

# ***Evaluating the Impacts of an Increase in Fuel-ethanol Demand on Michigan Agriculture and Economy***

**GREEN Project # : GR 02 - 074**  
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## **Statement of Challenge**

The demand for fuel ethanol made from corn is likely to increase sharply over the next few years due to several developments such as: proposed ban on methyl tertiary butyl ether (MTBE) as a gasoline additive, the proposed renewable fuels standard, rising petroleum prices, and the revised 8 hour ozone air quality standards. The increased demand for fuel ethanol will have significant implications for Michigan agriculture through likely increased corn prices, increased supply of byproduct distillers dried grains (DDG), and ripple effects on other crops and animal feeds. It will also significantly affect Michigan State finances due to the current ethanol subsidy structure and the dependence of highway funds on federal gasoline tax. Quantitative analysis of these effects is warranted to inform Michigan farmers as well as policy makers. This research proposes an analysis of several such scenarios using a multi-sector econometric model AGMOD developed at Michigan State University.

## **Objectives**

The specific objectives of this study are to address the following questions.

1. What are the effects of (i) a ban on MTBE, (b) a renewable fuel mandate, (c) new eight hour ozone standards, and (d) various combinations of these, on the automobile fuel market and the demand for ethanol nationally, and in Michigan?
2. How will the increased production of ethanol affect output and prices of corn, DDG, soybean meal, other crops, and livestock? What will be the impact on retail prices and net farm income in Michigan?
3. What are the implications for finances of the State of Michigan, if there is a substantial increase in ethanol use, under the current ethanol tax, subsidy and revenue sharing arrangements?

## **Discussion of Results**

Consolidating and updating several earlier studies by USDA, DOE and USEPA estimated the projected national fuel ethanol demands under the following scenarios for the period 2003-2010.

1. Fourteen state MTBE ban (current situation and Reference case)
2. Fourteen state MTBE ban and Federal MTBE ban (Case A)
3. Fourteen state MTBE ban and Federal Renewable Fuel Standard (Case B)
4. Federal MTBE ban and Federal Renewable Fuel standard (Case C)
5. Fourteen State MTBE ban + Federal RFS + 8 hour ozone standards (CASE D)
6. Federal MTBE ban + Federal RFS + 8 hour ozone standards (CASE H-high)

AGMOD, an econometric model of U.S. agriculture, was employed to estimate the

impact of these alternative levels of ethanol production on major farm and agri-business variables for the period of 2003 to 2010. The output of these solutions to AGMOD which were national, were then transferred to an econometric model of Michigan agriculture called MIAGMOD. MIAGMOD focuses on the major enterprises in the state in terms of production, prices, costs of production and profit margins. The output from MIAGMOD, in turn, was transferred to another model which is designed to aggregate data into total cash receipts from marketing, government payments, and other sources; into total cash expenditures; and then to net cash income. This econometric model, called MIINMOD, is also designed to generate financial statements for Michigan agriculture in the aggregate. The changes in ethanol demand in Michigan were estimated based on the national changes, which were then used to estimate the impacts on state finances under the current tax, subsidy and revenue sharing arrangements.

## **Results**

In the reference case, national ethanol production was projected from 2,500 million gallons per year in 2003 to 2,880 million gallons in 2010. In the other five scenarios, the projections to 2010 ranged from 3,250 million gallons to 4,670 million gallons. While the conclusions vary somewhat on the direction and timing of differences between the reference case and the alternative higher production levels of ethanol, the major conclusions can be described by comparing the impacts of the high (4,670 million gallons) case with the reference case. For expository purposes, the high scenario will be labeled “H” and the reference scenario “R”.

## **National Implications**

- Corn prices received by U.S. farmers by increased by 18 percent in 2007 in H over the R case and by 7 percent in 2010.
- Corn acreage increased by 4 percent in H over R by 2010.
- Because of the increased availability of high protein feeds from ethanol production, the utilization of soybean meal for feed was 3.6 percent lower in 2010 under H than under R. However, the higher prices on corn offset the increased availability of high protein feeds, and soybean meal prices were actually higher under H than under R until 2010. The prices on corn gluten meal were lower under H but prices of both corn gluten feed and meal depended on the assumption about exports. If exports of these feeds were much higher than forecast, prices on both would be above R under the H scenario.
- The total impact of H versus R was to increase total area in the U.S. to the major crops by about 2 to 3 percent with corn and wheat acreage up and soybean acreage down, corn acreage up by 4 percent and soybean acreage down by 3 percent in H relative to R. Wheat acreage is enhanced by the higher prices prompted by the fact that higher corn to wheat prices encouraged more feeding of wheat.

## **Implications for Michigan Agriculture and State Finances**

- Under H, higher prices on corn, soybeans and wheat generate total acreages of major crops in Michigan of one percent above the R scenario by 2010.
- Expanded ethanol production will be positive for crop production in Michigan with somewhat higher output early on with production of corn and soybeans up by 4-5

percent in 2010 in H over R. Wheat production could be as much as 10 percent higher in 2010. On the other hand, livestock production would be slightly lower in 2010 comparing H to R, but not more than one or two percent.

- Gross margins over variable costs were significantly higher on corn; also somewhat higher on soybeans and wheat until late in the 2003 to 2010 period. Because of higher corn prices along with other major crops, acreages were drawn away from dry beans nationally which enhanced prices on Michigan dry beans.
- The higher feed prices generated by the expanded production of ethanol tended to reduce gross margins over variable costs on milk production, beef cows, and cattle feeding. Higher feed prices also reduced prices on feeder cattle but not enough to increase feeding margins. Gross margins in hog production were also reduced under H versus R but the short biological cycle in hogs resulted in higher margins toward the end of 2003 to 2010 as swine operators cut back farrowings, both nationally and in Michigan.
- For the entire period of 2003 to 2010, the annual average net cash income for Michigan farmers was \$976 million under the R scenario and \$1016 million under the H alternative, 4.1 percent higher. Calculating the net present value using projected interest rates for short term and intermediate term loans, the average annual net present value of net cash income for the R alternative was \$786 million and \$814 million for the H assumption. That is a 3.6 percent increase in net farm income for the 2003 to 2010 period.
- Assuming that all the incremental ethanol is sold as a 10% mixture with gasoline, and Michigan's share of national gasoline consumption remains unchanged, the state gasoline tax revenues will increase (due to lower energy content of ethanol) by \$4.8 million in H compared to R. At the same time, transfers into the Highway Trust fund and hence Michigan's share of the Highway Trust fund will decline at the rate of about \$0.751/gallon of ethanol sold in the state, i.e. by up to \$51 million in 2010.

### **Impacts**

- As discussed, a rapid increase in corn-ethanol demand will affect various sectors of Michigan plant agriculture. The analysis carried out in this research will help Michigan's plant agriculture and state policy makers, to make informed decisions, respond in a timely manner, exploit the new opportunities created, and avoid mistakes.
- The project results are detailed in the following two working papers, which are being prepared for publication.
  - Joshi S., "Ethanol as an automobile fuel: putting the policy puzzle together." (Paper presented at MSU and University of Illinois, Urbana)
  - Ferris J and Joshi S., "Evaluating the impact of increased fuel-ethanol demand due to MTBE ban, renewable fuel mandate, and eight hour ozone standards on Michigan agriculture and economy."

### **Funding Partnerships**

While there were no direct funding partnerships in this project, this research has helped to generate another research grant aimed at assessing the potential for fuel ethanol from

cellulosic biomass, funded by General Motors and National Science and Engineering Research Council, Canada for CA\$ 706,044.