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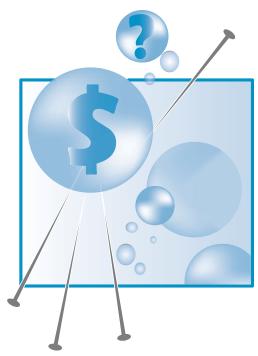
When Will the Bubble Burst?

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igh prices are their own worst enemy. Increased profit margins entice entrepreneurial investment, which results in increased production. Lower market prices inevitably follow. The magic hand of Adam Smith ensures that winners' gains and losers' losses will be temporary, as entrepreneurs correct market imbalances.

The temporary nature of high prices is well known to corn, soybean, and wheat farmers. Over the last 50 years there have been only two corn price increases that have been sustained for more than two years. The first was from 1973 to 1975 when a combination of short crops around the world and increased export demand dramatically increased prices. The second was from 1979 to 1984 when high corn prices were sustained by supply controls, government-defended floor prices, and drought. Farmers in the United States and around the world have always been able to out-produce the market and government policy.

Farmers have a strong incentive to continually adopt cost-reducing and yield-enhancing technologies. Thus, even when prices are low, agricultural supply tends to increase, as farmers seek out the seemingly never-ending advances in seed technology, improved pest management, and more productive machinery. When prices are high, farmers have the added incentive to bring more land into production and to plant the



crops that bring the greatest economic return.

Because farmers have traditionally produced ingredients that are turned into food, the demand for farm products reflects characteristics of that demand. World food demand depends primarily on population and income, both of which expand predictably and slowly. When production of food ingredients outstrips the growth in food demand for more than a year or two, prices inevitably decline. The resulting price declines can be large because food demand is quite insensitive to price. There really is only so much food any person can eat.

Nonstop increases in supply combined with slow and predictable demand growth have resulted in a seemingly inexorable long-run trend of falling inflation-adjusted agricultural prices intermixed with one or two years of high prices caused by unexpected supply disruptions. In

agriculture, as with most other commodities, it has not been a question of if price bubbles will burst but only a matter of when.

A New Era for Agriculture?

The last period of high prices was in 1995 when the season-average price of corn rose to \$3.24 per bushel. At the height of concern that 1996 production would not be sufficient to meet demand, 1996 new-crop futures rose as high as \$3.83 in July before beginning a five-year decline. It is noteworthy that Chicago Board of Trade corn prices did not indicate that such high prices were permanently with us. Futures prices for the 1997 crop never rose above \$3.08 and futures prices for the 1998 crop never rose above \$3.00 per bushel. It is clear that traders believed that the high prices in 1995 and 1996 were unsustainable in that a return to normal crop conditions would result in lower prices. A drop in demand caused by the late-1990s Asian financial crises caused prices to drop even further than traders thought likely.

The futures market is telling us a very different story today. Although we are coming off a record corn harvest, the 2008 new-crop corn harvest is more than \$5.00 per bushel. The new-crop soybean futures price is more than \$12.50 per bushel. In contrast to the 1995/96 high price period, the markets today are not indicating that these record prices are temporary. Farmers can sell their 2009 and 2010 crops for about the same price.

The impacts on agriculture would be staggering if these price levels were permanent. For example, current prices imply that land rents

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Printed with soy ink

in Iowa and the rest of the Corn Belt should increase by a factor of about 2.8, even after accounting for the loss of government payments, the higher production costs associated with increased demand for inputs, and increased returns to management and machinery. As land rents go, so too do land prices. Iowa State University's annual land price survev showed that in 2005 the average acre of farmland in Iowa was valued at \$2,914. That year is a useful benchmark for land values because crop prices had not yet increased. Multiplying the 2005 land value by 2.8 suggests that \$5.00 corn and \$12.00 soybeans could support average land values in excess of \$8,000

Crop prices at these levels dramatically increase the cost of raising hogs, finishing cattle, and producing milk and eggs. These costs will have to be passed on to consumers through higher retail prices for meat, eggs, and dairy products to keep livestock producers in business. Competition for land between specialty crops, oilseeds, and food and feed grains will also increase the prices of other products such as hops, malting barley, beans, and vegetables. Consequently, we should expect to see increased food prices over the next year or two as these cost increases are passed on to consumers.

But how much faith should we put in the Chicago Board of Trade as a long-run indicator of price levels, particularly when all the world's farmers face an unprecedented incentive to increase production? How can we reconcile what the markets are telling us with the iron rule of market economics that the cure for high prices is high prices?

Impact of the New Energy Bill

On December 6, 2007, the U.S. House of Representatives passed its version of the new energy bill that was later combined with a Senate version of the bill and signed by

President Bush on December 19. Early December is an important time for commodity prices because the House indicated for the first time that it would include an expanded renewable fuels standard for corn ethanol and a new mandate for biodiesel. On December 1, the price of December 2009 corn was \$4.15 per bushel. By January 14, this price had increased to over \$5.00 per bushel. The price of November 2009 soybeans increased from \$9.51 to \$12.40 per bushel over the same period. An examination of the shortand long-run impacts of the new corn ethanol mandate can help reconcile the laws of economics with what is happening on the Chicago Board of Trade.

Corn ethanol use is mandated to grow from 9 billion gallons this year to 13.2 billion gallons in 2012 and to 15 billion gallons in 2015. Accounting for the distillers grain that replaces the corn that is used to produce ethanol, and the expected growth in average yields, this level of production will require 16.2, 23.2, and 25.5 million acres of corn, respectively, to be devoted solely to ethanol production. The required level of corn production will occur, but only if farmers are compensated through high prices.

How Quickly and How Far Can Prices Drop?

Congress adopted new corn ethanol and biodiesel mandates during a time when world supplies of corn, wheat, and oilseeds are tight. Thus, the markets quickly responded by signaling the world's farmers to increase production. How quickly production can ramp up internationally will determine when commodity prices start retreating. The key countries and regions to watch are the United States, Brazil, Argentina, the European Union, Ukraine, and Russia.

The 2008 supply picture in South America indicates at most a small increase in production. U.S.

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production capacity can be quickly increased only by good growing conditions or a significant drop in acreage enrolled in the Conservation Reserve Program. The ability of Ukraine and Russia to expand production quickly is questionable given how far their agricultural sectors have fallen. And any expansion of E.U. acreage will likely be devoted to meeting their own biofuels mandates. An anticipated slow ramp-up in production combined with the need to meet new demand from biofuels mandates is why Board of Trade prices are so high for the next three crop years.

Over time, however, yield increases, infrastructure investments, and expansion of crop acreage will all work to increase world supplies; the profit signals are just too high for these price levels to be sustainable over the long term. Even so, the demand expansion from U.S. and other countries' biofuels mandates is so large that it is likely that meeting food and fuel demand will require higher-cost production practices and cultivation of lower-yielding acreage. In economic terms, this expansion of demand will push world agriculture up its long-run supply curve, which means that future price levels will be permanently higher.

A simple supply and demand analysis of three possible future scenarios provides insight into how low we can expect corn prices to fall. In the figure, demand for corn to produce 15 billion gallons of ethanol is insensitive to the price of corn because of the mandate. For quantities in excess of 15 billion gallons, the analysis assumes that ethanol production does not affect the price of gasoline.

Three Scenarios for Price Projections

1. Elimination of the \$0.51-per-gallon subsidy given to wholesale buyers of ethanol, wholesale price of gasoline at \$2.50, and ethanol valued at its energy value

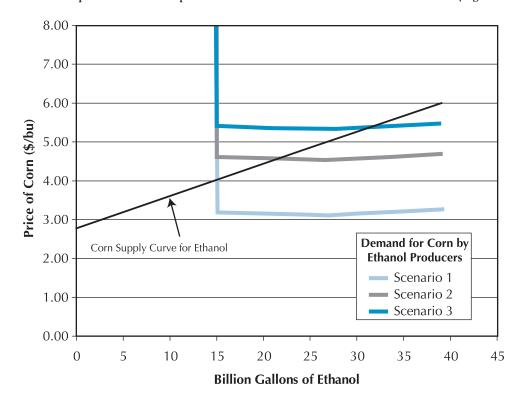
- 2. Continuation of the \$0.51 subsidy, \$2.50 gasoline, and ethanol valued at its energy value
- 3. No ethanol subsidy, \$2.50 gasoline, and ethanol valued on a par with gasoline value

The critical difference between these scenarios is the price of ethanol at production levels in excess of 15 billion gallons. In the first scenario, the additional ethanol will have to compete with gasoline without subsidy, which implies an ethanol price of \$1.67 per gallon. This translates into an ability to pay for corn at about \$3.12 per bushel. The second scenario adds a \$0.51-per-gallon subsidy, which makes the ethanol price equal to \$2.18 per gallon, and an ability to pay for corn equal to \$4.52. The third scenario assumes that automobile manufacturers and blenders optimize fuel pumps and car engines so that fuel mileage does not decrease with ethanol, which implies an ethanol price of

\$2.50 per gallon and an ability to pay for corn equal to \$5.33.

When ethanol producers' ability to pay for corn (indicated by the demand curves in the chart) in excess of the mandate is less than the price of corn needed by U.S. corn farmers to supply the required corn to meet the mandate (indicated by where the supply curve in the chart intersects 15 billion gallons), then the mandate will bind and the supply price of corn will be \$4.00 per bushel. This is what occurs in scenario 1. If some combination of market demand or additional subsidy to ethanol drives ethanol producers' ability to pay for corn to above \$4.00 at 15 billion gallons, then the mandate will not bind, the long-run price of corn will be greater than \$4.00 per bushel, and corn ethanol production will exceed 15 billion gallons. This occurs in scenarios 2 and 3 when corn supply meets corn demand at 21.5

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What Will the Price of Corn Be After the New Mandate Is Met?

Steady Supplies or Stockpiles? Dried Distillers Grains and U.S. Beef Production

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apid expansion in U.S. cornbased ethanol production has created concern that large surpluses of distillers grains will occur. Expected production levels are indeed high. Using a relatively conservative set of assumptions, a recent CARD study projects that the U.S. ethanol industry will produce nearly 15 billion gallons of ethanol and 40 million metric tons of distillers grains (dry matter basis) per year by 2011. Under a much more aggressive set of assumptions, the CARD study projects that ethanol production could reach nearly 30 billion gallons annually by 2016, generating more than 88 million metric tons of distillers grains per year. (See "Emerging Biofuels: Outlook of Effects on U.S. Grain, Oilseed, and Livestock Markets," available at www.card.iastate.edu.)

Some U.S. distillers grains are exported, but the primary users are the domestic livestock and poultry industries, especially beef and dairy cattle because ruminants are better able to accept the high fiber levels in conventional distillers grains. Estimates vary on how much distillers grains can be used in rations, but recommended rates for beef rations are frequently reported at 30 to 40 percent, with the maximum inclusion rate generally considered to be 50 percent (dry matter basis). By comparison, recommended inclusion rates are 20 to 25 percent for dairy cattle, 20 percent for growing and finishing hogs, and 10 to 15 percent for poultry.

Given the higher inclusion rates for beef rations, the beef industry has excellent potential to use more ...the level of
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distillers grains as the ethanol industry expands. However, the level of distillers grains that must be consumed to prevent surpluses—especially at the higher production level projected in the CARD study—raises questions about how much the U.S. beef industry can use and whether increased use will affect beef quality.

Cost will be the primary factor in producer decisions about using distillers grains. However, product availability and form, animal nutrition, carcass and meat quality, and environmental issues will also factor into distillers grains use in beef production.

Increasing total distillers grains consumption can be accomplished in two ways: increasing the number of producers who use distillers grains (adoption rate) and increas-

ing the amount of distillers grains used in rations (inclusion rate). A recent USDA survey showed that in 2006, 36 percent of respondents with beef-feeding operations were using co-products and 34 percent were considering doing so. Thirteen percent of respondents running beef cattle operations were feeding coproducts and 30 percent were considering doing so. Among respondents who did not use co-products, the most common reasons were availability (35 percent) and infrastructure and handling (22 percent). These results indicate significant opportunities to increase distillers grains adoption rates if transportation, handling, and storage problems can be resolved to make distillers grains available to all producers in a useful form. Some feedlots are co-locating with ethanol plants to eliminate the cost of drying distillers grains and to minimize transportation costs. However, given projected distillers grains production, most of it will be dried for efficient and economical transportation, and drying will help increase distillers grains availability to remote feedlots of all sizes.

Nutrient Concentration and Variability

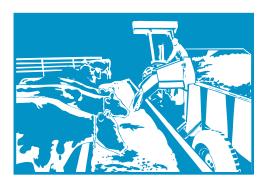
For beef cattle, distillers grains can provide a viable source of supplemental protein, replace some corn as an energy source, and improve average daily gain and feed conversion, depending on how much distillers grains is included in the ration. However, feeding distillers grains creates some nutrition management challenges, in part because most of the nutrients in corn become three times more concentrated in distillers grains. Nutrients such as sulfur are often added during ethanol

production and can occur at even higher concentrations. Formulating rations to accommodate the nutrient composition of distillers grains is further complicated by the significant variation in nutrient content that has been shown to occur between ethanol facilities and even between batches from the same facility. These nutrient issues can limit or even prohibit distillers grains use in some feeding situations.

Sulfur is the most likely nutrient to limit distillers grains use in beef production. Sulfur is a required macromineral for cattle, but ingesting too much can result in sulfur toxicity and reduce feed and water intake, and may cause polioencephalomalacia, a potentially fatal neurologic disease. Numerous analyses have shown that the sulfur content of distillers grains is generally four to seven times greater than that of corn. Further, the sulfur content of condensed distillers solubles, another ethanol co-product often mixed with distillers grains, can be up to 10 times that of corn. These high sulfur levels are especially problematic in areas with high sulfite levels in the water cattle drink and during seasons when water consumption is higher because of higher temperatures.

A second nutrient that can limit distillers grains use is fat. Distillers grains are an excellent source of energy for cattle, but too much total fat in rations can depress fiber intake and digestion. The fat levels reported for conventional distillers grains (8 to 13 percent) will generally limit distillers grains inclusion to about 50 percent to achieve acceptable growth performance.

A third nutrient of interest is phosphorus, which must be managed for both nutritional and environmental reasons. The nutritional concern is ensuring an appropriate ratio of calcium to phosphorus in rations. Because this ratio can be achieved by supplementing calcium, phosphorus generally is not consid-



ered a nutritionally limiting factor for distillers grains inclusion. The environmental concern is that higher phosphorus intake by cattle fed distillers grains results in greater phosphorus excretion, which may increase phosphorus run-off from feedlots and harm streams and rivers. In much of Iowa and other Corn Belt states that raise both corn and cattle, higher phosphorus excretion can be managed through appropriate manure distribution. However, phosphorus may be a limiting factor in feedlots in corn-importing regions with different soils types and environmental concerns.

Animal Performance and Beef Quality

As more data from feedings trials have become available, an understanding of the effects of feeding distillers grains at high (40 percent or more) inclusion levels has begun to emerge. A number of studies show significant improvement in several live-animal performance and carcass quality measures using distillers grains inclusion rates of up to 50 percent, compared to feeding traditional corn-based rations. Optimum performance and carcass quality generally are achieved at moderate (15 to 30 percent) inclusion rates, and most improvements decline and eventually disappear as inclusion rates increase.

Far fewer studies have been conducted to measure effects on quality and sensory evaluation of beef cuts. Moderate inclusion rates of

distillers grains have been shown to improve marbling and overall meat quality, and consumer panels have not detected significant reductions in beef tenderness, juiciness, and flavor. However, feeding distillers grains appears to have detrimental effects on shelf life. Recent studies at the University of Nebraska indicate that feeding moderate levels of wet distillers grains alters the fatty acid profile of beef, resulting in higher levels of polyunsaturated fatty acids that can speed oxidation, reduce color stability, and shorten shelf life. Other studies have shown more rapid discoloration in beef as inclusion levels of distillers grains approach 50 percent, and beef from cattle fed distillers grains at any inclusion level has been shown to become rancid more quickly.

How Much Is Too Much?

More scientific feeding trials are needed, and data are needed from feeding situations in which each animal is marketed at an optimum finish rather than the all-in-all-out system used for most scientific trials. More beef quality and sensory evaluations are needed. However, a common theme from the research to date is that 50 percent is the maximum practical inclusion rate in most feeding situations and that exceeding 50 percent may cause adverse health, performance, and/or carcass and meat quality effects. Economic incentives would encourage many producers to feed above optimal rates and some producers to feed above the maximum rate.

Returning to the CARD study, U.S. beef rations would have to include an average of 48 percent distillers grains under the conservative assumptions and 62 percent under the aggressive consumptions, if the beef industry is to use its projected share of distillers grains. Both scenarios exceed optimal inclusion rates, and

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A Billion Gallons of Biodiesel: Who Benefits?

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lthough 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 at less than 500 million gallons 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 breakeven 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

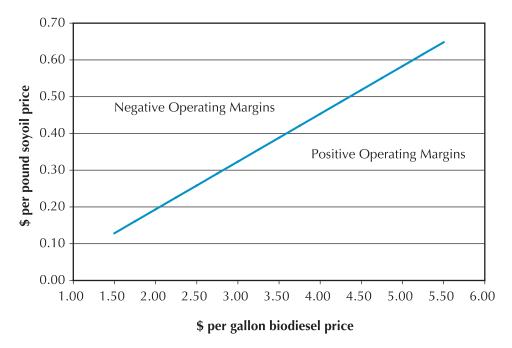


Figure 1. Break-even soybean oil prices



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 breakeven 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. •

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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. •

Agricultural Situation Spotlight

The Outlook for Corn and Ethanol

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The federal government definitely joined in the spirit of cooperation this holiday season with the passage of the 2007 energy act and progress on the farm bill. These moves, along with developments in the energy and agricultural sectors, have improved the prospects for corn and ethanol over the next few years.

The 2007 energy act set out a higher renewable fuels standard (RFS) of 36 billion gallons of biofuels by 2022. For 2008, 9 billion gallons of biofuels are needed to meet the standard, and corn-based ethanol will fill the lion's share. Corn-based ethanol is considered a conventional biofuel in the act. Table 1 shows the RFS volumes for conventional biofuels. Other advanced biofuels, such as cellulosic ethanol and biomass-based biodiesel, are to fill the rest of the RFS. This act supersedes the 2005 energy act that established an RFS of 7.5 billion gallons of biofuels by 2012.

The pace of ethanol plant construction is on target to reach and possibly exceed the new RFS over the next few years. As of early January 2008, the Renewable Fuels Association was reporting current ethanol production capacity of 7.5 billion gallons. With 5.8 billion gallons more capacity under construction, U.S. ethanol production capacity will exceed 13 billion gallons within the next three years. The RFS provides stability for the continued growth of the ethanol industry.

The market for ethanol continues to evolve as well. Ethanol prices were mostly on a downswing throughout 2007, but the last quar-

the second-largest use of U.S. corn this year, trailing only domestic livestock feeding.

ter of the year saw ethanol prices rebound from \$1.55 per gallon to prices over \$2.00 per gallon. This upswing in prices was due to several factors, including infrastructure improvements for ethanol transportation and usage, expanding interest in using ethanol in underserved areas of the country (especially the Southeast), and higher overall energy prices.

Crude oil recently hit \$100 per barrel, and the outlook for oil remains strong. Currently, crude oil futures prices are above \$90 per barrel for all contracts through December 2009 and are above \$88 per barrel for all contracts through December 2016. The markets are not anticipating any sizable drops in energy demand any time soon. Gasoline futures are over \$2.50 per gallon near-term and are holding above \$2.25 per gallon throughout 2009.

These higher prices are spurring additional interest in ethanol for discretionary blending. Current nearby ethanol futures are \$2.30 per gallon, roughly 20¢ below that of gasoline. This price gap, along with the 51¢-per-gallon tax credit given to blenders, makes ethanol attractive to both fuel blenders and consumers. With ethanol futures beyond April

2008 hovering at around \$2.00 per gallon, it looks as though ethanol will continue to be less expensive than gasoline for some time and will be able to penetrate additional markets over the next couple of years because of its pricing advantage.

The CARD ethanol gross margin graphs (available at http://www.card.iastate.edu/research/bio/tools/) show that margins have markedly improved over the last three months. While corn costs have risen, the surge in ethanol prices has more than covered the cost increases. Based on current futures prices, ethanol margins will back off slightly over the next two years but will remain above last fall's levels.

The continuing expansion of the ethanol industry is just one of several positive signs for the corn market. Corn usage for ethanol continues to grow and set records each year. Ethanol will become the second-largest use of U.S. corn this year, trailing only domestic livestock feeding. The growth in corn demand due to ethanol has been met with increased acreage devoted to corn and higher production. Over the past two

Table 1. Renewable fuel standard for conventional biofuels

Year	Billion Gallons
2008	9.0
2009	10.5
2010	12.0
2011	12.6
2012	13.2
2013	13.8
2014	14.4
2015	15.0

years, the United States has raised two solid corn crops—10.5 billion bushels in 2006 and a record 13.2 billion bushels in 2007—yet corn prices have continued to rise. While ethanol has been a driving factor, corn exports have also helped the strong price outlook. The latest USDA projections put corn exports for the 2007/08 marketing year at 2.45 billion bushels. That would be a record for corn exports, exceeding the previous record of 2.4 billion bushels for 1979/80. Cumulative export sales for the current marketing year are nearly 65 percent that of the USDA projection, well ahead of the average pace over the last five years of being at roughly half of the export projection. Outstanding export sales also show a brisk corn export pace.

The main factor supporting export sales is the relative weakness of the U.S. dollar. Table 2 shows the relative change in the value of the dollar in comparison with other currencies. Over 2007, the value of the dollar fell against many world currencies. A falling dollar makes our exports look relatively more attractive to importers and often spurs export demand. The effect

Table 2. Change in the value of the dollar (Jan. 1, 2007 – Jan. 1, 2008)

Currency	Percent Change
EU euro	-10
Australian dol	lar -10
Brazilian real	-15
Canadian doll	ar -16
Japanese yen	-6
Chinese yuan	-6

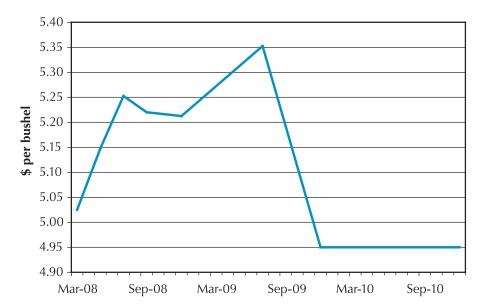


Figure 1. Corn futures prices (as of Jan. 16, 2008)

for corn is twofold. First, the dollar depreciated against the real and yuan, the currencies of two of our major corn export competitors, Brazil and China. So U.S. corn is relatively less expensive than Brazilian or Chinese corn. Second, the dollar also depreciated against the currencies of corn importers, such as Japan, making U.S. corn relatively less expensive to import.

The corn market has taken the ethanol and export projections into account over the next three years and is currently maintaining corn prices between \$4.95 and \$5.35 per bushel on corn futures all the way through December 2010. Figure 1 shows the corn futures prices. The market is projecting stronger corn prices for the rest of the marketing year and continued strengthening in the 2008/09 marketing year.

But corn prices are not the only crop prices that are strong this year; wheat and soybean prices are also high because of a variety of events. These crops will compete with corn for acreage and will likely pull some acreage away from corn. Early estimates point to 88 to 90 million acres of corn, down from last year's 93.6 million acres but still well above historical averages. Further price changes across the crop markets, higher fertilizer prices, weather, and possible input supply bottlenecks will continue to shape the planting outlook.

Overall, the picture looks bright for corn. Prices are high, production has been good, and demand attributed to ethanol and exports continues to grow. For the ethanol sector, 2008 looks to be another year of adjustment. Input prices (mainly corn) continue to be high, but energy—especially gasoline—prices are projected to stay higher. The passage of the 2007 energy act provides government support for additional ethanol production. The industry will continue to expand, but margins will likely remain relatively tight. •

Steady Supplies or Stockpiles? Continued from page 5

the aggressive projection exceeds the current maximum practical rate. Under either scenario, adoption and inclusion rates must both increase significantly. An alternative to increasing inclusion rates to such a high level is for the United States to develop export markets for distillers grains, an effort which will be facilitated by high feed grain prices.

Significant technological and management changes will be required to greatly increase adoption rates and push the maximum inclusion rate above 50 percent for most

producers. Economic incentives in both ethanol and beef production will determine whether changes are made. Given the federal mandate to increase both corn-based and cellulosic ethanol production under the new Energy Independence and Security Act, much new research will be performed and many new technologies will be developed during the period covered by the CARD study. Researchers are working to resolve transportation, storage, and shelf-life problems. As competition increases, the ethanol industry is

expected to have a strong incentive to increase the number and value of co-products, such as improving the nutritional value and consistency of distillers grains as a feed ingredient. New processes that modify distillers grains by lowering fat and/or fiber content may increase its use by other livestock sectors, and co-product blending may help mitigate nutritional issues. A combination of such changes will be needed to assure steady, consistent supplies and to take greater advantage of distillers grains in the beef industry. •

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