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A Billion Gallons of Biodiesel: Who Benefits?

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Although the expanded corn ethanol and cellulosic biofuels mandates contained in the new Energy Independence and Security Act (EISA) have generated the most headlines, the act's new biodiesel mandates may have a larger impact on U.S. agriculture over the next few years. Biodiesel use is now mandated to grow from 500 million gallons in 2009 to one billion gallons in 2012. U.S. biodiesel production was expected to decline significantly over the next few years because of low operating margins caused by high feedstock costs. The increased production due to the mandate will put upward pressure on already high vegetable oil prices, which in turn will further increase the cost of producing U.S. biodiesel.

It is quite likely that the price biodiesel producers will need to cover their production costs will be much greater than the price that consumers will be willing to pay. Production usually does not occur when production costs are greater than consumer willingness to pay. Some form of government intervention will need to occur to ensure that mandated biodiesel use levels are met. A review of the current situation and medium-term outlook facing the biodiesel industry may suggest alternative interventions that the federal government can take to make sure that biodiesel use increases to target levels.

Biodiesel Margins

Biodiesel plants will not be built unless investors expect to receive a

competitive return on their investment. Before a biodiesel plant can begin to pay out a return on investment, the plant must generate positive operating margins, which are defined as revenue minus all operating costs, including labor, energy, and feedstock costs. In 2007, most U.S. biodiesel plants found that they could not cover their operating expenses. Thus, actual production in 2007 was far less than the 1.85 billion gallons in capacity.

Operating costs other than the cost of feedstock currently average approximately 59¢ per gallon. By-products of biodiesel production (glycerin, fatty acids, and filter cakes) provide revenues of perhaps 8¢ per gallon. Most U.S. biodiesel plants operate on soybean oil. It takes approximately 7.6 pounds of soybean oil to produce a gallon of biodiesel. The main source of revenue from biodiesel plants is, of course, biodie-

sel, which serves primarily as a substitute for diesel fuel. However, biodiesel is an excellent additive that increases the lubricity requirements for ultra-low-sulfur diesel. For any given biodiesel price, it is easy to estimate the soybean oil price above which operating margins become negative and biodiesel plants will not operate. Break-even soybean oil prices for different biodiesel prices are shown in Figure 1.

Iowa biodiesel prices during the week ending January 11 averaged \$4.20 per gallon. Figure 1 shows that at this price, the break-even soybean oil price is 48¢ per pound. Actual soybean oil prices during this week averaged 48.5¢ per pound, which meant that plants that use soybean oil as a primary feedstock probably did not operate because they could not cover their operating costs. Figure 2 shows that returns over operating costs have steadily eroded since

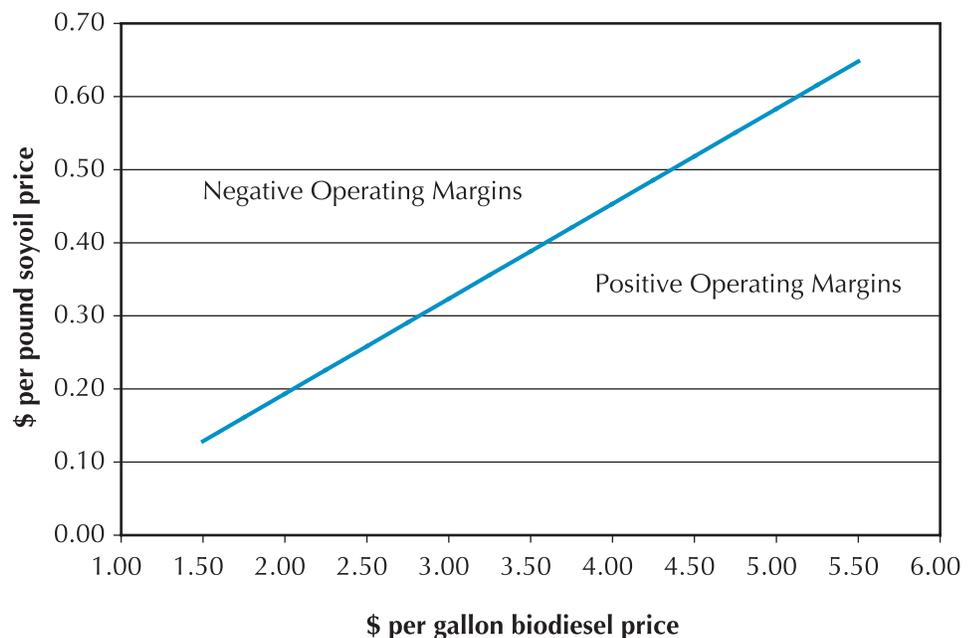
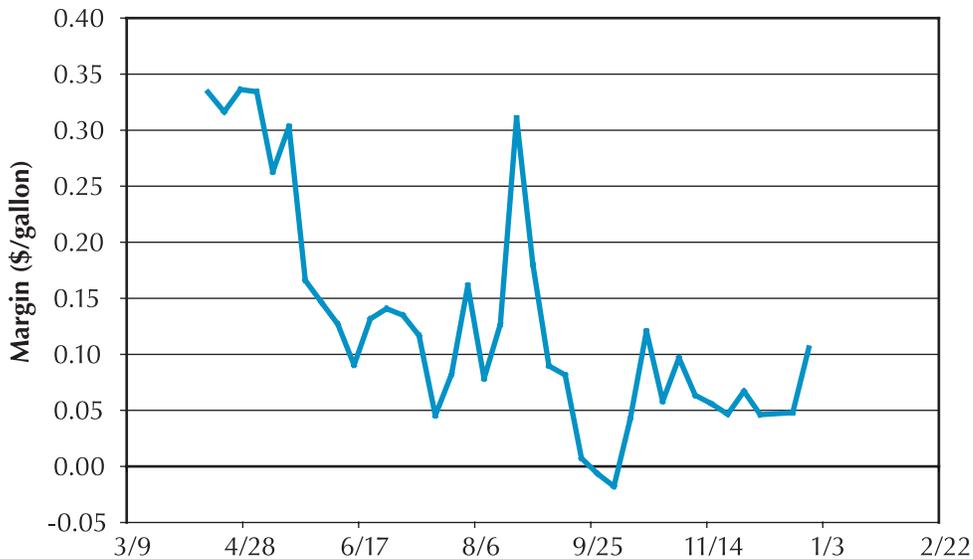


Figure 1. Break-even soybean oil prices



Source: Soybean oil and biodiesel weekly prices for Iowa from the Agricultural Marketing Service, U.S. Department of Agriculture.

Figure 2. Average returns over operating costs for an Iowa biodiesel plant

last spring, with the exception of a short-lived mid-August spike. With such low returns, it is not surprising that a large share of biodiesel capacity was idle in 2007. The National Biodiesel Board estimates that current biodiesel capacity is 1.85 billion gallons, with another 1.4 billion gallons of capacity in various stages of construction and planning. Actual fiscal year 2007 production is likely to come in at around 400 million gallons. Note that the costs included in the estimated returns in Figure 2 do not include any returns to capital.

Impact of Excess Biodiesel Capacity

One implication of the large amount of excess capacity is that soybean oil prices will not be able to fall below the break-even price shown in Figure 1 for any significant amount of time. Prices below break-even levels will trigger increased biodiesel production, which will then result in prices being bid back up to break-even levels. Each billion gallons of excess capacity represents 7.6 billion pounds of soybean oil, or 40 percent of total U.S. use in 2006.

Clearly, increased capacity utilization will have a large impact on soybean oil prices.

The overbuilding of the biodiesel industry thus promises low or zero returns to investors in biodiesel plants. Without the mandate, high feedstock prices will result in little or no production. Low feedstock prices will trigger production, but feedstock prices will consequently be bid back up to break-even levels that do not allow for a return on capital. Biodiesel plants integrated with soybean crushing facilities may enjoy some positive returns, especially when the price of soybean meal is high.

Implications of the New Renewable Fuels Standard

One of the big winners from passage of the EISA is thought to be the biodiesel industry because of the new mandate for one billion gallons by 2012. But the industry will only be a winner if the mandate leads to future industry profits. Profits will be realized only if the price of feedstock falls below the Figure 1 break-even levels, and that looks unlikely. Soybean oil prices on the Chicago Board

of Trade are currently between 50¢ and 55¢ per pound, which reflects the market's expectation that biodiesel production in the United States will grow to meet the new mandate and continue to put upward pressure on prices. Figure 1 shows that biodiesel wholesale prices will need to be greater than \$4.50 per gallon to generate enough revenue to cover such high feedstock prices. There are at least four ways that prices could rise to such a high level. The current method of increasing biodiesel prices is a maximum \$1.00-per-gallon tax credit given to diesel blenders who use biodiesel in their blends.

First, if wholesale diesel prices increase to \$4.50 per gallon, then without a tax credit, biodiesel prices would also increase to this level because biodiesel is a good substitute for diesel. But given the historical relationship between crude oil prices and diesel prices, the price of crude would have to increase to \$155 per barrel before diesel prices would increase to \$4.50 per gallon. Futures contracts for crude oil are currently below \$100. Thus, it seems unlikely that market demand for biodiesel as a substitute for diesel will allow biodiesel producers to cover their costs.

Second, two sources of market demand for biodiesel are the exports market and as a lubricity component in ultra-low-sulfur diesel blends. Just as the willingness to pay for ethanol as an octane enhancer and as an oxygenate is greater than the price of gasoline, the willingness to pay for biodiesel as a lubricity agent may be greater than the price of diesel. Tax breaks for biodiesel provided in other countries may have the same effect. There is some evidence that diesel blenders and exporters are willing to pay more for biodiesel than for diesel. In the first week of January, the Iowa spot price of biodiesel was \$4.15 per gallon. Subtracting the \$1.00-per-gallon tax credit results in a market demand price of \$3.15 per gallon. The spot [↔](#)

price of Midwest diesel was approximately \$2.80 per gallon, indicating a 35¢-per-gallon difference in the market demand price for biodiesel and diesel. However, to generate a market demand price of \$4.50 per gallon for biodiesel with this level of market price premium would require crude oil prices of \$140 per barrel. Exported quantities would not be counted toward the renewable fuels standard.

Third, the price of biodiesel could be increased to \$4.50 per gallon if the purchase of biodiesel by blenders were subsidized. The subsidy would have to vary inversely with the price of diesel to ensure a \$4.50 biodiesel price. If blenders are willing to pay 35¢ more per gallon for biodiesel than for diesel, then the required variable tax credit would equal \$4.15 minus the wholesale price of diesel. The cost of meeting the biodiesel mandate using tax credits would be borne fully by taxpayers.

Fourth, and lastly, biodiesel prices could be increased enough to cover feedstock costs if the government simply mandated that diesel blenders use levels of biodiesel required by the EISA. Blenders would have to pay biodiesel producers a price high

enough to allow the producers to stay in business to produce the required volumes. Blenders would then have to sell the blender product at whatever price they could induce diesel consumers to pay. The cost of the biodiesel mandate would be shared by consumers and blenders.

Economic Impacts of the Energy Independence and Security Act

Passage of the EISA with a one-billion-gallon biodiesel mandate was meant to help a biodiesel industry that has been squeezed by low margins caused by spiraling feedstock costs that have outpaced biodiesel prices. The mandate will indeed increase the price of biodiesel, either through higher subsidies to diesel blenders or because blenders are forced to pay biodiesel prices high enough to allow biodiesel producers to cover their feedstock costs. However, higher biodiesel prices do not automatically imply a profitable biodiesel industry. The capacity of the biodiesel industry will still be far in excess of that needed to meet the mandate. This excess capacity means that biodiesel prices will need to be increased only enough to induce biodiesel producers to run

their plants to produce the required amounts of biodiesel. That is, we should expect biodiesel prices to increase only enough to cover operation costs. If this is the case, then owners of biodiesel plants should not expect to obtain much, if any, return on their invested capital.

This dismal outlook for the U.S. biodiesel industry hinges on feedstock prices always being bid to the industry's break-even point. Prices cannot fall below this point as long as excess capacity exists. Prices cannot be bid above this point because demand for feedstock will drop as biodiesel plants stop operating. This new competitive environment is reinforced by increased biodiesel capacity in Europe, Brazil, and Argentina that has resulted from their mandates. Consequently, the ultimate beneficiary of expanded biodiesel mandates is not the biodiesel industry. Rather, farmers and landowners should expect to see the lion's share of benefits from these new mandates because feedstock prices will be maintained at levels that just keep the biodiesel industry afloat. ♦

When Will the Bubble Burst? *Continued from page 3*

and 31.5 billion gallons, respectively. The long-run corn price is determined solely by ethanol producers' ability to pay for corn in these two scenarios.

Cautionary Notes

Economists loathe making predictions about where future prices are headed because they are so often wrong. The long-run predictions of corn prices given here are predicated on a number of key assumptions.

The first is that current government biofuel mandates will be maintained despite opposition from an array of groups. The biodiesel mandates will increase the price of oilseeds, thus increasing competition for corn land, which results in the \$4.00 price of corn at 15 billion gallons of ethanol. If the biodiesel mandates are relaxed (but the ethanol mandate is maintained), the long-run corn price will be lower. The second key assumption is that corn yields will continue to grow as they have in the past. If seed companies increase the rate of yield growth, then the

corn supply curve will shift to the right in the graph. This shift will lower the long-run corn price if the ethanol mandate binds. However, if the mandate does not bind, then the shift simply means that the corn ethanol sector will grow even larger, leaving the long-run price of corn unchanged. Third, if the futures markets are completely wrong and crude oil prices drop significantly, then \$2.50 gasoline will just be a bad memory. However, because of the corn ethanol mandate, the price of corn will be determined by the mandate, as in scenario 1. ♦