Ethanol Subsidies, Who Gets the Benefits?

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Outline
- Introduction and literature review
- Subsidy received by the ethanol industry
  - A competitive framework
  - Special cases
  - In the presence of fuel standard
- Impacts of the subsidy on the price of corn (farmer share)
- Subsidy received by land owners

Introduction
Ethanol and Gasoline Prices Adjusted for the Energy Content

Literature Review
- Theory of tax incidence: This theory mainly elucidates that the statutory incidence of a tax (or a subsidy) can be different from its economic incidence
- Incidence of gasoline taxes: Consumers bear almost the full burden of gasoline taxes in the US

Subsidy Received by the Ethanol Industry
An Analytical Model (No Fuel Standard)
- A blender produces a homogeneous blend product using gasoline and ethanol with a HD1 production function \( B = B(G, E) \)
- Supply of gasoline is a function of its price and the crude oil price \( G^S = G(P_g, P_o) \)
- Supply of ethanol is a function of its price prices of corn and natural gas \( E^S = E(P_c, P_n, P_g) \)
- The government pays a flat subsidy \( S \) per unit of ethanol
Subsidy Received By the Ethanol Industry
An Analytical Result (No Fuel Standard)

\[
\frac{dP}{dS} = \frac{\alpha \eta_g + \sigma}{\alpha \eta_g + (1 - \alpha) \eta_e + \sigma}
\]

\(\eta_g\): Supply elasticity of gasoline with respect to its price

\(\eta_e\): Supply elasticity of ethanol with respect to its price

\(\sigma\): Elasticity of substitution between gasoline and ethanol

\(\alpha\): Share of ethanol in total blend production costs

Share of the subsidy on ethanol received by the ethanol industry (no fuel standard)

\[\gamma = \frac{E}{E + G}\]

Fuel Standard:

\[\gamma = \frac{E}{E + G}\]

Production Function:

\[B = \min\{\gamma E, (1 - \gamma) G\}\]

Subsidy Received:

\[\frac{dP}{dS} = \frac{\alpha \eta_g}{\alpha \eta_g + (1 - \alpha) \eta_e}\]

Share of the subsidy on ethanol received by the ethanol industry (fuel standard with limited capacity of ethanol production)

-The State of the Union: \(\gamma = \frac{E}{E + G} = 0.15\)

-This required 35 billion gallons ethanol in 2007

-The current capacity of ethanol production is 5.3 billion gallons

-This can generate a market power for the ethanol industry

\[\frac{dP}{dS} = \frac{\alpha \eta_g}{\alpha \eta_g + (1 - \alpha) \eta_e} = 1\]

Share of the subsidy on ethanol received by the ethanol industry in a competitive market with a relative elastic supply of ethanol

\[P_e = \beta S\]

Demand with subsidy

Demand without subsidy
Share of the subsidy on ethanol received by the corn producers in a competitive market with limited production capacity

\[ \text{Subsidy received by the corn producers} \]

An Analytical Model

- Ethanol production function \( E = E(C) \)
- Demand for corn in other industries \( O = O(P_c) \)
- Supply of corn \( C^s = S(P_c) \)

Subsidy received by the corn producers

An Analytical Result

\[
\frac{\partial P_c}{\partial \epsilon} = \frac{\partial \eta_C}{\partial \epsilon} \frac{1}{q} + \frac{(1 - \theta) \eta_D}{P_c} \frac{\eta_D}{P_c} > 0
\]

\( \eta_C \) Supply elasticity of corn

\( \eta_D \) Elasticity of demand for corn by the ethanol industry

\( \eta_D \) Elasticity of demand for corn by the other corn users

\( \theta \) Market share of the ethanol industry in the corn market

Subsidy received by land owners

- In the future, the demand of ethanol industry for corn will increase sharply
- This will push up the demand for land
- Since the supply of land is limited, land owners will capture most the benefits from a higher price of corn, including subsidy benefits

Conclusion

- In a competitive market with no fuel standard the ethanol and gasoline producers share the ethanol subsidy according to their supply elasticities and the elasticity of substitution between ethanol and gasoline
- In the presence of fuel standard and a limited production capacity of ethanol, the ethanol industry has the potential to capture the whole ethanol subsidy
- Ethanol industry passes a portion of the ethanol subsidy to the corn producer. This portion increases with the share of the ethanol industry in the corn market
- Farmers pass a large portion of their share from the ethanol subsidy to land owners