Food and Agricultural
Policy Research Institute

MU FAPRI

Staff Report

Impacts
of a
15 Billion Gallon
Biofuel Use
Mandate

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Summary

United States Senate Bill S.1321, the Energy Savings Act of 2007, includes a proposed change in the renewable fuel standard. The bill requires the use of 15 billion gallons of biofuels by 2015, which is double the level of biofuel use required for 2012 under current law.

This report examines the impacts of requiring a minimum of 15 billion gallons of biofuel use by 2015. The report does not consider other aspects of S.1321, such as the proposal to increase the mandated use of biofuels by three billion gallons per year after 2015, with the increase to come from "advanced biofuels."

The point of comparison for the analysis is the stochastic baseline for US agricultural and biofuel markets prepared by the Food and Agricultural Policy Research Institute (FAPRI) in early 2007. That baseline maintained current agricultural policies and assumed the extension of current biofuel tax credits and tariff provisions. The scenario assumes the mandated level of biofuel use is increased to 15 billion gallons in 2015, but maintains all the other assumptions of the baseline.

This report presents tables showing average results across 500 stochastic outcomes. The outcomes differ from one another because they are based on a range of assumptions concerning petroleum prices, crop growing conditions and a number of other factors affecting agricultural commodity and biofuel supply and demand. Selected results for 2015 are presented in Table 1.

- Relative to the baseline, ethanol production increases by an average of 2.4 billion gallons, or 19 percent. Imports also increase.

- Domestic use of ethanol and biodiesel slightly exceeds the mandate, on average. The mandate is most likely to be exceeded if high petroleum prices increase market demand for biofuels. The mandate is usually binding when petroleum prices are low.

- By placing a floor under demand for biofuels, the mandate increases average prices for ethanol and biodiesel. Plant prices for ethanol increase by an average of $0.25 per gallon (16 percent) in the 2015/16 marketing year relative to the baseline.

- Increased ethanol production results in greater demand for corn along with higher prices for corn and other agricultural commodities. Corn prices increase by an average of 6.6 percent relative to the baseline in the 2015/16 marketing year.

- Higher corn prices result in a 2.3 million acre increase in 2015 corn acreage with reduced acreage for soybeans and other crops.

- Farm program outlays decline by $0.21 billion in fiscal year 2015, as higher commodity prices reduce spending on price-based payment programs.

- Crop receipts increase by $3.7 billion relative to the baseline. The increase in net farm income is $1.6 billion. The increase in crop receipts is offset by higher feed costs for livestock producers, higher rental payments and other increases in production costs.

- Consumer food expenditures increase by $0.82 billion (0.1 percent) in 2015.

Table 1. Summary of 2015 impacts of a 15 billion gallon biofuel mandate

	Baseline	15 Billion Gallon Mandate	Absolute Difference	Percentage Difference
Ethanol Supply, Use, and Price	(Million Gallons, 2015)			
Production	12,604	15,024	2,420	19.2%
Net Imports	333	550	217	65.0%
Domestic Use	12,924	15,543	2,619	20.3%
	(Dollars per Gallon, 2015/16)			
Price, FOB Omaha Plant	1.58	1.83	0.25	15.8%
Corn Supply and Use	(Million Bushels, 2015/16			
Production	14,054	14,414	359	2.6%
Ethanol Use	4,126	5,024	898	21.8%
Feed Use	5,902	5,666	-236	-4.0%
Exports	2,543	2,282	-261	-10.3%
Crop Planted Acreage	(Million Acres, 2015)			
Corn	89.57	91.85	2.28	2.5%
Soybeans	70.05	68.86	-1.18	-1.7%
10 Other Crops Plus Hay	153.16	152.90	-0.26	-0.2%
Conservation Reserve Area	31.92	31.57	-0.34	-1.1%
12 Crops + Hay + CRP	344.69	345.19	0.50	0.1%
Prices	(Dollars per Bushel, 2015/16)			
Corn	3.06	3.26	0.20	6.6%
Soybeans	6.48	6.65	0.17	2.7%
Wheat	4.20	4.29	0.10	2.3%
	(Dollars per Ton, 2015/16)			
Soybean Meal	159.48	160.00	0.52	0.3%
Dried Distillers' Grains	105.83	99.61	-6.22	-5.9%
	(Cents per Pound, 2015/16)			
Upland Cotton	58.94	59.18	0.24	0.4%
Soybean Oil	34.54	35.60	1.06	3.1%
Farm Program Spending	(Billion Dollars, FY2015)			
Net CCC Outlays	10.62	10.41	-0.21	-2.0%
Farm Income	(Billion Dollars, 2015)			
Crop Receipts	156.25	159.91	3.66	2.3%
Livestock Receipts	137.13	137.85	0.71	0.5%
Government Payments	10.45	10.26	-0.19	-1.8%
Feed Costs	38.32	39.35	1.04	2.7%
Rent to Nonoperator Landlords	13.99	14.88	0.89	6.4%
Other Production Costs	239.43	240.15	0.72	0.3%
Other Net Farm Income	48.21	48.26	0.05	0.1%
Net Farm Income	60.31	61.90	1.59	2.6%
Consumer Food Expenditures	(Billion Dollars, 2015)			
US Total	958.44	959.26	0.82	0.1%

Introduction

The Energy Policy Act of 2005 includes a renewable fuel standard requiring the use of 7.5 billion gallons of biofuels by 2012. The proposed Energy Savings Act of 2007 (S.1321), would increase the required use of biofuels, beginning in 2008. By 2015, S.1321 would require the use of 15 billion gallons of biofuels. In subsequent years, the bill calls for a three billion gallon annual increase in the mandate, until it reaches 36 billion gallons in 2022. After 2015, the increase is to be provided by "advanced biofuels" including biodiesel, cellulosic ethanol and other biofuels not derived from corn starch.

This report examines the impact of increasing the biofuel mandate to the levels specified in S.1321 through 2015. The report does not examine other aspects of the bill or of other energy legislation being considered by Congress.

The point of comparison for the analysis is the FAPRI stochastic baseline prepared in January and February 2007, and based on information available in mid-January. The stochastic baseline consists of 500 sets of alternative agricultural and biofuel market outcomes for the period from 2007 to 2016. These 500 alternative outcomes share a common assumption that provisions of the 2002 farm bill that are currently scheduled to be expire in 2007 will instead be extended indefinitely. Biofuel support measures, including the ethanol and biodiesel tax credits and the ethanol tariff, are also extended when they would otherwise expire. The outcomes differ from one another in assumptions about the weather, petroleum prices, and other factors that affect agricultural commodity supply and demand. More detail on the 2007 FAPRI stochastic baseline can be found in the "FAPRI U.S. Baseline Briefing Book" on the FAPRI-MU website, www.fapri.missouri.edu.

The baseline is compared to a scenario that sets the 2008-2015 mandated amount of biofuel use at the levels specified in S. 1321 (Table 2).

Table 2. Baseline and scenario biofuel use mandates and baseline biofuel use

	Baseline Mandate (Energy Policy Act of 2005)	Scenario Mandate (Energy Savings Act of 2007)	Baseline Ethanol Plus Biodiesel Domestic Use
	(Billion Gallons)		
2008	5.4	8.5	10.1
2009	6.1	10.5	11.8
2010	6.8	12.0	12.6
2011	7.4	12.6	12.8
2012	7.5	13.2	12.8
2013	7.6	13.8	12.9
2014	7.7	14.4	13.1
2015	7.8	15.0	13.3

The use mandate can be met with domestically produced ethanol or biodiesel, or with imported biofuels. Thus, the requirement should not be seen as a mandate to produce the listed levels of corn-based ethanol in each year. Assuming a continuation of the existing tariff on imported ethanol (currently slated to expire in January 2009), ethanol import levels are expected to remain modest relative to domestic production and consumption. Likewise, projected levels of biodiesel and cellulosic

ethanol production are relatively small compared to conventional ethanol production. So, most of the mandate is likely to be met by US-produced corn-based ethanol.

Remaining tables within this report present average estimated changes from baseline values for a variety of indicators related to biofuel and agricultural markets. The reported averages summarize 500 stochastic outcomes that may differ from one another in important respects.

For example, the baseline assumes that average petroleum prices decline by approximately $10 per barrel between 2006 and 2016, but the stochastic analysis looks at a range of possible petroleum prices. In the outcomes where petroleum prices are assumed to be much higher than the average, ethanol prices and production levels exceed the average of all 500 outcomes. In some of those stochastic baseline outcomes, ethanol production in 2015 far exceeds 15 billion gallons. Under those conditions, imposing a 15 billion gallon use mandate does not have large market impacts, given the modeling approach used for the analysis.

On the other hand, some of the stochastic outcomes assume much lower levels of petroleum prices, which translate into lower ethanol prices and production levels under current policies. Under those circumstances, requiring the use of 15 billion gallons of biofuels by 2015 may result in larger changes than the reported averages across all 500 stochastic outcomes. While the tables may obscure some of these important differences in the results, the figures provided at the end of the report represent an attempt to highlight at least some of the sensitivity of the results.

Ethanol market

The 15 billion gallon biofuel mandate results in a 2.6 billion gallon average increase in US ethanol use in 2015, relative to the baseline (Table 3). Most of the increase is supplied by an increase in production of US corn-based ethanol. Ethanol imports increase by 217 million gallons, but remain a modest share of US ethanol supplies, assuming the existing tariff on ethanol imports is extended.

Producer prices for ethanol must increase to generate the required level of ethanol supplies. The estimated increases are small in early years, as the required changes in ethanol supplies are modest relative to the baseline. The average price increase relative to the baseline reaches $0.21 per gallon in calendar year 2015 and $0.25 per gallon over the 2015/16 corn marketing year.

Increased production of ethanol results in a corresponding increase in production of distillers' grains and other coproducts of corn-based ethanol production. On a dry-equivalent basis, production of distillers' grains increases by an average of 6.6 million tons in 2015/16. Exports increase, but most of the increase in production must be absorbed by domestic feed markets. To encourage livestock producers to use more of the product in feed rations, the dried distillers' grains (DDG) price declines by $6 per ton (six percent) relative to the baseline in 2015/16.[1]

Net returns over operating costs for dry mill ethanol producers increase, but by less than the increase in ethanol prices. The increase in ethanol prices is partially offset by the reduction in DDG prices and an increase in corn prices. Greater returns to ethanol producers result in both an expansion of production capacity and an increase in the proportion of existing capacity which is utilized.

These results do not consider possible effects of requiring large annual increases in the biofuel use mandate for 2016 and subsequent years. Under S.1321, the mandate increases by three billion gallons per year beginning in 2016, with all of the increase to come from "advanced biofuels," which do not include ethanol produced from corn starch. If approved, this provision is likely to result in substantial investment in cellulosic ethanol, biodiesel and other fuels designated as "advanced biofuels." Effects of this investment would likely be felt before 2016, but those effects are not reflected in this analysis.

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[1] The model used for the analysis assumes there is a maximum level of distillers' grains that can be fed to each species of livestock, and then estimates inclusion rates as a function of relative prices of distillers' grains, corn, and soybean meal.

Table 3. Ethanol and related markets under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Calendar or Crop Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Ethanol				(Million Gallons, Calendar Year)					
Production	0	40	231	587	969	1,325	1,668	2,016	2,420
From Corn	0	39	227	575	949	1,295	1,622	1,942	2,289
From Other Feedstocks	0	1	5	11	18	25	31	37	44
Cellulosic	0	0	0	1	2	5	14	37	87
Net Imports (Ethyl Alcohol)	0	0	3	14	35	62	98	150	217
Disappearance	0	40	228	585	985	1,370	1,750	2,150	2,619
Ending Stocks	0	1	8	24	43	60	76	92	110
Renewable Fuel Mandate	0	3,100	4,400	5,200	5,200	5,700	6,212	6,725	7,239
				(Dollars per Gallon, Calendar Year)					
Plant Price, FOB Omaha	0.00	0.00	0.02	0.05	0.08	0.10	0.14	0.17	0.21
Distillers, Brewers Grains				(Thousand Tons, Sep.-Aug. Year)					
Production (Dry Equivalent)	2	315	1,212	2,236	3,155	4,008	4,794	5,598	6,592
Domestic Use	1	297	1,152	2,126	3,004	3,820	4,570	5,339	6,295
Net Exports	0	18	60	110	151	188	224	259	297
				(Dollars per Ton, Sep.-Aug. Year)					
Price, Lawrenceburg, IN	0.00	-0.25	-0.86	-1.76	-2.74	-3.57	-4.49	-5.27	-6.22
Corn Dry Milling Returns				(Dollars per Gallon, Sep.-Aug. Year)					
Ethanol Value	0.00	0.01	0.04	0.07	0.09	0.13	0.16	0.20	0.25
Distillers Grains Value	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02
Total Receipts	0.00	0.01	0.03	0.06	0.09	0.12	0.15	0.18	0.23
Corn Cost	0.00	0.01	0.02	0.03	0.04	0.05	0.05	0.06	0.07
Fuel and Electricity Cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Operating Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Operating Costs	0.00	0.01	0.02	0.03	0.04	0.05	0.05	0.06	0.07
Net Operating Return	0.00	0.00	0.02	0.03	0.05	0.07	0.09	0.12	0.16
Percentage Changes				(Percentage Change from Baseline)					
Ethanol Production	0.0%	0.4%	2.1%	5.0%	8.1%	10.9%	13.6%	16.3%	19.2%
Ethanol Net Imports	0.0%	0.1%	1.1%	4.6%	11.5%	19.8%	31.0%	46.2%	65.0%
Ethanol Disappearance	0.0%	0.4%	2.0%	4.8%	8.0%	11.0%	14.0%	16.9%	20.3%
Ethanol Plant Price (Cal. Yr.)	0.0%	0.2%	1.1%	2.8%	4.5%	6.3%	8.4%	10.7%	13.5%
Distillers Grains Price	0.0%	-0.3%	-0.9%	-1.9%	-2.8%	-3.6%	-4.4%	-5.1%	-5.9%

Corn market

Increased production of ethanol results in an 898 million bushel (22 percent) increase in the amount of corn used for ethanol production in 2015/16 relative to the baseline (Table 4). This increase in corn demand results in higher corn prices, with the increase relative to the baseline reaching $0.20 per bushel (6.6 percent) by 2015/16.

Higher corn prices and producer returns result in more corn production. Higher prices increase producer market revenue by almost $34 per acre in 2015/16, and estimated reductions in government payments are very small.[2] Corn acreage planted increases by 2.3 million acres relative to the baseline in 2015, resulting in 359 million bushels of additional corn production.

Corn feed use falls by 236 million bushels relative to baseline levels in 2015/16. Higher corn prices and increased availability of distillers' grains encourage livestock producers to reduce the amount of corn included in feed rations. The increase in overall feed costs also results in a modest decline in livestock and poultry production, which also accounts for a small portion of the decline in corn feed use.

Corn exports decline by 261 million bushels relative to baseline levels in 2015/16 in response to higher corn prices. Foreign producers increase corn production. Livestock producers and other consumers of corn in other countries reduce corn consumption.

Slightly less corn is also used for production of high-fructose corn syrup (HFCS) and other food and industrial uses.

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[2] Baseline expenditures on the corn marketing loan and countercyclical payment (CCP) programs are very small, as baseline prices were generally above the levels that would trigger payments under those programs. In only a few of the 500 stochastic outcomes are there any payments under those programs in the baseline, and the proportion of outcomes triggering payments is further reduced under the 15 billion gallon mandate scenario.

Table 4. US corn supply and utilization under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Crop Year	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Area					(Million Acres)				
Planted Area	0.0	0.0	0.2	0.7	1.1	1.4	1.7	1.9	2.3
Harvested Area	0.0	0.0	0.2	0.6	1.0	1.3	1.6	1.8	2.1
					(Bushels per Acre)				
Yield	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					(Million Bushels)				
Supply	0	0	20	60	100	130	158	175	209
Beginning Stocks	0	0	-12	-38	-57	-78	-100	-123	-150
Production	0	0	32	98	157	208	258	299	359
Imports	0	0	0	0	0	0	0	0	0
Domestic Use	0	24	102	204	300	386	469	549	652
Feed, Residual	0	-18	-57	-90	-118	-147	-173	-202	-236
Fuel Alcohol	0	42	162	299	423	540	649	761	898
HFCS	0	-1	-2	-3	-4	-5	-5	-6	-7
Seed	0	0	0	0	0	0	0	1	1
Food, Other	0	0	-1	-2	-2	-3	-3	-3	-4
Exports	0	-11	-44	-87	-123	-157	-188	-224	-261
Total Use	0	12	58	117	178	230	281	325	391
Ending Stocks	0	-12	-38	-57	-78	-100	-123	-150	-181
CCC Inventory	0	0	0	0	0	0	0	0	0
Under Loan	0	-1	-4	-6	-9	-12	-16	-20	-24
Other Stocks	0	-11	-35	-51	-69	-88	-107	-130	-157
Prices and Returns					(Dollars)				
Farm Price/bu.	0.00	0.02	0.05	0.09	0.11	0.13	0.15	0.17	0.20
Gross Market Revenue/a.	0.02	2.35	7.80	12.93	16.47	20.35	23.85	28.75	33.80
LDP Revenue/a.	0.00	0.00	0.00	-0.02	-0.03	-0.07	-0.08	-0.20	-0.25
Variable Expenses/a.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mkt+LDP Net Returns/a.	0.02	2.35	7.80	12.91	16.44	20.28	23.77	28.55	33.58
CCP Revenue/Base a.	0.00	0.00	0.00	-0.05	-0.07	-0.11	-0.18	-0.38	-0.42
Direct Payment/Base a.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percentage Changes					(Percentage Change from Baseline)				
Production	0.0%	0.0%	0.2%	0.7%	1.2%	1.5%	1.9%	2.1%	2.6%
Feed Use	0.0%	-0.3%	-1.0%	-1.6%	-2.1%	-2.5%	-3.0%	-3.5%	-4.0%
Ethanol Use	0.0%	1.1%	3.9%	7.1%	10.1%	13.0%	15.7%	18.4%	21.8%
Exports	0.0%	-0.7%	-2.5%	-4.5%	-6.0%	-7.1%	-8.1%	-9.2%	-10.3%
Farm Price	0.0%	0.5%	1.6%	2.7%	3.3%	4.0%	4.7%	5.7%	6.6%

Soybean market

An increase in the mandated level of biofuel use results in an increase in corn production that largely comes at the expense of soybean production. Soybean acreage declines by 1.2 million acres relative to the baseline in 2015/16. Soybean production is reduced by 52 million bushels (Table 5).

Soybean markets are also affected by developments in soybean product markets. As described later, the increased biofuel use mandate affects demand for soybean oil to make biodiesel, and increased supplies of distillers' grains reduce domestic demand for soybean meal.

The net effect of the reduction in soybean production and the changes in product markets is to increase soybean prices. By 2015/16, the increase in soybean prices relative to the baseline is $0.17 per bushel, or 2.7 percent. This results in an $8 per acre increase in soybean market revenue. Reduced government payments only offset a small portion of this increase in market receipts. Soybean acreage declines because the increase in soybean returns is much smaller than the corresponding increase in returns to corn producers.

Higher soybean prices, in turn, contribute to reductions in soybean domestic use and exports. In 2015/16, soybean crush is reduced by 14 million bushels relative to the baseline, while exports are reduced by 32 million bushels.

Table 5. US soybean supply and utilization under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Crop Year	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Area					(Million Acres)				
Planted Area	0.0	0.0	-0.1	-0.4	-0.5	-0.7	-0.8	-1.0	-1.2
Harvested Area	0.0	0.0	-0.1	-0.4	-0.5	-0.7	-0.8	-1.0	-1.2
					(Bushels per Acre)				
Yield	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					(Million Bushels)				
Supply	0	0	-5	-15	-23	-31	-38	-45	-55
Beginning Stocks	0	0	1	1	0	-1	-1	-2	-3
Production	0	0	-6	-16	-22	-30	-37	-43	-52
Imports	0	0	0	0	0	0	0	0	0
Domestic Use	0	0	-2	-6	-8	-11	-13	-16	-19
Crush	0	0	-2	-4	-6	-8	-10	-12	-14
Seed, Residual	0	0	-1	-2	-2	-3	-3	-4	-4
Exports	0	0	-3	-9	-14	-19	-22	-26	-32
Total Use	0	-1	-6	-14	-22	-29	-36	-42	-50
Ending Stocks	0	1	1	0	-1	-1	-2	-3	-5
CCC Inventory	0	0	0	0	0	0	0	0	0
Under Loan	0	0	-1	-2	-2	-3	-4	-5	-7
Other Stocks	0	1	2	2	2	2	2	2	2
Prices and Returns					(Dollars)				
Farm Price/bu.	0.00	0.00	0.02	0.06	0.08	0.10	0.12	0.14	0.17
Gross Market Revenue/a.	0.00	-0.02	0.82	2.35	3.32	4.37	5.24	6.24	7.80
LDP Revenue/a.	0.00	0.00	-0.05	0.01	-0.21	-0.17	-0.46	-0.68	-0.65
Variable Expenses/a.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mkt+LDP Net Returns/a.	0.00	-0.02	0.77	2.36	3.12	4.20	4.78	5.56	7.16
CCP Revenue/Base a.	0.00	0.00	-0.01	-0.01	-0.08	-0.12	-0.26	-0.33	-0.31
Direct Payment/Base a.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48% Meal Price/ton	0.00	-0.15	0.05	0.49	0.54	0.63	0.52	0.49	0.52
Oil Price/cwt.	0.00	0.01	0.09	0.25	0.39	0.54	0.69	0.84	1.06
Crushing Margin/bu.	0.00	0.00	-0.01	-0.01	-0.02	-0.02	-0.03	-0.03	-0.04
Percentage Changes					(Percentage Change from Baseline)				
Production	0.0%	0.0%	-0.2%	-0.5%	-0.8%	-1.0%	-1.2%	-1.4%	-1.7%
Crush	0.0%	0.0%	-0.1%	-0.2%	-0.3%	-0.4%	-0.5%	-0.6%	-0.7%
Exports	0.0%	0.0%	-0.3%	-0.9%	-1.4%	-1.9%	-2.3%	-2.8%	-3.4%
Farm Price	0.0%	0.0%	0.3%	0.8%	1.1%	1.5%	1.8%	2.1%	2.7%
Meal Price	0.0%	-0.1%	0.0%	0.3%	0.3%	0.4%	0.3%	0.3%	0.3%
Oil Price	0.0%	0.0%	0.3%	0.7%	1.1%	1.6%	2.0%	2.4%	3.1%

Soybean product and biodiesel markets

Reductions in soybean production and crush result in reduced production of soybean meal and oil (Table 6). Reduced production is one reason prices increase for both products.

The increase in soybean meal prices is just $0.52 per ton (0.3 percent) in 2015/16. Increased supplies of distillers' grains result in the displacement of both corn and soybean meal in feed rations. The result is a reduction in domestic use of soybean meal. Reduced crushing margins result in a slight decline in foreign soybean crush, so the reduction in US soybean exports is partially offset by increased US exports of soybean meal and oil.

The increase in soybean oil prices in 2015/16 is about $0.01 per pound (3.1 percent) relative to the baseline. Soybean oil prices increase because of the reduction in production and the effect of higher biodiesel prices on the underlying demand for soybean oil.

The 15 billion gallon biofuel mandate primarily increases ethanol use and prices, but plant prices for biodiesel also increase (Table 7). In spite of this increase in biodiesel prices, biodiesel production actually falls slightly relative to baseline values. This occurs because the estimated increase in soybean oil prices increases the cost of biodiesel production by slightly more than the estimated increase in biodiesel prices.[3]

Two notes of caution are in order. First, it is difficult to anticipate just how biodiesel prices will respond if the higher biofuel mandate is put in place. While it seems likely that plant prices for both ethanol and biodiesel would increase to generate adequate supplies to satisfy the mandate, regulations to implement the mandate could prove decisive. Biodiesel production and consumption are very small relative to ethanol consumption in the US, so differences in how the mandate is implemented could have proportionally larger impacts on biodiesel markets than on ethanol markets.

Second, the analysis examines only the impact of a 15 billion gallon biofuel use mandate. It does not consider the possible effects of other aspects of S.1321. After 2015, the bill proposes to increase the mandated level of biofuel use by three billion gallons per year, with all of the increase to come from "advanced biofuels," a term that specifically includes biodiesel. This mandate could result in increased investment in biodiesel capacity and more biodiesel production than estimated here.

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[3] This result illustrates the difference between the economic concept of demand and the quantity consumed. The increase in the biofuel mandate increases the underlying demand for soybean oil to make biodiesel. All else equal, this would result in more soybean oil consumption at a higher price. However, cross-commodity effects arising from the increase in ethanol use result in reduced supplies of soybeans and soybean oil. The increase in demand and the reduction in supply both contribute to the increase in soybean oil prices. Prices increase enough that the quantity of soybean oil used for biodiesel production declines slightly, even though the underlying economic demand has increased.

Table 6. US soybean product supply and utilization under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Crop Year	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Soybean Oil				(Million Pounds)					
Beginning Stocks	0	0	-2	-10	-24	-39	-53	-67	-82
Production	0	-2	-17	-44	-70	-93	-115	-136	-163
Imports	0	0	0	0	0	0	0	0	0
Biodiesel Use	0	0	-13	-36	-56	-71	-78	-85	-92
Food and Other Use	0	-1	-7	-19	-29	-40	-51	-63	-76
Exports	0	1	11	25	30	32	28	27	24
Ending Stocks	0	-2	-10	-24	-39	-53	-67	-82	-101
				(Cents per Pound)					
Decatur Price	0.00	0.01	0.09	0.25	0.39	0.54	0.69	0.84	1.06
Soybean Meal				(Thousand Tons)					
Beginning Stocks	0	0	0	0	0	0	0	0	0
Production	0	-4	-36	-92	-145	-195	-239	-284	-340
Imports	0	0	0	0	0	0	0	0	0
Domestic Use	0	-18	-97	-212	-316	-411	-497	-589	-703
Exports	0	14	61	119	171	216	257	305	363
Ending Stocks	0	0	0	0	0	0	0	0	0
				(Dollars per Ton)					
Decatur Price, 48% Protein	0.00	-0.15	0.05	0.49	0.54	0.63	0.52	0.49	0.52

Table 7. US biodiesel sector results under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Calendar or Crop Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Biodiesel Production				(Million Gallons, Oct.-Sep. Year)					
From Soybean Oil	0	0	-2	-5	-7	-9	-10	-11	-12
From Canola Oil	0	0	0	-1	-1	-2	-2	-2	-2
From Other Fats and Oils	0	0	0	0	-1	-1	-1	-1	-1
Total Biodiesel Production	0	0	-2	-6	-9	-12	-13	-14	-16
Price				(Dollars per Gallon, Calendar Year)					
Biodiesel, Plant	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05
Costs and Returns				(Dollars per Gallon, Oct.-Sep. Year)					
Biodiesel Value	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06
Glycerin Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Receipts	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06
Soyoil Cost	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.08
Other Operating Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Operating Costs	0.00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.08
Net Operating Return	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02

Crop prices

The additional demand for corn resulting from a 15 billion gallon biofuel use mandate increases the price of corn by $0.20 per bushel (6.6 percent) in 2015/16 (Table 8). Substitution effects result in higher prices for other crops as well.

After corn, the largest proportional increases in prices occur for the grains that are close substitutes for corn in feed rations. Sorghum, barley, and oats prices all exceed baseline levels by four to five percent in 2015/16.

The estimated increases in soybean and wheat prices are between two and three percent in 2015/16. Higher corn prices result in reduced acreage and an increase in wheat feed use. The reduction in soybean production is proportionally larger than the reduction in wheat production, but the reduction in domestic demand for soybean meal limits the increase in soybean prices.

Estimated prices for cotton, rice, peanuts and hay all increase by less than one percent relative to the baseline, primarily because of modest reductions in production.

**Table 8. US crop prices under a 15 billion gallon biofuel mandate:
Average changes from stochastic baseline values**

Crop Year	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Absolute Changes					(Dollars per Bushel)				
Corn	0.00	0.02	0.05	0.09	0.11	0.13	0.15	0.17	0.20
Soybeans	0.00	0.00	0.02	0.06	0.08	0.10	0.12	0.14	0.17
Wheat	0.00	0.00	0.02	0.04	0.05	0.06	0.07	0.08	0.10
Sorghum	0.00	0.01	0.04	0.06	0.07	0.08	0.10	0.12	0.13
Barley	0.00	0.01	0.04	0.06	0.07	0.08	0.09	0.12	0.13
Oats	0.00	0.00	0.02	0.03	0.04	0.05	0.06	0.07	0.08
					(Dollars per Hundredweight)				
Rice	0.00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.03
					(Cents per Pound)				
Peanuts	0.00	0.00	0.01	0.05	0.08	0.10	0.12	0.14	0.17
Sunflowerseed	0.00	0.00	0.03	0.09	0.13	0.18	0.22	0.27	0.33
Upland Cotton	0.00	0.00	0.03	0.08	0.12	0.14	0.18	0.19	0.24
					(Dollars per Ton)				
Hay	0.00	0.03	0.10	0.22	0.33	0.41	0.49	0.55	0.59
Percentage Changes					(Percentage Change from Baseline)				
Corn	0.0%	0.5%	1.6%	2.7%	3.3%	4.0%	4.7%	5.7%	6.6%
Soybeans	0.0%	0.0%	0.3%	0.8%	1.1%	1.5%	1.8%	2.1%	2.7%
Wheat	0.0%	0.1%	0.4%	0.9%	1.2%	1.4%	1.7%	2.0%	2.3%
Sorghum	0.0%	0.4%	1.2%	1.9%	2.3%	2.8%	3.2%	3.9%	4.5%
Barley	0.0%	0.4%	1.1%	1.7%	2.2%	2.6%	3.0%	3.8%	4.3%
Oats	0.0%	0.2%	0.8%	1.5%	2.0%	2.5%	3.0%	3.7%	4.3%
Rice	0.0%	0.0%	0.0%	0.1%	0.2%	0.2%	0.3%	0.3%	0.4%
Peanuts	0.0%	0.0%	0.1%	0.2%	0.4%	0.4%	0.6%	0.6%	0.8%
Sunflowerseed	0.0%	0.0%	0.2%	0.6%	1.0%	1.3%	1.7%	2.0%	2.6%
Upland Cotton	0.0%	0.0%	0.1%	0.1%	0.2%	0.3%	0.3%	0.3%	0.4%
Hay	0.0%	0.0%	0.1%	0.2%	0.3%	0.4%	0.5%	0.5%	0.6%

Crop market returns and payments

Higher corn prices result in a $34 per acre increase in corn market returns in 2015/16 relative to the baseline (Table 9). Even at baseline corn prices, marketing loan benefits and countercyclical payments (CCP) are only available in a small fraction of stochastic market outcomes (primarily those where corn yields are above average and petroleum prices are below average). The higher prices in the 15 billion gallon mandate scenario mean that average marketing loan benefits and CCP are even smaller than in the baseline.

The increase in soybean prices increases market returns by about $8 per acre relative to the baseline in 2015/16. As with corn, higher soybean prices also result in lower marketing loan benefits and CCP, but the average effects are small because of the low level of such payments in the baseline. The smaller increase in soybean returns versus corn returns is consistent with acreage shifting from soybean to corn production.

For wheat, the increase in prices translates into a $4 per acre increase in market returns, with little impact on payments.

In the case of upland cotton, the increase in market returns is less than $4 per acre, and a larger portion of the increase is offset by lower government payments than is the case for other crops. In a higher proportion of the stochastic outcomes for cotton than for other crops, prices are low enough to generate marketing loan benefits and CCP.

Table 9. US crop returns and payments under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Crop Year	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Corn					(Dollars per Acre)				
Value of Production	0.02	2.35	7.80	12.93	16.47	20.35	23.85	28.75	33.80
+ Loan Program Benefits	0.00	0.00	0.00	-0.02	-0.03	-0.07	-0.08	-0.20	-0.25
= Market + Loan Returns	0.02	2.35	7.80	12.91	16.44	20.28	23.77	28.55	33.55
					(Dollars per Corn Base Acre)				
+ Countercyclical Payment	0.00	0.00	0.00	-0.05	-0.07	-0.11	-0.18	-0.38	-0.42
+ Direct Payment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
				(Dollars per Corn Base Acre Planted to Corn)					
= Returns and Payments	0.02	2.35	7.80	12.86	16.37	20.17	23.59	28.17	33.13
Soybeans					(Dollars per Acre)				
Value of Production	0.00	-0.02	0.82	2.35	3.32	4.37	5.24	6.24	7.80
+ Loan Program Benefits	0.00	0.00	-0.05	0.01	-0.21	-0.17	-0.46	-0.68	-0.65
= Market + Loan Returns	0.00	-0.02	0.77	2.36	3.12	4.20	4.78	5.56	7.15
					(Dollars per Soybean Base Acre)				
+ Countercyclical Payment	0.00	0.00	-0.01	-0.01	-0.08	-0.12	-0.26	-0.33	-0.31
+ Direct Payment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
				(Dollars per Soybean Base Acre Planted to Soybeans)					
= Returns and Payments	0.00	-0.02	0.76	2.35	3.03	4.08	4.52	5.23	6.84
Wheat					(Dollars per Acre)				
Value of Production	0.00	0.20	0.78	1.56	2.15	2.65	3.13	3.71	4.34
+ Loan Program Benefits	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.03	-0.02	-0.01
= Market + Loan Returns	0.00	0.20	0.77	1.55	2.14	2.64	3.10	3.68	4.33
					(Dollars per Wheat Base Acre)				
+ Countercyclical Payment	0.00	0.00	-0.02	-0.03	-0.03	-0.04	-0.08	-0.10	-0.06
+ Direct Payment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
				(Dollars per Wheat Base Acre Planted to Wheat)					
= Returns and Payments	0.00	0.20	0.76	1.51	2.11	2.60	3.02	3.59	4.27
Upland cotton					(Dollars per Acre)				
Value of Production	0.00	0.00	0.35	1.12	1.70	2.09	2.61	2.91	3.69
+ Loan Program Benefits	0.00	-0.02	-0.14	-0.32	-0.48	-0.59	-0.48	-0.57	-0.66
= Market + Loan Returns	0.00	-0.02	0.21	0.81	1.22	1.50	2.12	2.34	3.02
					(Dollars per Upland Cotton Base Acre)				
+ Countercyclical Payment	0.00	0.00	-0.10	-0.30	-0.39	-0.46	-0.55	-0.67	-0.82
+ Direct Payment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
				(Dollars per Upland Cotton Base Acre Planted to Cotton)					
= Returns and Payments	0.00	-0.03	0.11	0.51	0.83	1.04	1.58	1.67	2.21

Crop acreage

Corn acreage planted increases by 2.3 million acres (2.5 percent) relative to the baseline in 2015/16, as corn returns increase more than returns for other crops (Table 10).

Approximately half of the increase in corn acreage comes at the expense of soybeans. Soybean acreage is reduced by 1.2 million acres (1.7 percent) in 2015/16 relative to the baseline.

Acreage also declines for wheat, upland cotton and most other crops. The exceptions to the general rule are sorghum and barley. Prices and producer returns for those feed grains increase more than the prices for wheat and most other crops.

The increase in returns to corn and other crops is estimated to cause some producers to choose voluntarily not to renew conservation reserve contracts when they expire. Conservation reserve acreage shrinks by 0.3 million acres relative to the baseline in 2015/16.

The total acreage devoted to 12 major crops, hay and the conservation reserve increases by 0.5 million acres, or 0.1 percent in 2015/16. Higher returns do keep a few more acres in crop production, but the total area devoted to crop production is not very responsive to changes in returns.

**Table 10. US crop acreage under a 15 billion gallon biofuel mandate:
Average changes from stochastic baseline values**

Crop Year	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Planted Area					(Million Acres)				
Corn	0.00	0.00	0.22	0.68	1.07	1.38	1.69	1.94	2.28
Soybeans	0.00	0.00	-0.14	-0.37	-0.53	-0.71	-0.85	-0.98	-1.18
Wheat	0.00	0.00	-0.03	-0.09	-0.13	-0.14	-0.17	-0.19	-0.22
Upland Cotton	0.00	0.00	-0.01	-0.05	-0.07	-0.09	-0.10	-0.11	-0.13
Sorghum	0.00	0.00	0.01	0.04	0.05	0.06	0.08	0.08	0.10
Barley	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.05
Oats	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Rice	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02
Sunflowers	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Peanuts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sugar Beets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
Sugar Cane (Harvested)	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02
12 Crop Planted Area	0.00	0.00	0.06	0.21	0.39	0.51	0.65	0.75	0.86
Hay Harvested Area	0.00	0.00	0.00	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02
12 Crops + Hay	0.00	0.00	0.05	0.20	0.37	0.49	0.63	0.73	0.84
Conservation Reserve	0.00	0.00	-0.01	-0.03	-0.07	-0.12	-0.18	-0.26	-0.34
12 Crops + Hay + CRP	0.00	0.00	0.05	0.17	0.30	0.37	0.45	0.47	0.50
Percentage Changes					(Percentage Change from Baseline)				
Corn	0.0%	0.0%	0.2%	0.8%	1.2%	1.5%	1.9%	2.2%	2.5%
Soybeans	0.0%	0.0%	-0.2%	-0.5%	-0.8%	-1.0%	-1.2%	-1.4%	-1.7%
Wheat	0.0%	0.0%	0.0%	-0.2%	-0.2%	-0.2%	-0.3%	-0.3%	-0.4%
Upland Cotton	0.0%	0.0%	-0.1%	-0.3%	-0.5%	-0.6%	-0.8%	-0.8%	-1.0%
Sorghum	0.0%	0.0%	0.2%	0.6%	0.8%	0.9%	1.2%	1.3%	1.6%
12 Crops + Hay + CRP	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%

Livestock, poultry and dairy

An increase in ethanol production results in higher feed costs. Increases in grain prices outweigh the increased availability at lower prices for distillers' grains, while soybean meal prices remain near baseline levels. Producers using a high proportion of corn in their feed rations experience a larger increase in feed expenses than producers who are able to use significant amounts of distillers' grains.

Higher feed costs result in a modest decline in livestock, poultry and dairy production (Table 11). The production decline is greater for poultry and pork than it is for beef and milk, but in no case does production decline by more than one percent relative to the baseline. Reduced production translates into slightly higher prices for fed cattle, hogs, chicken and milk, but all of the increases are less than two percent relative to the baseline. Feeder steer prices decline marginally, as higher feed costs lead to lower bids from feedlot operators, in spite of higher fed cattle prices.

Higher meat and poultry prices result in lower levels of domestic consumption and exports. Consumer meat and poultry prices increase by an average of about $0.01 per pound in 2015 relative to the baseline.

Table 11. US livestock, poultry and dairy under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Calendar Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Production				(Million Pounds)					
Beef	0	0	-1	-4	-8	-13	-16	-21	-25
Pork	0	0	-1	-7	-21	-42	-64	-83	-101
Broiler	0	0	-9	-40	-84	-128	-174	-219	-270
Turkey	0	0	-1	-3	-5	-5	-6	-6	-7
Milk	0	0	-9	-37	-74	-111	-147	-185	-231
Domestic Use									
Beef	0	0	0	-2	-5	-7	-7	-8	-8
Pork	0	0	-1	-3	-9	-16	-22	-25	-28
Chicken	0	0	-4	-21	-51	-84	-117	-149	-183
Net Exports									
Beef	0	0	0	-1	-3	-6	-8	-13	-17
Pork	0	0	0	-3	-11	-25	-41	-57	-72
Chicken	0	0	-5	-17	-31	-42	-55	-68	-85
Prices				(Dollars Per Hundredweight)					
Nebraska Direct Steers	0.00	0.00	0.01	0.07	0.15	0.24	0.32	0.38	0.44
OK City Feeder Steers	0.00	0.00	-0.09	-0.22	-0.24	-0.10	-0.05	-0.02	-0.08
Barrows & Gilts, 51-52%	0.00	0.00	0.02	0.09	0.24	0.42	0.58	0.69	0.81
Broilers, 12 City Wholesale	0.00	0.00	0.05	0.21	0.40	0.55	0.73	0.88	1.08
Turkeys, E. Region Wholes.	0.00	0.00	0.05	0.18	0.34	0.43	0.53	0.61	0.72
All Milk	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.04	0.05
				(Cents Per Pound)					
Beef Retail	0.00	0.00	0.03	0.16	0.37	0.62	0.81	1.00	1.18
Pork Retail	0.00	0.00	0.03	0.13	0.33	0.58	0.80	0.96	1.12
Chicken Retail	0.00	0.00	0.02	0.10	0.26	0.46	0.65	0.85	1.06
Percentage Changes				(Percentage Change from Baseline)					
Beef Production	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	-0.1%
Pork Production	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.2%	-0.3%	-0.4%	-0.4%
Broiler Production	0.0%	0.0%	0.0%	-0.1%	-0.2%	-0.3%	-0.4%	-0.5%	-0.7%
Milk Production	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	-0.1%	-0.1%
Nebraska Steer Price	0.0%	0.0%	0.0%	0.1%	0.2%	0.3%	0.4%	0.4%	0.5%
Feeder Steer Price	0.0%	0.0%	-0.1%	-0.2%	-0.3%	-0.1%	0.0%	0.0%	-0.1%
Barrow & Gilt Price	0.0%	0.0%	0.0%	0.2%	0.4%	0.8%	1.2%	1.5%	1.6%
Broiler Price	0.0%	0.0%	0.1%	0.3%	0.6%	0.8%	1.0%	1.2%	1.5%
All Milk Price	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%	0.2%	0.3%	0.3%

Government farm program outlays

Under current farm program provisions, payments under the marketing loan and CCP programs depend on market prices. In the FAPRI baseline, average prices for grains and oilseeds are above levels that would trigger payments under those programs. In only a small share of 500 stochastic outcomes are market prices low enough to generate significant payments to grain and oilseed producers under the marketing loan and CCP programs.

The 15 billion gallon biofuel use mandate results in even higher prices than in the baseline for grains and oilseeds. The result is to reduce marketing loan benefits and CCP relative to the baseline (Tables 12 and 13). Average soybean program savings are actually slightly larger than corn program savings because baseline expenditures on corn marketing loan benefits and CCP are already so low that there are few dollars to be saved when prices increase.

In addition to the changes in grain and oilseed payments, other government farm program costs are also reduced. Dairy program spending declines slightly, as higher prices reduce the average cost of operating the price support program.[4] Sugar program outlays also decline slightly for similar reasons. Conservation Reserve Program (CRP) spending is also reduced a little because the model assumes a slight voluntary reduction in program enrollment in response to the increase in crop returns. This effect could be partially offset by increased payment rates for those who elect to remain in the program, but only if rental rates are increased.

Finally, what is labeled as "other net costs" includes net interest outlays. Higher commodity prices result in lower loan program activity, which is assumed to result in a modest reduction in net interest outlays.

Overall, net outlays by the Commodity Credit Corporation (CCC) decline by $209 million relative to the baseline in fiscal year 2015. This would offset a portion of the increase in expenditures on biofuel blending credits. Given a $0.51 per gallon baseline tax credit for ethanol blenders, the 2.6 billion gallon increase in ethanol use in 2015 would increase the value of ethanol tax credits by about $1.3 billion. A full accounting of budget costs and benefits is beyond the scope of this analysis, but would include effects on gasoline excise taxes and much more.

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[4] Since the FAPRI baseline was prepared before legislation was approved to extend the Milk Income Loss Contract (MILC) program, the MILC program was assumed to expire in 2007. If the program were extended in the baseline, the scenario would have shown some modest savings in MILC expenditures because of higher milk prices.

Table 12. US farm program outlays under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Fiscal Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Feed Grains					(Million Dollars)				
Corn	0	0	-2	-3	-6	-10	-16	-23	-42
Sorghum	0	0	0	0	0	0	0	-1	-1
Barley	0	0	0	0	-1	-1	-1	-3	-3
Oats	0	0	0	0	0	0	0	-1	-1
Food Grains									
Wheat	0	-1	-2	-4	-5	-5	-6	-9	-10
Rice	0	0	0	-1	-1	-2	-2	-3	-4
Oilseeds									
Soybeans	0	0	0	-5	-3	-18	-20	-45	-67
Peanuts	0	0	0	0	-1	-2	-3	-3	-4
Other Oilseeds	0	0	0	0	0	0	-1	-1	-2
Other Commodities									
Upland Cotton	0	0	0	-4	-9	-15	-19	-19	-23
Sugar	0	0	0	-1	-1	-5	-4	-5	-8
Dairy	0	0	0	-1	-2	-3	-3	-4	-7
CCC Conservation									
Conservation Reserve	0	0	0	-1	-4	-7	-12	-18	-24
Other CCC Conservation	0	0	0	0	0	0	0	0	0
Tobacco Trust Fund	0	0	0	0	0	0	0	0	0
Other									
Disaster Payments, NAP	0	0	0	0	0	0	0	0	0
Other Net Costs	0	0	-1	-3	-5	-7	-9	-11	-14
Net CCC Outlays	0	-1	-6	-23	-39	-78	-96	-146	-209

Table 13. Selected government payments under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Crop Year	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
					(Million Dollars)				
Direct Payments	0	0	0	0	0	0	0	1	1
Marketing Loans	0	0	-6	-8	-29	-31	-55	-84	-87
Counter-cyclical Payments	0	0	-4	-15	-23	-31	-52	-77	-80
Total	0	0	-11	-23	-52	-62	-106	-160	-166

Note: Includes direct payments, marketing loans (loan deficiency payments and marketing loan gains) and counter-cyclical payments for feed grains, food grains, oilseeds, and upland cotton.

Farm cash receipts and production expenses

Higher prices and production for corn and other feed grains result in a $3.3 billion increase in feed grain cash receipts in 2015 relative to the baseline (Table 14). Wheat, soybean, and other crop receipts also increase slightly.

Livestock, poultry and dairy cash receipts increase as the effect of higher prices more than offsets small reductions in production. Total cash receipts from crop and livestock marketings increase by $4.4 billion relative to the baseline in 2015.

Higher prices for corn and other grains increase feed costs to livestock producers by $1.0 billion relative to the baseline in 2015 (Table 15). The increase in feed costs is slightly greater than the increase in livestock cash receipts, suggesting part of the increase in feed costs is reflected in lower net returns to livestock, poultry, and dairy producers.

Purchased livestock expenditures decline marginally, as feeder cattle prices are reduced slightly. Increased corn acreage results in an increase in seed, fertilizer and chemical costs.

 Part of the increase in net returns over operating costs for crop producers is captured by landlords in the form of higher rental rates. Net rental payments to nonoperator landlords increase by $0.9 billion relative to the baseline.

Total farm production expenses increase by $2.6 billion relative to the baseline in 2015.

Table 14. US farm cash receipts under a 15 billion gallon biofuel mandate:
Average changes from stochastic baseline values

Calendar Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
					(Billion Dollars)				
Feed Grains	0.00	0.08	0.40	0.95	1.47	1.91	2.34	2.79	3.31
Food Grains	0.00	0.01	0.03	0.06	0.08	0.10	0.12	0.14	0.17
Oilseeds	0.00	0.00	0.00	0.03	0.06	0.08	0.10	0.13	0.17
Cotton	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.02	-0.02	-0.02
Sugar	0.00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.03
Other Crops	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cattle	0.00	0.00	-0.01	-0.01	0.02	0.09	0.12	0.15	0.15
Hogs	0.00	0.00	0.01	0.02	0.06	0.10	0.14	0.17	0.19
Dairy Products	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.06	0.06
Poultry, Eggs	0.00	0.00	0.02	0.07	0.12	0.16	0.21	0.25	0.31
Other Livestock	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
Total Cash Receipts	0.00	0.08	0.45	1.13	1.85	2.49	3.10	3.70	4.37

Table 15. US farm production expenses under a 15 billion gallon biofuel mandate:
Average changes from stochastic baseline values

Calendar Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
					(Billion Dollars)				
Feed	0.00	0.02	0.13	0.32	0.49	0.61	0.74	0.87	1.04
Purchased Livestock	0.00	0.00	-0.02	-0.04	-0.04	-0.02	-0.01	-0.01	-0.02
Seed	0.00	0.00	0.00	0.01	0.02	0.03	0.04	0.04	0.05
Fertilizer and Chemicals	0.00	0.00	0.02	0.05	0.09	0.11	0.14	0.17	0.20
Fuels and Electricity	0.00	0.00	0.01	0.02	0.02	0.03	0.04	0.04	0.05
Interest	0.00	0.00	0.00	0.01	0.01	0.03	0.04	0.06	0.08
Capital Consumption	0.00	0.00	0.00	0.01	0.02	0.04	0.07	0.10	0.14
Rent to Non-Operators	0.00	0.01	0.05	0.15	0.29	0.44	0.59	0.74	0.89
All Other	0.00	0.00	0.02	0.05	0.09	0.12	0.15	0.18	0.22
Total Production Expenses	0.00	0.03	0.21	0.57	0.99	1.40	1.80	2.20	2.65

Net farm income and farm real estate values

The 15 billion gallon biofuel mandate results in higher farm cash receipts and net farm income (Table 16). Relative to the baseline, 2015 crop receipts increase by $3.7 billion and livestock receipts by $0.7 billion.

Offsetting part of the increase in receipts are reductions in government payments and increases in production costs. Net farm income increases by $1.6 billion in 2015, less than half the increase in crop receipts.

An increase in net returns to crop producers results in an increase in farm real estate values (Table 17). Average farm real estate values increase by $39 per acre (1.4 percent) relative to the baseline in 2015.

Table 16. US farm income statistics under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Calendar Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
					(Billion Dollars)				
1. Farm Receipts	0.00	0.07	0.43	1.11	1.83	2.46	3.08	3.67	4.33
Crops	0.00	0.08	0.44	1.04	1.62	2.10	2.57	3.07	3.66
Livestock	0.00	0.00	0.01	0.09	0.23	0.38	0.53	0.63	0.71
Farm-Related	0.00	-0.01	-0.03	-0.03	-0.02	-0.02	-0.02	-0.03	-0.04
2. Government Payments	0.00	0.00	-0.01	-0.01	-0.04	-0.06	-0.09	-0.15	-0.19
3. Gross Cash Income (1 + 2)	0.00	0.07	0.42	1.09	1.78	2.40	2.98	3.52	4.14
4. Nonmoney Income	0.00	0.00	0.00	0.01	0.02	0.04	0.07	0.10	0.14
5. Value of Inventory Change	0.00	-0.03	-0.05	-0.05	-0.04	-0.07	-0.08	-0.06	-0.04
6. Gross Farm Income (3 + 4 + 5)	0.00	0.05	0.37	1.05	1.76	2.37	2.97	3.55	4.23
7. Cash Expenses	0.00	0.03	0.21	0.57	0.97	1.35	1.73	2.09	2.48
8. Total Expenses	0.00	0.03	0.21	0.57	0.99	1.40	1.80	2.20	2.65
9. Net Cash Income (3 - 7)	0.00	0.04	0.22	0.53	0.81	1.05	1.26	1.43	1.66
10. Realized Net Farm Inc (3 + 4 - 8)	0.00	0.04	0.22	0.52	0.81	1.05	1.25	1.42	1.63
11. Net Farm Income (6 - 8)	0.00	0.02	0.17	0.48	0.77	0.98	1.17	1.35	1.59
Deflated (1997 $)	0.00	0.01	0.13	0.36	0.57	0.71	0.84	0.95	1.09

Table 17. US average farm real estate values under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Calendar Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
					(Dollars per Acre)				
National Average, Jan. 1	0.00	0.00	0.61	2.59	6.76	12.96	20.28	28.89	38.54
				(Percentage Change from Baseline)					
Proportional Change	0.0%	0.0%	0.0%	0.1%	0.3%	0.5%	0.8%	1.1%	1.4%

Consumer food expenditures

The 15 billion gallon biofuel mandate results in higher prices for meats, dairy products, grains, vegetable oils and sugar. These higher prices translate into slightly higher consumer food expenditures (Table 18).

Relative to the baseline, 2015 expenditures on food to be consumed at home increase by a little under two dollars per capita. More than half of the increase results from higher meat expenditures. Expenditures on food away from home also increase slightly.

The average increase in national food expenditures in 2015 is $817 million, an increase of 0.1 percent relative to the baseline. The proportional change in consumer food expenditures is modest, both because the increases in farm gate prices are fairly modest for most commodities, and because farm gate prices account for a small share of consumer food expenditures.

Table 18. US consumer food expenditures under a 15 billion gallon biofuel mandate: Average changes from stochastic baseline values

Calendar Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Food at Home					(Dollars per Person)				
Meat	0.00	0.00	0.04	0.15	0.33	0.51	0.71	0.87	1.04
All Other Food at Home	0.00	0.01	0.05	0.14	0.26	0.39	0.50	0.63	0.75
Total Food at Home	0.00	0.01	0.08	0.29	0.58	0.90	1.21	1.51	1.78
Food Away from Home	0.00	0.00	0.04	0.13	0.26	0.39	0.52	0.64	0.74
Per Capita Food Expenditures	0.00	0.01	0.12	0.42	0.84	1.29	1.73	2.14	2.52
					(Million Dollars)				
Total Food Expenditures	0	4	37	130	264	408	552	688	817
				(Percentage Change from Baseline)					
Proportional Change	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%

Ethanol prices and production relative to petroleum prices

The results presented in the tables in this report represent averages across 500 stochastic outcomes for agricultural and biofuel markets. These averages can obscure important findings from the analysis.

Implications of a 15 billion gallon biofuel use mandate are very baseline dependent. If the current policy baseline projects biofuel production and use well below the proposed mandate, then the mandate scenario results will indicate very large impacts. Conversely, if the baseline projects more than 15 billion gallons of use, the scenario will suggest few, if any, impacts.

One key factor driving biofuel markets is the price of petroleum. We sorted the stochastic results for 2015 by the price of petroleum that was assumed for each of the 500 outcomes. The average 2015 refiners' acquisition price[5] used in the analysis was a little over $50 per barrel ($10 less than the 2006 value), but the range of prices examined ranged from less than $30 per barrel to more than $80 per barrel.

Under current policies supporting the biofuel industry, we estimate a strong correlation between plant prices for ethanol and the price of petroleum (Figure 1). In the stochastic outcomes for 2015/16 where the assumed price of petroleum was less than $30 per barrel, the average ethanol plant price is $1.24 per gallon. In the outcomes where the petroleum price is between $50 and $60 per barrel, the average ethanol price is $1.66 per gallon and at petroleum prices over $80 per barrel the average ethanol price is $2.21 per gallon.

All else equal, ethanol production levels are positively correlated with petroleum prices and plant prices for ethanol (Figure 2). In the 2015/16 baseline outcomes assuming a petroleum price of less than $30 per barrel, ethanol production averages only 7.6 billion gallons, a level barely sufficient to meet the existing renewable fuel mandate. At petroleum prices between $50 and $60 barrel, the resulting higher prices for ethanol result in an average 2015/16 production level of 14.1 billion gallons under current policies. At petroleum prices over $80 per gallon, baseline production in 2015/16 exceeds 20 billion gallons.

Imposing the biofuel use mandate has the effect of supporting biofuel prices and production when petroleum prices are low. Even when petroleum prices are less than $30 per barrel, the average level of ethanol production under the mandate scenario is almost 14 billion gallons (the rest of the 15 billion gallon use mandate is filled by biodiesel and imported ethanol), six billion gallons more than under current policies. In contrast, when petroleum prices are over $70 per barrel, the 15 billion gallon mandate has almost no impact on ethanol production, as production exceeds the mandated level even under current policies.

Ethanol prices at the plant level must be sufficient to generate the required levels of supply. Given the model used for the analysis, it takes an ethanol price of $1.70-$1.80 per gallon to stimulate 14 billion gallons or more of domestic ethanol production in 2015. Ethanol prices in the 15 billion gallon mandate scenario, therefore, are much higher than baseline levels when petroleum prices are low, but very similar to baseline levels at higher petroleum prices.

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[5] The refiners' acquisition price is the average price paid by US petroleum refiners. In 2005 and 2006, it averaged about $6 per barrel less than the price of West Texas Intermediate, a frequently cited benchmark.

Figure 1. Ethanol prices sorted by petroleum prices:
Average 2015/16 results for the baseline and the 15 billion gallon biofuel mandate scenario
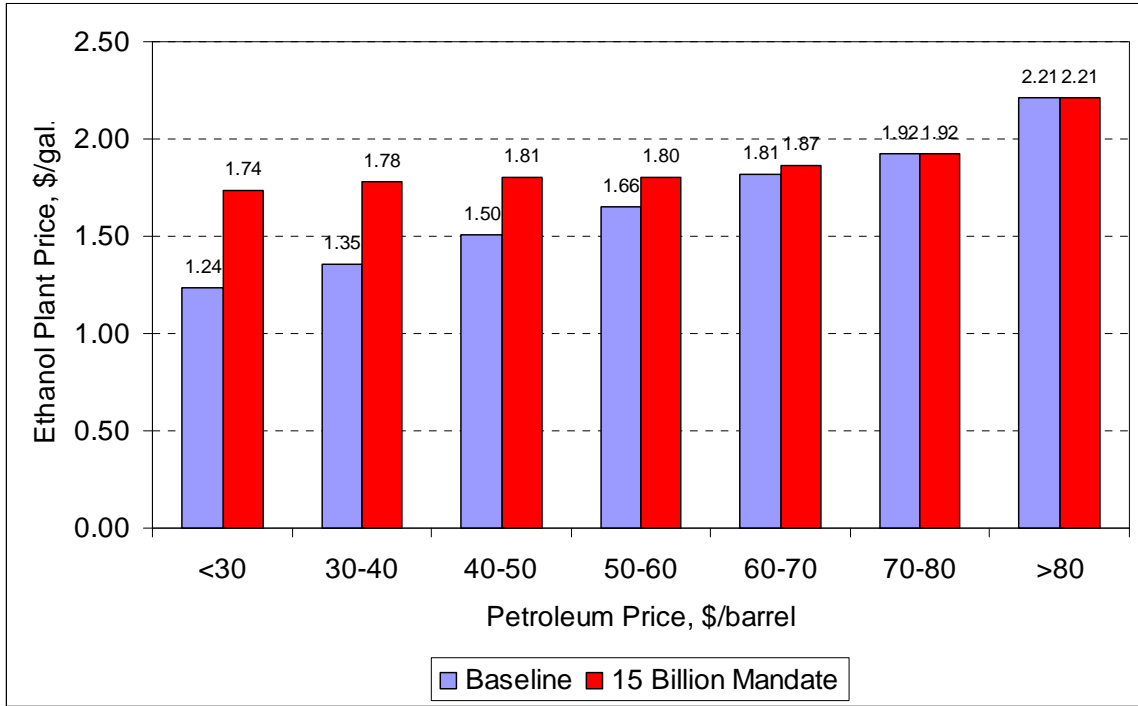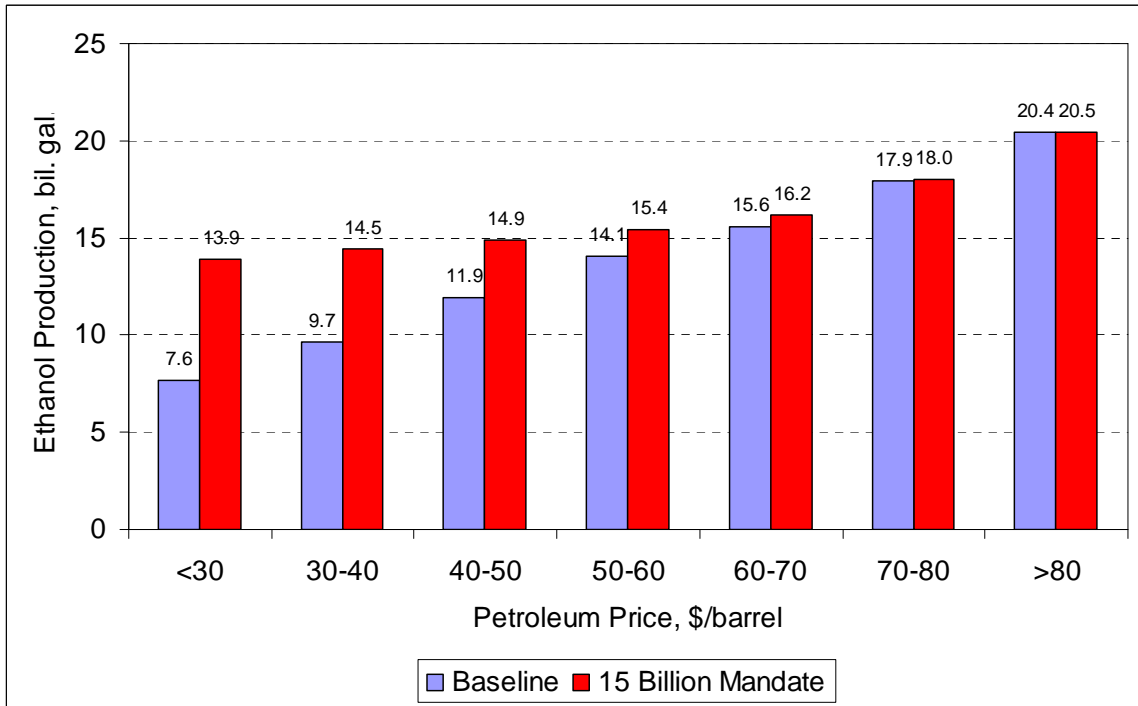

Figure 2. Ethanol production sorted by petroleum prices:
Average 2015/16 results for the baseline and the 15 billion gallon biofuel mandate scenario

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Corn prices relative to petroleum prices and corn yields

Petroleum prices have important implications for agricultural markets. Higher prices for petroleum and other energy sources generally correspond with higher prices for fuel, fertilizer and other agricultural inputs. This increase in production costs tends to reduce production of corn and many other crops.

Biofuels complicate the picture. Under current policies, higher petroleum prices are associated with higher ethanol prices and production levels. This results in an increase in corn demand, which tends to push up the price of corn and other agricultural commodities. Higher petroleum prices, therefore, have offsetting effects on corn supplies (higher input prices reduce supplies, while increased ethanol demand results in higher prices that result in more production). Both the supply and the demand effects tend to push corn prices higher when petroleum prices increase.

Under current polices, the correlation between corn prices and petroleum prices in 2015/16 is very strong (Figure 3). Corn prices average $2.66 per bushel when petroleum prices are less than $30 per barrel, $3.19 per bushel when petroleum prices are between $50 and $60 per barrel, and $3.69 per bushel when petroleum prices exceed $80 per barrel.

Under the 15 billion gallon biofuel use mandate, corn prices are far above baseline levels when petroleum prices are low, but about the same as in the baseline when petroleum prices are high. In the few stochastic outcomes where the assumed price of petroleum is less than $30 per barrel in 2015/16, the average price of corn is $3.09 per bushel, $0.43 per bushel more than in the baseline. The large difference occurs because ethanol production is much greater in the 15 billion gallon mandate scenario than in the baseline when petroleum prices are very low. In contrast, the average corn price is $3.69 per bushel when the 2015/16 petroleum price is over $80 per barrel both in the baseline and in the 15 billion gallon mandate scenario.

Many other factors affect corn prices. When good growing conditions result in above average yields, corn prices are likely to be below average, and when drought or other factors reduce corn yields, corn prices tend to be above average (Figure 4). Under baseline policy assumptions, corn prices in 2015/16 average $3.57 per bushel in the stochastic outcomes where the assumed corn yield is less than 150 bushels per acre, but just $2.73 per bushel when the corn yield is over 180 bushels per acre.

Introducing the 15 billion gallon biofuel use mandate increases average corn prices at every assumed level of corn yields. The increase in corn prices in the expanded mandate scenario is greater at low levels of corn yields than at higher yields. For example, corn prices under the 15 billion gallon mandate scenario exceed baseline levels by $0.34 per bushel when corn yields are less than 150 bushels per acre, but by only $0.14 per bushel when corn yields exceed 180 bushels per acre.

In the baseline, the increase in corn prices that results when corn yields are reduced translates into lower margins for ethanol producers and less corn used to make ethanol. In the mandate scenario, ethanol production is supported by the use mandate, even at very high corn prices. Relative to the baseline, this makes corn demand less responsive to price changes, and means that a given change in corn supplies will have a larger impact on corn prices.

Figure 3. Corn prices sorted by petroleum prices:
Average 2015/16 results for the baseline and the 15 billion gallon biofuel mandate scenario
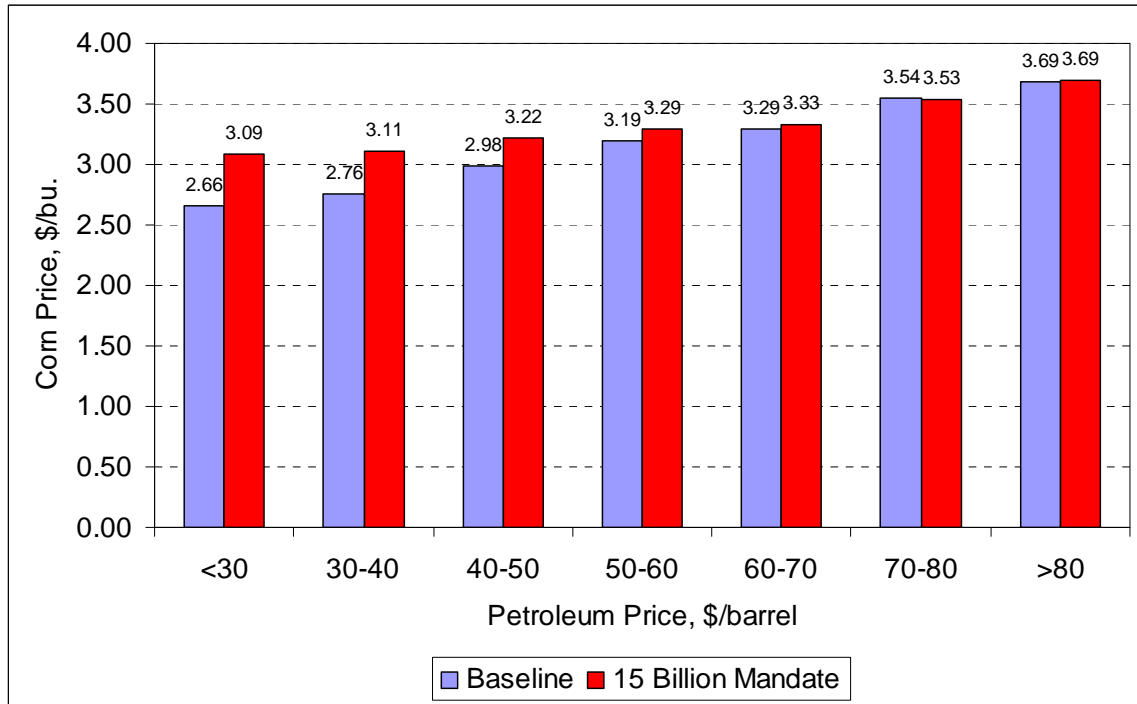

Figure 4. Corn prices sorted by corn yields:
Average 2015/16 results for the baseline and the 15 billion gallon biofuel mandate scenario