Socio-Economic Impacts of U.S. Ethanol
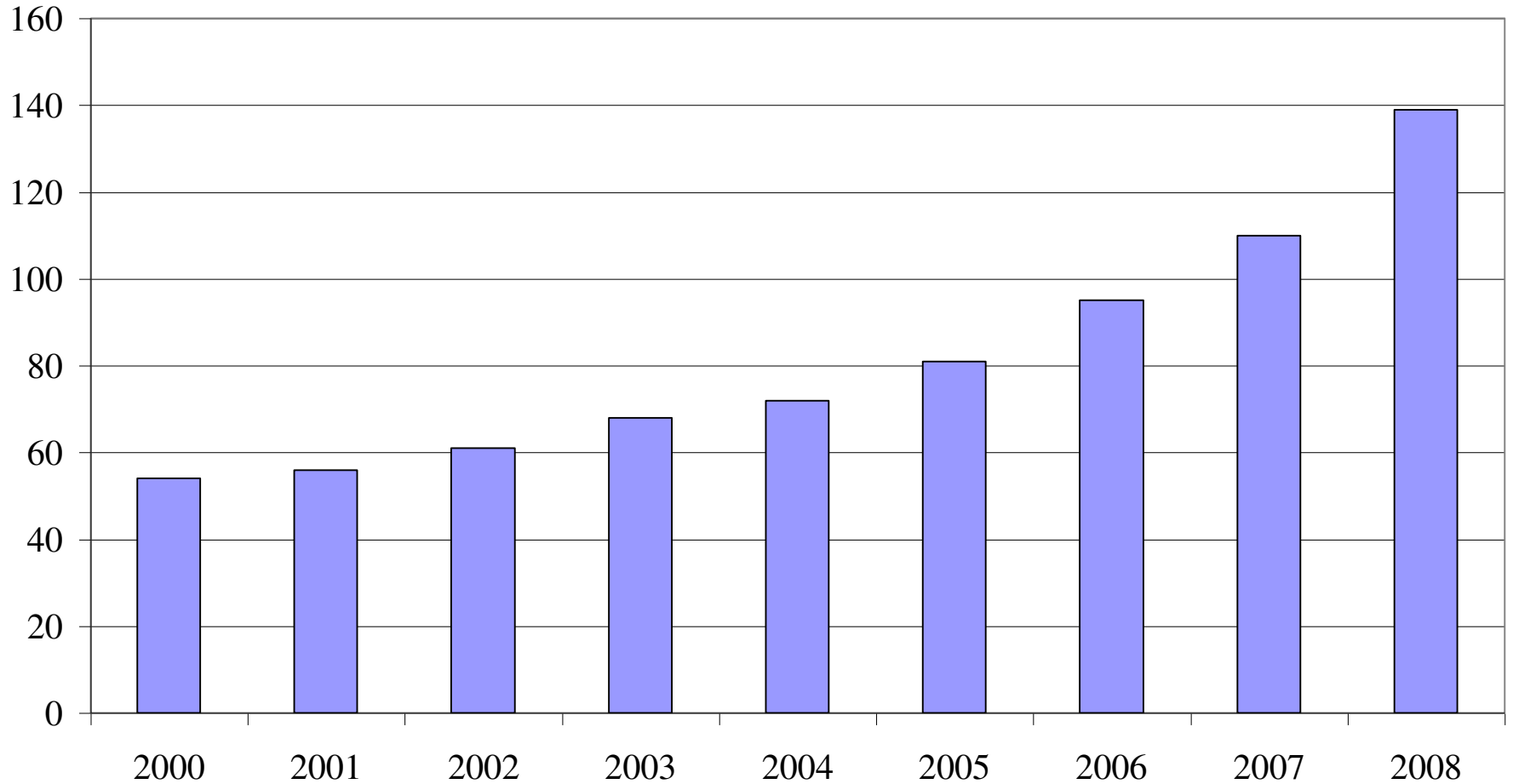
Bruce A. Babcock

Center for Agricultural and Rural Development
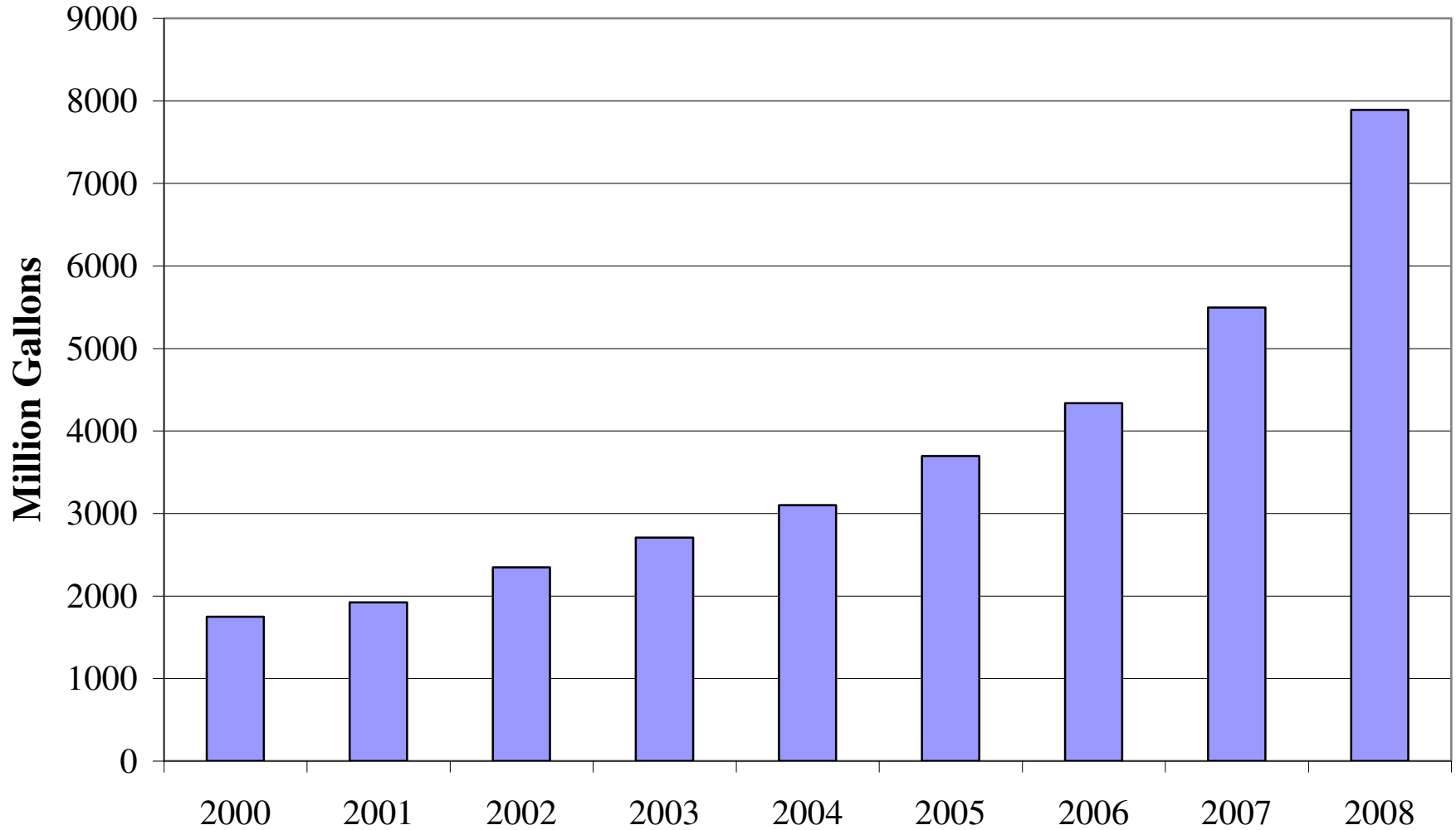Iowa State University

Overview

- Broad overview of U.S. and world biofuels

- Economics of the U.S. ethanol industry

- Impacts on grain prices and feed costs in the long term and short term

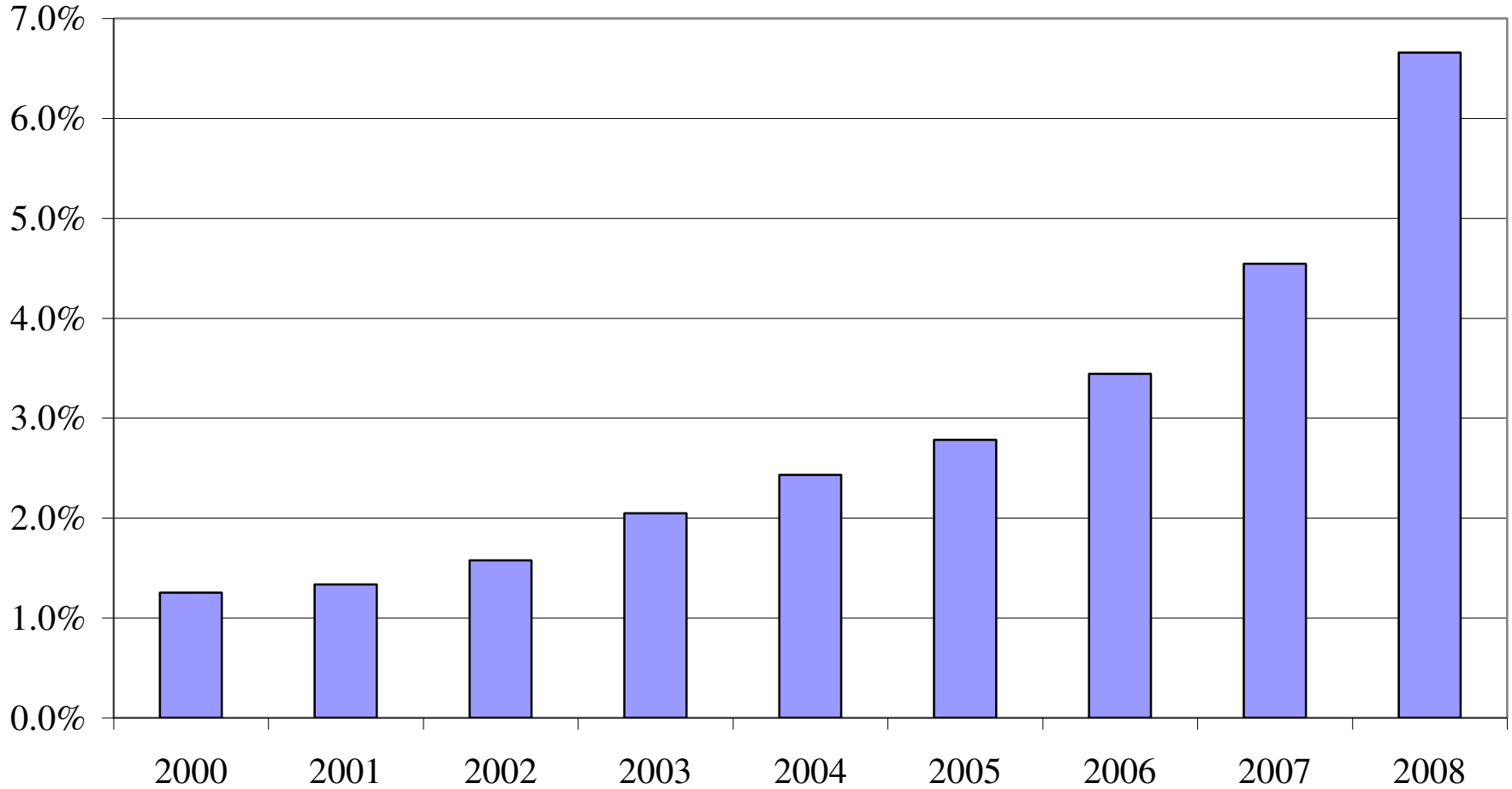- What is accomplished by corn ethanol?
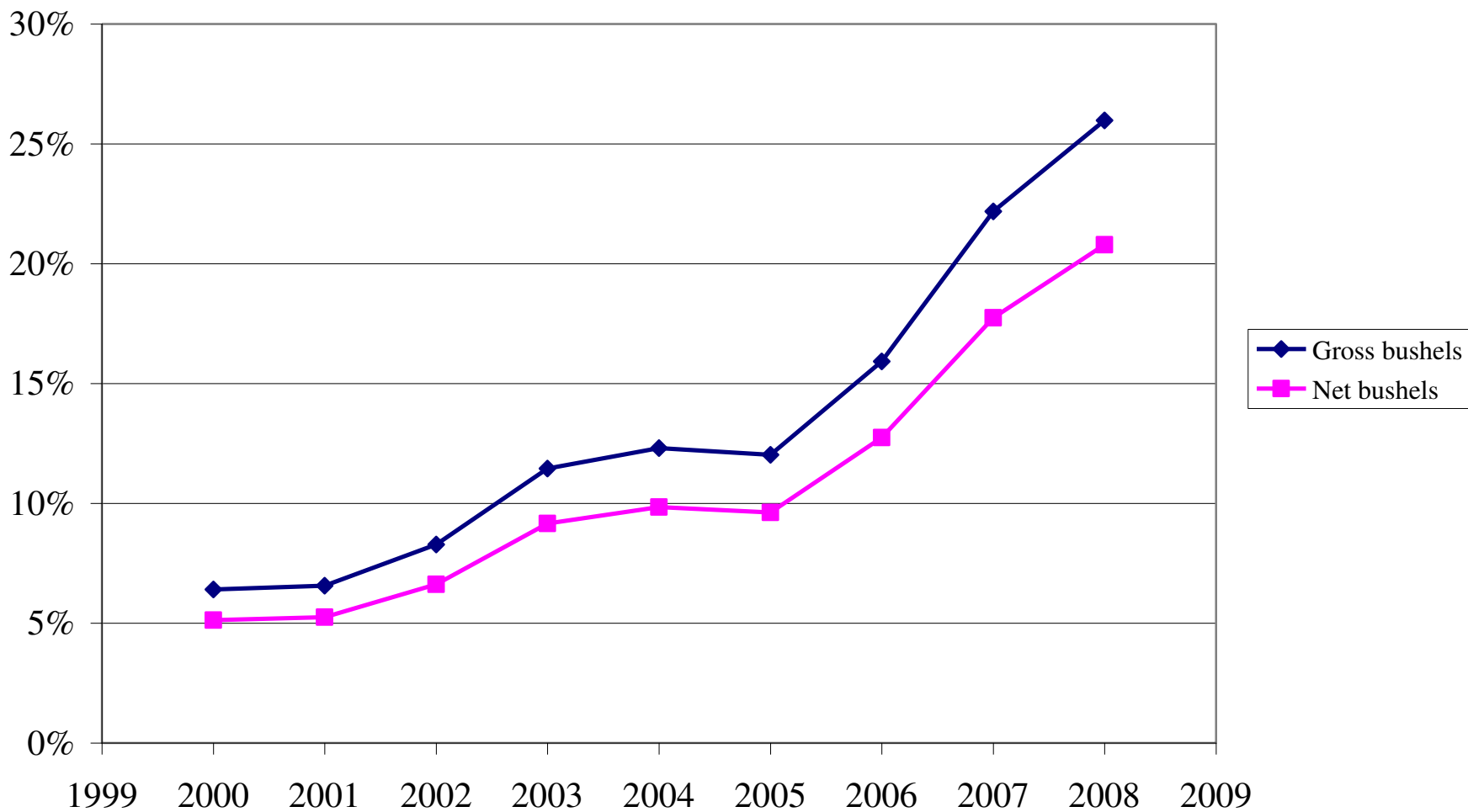
Number of U.S. Ethanol Plants
(Jan 1)

U.S. Ethanol Industry Capacity on January 1

U.S. Ethanol Production
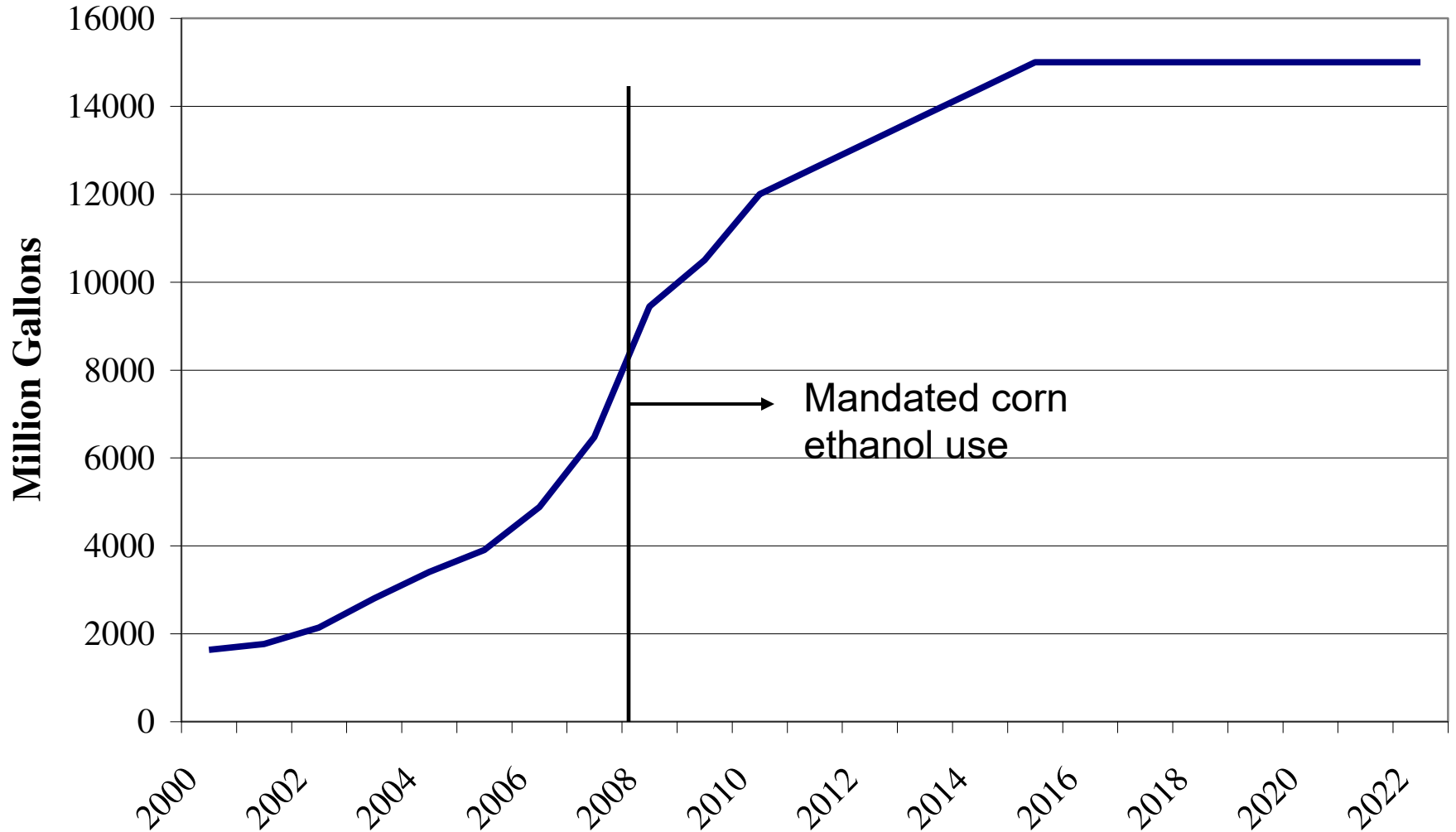## (% of U.S. Gasoline Consumption)

Corn Utilized for Ethanol
(Percent of U.S. Corn Crop)

Subsidies and Protection
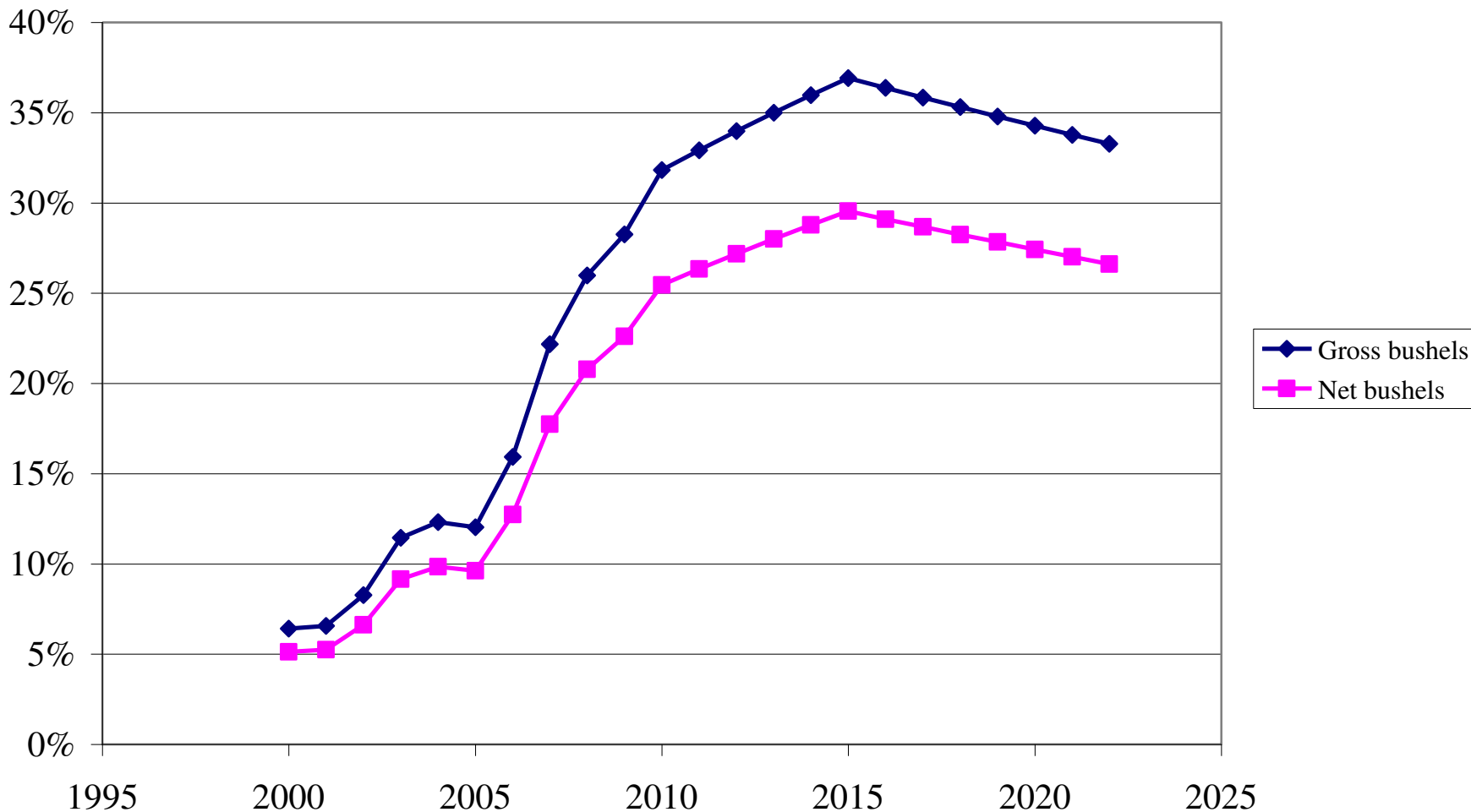
- $0.51 per gallon tax credit to blenders increase the WTP for corn by $1.47 per bushel

- $0.54 per gallon import tariff on most Brazilian ethanol

- Various tax credits for construction

U.S. Ethanol Production With New EISA Mandates
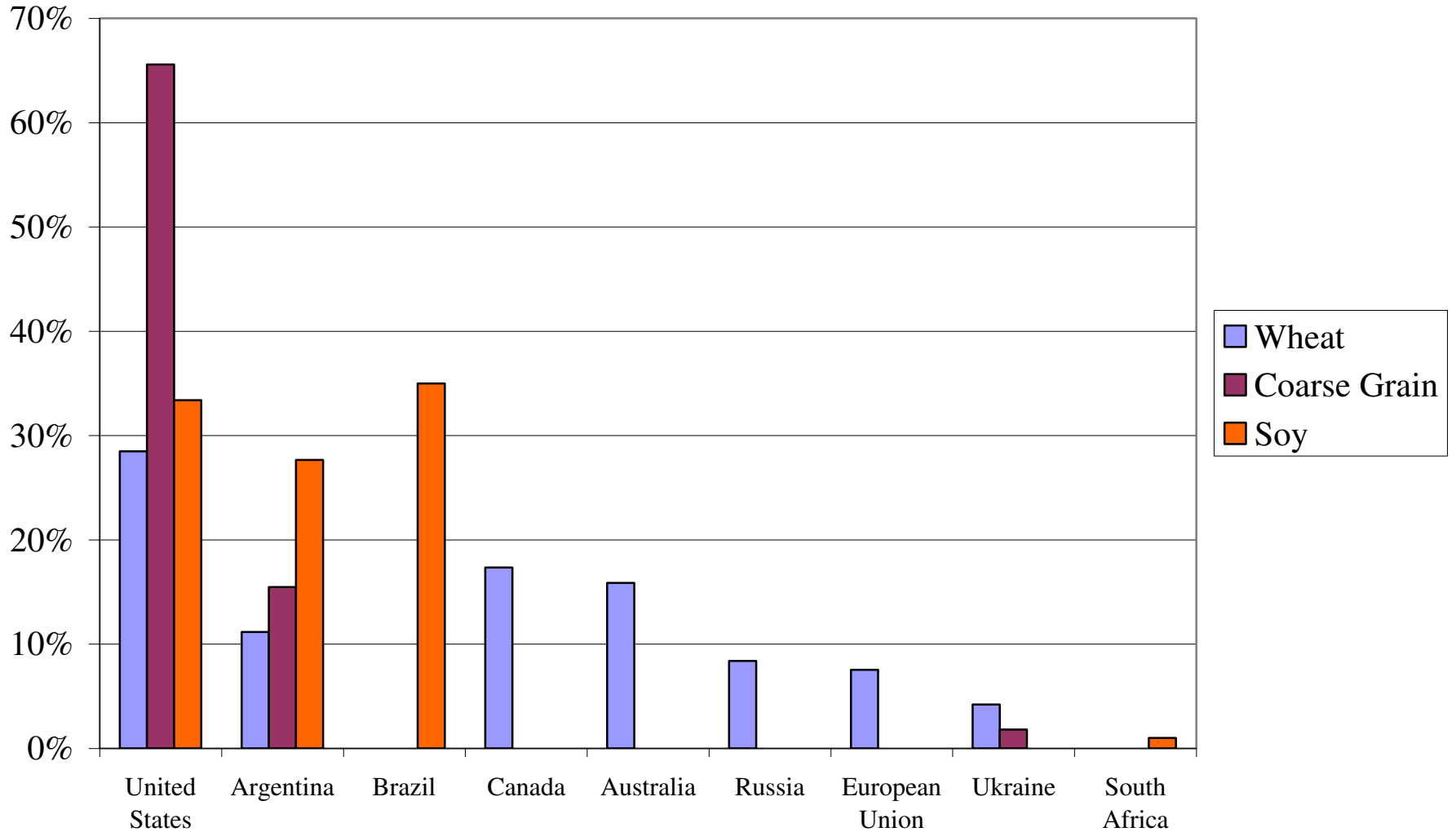
Corn Utilized for Ethanol
(Assumes 1.5% increase in annual production from 2007 base)

Average Share of World Exports 2002 through 2007

Three Indicators of World Food Demand
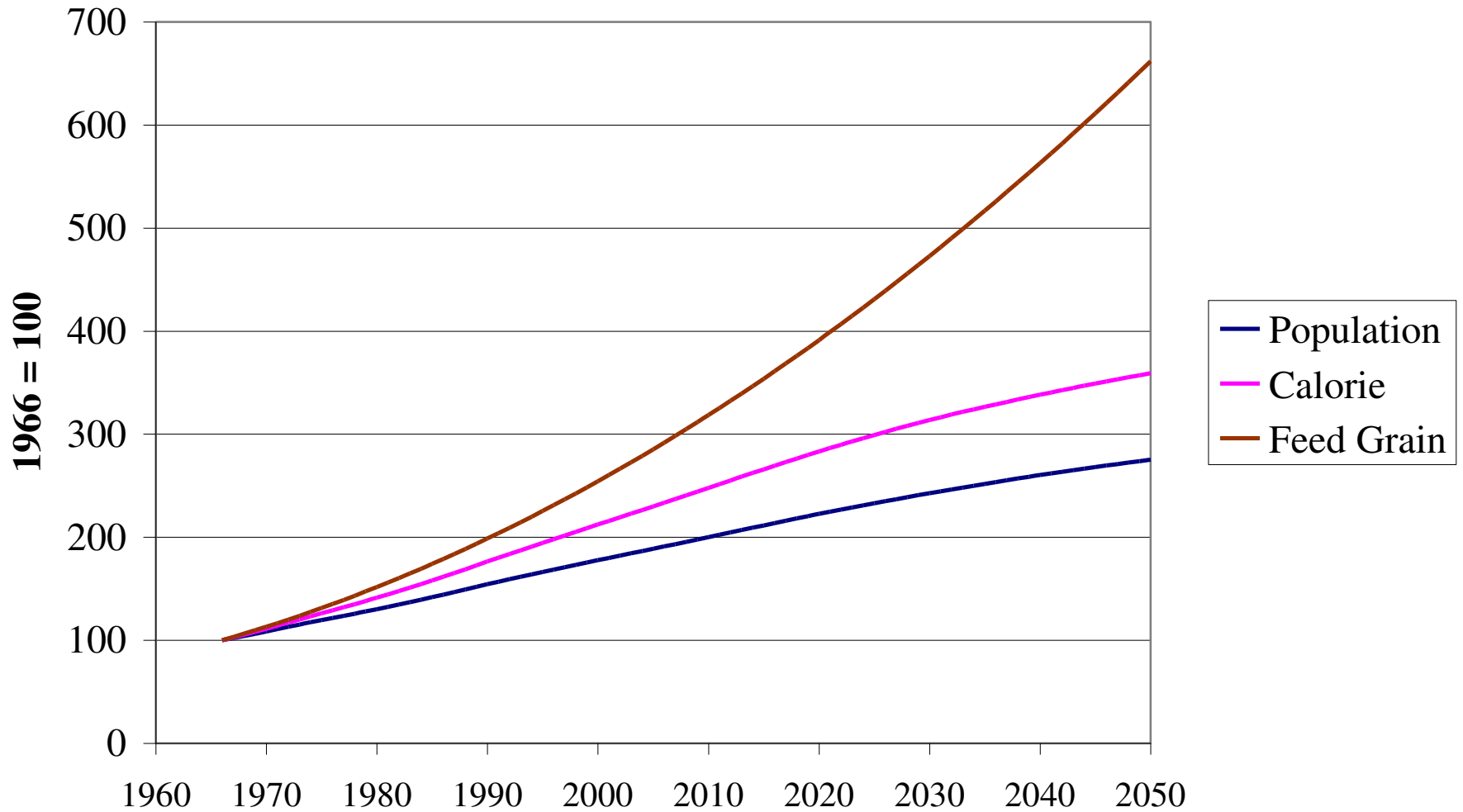
World Crop Area
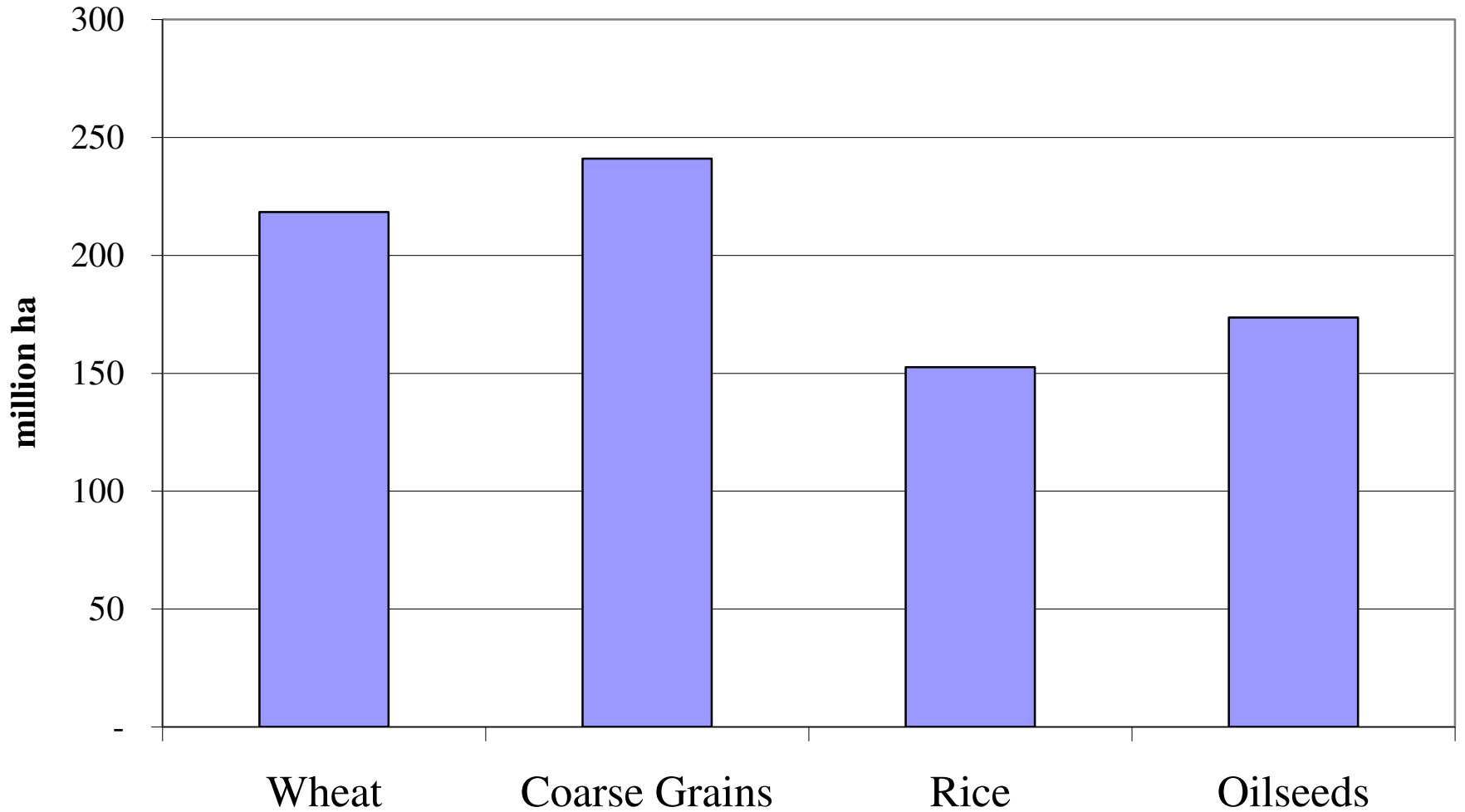
Projected Biofuels Production
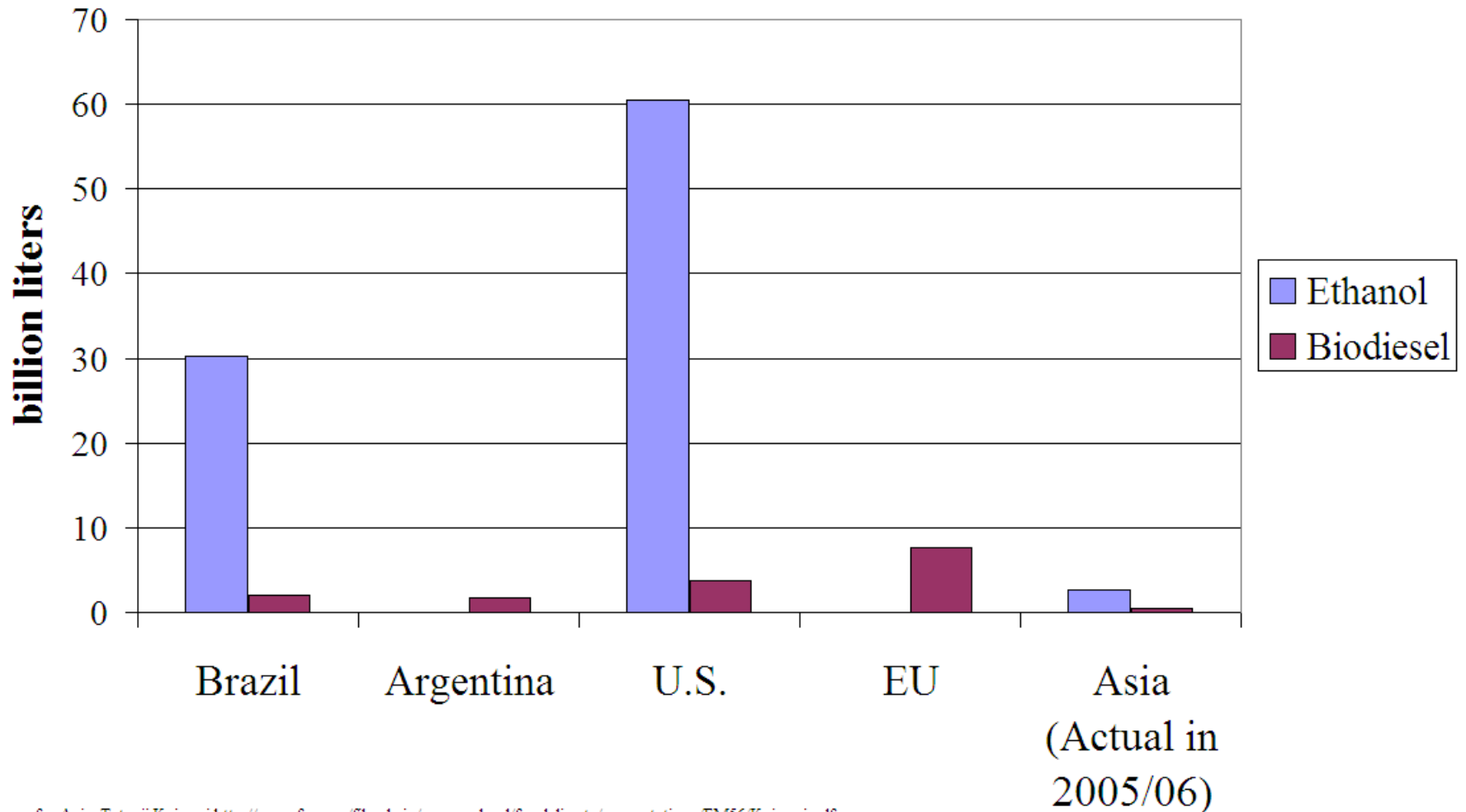
Biofuels Impacts

- Feed Grains: 60 billion liters of ethanol represents 12% of world production

- Oilseeds: 15 billion liters of biodiesel represents 11% of world production of vegetable oil

- Sugarcane: 30 billion liters of ethanol represents 6% of oilseeds land potentially displaced

Market Price Impacts

- Assuming no change in aggregate production
  - 17% reduction in available vegetable oil would increase price by 84%

  - 12% reduction in feed grain supplies would increase price by 60%

Commodity Economics

- Profits tend towards zero
  - When profits are positive, expansion occurs, output price goes down, profits go down
  - When profits are negative, contraction occurs, output price goes up, profits go up

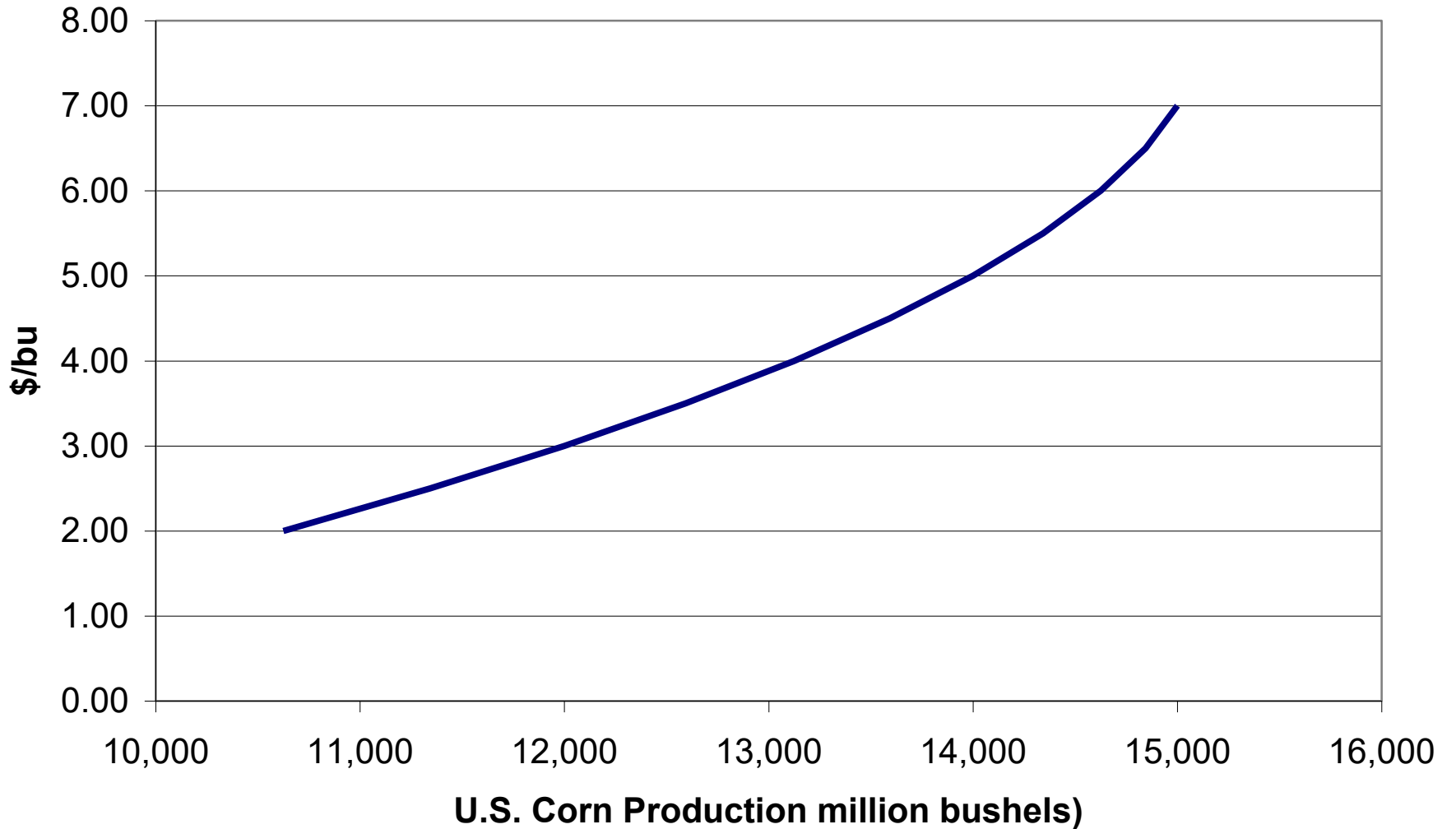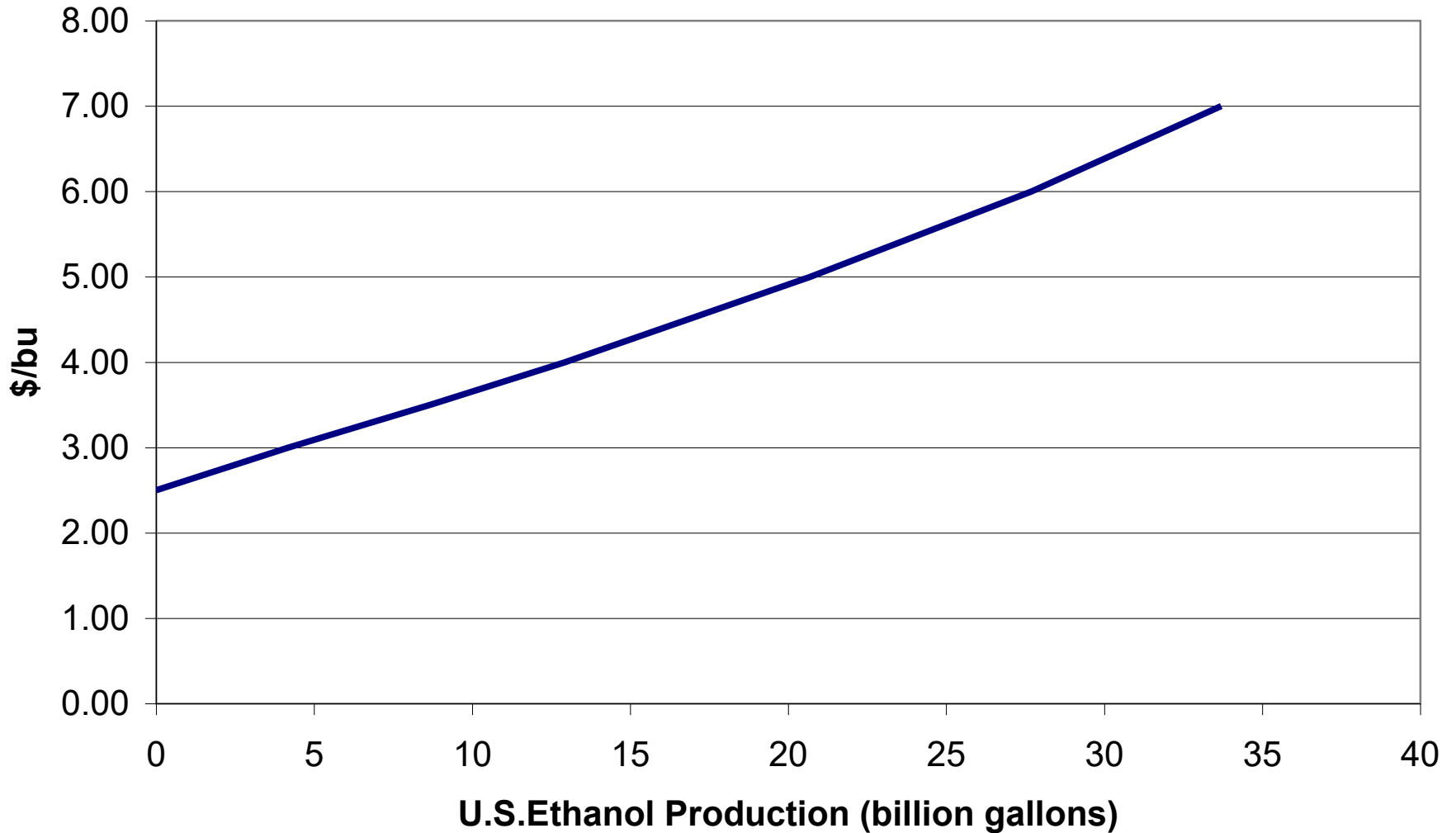# Biofuels Commodity Economics

- Profits tend towards zero
  - When profits are positive, expansion occurs, feedstock price goes up, profits go down
  - When profits are negative, contraction occurs, feedstock price goes down, profits go up

➢ So key is to determine the size of the ethanol industry that increases corn prices enough to drive industry profits towards zero.

U.S. Corn Supply Curve

Ethanol Supply as Determined by Available Corn

A line graph titled "Ethanol Supply as Determined by Available Corn." The vertical axis is labeled "$/bu" and ranges from 0.00 to 8.00 in increments of 1.00. The horizontal axis is labeled "U.S.Ethanol Production (billion gallons)" and ranges from 0 to 40 in increments of 5. A dark blue line rises from about 2.50 at 0 billion gallons to about 7.00 at roughly 34 billion gallons.
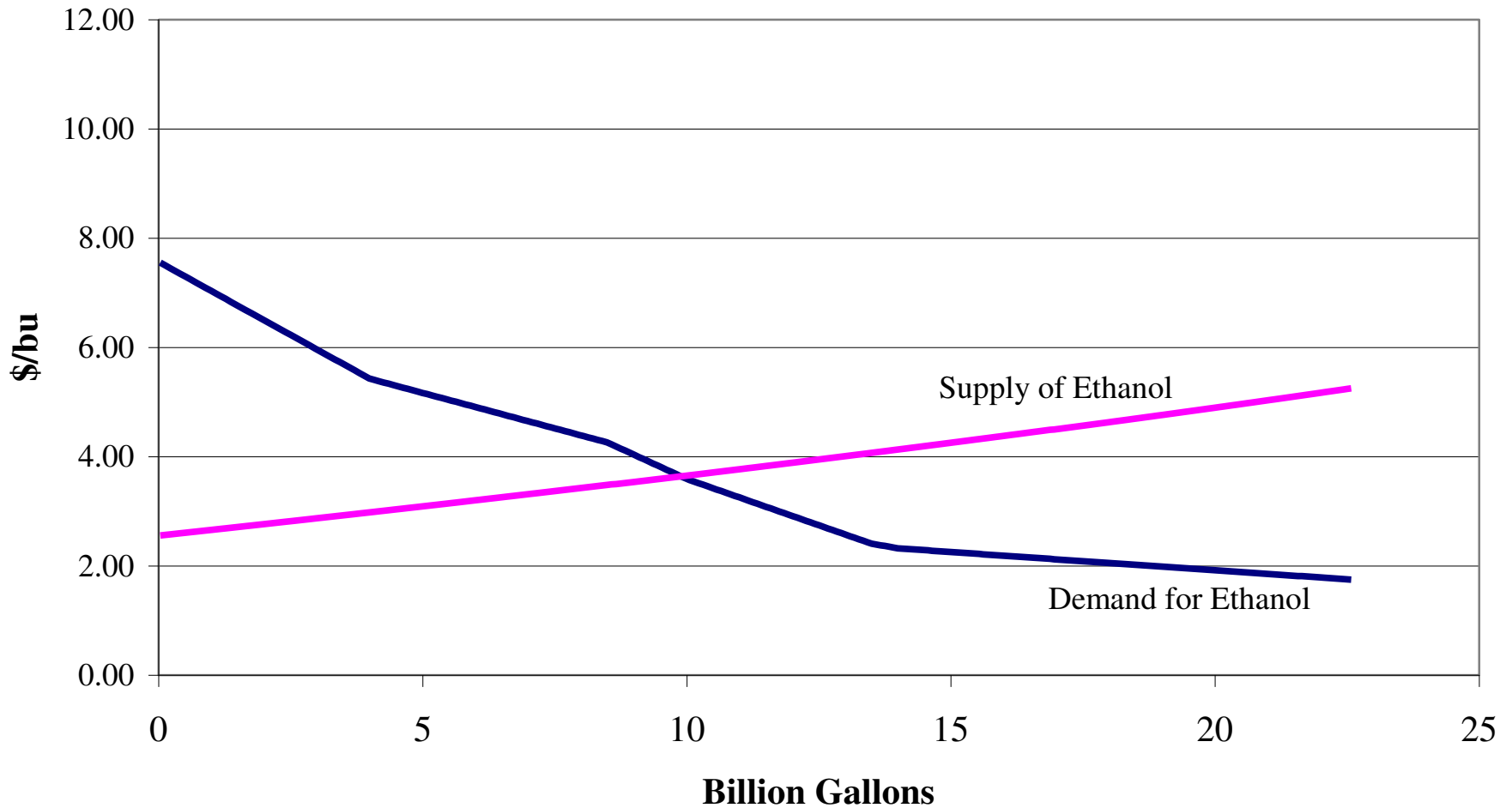
Demand for Ethanol

- Substitute for gasoline
- Octane enhancer
- Component in Clean Air Act fuels
- Fuel to meet state and federal RFS
- Fuel to meet low carbon fuel requirements

Market Demand for Ethanol: Price of Gas = $2.50/gal

What is the Market Price of Corn with No Government Intervention? (Price of gas = $2.00)

Supply of Ethanol

Demand for Ethanol

$/bu

Billion Gallons

What is the Market Price of Corn with No Government Intervention? (Price of gas = $2.50)

$/bu (y-axis)

12.00
10.00
8.00
6.00
4.00
2.00
0.00

Supply of Ethanol

Demand for Ethanol

Billion Gallons (x-axis)

0   5   10   15   20   25

What is the Market Price of Corn with No Government Intervention? (Price of gas = $3.00)

Demand for Ethanol

Supply of Ethanol

$/bu (y-axis)

Billion Gallons (x-axis)

What is the Market Price of Corn with No Government Intervention? (Price of gas = $4.00)

Demand for Ethanol

Supply of Ethanol

$/bu

Billion Gallons

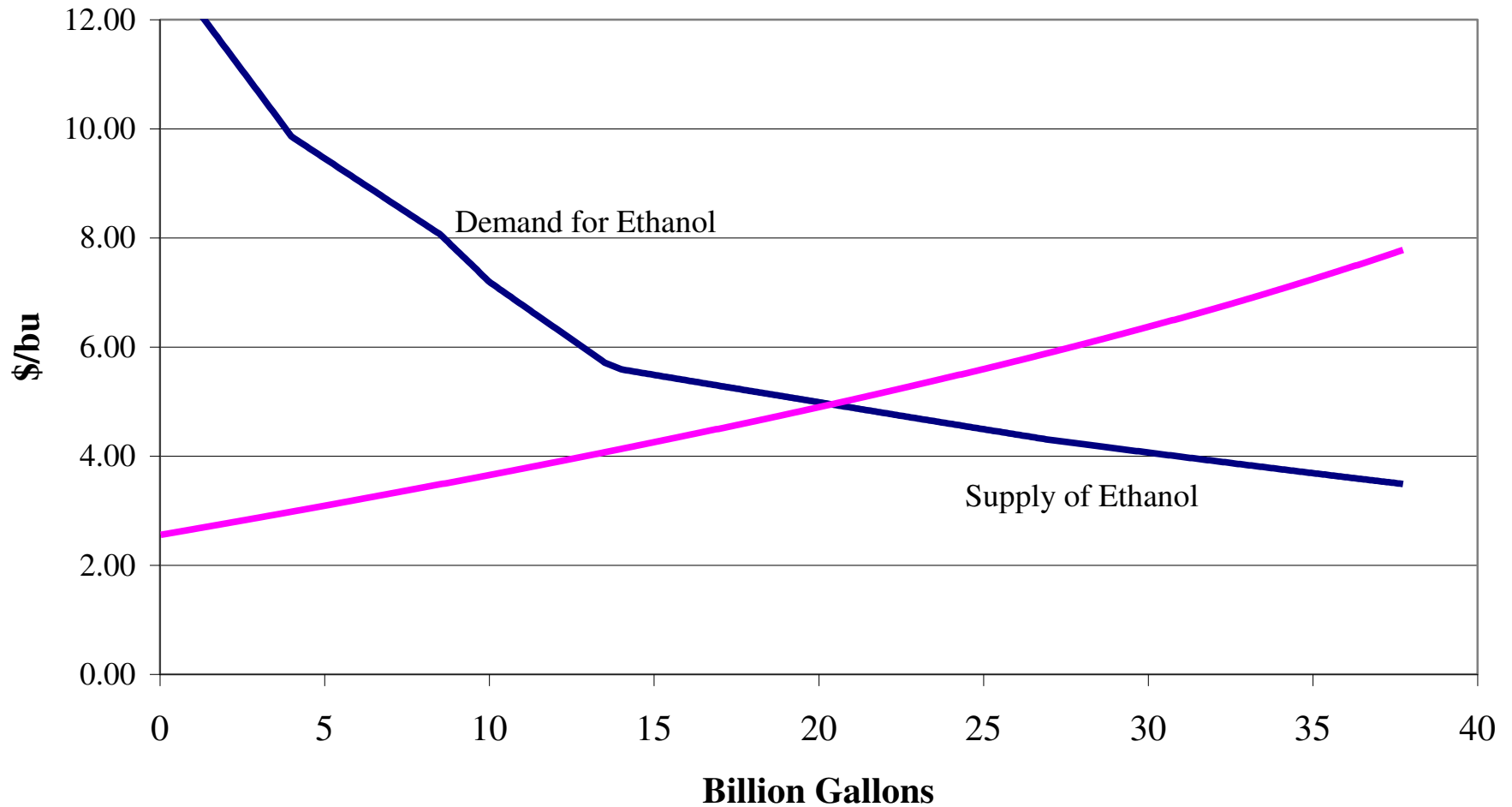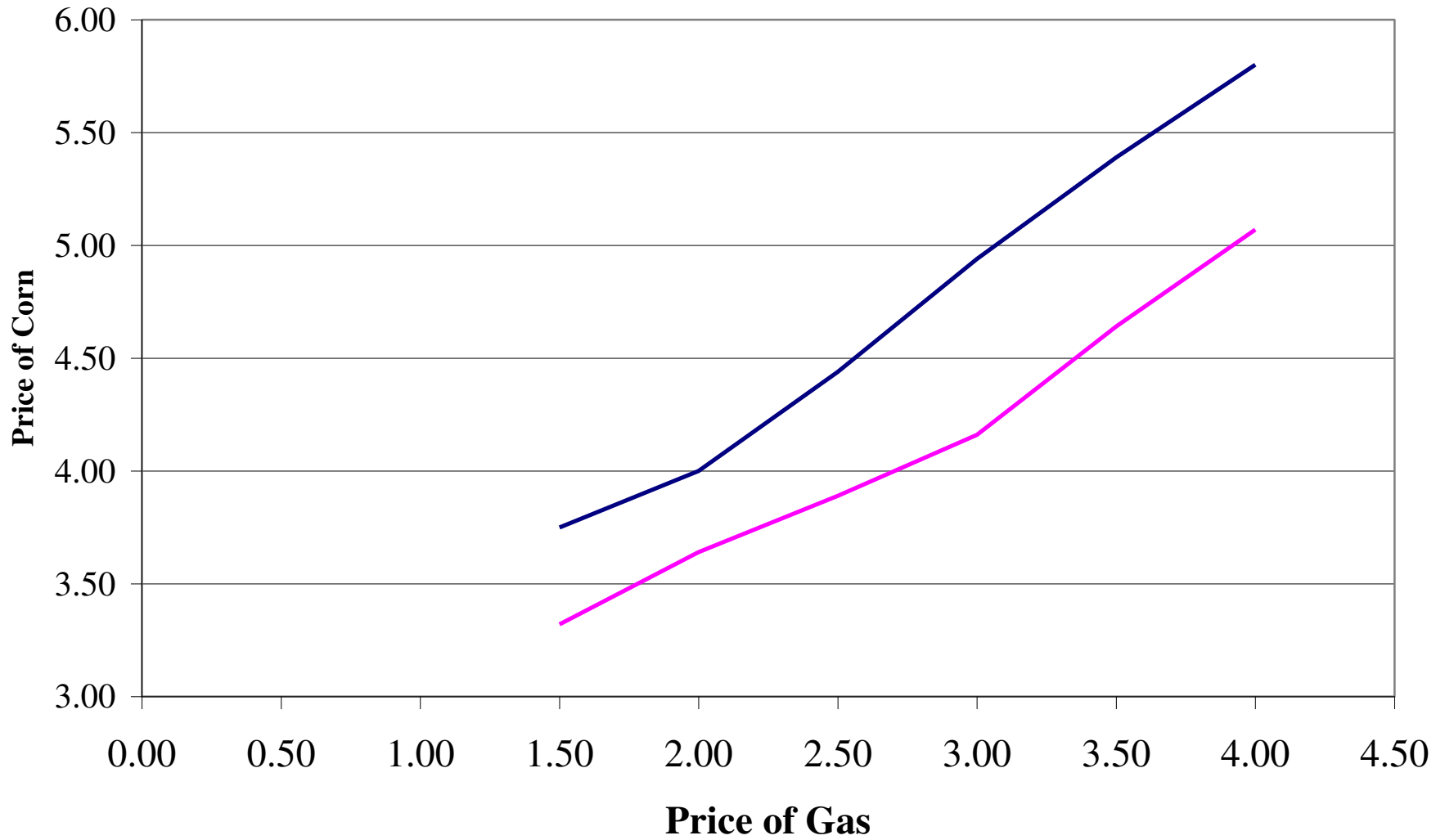**What is the Market Price of Corn with $0.51 per gallon Subsidy? (Price of gas = $2.00)**

What is the Market Price of Corn with $0.51 per gallon Subsidy? (Price of gas = $2.50)
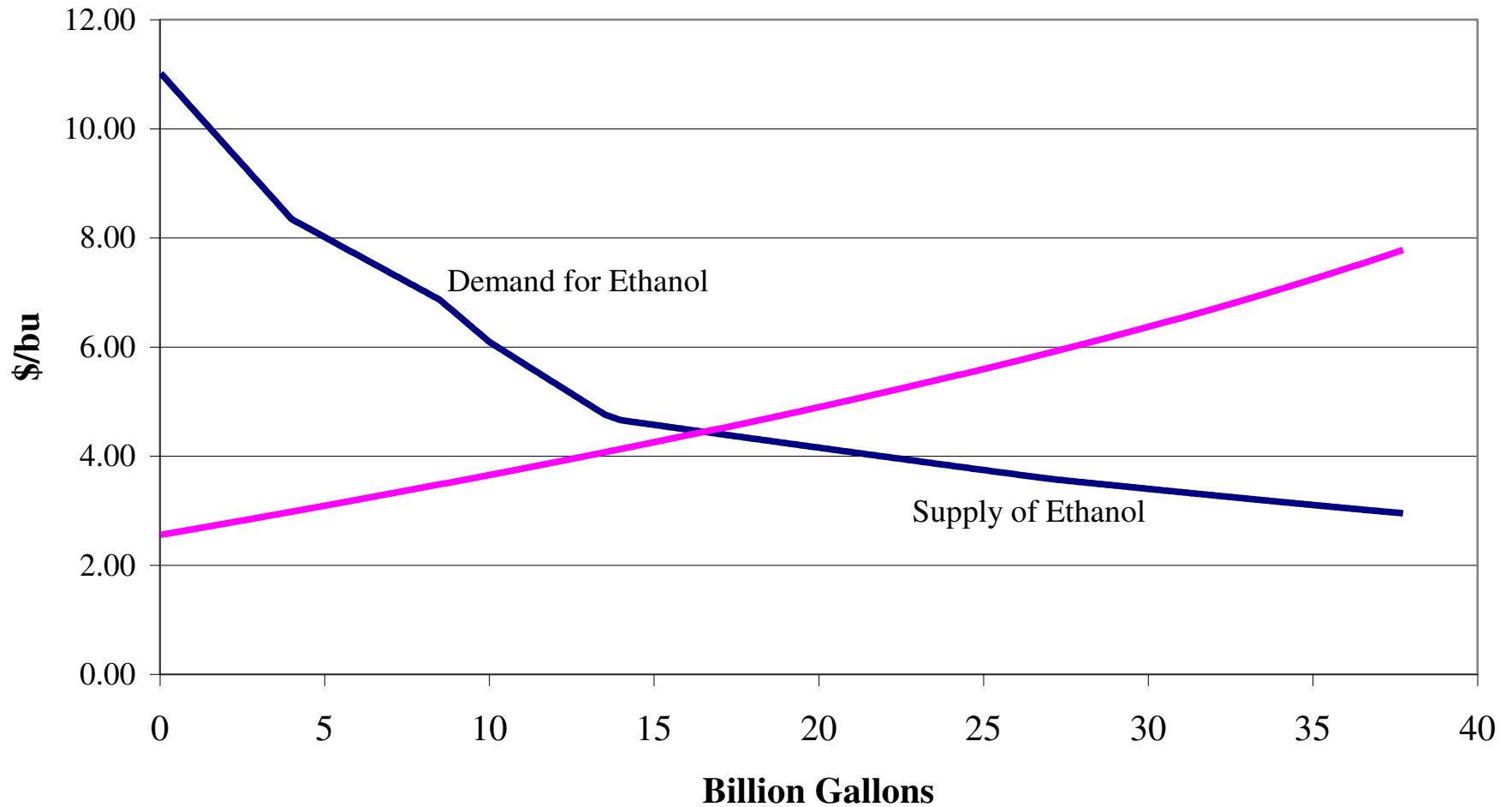
What is the Market Price of Corn with $0.51 per gallon Subsidy? (Price of gas = $3.00)

$/bu (y-axis), **Billion Gallons** (x-axis)

Demand for Ethanol

Supply of Ethanol

Long Run Corn Prices With and Without Blenders Subsidy

Short Run Outlook

- Calibrate 2008/09 corn demand curves to latest WASDE projections
  - food, feed, export, storage
- Supply equals

  Harvested Acreage * Harvested Yield

  Non-harvested Acreage = function of yield
- Stochastic Variables (parametric distributions)
  - Gasoline price (leads to random ethanol demand)
  - Planted acreage
  - Export demand
  - Corn yields
  - Ethanol industry capacity in 2008/09

Baseline Results

(10 billion gallon mandate, $0.51 cent tax credit)

- Expected planted acres: 86 million

- Expected yield: 151 bu/ac

- Expected corn price: $5.60/bu

- Expected ethanol production: 10.3 bg (billion gallons)

Impact of Eliminating the Mandate

(10 billion gallon mandate, $0.51 cent tax credit)

- Expected corn price: $5.34/bu (down 4.6%)

- Expected ethanol production: 9.3 bg (down 10%)

Removal of $0.51 Tax Credit

No Mandate

- Expected corn price: $4.83/bu (down 14%)
- Expected ethanol production: 7.25 bg (down 30%)

With Mandate

- Expected corn price: $5.20/bu (down 2.2%)
- Expected ethanol production: 7.25 bg (down 1%)
- Probability that mandate binds: 71%
- Average subsidy needed: $0.41 per gallon

Impact of a Drought

(detrended 1988 corn yield of 113 bu/ac)

No Mandate

- Expected corn price: $6.42/bu (up 29%)

- Price volatility: 14.3% (down 12.9%)

- Expected ethanol production: 3.2 bg (down 67%)

Impact of a Drought

(detrended 1988 corn yield of 113 bu/ac)

With Mandate

- Expected corn price: $7.99/bu (up 50%)

- Expected ethanol production: 10.1 bg

- Probability that mandate binds: 92.3%

- Average additional subsidy needed when mandate binds: $0.79 per gallon

Corn Ethanol Impacts

- Lowered gasoline prices

Reduction in Blended Fuel Prices from Increasing Annual Ethanol Volume by 10 Percent

Corn Ethanol Accomplishments

- Lowered gasoline prices

- Opened infrastructure pathways to potential cellulosic biofuels

- Forced adjustments in North American livestock industry

- Made world realize that agricultural production should not be taken for granted