Motivation

- Food prices are on a rise again and may continue rising
  - Various reasons: climate change, biofuels, rising population etc.
- Is it a problem?
  - Higher food prices may increase poverty
- What should we do about it?
  - Improve agricultural productivity
  - Protect agriculture
  - Deliver technical change to small farmers
Global projections 2010-2050

- Global population is projected to rise by 34 percent with regional variation
  - Sub-Saharan Africa rise of 120 percent
  - Very low population growth in East Asia: 10%
  - Moderate growth in Latin America: 33%
  - Decline in Europe and Central Asia of 4 percent
- Developing country growth also projected strong
  - Capital stock in East Asia to grow by 800 percent
  - Very high factor productivity growth in East and South Asia
How global growth affects food prices

- Growth in population raises demand for food and food prices in two ways
  - Population growth increases food demand directly
    - More mouths to feed with the same amount of land
  - Income growth increases demand
    - Income elasticity of food is high for low-income countries
    - Especially East & South Asia can afford more food as their per capita incomes grow significantly
How global growth affects food prices

• Growth can affect supply of food too
  ▫ Growth of capital stock “pulls” resources out of agriculture in developing countries
    • Rybczynski effect
  ▫ Improvements in agricultural productivity raise output
    • The same amount of land can produce more food
    • Higher effective prices attract additional resources
How global growth affects poverty

• Rising food demand and food prices
  ▫ Harm consumers who have to pay more for food
  ▫ Help net-selling farm households whose incomes rise
• Higher productivity and larger endowments
  ▫ Raise real incomes and lower poverty
  ▫ Higher agricultural productivity
    • Raises agricultural output and effective producer prices
    • Higher supply lowers actual prices
• Technology adoption rate
  ▫ A high rate of adoption of higher agricultural productivity by smallholder farmers may help the poor who are often smallholders as well
What analytical framework?

• Use a global CGE model to examine the impact of projections on agricultural outcomes
  ▫ Exogenous variables: population growth, factor accumulation, productivity changes
  ▫ Outputs: price changes

• To examine the impact of price changes on poverty we use a detailed household model
  ▫ Exogenous variables: price changes & productivity gains
  ▫ Outputs: individual households’ changes in welfare and poverty
Global general equilibrium model

• Standard GTAP model
  ▫ Six World Bank defined regions

• Latest GTAP database
  ▫ Expanded agricultural commodity detail (FAO data)
    • 22 original agricultural and food commodities split in 38
    • E.g. split Soybeans and Groundnuts from “Oil seeds”
    • Focus on “orphan” crops such as sorghum, cassava etc.

• Parameter values
  ▫ Doubled the trade elasticities for long run analysis
  ▫ Raised value-added substitution in “Forestry” and “Fishing” to allow for growth in these industries
Household model

- Calculate welfare changes for each household
  - Change in the cost of living
  - Change in business income
  - Change in wage income
- Take into account the second-order impacts
  - Households adjust their consumption and production with respect to changing prices
    - Demand (CDE)
    - Supply (CRETH)
    - Supply and demand parameters consistent with CGE model
Household model coverage

• A set of household income and expenditure surveys
  ▫ Recent surveys conducted in 2000-2007
  ▫ 21 developing countries
  ▫ Spread across regions
  ▫ Total of 190,000 households
    • Largest survey: Peru (22,201 households)
    • Smallest survey: Albania (1,671 households)
Scenarios

- Four broad scenarios
  - Baseline (projected growth)
  - Higher agricultural TFP worldwide (additional 1pct p.a.)
  - Higher agricultural TFP in developing countries (additional 1pct p.a.)
  - Protection of primary agriculture in developing countries
    - Raise self-sufficiency—halve import shares in 2050

- Additional analyses
  - Higher productivity in individual crops
  - Type of technical change
    - **Factor** productivity or **total** productivity
  - Assessing the importance of the adoption rate
Global aggregate changes

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Baseline</th>
<th>Ag TFP+1</th>
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<tbody>
<tr>
<td></td>
<td>Output</td>
<td>Price (CPI)</td>
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<tr>
<td>Primary agriculture</td>
<td>126.9</td>
<td>115.6</td>
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<tr>
<td>Processed food</td>
<td>124.6</td>
<td>14.0</td>
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<tr>
<td>All food</td>
<td>126.0</td>
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<tr>
<td>Energy</td>
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<tr>
<td>Durables</td>
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<td>-6.4</td>
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<tr>
<td>Services</td>
<td>177.1</td>
<td>-5.9</td>
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</tbody>
</table>

- Food prices are significantly lowered by higher agricultural TFP
Poverty impacts by country of higher agricultural TFP & protection (relative to baseline)
Decomposition of global poverty impacts (relative to baseline)

- Higher agricultural productivity lowers poverty mainly through favorable agricultural price and wage impacts
- Protection works in opposite direction, mainly hurting poor through lower wages
- Simulation: 1 pct additional agric growth by region
- Significant regional differences appear:
  - Africa benefits mainly from direct impacts on the price of agriculture
  - Asia benefits mainly from wages
  - Latin America and Eastern Europe benefit more equally
Impact of higher productivity on poverty by commodity (1pct TFP)
Adoption rates & poverty impacts of total factor productivity (1pct p.a.)
Adoption rates & total output productivity impacts on poverty (1pct p.a)
Conclusions

• Projected growth may result in higher global food prices with adverse impacts on poverty
• The adverse impact of higher food prices on poverty is best dealt with by raising productivity
  ▫ Productivity benefits consumers in developing countries through lower food prices
  ▫ Impacts on producers are less clear
    • Output productivity better than TFP productivity
• Agricultural protection generally raises poverty
  ▫ Benefits to the farmers, but heavy costs to consumers
Conclusions (continued)

- Poverty reduction may be targeted by promoting certain commodities with largest poverty impact
  - Some commodities (rice, maize and vegetables) help more than others
- Who adopts the technology matters
  - It is often not critical to reach everyone
  - Most of benefits are often realized without reaching households with very small output