cm} (2)

- Central government solves
  
  $$\max_{C(\lambda_1, \lambda_2, \tau)} \sum_{k=1}^{2} \gamma [\bar{\lambda} n_h \pi_h(k) + \lambda_k n_m(k) \pi_m(k)] + \sum_{k=1}^{2} \frac{\tau-1}{\tau} (n_f - n_m(k)) p_f x_f(k) + a \sum_{k=1}^{2} W_k(\tau, n_m(k)).$$  \hspace{1cm} (3)

- Government of Province $k$ solves
  
  $$\max_{\phi_k \geq 0} (1 - \gamma) [\lambda_k \pi_m(k) n_m(k) + \bar{\lambda} n_h \pi_h(k)].$$

- Each potential investor $j$ chooses:

  $$D_j^* \in \arg \max_{D_j \in \{A, B(1), B(2)\}} \{\Pi^A, \Pi^{B(1)}, \Pi^{B(2)}\}.$$
Definition. A Political Equilibrium (PE) is a collection of the policy variables $\tau^*$, $\{\phi^*_k, \lambda^*_k\}_{k \in \{1,2\}}$, the commodity prices $p^* (j)$, $j \in N_f \cup N_h$, the lobby schedule function $C^*(\lambda_1, \lambda_2, \tau)$, and the investment decisions $D^*_j$, for all $j \in N_f$, such that the interest group, the central government, each provincial government $k \in \{1,2\}$, each potential investor $j \in N_f$, each domestic firm $j \in N_h$, and each household maximize their goal functions, and markets are clear for domestic labor and each kind of commodity. [the international payment for the domestic economy can also be balanced]

Lemma

There always exists at least one Political Equilibrium.
Proposition 6. When $a \to \infty$, there exists only one symmetric PE, in which $\lambda^* = 1 - w^{1-\varepsilon}$, $\tau^* = 1$, $n^*_m(1) = n^*_m(2) = \frac{n_f}{2}$, and $\phi_1^* = \phi_2^* = 0$, if $1 - w^{1-\varepsilon} > \tilde{\lambda}(1)$.

Proposition 7. Suppose $a = 0$. If $\gamma$ is sufficiently small, then in the symmetric PE, we must have $\tau^* > \frac{\varepsilon}{\varepsilon - 1}$, $\lambda^* \leq \tilde{\lambda}(\tau^*)$ or $\lambda^* > 1 - \tau^{*-\varepsilon}w^{1-\varepsilon}$, $n^*_m(1) = n^*_m(2) = 0$, and $\phi_1^* = \phi_2^* \geq \Phi$.

$$\max_{\lambda_1, \lambda_2, \tau} \sum_{k=1}^{2} \left[ (1 - \bar{\lambda}) n_h \pi_h(k) + aW_k(\tau, n_m(k)) \right] + \sum_{k=1}^{2} \gamma [\bar{\lambda} n_h \pi_h(k)$$

$$+ \lambda_k n_m(k) \pi_m(k)] + \sum_{k=1}^{2} \frac{\tau - 1}{\tau} (n_f - n_m(k)) p_f(k) x_f(k)$$
is important

\[ \gamma \]

**Proposition 8.** When the central government’s share of the tax revenue becomes higher, it’s more likely that the central government will induce the provincial governments to compete for rather than block FDI.

\[
\max_{\lambda_1, \lambda_2, \tau} \sum_{k=1}^{2} \left[ (1 - \lambda) n_h \pi_h(k) + aW_n(\tau, n_m(k)) \right] + \sum_{k=1}^{2} \gamma \lambda n_h \pi_h(k) \\
+ \lambda_k n_m(k) \pi_m(k) \right] + \sum_{k=1}^{2} \frac{\tau - 1}{\tau} (n_f - n_m(k)) p_f(k) x_f(k)
\]
Calibration/ Simulation for China & India

Data Sources: China Statistical Yearbook (2005), Penn World Table, Economic Survey by India’s Ministry of Finance, 2003-2004 Annual Survey of Industries data.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Description</th>
<th>China</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma$</td>
<td>central government’s tax share</td>
<td>0.6</td>
<td>0.38</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>profit tax rate on domestic firms</td>
<td>0.33</td>
<td>0.36</td>
</tr>
<tr>
<td>$n_f : n_h$</td>
<td># foreign firms vs. # domestic firms</td>
<td>1:6</td>
<td>1:6</td>
</tr>
<tr>
<td>$c_f : c_h$</td>
<td>labor productivity ratio</td>
<td>6:1</td>
<td>7.4:1</td>
</tr>
<tr>
<td>$L$</td>
<td>total population</td>
<td>3</td>
<td>2.45</td>
</tr>
<tr>
<td>$\varepsilon$</td>
<td>substitution elasticity</td>
<td>1.89</td>
<td>3.05</td>
</tr>
<tr>
<td>$\theta$</td>
<td>price elasticity of CES aggregate</td>
<td>1.8</td>
<td>1.16</td>
</tr>
<tr>
<td>$a$</td>
<td>weight on average household welfare</td>
<td>1.302</td>
<td>1.302</td>
</tr>
<tr>
<td>$w$</td>
<td>foreign wage</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>$s$</td>
<td>tax enforcability constraint</td>
<td>1</td>
<td>1.6</td>
</tr>
</tbody>
</table>
Simulation Results

Table 4: Data and Simulation Results

<table>
<thead>
<tr>
<th></th>
<th>$n_m^*(k) : n_h$</th>
<th>$\lambda_k^*$</th>
<th>$\tau^*$</th>
<th>$l^<em>_h : l^</em>_m$</th>
<th>GDP : $n_h \pi_h$</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1: 12</td>
<td>0.300</td>
<td>1.104</td>
<td>2.4: 1</td>
<td>21.0: 2.4</td>
</tr>
<tr>
<td>Model</td>
<td>1: 12</td>
<td>0.238</td>
<td>1.155</td>
<td>2.4: 1</td>
<td>25.8: 2.4</td>
</tr>
<tr>
<td>India</td>
<td>0.06: 12</td>
<td>0.410</td>
<td>1.222</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Model</td>
<td>0: 12</td>
<td>$\geq 0.475$</td>
<td>1.235</td>
<td>/</td>
<td>/</td>
</tr>
</tbody>
</table>
## Table 5: Equilibrium FDI Might Be Sensitive to $\alpha$ and $\gamma$

<table>
<thead>
<tr>
<th>$(\alpha, \gamma)$</th>
<th>$n^<em>_m : n^</em>_h$</th>
<th>$\lambda^*_k$</th>
<th>$\tau^*$</th>
<th>$l_h : l_m : l_n$</th>
<th>GDP: $n_h \pi_h : n^*_m \pi_m$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$(0.072, 0.6)$</td>
<td>1: 12</td>
<td>0.8458</td>
<td>2.69</td>
<td>2.4: 1: 21.4</td>
<td>25.6: 2.44: 1</td>
</tr>
<tr>
<td>$(0.071, 0.6)$</td>
<td>0: 12</td>
<td>0</td>
<td>2.06</td>
<td>0.3 : 0 : 2.7</td>
<td>3.33 : 0.33 : 0</td>
</tr>
<tr>
<td>$(0.071, 0.61)$</td>
<td>1: 12</td>
<td>0.8458</td>
<td>2.69</td>
<td>2.4: 1: 21.4</td>
<td>25.6: 2.44: 1</td>
</tr>
</tbody>
</table>
Counterfactual Experiment Two

Minimal Requirement of Positive FDI for Tax Revenue Share $\gamma$

(Yong Wang (University of Chicago))
### Table 9: Counterfactual Experiments 3

<table>
<thead>
<tr>
<th>Country</th>
<th>( n_m^*(k): n_h )</th>
<th>[1] ( \alpha = 0.434 )</th>
<th>[2] ( \varepsilon = 3.31 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1 : 12</td>
<td></td>
<td>1: 12</td>
</tr>
<tr>
<td>India</td>
<td>0 : 12</td>
<td></td>
<td>0: 12</td>
</tr>
</tbody>
</table>
Conclusion

- We show how the central government, by optimally choosing the profit tax rates ($\lambda$) and tariff rate ($\tau$) under the influence of SIG, might induce the provincial government to compete for rather than block FDI (better technology) by reducing the *de facto* entry cost ($\phi$).

- Quantitative exploration suggests the large China-India FDI difference CAN be mainly because China’s central government is stronger than its Indian counterpart (higher $\gamma$).

- Some Future Extensions
  - Global game analysis when $\phi$ is uncommon Knowledge (done).
  - Tax enforcement constraint /sectoral Heterogeneity/export-promoting policies (in progress)
  - Dynamic version (macro dynamics due to productivity heterogeneity and policy dynamics due to common agency)
  - Determination of $\gamma$ in the federalism
  - Empirical relevance of our main result for the other developing economies