Staff Paper

Potential for Corn Oil Extracted from Distillers' Dried Grain and Solubles as a Feedstock for Biodiesel

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Rising prices on vegetable oils and animal fats have enabled dry mill ethanol plants to profitably extract corn oil from distillers' dried grain. While the mandates under the Energy Independence and Security Act of 2007 for grain based ethanol will level off at 15 billion gallons in 2015, the mandates for biodiesel will likely continue to increase from 1.0 billion gallons in 2012 to nearly 2.0 billion gallons in 2022. Corn oil from distillers' dried grain can provide the needed profits and diversification of feedstock to assist the biodiesel industry in meeting the mandates.

20 Pages

Introduction

Distillers' dried grain and solubles (DDGS) are the major by-products of dry mill ethanol plants, used almost exclusively as a middle protein livestock feed. Nearly all the expansion in ethanol production has been in dry mill plants as compared with the much larger scale wet mill plants. In the year 2000, U.S. ethanol production was 1,623 million gallons of which just over 30 percent originated from dry mills. By 2010, ethanol production reached 13,231 million gallons with dry mill output approaching 90 percent of the total. Increases in the production of DDGS were comparable – from 2.7 billion MT in the 2000 crop year to 34.5 billion MT in the 2009 crop year. Minor amounts of DDGS (about 3 percent) are produced as by-products of the alcoholic beverage industry.

The importance of the returns from DDGS to dry mill ethanol plants is indicated by tracing the gross receipts and net income from a typical plant over the 10 year period from 2001 to 2010, the production cost based upon USDA survey data (Shapouri and Gallagher, 2005). The price of ethanol averaged $1.80 per gallon, and the return from DDGS averaged $.32 per gallon with net income at $.23 per gallon. In addition, DDGS reduces the risk from corn prices. That is, higher DDGS prices on the output side tend to offset higher corn prices on the input side. The correlation coefficient is about .6.

Facing uncertainty about future energy prices and legislation as well as corn prices, the ethanol industry will be looking for ways to increase returns and reduce risks. The biodiesel industry is in a similar situation and in particular needs to find new and diverse sources of feedstock. The opportunity to extract corn oil from DDGS as a feedstock for biodiesel could be a win-win strategy for both biofuel industries.

Potential Profits and the Costs

In the first half of calendar year 2011, the price of DDGS sold by ethanol plants in Illinois averaged about $200 per short ton (Jacobsen Publishing). In essence, Illinois dry mill ethanol plants were selling corn oil (about 10 percent of the DDGS volume) at about 10 cents per pound. During these same six months, Jacobsen reported the following prices on vegetable oils and animal fats in cents per pound:

Soybean oil, crude degummed, Central IL	55
Bleachable fancy tallow, renderer, Chicago	50
Choice white grease, Chicago	49
Yellow grease, IL	44

The opportunities look attractive with the vegetable oil and animal fat sector posting prices from 44 to 55 cents per pound while the corn oil contained in DDGS is implicitly selling at 10 cents. Of course, the question is what would it cost to bring DDGS corn oil to the market? The question has two parts, (1) "What does it cost to extract the corn oil?" and (2) "How much would plants give up for the 10 percent of the DDGS replaced?"

Extraction Costs

Based on research at the Michigan Biotechnology Institute (MBI), circa 2006, a cost analysis was competed on the extraction costs (Hanchar, Rajagopalan, McCalla and Stowers, 2007). The following table presents the details of these costs in cents per pound of oil:

Variable operating costs		Depreciation, straight line, 10 years	3.17
Hexane	.22		
Electricity	.51	Interest, Return on Investment on	
Natural gas	3.74	a $9.5 million facility at 10%	3.17
Total	4.47		
		Grand total	13.06
Fixed operating costs			
Operation and maintenance	1.20		
Supervision	.33		
Fringe benefits	.46		
Insurance and taxes	.25		
Total	2.25		

To apply these costs to past and future years, a procedure was established based on the changing prices represented by the cost components. The costs for hexane and electricity were adjusted by the Bureau of Labor Statistics' Producer Price Index for "Fuels and Related Products and Power." For natural gas, the U.S. Department of Energy's spot prices for industrial natural gas were employed. Interest rates were tracked from the macro tables of the U.S. Department of Energy (U.S. Energy Information Administration, 2011). The bases for changing the costs for fixed operating costs and depreciation were derived from the U.S. Department of Commerce's "Implicit Deflator for Personal Consumption Expenditures." These prices and derived costs were projected by AGMOD, an econometric model of U.S. agriculture. Adjusting these costs to 2011 prices, the total is estimated at about 12 cents per pound, a one cent decline mostly due to a drop in prices on natural gas.

This research at MBI also determined that the free fatty acid content of the corn oil ranged from 8 to 12 percent compared to 10 to 15 percent for yellow grease. The corn oil extracted from DDGS using hexane as a solvent contained about 8 percent free fatty acids; using ethanol as a solvent, -- which would be readily available -- however, resulted in corn oil with about 12 percent free fatty acids.

Replacement Cost for DDGS

An "opportunity cost" is involved since 10 percent of the sale of DDGS is foregone. At the price of $200 per short ton, one might simply factor this cost in at 10 cents per pound. However, the "de-oiled DDGS" is higher in protein than DDGS and conceptually more valuable. Assuming that DDGS contains about 28 percent crude protein, the de-oiled

version would contain about 31 percent protein. While only limited information may be currently available about de-oiled prices, procedures are available to generate estimates.

AGMOD was employed in this study to review trends and to establish projections of the biofuels sector. The model was developed at Michigan State University beginning in 1986, building on previous activities related to a major main frame computer program involving several faculty members and graduate students in the Department of Agricultural, Food, and Resource Economics. Since 1986, the model has been developed and maintained by this author and is described in his textbook, *Agricultural Prices and Commodity Market Analysis* (Ferris, 1998, 2005, 2011). AGMOD is commodity specific and includes feed grain, by-product feeds, soybeans, wheat and major livestock enterprises domestically and coarse grain, wheat, oilseeds and vegetable oils internationally. Also included are sectors on ethanol and biodiesel. The model generates year by year projections 10 to 15 years ahead.

To generate prices on DDGS, as well as other by-product feeds, AGMOD incorporates synthetic prices for energy and protein. These prices are established from prices of the major sources of energy and protein --- U.S. corn and soybean meal. Details on the procedure are contained in "Modeling the U.S. Domestic Livestock Feed Sector in a Period of Rapidly Expanding By-Product Feed Supplies from Ethanol Production" (Ferris, 2006). A variable representing the "value" of DDGS is established based on its energy and protein content and the prices of energy and protein. This value becomes an independent variable in a regression equation which also incorporates a variable representing the relative importance of DDGS. The relative importance of DDGS is measured by a ratio of the amount of protein in DDGS fed in the U.S. to the total amount of protein from all sources fed. The equation is as follows:

$$PDDGSD = -13.5 + .954*VDDGFDD - 283*RDDGPT + 51.6*DV83$$
$$\qquad (30.33) \qquad (-7.37) \qquad (3.26)$$

where:

PDDGSD = Price of DDG, Illinois ethanol plants, deflated by the Implicit Price Deflator for Personal Consumption Expenditures (IPD), 2005 = 100% ($/Short Ton)

VDDGFDD = Value of DDG, deflated by IPD ($/Short Ton)

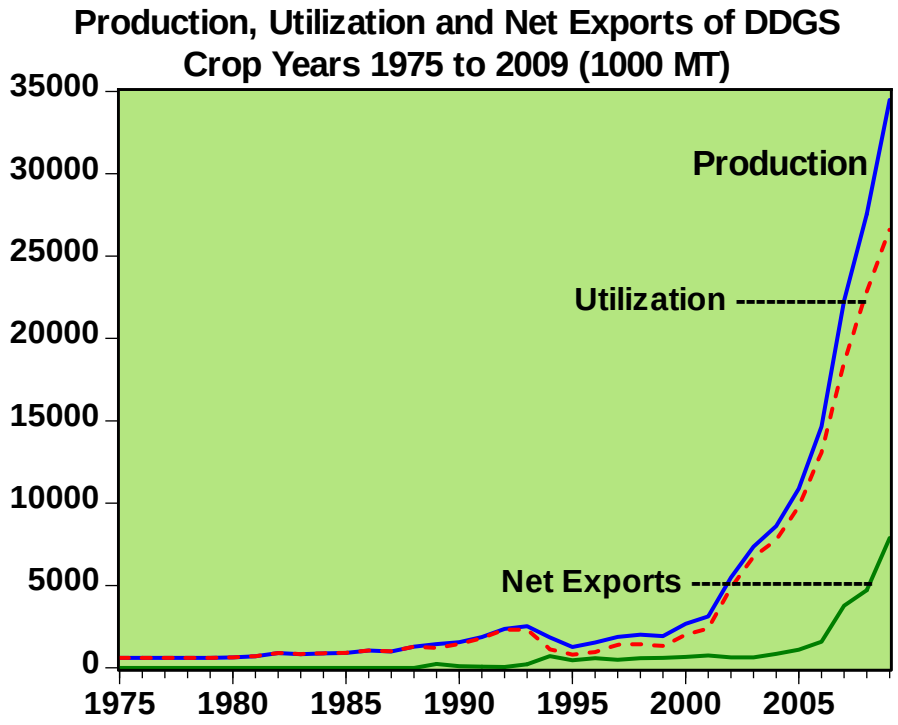
RDDGPT = Ratio of the domestic utilization of DDG in protein equivalents to the total domestic utilization of protein feeds in protein equivalents

DV83 = A dummy variable to account for the crop year 1983 which was an anomaly in the equation (The number "1" in 1983, "0" in other years)

The equation, based on crop year data from 1975 to 2009, carried an R-squared term of .975 and an Adjusted R-squared of .972. The "t-Statistic" values on the coefficients are in parentheses. In other words, the statistical properties are quite strong.

With the expansion of dry mill ethanol production and the attendant production and feeding of DDGS, the price of DDGS has declined significantly relative to its calculated value. In Figure 1 is a plot of the production, domestic utilization and net exports of DDGS. Production and utilization data are based on estimates of the percent of ethanol production from dry mills versus wet mills from the U.S. Department of Agriculture's (USDA) Economic Research Service's (ERS) along with their estimates of corn used for fuel alcohol. ERS has routinely excluded the amounts fed in their Yearbook Tables due to unavailability of production data. However, in a comprehensive analysis of the DDGS industry, ERS did generate these numbers (Hoffman and Baker, 2010). The production and utilization estimates are close to those of Hoffman and Baker.

Figure 1.



Note that net exports have increased substantially as there is some concern about how much DDGS can be introduced into domestic livestock rations, particularly into hog and poultry diets. In terms of how important the expansion in production of DDGS has been to the U.S. livestock feed sector, review Figure 2 which provides a perspective on both the total feeding of protein feeds but also the expanding role of DDGS which has approached 30 percent of the total utilization of protein feeds in the U.S. As a result of the dramatically increased availability of DDGS among the middle protein feeds, the price has dropped substantially relative to the calculated value. This is shown in Figure 3.

Figure 2.

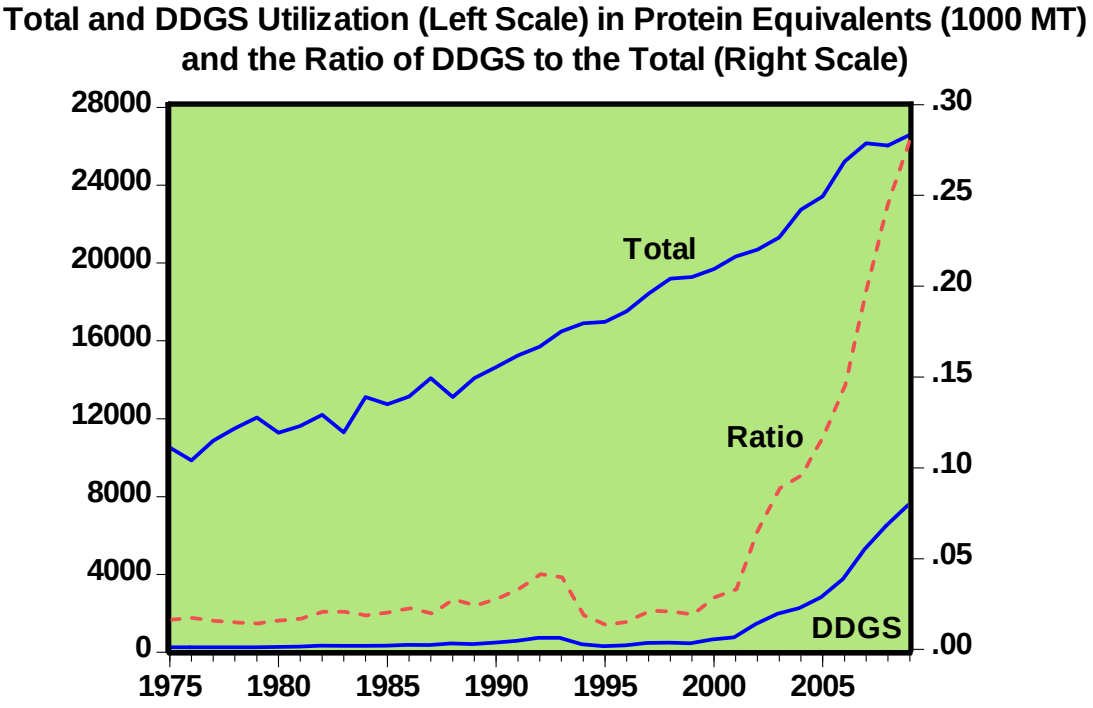
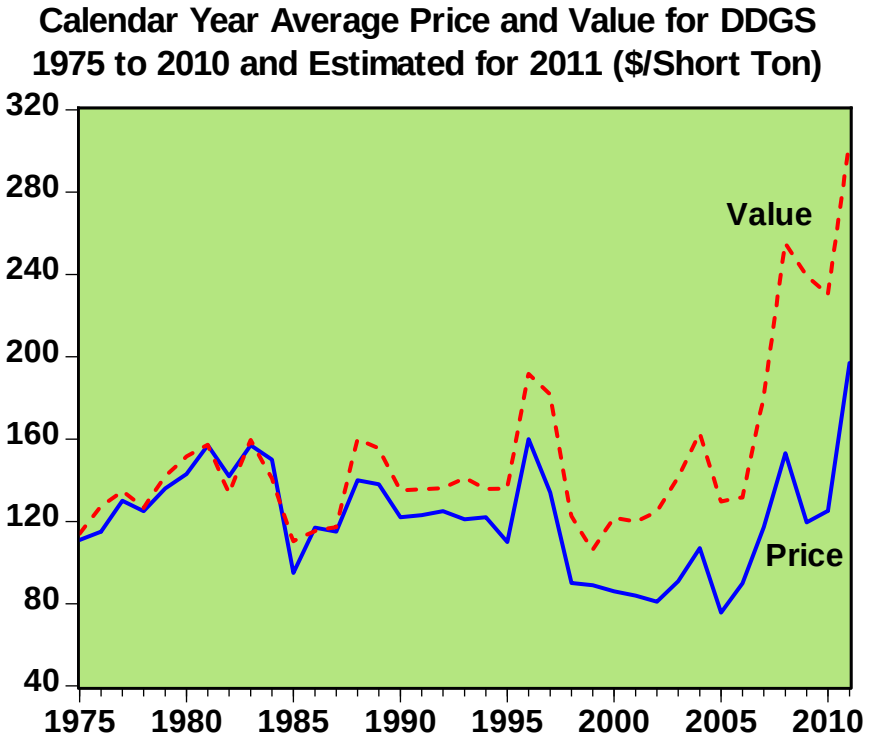


Figure 3.



For the 2011 calendar year, the average price for DDGS from ethanol plants in Illinois is estimated to be about $197 per short ton. The price of de-oiled DDGS with the higher protein content (31 versus 28 percent) is estimated at $206 per short ton, based on the synthetic prices of protein and energy derived from the wholesale price of corn in Chicago and soybean meal in Central Illinois --- a premium of $9. The loss of standard DDGS at about 10 cents per pound would be partly offset by higher prices on the other 9 pounds [(9 times $9)/2000=81/2000= about 4 cents]. The total cost per pound of corn oil would be the direct extraction cost of 12 cents plus the loss of the foregone 10 percent of the DDGS sales which would be 6 cents (10 cents minus 4 cents) for a total of 18 cents per pound.

Profits for Ethanol and Biodiesel

Profits are to be made as long as corn oil can sell at prices above 18 cents. As indicated in the MBI analysis, corn oil produced with hexane contained only 8 percent free fatty acids compared to 10 to 15 percent for yellow grease. A study by Canakci and Van Gerpen indicated pretreatment costs before transesterification for yellow grease in the production of biodiesel to run about 1.5 cents per pound (Canakci and Van Gerpen, 2001). The cost for corn oil would be less. Based on anecdotal observations, DDGS corn oil has been selling at prices just above yellow grease to confirm this supposition. In any case, assume that corn oil will sell just above the price for yellow grease in this analysis by 20 percent of the pretreatment cost for yellow grease.

For calendar 2011, the yellow grease price will likely average about 45 cent per pound. However, this is unusual in the perspective of the last six years (Figure 5). Plotted are monthly average prices of yellow grease and the costs for dry mill plants in producing corn from DDGS using the procedure described above. The profits so derived are "backcast" to the beginning of 2005 showing the variability of the returns (Figure 6). In any case, since 2007, the profits were strongly positive and trending upward except for a dip for a couple of months in late 2008.

The breakdown of the costs per pound of corn oil backcast to 2005 reveals some unexpected patterns (Figure 7). Included in Figure 7 are monthly costs of the direct extraction plus the foregone costs of replacing the 10 percent of the DDGS sales. Somewhat surprisingly in 2009, the replacement costs dropped to significantly negative levels in mid year. The reason was that prices on 48 percent soybean meal in Central Illinois peaked near $400 per short ton, while Chicago corn remained around $3.50 per bushel. The premium for de-oiled DDGS over the standard DDGS widened to $20 per ton. This brought down total costs to extract corn oil to about 5 cents per pound for a short period. Normally, the replacement costs would be expected to be positive and therefore negative for profits.

Based on patterns in the past for biodiesel plants using yellow grease as a feedstock, DDGS corn oil should (1) be profitable as a feedstock and (2) provide needed diversification from dependence on soybean oil, the preferred and dominant feedstock (Figure 8). Note the extended periods of losses from soybean oil.

Figure 5.

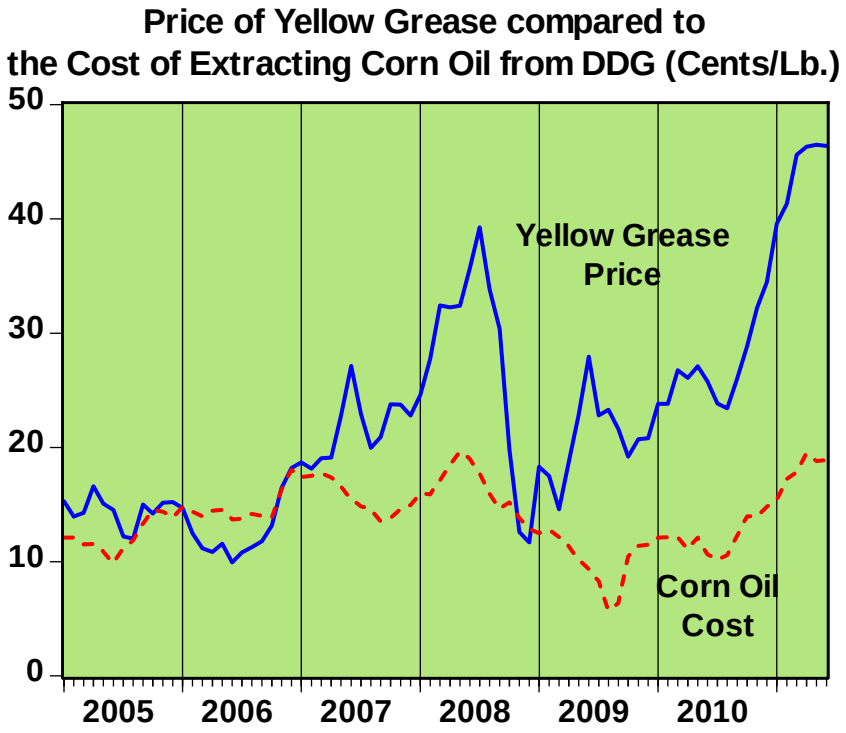


Figure 6.

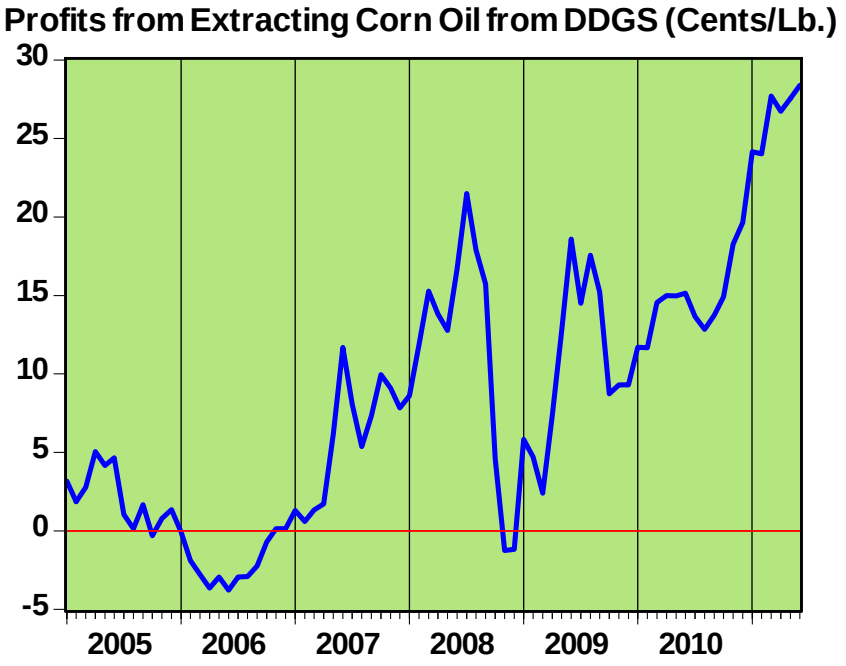


Figure 7.

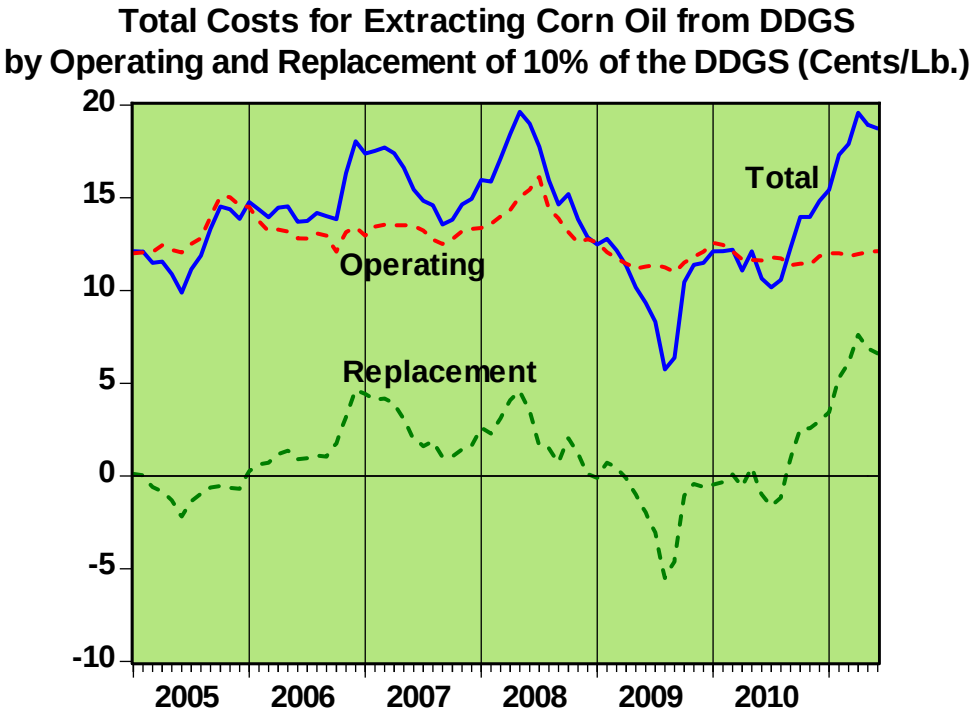
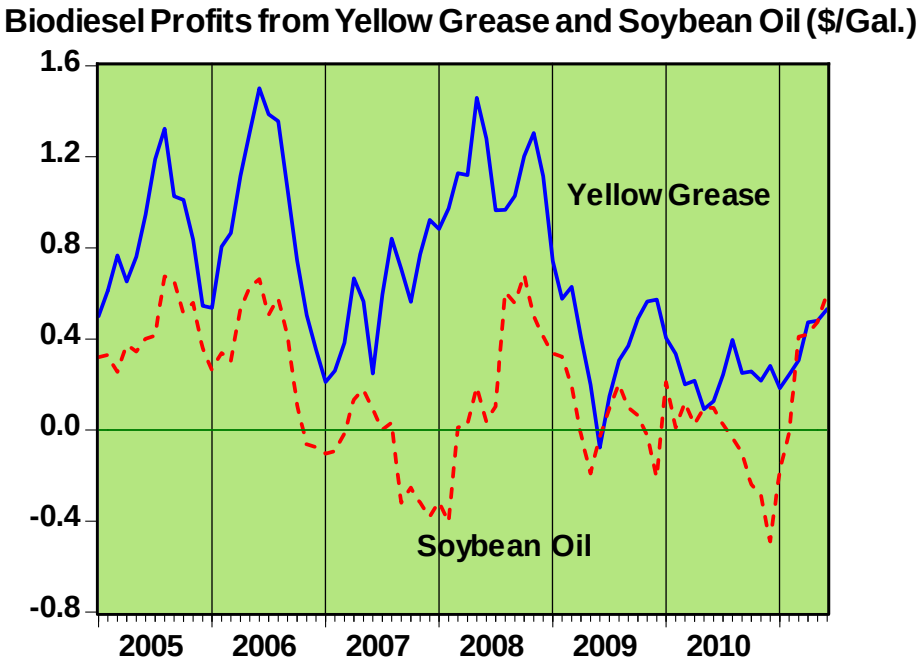


Figure 8.



Pros and Cons

Based on trends and a current assessment, the pros and cons for extracting corn oil from DDGS can be enumerated in an evaluation of the prospects. The **Pros** would be as follows:

1. With less free fatty acids (FFA), DDGS corn oil should sell at or above the price for yellow grease. Anecdotal evidence indicates that it does.
2. While de-oiled DDGS would fit into livestock rations at some level, the feed would be particularly favorable for dairy because of the reduced fat content. (Anecdotally, a large dairy farmer informed me that he feeds 13 pounds of DDG daily to his milk cows but cannot increase the intake further because of the problems with butterfat.)
3. Transporting and handling the traditional DDGS has been difficult because the fat content adds to the "stickiness."
4. DDGS corn oil as a feedstock for biodiesel could help that industry take advantage of its classification as an "Advanced Biofuel" by the Environmental Protection Agency (EPA) under the Energy Independence and Security Act of 2007 (EISA). The EPA proposed on June 20, 2011 that the mandate for biomass-based diesel be raised from the statutory minimum of 1.00 billion gallons for 2013 to 1.28 billion. Opportunities for much more expansion are available as the EISA calls for 5 billion gallons (ethanol equivalent) of such advanced biofuel by 2022.
5. Moreover, corn oil DDGS should be profitable for both the ethanol and biodiesel industries and provide more stability.

The **Cons** could be listed as follows:

1. Because DDGS has become prominent as a substitute for corn, deoiled DDGS may be discounted at least in a transition period.
2. DDGS corn oil is not food quality even though suitable for biodiesel.
3. The technology is competing with fractionation before ethanol processing which produces food quality corn oil.
4. Generating consistency in FFA content has been a problem.
5. Prices on vegetable oils, animal fats and yellow grease could decline sharply.

An Assessment of the Profit Prospects to 2022

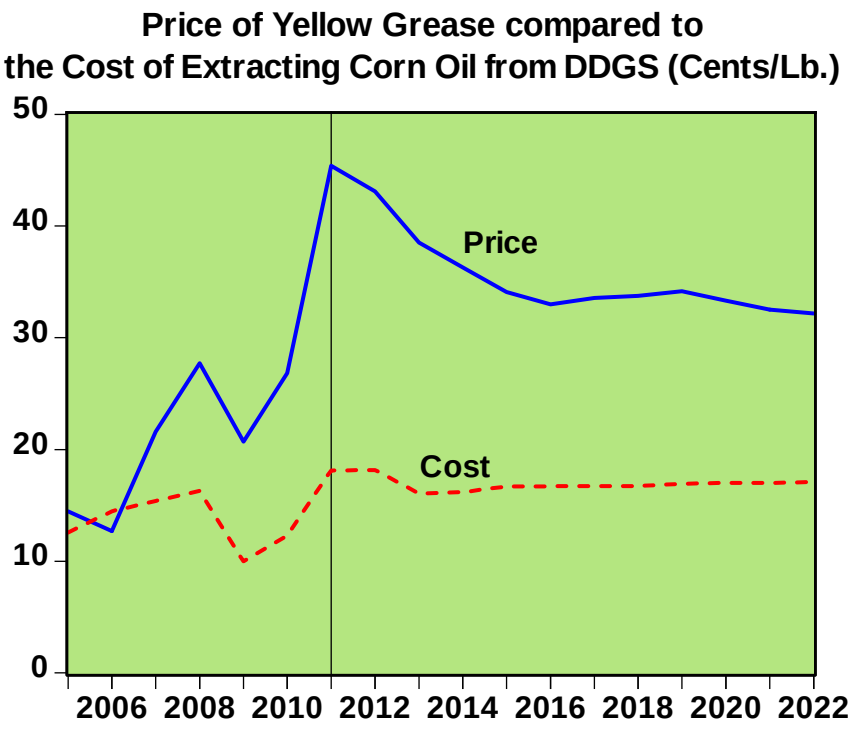
The ethanol and biodiesel sectors in AGMOD provide the means to generate projections on biofuels year by year and well as review trends. To address #5 in the **Con** list, alternatives to the base run of AGMOD were explored. The equation in the model which establishes the price of yellow grease includes two independent variables, the price of soybean oil (crude, Central IL) and the price of corn (wholesale #2 yellow at Chicago). Soybean oil was a logical choice for the one variable because of its dominance in the vegetable oil and animal fat sector . Because yellow grease is used to add energy to livestock rations where corn is the major source of such energy, corn prices are an

appropriate second variable. The equation "explained" about 94 percent of the variation in yellow grease prices in the 1987 to 2009 crop years.

Of course, the basic question is how prices on soybean oil and corn were forecast. Considering that the explanation is beyond the scope of this paper, suffice it to say that projections of production and utilization of vegetable oils and coarse grain provided the means to establish stock levels which were key variables in setting price levels. Parameters of government programs were involved as well as the impact of ethanol prices on the corn market.

Numerous assumptions were included in the base run of the model. A key assumption was that crude oil prices (Composite Refiners' Acquisition Cost reported by the DOE) would range between $95 and $100 per barrel. In Figure 9 are the projections in the base run for the price of yellow grease and the cost of producing corn oil from DDGS.

Figure 9.



As indicated, the price of yellow grease is projected to decline through most of the forecast period, and the costs are expected to be fairly stable. In any case, the profit margins are likely to remain intact. In general, the entire set of coarse grain and oilseed prices, along with animal fats, are expected to decline but not to the levels preceding 2006.

In the perspective of the per gallon of ethanol returns from corn oil extraction, the same picture as in Figure 9 can be portrayed in more detail (Table 1). In the table are the

Table 1.

Projections of Returns from Extracting Corn Oil from Distillers' Dried Grain

Year	Corn Oil	Price of De-oiled DDG	Price of DDG	Difference	Returns from De-oiled DDG	Returns from DDG	Difference	Net Returns
	Item							
	$/Gal.	$/Ton	$/Ton	$/Ton	$/Gal.	$/Gal.	$/Gal.	$/Gal.
2010	0.09	138	125	13	0.39	0.39	0.00	0.09
2011	0.22	202	193	9	0.57	0.60	-0.04	0.18
2012	0.24	216	208	8	0.61	0.65	-0.04	0.20
2013	0.22	204	193	12	0.57	0.60	-0.03	0.19
2014	0.15	213	198	15	0.60	0.62	-0.02	0.13
2015	0.14	204	189	15	0.57	0.59	-0.02	0.12
2016	0.12	193	179	14	0.54	0.56	-0.02	0.10
2017	0.11	193	179	14	0.54	0.56	-0.02	0.09
2018	0.12	200	185	15	0.56	0.58	-0.02	0.10
2019	0.12	206	191	15	0.58	0.60	-0.02	0.10
2020	0.11	212	197	15	0.60	0.61	-0.02	0.09
2021	0.11	219	203	16	0.62	0.63	-0.02	0.09
2022	0.10	224	207	16	0.63	0.65	-0.02	0.08

returns from the extraction operation (first column), the prices for the de-oiled and standard DDGS, the returns per gallon from the alternatives, and the net from the extraction operation and the replacement cost. The higher prices on the de-oiled DDGS on 90 percent of the output did not quite offset the returns from DDGS on 100 percent of the output except in 2010.

Because DDGS has been promoted as an energy feed rather than a protein feed, the emergence of de-oiled DDGS has resulted in some discounting from anecdotal reports. This would likely be related to non-dairy rations. To provide a perspective on the implications of de-oiled DDGS being discounted relative to DDGS, Table 2 shows the effects on profitability for dry mill ethanol plants should the discount amount to $5 per ton. The net returns would clearly be reduced but would remain positive.

Applicable to both Table 1 and 2 is assumption that the extraction level would be at 10 percent of the volume of DDGS. In practice, however, the rate has been less with examples of de-oiled DDGS containing from 2 to 6 percent crude fat (Shurson, 2009), (Stein, 2008), (Mueller, 2010). In any case, the conclusions from Tables 1 and 2 that extraction would be profitable would hold at other levels of extraction.

Table 2.

Projections of Returns from Extracting Corn Oil from Distillers' Dried Grain with De-oiled DDG Discounted by $5/Ton

Year	Corn Oil	Price of De-oiled DDG	Price of DDG	Difference	Returns from De-oiled DDG	Returns from DDG	Difference	Net Returns
	Item							
	$/Gal.	$/Ton	$/Ton	$/Ton	$/Gal.	$/Gal.	$/Gal.	$/Gal.
2010	0.09	120	125	-5	0.39	0.39	0.00	0.09
2011	0.22	188	193	-5	0.53	0.60	-0.07	0.15
2012	0.24	203	208	-5	0.57	0.65	-0.08	0.16
2013	0.22	188	193	-5	0.53	0.60	-0.07	0.14
2014	0.15	193	198	-5	0.54	0.62	-0.08	0.07
2015	0.14	184	189	-5	0.52	0.59	-0.07	0.07
2016	0.12	174	179	-5	0.49	0.56	-0.07	0.05
2017	0.11	174	179	-5	0.49	0.56	-0.07	0.04
2018	0.12	180	185	-5	0.51	0.58	-0.07	0.04
2019	0.12	186	191	-5	0.52	0.60	-0.07	0.05
2020	0.11	192	197	-5	0.54	0.61	-0.08	0.04
2021	0.11	198	203	-5	0.56	0.63	-0.08	0.03
2022	0.10	202	207	-5	0.57	0.65	-0.08	0.02

Production and Utilization Outlook

Estimates and projections of total and dry mill ethanol production are illustrated in Figure 10. The presumption is that grain based ethanol production will converge to the mandates (RFS2) under the Energy Independence and Security Act of 2007 and level off at 15 billion gallons from 2015 to 2022. Production would have to exceed 15 billion gallons if net exports would turn out to be positive because the mandates relate to domestic utilization. Dry mill production would follow the total in parallel since little expansion is expected for wet mill output. The implications for the production and utilization of DDGS are shown in Figure 11.

With the domestic utilization DDGS leveling off at just over 30 million MT annually, concerns about feeding limitations are minimized. Exports have provided a substantial alternative outlet.

Figure 10.

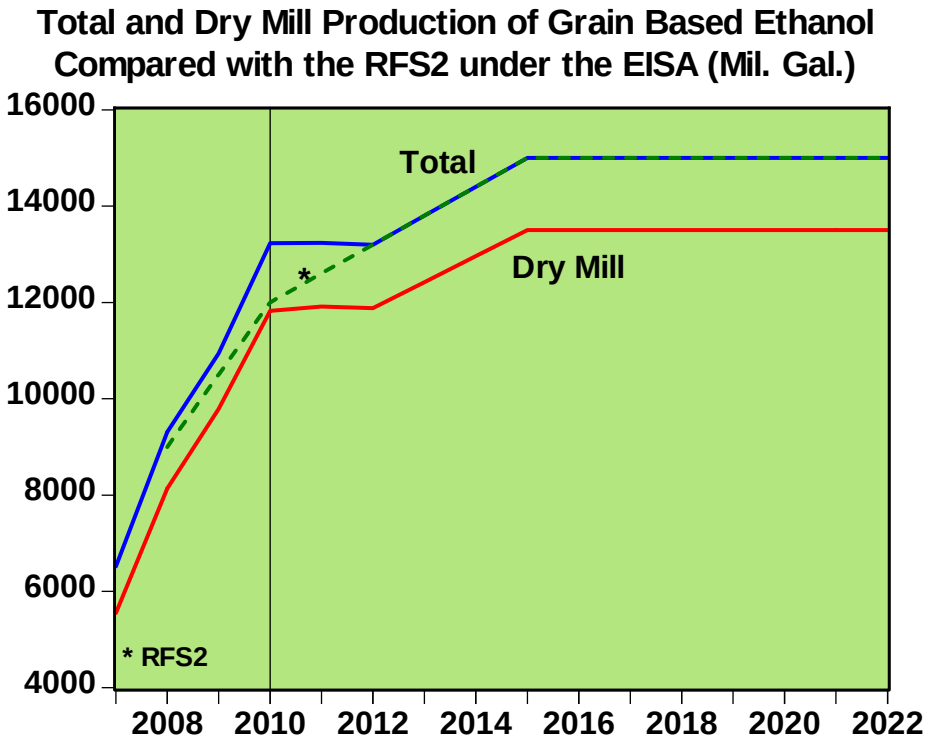
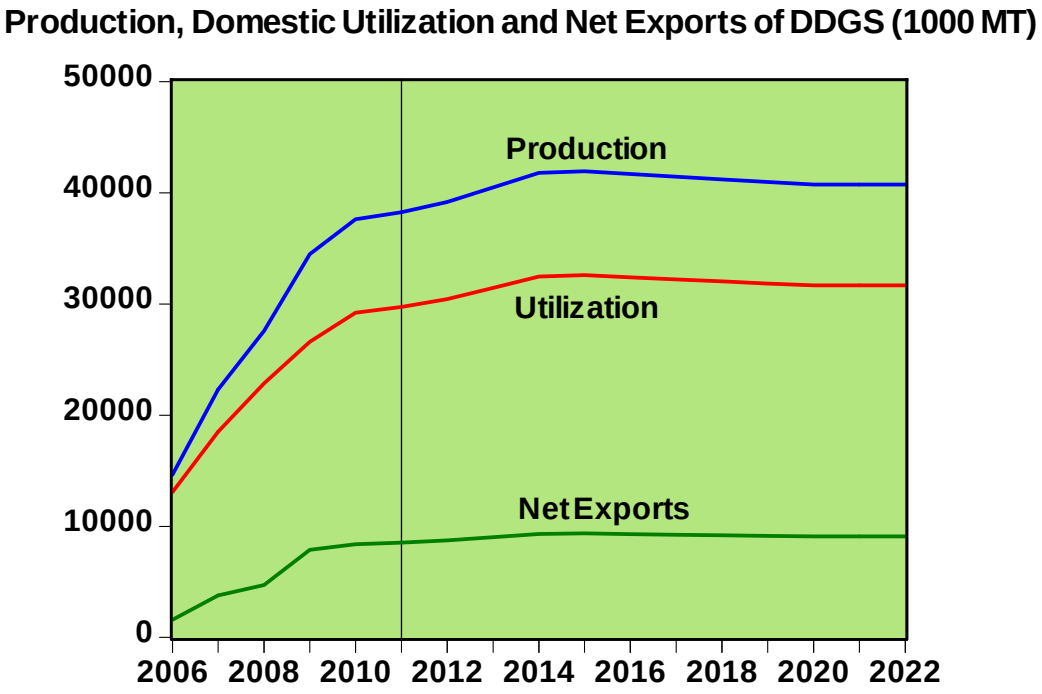


Figure 11.



Biodiesel Feedstocks

The RFS2 for biodiesel under EISA increased from 650 million gallons in 2010 to 800 million in 2011. The mandate is slated under the statutes to increase to a billion gallons in 2012, an amount which remains as a minimum through 2022. On June 20, 2011, EPA proposed an RFS2 of 1.28 billion gallons for biodiesel for 2013 and also published their own projections from "RFS2 Final Rulemaking" along with a report from IHS Global Insight (Table 3.). Of interest was that EPA's projection to 2022 was identical to the number which had been established in the AGMOD model. The projections from IHS Global Insight were much more optimistic about biodiesel expansion than either the EPA or AGMOD. Assuming that EPA's proposed 1.28 billion gallons for 2013 will be approved, the AGMOD projection set will be modified as indicated in Table 3 and Figure 12.

Table 3.

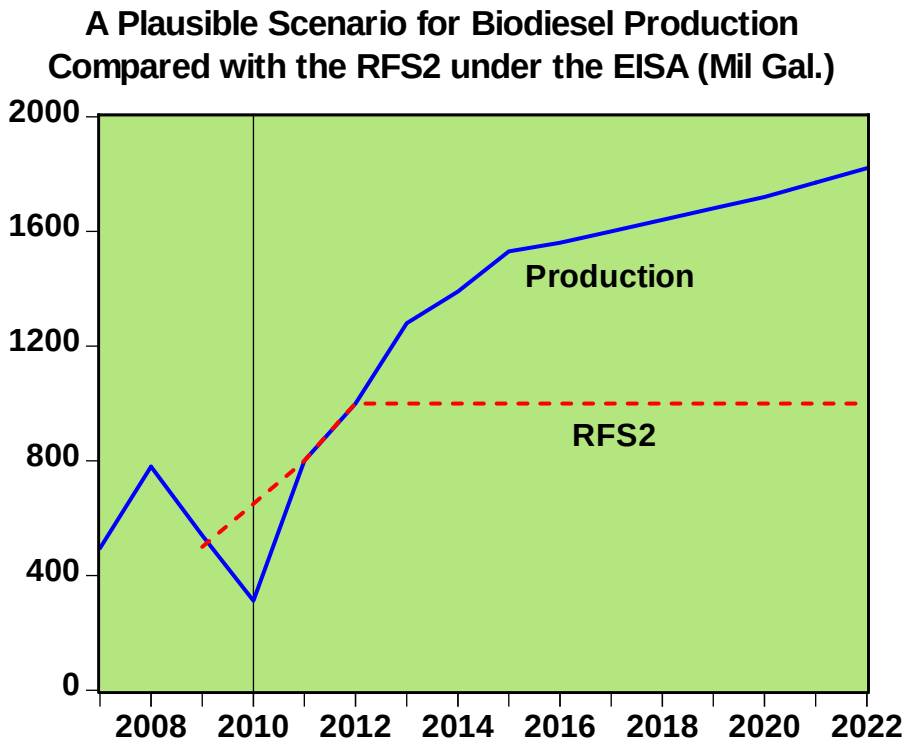
Projections for Biodiesel for 2013 to 2022 (Billion Gallons)

Year	RFS2 Final Rulemaking [1]	IHS Global Insight Report [1]	AGMOD Original	AGMOD Modified
2013	1.28	1.34	1.10	1.28
2014	1.39	1.50	1.18	1.39
2015	1.53	1.81	1.26	1.53
2016	1.56	2.18	1.34	1.56
2017	1.60	2.53	1.42	1.60
2018	1.64	2.74	1.50	1.64
2019	1.68	3.00	1.58	1.68
2020	1.72	3.14	1.66	1.72
2021	1.77	3.23	1.74	1.77
2022	1.82	3.30	1.82	1.82

[1] EPA, "Regulation of Fuels and Fuel Additives: 2012 Renewable Fuel Standards," 40 CFR Part 80, [EPA-HQ-OAR-2010-0133; FRL-XXXX-X], RIN 2060-AQ76, p. 66; The IHS Global Insight Report was "Biodiesel Production Prospects for the Next Decade," March 11, 2011.

In contrast to ethanol which has exceeded the RFS2 (Figure 10), biodiesel has been pushed to meet the mandate (Figure 12). While it appears that the required production was not reached in 2010, factoring in earlier production enabled the industry to comply. In the first few months of 2011, production picked up as the RINs (a market mechanism under EISA which pushes prices to the point to encourage the necessary output) provided the needed support. Likely, the industry will meet the 800 million gallon target, adjusted for net exports. For the same reason, biodiesel production should be in line with the one billion gallon RFS2 for 2012.

Figure 12.



Indications that corn oil will become a major feedstock for biodiesel came from the EPA in their final regulations for the "National Fuel Standard Program for 2010 and Beyond" released in February 2010. In the background material for this document was the statement, "Based on engineering research (refer to Section VIII.A) regarding expected technological adoption, it is estimated that 70% of dry mill ethanol plants will withdraw corn oil via extraction (from DDGS), resulting in corn oil that is non-food grade and can only be used as a biodiesel source; 20% will withdraw corn oil via fractionation (prior to the creation of DDGS), resulting in corn oil that is food-grade; and 10% will do neither extraction or fractionation" (EPA, 2010).

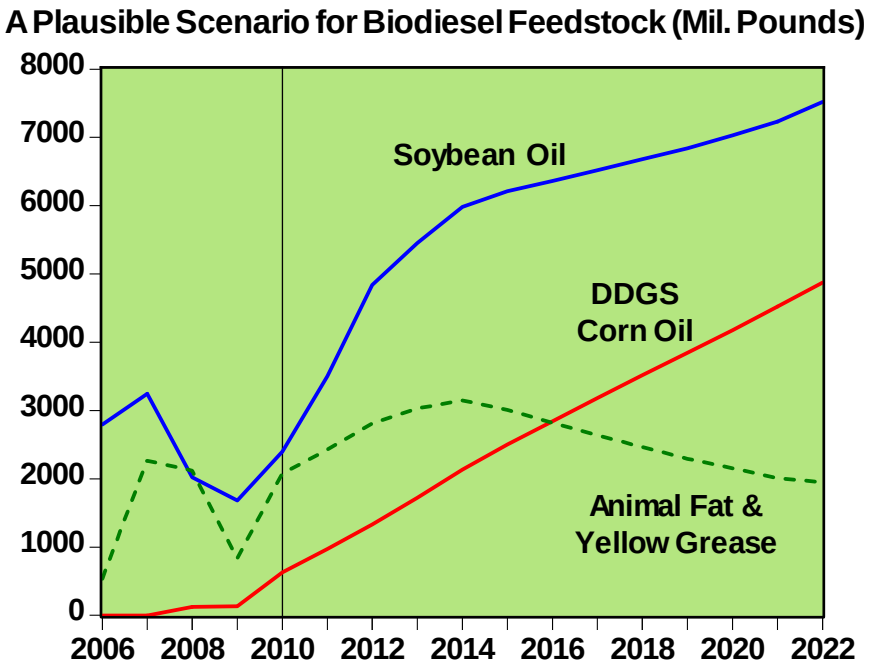
The EPA confirmed their earlier projections on June 20, 2011 and postulated that the feedstock in 2013 would be as follows in million gallons (EPA, 2011):

1. Yellow grease and other rendered fats – 380
2. Corn oil – 300
3. Virgin vegetable oil (including soybean oil) – 600
4. Total --- 1,280

In essence, EPA expects corn oil to be a major feedstock for biodiesel production as early as in 2013.

What are the implications for biodiesel production increasing to 1820 million gallons by 2022 in combination with the domestic utilization of DDGS reaching 31.7 million MT? The AGMOD projections for the amount of DDGS corn oil used as a feedstock for biodiesel have been very close to those of the EPA. Assuming that soybean oil remains about half of the feedstock, Figure 13 indicates the prospective pattern for DDGS corn oil and animal fat and yellow grease, along with soybean oil.

Figure 13.



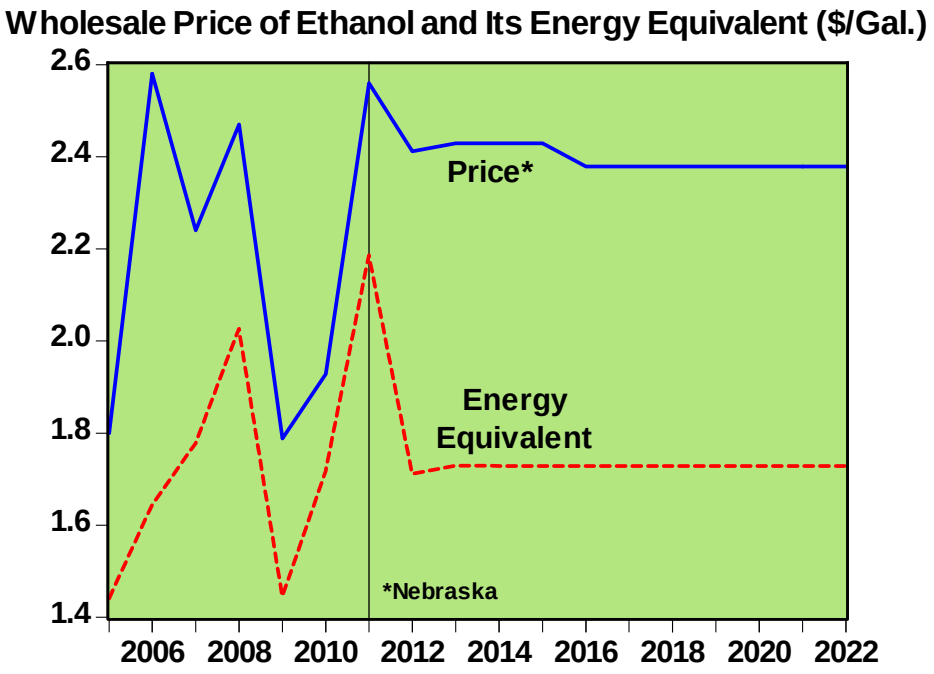
By the year 2022, DDGS corn oil would represent one-third of the biodiesel feedstock and 70 percent of the availability of corn oil from DDGS in the domestic market. Counting that some of the exports could be de-oiled DDGS, biodiesel plants would be using about 55 percent of the potential from the total production. The loss of the energy component in livestock rations from de-oiled DDGS could be met by the increased availability of animal fat and yellow grease.

Ethanol and Biodiesel Profits

Integrating the projections on profits from extracting corn oil from DDGS into the net returns from dry mill ethanol production provides a perspective on the possible important role corn oil may provide. In the past, ethanol prices have held well above their energy value which is the base in AGMOD for forecasting ethanol prices. The challenge is to forecast the margin. The energy equivalent wholesale price of ethanol is calculated as two-thirds of the price of gasoline at retail less the price spread from retail to wholesale plus the blenders' tax credit. In recent years, the blenders' tax credit has been 45 cents

per gallon and has been the subject of debate on whether it should be continued, phased out or shifted to support the ethanol infrastructure. In the projections, the credit is assumed to be discontinued beginning in 2012. As a result, ethanol prices are expected to remain above the energy value in the projection period (Figure 14).

Figure 14.



Given the projections on the wholesale price of ethanol along with corn prices and the processing costs, the net returns over total costs can be established for the standard dry mill (Base) and those extracting corn oil from DDGS (Figure 15). Note that in 2005 to 2007, there was no advantage for extraction as yellow grease prices, along with other fats and oils, were relatively cheap. After high corn prices will likely cut returns in 2012, the base data set indicates that net returns will be nominal. Extracting corn oil could help keep the industry in the black. In addition, expanding DDGS corn oil will benefit the biodiesel industry (Figure 16). Assuming that net returns from soybean oil will be enough to encourage the projected increase from that source, processing DDGS corn oil, along with yellow grease, should be profitable and provide needed diversification.

Figure 15.

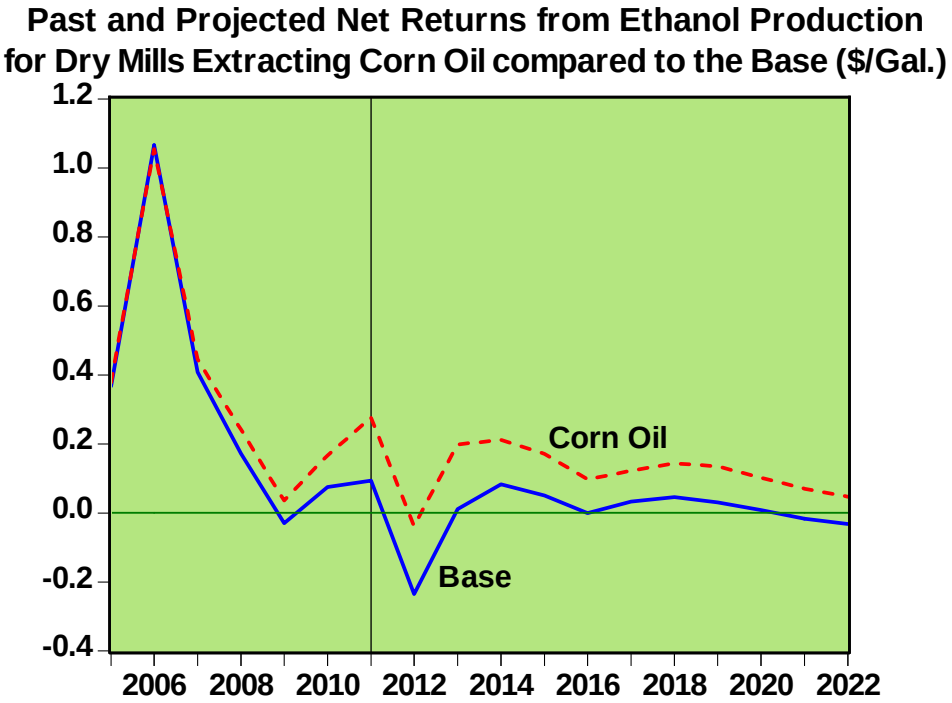
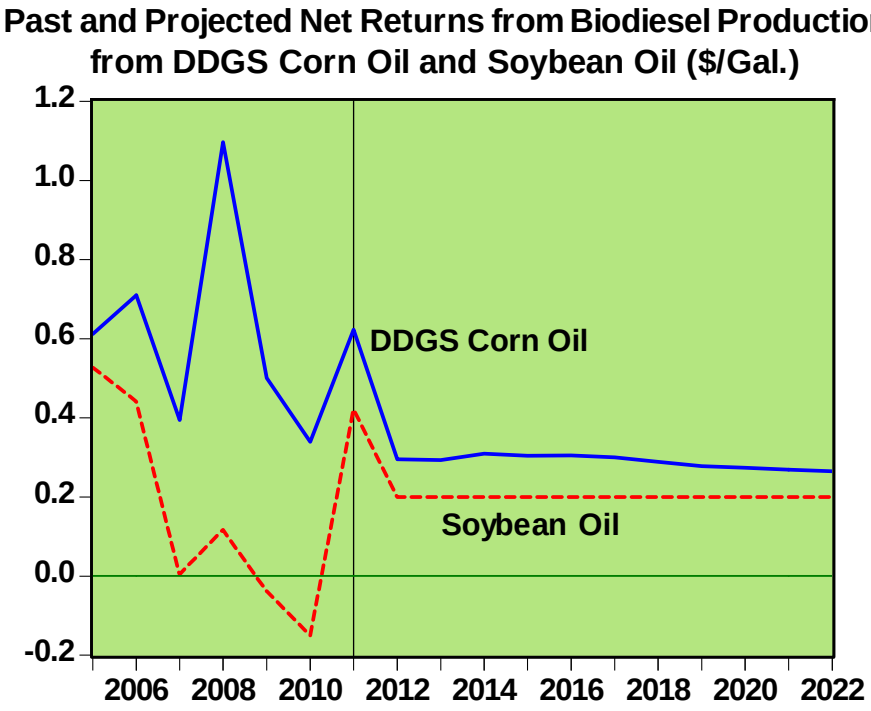


Figure 16.



Summary and Conclusions

Prospects for continued elevated prices on vegetable oils and animal fats should provide profits to dry mill firms extracting corn oil from DDGS. Not only is the extraction cost effective but the de-oiled DDGS will likely command a higher price than the standard DDGS and help offset the foregone sale of the 10 percent of the standard DDGS replaced. Due to the uncertainty relative to biofuel legislation and crude oil prices -- also the leveling off of the RFS2 at 15 billion gallons beginning in 2015 -- the additional income from DDGS corn oil may assist the dry mill plants in retaining a competitive edge.

Corn oil DDGS can provide a profitable and needed alternative feedstock source for the biodiesel industry. At times, soybean oil, the dominant and preferred feedstock, has been uneconomical; and biodiesel plants have either shut down or turned to alternative feedstock such as yellow grease and animal fat. However, these sources are limited and are demanded for other purposes such as adding energy to livestock rations and export. The availability of DDGS corn oil could easily supply the biodiesel industry with a third of its feedstock requirements by 2022.

DDGS corn oil could be a win-win solution for both the ethanol and biodiesel industries.

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