Global Agricultural Supply and Demand: Factors contributing to recent increases in food commodity prices

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Agricultural Markets and Food Price Inflation
Federal Reserve Bank of Chicago

October 2, 2008
Food commodity prices have risen 130% since January 2002 (>70% in last two years)

Source: International Monetary Fund: International Financial Statistics
Prices of many commodities rose even more

Index: January 2002 = 100

+ 585 %

+ 330 %

+ 130 %

Source: International Monetary Fund: International Financial Statistics
Food commodity prices:
Indices for selected crops and total food

Index: January 2002 = 100

Source: International Monetary Fund: International Financial Statistics
Crop price increases: real vs. nominal
Average of 4 crops (wheat, soybeans, corn & rice)

Index: January 2002 = 100

Source: International Monetary Fund: International Financial Statistics
Factors contributing to higher food commodity prices


- **Strong growth in demand, based on:**
  - Increasing population + Rapid economic growth + Rising per capita meat consumption

- Slowing growth in agricultural production

- Declining demand for stocks of food commodities

- Escalating crude oil price

- Increased biofuels production

- Dollar devaluation

- Rising farm production costs

- Adverse weather

- Large foreign exchange reserves

- Aggressive purchases by importers

- Exporter policies

- Importer policies

Demand factors in brown

Supply factors in green
World grain & oilseeds
Total production and use

Million metric tons

Source: USDA PS&D Database
Total world grain & oilseeds
Stocks and stocks-to-use ratio

Source: USDA PS&D Database
Long-term trends contributing to higher prices:

1. Supply-side factors
   - Slower growth rate in yields

2. Demand-side factors
   - Population growth
   - Income growth
   - Increased per capita meat consumption
### Total world grain & oilseeds

Production, yield, area harvested, population & percap production

**Index: 1970 = 100**

<table>
<thead>
<tr>
<th></th>
<th>1970-90</th>
<th>90-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>2.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Yields</td>
<td>2.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Area</td>
<td>0.15</td>
<td>0.14</td>
</tr>
<tr>
<td>Population</td>
<td>1.7</td>
<td>1.4</td>
</tr>
<tr>
<td>Per capita use</td>
<td>0.56</td>
<td>0.11</td>
</tr>
</tbody>
</table>

**Exponential trend growth rates:**

**Source:** Compiled from USDA’s PS&D Database

1 Total oilseeds = soybeans + rapeseed + sunflowers

**Diagram Notes:**
- Production
- Yield
- Population
- Percap production
- Area harvested

**ERS:** ECONOMIC RESEARCH SERVICE

Source: Compiled from USDA’s PS&D Database
Population growth rates decline
(Percent by period)

Source: USDA Agricultural Baseline Projections to 2017.
Strong economic growth
Average Real GDP growth rates

Source: USDA Agricultural Baseline Projections to 2017.
Global rice imports

Million metric tons

Source: USDA Agricultural Baseline Projections to 2017.

1/ European Union, former Soviet Union, and other Europe. 2/ Includes Mexico.
Global soybean oil imports

Million metric tons


Rest of world
EU, FSU, & OE 1/
India
China
Other Asia 2/
N. Africa & M. East
Latin Am 3/

1/ European Union, former Soviet Union, and other Europe.
2/ Asia excluding India and China. 3/ Includes Mexico.

Source: USDA Agricultural Baseline Projections to 2017.
Global meat\textsuperscript{1}
Production, per capita consumption, and population

<table>
<thead>
<tr>
<th></th>
<th>1975-90</th>
<th>90-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>3.1</td>
<td>2.5</td>
</tr>
<tr>
<td>Population</td>
<td>1.7</td>
<td>1.4</td>
</tr>
<tr>
<td>Per capita consumption</td>
<td>1.4</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Exponential trend growth rates:

Index: 1971 = 100


1 Total meat = beef + pork + chickens & turkeys.
Poultry imports 1/

Million metric tons


Russia
Other N Afr. & M. East
East Asia
China & Hong Kong
Saudi Arabia
Mexico
European Union 2/

1/ Selected importers.

Source: USDA Agricultural Baseline Projections to 2017.
Role of biofuels:

- Major producers
- Impact on land use
Biofuels production: Total of largest producers

The 6 largest producers (USA, Brazil, EU, China, Canada, & Argentina) accounted for 96% of world biofuel production in 2007.

Source: FO Licht, various reports
Biofuels production: Largest producers

Million Gallons

Source: USDA Agricultural Projections to 2017
Global area harvested\textsuperscript{1}:
Total, and for biofuels feedstocks

\begin{verbatim}
\begin{center}
\begin{tabular}{c}
\hline
Year & Million hectares \\
\hline
1970 & \text{700} \\
1975 & \text{750} \\
1980 & \text{800} \\
1985 & \text{850} \\
1990 & \text{900} \\
1995 & \text{950} \\
2000 & \text{1000} \\
2005 & \text{1050} \\
\hline
\end{tabular}
\end{center}
\end{verbatim}

\textsuperscript{1}Crops include: Wheat, Rice, Corn, Barley, Sorghum, Other cereals, Soybeans, Rapeseed, Sunseed, Cotton. Excludes sugarcane and beets.

Source: Compiled from data associated with generating Baseline Projections to 2017
U.S. corn use

Billion bushels


Ethanol
FSI less ethanol 1/
Exports
Feed & residual

1/ Food, seed, and industrial less ethanol.

Source: USDA Agricultural Baseline Projections to 2017.
Growth in world wheat and coarse grains use:
1980/81 - 2002/03 vs. 2002/03 - 2007/08

<table>
<thead>
<tr>
<th>Use</th>
<th>1980/81 to 2002/03</th>
<th>2002/03 to 2007/08</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MMT</td>
<td>%</td>
</tr>
<tr>
<td>Food</td>
<td>160</td>
<td>49</td>
</tr>
<tr>
<td>Feed*</td>
<td>144</td>
<td>44</td>
</tr>
<tr>
<td>U.S. corn for ethanol</td>
<td>27</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>328</td>
<td>100</td>
</tr>
</tbody>
</table>
Adverse weather reduced production:

- In 2006
  - Australia
  - Ukraine & Russia

- and 2007
  - Europe: dry spring; harvest floods
  - SE Europe: drought
  - Ukraine & Russia: drought (2nd year)
  - USA: late spring freeze
  - Canada: hot and dry
  - Australia: 2nd year of severe drought
  - NW Africa: drought
  - Turkey: dry
Total world grain & oilseeds¹
Production, yield, & area harvested

Index: 1970 = 100

Trend growth rates:

<table>
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<tbody>
<tr>
<td>Prod</td>
<td>2.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Area</td>
<td>0.15</td>
<td>0.17</td>
</tr>
<tr>
<td>Yields</td>
<td>2.0</td>
<td>1.1</td>
</tr>
</tbody>
</table>

¹ Total oilseeds = soybeans + rapeseed + sunflowers

Source: USDA Agricultural Projections to 2017
Other contributing factors:

- Devaluation of U.S. dollar
- Increasing foreign exchange reserves held by importers
- Role of hedge funds, index funds, & sovereign wealth funds: (affect demand and/or volatility?)
Value of U.S. dollar declines after 2002 1/

Index values, 2000=100

1/ Real U.S. agricultural trade-weighted dollar exchange rate, using U.S. agricultural export weights, based on 192 countries.

Source: USDA PS&D Database
Policy responses to food price inflation
## Policy responses to rising prices by selected countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Exports</th>
<th></th>
<th>Imports</th>
<th>Domestic policies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Raised export export export reduced increased imposed</td>
<td></td>
<td>taxes volume bans tariffs consumer price subsidies caps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>taxes volume bans</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Argentina</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cambodia</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Egypt</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kazakhstan</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Russia</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ukraine</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vietnam</td>
<td>x x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bangladesh</td>
<td>x x</td>
<td></td>
<td>x x</td>
</tr>
<tr>
<td></td>
<td>EU</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mexico</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Morocco</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mongolia</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Philippines</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thailand</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Policy responses to rising prices by selected countries

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<tr>
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<th>Imports</th>
<th>Domestic policies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raised</td>
<td>Export</td>
<td>Reduced</td>
<td>Increased</td>
</tr>
<tr>
<td></td>
<td>Export</td>
<td>volume</td>
<td>import</td>
<td>Imposed</td>
</tr>
<tr>
<td></td>
<td>export</td>
<td>bans</td>
<td>tariffs</td>
<td>price</td>
</tr>
<tr>
<td></td>
<td>taxes</td>
<td>restrictions</td>
<td>subsidies</td>
<td>caps</td>
</tr>
</tbody>
</table>

**Both export and import policies:**

- **China**
  - Export raised: x
  - Export reduced: x
  - Import reduced: x
  - Increased consumer price: x

- **India**
  - Export raised: x
  - Export reduced: x
  - Import reduced: x
  - Increased consumer price: x

- **Indonesia**
  - Export raised: x
  - Import reduced: x
  - Increased consumer price: x

- **Malaysia**
  - Export raised: x
  - Increased consumer price: x

- **Serbia**
  - Export raised: x
  - Increased consumer price: x
## Impact of high food commodity prices on consumers food budgets

<table>
<thead>
<tr>
<th></th>
<th>High-income countries</th>
<th>Low-income food-deficit countries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. Base Scenario</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td>40,000</td>
<td>800</td>
</tr>
<tr>
<td>Food expenditure</td>
<td>4,000</td>
<td>400</td>
</tr>
<tr>
<td>Food as % of income</td>
<td>10.0%</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Disaggregate retail food spending</strong></td>
<td>(staples vs. non-staples)</td>
<td></td>
</tr>
<tr>
<td>Staples as % of total food spending</td>
<td>20%</td>
<td>70%</td>
</tr>
<tr>
<td>Expenditures on staples</td>
<td>800</td>
<td>280</td>
</tr>
<tr>
<td>Expenditures on non-staples</td>
<td>3,200</td>
<td>120</td>
</tr>
<tr>
<td><strong>II. Scenario: 50% Price increase in staples</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partial pass through on staples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assumed % pass through</td>
<td>60%</td>
<td>60%</td>
</tr>
<tr>
<td>Increase in cost of staples</td>
<td>240</td>
<td>84</td>
</tr>
<tr>
<td>New cost of staples</td>
<td>1040</td>
<td>364</td>
</tr>
<tr>
<td>New total food costs</td>
<td>4,240</td>
<td>484</td>
</tr>
<tr>
<td>Food as % of income</td>
<td>10.6%</td>
<td>61%</td>
</tr>
</tbody>
</table>
U.S. Title II Food Aid Allocations

*2008 is a forecast
Spikes in food commodity prices: Will this time be any different?

Index: January 2002 = 100

Source: International Monetary Fund: International Financial Statistics
Categories of factors contributing to higher food commodity prices

Temporary factors:
- Adverse weather
- Trade policies by exporters and importers
- Aggressive buying by importers

Structural changes:
- High oil prices
- Biofuels production
- High ag production costs

Continuation of long-term trends:
- Rapid economic growth in many developing countries
- Population growth in developing countries
- Increasing per capita meat consumption

Questionable future impact:
- Further dollar depreciation
- Slower growth in ag productivity
- Role of large foreign exchange reserves held by importers

Supply factors
Demand factors
Prices have declined from their peaks

(as of September 30, 2008)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Down</th>
<th>Since peak in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>51 %</td>
<td>Mid March</td>
</tr>
<tr>
<td>Corn</td>
<td>38 %</td>
<td>End of June</td>
</tr>
<tr>
<td>Soybeans</td>
<td>39 %</td>
<td>Early July</td>
</tr>
</tbody>
</table>
U.S. Commodity Prices: History & Projections
Soybeans, Wheat, & Corn

Global Agricultural Supply and Demand: Factors Contributing to the Recent Increase in Food Commodity Prices

The report is available at:


Ronald Trostle
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rtrostle@ers.usda.gov
202-694-5280