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Biofuel Support Costs to the U.S. Economy: The Key Role of the RFS in a Corn and Soybean Shortage Scenario

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Executive Summary: The U.S. government has a long history of aiding the biofuel industry. In 1978 the first federal financial supports for use of ethanol blended with gasoline were set at a fixed $0.40 per gallon payment for 1 gallon of ethanol added to 9 gallons of gasoline to make "gasohol"[1], now known as "E10". Subsequent programs changed support levels and added usage mandates, but we have had continuous Federal financial support of biofuels for over 30 years.

With the enactment of the 2008 Farm Bill current Federal law pays a fixed minimum of $0.45 per gallon[2] for all ethanol blended with gasoline. Payments go to petroleum blenders in the form of a tax rebate. The recently enacted Energy Independence and Security Act of 2007 also mandated 9 billion gallons of renewable food-based biofuel use in 2008, 10.5 billion in 2009, and 15 billion gallons by 2015. There is also a $0.54 per gallon import duty on ethanol, and biodiesel tax credits. Additional Federal mandates for biofuels raise the total mandate to 36 billion gallons in 2022. State and local programs for both fuel ethanol and biodiesel also add to the financial support for biofuels. This paper will focus on the effects of the Federal biofuels program for corn-based ethanol and soyoil-based biodiesel in a situation where the corn crop is insufficient to meet the RFS and maintain food, feed and export use.

Federal biofuel support policy has significantly increased the attractiveness of ethanol and biodiesel production to levels well beyond that furnished by market forces alone. U.S. energy policy is now having major effects on crop demand, crop plantings, crop prices, food production costs and the long term availability of major U.S. grain and oilseed crops for food use and exports.

The feedstock demand and commodity price-enhancing effects of Federal energy policy have been so extreme that feedstock prices have increased to the point where biofuels profitability itself has been reduced significantly. An ethanol refinery model maintained by DTN[3] showed losses for much of the first half of 2008. In 2006 and 2007, when corn prices were much lower, the model was showing significant profits. Biodiesel production from soy oil has become very unprofitable.

The effect of biofuel policy on biofuel costs and profitability is perhaps the greatest irony of our biofuels support policy. By dramatically increasing demand for limited supplies of feedstocks our Federal energy policy has increased the total cost of biofuel production well beyond what the free market alone would have allowed. Biofuel producers are not reaping most of the benefits of the program. Biofuels policy has become windfall profit gains for grain and soybean producers.

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[1] Energy Tax Act of 1978

[2] The payment is $0.51 until 1-1-09 and $0.45 after as long as ethanol production plus imports exceeds 7.5 billion gallons in a calendar year.

[3] http://www.dtnethanolcenter.com/index.cfm?show=10&mid=32

In a situation where feedstock crops fall short of being able to meet the RFS and maintain the nation's food supply the price effects of biofuel policy are greatly exaggerated. The combined effects of a tax credit subsidy and RFS-based demand that is not responsive to price can result in extreme price movements. This has become abundantly evident in 2008. Poor weather through mid June has reduced prospects for both the U.S. corn and soybean crops. As a result, corn and soybean prices have far surpassed prior records.

Theoretical Background

Overview: Federal U.S. biofuels policy is designed to increase biofuels production to levels well beyond those that would result from the marketplace alone. However, ethanol and soyoil-based biodiesel, our two major biofuels, use corn and soybeans as their feedstocks. Corn and soybean production are both limited by a combined available land resource of about 160 million acres. There simply is no significant reserve of fertile, productive, farm land in the U.S. (or in the world) that can be brought into production to satisfy major demand increases. Neither is there any significant government sponsored set-aside that could be released for corn and soybean production. Yields of both crops have trended up over time, but too slowly to have much short term impact on production. Therefore, if biofuel producers are to use significantly more food, some other U.S. user or overseas customer will need to use less.

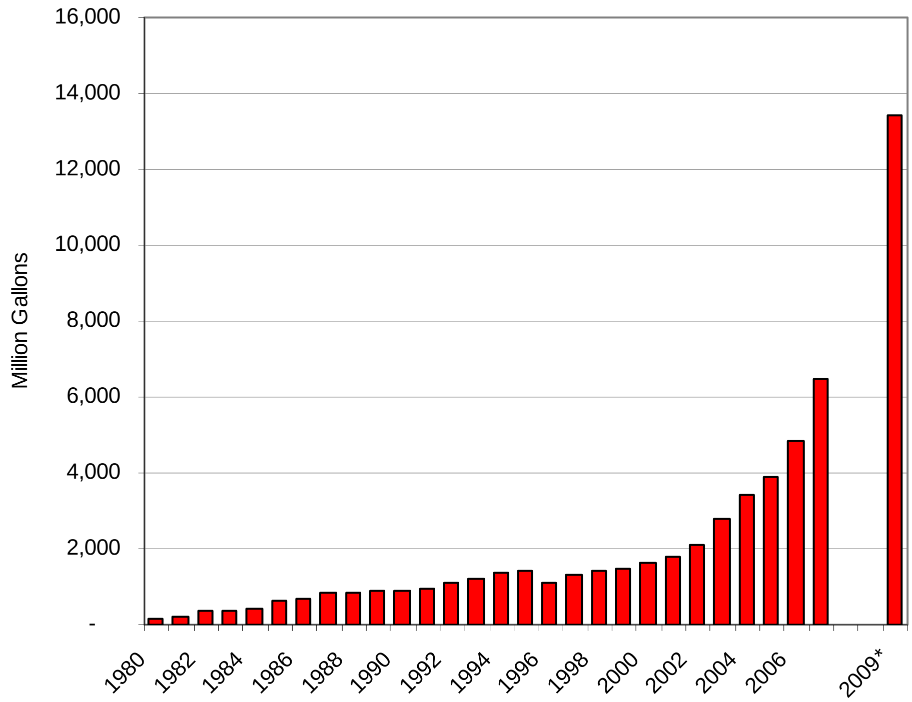
Biofuel market value is derived from the underlying prices of petroleum-based fuels and federal tax credits. In the case of ethanol there are two major uses – additives replacement and gasoline replacement. Ethanol has a higher value as an additive replacer than it has for its energy content. Used to replace MTBE as an oxygenator, and as an octane enhancer, ethanol can be priced higher than if it is used simply to replace gasoline for its energy content.

Federal biofuel tax credits add to the market price of biofuels by refunding a fixed amount for every gallon blended with petroleum-based fuels. The refund is, in effect, an amount above market value that can be paid by the blender. Biofuel tax credits drive a wedge between a biofuel's lower true market value and their apparent higher market price.

The high-value market for gasoline additives is limited to a small percent of overall gasoline use. As ethanol production has expanded in recent years the high value additive market has been saturated, and now ethanol is increasingly priced as a lower value gasoline replacement. Since ethanol has only about 66% of the net energy of gasoline fuel mileage in engines designed for gasoline declines as ethanol content in fuel blends increase. Therefore, ethanol's market price per gallon needs to be about 66% of that of gasoline to give equal cost per mile.

Until the 2004/2005[4] crop year the energy value of crops used for fuel production was so low that it was not profitable to use them for biofuel production without government support payments. Aided by federal support, limited amounts of corn were being made into ethanol for high value fuel additive use even prior to 2004 (Figure 1).

Figure 1: U.S. Fuel Ethanol Production
(1980 to 2007 Actual, beginning of 2009 Projected Rated Capacity)[5]*



Federal Ethanol Tax Credit Support Payments: The rapid increase in ethanol production in 2004 and beyond is a result of a period of time when rapidly increasing gasoline prices coupled with fixed-value Federal support payments and mandated use made it extremely profitable to convert corn to ethanol.

Potential demand for corn as an energy replacement for gasoline is not a limiting factor. The available supply and cost of feedstocks limits the growth of biofuels production. Federal tax rebates can be viewed as funds used to lower the cost of feedstocks. By lowering the effect cost of biofuels producers are given an advantage in the market, and can expand production beyond the level that would happen in a free market. However, feedstock supplies are limiting, and eventually biofuel producers will bid up their prices until they can no longer afford to expand. Take away the tax rebates and the cost of feedstocks would have to fall as biofuel

[4] Crop years start on September 1. All estimates in this study are for crop years.
[5] Renewable Fuels Association. http://www.ethanolrfa.org/industry/locations/

producers exit the business. In other words, without the tax rebates the cost of feedstocks, and the cost of biofuel production itself, would be lower than with them.

Comparing actual prices of gasoline and ethanol to the energy value of ethanol also shows the effects of the Federal support program on ethanol prices. To reflect the difference in BTUs per gallon, ethanol's energy value (Figure 2, light blue line) was calculated as 66% of the price of gasoline (dark blue line).

Figure 2: Ethanol Prices Relative to Gasoline and Ethanol Energy Value (Wholesale)

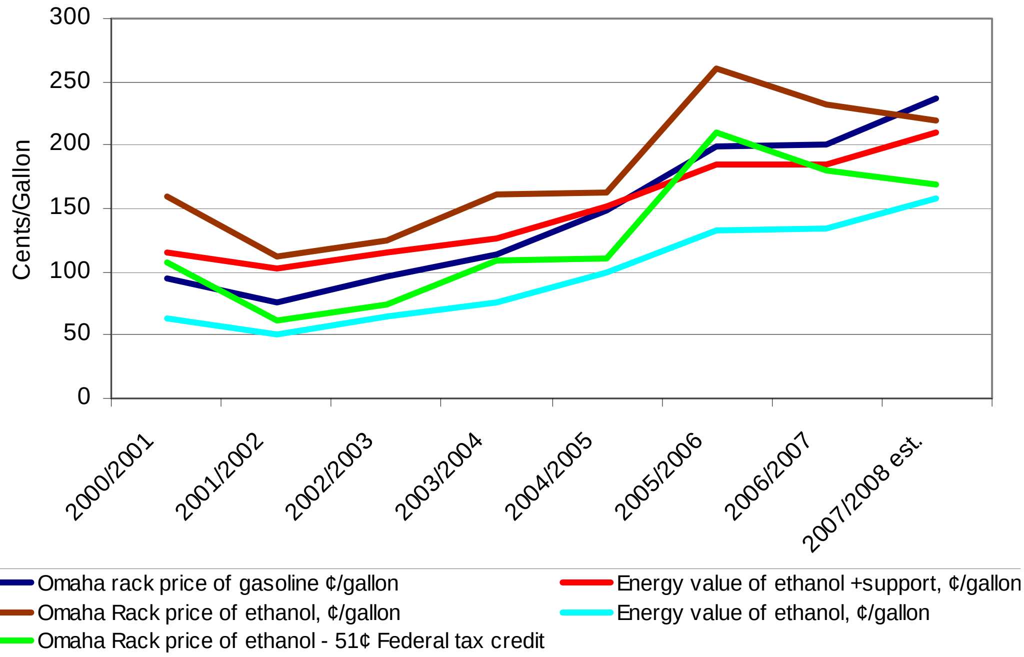


Figure 2 shows that the actual price of ethanol (brown line) has typically exceeded its energy value and the price of gasoline. The high price of ethanol relative to both gasoline and its energy value is largely a function of Federal support. The Omaha ethanol rack price reflects the price paid by a blender to the ethanol refiner, and includes the value of the Federal tax credits received by the blender. That tax credit makes ethanol more valuable to the blender that just the ethanol alone.

If the $0.51 Federal tax credit that was in place in the period covered in Figure 2 is subtracted from the ethanol rack price to get a net cost to the blender, the comparison to energy value is much closer. In Figure 2 the net blender price (excluding a $0.51 tax credit) of ethanol (green line) is much closer to the energy value (light blue line)[6]. If other credits and government support (mainly state and local) received by ethanol plants are taken into account the true market value of ethanol is even closer to the energy value.

[6] The high value of ethanol relative to gasoline in 2005/2006 was largely caused by outages at oil refineries and the removal of MTBE from the market.

In summary, ethanol pricing is a result of a complex mixture of market forces and support policy. Fundamental economic value of ethanol is severely distorted by Federal support payments in the form of tax credits received by companies who buy ethanol to blend it with gasoline.

Biofuels Support Policy, the Role of the RFS

A stated objective of U.S. biofuel policy is to increase both the supply and demand for biofuels. On the demand side of the market policy mandates levels of biofuel use. On the supply side policy offers financial support for producers and protects the U.S. ethanol market via an ethanol tariff that shields U.S. producers from competition.

The "Renewable Fuel Standard" (or RFS) contained in current energy law mandates levels of use of ethanol and biodiesel as motor fuels. This feature creates a guaranteed market for the RFS level of production. The current RFS for all biofuels is contained in the table below[7]. The "Renewable Biofuel" column includes both ethanol and biodiesel. To make biodiesel more attractive each gallon used counts for 1.5 gallons of the RFS. Ethanol from cellulose is given 2.5 gallons of credit for each gallon used. This paper is concerned with only the "Renewable Biofuel" RFS.

Table 1: U.S. 2008-2022 Biofuel Standards, Billion Gallons/Year

Year	Renewable Biofuel	Advanced Biofuel	Cellulosic Biofuel	Biomass-based Diesel	Undifferentiated Advanced Biofuel	Total RFS
2008	9					9
2009	10.5	0.6		0.5	0.1	11.1
2010	12	0.95	0.1	0.65	0.2	12.95
2011	12.6	1.35	0.25	0.8	0.3	13.95
2012	13.2	2	0.5	1	0.5	15.2
2013	13.8	2.75	1		1.75	16.55
2014	14.4	3.75	1.75		2	18.15
2015	15	5.5	3		2.5	20.5
2016	15	7.25	4.25		3	22.25
2017	15	9	5.5		3.5	24
2018	15	11	7		4	26
2019	15	13	8.5		4.5	28
2020	15	15	10.5		4.5	30
2021	15	18	13.5		4.5	33
2022	15	21	16		5	36

Feedstock Demand and Price Effect of the RFS: The RFS is a mandate for use of biofuels. Blenders are assigned a percent of the fuel they buy that must consist of the various biofuels in Table 1. It is enforced via fines and penalties if blenders do not purchase and blend their minimum required amounts of biofuels. A blender is

[7] Renewable Fuels Association. http://www.ethanolrfa.org/resource/standard/

free to purchase and use more than his RFS minimum, and will if the biofuel price is low enough relative to petroleum fuels to make substitution attractive.

In effect, the RFS creates a price inelastic demand curve for biofuels. The 2008 RFS mandates the use of 9 billion gallons of ethanol and methyl ester. The vast majority of that volume will be ethanol. At 2.75 gallons of ethanol per bushel, the 2008 RFS mandates that about 3.2 billion bushels of corn (close to 25% of the record-large 2007 crop) will be made into ethanol. Given that the capacity of all ethanol plants will easily exceed 9 billion gallons per year by mid 2008, and the record corn crop of 2007, ethanol production alone is likely to come close to the 2008 RFS.

The 2009 RFS of 10.5 billion gallons is much more problematic. The combined RFS for 2008 and 2009 equates to 10 billion gallons of ethanol production from the 2008 corn crop. That level would be 31% of the June USDA 2008 corn crop forecast. USDA is forecasting 4,000 bushels of 2008 corn, over 33% of the crop, will be used for ethanol. Given the flooding that has occurred since the USDA production forecast was issued the impact of the RFS on market conditions has likely increased.

In the event of a crop shortfall, such as is happening in 2008, the RFS still mandates a fixed amount of use for biofuels. Unless the EPA and Department of Agriculture agree to reduce the RFS in a short-crop year a higher price of feedstocks would need to choke off enough feed use, food use and exports to make the RFS mandate possible. There are no specific guidelines for adjusting the RFS to account for feedstock supplies.

In 2008, the first year of the expanded RFS schedule, we are already seeing the effect of the higher RFS on corn and other commodity prices. Farmers reduced corn acres due to high soybean prices from 2007. Extremely wet weather has flooded large areas of Iowa, Illinois and Indiana. Ponding in fields has been extensive, and plantings were about two weeks later than normal.

As of the week of June 15 USDA reported that 57% of the corn crop was rated Good or Excellent compared to 70% in 2007. Only 56% of the soybean crop was rated Good or Excellent compared to 65% in 2007. Conditions declined significantly from the prior week. In addition, corn and plantings were both well behind normal. As of June 15 only 84% of soybeans were planted compared to 95% in 2007.

USDA has already reduced its estimate of feed corn available from the 2008 crop by 1 billion bushels versus 2007. Exports are also forecast to be lower and ending corn and soybean stocks are forecast to be at minimum pipeline levels[8].

The effect of the expanded RFS on 2008 corn prices has been dramatic. Since the Energy Act was signed on December 19, 2007 corn prices have marched steadily upward by over $3 per bushel (Figure 3). Soybean prices have followed also setting new record highs (Figure 4).

[8] USDA. WAOB. World Agricultural Supply and Demand Estimates. 6-10-2008

Given prospects for a reduced corn crop in the face of the guarantee of 10 billion gallons of ethanol production during the 2008/2009 corn marketing year the market is fully justified in these price increases. In fact, if crop prospects decline further much higher prices are likely necessary to reduce feed use and exports by enough to accommodate the 2008/2009 RFS.

Figure 3: Corn Prices, July 2009 Futures, as of June 12, 2008

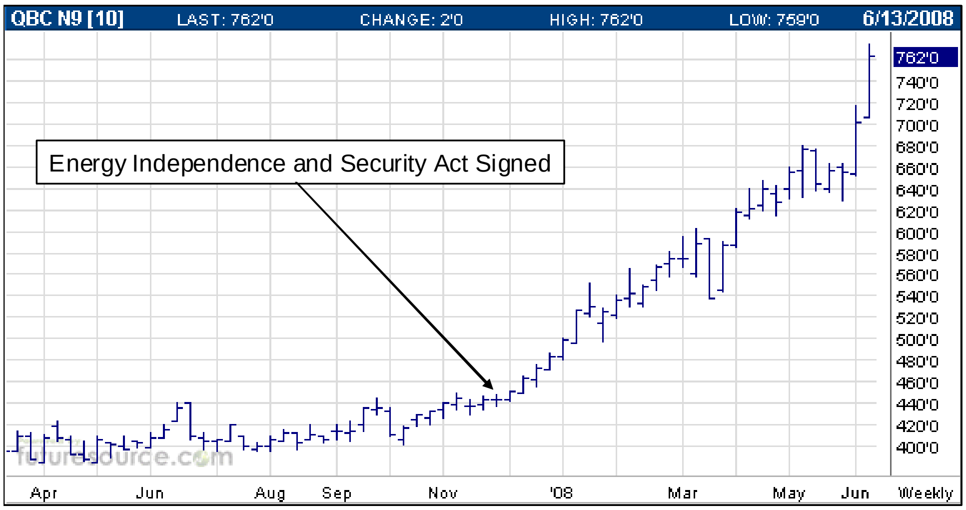


Figure 4: Soybean Prices, July 2009 Futures, as of June 12, 2008

Feedstock Demand and Price Effects of the Renewable Fuel Tax Credits: The tax credits given blenders for ethanol and biodiesel lower the actual **cost** of those fuels by the amount of the credit. This partially explains why the market **prices** of biofuels can exceed their petroleum-based counterparts. In 2009 the effective price paid for ethanol will be about $0.45 per gallon less than the market price. For soy-based methyl ester the effective price is $1.00 less than the methyl ester market price.

Competition among blenders ensures that the majority of the tax credit is passed back to biofuels producers. Market conditions may allow blenders to keep a portion of the tax credit if there is oversupply of a biofuel, but this tends to be short term.

Above the RFS amount, the U.S. cannot produce enough corn or soybeans to make a major difference in overall energy supplies. **To replace just the U.S. gasoline supply with 100% ethanol would use not only the U.S. corn crop, but the entire world's total grain crop.** Blending all U.S. diesel with 20% soybean-based methyl ester would require about 70 billion pounds of soybean oil, 3.5 times the current U.S. soyoil production and 25% of the world's total vegetable oil supply.

While there are limits on **supply**, the long term **demand** for ethanol and biodiesel is effectively limited only by the underlying demand for gasoline and diesel. With essentially unlimited potential demand, and limited feedstock supplies, the market will ensure that feedstock producers, not biofuel producers, will be the major beneficiaries of biofuel production and biofuel policies that support that production.

In summary, tax credits given to biofuel blenders subsidize biofuel producers. However, biofuel producers must compete for limited supplies of feedstocks. Given a limited supply of feedstocks, biofuel producers will tend to bid up feedstock prices until they cannot afford to build additional capacity. The end result is that tax credits flow from taxpayers to blenders to biofuel producers to feedstock producers. At the current time the only major U.S. potential feedstock sources are corn and soybeans.

Combined Effects of the RFS and Tax Credits: Federal biofuels policy, by design, distorts market forces of demand for biofuels and the underlying demand for feedstocks. Normally, a market price will reflect both the value that consumers place on a product and the costs of production of suppliers. Also, we normally expect that if prices rise consumers will buy less and producers will want to supply more. Thus the classic demand and supply diagram, Figure 5. In Figure 5 price and quantity are determined by the intersection of the 2 lines at point A. A movement in either line will change equilibrium Point A, and both price and quantity.

For biofuels, the RFS creates a portion of the demand curve that does not respond to price. The 2008 RFS specifies 9 billion gallons of renewable biofuel production regardless of price. For 2009 that amount increases to 10.5 billion gallons.

Long term market demand for biofuels is essentially unlimited by potential demand. That is, relative to the supply limit imposed by feedstocks, potential amounts of biofuels are near-perfect substitutes for gasoline and diesel. This is true even if we do not support biofuels with tax credits.

Figure 5: Normal Supply and Demand Market

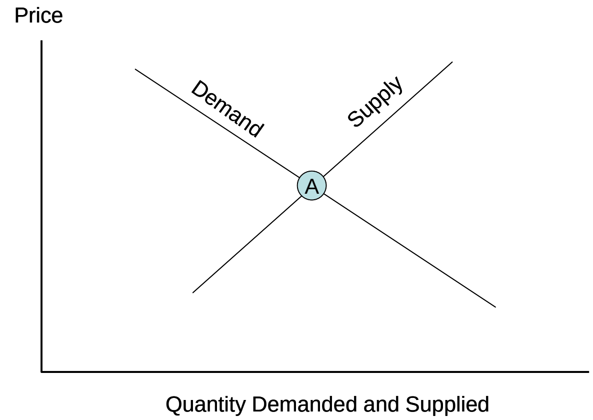
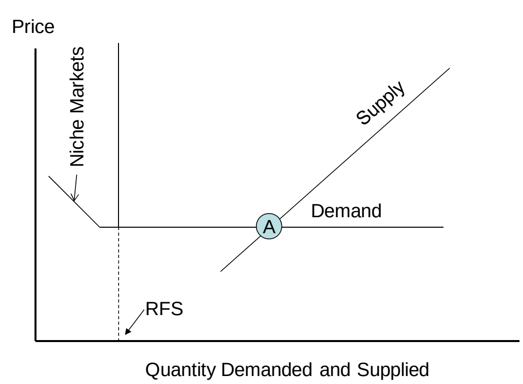


Figure 6 shows a general demand curve for a biofuel with a RFS mandate but no tax credit. The graph assumes that the supply is sufficient to meet the RFS. Assuming the RFS is set at a volume that more than satisfies higher value/price niche markets (oxygenation or MTBE replacement for ethanol) the equilibrium price will be the energy value of the biofuel as a substitute for a petroleum product, and the quantity produced is determined by the intersection of supply and demand at point A. The energy value is set by the BTU content of the biofuel relative to the petroleum fuel (about 66% for ethanol, near 100% for methyl ester). If wholesale gasoline is priced at $3.00 per gallon the energy value of ethanol is $1.98. The horizontal part of the demand curve would be at a price of $1.98 per gallon.

At that price the market will freely substitute the biofuel for petroleum fuel. As the price of petroleum fuel changes, the price for biofuel will also change in the same direction. In Figure 6, the demand line will shift up if the price of petroleum-based fuel increases and down if it decreases. If the petroleum price declines enough no biofuel production may be possible if cost exceeds the petroleum product price.

Figure 6: Biofuel Supply and Demand with RFS, no Tax Credit



Note that if we shift the supply curve in Figure 6 to the right the price of the biofuel does not change. The supply curve's position is determined largely by the supply of the feedstock available. So, if the feedstock supply increases, shifting the biofuel supply curve to the right, the value of the feedstock does not change, but production increases. This seems to defy logic, but in this case the supply of the biofuel feedstock is simply too small relative to the larger energy market to make any difference in prices. The effect is that the biofuel demand curve beyond the RFS sets a price for the biofuel, and thus the underlying feedstock price.

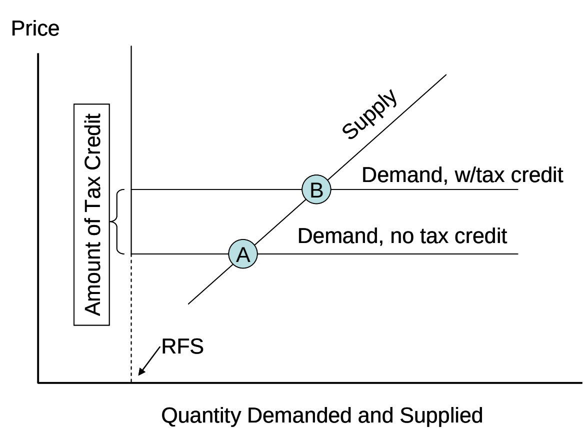
We have seen this effect clearly with the 2007 U.S. corn crop. A record 13+ billion bushel crop had no depressing effect on prices. Rapidly expanding ethanol production, due to extraordinary profits of 2005-2006, soaked up all the additional production, and more. Corn prices actually increased despite the large crop.

Simply put, at a given demand level we cannot produce enough agriculturally-based biofuel feedstocks to depress the prices of those feedstocks for more than a short period of time. Biofuel market value, and the underlying feedstock value, is based on a much larger energy market that dwarfs potential biofuels production by a factor of about 100.

A fixed per gallon tax credit shifts the demand curve for biofuels by the amount of the credit. That is, at any given production level the credit increases the price that can be paid for the biofuel. In the case of ethanol, the Federal tax credit shifts the demand line for ethanol upward by the amount of the credit and moves the equilibrium from A to B in Figure 7. In Figure 7 the lower demand line reflects the market value of the biofuel based on its economic value as a fuel. The higher demand line reflects the increased value made possible by a fixed tax credit. For simplicity's sake the sloping demand curve to the left of the RFS is ignored.

In addition to increasing price, the tax credit also increases the amount supplied by producers. At point B the price of ethanol is higher, as is the amount produced. As point B implies more acreage for the crop planted for this biofuel's feedstock those acres will be taken from other crops, or from previously unplanted land.

Figure 7: Biofuel Supply and Demand with RFS and Tax Credit

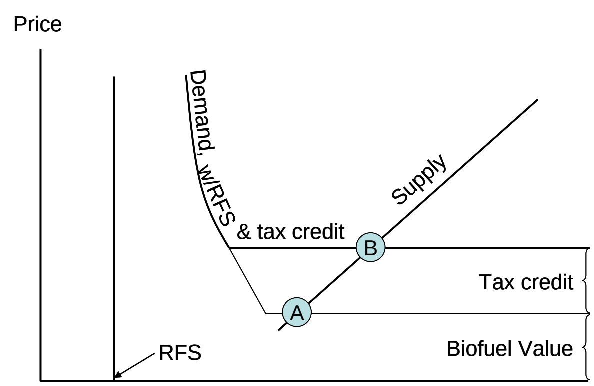


Of course, corn and soybeans have many uses other than biofuels. Biofuel producers must compete with those who want to produce food and other products. The total demand for biofuel feedstocks is the sum of the demand for all users.

For uses other than biofuel production, mainly food production, demand for feedstocks is the normal sloping demand curve (as shown in Figure 5). As prices increase food production users will reduce feedstock use. However, both corn and soybean use for food production is known to not be very responsive to prices, especially in the short run.

Figure 8 shows the combined feedstock demand for biofuels and other uses with both the effects of the RFS and a tax credit. The flat portion of the demand curve is shifted upward by the tax credit. In the case of corn, the upward shift is the value of ethanol made from corn. Since a bushel of corn yields about 2.75 gallons of ethanol the 2009 minimum $0.45 tax credit increases the market value of corn by about $1.24 per bushel ($0.45 times 2.75). Looked at another way, the tax credit reduces the corn price the biofuel producer pays by $1.24.

Figure 8: Total Feedstock Supply and Demand with RFS and Tax Credit[9]
(Feedstock supply sufficient to exceed RFS without tax credit)



The RFS portion of biofuel policy also results in an increased feedstock demand curve slope. Total use is less responsive to price due to the fact that the RFS does not decline with increasing prices[10]. Bruce Babcock, Iowa State University professor of Agricultural Economics, reached the same conclusion in a paper published in early 2008[11].

Figure 8 was drawn so that the supply and demand curves imply that biofuels demand will set the minimum price for corn with or without a tax credit. Biofuel

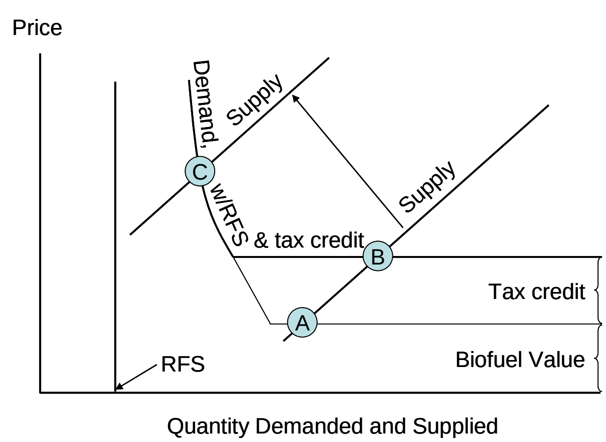
[9] Figures 8 and 8a are for illustrative purposes only. No attempt was made to estimate the actual positions of the lines.
[10] The RFS can be reduced by decision of the Secretary of Agriculture and the EPA. How this might happen and what role feedstock prices might play is not spelled out in the energy act.
[11] Babcock, Bruce. "When Will the Bubble Burst?". Iowa Ag Review. Winter 2008 Vol. 14 No. 1

production is not limited by price, and will exceed the RFS. This is not the only possibility (Figure 8a).

In Figure 8a the supply line is shifted to the left, possibly due to a partial crop failure. At Point C the price of the feedstock has increased enough to choke off non-biofuel usage enough to make the RFS feasible. Again, the effect of the RFS in a feedstock shortage scenario is to increase prices until enough competing uses are choked off to make the RFS possible. **This is where we find ourselves in 2008. If the RFS is not reduced there is no theoretical upper limit to the price as the crop worsens.**

In summary, U.S. biofuels policy increases feedstock prices via a tax credit for biofuel use and also increases feedstock prices and price volatility via the RFS. By subsidizing one use of feedstocks, biofuels, less total agricultural production is available for other uses, mainly food production and exports. As a consequence of higher prices more of some feedstocks are supplied. However, all of the increased supply will go into biofuel use, and other crop production is reduced to satisfy the increased feedstock demand. As we have seen with soybeans, the price effects of the biofuel policy thus spread to other crops, and their prices as well.

Figure 8a: Total Feedstock Supply and Demand with RFS and Tax Credit
(Feedstock supply insufficient to meet RFS)



Finally, the feedstock price effects of biofuels policy can severely distort crop production decisions and other crop prices. Crops supplying biofuels feedstocks with high policy support levels will have increased acreage; other crops will have less land available. All crops affected by lower acreage will see increased prices, even though they may not be used for biofuel production.

U.S. soybean acreage decreased in 2007 despite biofuel subsidies for soyoil-based biodiesel. Ethanol tax credits, taken back to underlying feedstock production economics, are significantly more valuable than soy-diesel. To make soybean oil competitive with corn used for ethanol would require a significant increase in the biodiesel tax credit. In effect, the ethanol tax credit is so attractive that it has severely curtailed the biodiesel market.

In 2008 we have seen an acreage shift back to soybeans and away from corn due to the doubling of soybeans prices that happened after the 2007 acreage shift to corn. However, with soybean stock depleted by the small 2007 crop the increased soybean production will not be enough to have any major effect on soybean oil prices.

In summary, U.S. biofuel policy offers a guaranteed minimum biofuel and feedstock market, shifts demand upward for crops supplying feedstocks, distorts planting decisions, and artificially raises prices throughout the U.S. crop sector. Those higher prices are increased revenue for feedstock producers, but costs to all feedstock users. The next section contains estimates of the magnitude of those cost increases.

Modeling the RFS Cost Effects of U.S. Biofuel Support Policy

In 2008, the first year of a new energy policy, we are already experiencing the effects of the expanded RFS. Corn acreage is down and extremely wet weather is sharply reducing yield prospects from that smaller acreage.

Modeling the cost effects of the RFS on feedstock prices and users requires a number of market-based assumptions. The most important variable in the model is crop production. With large crops relative to the demands of the RFS prices may not be materially affected. However, if the RFS is large relative to the crop, and competing demand, prices become highly volatile.

To estimate the impact of the RFS policy models of biofuel production system and costs were needed. A model from the University of Minnesota was used for ethanol production and a simple Iowa State University model was used for soy-based biodiesel. These models are incorporated into the overall FarmEcon LLC policy cost model.

Up until late 2007 the RFS was too small relative to feedstock supplies to have much feedstock demand and price effect. In 2008 the increased RFS and prospects of a smaller corn crop are having a dramatic effect on prices. If the corn crop is even smaller than the current USDA forecast the effects are increased by the price-inelastic nature of the RFS.

Given the rapidly evolving conditions affecting crop production there are two scenarios presented in this paper. The first ("USDA") is the impact of the RFS if the USDA June crop production forecast for corn and soybeans is correct. The second ("Weather Impact") is an estimate of the RFS impact if crop production is only slightly lower than the USDA forecast and the RFS is not reduced. The Weather Impact scenario is an attempt to forecast the possible impact of the USDA July crop production estimate to be issued at 8:30 AM EDT on July 11, 2008.

Underlying assumptions, crop years 2007/2008 and 2008/2009: The 2007/2008 USDA scenario balance sheets reflect current USDA estimates as of June 10, 2008. Crop balance sheet estimates for 2008/2009 were also taken as given by USDA in the June 10 WASDE report cited earlier. The Weather Impact estimate with a smaller crop was prepared by FarmEcon LLC. FarmEcon LLC estimates for 2008/2009 corn and soybean production are based on prior experience in 1995 when both harvested acreage and yields were reduced by wet weather in May and June.

Major assumptions in the FarmEcon LLC Weather Impact estimate for the RFS impact are:

1. The RFS is 9 billion gallons for 2008 and 10.5 billion for 2009. Over the 2008/2009 crop year the weighted RFS is 10 billion gallons.

2. Corn harvested acreage is reduced by 1.3 million versus the June 10 USDA estimate. Soybean harvested acreage is reduced by 1 million acres versus the USDA estimate. These reductions reflect a combination of flooding and prevented planting due to excessive moisture.

3. Corn yield is estimated to be 140 bushels per acre, slightly less than the June USDA estimate of 148.9, to reflect continued heavy rains across Iowa, Illinois and Indiana. Similarly, soybean yields are estimated at 39 bushels per acre versus 42.1 for USDA for the same reason.

4. Supply, demand and price estimates were made for full enforcement of the 10 billion gallon 2008/2009 RFS and a 50% reduction to 5 billion gallons. Note that this implies that both the 2008 and 2009 RFS are reduced by 50%

All historical energy data were compiled from the Department of Energy and the Nebraska Ethanol Board.

Summary of Results: Differences between the full RFS and 50% reduction scenarios for key variables are shown in Table 2 for crop years 2007/08 & 2008/2009. Differences are calculated for both the current USDA crop production forecast and the Weather Impact scenario.

The results tell us that in both cases if ethanol were to compete with other uses without the full RFS fewer gallons of the biofuel would be produced. Other corn and soybean users would have more of the feedstock crops available, and also at lower prices. With the lower prices of the reduced RFS scenario costs of producing meat, poultry, dairy and other food products would be higher than 2007/2008, but lower than with the full RFS. Gasoline prices would rise slightly due to less ethanol production. In the case of the Weather Impact scenario overall energy costs fall due to the reduced cost of ethanol production more than offsetting the higher costs for gasoline.

Complete corn and soybean balance sheets are in the appendix of the paper.

Table 2: 2007/08 & 2008/2009, Full and 50% RFS, Key Variables
USDA June Production and Weather Impact Scenarios

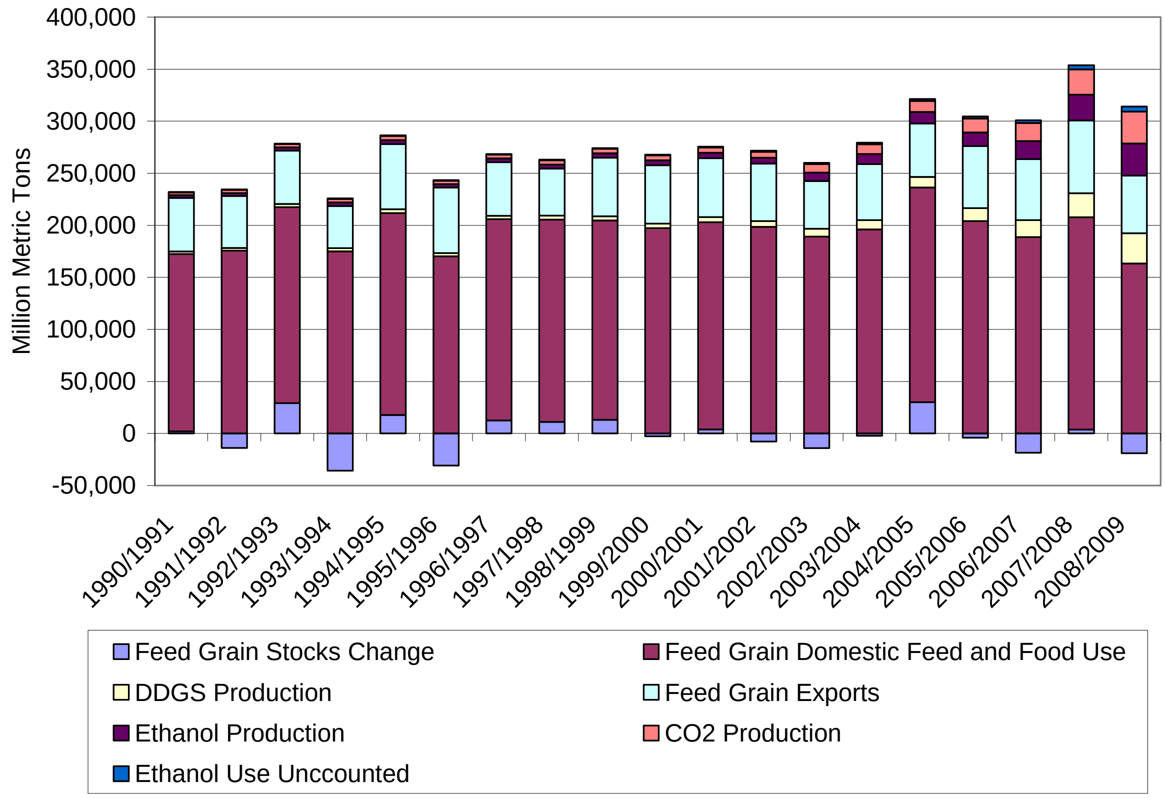
		Current USDA Forecast, Mandate Impact			Additional Weather Impact, Mandate Impact		
Item	Estimated, USDA, 2007/2008	2008/2009 USDA, No Mandate Relief	2008/2009 USDA, 50% Mandate Relief	Difference: USDA 2008/2009 With 50% Mandate Relief	2008/2009 Weather Impact, No Mandate Relief	2008/2009 Weather Impact, 50% Mandate Relief	Difference: Weather Impact 2008/2009 With 50% Mandate Relief
Corn							
Corn Average Price, $/Bu.	$4.35	$5.80	$4.75	-$1.05	$8.00	$5.75	-$2.25
Corn Used for Feed and Food, Mill. Bu.	7,510	6,510	6,960	450	6,060	6,760	700
Corn Ending Stocks	1,433	673	873	200	693	643	(50)
Cost of Domestic Corn, Feed and Food, $Billion	$32.67	$37.76	$33.06	-$4.70	$48.48	$38.87	-$9.61
DDGS							
DDGS, Dry Matter, Average price, $/ton	$180.00	$200.00	$170.00	-$30.00	$290.00	$230.00	-$60.00
DDGS Equivalent, Dry Matter, Mill. Tons	24.30	32.40	26.33	(6.08)	30.38	24.30	(6.08)
Cost of DDGS, $ Billion	$4.37	$6.48	$4.48	-$2.00	$8.81	$5.59	-$3.22
Soybean Meal							
Soybean Meal Average Price, $/Ton	$315.00	$325.00	$315.00	-$10.00	$500.00	$350.00	-$150.00
Soybean Meal Used for Feed, Mill. Tons	34.80	35.05	35.05	-	34.00	34.00	-
Cost of Domestic Soybean Meal, $Billion	$10.96	$11.39	$11.04	-$0.35	$17.00	$11.90	-$5.10
Soybean Oil							
Soybean Oil Average Price, $/lb	$0.54	$0.54	$0.55	$0.01	$0.60	$0.58	-$0.03
Soybean Oil Used for Food, Bill. Lbs.	15.60	15.50	15.50	-	15.00	15.00	-
Cost of Domestic Soybean Oil, $Billion	$9.84	$10.04	$10.80	$0.76	$10.80	$10.35	-$0.45
Ethanol							
Ethanol Average Price, Omaha Rack, $/gallon	$2.20	$2.76	$2.76	$0.00	$3.85	$2.76	-$1.09
Ethanol Production, billion gallons	8.25	11.00	8.94	(2.06)	10.31	8.25	(2.06)
Corn Use for Ethanol Production, Mill. Bu.	3,000	4,000	3,250	-750	3,750	3,000	-750
Cost of Corn To Ethanol Producers, $ Bill.	$13.05	$23.20	$15.44	-$7.76	$30.00	$17.25	-$12.75
Cost of ethanol, $ billion	$18.15	$30.36	$24.67	-$5.69	$39.75	$22.77	-$16.98
Gasoline							
Gasoline Average Price, Omaha Rack, $/gallon	$2.75	$3.50	$3.53	$0.03	$3.51	$3.55	$0.04
Gasoline Production, billion gallons	140.00	138.19	139.55	1.36	138.64	140.00	1.36
Cost of gasoline, $billion	$385.00	$483.65	$492.60	$8.95	$486.62	$497.00	$10.38
Total Cost to U.S. Feed and Food Production	$57.85	$65.67	$59.38	-$6.30	$85.09	$66.71	-$18.38
Total Cost to U.S. Energy Users, $ Billion	$403.15	$514.01	$517.27	$3.26	$526.37	$519.77	-$6.60
Total Cost to U.S. Economy, $ Billion	$461.00	$579.68	$576.64	-$3.04	$611.46	$586.48	-$24.98

Discussion:

Corn and DDGS Prices and Use: With the full 10 billion gallon RFS combined food and feed use is reduced by 1 and 1.45 billion bushels in the USDA and Weather Impact scenarios. Essentially all of the reductions come from feed use. Partially offsetting the reduced amount of corn for feeding is increased DDGS[12] production. However, DDGS is far from a perfect substitute for corn or other feed grains. The actual feed grains available for U.S. feed and food use in the Weather Impact scenario is reduced to the lowest level of the past 20 years (Figure 9) [13].

[12] In practice a variety of distiller's grains are produced by ethanol plants. A standardized 10% moisture DDGS product is used in this paper to model the effects of the RFS.
[13] In Figure 9 ethanol production was calculated as 2.75 gallons per bushel of corn used for ethanol. DDGS production was calculated as 17 pounds per bushel of corn used for ethanol. CO_2 production was calculated as 18 pounds per bushel of corn used for ethanol. Ethanol use unaccounted for is the difference between the total amount of corn used and the yields of ethanol, DDGS and CO_2. Unaccounted ethanol use is mostly water that was in the corn refined into ethanol.

Figure 9: U.S. Feedgrain[14] Use for Ethanol, Export and Domestic Feed and Food Weather Impact Scenario



Under the USDA scenario the changes in prices and use are modest relative to the size of the markets. Decreased corn feeding is somewhat offset by increased DDGS production.

In the Weather Impact scenario almost all of the additional production cut is taken out of feed and food use. Corn prices are forced up to $8 per bushel in order to take corn used for feed and food down to 6,060 million bushels. Corn exports (see Appendix) are also reduced further in this scenario.

The large drop in feed grain availability for U.S. feed and food consumption in the Weather Impact scenario is likely the driving force behind the recent sharp run-up in corn and other feed grain prices[15]. With exports already forecast to decline, rapidly increasing ethanol demand since 2005 is the major driving force behind the reduced feed grain availability for feed and food production, and the sharp increase in prices. Corn prices will need to average an estimated $8 per bushel, up 80% from 2007/2008, to cause the large reduction needed in feed use. DDGS prices would increase in line with corn, averaging $110 per ton higher than 2007/2008. The

[14] Feedgrains = total corn, sorghum, barley and oats.
[15] July, 2009 corn futures closed at a record high of $7.95 as of the date of this report.

combined “full RFS” effects of higher corn and DDGS prices would be an added $12.83 billion in feed and food production costs from these two items alone.

Soybean Meal and Oil Prices and Use: In both scenarios the RFS does not materially affect soybean use in 2008/2009. The assumed larger 2008 soybean crop, even in the Weather Impact scenario, is sufficient to meet the reduced feeding needs of feed users. However, soybean meal prices rise due to the higher corn prices. Food production costs are increased by an estimated $5.1 billion in the Weather Impact scenario and marginally in the USDA scenario. The effects on the soybean oil market in both scenarios are negligible.

However, if the soybean production forecast in the Weather Impact scenario is reduced further the impact on soybean oil and meal supplies and prices are higher than shown.

Ethanol Prices, Costs, and Production: In the USDA scenario with the full RFS in force 11 billion gallons of ethanol are produced. Corn use for ethanol is forecast at 4 billion bushels.

In the Weather Impact scenario, with lower corn production, it requires an $8.00 corn price to ration corn use for exports, food and feed to meet the RFS demand. Ethanol production falls to 10 billion gallons, 1 billion lower than the USDA scenario, and just enough to meet the RFS. Corn used for ethanol declines to 3.75 billion bushels.

Higher corn prices force the cost and price of ethanol production higher in the Weather Impact scenario. If ethanol producers only recover their operating costs the ethanol price needs to increase to $3.85 per gallon due to higher corn prices and subsequent higher cost of ethanol production. The price of ethanol would thus exceed forecast gasoline prices. The cost of 2008/2009 ethanol production would increase due to the RFS and the smaller corn crop.

If the RFS is reduced 50% in 2008/2009 ethanol buyers would not be required to purchase enough ethanol to force corn prices as high as with the full RFS in force. Ethanol production would drop, as would corn demand and prices. Ethanol producers would find it possible to produce 8.94 billion gallons in the USDA scenario and 8.25 billion in the Weather Impact scenario. Both would be the second highest ethanol production on record. However, a significant portion of the ethanol industry would be idled in either case.

Note that the reduced cost of ethanol production helps offset the increased cost of gasoline that would be a result of an RFS reduction. In the Weather Impact a net savings of $6.6 billion would be available to energy users from the substitution of lower cost gasoline for ethanol produced with very high cost corn.

Gasoline Prices and Production: In the two scenarios and a 50% RFS reduction ethanol production is reduced by either 2.06 (USDA) or 2.75 (Weather Impact) billion gallons compared to the full RFS-USDA scenario of 2008/2009. However, regardless of the scenario ethanol production is equal to or higher than 2007/2008. **Gasoline**

production in 2008/2009 is either less than or equal to 2007/2008 in all scenarios.

The price differences in gasoline for the scenarios are based on two different sets of analysis. In the first, the increase in gasoline production was measured against global oil supply and an assumed gasoline demand elasticity of -0.10[16]. Global oil supply in 2008/2008 will be about 1.3 trillion gallons. The $3.50 gasoline price and need for 138.19 billion gallons of production in the USDA scenario with no RFS reduction is used as a base point.

In second analysis the crack spreads[17] of gasoline, diesel fuel, heating oil and jet fuel were regressed against crude oil prices and ethanol production[18]. The data were from January 2000 through May 2008. In none of the regressions did ethanol production affect the product crack spreads. Crude oil prices did have a strong affect on diesel, heating oil and jet fuel spread, but not on gasoline. **This analysis indicates that ethanol production is having no affect on U.S. petroleum pricing for these products, including gasoline. If we use the regression results there is no difference in gasoline prices among all the scenarios and the impact of the RFS is significantly raised.**

Another piece of evidence for minimal effect on gasoline prices is that U.S. refineries are running at only 88% of capacity, well below the normal summer level of 90-91%[19]. Increasing gasoline supply would not be an issue for the petroleum sector.

By-Product Proteins: Products such as meat and bone meal, fish meal, distiller's grains and feather meal have seen price increases that are similar to soybean meal. The 2007 reduction in soybean acres as a result of the ethanol program is a major driver in those price increases. Price increases from 2004 to January 2008 for several key feed ingredients are shown in Table 3 but are not included in this analysis. Reductions in the costs of these and similar feed ingredients could add significantly to the benefit of RFS reduction but are not included in this analysis.

Table 3: 2004-2008 Other Feed Ingredient Price Increases

Item	2004	Forecast 2008/2009, Full RFS	% Change 2004-2008
Meat and Bone Meal/Ton	$191.68	$350.00	83%
Meat Meal/Ton	$190.63	$375.00	97%
Sunflower Meal/Ton	$107.42	$200.00	86%
Feather Meal/Ton	$246.86	$450.00	82%
Yellow Grease/Ton	$335.70	$650.00	94%
Rice Millfeed/Ton	$27.05	$55.00	103%
Distillers grains, 50%	$45.00	$90.00	100%

[16] That is, a 1% change in supply changes price by 10% in the opposite.
[17] The difference between the price of a petroleum product versus crude oil price.
[18] Regression results are shown in an appendix
[19] http://tonto.eia.doe.gov/dnav/pet/pet_pnp_wiup_dcu_nus_w.htm

RFS Effects on Livestock, Dairy and Poultry Production and Prices

Poultry, red meat and dairy are the major food production users of corn, soybean meal and other feed ingredients. Combined use of these sectors account for nearly all of the feed use reported for corn and soybean meal by USDA. Most of the consumption of ethanol feed by-products is also accounted for in the model.

A major portion of the cost impact of biofuel policy thus falls on animal feed users of corn and soybeans. Costs also fall on other users. Food use of soybean oil, food and industrial use of corn other than ethanol, ethanol users and biodiesel users also pay higher feedstock costs as a result of biofuels support policies. Ethanol, now the largest user of U.S. corn (if you count each feed user as a separate category), is the most heavily affected by policy-driven price increases for corn.

In the Weather Impact scenario, and no change in the RFS, reduced amounts of corn mandated for ethanol production will result in large reductions in meat, dairy and poultry production. The reductions shown in Table 4 are based on the USDA/ERS demand elasticity database. Items with the lowest demand elasticities – milk and eggs – were reduced less than items with high price elasticities.

Table 4: Effects of the RFS on Production, Corn and Soybean Prices, and Use

Item	2008/2009 USDA, No Mandate Relief	2008/2009 USDA, 50% Mandate Relief	2008/2009 Weather Impact, No Mandate Relief	2008/2009 Weather Impact, 50% Mandate Relief
	% Change	*% Change*	*% Change*	*% Change*
Effects on Corn and Soybean Production, Prices and Use				
Corn production	-10%	-10%	-17%	-17%
Corn supply	-7%	-7%	-15%	-15%
Ethanol corn use	33%	8%	25%	0%
Corn feed use	-16%	-9%	-24%	-12%
Corn price	33%	9%	84%	28%
Soybean production	20%	20%	9%	9%
Soybean supply	2%	2%	-5%	-5%
Soybean meal feed use	1%	0%	-2%	-2%
Soybean meal price	3%	-3%	59%	11%
Effects on Meat, Poultry and Dairy Production				
Broiler production	-4%	-2%	-8%	-3%
Turkey production	-4%	-2%	-8%	-3%
Egg production	-2%	-1%	-4%	-2%
Pork production	-8%	-3%	-15%	-5%
Fed beef production	-8%	-3%	-15%	-5%
Milk production	-2%	-1%	-4%	-1%

The reductions in Table 4 are needed to reduce feed use, also accounting for changes in DDGS production, in line with reduced feedstuff supplies. Reduction in the RFS would reduce the impact of a smaller 2008 corn crop, but not eliminate it.

Note that for both scenarios the reduction in corn feed use is much larger than any of the required reductions in the individual food items. In the past meat and dairy producers have been able to cope to some extent with high feed costs by reducing feed input per unit of output. As a result, finished food output does not change as much as corn feeding.

Estimated Changes in 2008/2009 Meat, Poultry and Dairy Prices

The increase in feed costs that have occurred since early 2007 had little impact on meat, poultry and dairy production as of mid-2008. Given the long production cycles in animal agriculture it normally takes months, or years, for higher costs to result in producer decisions that result in changes in production numbers and market prices. While mid-2008 profitability indicators for meat and poultry production were depressed well below normal levels, production was still generally higher than prior year levels.

Without a reduced RFS that will all change in the coming months. Meat, poultry and dairy producers will find it necessary to deal with not only higher feed costs, but the sheer availability of feed ingredients at any price. Based on the reductions in production needed to balance feed use with available supply Table 5 shows estimates of those reductions on prices and the CPI for the selected items and the overall Food at Home index.

Price elasticities for calculating the price increases were taken from the USDA/ERS elasticity database[20]. From a range of studies the most recent were selected.

Table 5: 2008/2009 Increases in the CPI Food at Home Price Index
USDA Current Production and Weather Impact Scenarios

Item	USDA Current RFS Price Increase	USDA, 50% RFS Relief Price Increase	Weather Impact, Current RFS Price Increase	Weather Impact, 50% RFS Relief Price Increase
Broilers	14.7%	5.5%	26.7%	10.0%
Turkey	8.0%	3.0%	14.5%	5.4%
Eggs	38.7%	19.3%	70.3%	35.1%
Pork	12.0%	4.0%	21.8%	7.3%
Beef	23.3%	7.8%	42.4%	14.1%
Milk	14.3%	3.6%	26.1%	6.5%
Weighted Average Increase	18.4%	6.5%	33.5%	11.8%
Increase in CPI Food at Home	3.9%	1.4%	7.1%	2.5%

With the current USDA production forecast for corn and soybeans the implications for consumer food prices would be for a modest rise of about 4 percentage points in the CPI Food at Home Price index. Reducing the RFS to 50% of its current level would cut that impact by more than half, to only 1.4 points.

[20] http://www.ers.usda.gov/Data/Elasticities/Query.aspx

If the Weather Impact scenario is used the impact on consumer prices is much larger. In order to maintain the current RFS the Food at Home CPI will need to increase an additional 7 percentage points over the 2008/2009 year. The prices of meat, poultry and dairy items will need to increase, on average, about 33% as available supplies shrink. Reducing the RFS would hold that to about 12%. Reducing the RFS would keep the impact of short corn supplies on price increases in the Food at Home Index to about 2.5 percentage points.

Conclusions

Maintenance of the current RFS schedule in the face of the Weather Impact scenario for the 2008 corn and soybean crops will be devastating to meat, dairy and poultry producers. Consumers will suffer as food and fuel costs rise rapidly and supplies of corn-based foods diminish. The overall economy will be damaged from higher food price inflation and lost jobs in the food production sector.

The 2008/2009 increase in fuel production made possible by the RFS is almost too small to measure against the global energy market, but the effects on food prices and security are huge. The U.S. government should re-examine and reduce the RFS in light of the damage it can do to our food production capacity, food security for the U.S., and the overall welfare of the country.

Appendix: Corn and Soybean Balances

Corn Production, Supply and Use

Item	2006/2007	2007/2008 June USDA Est.	2008/2009 June USDA fcst.	2008/2009 Weather Impact, No Mandate Relief	2008/2009 USDA, 50% Mandate Relief	2008/2009 Weather Impact, 50% Mandate Relief
Area Harvested (Mill. Ac.)	70.6	86.5	78.8	77.5	78.8	77.5
Yield (Bu/Ac)	149.1	151.1	148.9	140.0	148.9	140.0
Beginning Stocks (Mill. Bu.)	1,967	1,304	1,433	1,433	1,433	1,433.0
Production (Mill. Bu.)	10,535	13,074	11,735	10,850	11,735	10,850.0
MY Imports (Mill. Bu.)	12	12	15	20	15	20.0
Total Supply (Mill. Bu.)	12,514	14,393	13,183	12,303	13,183	12,303.0
MY Exports (Mill. Bu.)	2,125	2,450	2,000	1,800	2,100	1,900
Feed Consumption (Mill. Bu.)	5,598	6,150	5,150	4,700	5,600	5,400
FSI Consumption (Mill. Bu.)	3,488	4,360	5,360	5,110	4,610	4,360
Fuel Ethanol Consumption (Mill. Bu.)	2,117	3,000	4,000	3,750	3,250	3,000
Other FSI Consumption (Mill. Bu.)	1,371	1,360	1,360	1,360	1,360	1,360
Total Domestic Consumption	9,086	10,510	10,510	9,810	10,210	9,760
Total Consumption (Mill. Bu.)	11,210	12,960	12,510	11,610	12,310	11,660
Ending Stocks (Mill. Bu.)	1,304	1,433	673	693	873	643
U.S. Average Farm Price, Corn, $/Bu.	$3.04	$4.35	$5.80	$8.00	$4.75	$5.75

Soybean Production, Supply and Use

Item	2006/2007	2007/2008 June USDA Est.	2008/2009 June USDA fcst.	2008/2009 Weather Impact, No Mandate Relief	2008/2009 USDA, 50% Mandate Relief	2008/2009 Weather Impact, 50% Mandate Relief
Area Harvested (Mill. Ac.)	74.6	62.8	73.8	72.4	73.8	72.4
Yield (Bu/Ac)	42.7	41.2	42.1	39.0	42.1	39.0
Beginning Stocks (Mill. Bu.)	449	574	125	186	125	186
Production (Mill. Bu.)	3,188	2,585	3,105	2,824	3,105	2,824
MY Imports (Mill. Bu.)	9	10	8	8	8	8
Total Supply (Mill. Bu.)	3,647	3,169	3,238	3,018	3,238	3,018
MY Exports (Mill. Bu.)	1,118	1,110	1,050	950	1,050	950
Crush (Mill. Bu.)	1,806	1,840	1,840	1,750	1,840	1,750
Feed Waste Dom. Cons. (Mill. Bu.)	148	94	172	150	172	150
Total Dom. Cons. (Mill. Bu.)	1,955	1,934	2,012	1,900	2,012	1,900
Total Use	3,073	3,044	3,063	2,850	3,063	2,850
Ending Stocks (Mill. Bu.)	574	125	175	168	175	168
Farm Price, $/Bu.	$6.43	$10.00	$11.75	$14.50	$10.50	$12.00

Appendix: Regression Analysis of Ethanol Production Effect on Fuel Prices

Gasoline price spread against WTI and ethanol production

Regression Statistics	
Multiple R	0.301581307
R Square	0.090951285
Adjusted R Square	0.07239927
Standard Error	12.72730266
Observations	101

ANOVA

	df	*SS*	*MS*	*F*
Regression	2	1588.255986	794.1279928	4.90250179
Residual	98	15874.45485	161.9842331	
Total	100	17462.71083		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	9.653312574	3.183468584	3.032325377	0.003105449
Cushing, OK WTI Spot Price FOB (Cents per Gallon)	0.031089529	0.039060711	0.795928384	0.427997424
Ethanol Production, 1,000 Barrels	0.000325455	0.000916322	0.355174986	0.723221776

Heating oil price spread against WTI and ethanol production

Regression Statistics	
Multiple R	0.861095496
R Square	0.741485452
Adjusted R Square	0.736209645
Standard Error	6.411417338
Observations	101

ANOVA

	df	*SS*	*MS*	*F*
Regression	2	11554.51758	5777.258791	140.5444588
Residual	98	4028.414683	41.10627228	
Total	100	15582.93226		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-5.420905202	1.603681959	-3.380286952	0.001040906
Cushing, OK WTI Spot Price FOB (Cents per Gallon)	0.124813403	0.019676952	6.343126998	6.96576E-09
Ethanol Production, 1,000 Barrels	-0.000134068	0.0004616	-0.290441877	0.77209193

Diesel price spread against WTI and ethanol production

Regression Statistics	
Multiple R	0.884966265
R Square	0.783165289
Adjusted R Square	0.778740091
Standard Error	7.6046283
Observations	101

ANOVA

	df	*SS*	*MS*	*F*
Regression	2	20469.4741	10234.73705	176.9785801
Residual	98	5667.376414	57.83037158	
Total	100	26136.85051		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-8.197808085	1.902138727	-4.309784545	3.89135E-05
Cushing, OK WTI Spot Price FOB (Cents per Gallon)	0.142501744	0.023338974	6.105741544	2.06042E-08
Ethanol Production, 1,000 Barrels	0.000413521	0.000547507	0.755280867	0.451891898

SUMMARY OUTPUT
Jet fuel price spread against WTI and ethanol production

Regression Statistics	
Multiple R	0.887490546
R Square	0.787639469
Adjusted R Square	0.783305581
Standard Error	8.151245983
Observations	101

ANOVA

	df	*SS*	*MS*	*F*
Regression	2	24150.58984	12075.29492	181.7396754
Residual	98	6511.395485	66.44281108	
Total	100	30661.98532		

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-7.824850641	2.038863708	-3.837848803	0.000219896
Cushing, OK WTI Spot Price FOB (Cents per Gallon)	0.14483012	0.02501657	5.7893675	8.51496E-08
Ethanol Production, 1,000 Barrels	0.000694843	0.000586861	1.183999185	0.239277226

Data: DOE, Energy Information Administration, June 11, 2008. The period used is January 2000 through May 2008. April/May ethanol production was partially estimated based on March DOE data plus RFA reports on new capacity coming on-line.

Observations:

- Gasoline’s price spread regressed against the WTI crude price and ethanol production showed no correlation. The t-Statistics for both independent variables were not different from zero. This implies that factors other than these two variables are associated with the price spread. Ethanol production had no independent effect on gasoline prices over the period.

- Price spreads of diesel fuel, heating oil and jet fuel were strongly correlated with the WTI crude price, but not correlated with ethanol production. The correlation with the WTI crude price would indicate that increased costs of crude used in the refining process are being at least partially captured by refineries. This could also be an indirect indication that U.S. and global demand for these fuels is stronger than gasoline.

Conclusion: Ethanol production had no independent effect on price spreads of any of the products over the period examined. Crude oil prices are the driving force behind product prices, not ethanol.