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Implications of MTBE Bans for the Iowa Economy

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The growth of ethanol originates with a number of government regulatory decisions in the gasoline additives market. The ban on lead-based octane additives as a carcinogen during the 70’s and the requirement of oxygenated fuels in major U.S. cities in an effort to reduce smog has boosted the ethanol industry. Now a third regulation may also increase ethanol demand during the current decade. Methyl tertiary butyl ether (MTBE), the oxygenated chemical of the petroleum industry, appeared in the drinking water in California and other states that use reformulated fuels. California banned MTBE from gasoline effective at the end of 2002 after the U.S. EPA issued a health advisory against drinking water with MTBE. California’s request for a waiver from the federal oxygen requirement for reformulated fuel, which would avoid reliance on ethanol, was denied by the EPA. Ethanol has an assured share of the California reformulated gas market since it is the only remaining oxygen containing additive. Other urban states on the East Coast also face an MTBE ban. Based on the EPA’s recent ruling, these states are unlikely to get an oxygen waiver and they will also require ethanol.

Ethanol has grown from negligible levels in 1980 to the point where it now accounts for about 1.6 billion gallons or about 5% of US corn production (640 million bushels). Estimates of new ethanol demand associated with the bans are calculated from the consumption of reformulated gasoline and the ethanol proportion needed to meet oxygen requirement. The California ban is expected to result in a demand expansion of 985 million gallons of ethanol. The national demand expansion that includes the East Coast and the West Coast is 1852 million gallons of ethanol. These two production levels form the basis for examining the effects of growing ethanol demands in major feed markets and the rural economy that will participate in this expansion.

Processing Margins
Processing margins are calculated as the sum of revenues on ethanol and byproducts, less the expenditure on the corn input, all expressed in terms of one bushel of corn processed. In Figure 1, the annual average wet-mill margin for an Iowa processor includes byproduct revenues from gluten feed, gluten meal, and corn oil. The dry-mill margin uses byproduct revenues from distiller’s dry grains. In recent years the processing margins for both has moved up into the $3.0/bushel of corn range which is the market signal for expansion. The typical range for the sum of operating and annual capital costs is $1.6/bu to $1.8/bu.

Price Impacts
Related price adjustments in the input (corn) and byproduct (distiller’s dried grain, or gluten feed, meal and corn oil) also contribute margin declines when ethanol output expands. First, increasing corn input demand will increase corn price, to attract corn away from alternative uses like exports and feed demand and to provide an incentive for farmers to produce more. Second, increasing byproduct output will require lower prices to encourage increased consumption.
The ethanol production expansion causes a simultaneous outward shift in demand for the corn market and an outward shift in supply for the byproduct and corn oil markets. Our estimates of the relation between price and domestic (feed or human) demand can be used for the price impact when combined with an appropriate assumption about production adjustments.

The corn market response to the demand shift consists of a price increase, which encourages increased production and reduced demand. A small three equation model was used to calculate the corn price change. The estimate of a byproduct production increase for gluten feed, gluten meal, or corn oil is the increase in corn use for ethanol times the appropriate byproduct yield. Then the price adjustment is calculated from the corresponding price equation. Next, the DDG price change is calculated from the regression-weighted average of the gluten feed, meal, and oil prices. Finally, the byproduct price declines calculated using the price equations are limited by nutrient content equivalence with corn and gluten feed; by protein content equivalence with soy meal and gluten meal; and by soy oil prices with corn oil.

To illustrate the results from this estimation process, consider the extended ban. In this scenario, U.S. ethanol output from corn increases by 1620 million gallons, thereby doubling production. In turn, the ethanol expansion causes a national expansion in corn demand of 660.8 million bushels. Finally, the price increases by $0.15/bu to $1.88/bu on a North Central Iowa basis.

The supply increases for byproducts are large, nearly 50% of existing supplies with the extended ban. So all byproduct prices decline. But estimated byproduct prices declines are all limited by the value of nutrient content, protein and oil content in corn and soy-product markets, because byproduct demands are inelastic. Hence the estimated gluten feed price decline is negligible because the baseline price is already near the nutrient value of corn. Similarly, the corn oil price change is negligible. The gluten meal price declines by about 35% before falling to the protein value of soy-meal. The DDG price falls by about 15%.

For an estimate of the eventual ethanol price change, we also calculated the ethanol price that is consistent with long-run competitive equilibrium (10% return on investment), processing costs and processing margins at the new input and byproduct prices. The resulting ethanol prices, $1.05/gal for a wet mill and $1.08/gal for a dry mill are the prices that balance processing margins and processing costs. The ethanol market price will return to these levels when processing capacity is sufficient to cover the demand expansion associated with the MTBE ban. How long it takes to return to the normal ethanol price level depends on plant construction lags, and the implementation schedules for East Coast MTBE bans.

**Livestock and Poultry feeding**

The potential for a livestock industry expansion arises with more by-product supplies. Wet mills separate the starch for ethanol production and then remove the fat for corn oil, the
high-protein for corn gluten meal (CGM) with 60% protein, and corn gluten feed (CGF) with about 18% protein. The Distillers Dried Grains (DDG) produced in dry mill is a composite byproduct that still includes the fat and all protein components. In comparison to CGF, DDG has higher protein, fat and methionine (Weigell et al., 1997a). DDG gets about a 10% premium over CGF in the marketplace, likely because some users value DDG characteristics.

Grain prices in Iowa tend to be lower than in other locations that export similar products. The Iowa price is the export price less the Iowa-Gulf transport cost. Further, the export-Iowa price difference equals the transport cost in a competitive market. Similarly, the Central Illinois price is the export price less the Illinois-Gulf transport cost, and the price difference because the export market looks at the Iowa-Gulf transport cost is higher than the Illinois-Gulf transport cost. The corn price differentials suggest that feeding corn will cost about $6/ton less in Iowa than in central Illinois. The feed cost of ethanol co-products in Iowa will also be lower than central Illinois prices by about the same amount, since gluten feed and gluten meal and distillers dried grains also have export markets at the gulf port. That is, prices for gluten feed, gluten meal and distiller’s dried grains will likely be about 10% less in Iowa than in Central Illinois.

Moreover, the feed cost advantage is a strong incentive for the location of livestock in Iowa. To see this, note that it takes about 5 tons of feed to produce 1 ton of meat. Suppose the livestock is located in Iowa and a profit calculation is made on a per cow basis. Then no transport cost is paid on 5 tons of feed, but transport charges are paid on the corresponding 1 ton of meat to a final product market, such as Europe. The alternative is to put the cow in Europe; then the transport cost is paid on 5 tons of feed but the cost of shipping the livestock product is avoided. The Iowa location has lower net transport costs than the Europe location, unless the meat transport rate is more than 5 times the grain transport rate. Central Illinois is not competitive for cattle location, since higher feed costs and meat transport are both required.

However, the required feed ration must fit the price changes implied by the ethanol expansion and the particular byproduct feeds must be available locally. Generally speaking, the feed cost with ethanol byproducts in Iowa must be lower than it is in the dominant feeding area with a standard ration.

A comparison of beef cattle rations in Iowa and Kansas before and after the (extended) MTBE ban illustrates some of the limitations and possibilities. Initially, a conventional corn-soybean-hay-silage ration is about $1.74/ton cheaper in Iowa, mainly because corn prices are lower. After the ban, the feed cost at both locations increase because the corn price increases. But Iowa’s advantage would widen to $3.64/ton if it used gluten feed after the price changes. In contrast, Iowa’s cost advantage would erode (to $1.31/ton) with distillers dried grain; DDG is a more expensive way to displace corn in the ration. The problem is that DDG is the feed that will likely be available. Rations that replace more than corn with byproducts may give larger cost advantages.
Some feeding activities, such as dairy replacement cows, are good candidates for DDG utilization. The demand for dairy replacement cows has been expanding because the length of a cow's production period has declined. Further, the ration for a dairy replacement cow removes some corn and some soy-meal when DDG is introduced in the diet. Some approximate dairy cow replacement rations use 31% corn and 13% soy-meal in the conventional ration, and then substitute 13% corn and 23% CGF or DDG in the post-ban ration. Iowa's competitive feeding position for replacement improves when the protein substitution is included and declining byproduct prices are taken into account.

Also, the poultry ration appears best suited to DDG introduction. Poultry diets typically add all of the components that are present in DDG. These factors are protein, methionine, and fat. So cost-reducing possibilities are likely when DDG prices fall closer to the value or its protein component. In fact, the premium for DDG over gluten feed may arise from the fact that it is well suited to poultry and poultry is a growth industry.

To illustrate the potential for livestock and poultry expansion, we took the previous estimates of expansion for Iowa’s ethanol industry, calculated the DDG supply increase, and arbitrarily assumed that the export industry, dairy replacement, and poultry feeding all get one-third of the increase in DDG supplies. Next, the maximum feed ration fraction was used to compute a total feed expansion and an implied animal population adjustment. For cows, the baseline is 3.9 million head; the expansion was 7.2% with the California ban and 18.8% for the extended ban. For poultry, the baseline is 33.2 million birds; the expansion was 100% for the California ban and 200% for the extended ban. For poultry, the percent changes are large because the industry is small. Also, the DDG fraction in the ration is small, and so may exaggerate the size of population adjustments.

Ethanol Expansion Impacts on Iowa’s Economy
The state level analysis of impacts to the general and agricultural economy considers two expansion scenarios for the ethanol industry for Iowa in particular. The first case considers the expansion potential and implications of a West Coast ban on MTBE. In the second case, an extended MTBE ban is considered. Assumptions and results from the simulations of these two scenarios are presented in Table 2. From earlier analysis, the Iowa share is 193 million gallons for the West Coast ban, and 506 gallons of ethanol for a generalized ban.

For the West Coast ban scenario, we assume the ethanol processing capacity in Iowa will expand to meet the new 193 million gallon requirement via a combination of one 80-million gallon facility, one 40-million gallon, two 18-million gallon, and four 10-million gallon plants. An Input-Output model was used to estimate the general impacts to the Iowa economy for four different sized facilities that are then added to arrive at an overall estimate of economic impacts from a 193 million gallon ethanol demand change.

For the general economy, the sum of direct employment at the new ethanol facilities is estimated as 231 additional workers with economy-wide effects estimated as 976 workers. Labor income at the new ethanol facilities is estimated as $9.21 million with total indirect and consumer-related spending impacts of over $30.93 million. Total value added to the
state is $81.0 million. Based on average revenue yields from income changes, general state revenues are expected to increase by $8.47 million.

For crop agriculture, 77.2 million bushels of corn and generate additional statewide price increases for corn of about $.043 per bushel. The additional corn value applied to 1,740 million bushel corn production implies a $74.8 million income gain to Iowa corn producers. This price benefit on corn production is expected to be concentrated in the 50-mile radius surrounding a new ethanol facility. Producers near the facility could expect a 20 cents per bushel premium that diminishes as distance and transportation costs to the facility increase.

For livestock agriculture, new feeding opportunities associated with DDG could generate $26.9 million in the West coast ban scenario. The calculation is based on an equal three-way split of available DDG supplies for dairy replacement, poultry and exporting. Also, a livestock profit margin of $.025/lb meat output was used.

The second scenario involves an extended MTBE ban, with Iowa’s share of that expansion is expected to be 505.9 million gallons of ethanol and 202.4 million bushels of corn processed. We assume a configuration of ethanol plants involving three 80-million gallons, three 40-million gallons, five 18-million gallons and six 10 million-gallon facilities around the state. The direct and total economic impacts associated with this expansion are also presented in Table 6.

Direct employment at all the new facilities is estimated at 593 new workers with 2,550 total jobs supported throughout the economy. Direct labor income from the new facilities is an estimated $24.13 million with $81.74 million of income supported throughout the state. Value added is $244.7 million. Crop income increases by $189.7 million with increased revenues on the State’s corn production. Livestock income increases by $70.6 million with expanded feeding. General State tax revenues increase by $17.2 million.

The local economy benefits of expanding ethanol production in Iowa include an income improvement to corn producers and employment, income and value added gain for the rest of the state. While both effects are important, the agriculture income benefit is becoming relatively more important. The jobs benefit of a given level of ethanol processing has declined during the last decade because ethanol plants are using less labor in an effort to get processing costs down. While the size of the facilities do not appear to affect the economic impact, the ownership structure may be important. A cooperatively-owned facility may keep more of the value-added (profit) effects in the regional economy, compared to an outside firm.
Table 1. Direct and Indirect Effects of an MTBE Ban on the Iowa Economy

<table>
<thead>
<tr>
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<th>West Coast Ban</th>
<th>Extended Ban</th>
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<tbody>
<tr>
<td>IA Ethanol Demand Change (mil gal)</td>
<td>193</td>
<td>506</td>
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<tr>
<td>Corn Price Impacts, IA ($/bu)</td>
<td>.043</td>
<td>.109</td>
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<td>Corn Producer Revenues ($ Mil)</td>
<td>74.8</td>
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<td>Livestock and Poultry Revenues</td>
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<td>Direct Employment in Plants</td>
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<td>Total Employment in State</td>
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<td>Direct Income in Plants ($ mil)</td>
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<tr>
<td>Total Income in State ($ mil)</td>
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<tr>
<td>Total Value Added in State ($mil)</td>
<td>81.0</td>
<td>244.7</td>
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Figure 1. Ethanol Processing Margins