The Global Impact of Chinese Growth

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Facts and Motivation

- Facts on China’s opening-up and growth:
  - China’s openness jumped up in 1978 (10%→40%)
  - China’s per capita GDP growth rate jumped up in 1978 (2.5%→nearly 8%)
  - China’s trade balance was roughly zero, especially prior to 1978

- Question: How do China’s opening-up and growth affect welfare in China and the rest of the world (ROW)?
This Paper

- Two-country two-good model consisting of China and ROW
  - Backus, Kehoe, and Kydland (1994)

- Deduce shocks to China’s "home goods weight" and productivity by matching data on China’s openness and GDP growth

- Analyze effects of China’s opening-up and growth on welfare in China and ROW

- Counterfactual simulation: case of no tariffs after 1978
Effects of China’s Opening-up and Growth on Welfare

- China’s opening-up: welfare improving for China, little impact on ROW
  - China: imports more and produces less domestically (labor↓)

- China’s productivity growth: welfare improving for both China and ROW
  - China: sustained increase in consumption
  - ROW: terms of trade improves → consumption↑

- Combination of China’s opening-up and productivity growth: welfare improving for both China and ROW
Effects of China’s Opening-up and Growth on Welfare (ctd.)

- Counterfactual: Without balanced trade constraint, China’s welfare would have been higher and ROW’s welfare would have been lower
  - China: large wealth effects of expected future growth $\rightarrow$ consumes more by running trade deficit
  - ROW: works more to supply goods to China
Related Studies

- Dekle and Vandenbroucke (2006): *Dynamic but closed model*
  - Shift in labor to private non-agriculture sector contributed to TFP growth in China
  - Importance of TFP in China’s GDP growth

- Coleman (2007): *Open but static model*
  - Effects of China’s opening-up on ROW
    * International production adjustment through changes in international relative prices

- This paper: *Dynamic and open model*
  - Enables us to consider combined effects of China’s TFP growth and opening-up on both China and ROW
Outline

• Facts on Opening-up and Growth in China (data: Penn World Tables 6.2)

• Model

• Quantitative Analysis
Output per capita

(in logs, linearly detrended at 2.5% growth)
Consumption per capita

(in logs, linearly detrended at 2.5% growth)
Investment per capita

(in logs, linearly detrended at 2.5% growth)
Employment per capita

Labor


China

ROW

(source: OECD)
"Crude" Measure of TFP

(linearly detrended at 2.5% growth)
Model


- Intermediate goods are produced from capital and labor, and are traded in international goods market
  - China specializes in producing intermediate good $a$
  - ROW specializes in producing intermediate good $b$

- In each country, final goods are produced from both home and foreign intermediate goods

- State contingent claims are traded in complete international financial market

- Chinese government imposes tariffs on imports in order to maintain balanced trade
Households

- For $i = \text{China, ROW}$,

$$\max U_i = \sum_t \beta^t \left( \Psi_i \log c_{i,t} + (1 - \Psi_i) \log(1 - l_{i,t}) \right)$$

subject to

$$w_{i,t}l_{i,t} + r_{i,t}k_{i,t} + T_{i,t} + rer_{i,t}d_{i,t} = c_{i,t} + x_{i,t} + rer_{i,t}Q_t \Gamma d_{i,t+1}$$

$$\Gamma k_{i,t+1} = (1 - \delta)k_{i,t} + x_{i,t}$$

$T_{i,t}$: lump-sum transfer from government (only in China)

$rer_{i,t}$: real exchange rate (claims are denominated in ROW currency)

$Q_t$: price of international claims
Intermediate Goods Firms

- Using capital and labor, China produces good $a$, ROW produces good $b$

- For $i =$ China, ROW

  \[
  \max \pi_i = p^j_i y_i - w_i l_i - r_i k_i
  \]

  subject to

  \[
  y_i = \exp(z_i) k_i^\theta l_i^{1-\theta}
  \]

  $p^j_i$: price of intermediate goods $j$ in country $i$ relative to final goods price in country $i$

  $z_i$: productivity

- $GDP = \underbrace{p \exp(z) k^\theta l^{1-\theta}}_{\text{TFP}}$: Endogenous movements $p$ also affect TFP and hence production decisions

- Terms of trade $= p^a/p^b$
Final Goods Firm in China

• Both domestic and foreign intermediate goods are used to produce final goods:

\[
\max G_{C,t}(a_{C,t}, b_{C,t}, \eta_{C,t}) - p^{a}_{C,t} a_{C,t} - (1 + \tau_{C,t}) p^{b}_{C,t} b_{C,t}
\]

where

\[
G_{C,t}(a_{C,t}, b_{C,t}, \eta_{C,t}) = \left( \eta_{C,t} a_{C,t}^{\varepsilon} + (1 - \eta_{C,t}) b_{C,t}^{\varepsilon} \right)^{\frac{\varepsilon}{\varepsilon - 1}}
\]

\(\tau_{C,t}\): tariffs on imports

\(\varepsilon\): elasticity of substitution between home and foreign goods

\(\eta_{C,t}\): China’s "home goods weight"

• \(\eta_{C,t}\) determines the share of Chinese intermediate goods among intermediate goods used to produce final goods
Final Goods Firm in ROW

\[
\max G_{R,t}(a_{R,t}, b_{R,t}, \eta_{R,t}) - p^a_{R,t}a_{R,t} - p^b_{R,t}b_{R,t}
\]

where

\[
G_{R,t}(a_{R,t}, b_{R,t}, \eta_{R,t}) = \left((1 - \eta_{R,t})^{\frac{\varepsilon-1}{\varepsilon}} + \eta_{R,t}^{\frac{\varepsilon-1}{\varepsilon}}\right)^{\frac{\varepsilon}{\varepsilon-1}}
\]

- ROW government does not impose tariffs
Government Budget Constraint in China

\[ \tau_{C,t} p^b_{C,t} b_{C,t} = T_t \]
Shocks

- Shocks to China’s "home goods weight" ($\eta_C$)
  - China’s *reform and opening-up policy* → sudden fall in $\eta_C$

- Shocks to China’s productivity ($z_C$)

- Throughout, Chinese government adjusts tariffs on imports ($\tau_C$) to maintain balanced trade
## Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>(description)</th>
<th>China</th>
<th>ROW</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\pi$</td>
<td>(population weight)</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>$\varepsilon$</td>
<td>(elasticity of substitution)</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>$\delta$</td>
<td>(depreciation)</td>
<td>0.035</td>
<td>0.035</td>
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<tr>
<td>$\beta$</td>
<td>(discount factor)</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>$\Psi$</td>
<td>(preferences)</td>
<td>0.34</td>
<td>0.34</td>
</tr>
<tr>
<td>$\eta$</td>
<td>(&quot;home goods weight&quot;)</td>
<td>0.71</td>
<td>0.71</td>
</tr>
<tr>
<td>$\theta$</td>
<td>(capital share)</td>
<td>1/3</td>
<td>1/3</td>
</tr>
</tbody>
</table>

- $\eta$ is chosen so that openness in symmetric steady state is 30%
Simulation

- Deterministic

- Divide the simulation period into two:
  - Initial equilibrium (1950-1977): China has low openness and low GDP (5% of ROW)
  - Post-1978 (1978-2100): In 1978, agents are surprised by shocks to China’s home goods weight and productivity and re-optimize

- Choose shocks to China’s home goods weight and productivity such that:
  - China’s openness jumps up from 10% to 30% in 1978 and remains at that level
  - China’s per-capita GDP growth rate jumps up from 2.5% to 7.5% in 1978 and stays at that rate until China’s GDP catches up to ROW level
Implied Path of Exogenous Variables:
China’s Home Goods Weight (- - -), China’s detrended Productivity (___)

1950-77: China’s GDP level is 5% of ROW, GDP growth is 2.5%, openness is 10%
1978-: China’s GDP growth is 7.5% (until reaching ROW level), openness is 30%
Shocks to China’s "Home Goods Weight" Only

China: imports more and produces less (labor ↓)
Shocks to China’s Productivity Only

China: sustained increase in consumption

ROW: terms of trade improves → consumption↑
Both Shocks

Home Goods Weight

Productivity

Terms of Trade

Consumption

Labor

Utility

GDP

Tariff

Openness

Tariff
Effects on Welfare

• Welfare improvements relative to the case of no shocks to China’s home goods weight and productivity:

<table>
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<th>Both Shocks</th>
<th>$\eta_C$ Only</th>
<th>Productivity Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>8.31</td>
<td>0.95</td>
<td>9.52</td>
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<tr>
<td>ROW</td>
<td>0.82</td>
<td>0.03</td>
<td>0.84</td>
</tr>
</tbody>
</table>

• – China’s opening-up: welfare improving for China, little impact on ROW

– China’s productivity growth: welfare improving for both China and ROW

– Combination of China’s opening-up and productivity growth: welfare improving for both China and ROW
Counterfactual Simulation

- What if China removed tariffs in 1978 and did not maintain balanced trade after 1978?

- Removal of tariffs stimulates China’s imports:
  - China runs trade deficit, works less, and consumes more
    * Removal of tariffs is welfare-improving for China
  - ROW works harder in order to meet increased demand from China
    * Removal of tariffs is welfare-decreasing for ROW

- In the following simulations, shocks to China’s home goods weight and productivity are the same as in previous simulations
Effects on Welfare (No Tariff Case)

- Welfare improvements relative to the case of no shocks to China’s home goods weight and productivity:

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<th>$\eta_C$ Only</th>
<th>Productivity Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>14.94</td>
<td>12.29</td>
<td>11.29</td>
</tr>
<tr>
<td>ROW</td>
<td>−1.92</td>
<td>−3.72</td>
<td>−0.21</td>
</tr>
</tbody>
</table>

- China’s welfare would have been higher and ROW’s welfare would have been lower if the balanced trade constraint was removed in 1978
Conclusion

• China’s opening-up is welfare improving for both China and ROW if it led to significant productivity growth in China

• China’s balanced trade helped ROW at the expense of China
Extensions

• Link between opening-up and productivity growth
  – Import of ideas

• Balanced trade in China
  – Incomplete international capital market, Infant industry protection,

• Stochastic model
Shocks to China’s "Home Goods Weight" Only (No Tariff)
Shocks to China’s Productivity Only (No Tariff)