Opportunities and Challenges Facing the Food and Agricultural Sector

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Major Changes in Food and Agricultural Economy

**Demand:**
- **Food, feed and fibre:** Driven by conventional forces (income and population) in developing countries
- **Biofuels:** Driven by new forces

**Supply:**
- Shifting land/water/labor away from agriculture during economic transformation in developing countries
- Technological changes (botech)
- Climate changes
- ...

Trade patterns will experience substantial changes due to trade liberalization and biofuel development: meat and feed
World meat production (million tons), 1961-2005

Increased 4 times

Source: FAO
About two third of increase in meat output has been come from Asia since early 1990s
Per capita meat and total living expenditure in China

Real GDP growth and projected trend in China, 1980-2030

A similar growth trend has also experienced in South Asia (e.g., India) and Southeast Asia (e.g., Vietnam, Indonesia and Thailand)
Shares of Asian maize production in the world (%)

1961
RoW 85%
Asia 15%

2006
RoW 72%
Asia 28%

Source: FAO
Emerging trend in world production of biofuels

**Bioethanol production**

**Biodiesel production**

Why are governments interested in biofuels?

• **Major arguments:**
  
  - **Energy security:** to improve national and global energy security
  
  - **Environment protection:** to lower air pollution and greenhouse gas emission
  
  - **Agricultural and rural development:** to support farming by expanding the agricultural output markets
While the order of importance of the arguments used by governments to promote biofuels differs among countries, there are many developed and developing countries that are decisively moving into biofuels........
Projected Total Biofuel (bioethanol and biodiesel) Production in the Next 30 Years.

Source: Msangi, et al., 2007
However……

• We believe that while arguments may be valid, much of the shift into biofuels is being done without carefully understanding of its social, economic and environmental implications, especially in the case of developing countries.
Driving forces for biofuel development

Energy security

Environment protection

Agriculture

Policy and welfare implications

Energy security

Environment protection

Agriculture

“Our opinion”
Despite substantial growth of biofuel in the future, it would not significantly improve global/national energy security

Source: Claude Mandil, 2007. A Global Oil Outlook: Demand and Supply
Real cereal price index
(All prices = 100 in 1960)
Real cereal price index
(All prices = 100 in 1960)

Business as usual
Real cereal price index
(All prices = 100 in 1960)

Our argument: if emergence of biofuels caused a large, sustained rise in food prices [unprecedented in last 100+ years], it could have HUGE effect on many parts of the population …
Thinking about the emergence of biofuels triggers many questions:

Will the prices of feedstocks (e.g., maize, sugarcane, etc) continue to increase forever?

How will it affect other parts of the economy? (e.g. those that produce horticulture; livestock…)

How will it affect poor farmers? Poor urban residents?

How will it affect people in poor countries that import grains?

How will it affect land and water uses as well as environment?

How will it affect global and regional trade?

How will it affect R&D spending and investment in agriculture?

…
Impacts on average farm income of producing 10 million kiloliters of bio-ethanol based on maize in China in 2020

Through price and cross-price effects, farmer income will rise in ALL regions (with more gains in maize production zone).

As the maize farmers are relatively poor, there is gain in income distribution
Impacts on regional maize production of producing 10 million kiloliters of bio-ethanol in China in 2020

While it will provide a great opportunity for farmers..., it will also have significant implications for land and water uses in Northeast, North China Plain and Southwest China.
Technological changes:
(e.g., Biotechnologies)
## Impacts of Bt cotton in China

*(By empirical study, per hectare)*

- **Increase yield:** 9.6%  
  930 yuan

- **Reduce pesticide use:** 60%  
  923 yuan

- **Reduce labor input:** 7%  
  574 yuan

- **Increase seed cost:**  
  570 yuan

- **Increase net income:**  
  1857 yuan
  *(US$ 225)*

Sources: Huang et al., *Science*, 29 Jan 2002: 674-677

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**Note:** per capita income of sample farmers was 2160 yuan in 2001
Impacts of GM rice in China
(Based on pre-production trial of GM rice in farm fields)

- Pesticide: - 80%
- Yield: + 4~8%
- Labor: - 5.5%
- Net income: US$ 82~100 /ha

Huang et al., 2005, Science
Overall Impacts in China (million US$) in 2010

Huang et al., 2004, *JDE*
Climate changes

Emerging challenge to food and agricultural production in the coming decades
Marginal temperature effect

Source: Wang et al., 2007
Trade patterns will experience substantial changes due to trade liberalization and biofuel development

- There will be large uncertainty on global trade of:
  - maize and other biofuel feedstocks
  - meat, and
  - many other food and agricultural products
Concluding remarks: Opportunities and Challenges Facing Agricultural Sector

• **Opportunities:**
  - Rising food and agricultural prices due to increasing demand for food, feed and biofuels
  - Technological changes (biotech, IT, etc)
  - Increase investment in R&D and others
  - ...

• **Challenges:**
  - Trade off among food, feed, and fuel
  - Intensification, sustainability, and uncertainty of agricultural production
  - Substantial changes in global agricultural trade (meat, feed and feedstocks)