Impacts of the Chinese Fuel-Ethanol Program on the World Corn Market: An Econometric Simulation Approach

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Purpose of this Study

Evaluate how Chinese fuel-ethanol programs will affect the world corn market

Based on a newly developed world corn market model
The number of automobile in China is increasing

$<10^3$ Cars

Source: China Statistical Yearbook 2005
Chinese petroleum consumption is increasing and its import of crude oil and oil products are rising too.

Source: China Statistical Yearbook 2005
The increase in petroleum consumption is causing serious air pollution problems

In order to deal with energy security and the air pollution problem, the Chinese government is strongly promoting the National Fuel-ethanol program

In June 2002, the government started to make the use of fuel-ethanol blended gasoline mandatory
Chinese Fuel-Ethanol Program

Motorization

- Increasing petroleum consumption
- Surging gasoline price

Concern for Energy Security

Fuel-Ethanol Program (2002)

Demand

Inferior Corn

High Economic Growth

Promoting Industrialization

Concern for Environment
The Chinese Fuel-Ethanol Program

In 2004, the government introduced the compulsory use of a 10% bio-ethanol blended gasoline (E10) in provinces of Helongjiang, Jilin, Liaoning, Henan, and Anhui.

The government expands the E10 program to 27 cities in the provinces of Shandong, Jiangsu, Hebei, and Hubei in 2006.
Fuel-Ethanol Production Sites

China Resources Alcohol Co, Heilongjiang (Corn)

Jilin Fuel Ethanol Co, Jilin (Corn)

Anhui BBCA Biochemical Co. (Corn)

Henan Tian Guan Fuel-Ethanol Co, Henan (Wheat)

Tian Guan Fuel-Ethanol Co, Hubei (From 2007, Grains)

China Resources Alcohol Co, Hebei (From 2007: Sweat potato, corn etc)

China Resources Alcohol Co, Guangxi (From 2007, Cassava)

Corn is the major source of fuel-ethanol in China

1) Corn
   80% of fuel-ethanol is made from corn in China
   Ethanol facilities in Heilongjiang, Jilin, and Anhui use corn

2) Wheat
   Wheat is used in Henan

3) Cassava
   - The Guagxi Zhuang autonomous region plans to build a fuel-ethanol plant
   - The plant is scheduled to begin operations in October of 2007 at a production capacity of 110,000 MT

4) Others
   - Potato, sorghum, rice, sugar, and lignocellulose are on experimental stage for fuel-ethanol production
Chinese fuel-ethanol production cost and agricultural production

Production data is derived from FAS, USDA, PS&D (2006)
Production cost is derived from the Chinese National Development and Reform Commission
Corn use for Fuel-Ethanol production

Although Chinese central government ordered to use inferior corn for fuel-ethanol production, facilities in Heilongjiang and Jilin use normal corn.

If China continues to expand corn-based fuel-ethanol production, corn utilization ratio for ethanol will increase.
The world corn market model

The world corn market model is a dynamic partial equilibrium model

The model covers 11 major countries and regions (China, U.S., Argentina, Brazil, South Africa, Japan, Canada, EU25, Mexico, the Korean Republic and the Rest of the World)

The model simulates production, consumption, export, import, and ending stocks to the year 2014/15
For each simulation year, the model determines gross exports and imports for each country and region.

A world corn market equilibrium price is obtained from equilibrium conditions through the use of the Gauss-Seidel algorithm.

World corn price (Corn No.2 yellow, Chicago) refers to the world corn market clearing price.

Wheat price, soybean price, beef production, pork production and dairy production were exogenous variables.
Structures of the world corn model

Chinese corn market

- Domestic wheat price
- Domestic soybean price
- Technical growth rate
- Yield
- Area harvested

Production

- Ending stocks
- Import (definition)

Feed consumption

- Consumption
- Export

Export

Other consumption

Per capita consumption

Population

Per capita GDP growth rate

World corn market

- U.S. market
- EU25 market
- Japanese market
- South African market
- Argentine market
- Korean market
- Brazilian market
- Canadian market
- Rest of the World's market

World Total Export = World Total Import

\[ P_w \]

0

Q

W world corn price

Endogenous

Exogenous

Pw
Baseline Assumptions in general

The current agricultural policy will be continued in all countries

Normal weather and historical rates of technological innovation are taken for granted
Baseline Assumptions China specific

Chinese government will maintain and promote the E10 program in Heilongjiang, Jilin, Liaoning, Henan and Anhui from 2005

Shandong, Jiangsu, Hebei, and Hubei are assumed to start the E10 program in 27 cities from 2006

Ethanol facilities in Heilongjiang and Jilin use corn
Chinese corn consumption for fuel-ethanol is projected to increase from 2,363 thousand MT in 2004/05 to 4,317 thousand MT in 2014/15.

<table>
<thead>
<tr>
<th></th>
<th>Fuel-ethanol Consumption, Corn Equivalent: (1)*3.07</th>
<th>Fuel-ethanol Consumption: (1)=(2)+(3)+(4)</th>
<th>Fuel-ethanol consumption in Jilin (2)</th>
<th>Fuel-ethanol consumption in Heilongjiang (3)</th>
<th>Fuel-ethanol consumption in Liaoning (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004/05</td>
<td>2,363.3</td>
<td>769.8</td>
<td>126.2</td>
<td>336.4</td>
<td>307.2</td>
</tr>
<tr>
<td>2005/06</td>
<td>2,535.8</td>
<td>826.0</td>
<td>135.4</td>
<td>361.0</td>
<td>329.6</td>
</tr>
<tr>
<td>2006/07</td>
<td>2,708.3</td>
<td>882.2</td>
<td>144.6</td>
<td>385.5</td>
<td>352.0</td>
</tr>
<tr>
<td>2007/08</td>
<td>2,880.9</td>
<td>938.4</td>
<td>153.8</td>
<td>410.1</td>
<td>374.5</td>
</tr>
<tr>
<td>2008/09</td>
<td>3,053.4</td>
<td>994.6</td>
<td>163.0</td>
<td>434.7</td>
<td>396.9</td>
</tr>
<tr>
<td>2009/10</td>
<td>3,225.9</td>
<td>1,050.8</td>
<td>172.3</td>
<td>459.2</td>
<td>419.3</td>
</tr>
<tr>
<td>2010/11</td>
<td>3,398.5</td>
<td>1,107.0</td>
<td>181.5</td>
<td>483.8</td>
<td>441.7</td>
</tr>
<tr>
<td>2011/12</td>
<td>3,628.0</td>
<td>1,181.8</td>
<td>193.7</td>
<td>516.5</td>
<td>471.6</td>
</tr>
<tr>
<td>2012/13</td>
<td>3,857.5</td>
<td>1,256.5</td>
<td>206.0</td>
<td>549.1</td>
<td>501.4</td>
</tr>
<tr>
<td>2013/14</td>
<td>4,087.0</td>
<td>1,331.3</td>
<td>218.2</td>
<td>581.8</td>
<td>531.2</td>
</tr>
<tr>
<td>2014/15</td>
<td>4,316.5</td>
<td>1,406.0</td>
<td>230.5</td>
<td>614.5</td>
<td>561.1</td>
</tr>
</tbody>
</table>

Alternative scenario

Shandong, Jiangsu, Hebei, and Hubei will start the E10 program from 2007/08. As a result of this new program, the nine provinces are assumed to promote the fuel-ethanol program at the provincial level from 2007/08.

As a result of the expanded program, corn consumption for fuel-ethanol is predicted to increase from 6,240 thousand MT in 2007/08 to 9,946 thousand MT in 2014/15.
## Chinese corn consumption for fuel-ethanol (Alternative Scenario)

(1000 tons)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel-ethanol consumption, corn equivalent: ( (1) \times 3.07 )</td>
<td>6,240.0</td>
<td>6,685.4</td>
<td>7,130.8</td>
<td>7,576.3</td>
<td>8,168.8</td>
<td>8,761.3</td>
<td>9,353.8</td>
<td>9,946.3</td>
</tr>
<tr>
<td>Fuel-ethanol consumption ( (1)=(2)+(3) )</td>
<td>2,032.6</td>
<td>2,177.7</td>
<td>2,322.7</td>
<td>2,467.8</td>
<td>2,660.8</td>
<td>2,853.8</td>
<td>3,046.8</td>
<td>3,239.8</td>
</tr>
<tr>
<td>Fuel-ethanol consumption (Baseline) ( (2) )</td>
<td>938.4</td>
<td>994.6</td>
<td>1,050.8</td>
<td>1,107.0</td>
<td>1,181.8</td>
<td>1,256.5</td>
<td>1,331.3</td>
<td>1,406.0</td>
</tr>
<tr>
<td>Additional Fuel-ethanol consumption (From maize): ( (3)=(5)-(4) )</td>
<td>1,094.2</td>
<td>1,183.1</td>
<td>1,272.0</td>
<td>1,360.8</td>
<td>1,479.1</td>
<td>1,597.3</td>
<td>1,715.6</td>
<td>1,833.8</td>
</tr>
<tr>
<td>Fuel-ethanol consumption (from wheat) ( (4) )</td>
<td>390.0</td>
<td>390.0</td>
<td>390.0</td>
<td>390.0</td>
<td>390.0</td>
<td>390.0</td>
<td>390.0</td>
<td>390.0</td>
</tr>
<tr>
<td>4 Province Total: ( (5)=(6)+(7)+(8)+(9) )</td>
<td>1,484.2</td>
<td>1,573.1</td>
<td>1,662.0</td>
<td>1,750.8</td>
<td>1,869.1</td>
<td>1,987.3</td>
<td>2,105.6</td>
<td>2,223.8</td>
</tr>
<tr>
<td>Fuel-ethanol consumption in Hebei ( (6) )</td>
<td>369.2</td>
<td>391.3</td>
<td>413.4</td>
<td>435.5</td>
<td>464.9</td>
<td>494.4</td>
<td>523.8</td>
<td>553.2</td>
</tr>
<tr>
<td>Fuel-ethanol consumption in Shandong ( (7) )</td>
<td>280.5</td>
<td>297.3</td>
<td>314.1</td>
<td>330.8</td>
<td>353.2</td>
<td>375.5</td>
<td>397.9</td>
<td>420.2</td>
</tr>
<tr>
<td>Fuel-ethanol consumption in Hubai ( (8) )</td>
<td>369.2</td>
<td>391.3</td>
<td>413.4</td>
<td>435.5</td>
<td>464.9</td>
<td>494.4</td>
<td>523.8</td>
<td>553.2</td>
</tr>
<tr>
<td>Fuel-ethanol consumption in Jiangsu ( (9) )</td>
<td>465.3</td>
<td>493.2</td>
<td>521.1</td>
<td>548.9</td>
<td>586.0</td>
<td>623.1</td>
<td>660.1</td>
<td>697.2</td>
</tr>
</tbody>
</table>

Baseline projections

<10^3 tons>

Production

Consumption

World Corn Price (Corn No2 Yellow) <Right>

Export

Ending Stocks

<dollars/Bushel>
Impacts on the World Corn Market Scenario / Baseline : 2014/15

(Percent)

<table>
<thead>
<tr>
<th>Production</th>
<th>Exports</th>
<th>Imports</th>
<th>Consumption</th>
<th>World Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.35</td>
<td>3.20</td>
<td>3.20</td>
<td>0.35</td>
<td>1.60</td>
</tr>
</tbody>
</table>

Note: Each percentage means “(Scenario(2014/15)/Baseline (2014/15)-1)*100”
Conclusions

The Chinese expanded fuel-ethanol programs are predicted to affect the world corn market

Fuel-ethanol is competing with feed, food and others for the consumption of corn

Chinese central government stated to regulate corn-based fuel-ethanol production (Statement from National Development and Reform Commission in 21/12/2006)

Chinese government wants to diversify the sources of fuel-ethanol production
Future directions of this study

How DDGS (Distillers' Dried Grains with Solubles) will affect feed and livestock markets

How the fluctuation of the world crude oil price influences the world ethanol and corn markets
Special thanks to

- Dr. Qiao Jiang, Heilongjiang Academy of Agricultural Science, China

- Mr. Manabu Takamizawa, Director, Japan-China Economic Association, Japan

- Mr. Norihiro Yamashita, Senior Economist, Policy Research Institute, Ministry of Agriculture, Forestry and Fisheries Japan

- Dr. Takeshi Sakurai, Senior Economist, Policy Research Institute, Ministry of Agriculture, Forestry and Fisheries Japan
Impacts of Japanese Bio-Ethanol Import on the Brazilian and World Sugar Markets: An Econometric Simulation Approach

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** Professor, College of Bioresource Science, Nihon University
Purpose of this study

Evaluate how Japanese bio-ethanol import will affect on Brazilian and international sugar markets

Based on a newly developed world sugar market model
Japanese bio-ethanol Program (Background)

Preventing global warming

Development of strategic industries

Vitalization of rural and farming communities

Biomass Nippon Strategy was formulated in December 2002
Revised Biomass Nippon Strategy (Japan)

Kyoto Protocol was put into effect in February 2005

Revised Biomass Nippon Strategy was formulated in March 2006

Promotion of utilization of biomass for transportation fuel, particularly of domestic biomass
Current Bio-Ethanol Production (Japan)

Japanese bio-ethanol production is at an experimental stage

Current production level is 30 kl (April 2006)

Tokachi area, Hokkaido (From wheat and corn unsuited to food)

Shinjo city, Yamagata (From sorghum)

Maniwa city, Okayama (From wasted woods)

Sakai city, Osaka (From wasted woods)

Ie village, Okinawa (From Molasses)

Iiyako Island, Okinawa (From Molasses)
Expected Result (Japan)

Food and Agriculture
- Reinforcement of international competitiveness to agriculture
- Improvement and maintenance of food supplying capability

Environment
- Contribution to fulfillment of the target dedicated by the Kyoto Protocol
- Actions in consideration of Post-Protocol situation

Energy
- Action to cope with rising crude oil price
- Diversification of energy sources (energy security)
Production cost and fuel-tax need to be reduced to expand bio-ethanol production in Japan

Yen/Liters

<table>
<thead>
<tr>
<th></th>
<th>Gasoline</th>
<th>Imported Ethanol from Brazil</th>
<th>Domestic Molasses</th>
<th>Wheat (Non-food grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Import Tariff</td>
<td></td>
<td>53.8</td>
<td>53.8</td>
<td>53.8</td>
</tr>
<tr>
<td>Processing Cost</td>
<td></td>
<td>83.4</td>
<td>7.0</td>
<td>46.0</td>
</tr>
<tr>
<td>Raw Material Cost</td>
<td></td>
<td>7.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Import Price</td>
<td>66.2</td>
<td>76.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate Price from oil Manufacture</td>
<td>121.0yen</td>
<td>148.4yen</td>
<td>144.2yen</td>
<td>151.8yen</td>
</tr>
</tbody>
</table>

Note: The diagram shows the breakdown of costs for different raw materials used in bio-ethanol production, with emphasis on the need for reduced production costs and fuel-tax to expand production in Japan.
Domestic bio-ethanol or Imported bio-ethanol?

Japanese government permits to blend bio-ethanol in gasoline up to 3% by law

Japanese government promotes to utilize of bio-fuel, especially for bio-ethanol

Securing feedstock for bio-ethanol, reduction of production cost, tax reduction for bio-ethanol are needed to expand bio-ethanol production in Japan

Due to limitation of domestic bio-ethanol supply, there is an argument whether Japan should depend on imported bio-ethanol (from Brazil) or not
The world sugar market model

The world sugar market model is a dynamic partial equilibrium model.

The model covers 12 major countries and regions (Brazil, U.S., EU15, Australia, Mexico, Japan, India, China, ACP countries, Thailand, Former USSR, and the Rest of the World.)

The model simulates production, consumption, export, import, and ending stocks to the year 2015.
For each simulation year, the model determine gross exports and imports for each country

A world sugar market equilibrium price is obtained from equilibrium conditions through the use of the Gauss-Seidel algorithm

World sugar price refers to the world sugar market clearing price

World white sugar price is linked to the world raw sugar price

Corn and wheat price are exogenous variables
In the model, sugar and bio-ethanol markets are linked together in Brazilian market

The main driving factor that determines the production levels of bio-ethanol and sugar is the relationship between the domestic sugar price and the domestic bio-ethanol price

In the Brazilian market, a *sugarcane allocation ratio variable* is defined as the relative proportions of sugarcane that go to bio-ethanol production and sugar production
Brazilian bio-ethanol and sugar production (Abstract)

Sugar cane
  ↓
Washing
  ↓
Juice Extraction
  ↓
Juice treatment
  ↓
Producer’s Decision
  |   |
  ↓   ↓
Domestic Sugar Price   Domestic Ethanol Price
  ↓   ↓
World Raw Sugar Price
  ↓
  ↓
Distillation
  ↓
Centrifuge
  ↓
Bio-ethanol
  ↓
Raw Sugar
World Sugar Market Model (Raw Sugar Equivalent)
Baseline scenario

The current agricultural policy will be continued in all countries

Normal weather and historical ratio of technological innovation are taken for granted

Brazil will maintain anhydrous ethanol blend ratio at 23%
Baseline Projection

<10^6 tons>
Scenario 1

Hypotheses: Japan will start E3 (3 percent bio-ethanol blend in gasoline) program in all areas from 2012 and depend on imported bio-ethanol from Brazil.

Bio-ethanol consumption to meet E3 program is predicted to increase at 1,737 thousand kl in 2012 and 1,756 thousand kl in 2015.

Japanese gasoline and Bio-ethanol consumption

\[<10^3 \text{ kl}>\]

<table>
<thead>
<tr>
<th>Year</th>
<th>Gasoline Consumption</th>
<th>Bio-ethanol Consumption from E3 Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>61,430</td>
<td>1,788</td>
</tr>
<tr>
<td>2005</td>
<td>61,064</td>
<td>1,777</td>
</tr>
<tr>
<td>2008</td>
<td>59,967</td>
<td>1,745</td>
</tr>
<tr>
<td>2012</td>
<td>59,675</td>
<td>1,737</td>
</tr>
<tr>
<td>2013</td>
<td>59,894</td>
<td>1,743</td>
</tr>
<tr>
<td>2014</td>
<td>60,114</td>
<td>1,749</td>
</tr>
<tr>
<td>2015</td>
<td>60,333</td>
<td>1,756</td>
</tr>
</tbody>
</table>

Imposition scenario2 (Background)

Petrobras plans to export 3 million kl of bio-ethanol not only for fuel-use but also for thermal power generation use from 2010.

The use of bio-ethanol use for thermal power generation is at an experimental stage.

Setting the blend ratio to heavy oil, modification of thermal power facilities, costs and other technical and transport problems are crucial issues to use bio-ethanol for thermal power.
Scenario 2

Hypotheses: Japan will import 3 million kl of Brazilian bio-ethanol from 2010, assuming that all the technological and other problems are solved
Impact on Brazilian Ethanol market (Scenario1/Baseline: 2015)

Note: Each percentage means "(Scenario1(2015)/Baseline (2015)-1)*100"
Impact on Brazilian Ethanol market (Scenario2/Baseline: 2015)

Note: Each percentage means \((\text{Scenario2}(2015)/\text{Baseline (2015)}-1)*100\)
Impact on Sugar Markets (Scenario1/Baseline:2015)

Note: Each percentage means “(Scenario1(2015)/Baseline (2015)-1)*100”
Impact on Sugar Markets (Scenario2/Baseline:2015)

Note: Each percentage means 
\[((\text{Scenario2}(2015)/\text{Baseline (2015)}-1)\times100\%\)
Conclusions

The expansion of Japanese bio-ethanol import from Brazil is predicted to impact on not only Brazilian but also world sugar markets

Brazilian bio-ethanol and sugar producers, and some sugar exporters will benefit from relatively higher sugar price

Sugar-importing countries may decrease their import and consumption due to the relatively high sugar price

The expansion of Japanese bio-ethanol import from Brazil can have negative impact on some countries
Special thanks to

- Dr. Koji Yanagishima, Economist, Food and Agricultural Organization of the United Nations, Italy

- Dr. Takeshi Sakurai, Senior Economist, Policy Research institute, Ministry of Agriculture, Forestry and Fisheries, Japan
Thank you for your attention!!
Chinese corn production, consumption and ending stocks

(10^3 tons)

## Current and Future Fuel-Ethanol Production (1)

<table>
<thead>
<tr>
<th>Province</th>
<th>Company Name</th>
<th>Feedstock</th>
<th>2005 production (MT/Year)</th>
<th>2007 production capacity (MT/Year)</th>
<th>Supply location</th>
<th>Supply volume (MT/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heilongjiang</td>
<td>China Resources Alcohol Co.</td>
<td>Corn</td>
<td>100,000</td>
<td>100,000</td>
<td>Heilongjiang</td>
<td>100,000</td>
</tr>
<tr>
<td>Jilin</td>
<td>Jilin Fuel Ethanol Co.</td>
<td>Corn</td>
<td>300,000</td>
<td>600,000</td>
<td>Jilin</td>
<td>100,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Liaoning</td>
<td>200,000</td>
</tr>
<tr>
<td>Henan</td>
<td>Henan Tian Guan Fuel-Ethanol Co.</td>
<td>Wheat</td>
<td>200,000</td>
<td>200,000</td>
<td>Henan</td>
<td>86,842</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hubei (9 cities)</td>
<td>113,158</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hebei (4 cities)</td>
<td></td>
</tr>
<tr>
<td>Anhui</td>
<td>Anhui BBCA Biochemical Co.</td>
<td>Corn</td>
<td>320,000</td>
<td>320,000</td>
<td>Anhui</td>
<td>100,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shandong (7 cities)</td>
<td>220,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Jiangsu (5 cities)</td>
<td></td>
</tr>
<tr>
<td>Guangxi</td>
<td>China Resources Alcohol Co.</td>
<td>Cassava</td>
<td>0</td>
<td>110,000</td>
<td>Guangxi</td>
<td>110,000</td>
</tr>
<tr>
<td>Hebei</td>
<td>China Resources Alcohol Co.</td>
<td>Sweet potato, corn etc</td>
<td>0</td>
<td>230,000</td>
<td>Hebei</td>
<td>230,000</td>
</tr>
<tr>
<td>Hubei</td>
<td>Tian Guan Fuel-Ethanol Co.</td>
<td>Grains</td>
<td>0</td>
<td>100,000</td>
<td>Hubei</td>
<td>100,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>920,000</strong></td>
<td><strong>1,660,000</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chinese ethanol production cost is higher than other producers

If China expands ethanol production from cassava, China will have to rely on imported cassava.

Conclusions (China)

80% of fuel-ethanol was made from corn in China in 2005

Chinese central government wants to regulate corn-based ethanol production

Chinese government wants to diversify the sources of fuel-ethanol production, especially to cassava

Technological innovation is required for developing cassava-based fuel-ethanol production
2. U.S. Ethanol Programs

Corn is the major feedstock used to produce ethanol.

The U.S. ethanol market was initiated in the 1970s when oil price disruptions impacted on the U.S. economy.

The Clean Air Act Amendments (CAAA90) boosted ethanol markets.

The two methods to increase the oxygen level of gasoline consist in blending it with ethanol or MTBE (methyl tertiary butyl ether).

Most oil refiners choose MTBE because of its economic and blending characteristics.
In March 1999, Governor Gray Davis announced a phase-out of the use of MTBE in California after 2002.

By the end of 2005, 25 States had barred MTBE or passed laws banning its use.

MTBE was replaced by ethanol as an oxygenated fuel.

The ethanol consumption increased by 9.6% per year between 1992 and 2004. (EIA 2005)
The Energy Policy Act of 2005 (EPACT 2005) established the Renewable Fuel Standards (RFS), which made the use of biofuels mandatory, from 4 billion gallons to 7.5 billion gallons by 2012.

EPACT 2005 doesn’t provide MTBE producers with any protection against lawsuits.

Most petroleum companies are trying to move away from MTBE before the 2006 summer driving season.

Some States have their own renewable fuels programs.
California, Minnesota, Montana and Hawaii have passed legislation for ethanol use requirements.

Some other States are following thorough with these ethanol use requirements.

The RFS, MTBE phase-out and ethanol use requirements will lead to expanding ethanol markets.
5 Scenarios

(1) Baseline scenario (assumptions) (1)

The current agricultural policy will be continued in all countries.

Normal weather and historical rates of technological innovation are taken for granted.

MTBE will be eliminated in all States and RFS will be enforced during the projection period.

California, Minnesota, Montana and Hawaii will proceed and start their own ethanol use requirements.
(1) Baseline scenario ( )

The U.S. ethanol use requirements are projected to increase from 8,221 thousand MT in 2006/07 to 9,188 thousand MT in 2014/15.

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<tbody>
<tr>
<td>Ethanol use requirement (Corn equivalent):</td>
<td>1,000</td>
<td>8,221</td>
<td>8,745</td>
<td>8,810</td>
<td>8,871</td>
<td>8,929</td>
<td>8,984</td>
<td>9,041</td>
<td>9,095</td>
<td>9,144</td>
<td>9,188</td>
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<tr>
<td>Ethanol use requirement (2)= (3)+(4)+(5)</td>
<td>1,000KL</td>
<td>3,259</td>
<td>3,466</td>
<td>3,492</td>
<td>3,517</td>
<td>3,540</td>
<td>3,561</td>
<td>3,584</td>
<td>3,605</td>
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<td>Ethanol use requirement in California (3)</td>
<td>1,000KL</td>
<td>3,060</td>
<td>3,083</td>
<td>3,105</td>
<td>3,126</td>
<td>3,146</td>
<td>3,164</td>
<td>3,182</td>
<td>3,199</td>
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<td>3,227</td>
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<tr>
<td>Ethanol use requirement in Montana (4)</td>
<td>1,000KL</td>
<td>199</td>
<td>200</td>
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</tr>
<tr>
<td>Ethanol use requirement in Hawaii (5)</td>
<td>1,000KL</td>
<td>-</td>
<td>183</td>
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<td>193</td>
<td>195</td>
<td>198</td>
<td>200</td>
<td>203</td>
</tr>
</tbody>
</table>


(Notes) Ethanol consumption in Minnesota is projected to exceed their ethanol use requirements.
Studies for U.S. and Chinese ethanol policies and markets.

The increased ethanol production will raise the corn price and benefit to corn producers. (US General Accounting Office 1990)

MTBE phase-out will increase the amount of ethanol production from corn and impact on domestic crops and feed prices. (Ferris 2004, USDA 2002)

Chinese ethanol will impact on domestic and international corn markets. (Koizumi and Ohga 2006)

Neither of these studies dealt with how the concurrent U.S. and Chinese fuel-ethanol programs would impact on the world corn market.
Ethanol Use Requirements

- Law enacted
- Pending Legislation
- Failed Legislation in current session

Map showing ethanol use requirements across the United States.

(Source) NCGA (May 2006)
○ The Chinese fuel-ethanol program (Baseline scenario)
The Chinese government will maintain and promote the E10 program in Henan and Anhui from 2006.

Henan and Anhui are assumed to meet ethanol consumption in Shandong, Jiangsu, Hebei and Hubei.
○ Chinese fuel-ethanol program (Scenario )

- Heilongjiang
- Jillin
- Hebei
- Liaoning
- Shandong
- Jiangsu
- Anhui
- Henan
- Hubei
Impacts on World Corn Consumption (Scenario / Baseline)
Impacts on World Corn Production Scenario / Baseline

- USA: 0.33
- China: 0.10
- Argentina: 0.98
- Brazil: 0.46
- S. Africa: 0.03
- Canada: 0.17
- Mexico: 0.04
Impacts on World Corn Exports Scenario / Baseline

- USA: 3.32
- Argentina: 1.63
- Brazil: 13.07
- South Africa: 1.47
- Canada: 1.60
Impacts on World Corn Imports Scenario / Baseline

- China: 125.32
- Japan: -0.17
- South Korea: -0.50
- Canada: -2.90
- Mexico: -0.63
For Further Promotion of Domestic Bio-Ethanol (Japan)

The abandoned arable land can be used to grow crops for bio-ethanol production

Farmland planted with crops may be used to provide raw materials for bio-ethanol

Technological innovation is the key
Conclusions (Japan)

Japanese government promotes bio-ethanol production and utilization for automobile

Securing feedstock for bio-ethanol, reduction of production cost, tax reduction for bio-ethanol are needed to expand bio-ethanol production in Japan

Further technical innovation is the key factor to promote domestic bio-ethanol production