Effects of China’s Growth on the Food Prices and Food Exports of other Developing Countries.

Nelson Villoria

Department of Agricultural Economics
Purdue University

IATRC Annual Meeting
St. Pete, Florida

December 13, 2011
Motivation

Two debates about the consequences of the growth in China’s food demand for the agricultural prices facing other countries.
Debate # 1

China’s rapid economic emergence is a source of inflation in food prices:

- Limited grain imports because of self-sufficiency policies [Abbott, Hurt, and Tyner(2008), Headey and Fan(2008)]
- Food consumption expenditures have risen more slowly than income [Wright(2008)]
- China’s increased food demand may be one of many factors contributing to high world food prices [Carter, Rausser, and Smith(2008)]
Debate # 2


- By directly exporting ag./food to China
- By benefiting from China-induced high food prices
China’s share of global food markets 1998-2009 (I)
China’s share of global food markets 1998-2009 (II)
Table: China's main suppliers by commodity group (as % of total food imports in 1995-1997 and in 2007-2009.)

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<td>0.80</td>
<td>2.40</td>
<td>17.70</td>
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<tr>
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<td>63.80</td>
<td>100.00</td>
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Notes: China’s imports by food group and exporter during 1995-1997 (upper panel) and 2007-2009 (lower panel). In each panel, the row total describes the structure of food imports by product, while the column totals describe the structure of food imports by exporter. Source: COMTRADE, 2010.
Research Questions

- What are the inflationary effects of China’s growth on food prices in developing countries?
- Has (so far) China been an engine of growth to developing countries’ exports?
  - Are these effects direct or indirect?
Short-Run Partial Equilibrium Model of International Trade in Agricultural Products

Supply:
\[ Y_i = p_i \bar{Q}_i \]
\[ \bar{Q}_i = \sum_j q_{ij} \]

Demand:
\[ E_j = \left[ \sum_i \beta_{ij} \sigma p_{ij}^{1-\sigma} \right]^{1/(1-\sigma)} \]
\[ U_j E_j = S_j \]

Market Clearing:
\[ S_i - \sum_{m \neq i} p_{mi} q_{mi} = Y_i - p_i \sum_j q_{ij} \]

\( Y_i \) = agricultural output value in region \( i \) (endogenous)
\( Q_i \) = fixed supply of the ag. sector in country \( i \) (exogenous)
\( p_i \) = ag. output price (endogenous)
\( q_{ij} \) = sales from region \( i \) to market \( j \).
\( \beta_{ij} > 0 \) = (exogenous) distribution parameters (bilateral preference weights)
\( \sigma > 1 \) is the elasticity substitution
\( S_j \) = food expenditures in region \( j \) (endogenous)
\( U_j \) = Utility (endogenous)
\( E_j \) = CES Price Index (endogenous)
\( p_{ij} = p_i \bar{t}_{ij}, t_{ij} - 1 = ad-valorem \) tariff equivalent of trade costs. (exogenous)
As an artifact of the equilibrium recover bilateral demands:

\[ q_{ij} = \beta_{ij}^{\sigma} p_{ij}^{1-\sigma} E_j^{1-\sigma} S_j. \]

Anderson and Wincoop (2003)' gravity theory:

\[ X_{ij} = \beta_{ij}^{\sigma} \frac{Y_i S_j}{MA_i} \left( \frac{t_{ij}}{E_j} \right)^{1-\sigma}, \]

where market access (\( MA_i \)) (aka OMR) is:

\[ MA_i = \sum_j \beta_{ij}^{\sigma} t_{ij}^{1-\sigma} E_j^{\sigma-1} S_j \]

and (IMR):

\[ E_j = \left[ \sum_i \beta_{ij}^{\sigma} t_{ij}^{1-\sigma} Y_i MA_i^{\sigma-1} \right]^{1/(1-\sigma)}. \]

Trade costs function:

\[ t_{ij} = (DIST_{ij}^{\delta_1} WT_{ij}^{\delta_2} \exp \sum_{k=3}^{K} \delta_k ind_k). \]
Model Implementation

- Mixed complementarity program (MCP) using the *calibrated share form* of the CES function of Rutherford (1995)
- Calibrated share form decomposes $\beta_{ij}$ in terms of the value shares $\theta_{ij}$, income terms $\phi_j$,
- Trade costs $t_{ij}$ and $E_j$ estimated from gravity:

$$\hat{t}_{ij}^{1-\sigma} = (DIST_{ij}^{\hat{\delta}} \exp \sum_{k=2}^{K} \hat{\delta}_k \text{ind}_k)$$

- Rest of the variables are observed
Estimation

Santos-Silva and Tenreyro (2006)’s critique: Heterokedasticity and zero trade flows
Poisson Pseudo-Maximum Likelihood (PPML) $X_{ij} \sim \text{Poisson}(\lambda_{ij})$

$$X_{ij} = \exp \left( \beta_0 + \alpha_i \text{EXP}_i + \alpha_j \text{IMP}_j + \gamma_1 \log(DIST_{ij}) + \gamma_2 \log(WT_{ij}) + \sum_{k=3}^{\gamma_k \text{ind}_k} + \varepsilon_{ij} \right)$$
Data

- Normalize $p_i^0 = 1 \rightarrow Q_i^0 = Y_i^0$
- $Y_i^0$, $S_j^0$ come from GTAP V. 8.2 (91 countries in 2007)
- Bilateral imports in 2007 from COMTRADE (2010)
- Sample (91 countries) aprox. 94% of total food output value and global food expenditures, and 94% and 96% of global food imports and exports
- $91 \times 90 = 8,190$ potential trade flows. 1,579 (19.28% of the sample) are either NA/0
## Results

### Table: Regression results

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std.Err</th>
<th>p-value</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(DIST(_{ij})) (bilateral distance)</td>
<td>-0.82</td>
<td>0.05</td>
<td>0.00</td>
<td>-0.92</td>
<td>-0.73</td>
</tr>
<tr>
<td>log(WT(_{ij})) (bilateral import tariffs)</td>
<td>-0.33</td>
<td>0.33</td>
<td>0.31</td>
<td>-0.97</td>
<td>0.31</td>
</tr>
<tr>
<td>ind(_1): share a border</td>
<td>0.37</td>
<td>0.08</td>
<td>0.00</td>
<td>0.22</td>
<td>0.53</td>
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<tr>
<td>ind(_2): both are landlocked</td>
<td>0.67</td>
<td>0.21</td>
<td>0.00</td>
<td>0.27</td>
<td>1.08</td>
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<td>ind(_3): speak the same language</td>
<td>0.03</td>
<td>0.10</td>
<td>0.77</td>
<td>-0.17</td>
<td>0.23</td>
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<td>ind(_4): belong in the same preferential trade agreement</td>
<td>0.55</td>
<td>0.09</td>
<td>0.00</td>
<td>0.36</td>
<td>0.73</td>
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<td>ind(_5): have the same legal system</td>
<td>0.17</td>
<td>0.06</td>
<td>0.14</td>
<td>-0.05</td>
<td>0.30</td>
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<td>ind(_6): have the same currency</td>
<td>0.15</td>
<td>0.10</td>
<td>0.09</td>
<td>-0.05</td>
<td>0.35</td>
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<td>ind(_7): shared a colonizer</td>
<td>0.38</td>
<td>0.22</td>
<td>0.00</td>
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<td>0.82</td>
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<td>ind(_8): have had a colonial relationship</td>
<td>0.40</td>
<td>0.12</td>
<td>0.15</td>
<td>0.17</td>
<td>0.64</td>
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<td>ind(_9): have been part of the same empire</td>
<td>0.24</td>
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<td>0.15</td>
<td>-0.09</td>
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</tr>
</tbody>
</table>

Notes: \(n = 8,190\), 19.28% of the sample are either NA/0. “Lower” and “Upper” are the limits of a 95% confidence interval. pseudo-\(R^2 = 91.2\%\).
Counterfactual: Evolution of food expenditures in China during 1995-2008
Supply Prices

East Asia & Pacific
South Asia

Sub-Saharan Africa
Middle East & North Africa

Europe & Central Asia

Latin America & Caribbean
Changes in Exports

East Asia & Pacific
South Asia

Sub-Saharan Africa
Middle East & North Africa

Latin America & Caribbean

% Change in food exports to:

- the world
- China (relative to total exports)

Malaysia
Indonesia
Thailand
Vietnam
Philippines
India
Pakistan
Bangladesh
Sri Lanka
Cambodia

% Change in food exports to:

- the world
- China (relative to total exports)

Zimbabwe
Ethiopia
Senegal
Tanzania
Uganda
South Africa
Morocco
Madagascar
Botswana
Malawi

% Change in food exports to:

- the world
- China (relative to total exports)

Argentina
Peru
Brazil
Uruguay
Chile
Guatemala
Venezuela
Colombia
Panama
Ecuador
Costa Rica
Nicaragua
Bolivia
Mexico
Paraguay
Conclusions

- China has been a source of some food price inflation; on average (weighted by import volumes), CES prices fell by 1.27%, 0.32%, and 0.22% in ASIA, MENA-SSA, and LATAM, respectively.

- On the export side, Asian and Latin American exporters of vegetable oils have benefited from China’s growth. In Africa, we find sizable effects on the exports coming from Ethiopia, Zimbabwe, Zambia, and Mozambique, countries that export tobacco, cotton, and also oilseeds to China.

- Effects are directly driven by China’s growth in demand, no evidence of benefits from an overall China-induced higher level of food prices attributable to the growth in China.