

# Overhauling Renewable Energy Markets

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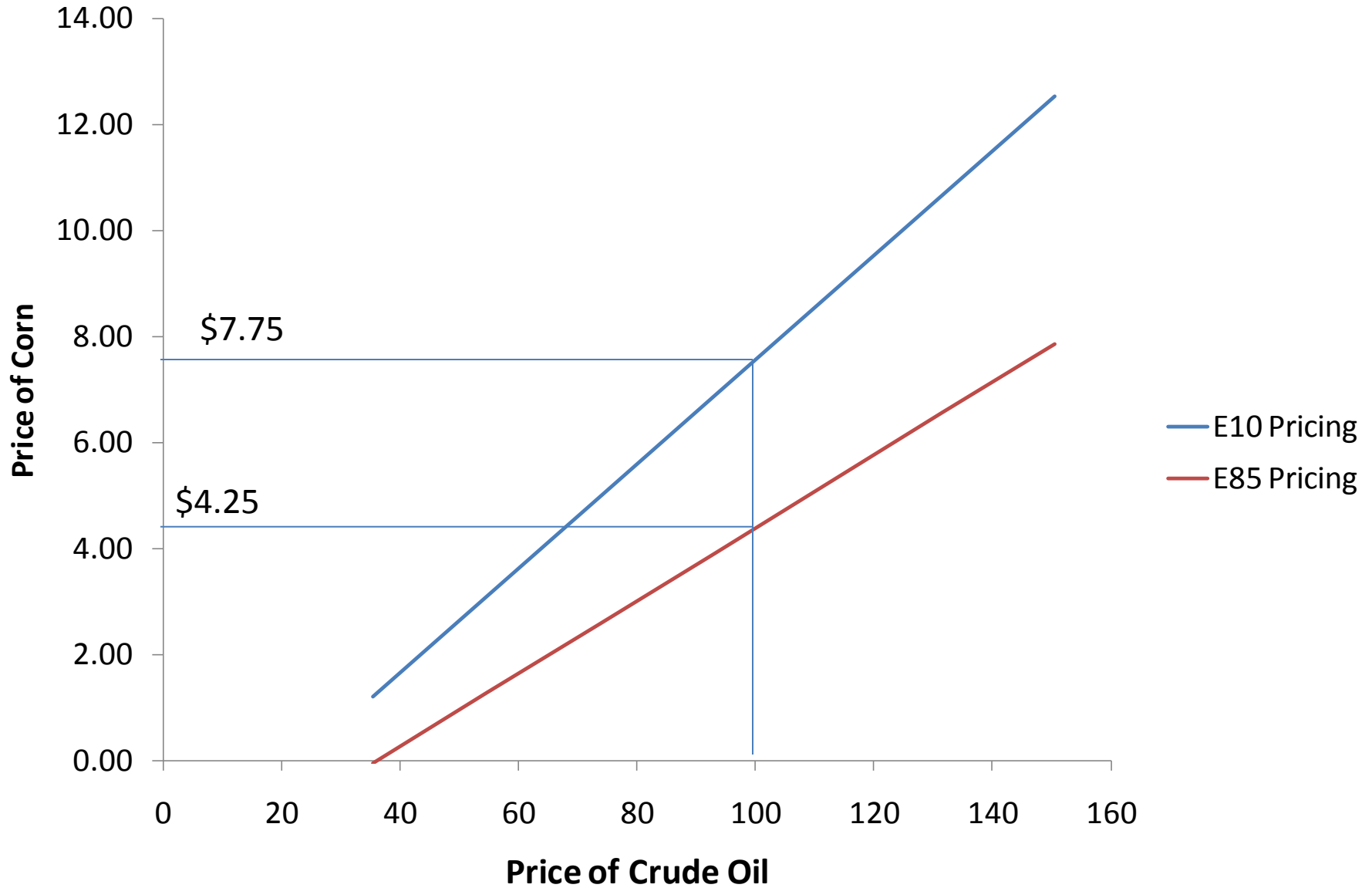
Iowa State University

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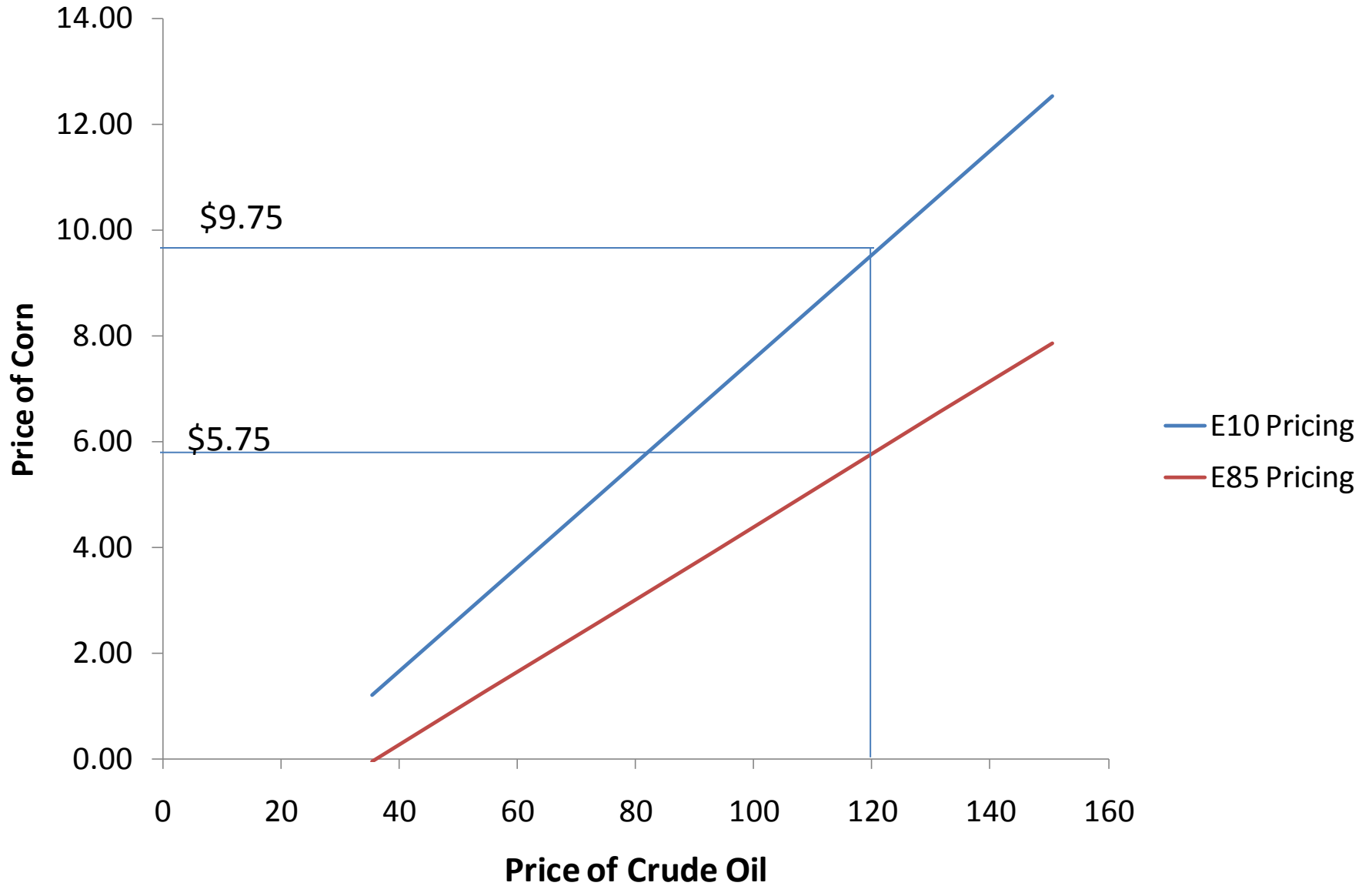
# What is the Value of Biofuels?

- Market Value
  - Source of BTUs in fuel
  - Ethanol is a source of octane in fuel
- Non-market Value
  - Reduction in greenhouse gas emissions
  - Lower air pollution
  - Domestic source of fuel

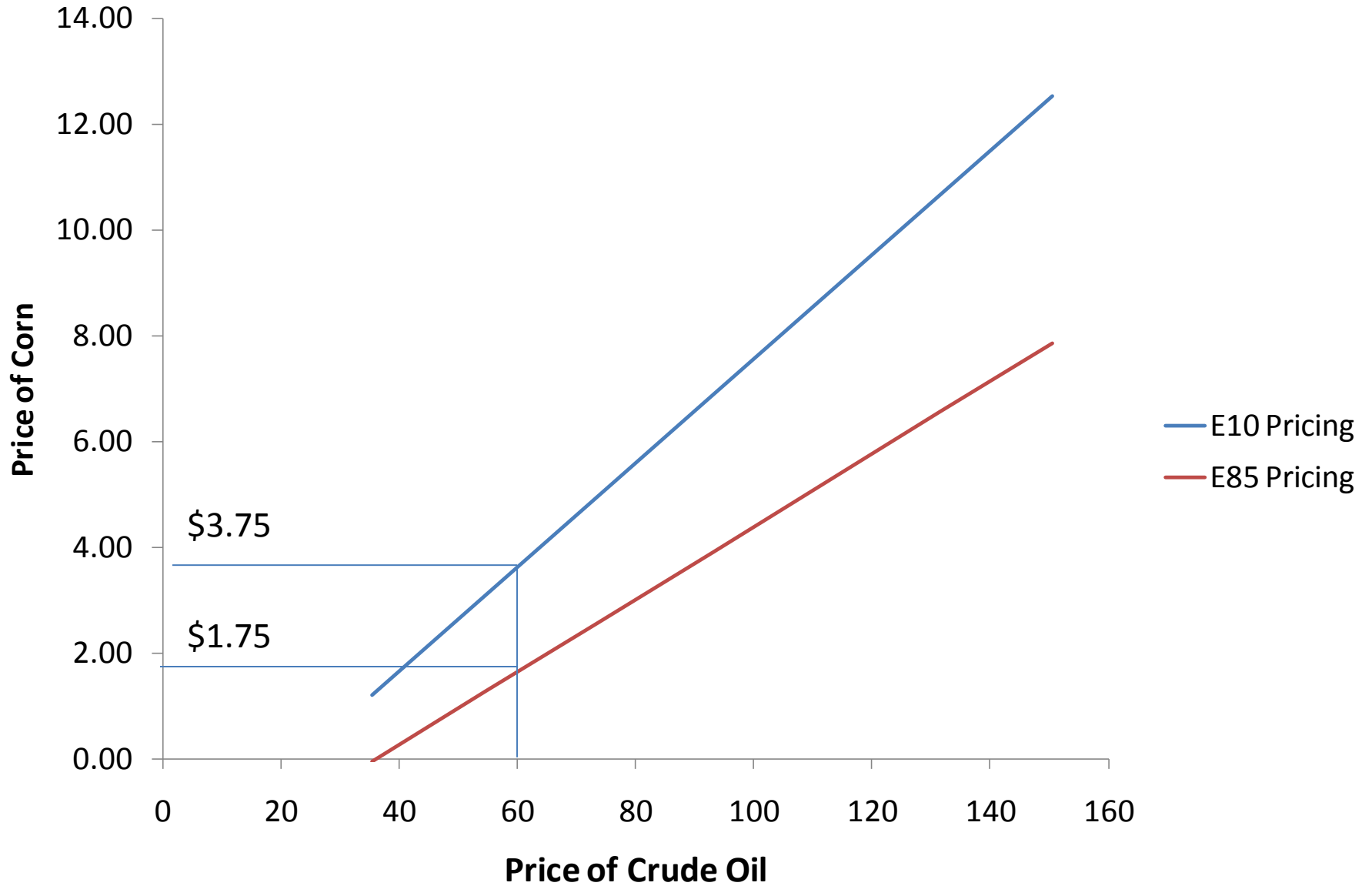
# Ability to Pay for Corn in E10 and E85



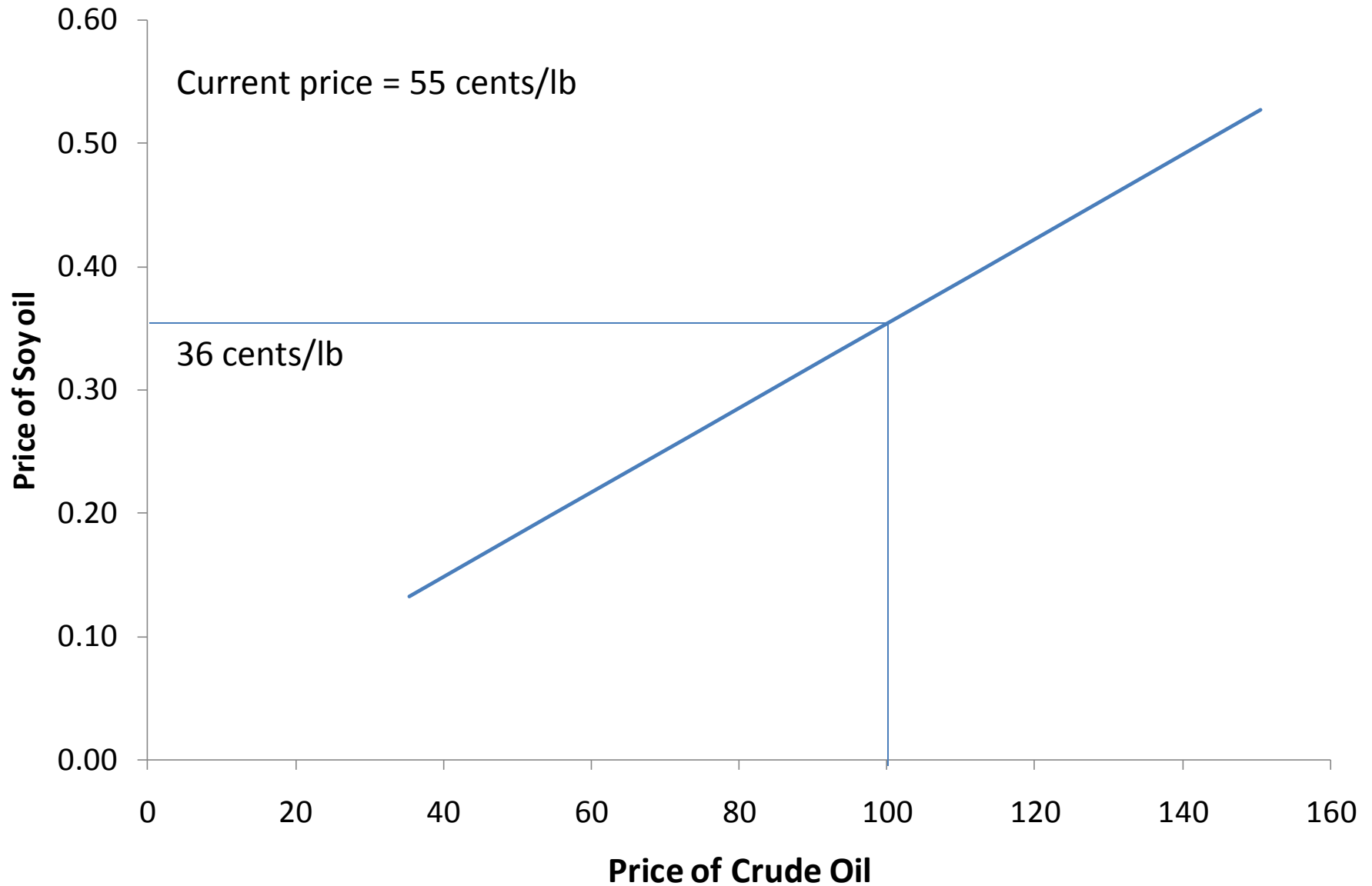
# Ability to Pay for Corn in E10 and E85



# Ability to Pay for Corn in E10 and E85



# Ability to Pay for Soybean Oil in Biodiesel



# Market Value Summary

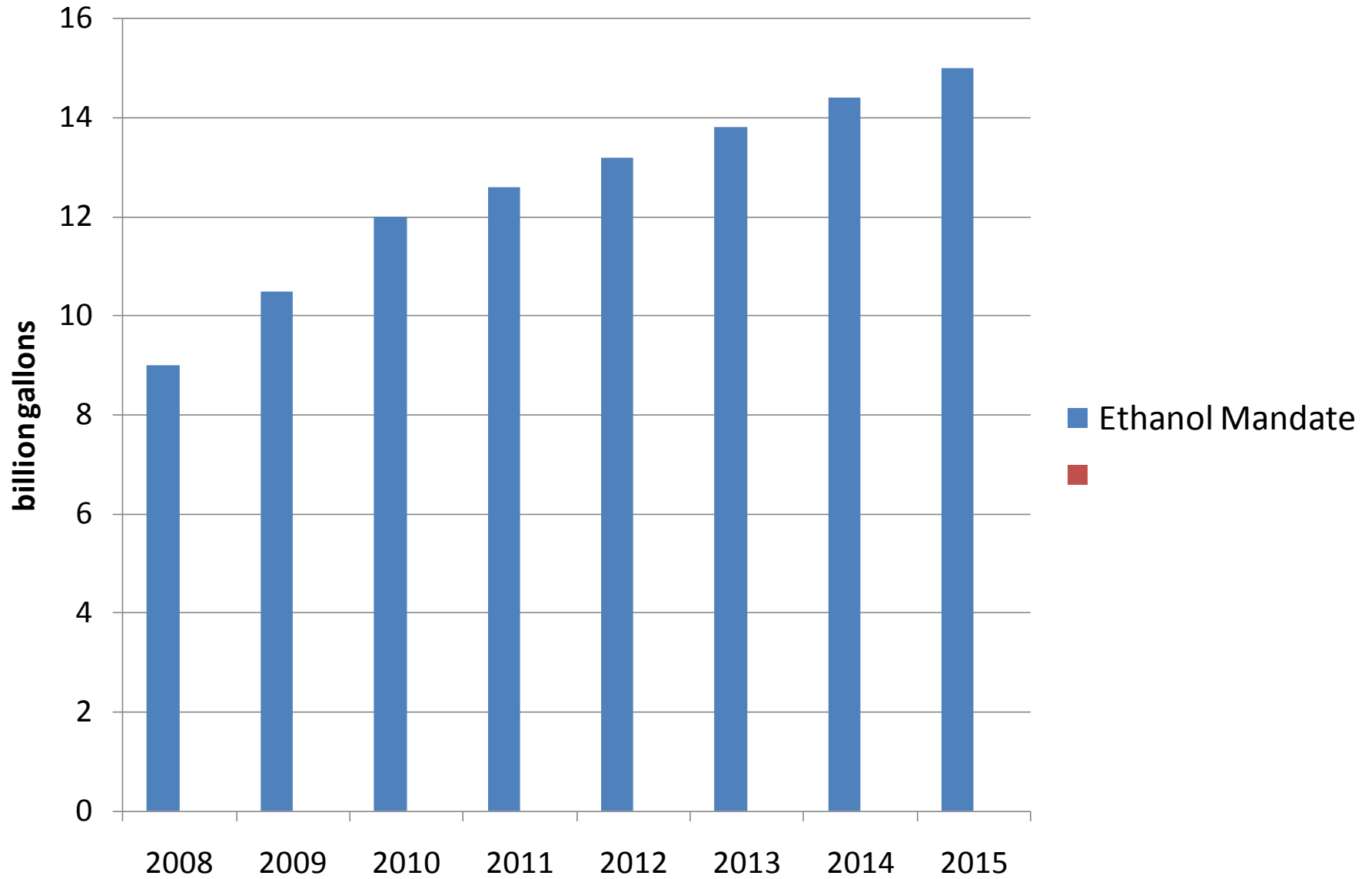
- US ethanol industry is competitive with gasoline and can pay a high price for corn in E10 blends
- US ethanol is competitive at producing E85 only if crude stays at \$100 or corn becomes cheap
- Biodiesel is not competitive using vegetable oil
  - Production cost from using soybean oil at least \$2 per gallon too high

# Policy Tools

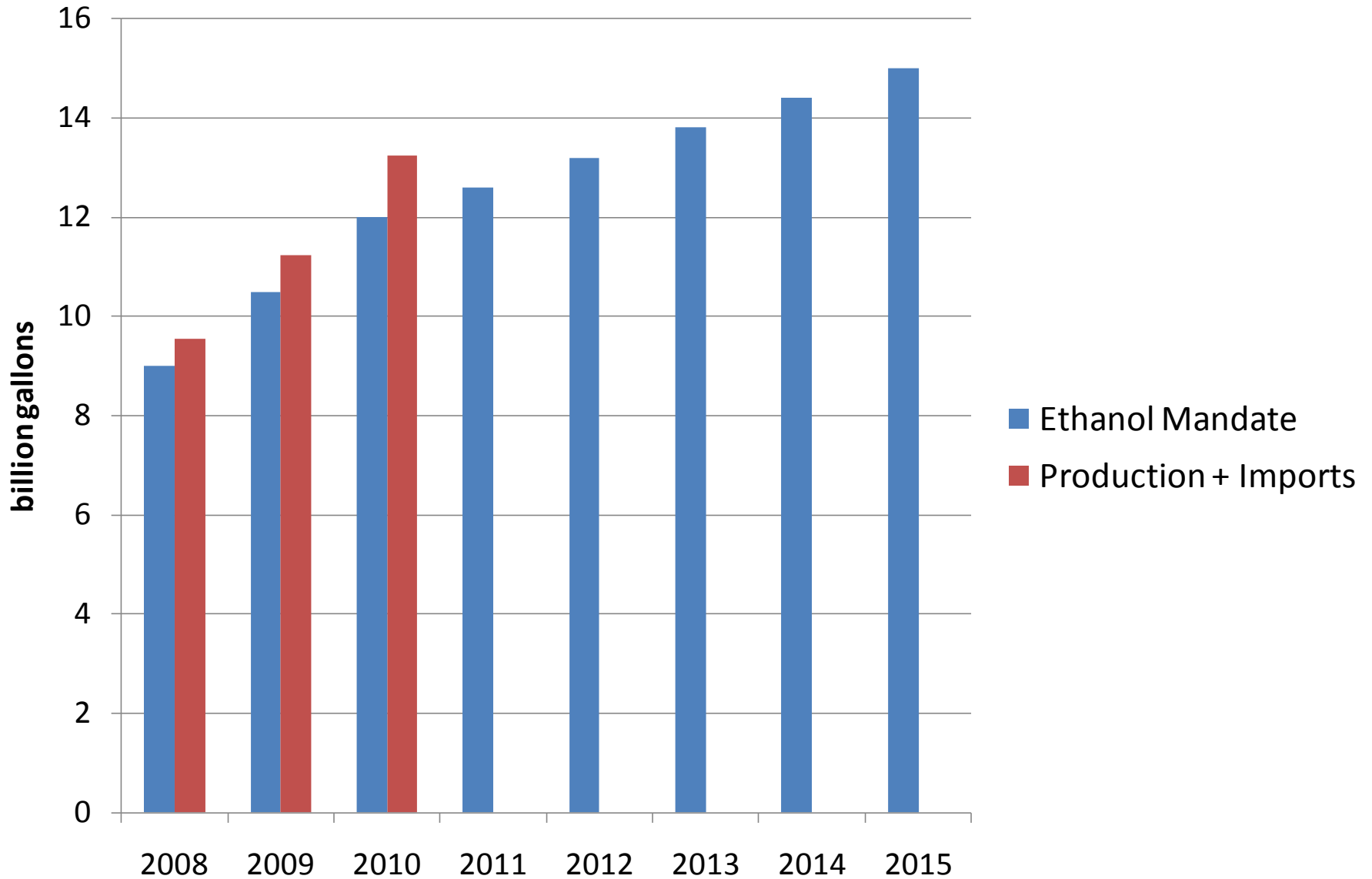
- Tax credits increase fuel blenders' ability to pay for biofuels
  - \$1.00 per gallon for biodiesel
  - \$0.45 per gallon for ethanol
- Mandates force the purchase of minimum amounts of biofuels into fuel blends



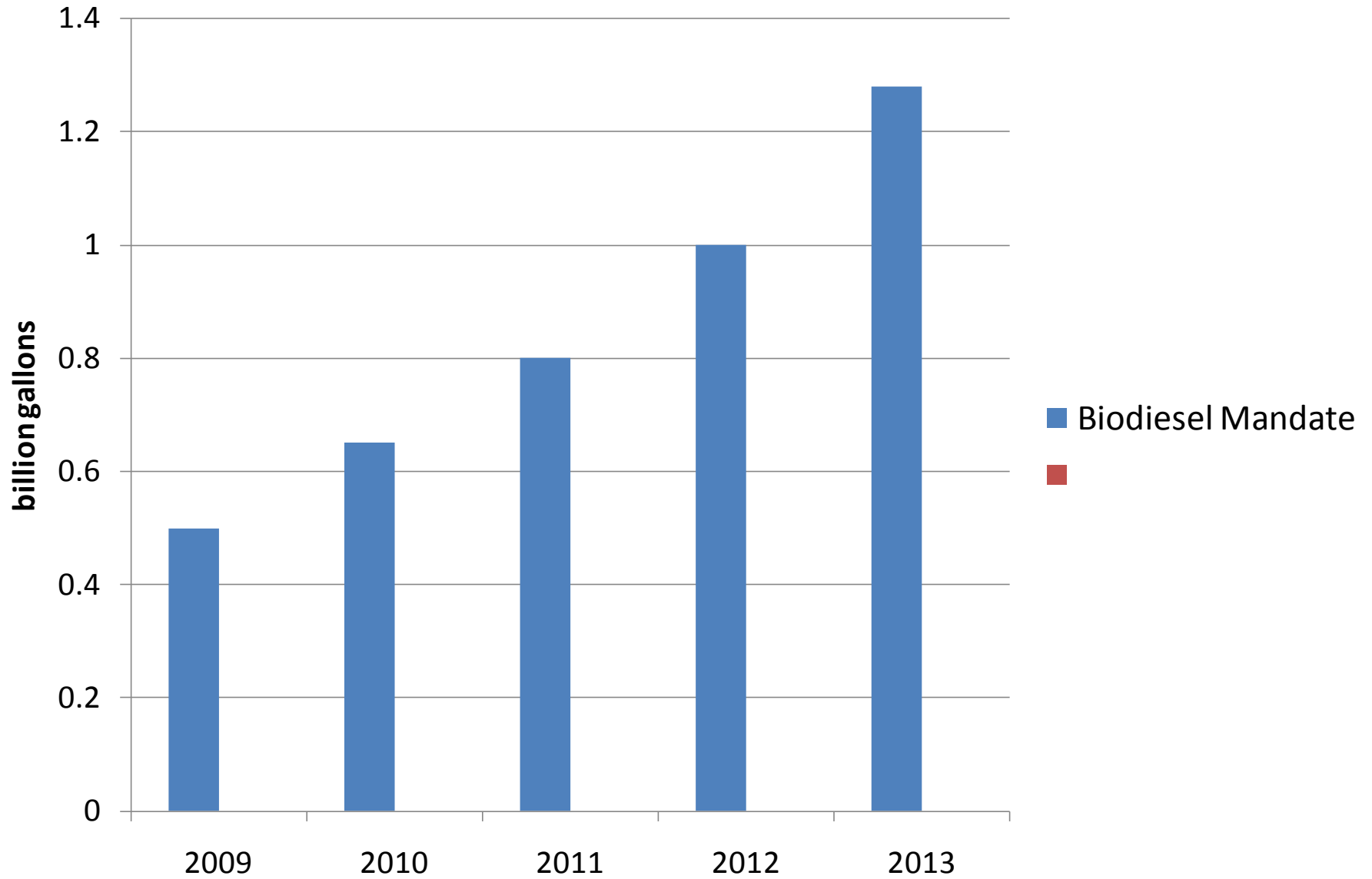
# Ethanol Mandate: 2008 to 2015



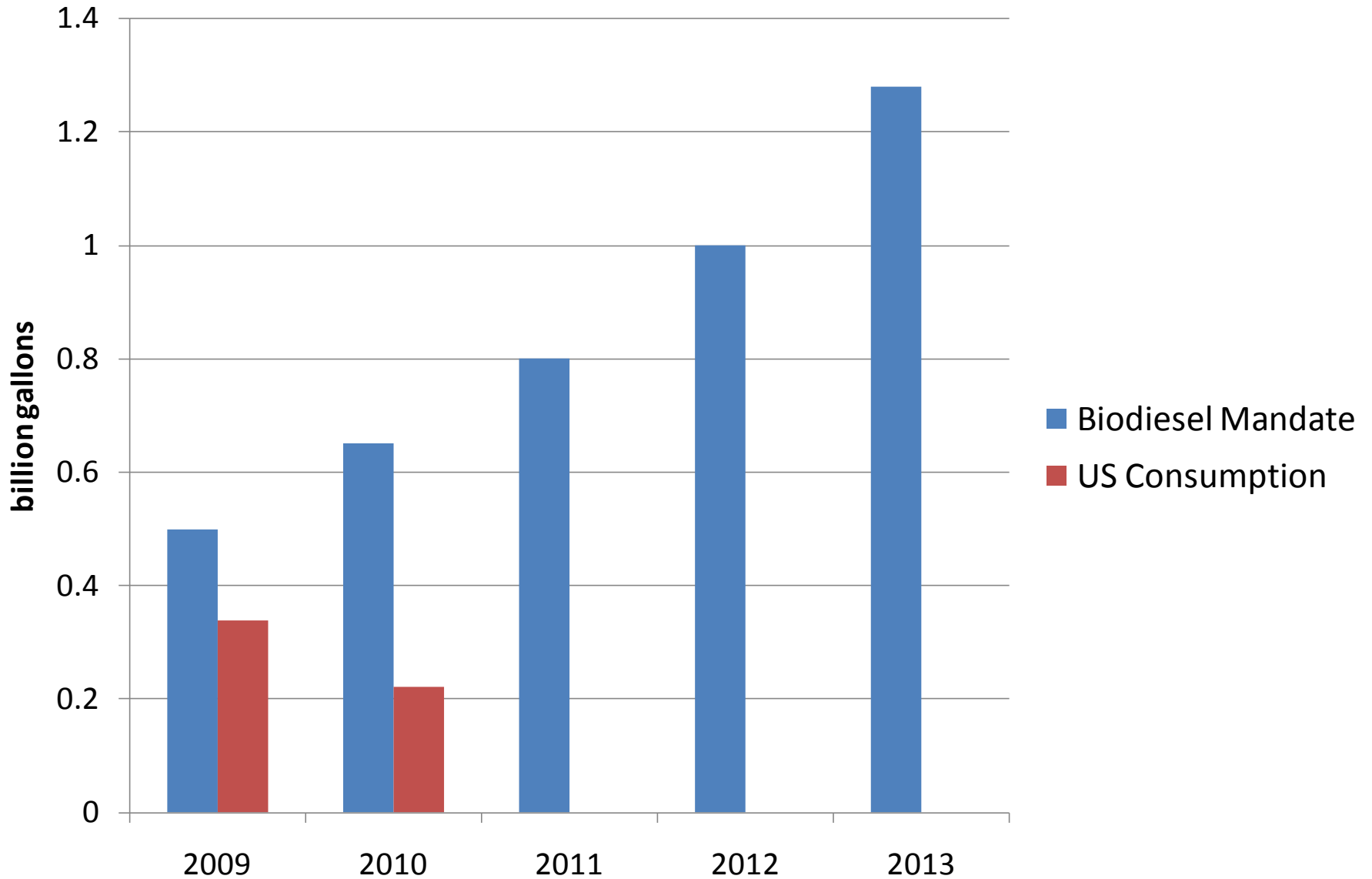
# Ethanol Mandate and Historical Use



# Biodiesel Mandate: 2009 to 2013



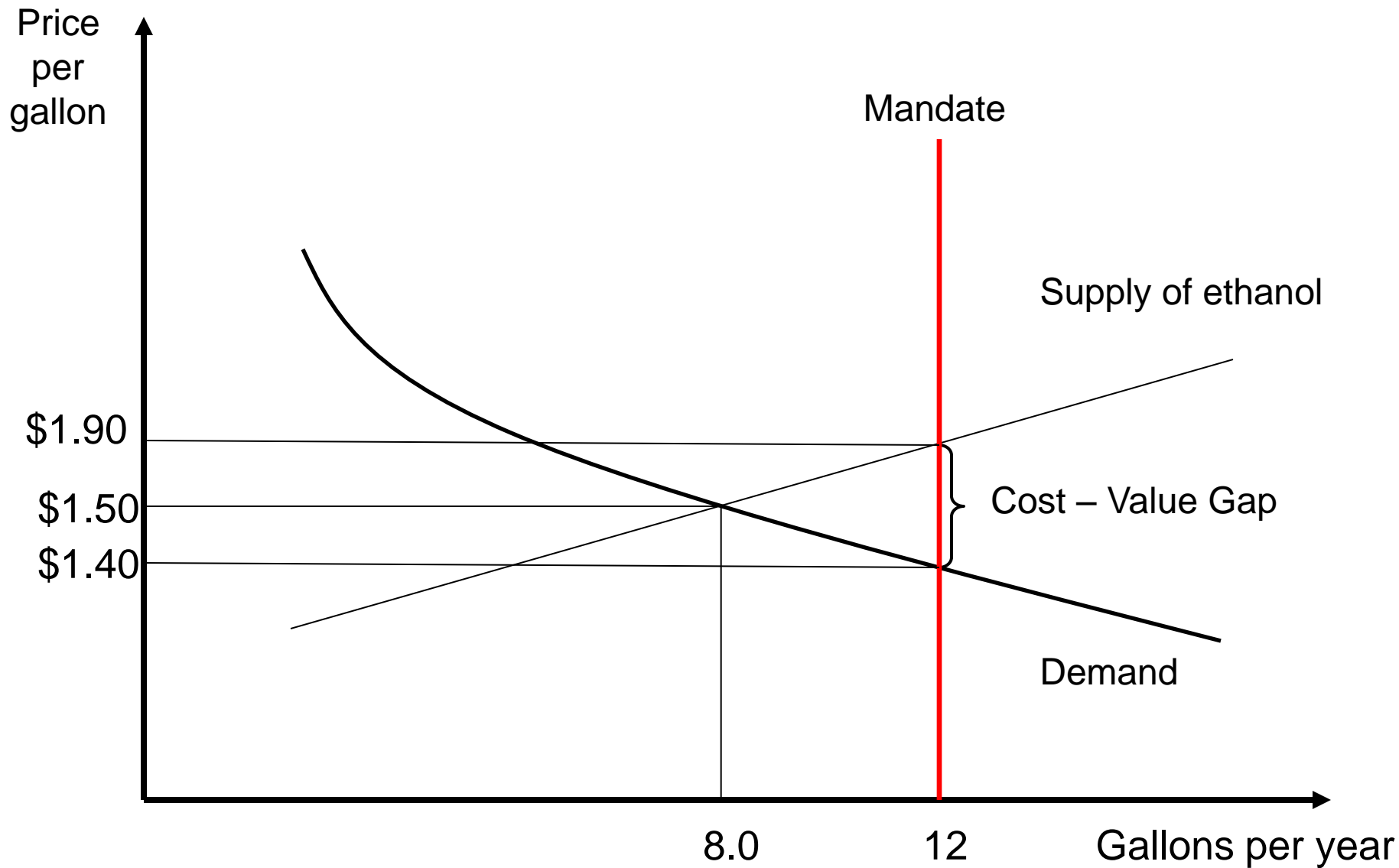
# Biodiesel Mandate and Historical Use



# Economics of Blending Mandates

- If market demand is high enough, mandate has no impact on production, price, or consumption of biofuels
- If demand is not high enough, then there is a gap between production costs and the market value of biofuels

# Impact of Mandate



# Why close the gap?

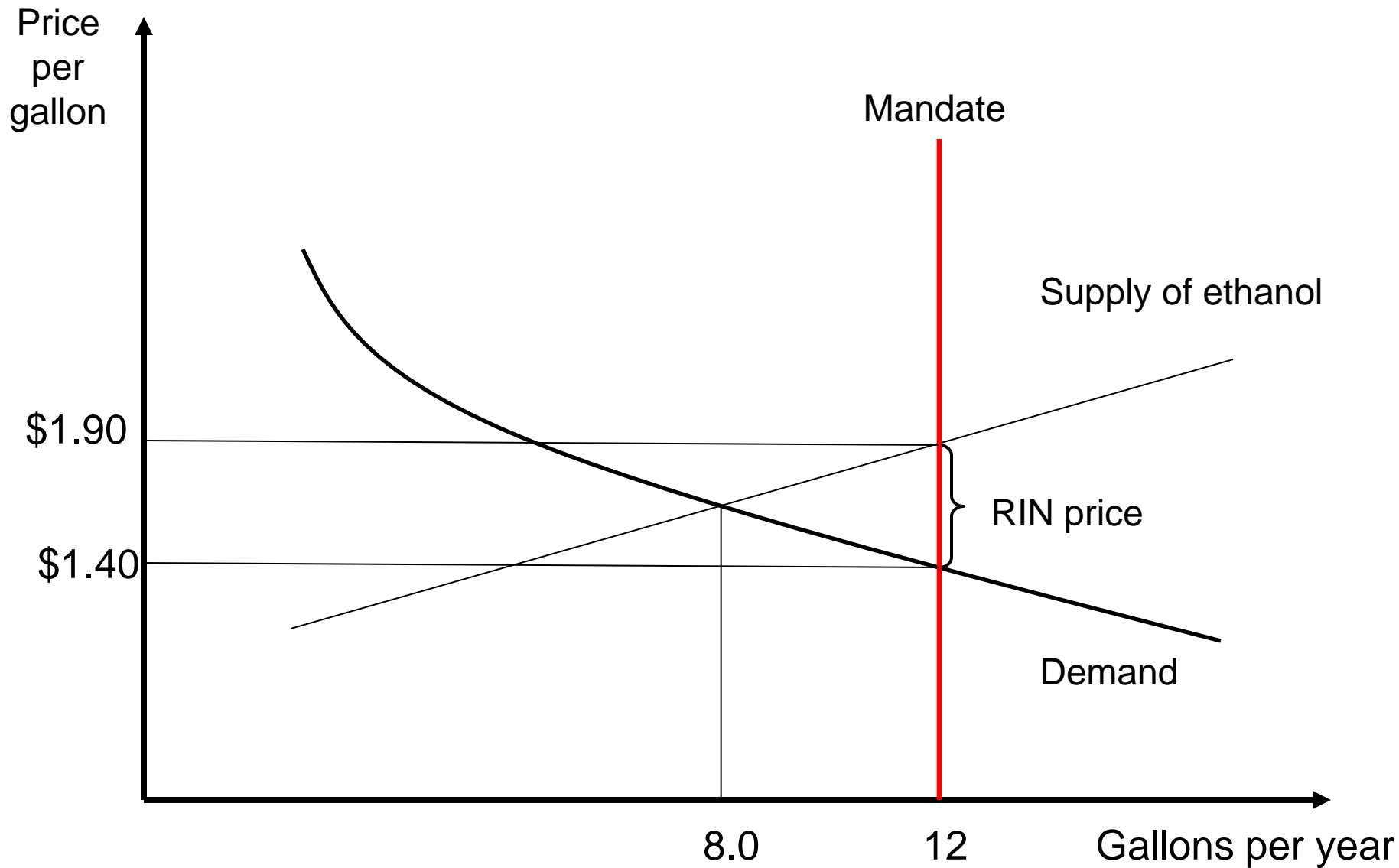
- Non-market values of biofuels
  - Reduction in greenhouse gas emissions
  - Lower air pollution
  - Domestic source of fuel

# How to Close the Gap?

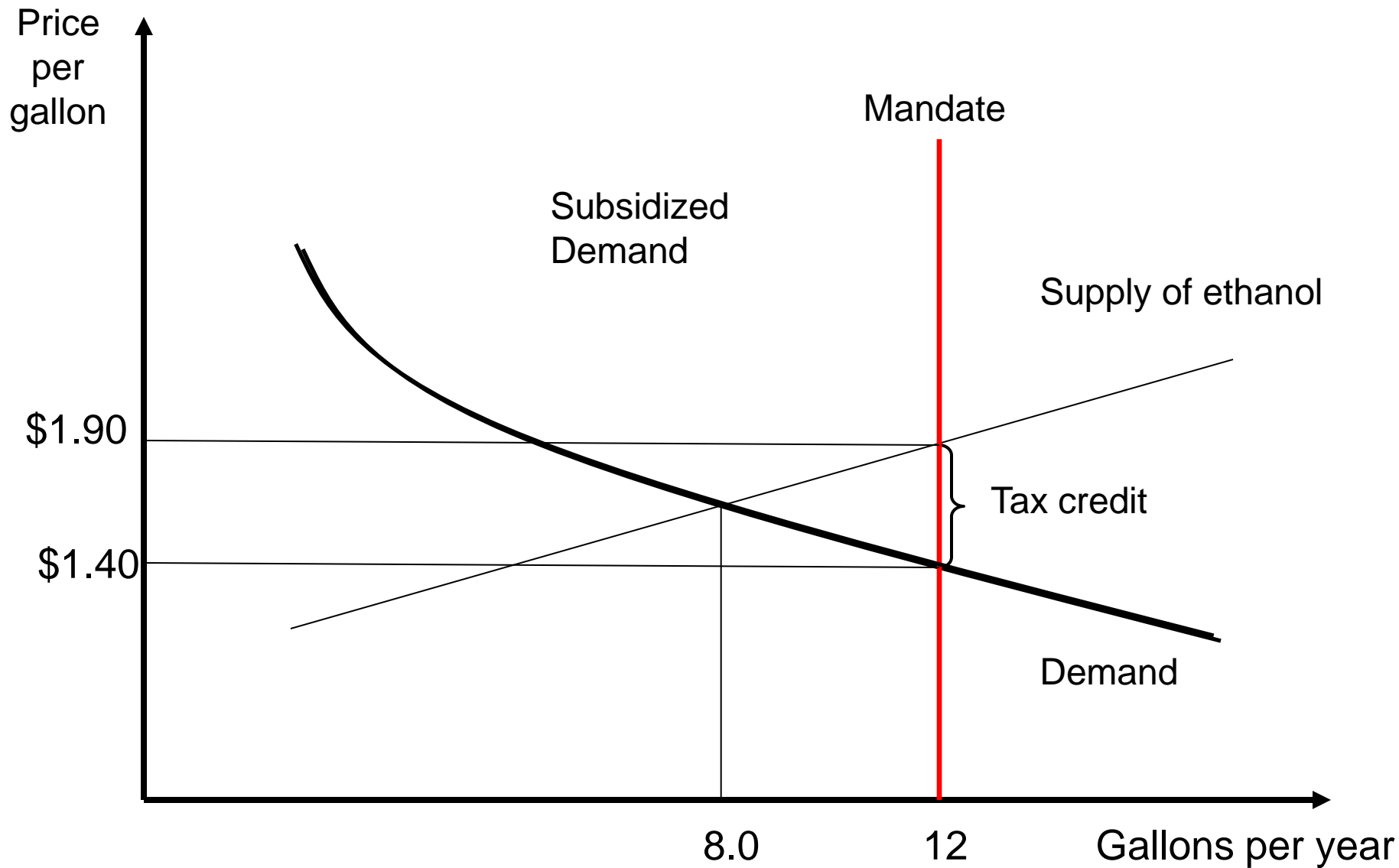
1. Subsidize the use of biofuels through tax credit
2. Create a tradable biofuel credit program where each fuel blender must blend or buy biofuel credits from blenders who blend in excess of their obligation



# Impact of Mandate



# Closing the Gap with a Subsidy



# Current Policy Does Both

- Biodiesel tax credit covers about half of the price gap, RIN price covers the other half
- Ethanol tax credit covers all of the gap and pushes demand beyond mandate levels

# Impacts of Alternative Policies: Biodiesel

- Elimination of biodiesel tax credit would not affect production, price of biodiesel, or price of soybeans
- Elimination of mandate would cause production to fall dramatically
  - Little or no vegetable oil would be used to produce biodiesel
  - Small impact on soybean prices

# Impacts of Alternative Policies: Ethanol

- Elimination of tax credit would decrease ethanol production, the price of ethanol, and the price of corn
- Elimination of both tax credit and mandate would cause production to fall further
- Magnitude of impact depends on the price of crude oil and on the supply of corn

# Simulation Results

- Looked ahead at the 2012 calendar year to estimate the impacts of eliminating the ethanol and biodiesel tax credits and on eliminating the mandate
- Key variables are the future price of crude oil and US corn yields in 2011 and 2012
- Model calibrated to July 2011 USDA-WASDE projections and current futures prices for crude oil

# Elimination of Ethanol Tax Credit:

Average Impact Across 500 Crude Oil Prices and Corn Yields

- US Ethanol Production
  - Decreases 4.7% from 13.82 to 13.16 billion gallons
- Corn price
  - Decreases 9.4% from \$6.27 to \$5.68/bu
- US ethanol price
  - Plant price decreases 6% from \$2.43 to \$2.28
  - Net cost to blenders increases 15% from \$1.98 to \$2.28 per gallon

# Other measures of impacts from eliminating ethanol tax credit

- Taxpayer cost reduced by \$6.2 billion
- Ethanol plant returns over corn costs decrease by 3% from \$10.2 to \$9.84 billion
- Value of corn crop decreases by \$8.2 billion
- Cost of domestic feed reduced by \$3 billion
- Consumer cost of fuel
  - If tax credit was passed on to consumers, increases by \$4.2 billion
  - If tax credit was not passed onto consumers, decreases by \$2.1 billion

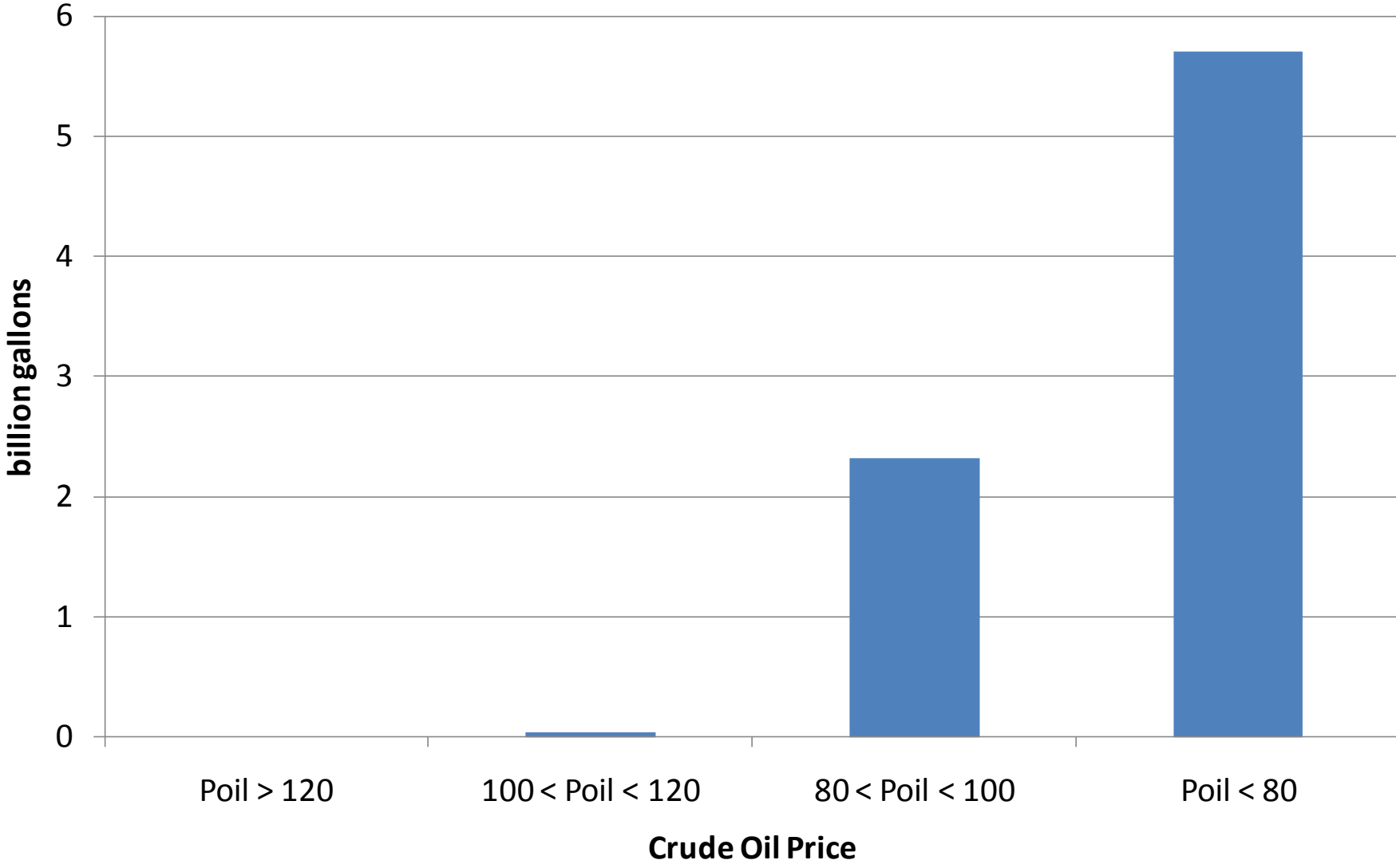


# Elimination of Ethanol Mandate:

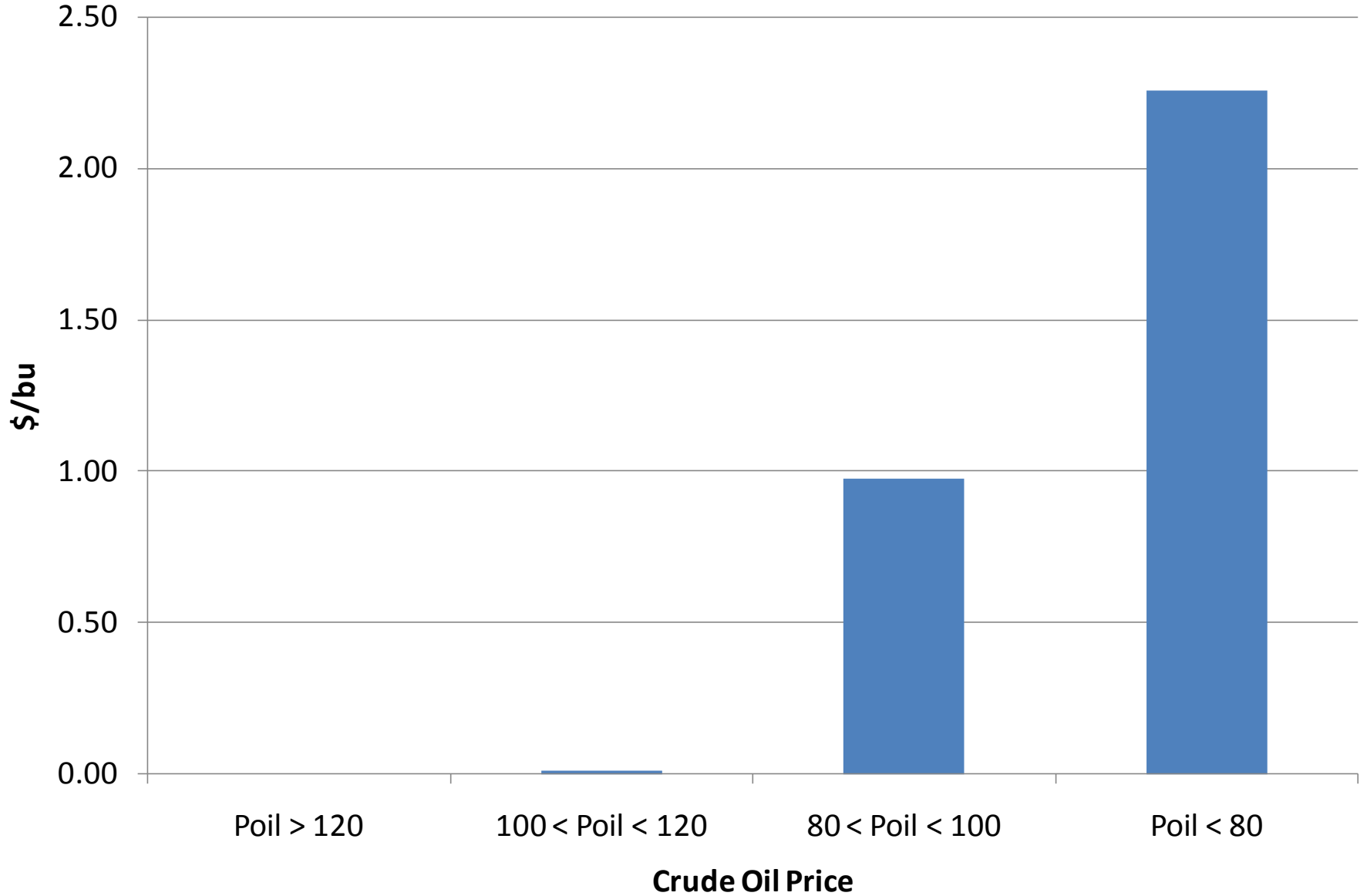
Average Impact Across 500 Crude Oil Prices and Corn Yields

- US Ethanol Production
  - Decreases to 10.9 billion gallons
- Corn price
  - Decreases to \$5.30/bu
- US ethanol price
  - Plant price decreases to \$2.17

# Drop in Ethanol Production from Elimination of Mandate



# Drop in Corn Price from Elimination of Mandate



# General Policy Conclusions

- Lower cost ways of obtaining non-market values from biofuels
  - Tax carbon to lower greenhouse gas emissions
  - Gasoline tax to reduce consumption of imported oil
  - Ethanol may be low cost way of meeting air quality standard. If so, then market will sort it out
- But when does Congress look for low-cost ways of achieving public policy objectives?

# Specific Policy Observations

- Makes no sense for taxpayers to close the gap between production costs and market value of fuel
  - Fuel users cause the problems, they should pay
  - The tax credit seems like it is ready to go, and it should
  - Biodiesel tax credit should be next

# Further Conclusions

- Makes no sense to enforce costly mandate, particularly for a mature industry
  - Incremental gallon of biodiesel costs more than \$2.00 per gallon more than diesel to produce.
- Mandates for advanced biofuels may have more justifications, but no clear that mandated use will drive investments.

# Future Policy Direction

- Current ethanol mandate too large without extensive investment in blending infrastructure
  - Flex-fuel cars
  - Blender pumps
- Do we really want ethanol as our alternative fuel?

# Biofuel Alternatives to Ethanol

- Drop-in fuels or bio-butanol can use existing blending infrastructure
- Can be produced from any source of sugar
- New processes can create synthetic diesel or gasoline
  - Feedstocks are algae, corn starch, sugar cane, cellulose
- If we invest in ethanol infrastructure, investment in drop-in fuel technologies likely to falter



# Current RFS is too Aggressive for Corn Ethanol

- Department of Energy and EPA assumed that ethanol would be the preferred biofuel
- 15 billion gallons of ethanol is more than can be absorbed by US consumers without a large discount in price if complementary investments in vehicle fleet and fuel infrastructure would come about
- US needs to decide if ethanol is our future fuel