

Food and Fuel: The Implications for Agricultural Research Policy

An Analysis of the Long-Run Impact of Ethanol Expansion on U.S. Agricultural Markets

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Outline

- Based on the CARD study “Emerging Biofuels: Outlook of Effects on U.S. Grain, Oilseed, and Livestock Markets”

<http://www.card.iastate.edu/publications/synopsis.aspx?id=1050>

- The objective of the study is to estimate:
 - how large the biofuels sector in the U.S. could become
 - the impact of the biofuels sector on crops markets, trade, and on livestock markets
 - the response of world agricultural markets

Outline

- After establishing a **baseline**, we ran a number of scenarios including:
 - **high crude oil price with no bottleneck**
 - high crude oil price with bottleneck
 - **drought with an ethanol mandate**
 - removal of CRP land for ethanol production
 - removal of tax credit and import tariff

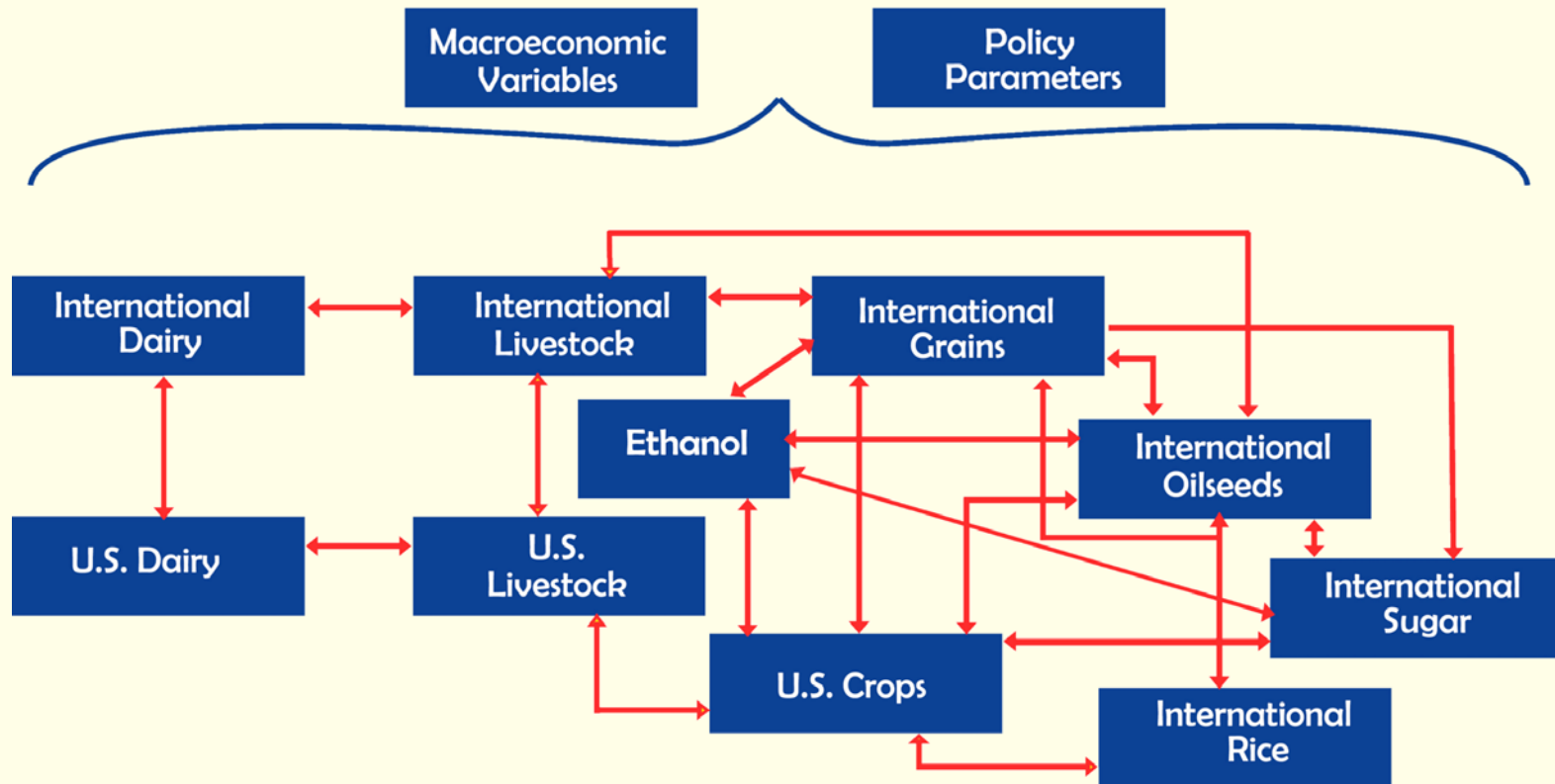
General Description of the Models

- Broad modeling system of world agricultural economy
- Non-spatial multi-market multi-country deterministic partial equilibrium models of supply and demand
- Behavioral equations for production, consumption, ending stocks and net trade
- Solve for a representative world price
- Domestic prices linked to world price through price transmission equations
- Linkages between all agricultural commodity markets and energy markets

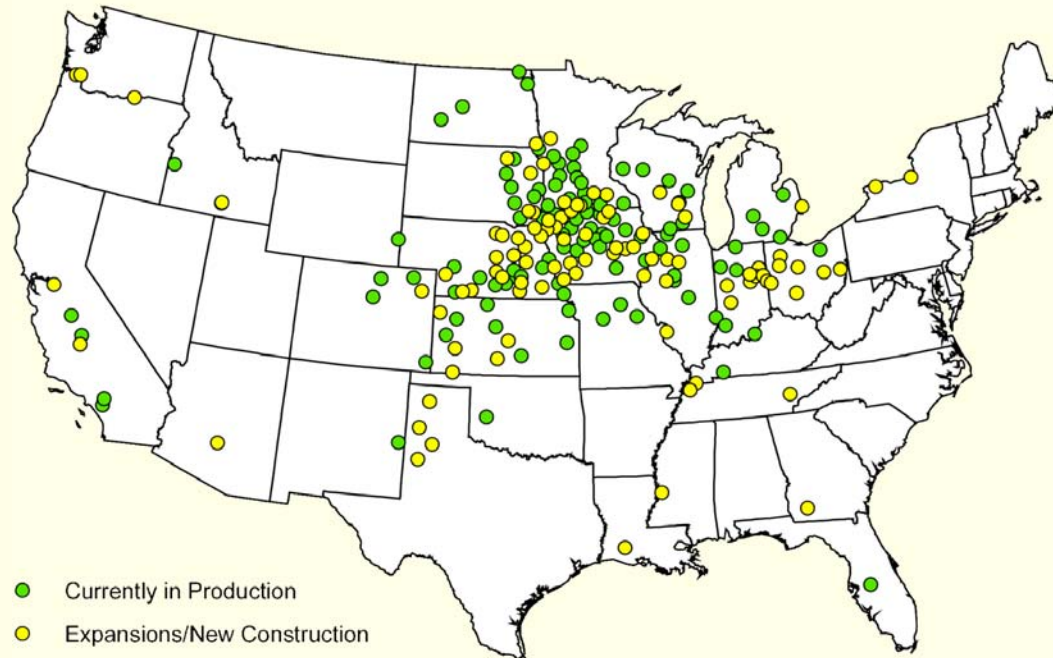
Model Interactions

Model Interactions

Trade, Prices, and Physical Flows



U.S. Ethanol Industry



- Current ethanol capacity: 120 plants, 6.2 billion gallons/year
- Total capacity under construction and expansion: 6.4 billion gallons/year
- 77 new ethanol plants and 8 expansion projects underway
- 2.2 billion bushels of corn were used in producing fuel ethanol in 2006/2007 marketing year.
- 3.2 billion bushels of corn are expected to be used in producing fuel ethanol for 2007/2008 marketing year.

Baseline

- All models are calibrated on 2006 historical data and projections cover the period between 2007 and 2016 (2007/08 and 2016/17 marketing year)
- Ethanol production out to mid-2010 is based on actual construction; after that the number of ethanol plants responds to economic stimuli
- Ethanol demand is modeled based on gasoline prices and ultimately on crude oil prices
- Existing domestic and trade policies remain unchanged

Baseline Assumptions

- No impact on trend yields from changes in planted acreage
- No impact on meat quality from feeding distillers' grains (dg)
- All potential bottlenecks involved in transporting ethanol, dg, corn and fertilizer are solved
- Cellulosic ethanol is not competitive under current policy incentives
- Only direct food price increases caused by increased feed costs are accounted for

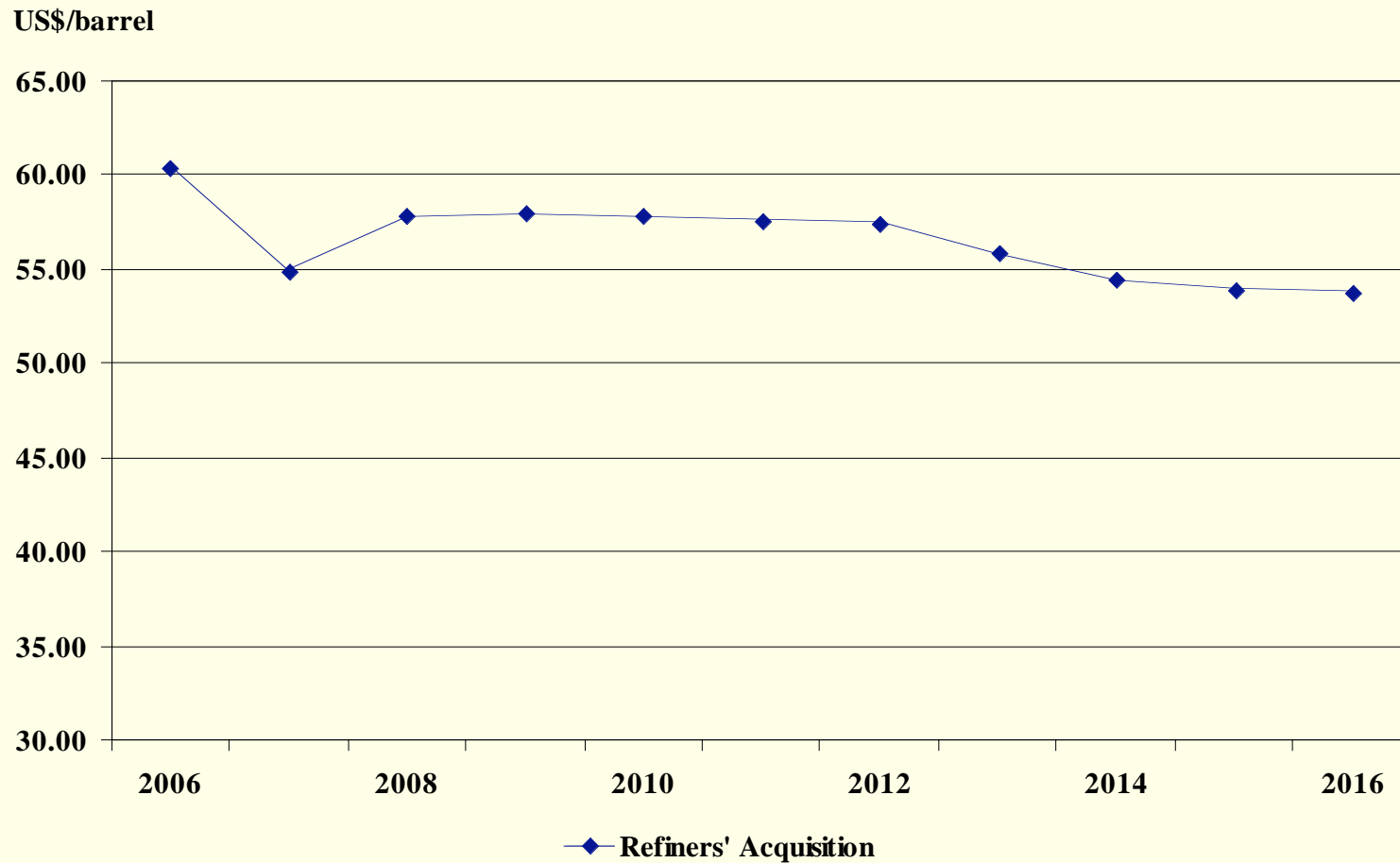
Concept of Long-run Equilibrium

- At long-run equilibrium
 - There is no incentive to build new ethanol plants and no incentive to shut down existing plants
 - In the livestock industry, net returns go back to “normal” levels to keep producers in business (through a reduction in supply and increase in price)
 - All markets clear

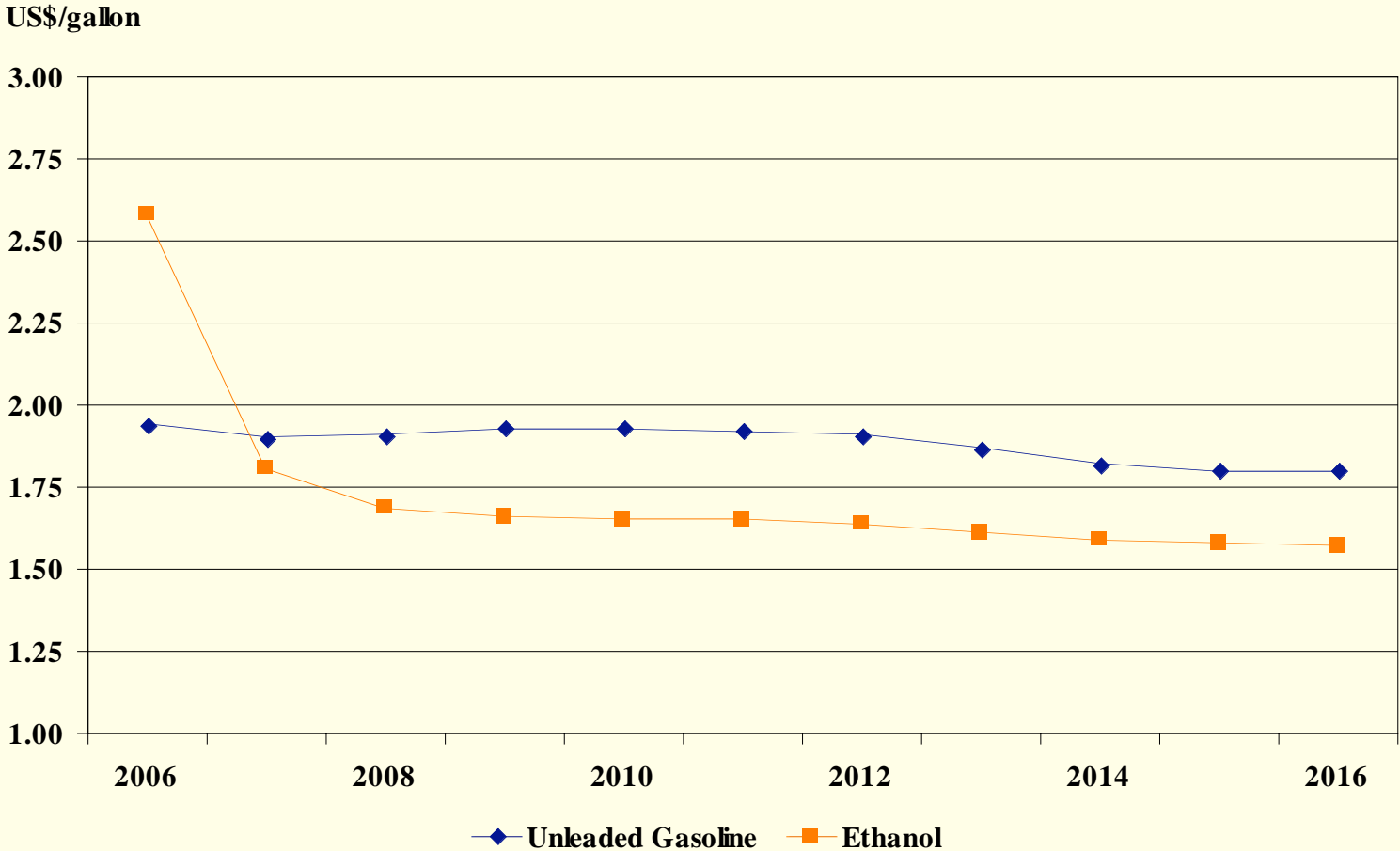
Key Determinants of Impacts

- Crude oil prices
 - Used NYMEX futures prices as a guide
- Policy incentives in the U.S.
 - \$0.51/gallon ethanol blenders credit
 - \$0.54/gallon import duty and 2.5% import tariff
- Demand for E-85

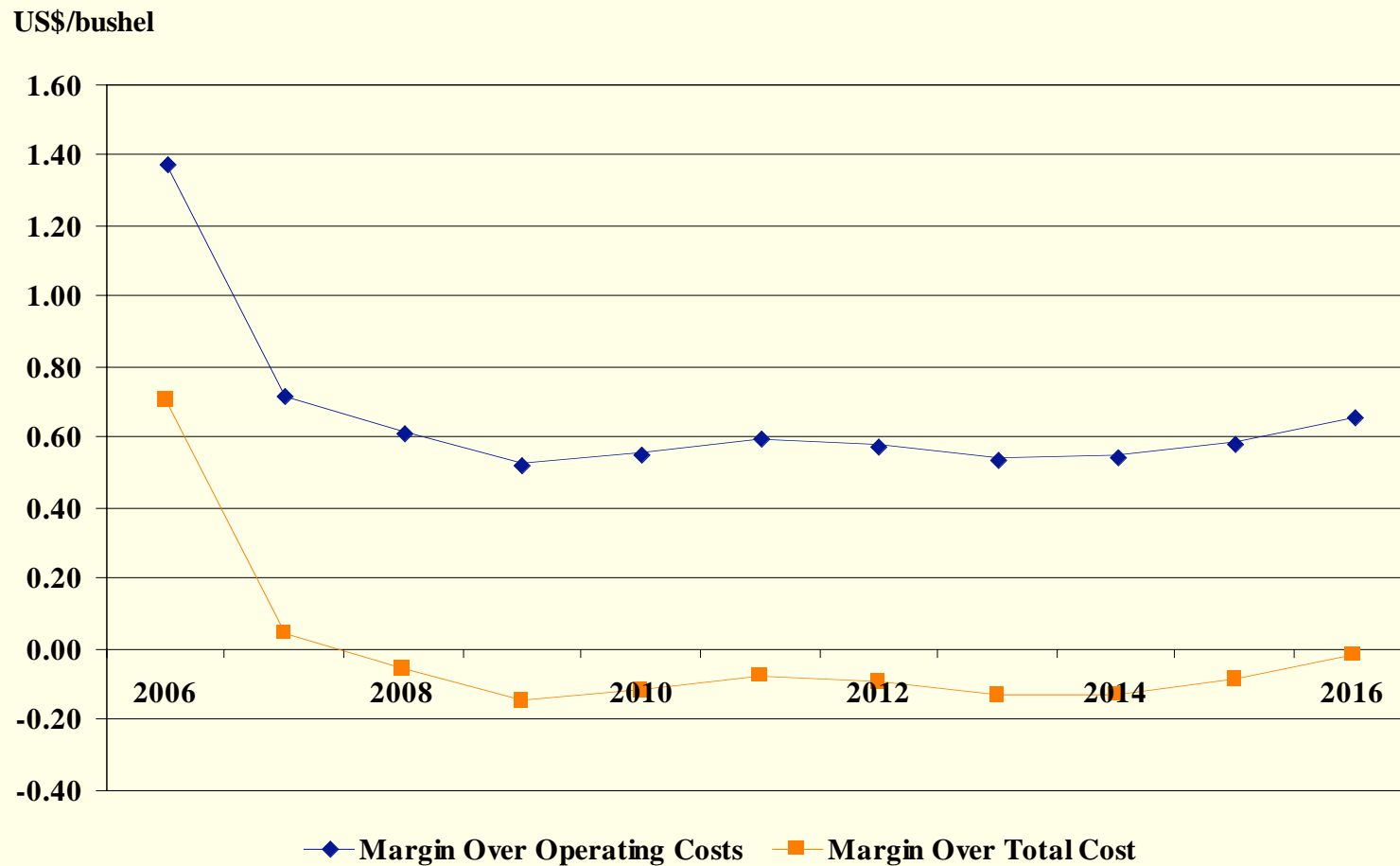
Baseline Crude Oil Price



Wholesale Gasoline and Ethanol Prices

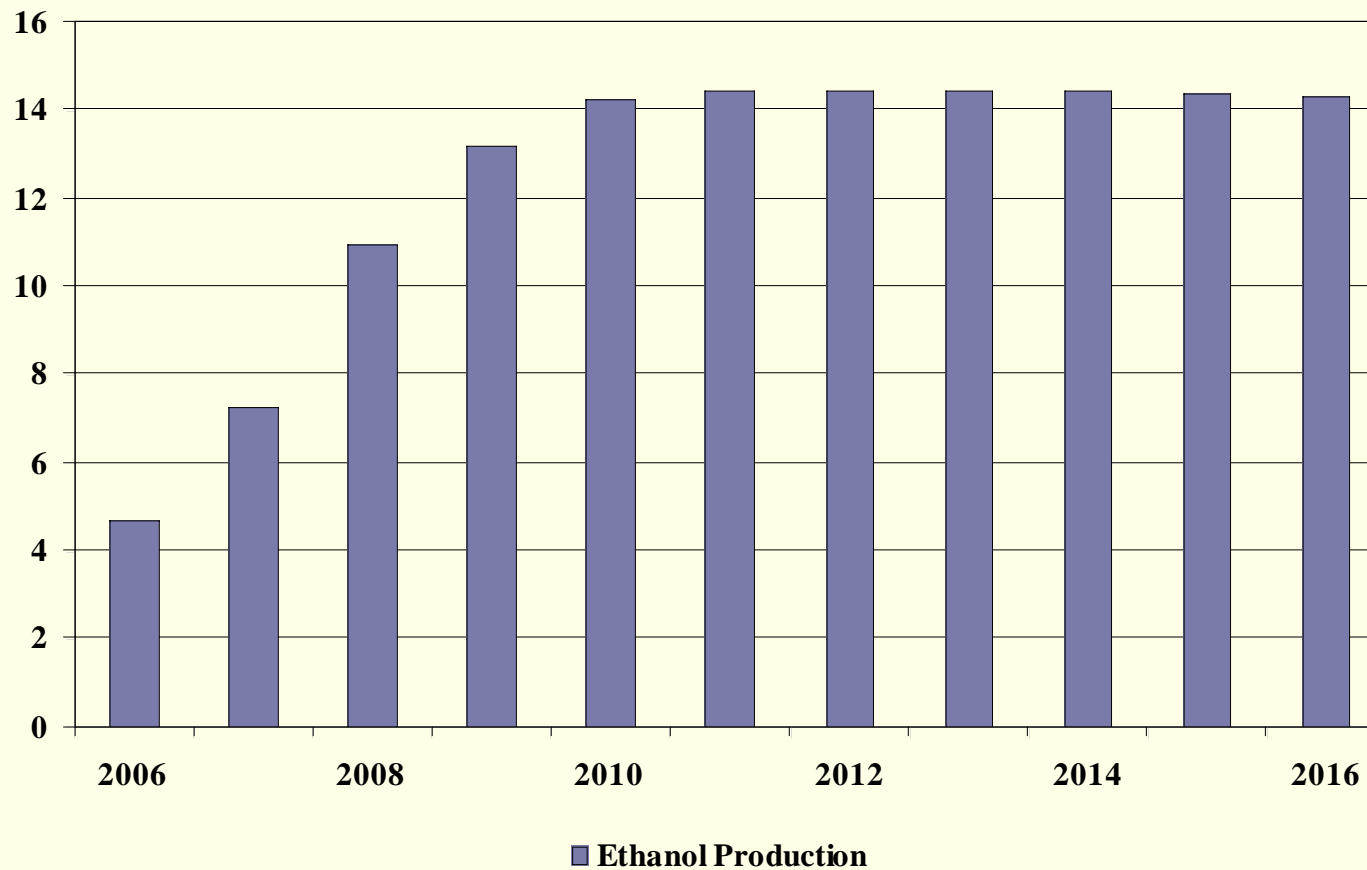


Projected U.S. Dry Mill Margins



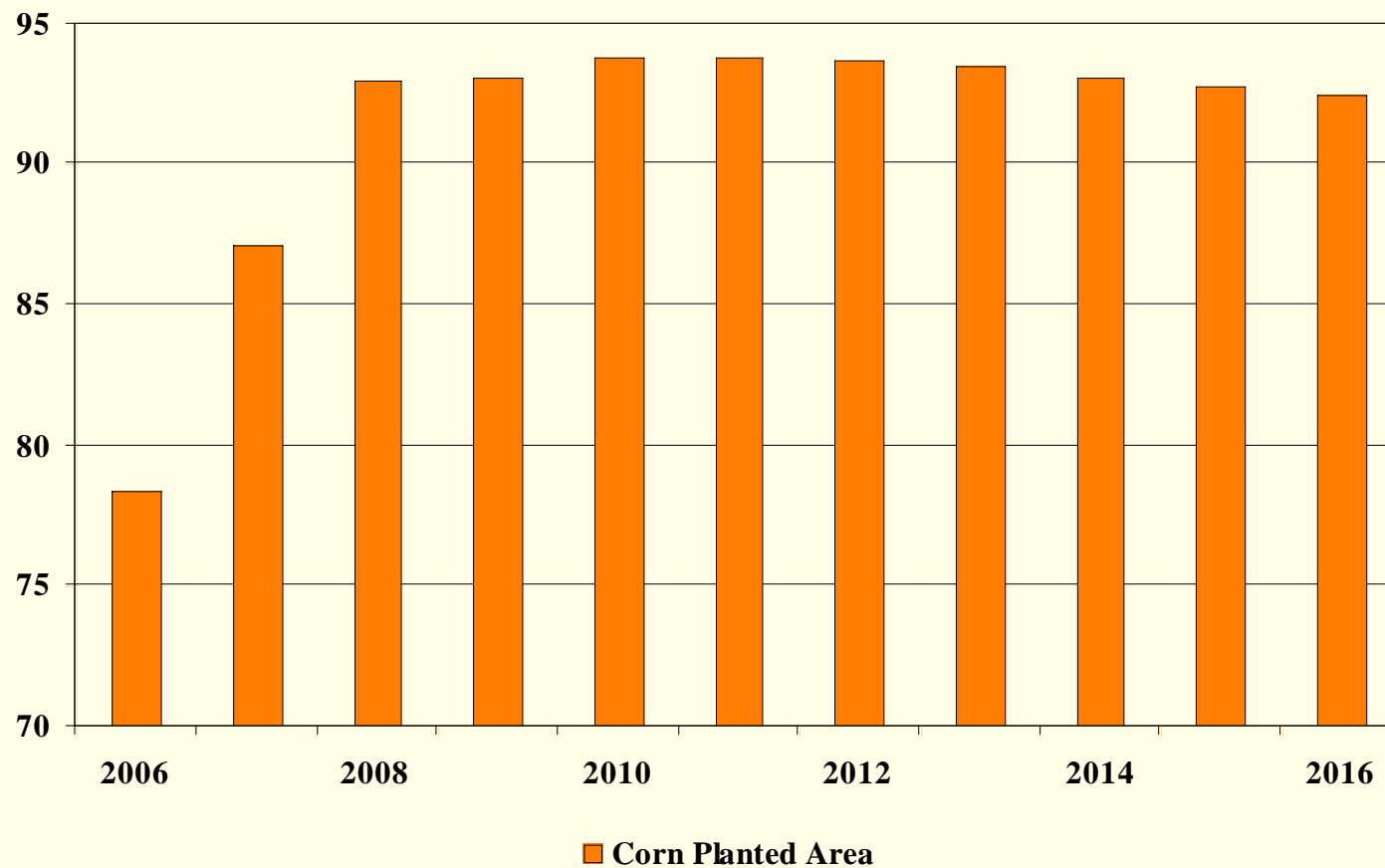
Projected U.S. Ethanol Production from Corn

billion gallons

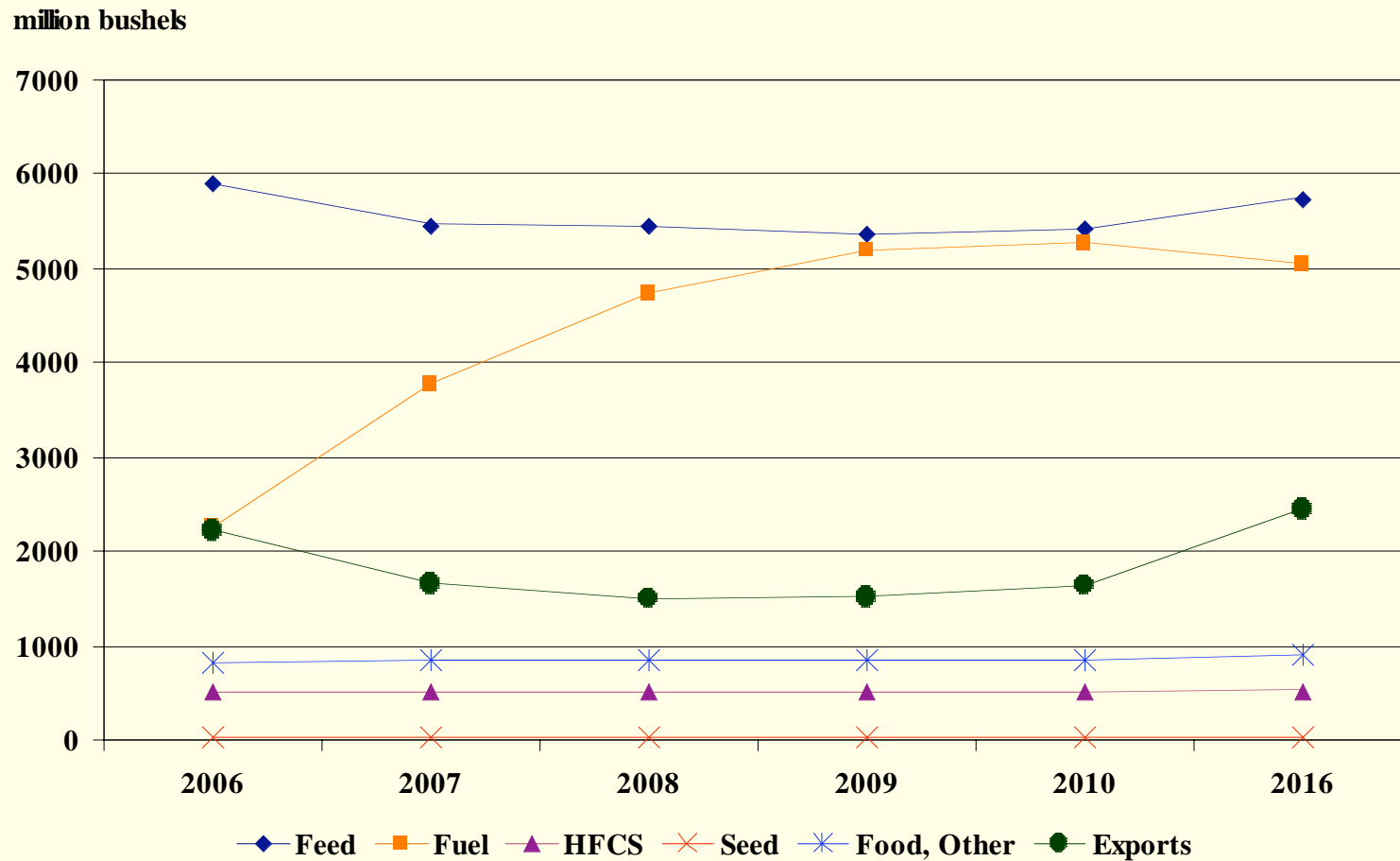


Projected U.S. Corn Planted Area

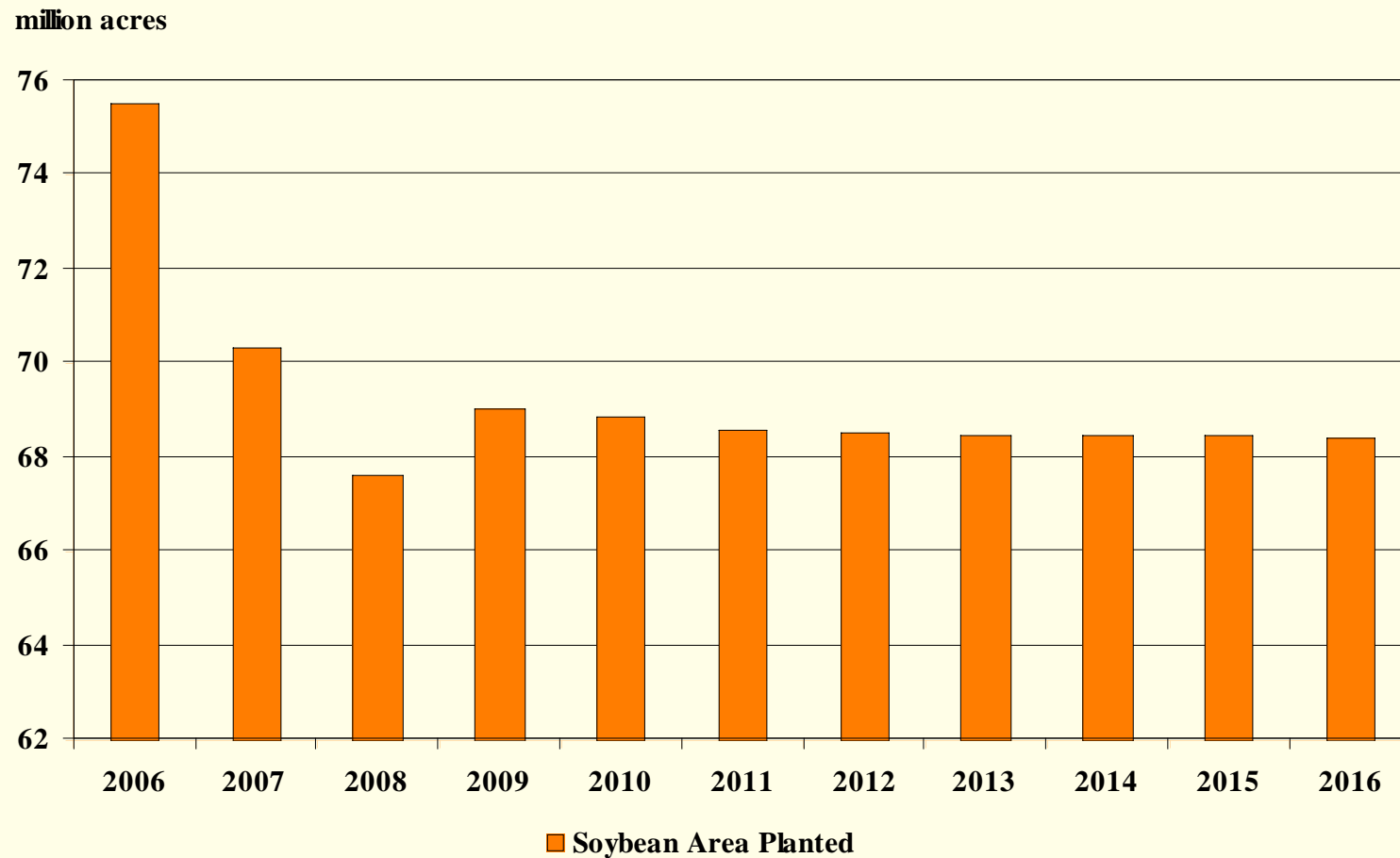
million acres



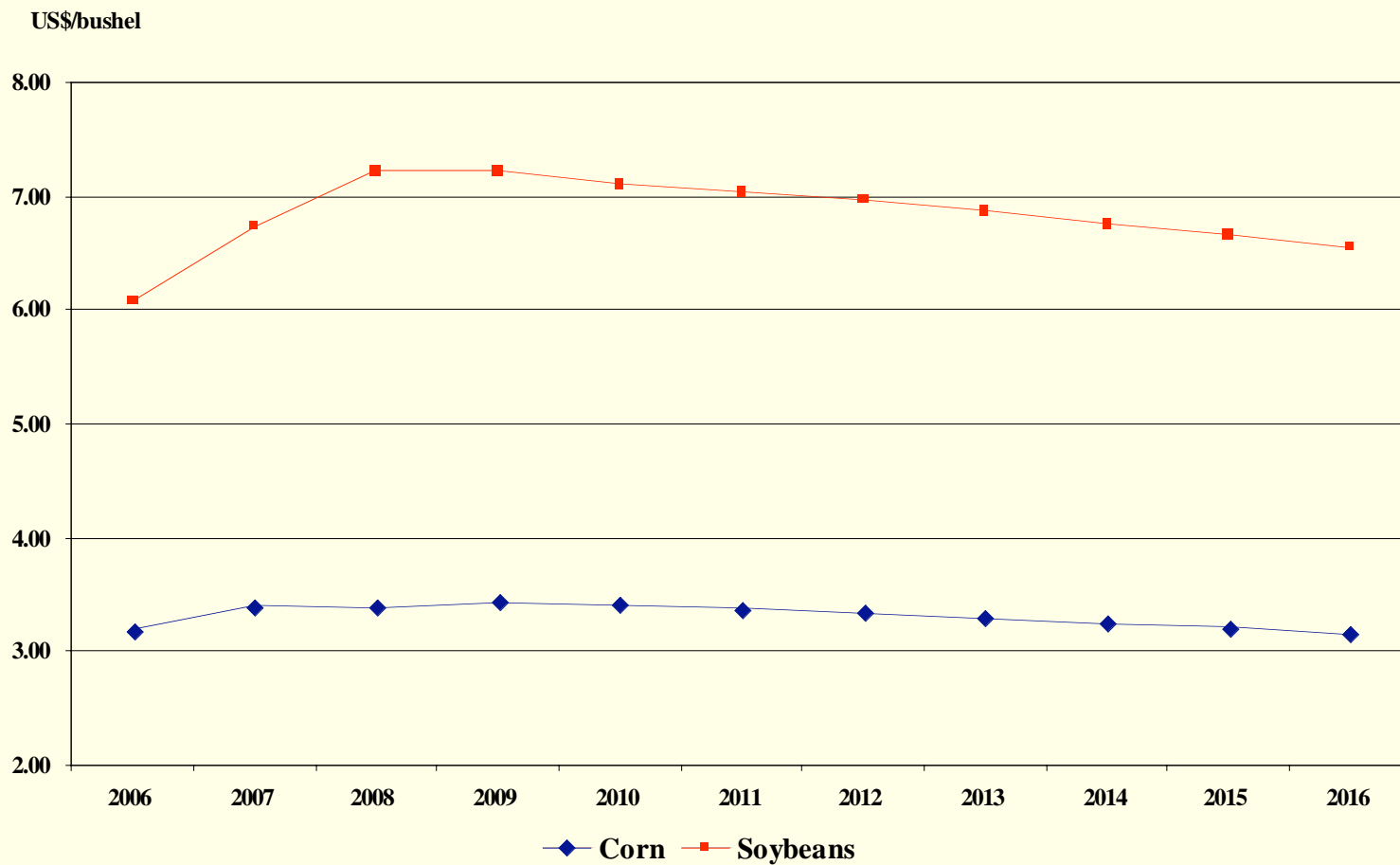
Projected Utilization of Corn



Projected U.S. Soybean Planted Area

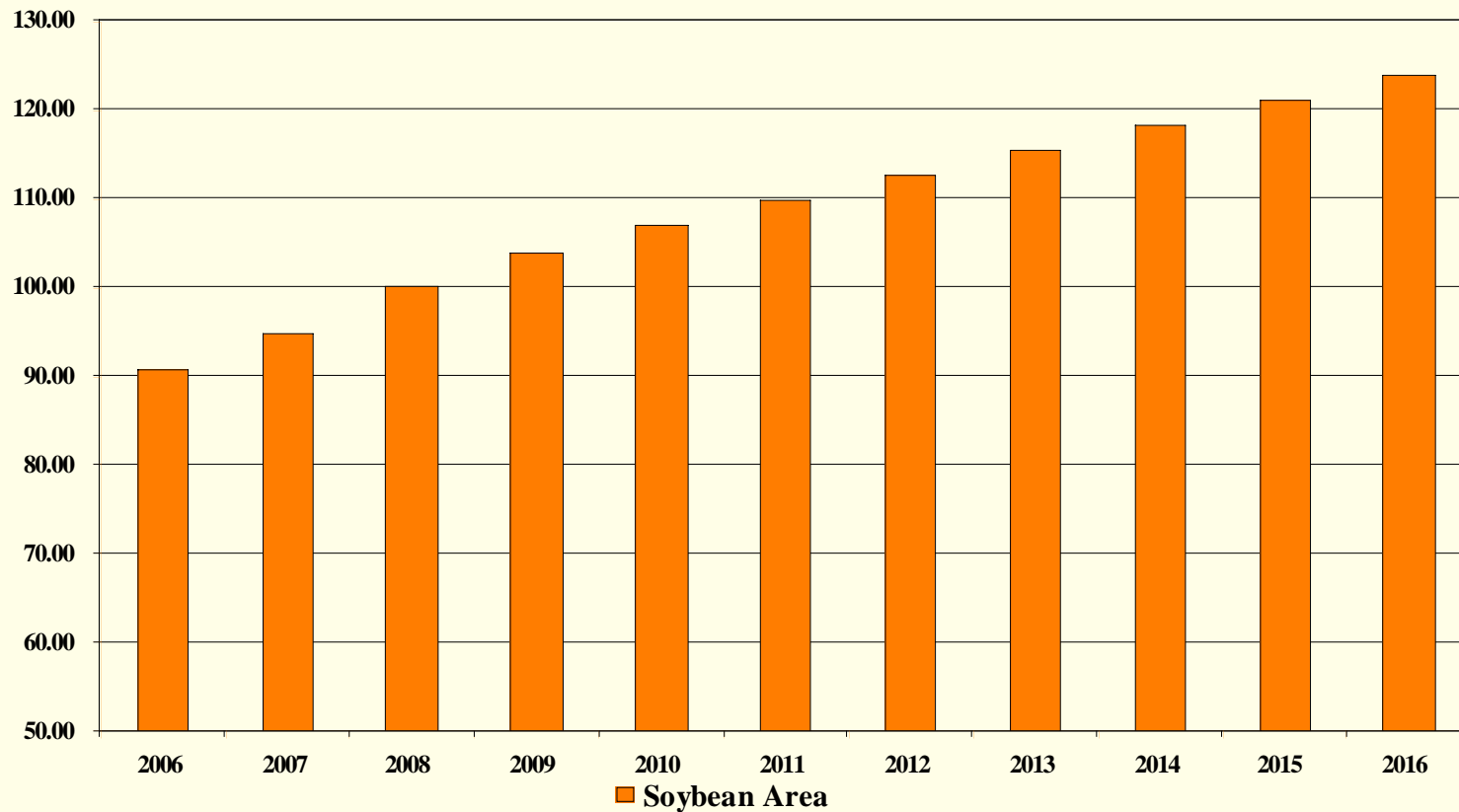


Projected U.S. Corn and Soybean Prices



Brazilian and Argentine Soybean Planted Area

million acres



Impact of Higher Crude Oil Price

- Increased crude oil price by \$10/barrel over the projection
- Margins on ethanol plants increase
- New incentive to invest in added capacity for ethanol production
- Eventually, a new equilibrium reached where there is no incentive to invest in or exit the ethanol industry
- Will demand for ethanol be enough?
 - E-10 market will saturate around 15 billion gallons
 - Drop in ethanol price will eventually encourage increase in demand for the flex-fuel cars

Corn Market

| | Baseline (2016) | Long-Run | Percentage Change |
|--|-----------------|----------|-------------------|
| Corn Price (\$/bushel) | 3.16 | 4.43 | 40.2% |
| Corn Area (million acres) | 92.5 | 112.3 | 21.4% |
| Corn Production (million bushels) | 14,750 | 18,038 | 22.3% |
| Corn Use in Ethanol (million bushels) | 5,046 | 10,765 | 113.3% |
| Corn Feed Use (million bushels) | 5,746 | 4,914 | -14.5% |
| Corn Exports (million bushels) | 2,451 | 911 | -62.8% |

Ethanol and Distillers Grains Markets

| | Baseline (2016) | Long-Run | Percentage Change |
|---|-----------------|----------|-------------------|
| Ethanol Production from Corn (million gallons) | 14,568 | 29,063 | 99.5% |
| Ethanol Consumption (million gallons) | 15,244 | 29,934 | 96.4% |
| Ethanol Wholesale Price (US\$/gallon) | 1.57 | 1.91 | 21.7% |
| Ethanol Net Imports (million gallons) | 314 | 337 | 7.3% |
| Distillers Grains Production (thousand tons) | 39,758 | 87,614 | 120.4% |
| Distillers Grains Price (US\$/ton) | 105.81 | 143.94 | 36.0% |
| Distillers Grains Domestic Use (thousand tons) | 37,280 | 63,658 | 70.8% |



Soybean Market

| | Baseline (2016) | Long-Run | Percentage Change |
|---|-----------------|----------|-------------------|
| Soybean Planted Area (million acres) | 68.4 | 57.3 | -16.2% |
| Soybean Production (million bushels) | 3,048 | 2,515 | -17.5% |
| Soybean Domestic Use (million bushels) | 2,164 | 1,921 | -11.2% |
| Soybean Exports (million bushels) | 880 | 594 | -32.5% |
| Soybean Price (US\$/bushel) | 6.56 | 8.07 | 23.0% |
| Soybean Meal Price (US\$/ton) | 158.5 | 191.1 | 20.6% |
| Soybean Meal Use (thousand tons) | 38,722 | 34,256 | -11.5% |

Livestock Market

| | Baseline (2016) | Long-Run | Percentage Change |
|--|-----------------|----------|-------------------|
| Beef Production (million pounds) | 28,292 | 27,778 | -1.8% |
| Pork Production (million pounds) | 22,916 | 21,700 | -5.3% |
| Broiler Production (million pounds) | 40,927 | 38,499 | -5.9% |
| Turkey Production (million pounds) | 6,275 | 6,058 | -3.5% |
| Egg Production (million dozen) | 8,256 | 8,127 | -1.6% |
| Milk Production (million pounds) | 204,094 | 202,656 | -0.7% |

Livestock Market

| | Baseline (2016) | Long-Run | Percentage Change |
|-------------------------------------|-----------------|----------|-------------------|
| Beef Retail Price (US\$/pound) | 4.52 | 4.71 | 4.2% |
| Pork Retail Price (US\$/pound) | 3.30 | 3.44 | 4.2% |
| Broiler Retail Price (US¢/pound) | 196.07 | 205.32 | 4.7% |
| Turkey Retail Price (US¢/pound) | 126.28 | 136.96 | 8.5% |
| Egg Retail Price (US¢/dozen) | 162.98 | 177.07 | 8.6% |
| Milk Retail Price (US\$/cwt) | 14.65 | 15.44 | 5.4% |

Impact on Rest of the World

- World grain and oilseed prices increase
- Result in higher feed prices
- Higher livestock production cost
- Higher food prices

- Countries in South America and Asia fill the gap

Impact of Short Crop Scenario

- Drought in 2012 similar to 1988
 - Regional yields of corn, soybeans and wheat changed from trend levels
 - Yields fell by 25% for corn, 18% for soybeans, 11% for wheat
- Ethanol mandate for 2012 assumed to be 14.7 billion gallons

Corn, Soybean and Ethanol Markets

- Corn price increases by 42% above baseline levels
- Soybean price rises by 22%
- Corn exports and stock levels decline by more than 60%
- Corn exports from South America, China, etc. fill part of the gap from decline in U.S. corn exports
- Corn feed use declines by 15% (switch to wheat)
- Ethanol trade increases moderately

Livestock Market

- Higher feed costs affect the livestock sector but to a lesser extent as shock is perceived as temporary
 - Production declines
 - Broiler production declines the most (over 2.5%)
 - Milk production declines the least (0.5%)
 - Decline for beef, pork and turkey ranges between 1% and 1.5%
 - Retail prices increase
 - Egg prices increase the most (about 5.5%)
 - Prices of other products increase by a range between 2% and 4%

Thank You