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The Net Impact of Ethanol on Households

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Introduction

There has been a great deal of emphasis placed on the role of biofuels on higher food prices. Research on the issue indicates that the use of crops to produce biofuels, particularly ethanol, has had a small but real impact on food prices at the consumer level (Knudson and Schweikhardt). However, the impact of increased ethanol use on gas prices has not been analyzed.

This paper will look at the net effect of increased ethanol production on households. It will consider two scenarios: a household made up of one person who drives 15,000 miles a year and a household of 4 who drives 30,000 miles a year. It will assume that the vehicle driven by a single person averages 25 miles a gallon, and that the vehicle or vehicles driven by a family of four averages 20 miles a gallon. Food cost estimates will come from other published sources. The analysis is for the U.S. and does not include impacts on foreign countries. It also assumes that oil refinery capacity would not have increased in the absence of ethanol production.

Results show that the net impact of increased ethanol utilization is positive, that is the savings from lower prices resulting from increased ethanol utilization is greater than the higher food costs resulting from diverting corn from food production to gasoline production. The net savings for a single person ranges from \$55.60 for a person living in the Rockies to \$193.00 for a person living in the Midwest. Net savings for a family of four ranges from \$68.50 for a household living in the Rockies to \$404.50 for a household living in the Midwest.

Food and fuel have many similar characteristics. Food and gasoline are products that most households have to buy. The supply and demand for both of these items is what economists call inelastic; the quantity supplied and consumed does not vary much with changes in the price of these items. However, changes in supply such as new discoveries of oil, crop failures, technological advance, global disruptions, etc. can cause large changes in price. In this case even though the amount of ethanol used in gasoline is relatively small compared to the total amount of gasoline used; it can have a relatively large effect on price because it increases the supply of motor fuel.

Impact of Ethanol Production on Food Prices

There have been several attempts to measure the impact of ethanol on food prices. The International Policy Research Institute believes that the expansion in biofuel production accounts for 25 to 33 percent of increase in global agricultural commodity prices (Martin, p.1). In 2007, Tokgoz et al estimate that in 2007 consumers will pay 1.1 percent more for food as a result of increased use of corn for ethanol (Tokgoz et al, p.i). From 2006 to August of 2007, the same paper estimates that per capita food costs have increased by \$47 (Tokgoz et al p.23) or \$188 for a family of four. The weekly increase in food

spending in this case is slightly more than 90 cents per person or \$3.62 for a family of four. Most of this increase is due to higher meat and dairy prices (Tokgoz et al, p.24).

This analysis is for the U.S. economy and does not directly consider the impacts on the profits of the food processing, wholesaling and retail industries of the agri-food system. There may also be regional differences in food costs from one area to the country to another. The analysis does not take regional differences into account. However, it should also be noted that transportation costs would be a major factor in determining regional difference in food costs, and the use of biofuels would reduce the impacts of higher transportation costs of food prices. Also, the analysis does not consider the impacts on the livestock sector.

Impact of Ethanol Production on Fuel Prices

Ethanol is primarily used as a fuel extender and an oxygenate, which improves the performance of gasoline (Du and Hayes, pp.1,2). In 2007, approximately 7.22 billion gallons of ethanol were produced; this is approximately 5 percent of total U.S. gasoline consumption. This has the effect of expanding the supply of gasoline by 5 percent compared not having any ethanol in the fuel supply.

The expansion of gasoline supplies has had a fairly substantial effect on fuel prices. This effect varies depending on the area of the country. The impact has been greatest in the Midwest, the area where the production of ethanol is the greatest and that is a net importer of petroleum based gasoline. Impacts are smaller but still significant in other parts of the country that produce less ethanol but produce more petroleum. Table 1 shows the impact of ethanol on gasoline prices as estimated by Du and Hayes.

**Table 1: Reduction in Gasoline Prices
Resulting From Ethanol By Region**

Region	Price Reduction (cents per gallon)
East Coast	23.3
Midwest	39.5
Gulf Coast	24.6
Rocky Mountain	17.1
West Coast	23.3

Source: Du and Hayes

The impact is greatest in the Midwest and smallest in the Rocky Mountain region. These regions are based on Department of Energy regions. The East Coast region includes New England and all the states that border the Atlantic Ocean including Florida. The Midwest Region includes all the states generally considered Midwestern but also includes Kentucky, Tennessee, and Oklahoma. The Gulf Coast Region includes the states other

than Florida that border the Gulf of Mexico plus Arkansas and New Mexico. The West Coast includes the state bordering the Pacific Ocean plus Arizona and Nevada.

Michigan is considered part of the Midwest but given its location relative to other Midwestern states and the fact that Michigan is not a major producer of ethanol compared to Illinois, Iowa and South Dakota, the actual cost savings may be more in line with East Coast than Midwest figures.

Results

Given the variability in the impact of ethanol on gasoline prices the scenarios will be divided by region. Table 2 shows the impact on a single person who drives 15,000 miles a year and has a car that averages 25 miles a gallon.

Region	Savings on Gas (dollars)	Higher Food Costs (dollars)	Net Savings (dollars)
East Coast	139.80	47.00	92.80
Midwest	237.00	47.00	190.00
Gulf Coast	147.60	47.00	100.60
Rocky Mountain	102.60	47.00	55.60
West Coast	139.80	47.00	92.80

Annual gas savings resulting from the use of ethanol for a single person varied from \$102.60 in the Rocky Mountain Region to \$237.00 in the Midwest. The savings are greater for persons who drive vehicles that average less than 25 miles per gallon, and are smaller for persons who drive vehicles that average more than 25 miles per gallon. The amount driven also impacts these figures. After accounting for higher food costs, net savings on household budgets ranged from \$55.60 in the Rocky Mountain Region to \$190.00 in the Midwest.

Table 3 shows the budget savings for a household comprised of four individuals who drive 30,000 miles a year and whose vehicle(s) average 20 miles a gallon. Gas savings for a family of four varies from \$256.50 in the Rocky Mountain Region to \$592.50 in the Midwest. After accounting for higher food costs, net savings on household budgets for a family of four varied from \$68.50 in the Rocky Mountain Region to \$404.50 in the Midwest.

**Table 3: Budget Savings Resulting From Ethanol By Region
(Household of Four)**

Region	Savings (dollars)	Higher Food Costs (Dollars)	Net Savings (Dollars)
East Coast	349.50	188.00	161.50
Midwest	592.50	188.00	404.50
Gulf Coast	369.00	188.00	181.00
Rocky Mountain	256.50	188.00	68.50
West Coast	349.50	188.00	161.50

Again as is the case with a single household the actual annual savings will vary with gas mileage and miles driven.

Given the estimate that food costs as a result of the increased production of ethanol is \$47 more per person or \$188 for a family of four, it is clear that expanded ethanol production has had a positive effect on household budgets. Overall the net savings are real but small for people throughout the country, but there is a real and noticeable positive impact for residents of the Midwest.

It should be noted that this paper does not analyze the supply response in the oil industry that might have occurred if there were no ethanol industry. Higher oil and gasoline prices might have increased exploration of petroleum and increased the level of investments in new refining capacity. However, given the long time period needed for oil exploration to impact the petroleum market and the difficulty in expanding refining capacity in the U.S. this is not likely to be a major oversight.

Conclusion

There has been some concern about the rising cost of food resulting from the increased use of corn for ethanol use. Research has shown that the increased production of ethanol has impacted food prices for U.S. consumers. However, the increased use of ethanol has allowed ethanol to be substituted for gasoline, moderating gasoline price increases.

Results of this study based on work by Du and Hayes, indicate that the net impact of expanded ethanol production have a positive impact on consumer budgets. The cost saving from lower gasoline prices more than offset higher food prices. This impact varies depending on what region of the country the household lives. The net savings for a single person ranges from \$55.60 for a person living in the Rockies to \$193.00 for a person living in the Midwest. Net savings for a family of four ranges from \$68.50 for a household living in the Rockies to \$404.50 for a household living in the Midwest. Actual savings will vary from household to household depending on gas mileage the vehicle actually gets and the miles driven.

References

Du, X. and D. Hayes. *The Impact of Ethanol Production on U.S. and Regional Gasoline Prices and on the Profitability of the U.S. Oil Refinery Industry*, Working Paper 08-WP 467. Ames: Center for Agricultural and Rural Development, Iowa State University, 2008.

Knudson B. and D. Schweikhardt. *Food vs. Fuel* (Forthcoming).

Martin, A. "Fuel Choices, Food Crises and Finger-Pointing". *The New York Times*, nytimes.com, April 15, 2008.

Tokgoz, S., A. Elobeid, J. Fabiosa, D. Hayes, B Babcock, T.-H. Yu, F Dong, C. Hart, and J. Beghin. *Long Term and Global Tradeoffs between Bio-Energy, Feed and Food*. Paper presented at the American Agricultural Economics Association Annual Meeting, 2007.