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Impacts of Selected US Ethanol Policy Options

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This report was prepared in response to a request from US Representatives Randy Neugerbauer, K. Michael Conaway, Henry Cuellar, John R. Carter, and Kay Granger.

At the suggestion of the Members of Congress, organizations representing Texas crop and livestock producers helped identify nine of the eleven scenarios examined in this report. These organizations include the Texas Cattle Feeders Association, the Texas and Southwestern Cattle Raisers Association, the Independent Cattlemen's Association of Texas, the Texas Pork Producers Association, the Texas Poultry Federation, the Texas Association of Dairymen, the Corn Producers Association of Texas, the Texas Corn Producers Board, the Texas Grain Sorghum Producers Association, the South Texas Cotton and Grain Association and the Southwest Council of Agribusiness.

While input from the organizations was very valuable in establishing the assumptions for the analysis, all results and conclusions are the responsibility of the Food and Agricultural Policy Research Institute (FAPRI) at the University of Missouri (MU).

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Table of Contents

Summary	1
Background.....	2
Baseline and scenarios.....	2
Ethanol market results	8
Ethanol production dynamics.....	10
Corn market results	12
Corn price dynamics.....	14
Farm income and consumer expenditures	16
Corn price variability.....	18
Particular outcomes with high corn prices.....	20
Particular outcomes with low corn prices	22
Countercyclical triggers	24
Endnotes.....	25
Appendix.....	26
Table A.1. Ethanol tax credit expires.....	26
Table A.2. Countercyclical ethanol tax credit	28
Table A.3. Ethanol tariff expires.....	30
Table A.4. Countercyclical ethanol tariff	32
Table A.5. 15% ethanol blends allowed	34
Table A.6. Countercyclical ethanol plant payment	36
Table A.7. Modified Renewable Fuel Standard	38
Table A.8. Distillers grains diversion	40
Table A.9. Countercyclical Renewable Fuel Standard	42
Table A.10. Elimination of total RFS.....	44
Table A.11. No corn ethanol support policies.....	46

Summary

In response to a request from several members of Congress, the Food and Agricultural Policy Research Institute at the University of Missouri (FAPRI-MU) has examined alternatives to current US ethanol policies. Some of the alternative scenarios modify or eliminate tax credits to ethanol blenders, import tariffs and use mandates. Others make payments to ethanol plants, allow 15% ethanol blends and divert distillers grains from domestic feed markets.

The FAPRI-MU 2009 stochastic baseline was used to explore these policy options under a range of market contexts. The results consequently depend on assumptions about macroeconomic conditions and policy implementation that were based on information available in January 2009. The following conclusions can be drawn from the analysis of the diverse scenarios:

1. **Allowing the ethanol tax credit or ethanol tariff to expire tends to reduce domestic ethanol production and corn prices.** The average corn price over the 2011-2018 period falls by 0.6% if the credit expires and 2.8% if the tariff expires.
2. **Reducing biofuel use mandates also tends to reduce ethanol production and corn prices.** A scenario that reduces the average use mandate by 1 billion gallons reduces average ethanol production by 0.56 billion gallons and corn prices by 1.0%. Without a mandate supporting use of corn-based ethanol, ethanol production falls by an average of 1.91 billion gallons and corn prices decline by 4.6%.
3. **Current policies often provide redundant support.** The effect of removing all corn ethanol support policies is not equal to the sum of the effects of eliminating them one at a time. With no tax credits, tariffs or mandates supporting corn ethanol use, average ethanol production declines by 5.5 billion gallons and corn prices fall by 13.1%.
4. **Policy options that reduce biofuel support when corn prices are high can slightly moderate high grain prices.** Scenarios that reduce tax credits, tariffs or use mandates when corn prices are high do reduce ethanol production when corn markets are tight. The resulting reduction in corn demand slightly reduces high grain prices.
5. **Allowing 15% ethanol blends increases ethanol use and average corn prices, but the effects are modest.** Such intermediate blends expand the potential ethanol market and raise corn prices by an average of 1.1%.
6. **Market circumstances matter.** The relative importance of different ethanol support policies depends on the price of oil, the weather, and other market circumstances.

Background

In response to a request from Representatives Randy Neugebauer, K. Michael Conaway, Henry Cuellar, John R. Carter, and Kay Granger, FAPRI–MU analyzed the implications of hypothetical changes to US ethanol policies. As suggested by the requesting Members of Congress, nine scenarios were identified with the assistance of organizations representing Texas livestock and grain producers.¹ Two additional scenarios were identified by FAPRI-MU staff to help put results of the other scenarios in context. These changes revolve around certain US biofuel policy mechanisms.

- *Biofuel use mandates* established as part of the Renewable Fuel Standard (RFS) defined by the Energy Independence and Security Act of 2007. Four mandates, relating to overall biofuel, advanced biofuels, biodiesel, and cellulosic biofuels, require that at least a certain level of each type is used.
- *Tax credits* (volumetric ethanol excise tax credits, or VEETC) are given to blenders for each gallon of ethanol they mix with other fuels.
- *Tariffs* on ethanol imports must be paid. The larger specific tariff applies to imports from Brazil, but not to imports from trading partners in the Caribbean Basin Initiative.

Here, a series of 11 scenarios test alternative assumptions about key ethanol policies by comparing how markets evolve under the various policy alternatives relative to a baseline that assumes constant policies.

Baseline and scenarios

The *baseline* is the 2009 FAPRI-MU stochastic baseline for biofuel and agricultural commodity markets to 2018.² We assume a continuation of current policies. The mandates are set to rise in the coming years, and these minimum volumes of use are often binding given the assumed ranges of petroleum prices and other market conditions.³ The ethanol blender's tax credits and tariffs are extended indefinitely instead of expiring on schedule at the end of 2010.

Scenario 1: Ethanol tax credit expires. The \$0.45 per gallon ethanol blender's tax credit expires as scheduled at the end of 2010.

Scenario 2: Countercyclical ethanol credit. The fixed ethanol tax credit is replaced with a countercyclical tax credit that depends on the corn price.

Beginning in September 2010, the credit remains at \$0.45 per gallon if the corn price is below \$4.00 per bushel. The credit is reduced if corn prices are greater than \$4.00 at a rate that implies a \$0.25 per gallon credit at \$5.00 corn and no tax credit at a corn price of \$6.25 per bushel or more. Results are sensitive to the exact trigger assumed.

Scenario 3: No tariff. The \$0.54 per gallon ethanol tariff expires as scheduled at the end of 2010.

Scenario 4: Countercyclical ethanol tariff. The fixed ethanol tariff is replaced with a countercyclical ethanol tariff that depends on the corn price.

Beginning in September 2010, the tariff stays at \$0.54 per gallon if the corn price is below \$4.00 per bushel. Higher corn prices lead to a lower tariff; the tariff is \$0.30 at \$5.00 corn, and the tariff is zero if the corn price is \$6.25 per bushel or higher. Results depend on the exact trigger.

Scenario 5: 15% ethanol blends allowed. Fuel with as much as 15% ethanol (E15) is permitted starting in September 2009, rather than the current 10%. As in the baseline, E85 is available for use in flex fuel vehicles. We assume that there are few hindrances to widespread adoption of E15 to test the magnitude of possible market effects.⁴

Scenario 6: Countercyclical plant payment. The ethanol blender's tax credit and the ethanol import tariff are replaced with a payment made directly to ethanol plants that is countercyclical to corn prices.

Beginning in September 2010, the payment to ethanol plants is \$0.45 per gallon if the corn price is below \$4.00 per bushel. This payment is reduced if corn prices rise above \$4.00: it would be \$0.25 per gallon at \$5.00 corn and zero at a corn price of \$6.25 per bushel or more. Results would change with the assumptions about the payment.

Scenario 7: Modified RFS. The rate of increase in the RFS over the next several years is slowed, but in later years accelerates to reach the same RFS for 2018. By slowing the early increase in the overall mandate while leaving the submandate that must be met by advanced biofuels unchanged, the result is that the space for conventional biofuels, such as corn-based ethanol, is reduced until 2018.

Scenario 8: Distillers grains diversion. Distillers grains are diverted from the livestock sector for use as an energy source. Willingness to use distillers grains as an energy source is assumed to be higher when distillers grains prices are low or when energy prices are high. Distillers grains are not used for biofuel production in this scenario.

Scenario 9: Countercyclical RFS. Whereas scenario 7 featured a delayed implementation of the overall RFS mandate, in this case the part of the mandate that conventional corn-based ethanol can meet is reduced, subject to the corn price. The mandate is reduced when the corn price exceeds \$4.00 per bushel, and the mandate is reduced by 5 billion gallons if the price hits \$6.25. If the corn price is below \$4.00, then the RFS is not changed. As before, the results are sensitive to the exact design of the policy.

In addition to the nine scenarios identified with the help of Texas livestock and grain producers, FAPRI staff identified two additional scenarios that help provide context for the analysis.

Scenario 10: No total RFS. In contrast to scenarios 7 and 9, which only reduce the RFS, this option eliminates the overall RFS, maintaining only the mandates for the use of advanced biofuels, effective January 1, 2011. In other words, the use of corn-based ethanol would no longer be supported by the RFS.

Scenario 11: No RFS, credits or tariffs. This option combines the assumptions of scenarios 1, 3 and 10. Effective January 1, 2011, there would be no overall RFS, ethanol tax credits, or tariffs supporting the domestic corn-based ethanol industry. As in scenario 10, the RFS for advanced biofuels would remain in place, as would biodiesel tax credits.

Table 1a. Scenario assumptions

Scenario	Policy	Parameters
Baseline	Ethanol blender's tax credit	\$0.45 per gallon, 2009-2018
	Ethanol specific tariff	\$0.54 per gallon, 2009-2018
	RFS, total - advanced biofuels	
	2009	10.5 billion gallons
	2010	12.0
	2011	12.6
	2012	13.2
	2013	13.8
	2014	14.4
	2015	15.0
	2016	15.0
	2017	15.0
	2018	15.0
	Blended fuels available	E-10 or less; E-85
1. Ethanol tax credit expires	Ethanol blender's tax credit	\$0.45 per gallon, 2009-2010 \$0.00 per gallon, 2011-2018
	All other policies	Same as baseline
2. Countercyclical ethanol credit	Ethanol blender's tax credit	\$0.45 per gallon, 2009/10 ¹ For 2010/11-2018/19 ¹ , \$0.45/gal. if corn price < \$4/bu. Reduce by \$0.20/gal. for every \$1/bu. that corn price exceeds \$4/bu.
	All other policies	Same as baseline
3. Ethanol tariff expires	Ethanol specific tariff	\$0.54 per gallon, 2009 \$0.00 per gallon, 2010-2018
	All other policies	Same as baseline
4. Countercyclical ethanol tariff	Ethanol specific tariff	\$0.54 per gallon, 2009/10 ¹ For 2010/11-2018/19 ¹ , \$0.54/gal. if corn price < \$4/bu. Reduce by \$0.24/gal. for every \$1/bu. that corn price exceeds \$4/bu.
	All other policies	Same as baseline

¹ September-August crop year

Table 1b. Scenario assumptions, continued

Scenario	Policy	Parameters
5. 15% ethanol blends allowed	Blended fuels available	E-15 or less starting in 2009/10 ¹ ; E-85
	All other policies	Same as baseline
6. Countercyclical plant payment	Ethanol blender's tax credit	\$0.45 per gallon, 2009/10 ¹ \$0.00 per gallon, 2010/11-2018/19 ¹
	Ethanol specific tariff	\$0.54 per gallon, 2009/10 ¹ \$0.00 per gallon, 2010/11-2018/19 ¹
	Ethanol plant payment	\$0.00 per gallon, 2009/10 ¹ \$0.45 per gallon, 2010/11-2018/19 ¹ if corn price < \$4/bu. Reduce by \$0.20/gal. for every \$1/bu. that corn price exceeds \$4/bu.
	All other policies	Same as baseline
7. Modified RFS	RFS, total - advanced biofuels	
	2009	10.5 billion gallons
	2010	11.0
	2011	11.5
	2012	12.0
	2013	12.5
	2014	13.0
	2015	13.5
	2016	14.0
	2017	14.5
	2018	15.0
	All other policies	Same as baseline
8. Distillers grains diversion	Distillers grain value for energy production	Increased so that on average about one-fourth of production is diverted from the feed market
	All policies	Same as baseline
9. Countercyclical RFS	RFS, total - advanced biofuels	Same as baseline if corn price <\$4/bu. For ever \$1/bu. that the corn price exceeds \$4/bu., reduce the RFS for that year by 2.22 bil. gal.
	All other policies	Same as baseline

¹ September-August crop year

Table 1c. Scenario assumptions, continued

Scenario	Policy	Parameters
10. No total RFS	RFS, total - advanced biofuels	
	2009	10.5 billion gallons
	2010	12.0
	2011-2018	0.0
	All other policies	Same as baseline
11. No RFS, credits, or tariffs	RFS, total - advanced biofuels	
	2009	10.5 billion gallons
	2010	12.0
	2011-2018	0.0
	Ethanol blender's tax credit	\$0.45 per gallon, 2009-2010 \$0.00 per gallon, 2011-2018
	Ethanol specific tariff	\$0.54 per gallon, 2009 \$0.00 per gallon, 2011-2018

Ethanol market results

1. *Ethanol tax credit expires.* Eliminating tax credits supporting ethanol use decreases the price blenders are willing to pay, reducing ethanol plant profitability and production. Effects would be larger, but binding mandates often do not allow for volumes to contract.
2. *Countercyclical ethanol credit.* This scenario has the same directional effect as allowing the credit to expire completely, but effects are smaller on average, given that the reduction in support is typically smaller, and zero if corn prices are below \$4.00 per bushel.
3. *No tariff.* Eliminating the tariff often allows imports of sugar-based ethanol above the advanced biofuel mandate, displacing domestic corn-based ethanol and pushing prices lower. Effects are largest when the overall mandate remains binding.
4. *Countercyclical ethanol tariff.* The effects are directionally the same as in scenario 3, but are smaller given the trigger level chosen here. If the overall mandate is not binding, then ethanol consumption expands, mitigating some of the domestic production effect.
5. *15% ethanol blends allowed.* Giving consumers greater access to ethanol without the costs of E85 adoption tends to increase demand, particularly when petroleum prices are high. The average effect is more ethanol use, production and imports at a higher price.
6. *Countercyclical plant payment.* The variable direct subsidy and tariff elimination results in little change in use overall, but with a greater share of it imported, even as prices fall.
7. *Modified RFS.* Requiring less use of ethanol when mandates are otherwise binding leads to less use on average, and consequently less production and imports.
8. *Distillers grains diversion.* Reducing the availability of distillers grains for the domestic feed market raises the prices of both distillers grains and corn. This has little net effect on ethanol plant profitability, so ethanol markets are little changed.
9. *Countercyclical RFS.* Reducing the mandate when corn prices are high allows fuel blenders to forego expensive ethanol purchases. The resulting decline in ethanol prices further reduces ethanol plant profitability when plants are paying the most for their key input.
10. *No total RFS.* Without an RFS to support use, blenders only use corn-based ethanol when it is priced competitively as a fuel. Except when oil prices are high and corn supplies are ample, this results in lower ethanol prices, production and imports.
11. *No RFS, credits or tariffs.* Removing all supports to corn ethanol use reduces ethanol production by 5.5 billion gallons, more than the sum of effects from scenarios 1, 3 and 10. In many cases, either the RFS or the tax credit would be sufficient to support ethanol production levels, but removing both at the same time has much larger impacts.

Table 2. Ethanol market results, 2011-2018 averages across 500 stochastic outcomes

	Ethanol production	Ethanol imports	Ethanol domestic use	Ethanol rack price, Omaha	Dry mill plant net returns
	(bil. gal.)	(bil. gal.)	(bil. gal.)	(\$/gal.)	(\$/gal.)
Baseline	15.38	1.38	16.56	2.07	0.38
1. Ethanol tax credit expires	15.08	1.39	16.26	2.04	0.36
2. Countercyclical ethanol credit	15.31	1.37	16.48	2.06	0.38
3. Ethanol tariff expires	14.03	3.16	16.95	1.97	0.32
4. Countercyclical ethanol tariff	15.23	1.56	16.58	2.06	0.37
5. 15% ethanol blends allowed	16.00	1.54	17.34	2.11	0.41
6. Countercyclical plant payment	15.19	1.62	16.49	1.65	0.37
7. Modified RFS	14.82	1.27	15.89	2.05	0.38
8. Distillers grains diversion	15.36	1.39	16.54	2.07	0.38
9. Countercyclical RFS	15.07	1.31	16.17	2.04	0.36
10. No total RFS	13.46	1.15	14.40	1.90	0.27
11. No RFS, credits, or tariffs	9.87	1.57	11.04	1.59	0.08
Absolute change from baseline					
1. Ethanol tax credit expires	-0.30	0.01	-0.30	-0.02	-0.02
2. Countercyclical ethanol credit	-0.06	-0.01	-0.08	-0.01	0.00
3. Ethanol tariff expires	-1.35	1.78	0.39	-0.10	-0.06
4. Countercyclical ethanol tariff	-0.15	0.18	0.03	-0.01	-0.01
5. 15% ethanol blends allowed	0.63	0.16	0.78	0.04	0.03
6. Countercyclical plant payment	-0.19	0.24	-0.07	-0.42	-0.01
7. Modified RFS	-0.56	-0.11	-0.67	-0.01	0.00
8. Distillers grains diversion	-0.02	0.00	-0.02	0.00	0.00
9. Countercyclical RFS	-0.31	-0.07	-0.38	-0.03	-0.02
10. No total RFS	-1.91	-0.23	-2.16	-0.17	-0.11
11. No RFS, credits, or tariffs	-5.50	0.19	-5.52	-0.47	-0.30
Percentage change from baseline					
1. Ethanol tax credit expires	-1.9%	0.6%	-1.8%	-1.2%	-4.5%
2. Countercyclical ethanol credit	-0.4%	-0.9%	-0.5%	-0.3%	-1.1%
3. Ethanol tariff expires	-8.8%	128.4%	2.3%	-4.8%	-16.1%
4. Countercyclical ethanol tariff	-1.0%	12.8%	0.2%	-0.4%	-1.3%
5. 15% ethanol blends allowed	4.1%	11.5%	4.7%	2.0%	6.9%
6. Countercyclical plant payment	-1.2%	17.3%	-0.4%	-20.2%	-3.3%
7. Modified RFS	-3.6%	-8.1%	-4.1%	-0.7%	0.0%
8. Distillers grains diversion	-0.1%	0.1%	-0.1%	0.1%	0.6%
9. Countercyclical RFS	-2.0%	-5.3%	-2.3%	-1.2%	-4.3%
10. No total RFS	-12.4%	-16.9%	-13.0%	-8.2%	-28.9%
11. No RFS, credits, or tariffs	-35.8%	13.7%	-33.4%	-22.8%	-77.8%

Ethanol production dynamics

1. *Ethanol tax credit expires.* Eliminating the ethanol tax credit reduces the profitability of ethanol production if mandates are not binding. However, ethanol production still must grow over time to satisfy use mandates.
2. *Countercyclical ethanol credit.* Average effects on ethanol production increase over time because of the trigger tied to a fixed corn price and a baseline where corn prices modestly increase over time.
3. *No tariff.* Increases in ethanol imports are most likely to displace ethanol production when the overall RFS is binding, but the advanced biofuel mandate is not binding. This is most likely to occur around 2015, so the impact on ethanol production grows until then.
4. *Countercyclical ethanol tariff.* The effects are much smaller than in the third scenario, but the pattern over time is similar.
5. *15% ethanol blends allowed.* Easier consumer use of ethanol can lead to more production if the mandates are not binding. Production impacts generally increase over time, in part because it takes time for new capacity stimulated by higher profitability to come on line.
6. *Countercyclical plant payment.* Eliminating tariffs results in higher imports and lower production, but this effect diminishes after 2015, as seen in the no tariff scenario. The countercyclical plant payment provides smaller benefits to plants as average corn prices rise between 2009 and 2015. Thus, the impacts on ethanol production peak around 2015.⁵
7. *Modified RFS.* Delaying the pace of RFS expansion allows production to fall when the mandate would otherwise be binding. The reduction shrinks after 2015 as the modified RFS gradually rises to the level of the baseline RFS by 2018.
8. *Distillers grains diversion.* The average effects on production are uniformly small.
9. *Countercyclical RFS.* The effects are similar to those of scenario 7, but smaller. They tend to increase over time as rising corn prices result in larger RFS adjustments.
10. *No total RFS.* Without support from the RFS, ethanol prices and production can fall sharply when corn supplies are limited or oil prices are low. Without a rising RFS to support the use of corn-based ethanol, there may be little additional investment in corn ethanol plants. Thus, the decline in production relative to the baseline increases over time.
11. *No RFS, credits or tariffs.* With no support for corn-based ethanol, total ethanol production drops below 10 billion gallons. Investment in new plants is unlikely and many existing plants would shut down or operate below full capacity. The limited growth shown at the end of the projection period is based on feedstocks other than corn starch.

Table 3. Ethanol production, averages across 500 stochastic outcomes

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
	(billion gallons)									
Baseline	11.25	12.58	13.18	13.65	14.21	14.88	15.77	16.55	17.08	17.70
1. Ethanol tax credit expires	11.25	12.16	12.67	13.23	13.89	14.72	15.57	16.32	16.83	17.43
2. Countercyclical ethanol credit	11.25	12.54	13.14	13.60	14.14	14.83	15.71	16.49	17.00	17.61
3. Ethanol tariff expires	11.25	12.10	12.19	12.59	12.96	13.34	14.07	14.94	15.65	16.49
4. Countercyclical ethanol tariff	11.25	12.52	13.10	13.56	14.08	14.72	15.55	16.34	16.90	17.58
5. 15% ethanol blends allowed	11.35	12.75	13.50	14.17	14.87	15.61	16.43	17.24	17.75	18.46
6. Countercyclical plant payment	11.25	12.59	13.09	13.52	14.00	14.61	15.43	16.26	16.92	17.71
7. Modified RFS	10.72	11.99	12.78	13.25	13.68	14.05	14.78	15.82	16.65	17.55
8. Distillers grains diversion	11.23	12.55	13.16	13.64	14.20	14.88	15.77	16.52	17.04	17.64
9. Countercyclical RFS	11.25	12.46	13.09	13.55	14.06	14.61	15.38	16.09	16.55	17.19
10. No total RFS	11.24	11.45	12.40	12.95	13.36	13.44	13.49	13.68	13.93	14.46
11. No RFS, credits, or tariffs	11.24	9.83	9.39	9.64	9.88	9.79	9.69	9.77	10.05	10.77
Absolute change from baseline										
1. Ethanol tax credit expires	0.00	-0.42	-0.51	-0.42	-0.32	-0.16	-0.20	-0.24	-0.25	-0.27
2. Countercyclical ethanol credit	0.00	-0.04	-0.04	-0.05	-0.07	-0.06	-0.07	-0.07	-0.08	-0.09
3. Ethanol tariff expires	0.00	-0.47	-0.99	-1.06	-1.24	-1.54	-1.70	-1.61	-1.43	-1.21
4. Countercyclical ethanol tariff	0.00	-0.06	-0.07	-0.09	-0.12	-0.16	-0.22	-0.21	-0.17	-0.12
5. 15% ethanol blends allowed	0.11	0.17	0.32	0.52	0.66	0.73	0.66	0.68	0.67	0.76
6. Countercyclical plant payment	0.00	0.01	-0.09	-0.13	-0.20	-0.28	-0.35	-0.30	-0.16	0.02
7. Modified RFS	-0.53	-0.59	-0.40	-0.40	-0.53	-0.83	-0.99	-0.74	-0.43	-0.15
8. Distillers grains diversion	-0.02	-0.03	-0.02	-0.01	0.00	0.00	-0.01	-0.03	-0.03	-0.06
9. Countercyclical RFS	0.00	-0.11	-0.08	-0.10	-0.15	-0.27	-0.40	-0.47	-0.52	-0.51
10. No total RFS	0.00	-1.13	-0.77	-0.70	-0.84	-1.45	-2.29	-2.87	-3.15	-3.24
11. No RFS, credits, or tariffs	0.00	-2.75	-3.78	-4.01	-4.32	-5.09	-6.09	-6.78	-7.03	-6.93
Percentage change from baseline										
1. Ethanol tax credit expires	0.0%	-3.3%	-3.9%	-3.1%	-2.2%	-1.1%	-1.3%	-1.4%	-1.4%	-1.5%
2. Countercyclical ethanol credit	0.0%	-0.3%	-0.3%	-0.4%	-0.5%	-0.4%	-0.4%	-0.4%	-0.5%	-0.5%
3. Ethanol tariff expires	0.0%	-3.8%	-7.5%	-7.7%	-8.7%	-10.4%	-10.8%	-9.7%	-8.4%	-6.8%
4. Countercyclical ethanol tariff	0.0%	-0.5%	-0.5%	-0.6%	-0.9%	-1.1%	-1.4%	-1.3%	-1.0%	-0.7%
5. 15% ethanol blends allowed	0.9%	1.3%	2.4%	3.8%	4.7%	4.9%	4.2%	4.1%	3.9%	4.3%
6. Countercyclical plant payment	0.0%	0.1%	-0.7%	-0.9%	-1.4%	-1.9%	-2.2%	-1.8%	-0.9%	0.1%
7. Modified RFS	-4.7%	-4.7%	-3.0%	-2.9%	-3.7%	-5.6%	-6.3%	-4.4%	-2.5%	-0.9%
8. Distillers grains diversion	-0.2%	-0.2%	-0.1%	-0.1%	0.0%	0.0%	0.0%	-0.2%	-0.2%	-0.4%
9. Countercyclical RFS	0.0%	-0.9%	-0.6%	-0.7%	-1.0%	-1.8%	-2.5%	-2.8%	-3.1%	-2.9%
10. No total RFS	0.0%	-9.0%	-5.9%	-5.1%	-5.9%	-9.7%	-14.5%	-17.4%	-18.4%	-18.3%
11. No RFS, credits, or tariffs	0.0%	-21.9%	-28.7%	-29.4%	-30.4%	-34.2%	-38.6%	-41.0%	-41.1%	-39.1%

Corn market results

1. *Ethanol tax credit expires.* Less support to blending ethanol with other fuels leads to less demand for corn to make ethanol, on average. Less demand for corn leads to lower prices, increases in other uses of corn, and lower corn production.
2. *Countercyclical ethanol credit.* The average effects are similar to those of scenario 1, but smaller as the tax credit is reduced only on some occasions.
3. *No tariff.* When ethanol imports displace some domestic production, the result is lower demand for corn to make ethanol. This results in lower corn prices, more corn used for feed and export, and less production.
4. *Countercyclical ethanol tariff.* The average effects are more modest than in scenario 3, but go in the same direction.
5. *15% ethanol blends allowed.* Facilitating ethanol use allows production to expand, drawing more corn into ethanol production. Corn prices are bid higher, so less corn is used to feed livestock or for exports, and production rises.
6. *Countercyclical plant payment.* The net effect of no tariff and a direct plant payment that is countercyclical to the corn price, given the assumptions here, is a reduction in average ethanol output. Less corn-based ethanol causes lower corn prices with expected quantity effects.
7. *Modified RFS.* Delaying mandate expansion causes less corn-based ethanol production on average. The corn price is lower, competing corn uses rise, and production falls.
8. *Distillers grains diversion.* As distillers grains are bid away for use as an energy source, livestock producers must rely more on other feeds. The use of corn for feed increases to offset the diverted distillers grains, causing corn prices to rise on average. Higher corn prices lead to falling exports and more production.
9. *Countercyclical RFS.* Much like the delayed RFS, this hypothetical policy would decrease ethanol demand on average. But the targeting mechanism assumed here makes smaller average adjustments in the RFS, so the ethanol and corn market impacts are smaller.
10. *No total RFS.* A 13.9% reduction in corn ethanol use results in a 4.6% reduction in average corn prices, reduced corn production, and greater exports and feed use.
11. *No RFS, credits or tariffs.* The sharp reduction in corn-based ethanol production results in significantly lower corn prices. The 13.1% reduction in average corn prices is greater than the sum of effects from scenarios 1, 3 and 10.

Table 4. Corn market results, 2011-2018 averages across 500 stochastic outcomes

	Corn production	Corn ethanol use	Corn feed use	Corn exports	Corn farm price
	(bil. bu.)	(bil. bu.)	(bil. bu.)	(bil. bu.)	(\$/bu.)
Baseline	13.82	5.09	5.28	2.08	4.04
1. Ethanol tax credit expires	13.75	4.98	5.30	2.11	4.02
2. Countercyclical ethanol credit	13.80	5.07	5.28	2.09	4.03
3. Ethanol tariff expires	13.55	4.62	5.37	2.19	3.93
4. Countercyclical ethanol tariff	13.79	5.04	5.28	2.10	4.03
5. 15% ethanol blends allowed	13.91	5.27	5.24	2.04	4.08
6. Countercyclical plant payment	13.75	4.96	5.30	2.12	4.02
7. Modified RFS	13.69	4.89	5.31	2.13	4.00
8. Distillers grains diversion	14.00	5.09	5.54	2.00	4.13
9. Countercyclical RFS	13.75	4.98	5.30	2.11	4.01
10. No total RFS	13.44	4.38	5.43	2.26	3.85
11. No RFS, credits, or tariffs	12.78	3.07	5.73	2.59	3.51
Absolute change from baseline					
1. Ethanol tax credit expires	-0.06	-0.11	0.02	0.03	-0.02
2. Countercyclical ethanol credit	-0.02	-0.02	0.00	0.00	0.00
3. Ethanol tariff expires	-0.27	-0.47	0.10	0.11	-0.11
4. Countercyclical ethanol tariff	-0.03	-0.05	0.01	0.01	-0.01
5. 15% ethanol blends allowed	0.10	0.18	-0.04	-0.04	0.04
6. Countercyclical plant payment	-0.07	-0.13	0.03	0.04	-0.02
7. Modified RFS	-0.13	-0.20	0.04	0.04	-0.04
8. Distillers grains diversion	0.19	0.00	0.27	-0.08	0.09
9. Countercyclical RFS	-0.07	-0.11	0.02	0.03	-0.03
10. No total RFS	-0.37	-0.71	0.15	0.17	-0.18
11. No RFS, credits, or tariffs	-1.04	-2.02	0.46	0.51	-0.53
Percentage change from baseline					
1. Ethanol tax credit expires	-0.5%	-2.1%	0.4%	1.3%	-0.6%
2. Countercyclical ethanol credit	-0.1%	-0.4%	0.1%	0.2%	-0.1%
3. Ethanol tariff expires	-1.9%	-9.3%	1.8%	5.3%	-2.8%
4. Countercyclical ethanol tariff	-0.2%	-1.0%	0.2%	0.5%	-0.3%
5. 15% ethanol blends allowed	0.7%	3.5%	-0.7%	-2.0%	1.1%
6. Countercyclical plant payment	-0.5%	-2.6%	0.5%	1.8%	-0.5%
7. Modified RFS	-0.9%	-4.0%	0.7%	2.1%	-1.0%
8. Distillers grains diversion	1.3%	0.0%	5.1%	-4.1%	2.2%
9. Countercyclical RFS	-0.5%	-2.2%	0.4%	1.3%	-0.7%
10. No total RFS	-2.7%	-13.9%	2.9%	8.3%	-4.6%
11. No RFS, credits, or tariffs	-7.5%	-39.8%	8.7%	24.5%	-13.1%

Corn price dynamics

In general, the pattern of corn price effects over time follows the pattern of ethanol production effects. Corn prices generally decrease (increase) the most when ethanol production decreases (increases) the most. The story can be a bit more complicated, however, given the dynamics of agricultural production and the interactions among various markets.

For example, reduced demand for corn to make ethanol this year results in lower corn prices. If the change in corn prices was not anticipated by farmers, it may have no effect on corn production in the current year, but may have effects on production in subsequent years. If the result is less corn production in the second year, the negative effect of reduced ethanol use on corn prices is likely to be smaller in the second year than in the first.

Furthermore, lower corn prices increase the profitability of feeding livestock in the United States and around the world, resulting in increased livestock production. Because of basic biological constraints, it takes time for this increase to occur, so it takes time for a drop in corn prices to have its long-term effect on feed consumption.

Finally, note that effects on corn prices begin during the 2009/10 marketing year for some scenarios and in the 2010/11 marketing year for other scenarios. In the scenarios allowing 15% ethanol blends (5), modifying the RFS (7), and diverting distillers grains from feed uses (8), it is assumed that effects begin in September 2009. In contrast, the scenarios that allow tax credits and tariffs to expire on schedule have no changes in policy assumptions prior to January 1, 2011.

Table 5. Corn prices, averages across 500 stochastic outcomes

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
	(dollars per bushel)									
Baseline	3.74	3.78	3.80	3.91	3.99	4.06	4.15	4.14	4.14	4.11
1. Ethanol tax credit expires	3.74	3.70	3.75	3.88	3.98	4.07	4.12	4.12	4.13	4.08
2. Countercyclical ethanol credit	3.74	3.77	3.80	3.90	3.98	4.06	4.14	4.14	4.14	4.11
3. Ethanol tariff expires	3.74	3.69	3.67	3.82	3.88	3.91	4.00	4.03	4.05	4.04
4. Countercyclical ethanol tariff	3.74	3.77	3.79	3.90	3.98	4.05	4.13	4.13	4.13	4.11
5. 15% ethanol blends allowed	3.76	3.80	3.84	3.97	4.05	4.12	4.18	4.18	4.17	4.14
6. Countercyclical plant payment	3.74	3.77	3.78	3.89	3.96	4.03	4.11	4.12	4.14	4.13
7. Modified RFS	3.65	3.73	3.79	3.87	3.93	3.97	4.06	4.12	4.14	4.12
8. Distillers grains diversion	3.80	3.88	3.93	4.02	4.09	4.14	4.22	4.22	4.22	4.20
9. Countercyclical RFS	3.74	3.76	3.80	3.90	3.97	4.03	4.10	4.10	4.10	4.08
10. No total RFS	3.74	3.58	3.78	3.87	3.90	3.89	3.88	3.85	3.85	3.82
11. No RFS, credits, or tariffs	3.74	3.29	3.37	3.56	3.60	3.56	3.53	3.50	3.48	3.46
Absolute change from baseline										
1. Ethanol tax credit expires	0.00	-0.08	-0.04	-0.02	-0.02	0.00	-0.02	-0.03	-0.02	-0.03
2. Countercyclical ethanol credit	0.00	-0.01	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	-0.01
3. Ethanol tariff expires	0.00	-0.09	-0.12	-0.08	-0.12	-0.16	-0.15	-0.11	-0.09	-0.07
4. Countercyclical ethanol tariff	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.01	-0.01	0.00
5. 15% ethanol blends allowed	0.02	0.02	0.04	0.06	0.06	0.06	0.03	0.04	0.02	0.03
6. Countercyclical plant payment	0.00	-0.01	-0.02	-0.02	-0.03	-0.04	-0.04	-0.02	0.00	0.02
7. Modified RFS	-0.10	-0.06	-0.01	-0.04	-0.06	-0.09	-0.09	-0.03	-0.01	0.01
8. Distillers grains diversion	0.06	0.10	0.13	0.12	0.09	0.07	0.07	0.08	0.07	0.08
9. Countercyclical RFS	0.00	-0.02	0.00	-0.01	-0.02	-0.04	-0.05	-0.04	-0.05	-0.04
10. No total RFS	0.00	-0.21	-0.02	-0.04	-0.09	-0.18	-0.27	-0.29	-0.30	-0.29
11. No RFS, credits, or tariffs	0.00	-0.49	-0.42	-0.34	-0.39	-0.50	-0.62	-0.65	-0.66	-0.66
Percentage change from baseline										
1. Ethanol tax credit expires	0.0%	-2.0%	-1.2%	-0.6%	-0.4%	0.1%	-0.6%	-0.6%	-0.4%	-0.8%
2. Countercyclical ethanol credit	0.0%	-0.2%	0.0%	-0.1%	-0.2%	0.0%	-0.1%	-0.1%	-0.1%	-0.2%
3. Ethanol tariff expires	0.0%	-2.4%	-3.2%	-2.1%	-2.9%	-3.9%	-3.5%	-2.6%	-2.2%	-1.8%
4. Countercyclical ethanol tariff	0.0%	-0.3%	-0.2%	-0.2%	-0.3%	-0.4%	-0.5%	-0.3%	-0.2%	0.0%
5. 15% ethanol blends allowed	0.5%	0.5%	1.0%	1.6%	1.5%	1.4%	0.7%	1.0%	0.5%	0.7%
6. Countercyclical plant payment	0.0%	-0.3%	-0.6%	-0.5%	-0.8%	-0.9%	-1.0%	-0.5%	-0.1%	0.4%
7. Modified RFS	-2.6%	-1.5%	-0.2%	-0.9%	-1.4%	-2.3%	-2.2%	-0.6%	-0.2%	0.2%
8. Distillers grains diversion	1.6%	2.7%	3.4%	3.0%	2.4%	1.8%	1.7%	1.9%	1.8%	2.0%
9. Countercyclical RFS	0.0%	-0.6%	0.0%	-0.2%	-0.5%	-0.9%	-1.1%	-0.9%	-1.2%	-0.9%
10. No total RFS	0.0%	-5.4%	-0.6%	-0.9%	-2.3%	-4.4%	-6.5%	-7.0%	-7.1%	-7.2%
11. No RFS, credits, or tariffs	0.0%	-12.9%	-11.1%	-8.8%	-9.8%	-12.4%	-14.8%	-15.6%	-16.0%	-16.0%

Farm income and consumer expenditures

Most of the scenarios explored here reduce support for corn-based ethanol production, at least under certain market circumstances. In general, these changes would reduce demand for corn to make into ethanol, leading to lower crop prices and crop receipts.

The lower crop prices cause feed costs for livestock producers to fall. This results in a modest expansion of meat and dairy production, which leads to a reduction in prices for livestock, poultry and milk. In general, feed costs decline more than livestock receipts, suggesting a slight increase in livestock sector profitability.

The average net effect on farm income is estimated to be negative in these cases, as negative effects on crop producers outweigh positive effects on livestock producers. Changes of a percent or two in agricultural commodity prices imply only very small reductions in consumer food expenditures.

The largest impacts occur in scenario 11, which removes all support for corn-based ethanol. Crop receipts decline by an annual average of more than \$11 billion from baseline levels. Livestock receipts fall by almost \$3 billion, but feed costs fall by \$4 billion, suggesting an increase in livestock sector profitability (which is supported by estimates of livestock producer net returns reported in the Appendix tables). Net farm income falls by about \$5 billion, as the benefits to livestock producers are far outweighed by reduced income to crop producers. Consumer food expenditures decline by about \$4 billion, or 0.3%.

In two cases, the results differ from this pattern.

5. *15% ethanol blends allowed.* The results in this case are opposing. Greater corn demand for ethanol causes higher crop prices, rising crop receipts, and greater livestock feed costs. The overall effect is an increase in net farm income. The increase in consumer food expenditures is proportionately small.
8. *Distillers grains diversion.* Drawing distillers grains into energy production and away from feed use leads to rising prices for distillers grains, corn and other feeds. These higher feed costs almost exactly offset the impact of higher crop and livestock sales receipts, so the net effect for overall farm income is approximately zero, on average. Rising overall prices for crop and animal products lead to slightly higher consumer food expenditures.

Table 6. Farm income and consumer food expenditures, 2011-2018 averages across 500 stochastic outcomes

	Crop receipts	Livestock receipts	Feed expenses	Net farm income	Consumer food expend.
	(billion dollars)				
Baseline	188.83	156.98	42.78	95.49	1395.87
1. Ethanol tax credit expires	188.23	156.79	42.56	95.23	1395.66
2. Countercyclical ethanol credit	188.72	156.96	42.75	95.44	1395.91
3. Ethanol tariff expires	186.11	156.37	41.91	94.27	1394.96
4. Countercyclical ethanol tariff	188.55	156.93	42.70	95.38	1395.78
5. 15% ethanol blends allowed	189.86	157.21	43.09	95.95	1396.21
6. Countercyclical plant payment	188.37	156.89	42.64	95.32	1395.72
7. Modified RFS	187.67	156.66	42.42	94.97	1395.49
8. Distillers grains diversion	191.23	157.92	45.19	95.45	1396.97
9. Countercyclical RFS	188.19	156.86	42.58	95.21	1395.69
10. No total RFS	184.78	156.11	41.42	93.61	1394.72
11. No RFS, credits, or tariffs	177.38	154.24	38.83	90.30	1391.89
Absolute change from baseline					
1. Ethanol tax credit expires	-0.59	-0.18	-0.21	-0.26	-0.22
2. Countercyclical ethanol credit	-0.11	-0.02	-0.03	-0.04	0.04
3. Ethanol tariff expires	-2.72	-0.61	-0.86	-1.22	-0.91
4. Countercyclical ethanol tariff	-0.28	-0.05	-0.08	-0.11	-0.09
5. 15% ethanol blends allowed	1.04	0.23	0.31	0.46	0.34
6. Countercyclical plant payment	-0.45	-0.09	-0.14	-0.17	-0.15
7. Modified RFS	-1.16	-0.32	-0.35	-0.52	-0.38
8. Distillers grains diversion	2.40	0.95	2.41	-0.04	1.09
9. Countercyclical RFS	-0.63	-0.11	-0.20	-0.27	-0.19
10. No total RFS	-4.05	-0.86	-1.36	-1.87	-1.15
11. No RFS, credits, or tariffs	-11.45	-2.74	-3.95	-5.19	-3.98
Percentage change from baseline					
1. Ethanol tax credit expires	-0.3%	-0.1%	-0.5%	-0.3%	0.0%
2. Countercyclical ethanol credit	-0.1%	0.0%	-0.1%	0.0%	0.0%
3. Ethanol tariff expires	-1.4%	-0.4%	-2.0%	-1.3%	-0.1%
4. Countercyclical ethanol tariff	-0.1%	0.0%	-0.2%	-0.1%	0.0%
5. 15% ethanol blends allowed	0.6%	0.1%	0.7%	0.5%	0.0%
6. Countercyclical plant payment	-0.2%	-0.1%	-0.3%	-0.2%	0.0%
7. Modified RFS	-0.6%	-0.2%	-0.8%	-0.5%	0.0%
8. Distillers grains diversion	1.3%	0.6%	5.6%	0.0%	0.1%
9. Countercyclical RFS	-0.3%	-0.1%	-0.5%	-0.3%	0.0%
10. No total RFS	-2.1%	-0.6%	-3.2%	-2.0%	-0.1%
11. No RFS, credits, or tariffs	-6.1%	-1.7%	-9.2%	-5.4%	-0.3%

Corn price variability

The ranges of results among the 500 stochastic simulations estimate the implications for price variability of different hypothetical policies. The following table shows the single year 2010/11 corn price range of all 500 simulations, as characterized by average and standard deviation (left two columns); and the average 2010/11 corn prices for the 50 simulations with the highest corn price (middle column). The high corn price simulations are further divided to identify how the triggers chosen here relate to some underlying factors that cause corn price variability. First, the 25 with the highest petroleum price (fourth column) and, second, the 25 with the lowest corn yield (fifth column).⁶

Expired and countercyclical tax credit. Average corn price is lower than in the baseline if the tax credit is allowed to expire or if it is reduced automatically when corn prices are high. When market conditions result in high corn prices, either alternative will slightly moderate those prices. Changing the tax credit has a larger impact on corn prices when high corn prices are caused by high petroleum prices than when they are caused by low corn yields. High petroleum prices make it less likely that use mandates are binding, so changing tax credits has significant market impacts.

Expired and countercyclical tariff. Both forms of tariff adjustment reduce the range in corn price variation, primarily by moderating high corn prices. In contrast to the tax credit scenarios, changing the tariff has a larger impact when high corn prices are caused by low corn yields than when they are caused by high petroleum prices. Low corn yields make it more likely that the total RFS mandate is binding, so the increase in imports caused by a lower tariff results in a similar reduction in ethanol production.

Countercyclical plant payment. This policy tends to reduce the range of corn price effects for much the same reason as the tariff expiration, namely easier access to foreign ethanol.

Modified, countercyclical or eliminated RFS. A lower RFS significantly reduces corn prices. The countercyclical RFS has a greater effect on corn prices when low corn yields make it more likely that the RFS is binding. If mandates are not binding because of a high petroleum price or other factors, reducing the RFS may have little impact on corn prices.

No RFS, credits or tariffs. In scenario 11, effects are much larger than in all of the other scenarios. Corn price effects are especially large when low corn yields limit supplies. Without mandates or other support policies, ethanol production is free to contract sharply, resulting in significantly lower corn prices. Scenario 11 reduces corn prices by an average of \$0.49 per bushel across all outcomes, and by \$0.74 per bushel in the outcomes where baseline corn prices were high and corn yields were low.

Table 7. 2010/11 corn prices: Averages and sorted outcomes

	Average of all 500 outcomes	Standard deviation of all 500	Average of top 50 outcomes	25 of top 50 with highest oil prices	25 of top 50 with lowest corn yields
	(dollars per bushel)				
Baseline	3.78	0.61	4.93	4.95	4.93
1. Ethanol tax credit expires	3.70	0.61	4.86	4.86	4.88
2. Countercyclical ethanol credit	3.77	0.60	4.89	4.89	4.90
3. Ethanol tariff expires	3.69	0.57	4.73	4.81	4.70
4. Countercyclical ethanol tariff	3.77	0.59	4.83	4.88	4.81
5. 15% ethanol blends allowed	3.80	0.61	4.94	4.99	4.92
6. Countercyclical plant payment	3.77	0.56	4.77	4.81	4.76
7. Modified RFS	3.73	0.60	4.85	4.91	4.83
8. Distillers grains diversion	3.88	0.57	4.94	4.99	4.92
9. Countercyclical RFS	3.76	0.57	4.77	4.86	4.74
10. No total RFS	3.58	0.58	4.59	4.85	4.48
11. No RFS, credits, or tariffs	3.29	0.59	4.28	4.51	4.19
Absolute change from baseline					
1. Ethanol tax credit expires	-0.08	0.00	-0.07	-0.10	-0.05
2. Countercyclical ethanol credit	-0.01	-0.01	-0.04	-0.06	-0.03
3. Ethanol tariff expires	-0.09	-0.04	-0.20	-0.14	-0.23
4. Countercyclical ethanol tariff	-0.01	-0.02	-0.10	-0.07	-0.12
5. 15% ethanol blends allowed	0.02	0.00	0.01	0.04	-0.01
6. Countercyclical plant payment	-0.01	-0.05	-0.16	-0.14	-0.17
7. Modified RFS	-0.06	-0.01	-0.08	-0.04	-0.10
8. Distillers grains diversion	0.10	-0.04	0.01	0.03	-0.01
9. Countercyclical RFS	-0.02	-0.04	-0.15	-0.09	-0.19
10. No total RFS	-0.21	-0.03	-0.34	-0.11	-0.45
11. No RFS, credits, or tariffs	-0.49	-0.02	-0.64	-0.45	-0.74
Percentage change from baseline					
1. Ethanol tax credit expires	-2.0%	-0.5%	-1.4%	-2.0%	-1.0%
2. Countercyclical ethanol credit	-0.2%	-2.1%	-0.9%	-1.2%	-0.6%
3. Ethanol tariff expires	-2.4%	-7.3%	-4.0%	-2.9%	-4.6%
4. Countercyclical ethanol tariff	-0.3%	-3.7%	-2.0%	-1.5%	-2.4%
5. 15% ethanol blends allowed	0.5%	0.6%	0.3%	0.8%	-0.1%
6. Countercyclical plant payment	-0.3%	-8.2%	-3.2%	-2.8%	-3.4%
7. Modified RFS	-1.5%	-0.9%	-1.6%	-0.9%	-2.0%
8. Distillers grains diversion	2.7%	-7.1%	0.2%	0.7%	-0.2%
9. Countercyclical RFS	-0.6%	-6.0%	-3.1%	-1.9%	-3.8%
10. No total RFS	-5.4%	-4.2%	-7.0%	-2.2%	-9.1%
11. No RFS, credits, or tariffs	-12.9%	-3.7%	-13.1%	-9.1%	-15.0%

Particular outcomes with high corn prices

Estimates of average impacts can fail to demonstrate how the impacts of particular biofuel policies are very sensitive to the market context. Focusing on a few selected outcomes may further clarify the sensitivity of policy impacts to market circumstances.

Table 8 examines three of the 500 results for 2010/11 corn prices. In outcome #5, the baseline corn price is \$5.33 per bushel, primarily because corn yields are assumed to be well below average because of unfavorable weather. In such a case, ethanol production would contract were it not for the RFS. The scenario results demonstrate this clearly. Removing the RFS (scenario 10) reduces the corn price by \$0.63 per bushel, but allowing tax credits to expire (scenario 1) has little impact. Removing the ethanol tariff has a moderate impact, as the resulting increase in imports displaces domestic ethanol production.

In outcome #121, the baseline corn price is \$5.81 per bushel, primarily because a very high petroleum price results in strong ethanol demand. Ethanol consumption exceeds the RFS, so removing the RFS has no impact on ethanol markets or corn prices. Eliminating the ethanol tax credit, on the other hand, has the effect of reducing producer prices for ethanol, which in turn reduces the price that they can pay corn producers. Thus, allowing the tax credit to expire would reduce the corn price by \$0.23 per bushel. Eliminating the ethanol tariff would result in more imports, but would only slightly depress ethanol and corn prices, as the high petroleum prices make it fairly easy for the market to absorb additional ethanol supplies.

In outcome #288, the baseline corn price is \$5.42 per bushel, as petroleum prices are high and corn yields are low.⁷ In this case, removing either the ethanol tax credit or the RFS supporting corn-based ethanol has only a modest impact on ethanol markets and corn prices. If the tax credit is removed, ethanol use falls slightly until the RFS becomes binding. If the RFS is removed, ethanol use is no longer constrained, but the tax credit and tariff provide sufficient support to maintain ethanol use and corn prices near baseline levels. When the tariff is eliminated, the result is a significant increase in imports that displaces domestic ethanol production with use near the RFS levels, and this reduces corn prices by \$0.20 per bushel. When all three policies are eliminated at the same time (scenario 11), the \$0.48 per bushel impact on corn prices is greater than the sum of the impacts of the policies removed separately (\$0.05 + \$0.20 + \$0.10, or \$0.35 per bushel).

These three outcomes show that which policy has the greatest impact on ethanol and corn markets depends on the market context. Depending on the cause of a high corn price, changing only one of the RFS, the ethanol tax credit, or the tariff may have very large or almost no impact. However, when policy options are combined, they may have joint effects that are different than the sum of their effects considered one at a time.

Table 8. Three outcomes with high 2010/11 corn prices

	Average of all 500 outcomes	Outcome #5	Outcome #121	Outcome #288
<u>Corn yield</u> (bushels per acre)				
Baseline	157.96	131.37	156.33	130.18
Absolute deviation from average		-26.59	-1.63	-27.78
Percentage deviation from average		-16.8%	-1.0%	-17.6%
<u>Crude oil price</u> (dollars per barrel)				
Baseline	63.78	59.88	135.78	93.26
Absolute deviation from average		-3.91	72.00	29.48
Percentage deviation from average		-6.1%	112.9%	46.2%
<u>Corn price</u> (dollars per bushel)				
Baseline	3.78	5.33	5.81	5.42
Absolute deviation from average		1.54	2.03	1.64
Percentage deviation from average		40.8%	53.6%	43.4%
1. Ethanol tax credit expires	3.70	5.28	5.58	5.37
3. Ethanol tariff expires	3.69	5.07	5.77	5.22
10. No total RFS	3.58	4.70	5.81	5.32
11. No RFS, credits, or tariffs	3.29	4.50	5.55	4.94
Absolute change from baseline				
<u>Corn price</u> (dollars per bushel)				
1. Ethanol tax credit expires	-0.08	-0.04	-0.23	-0.05
3. Ethanol tariff expires	-0.09	-0.26	-0.03	-0.20
10. No total RFS	-0.21	-0.63	0.00	-0.10
11. No RFS, credits, or tariffs	-0.49	-0.82	-0.26	-0.48
Percentage change from baseline				
<u>Corn price</u>				
1. Ethanol tax credit expires	-2.0%	-0.8%	-3.9%	-1.0%
3. Ethanol tariff expires	-2.4%	-4.9%	-0.6%	-3.7%
10. No total RFS	-5.4%	-11.8%	0.0%	-1.8%
11. No RFS, credits, or tariffs	-12.9%	-15.5%	-4.4%	-8.9%

Particular outcomes with low corn prices

Table 8 showed that ethanol policy impacts on markets when corn prices are high are very sensitive to the reasons why corn prices are high. Table 9 shows that policy impacts when corn prices are low are likewise very sensitive to the reasons why corn prices are low.

In outcome #72, the baseline corn price is \$2.41 per bushel, in part because petroleum prices are well below average and non-ethanol demand for corn is assumed to be weak. In such a case, ethanol production would contract were it not for the RFS. Removing the RFS supporting corn-based ethanol (scenario 10) reduces the corn price by \$0.19 per bushel, but allowing tax credits to expire (scenario 1) or removing the ethanol tariff (scenario 3) have little impact.

Removing all support for corn-based ethanol (scenario 11) reduces corn prices by \$0.49 per bushel, far more than the sum of the effects of the individual policies considered one at a time. Once again, this is evidence of redundant support under current policies—either the tax credit or the mandate would be adequate to support a certain level of ethanol production, and large ethanol and corn market effects occur only when both are removed simultaneously.

In outcome #88, the baseline corn price is \$2.38 per bushel, as corn yields are well above average and petroleum prices are below average. Results of the various policy scenarios are broadly similar to those for outcome #72, except removing the RFS only reduces the corn price by \$0.05 per bushel. Higher corn yields and crude oil prices make the RFS a little less binding than in outcome #72. Once again, there is strong evidence of redundant support, as indicated by the impacts of scenario 11 relative to the impacts of scenarios 1, 3 and 10 combined.

In outcome #294, the baseline corn price is \$2.65 per bushel. This is well below the average corn price of all 500 outcomes, primarily because the corn yield is well above average. With crude oil prices actually a little above average, the result is that there is more than enough ethanol production to satisfy the RFS. In such a case, removing the RFS makes no difference, but eliminating the blender's tax credit reduces the price that plants can pay for corn and still remain in operation. Without a binding RFS at play, the effect of removing all three policies is simply the sum of the effects of removing the tax credit and the tariff.

In contrast to the outcomes with high corn prices, removing the ethanol import tariff has only small impacts on corn markets when market conditions result in low corn prices. In the outcomes with a binding RFS (#72 and #88), this occurs because domestic ethanol prices are low enough relative to Brazilian prices that there is little incentive to import much additional ethanol even when there is no tariff. In outcome #294, ethanol prices are high enough to draw in additional imports when tariffs are removed, but without a binding mandate, the main effect is to increase total ethanol use and only marginally reduce ethanol prices.

Table 9. Three outcomes with low 2010/11 corn prices

	Average of all 500 outcomes	Outcome #72	Outcome #88	Outcome #294
<u>Corn yield</u> (bushels per acre)				
Baseline	157.96	161.41	170.27	171.75
Absolute deviation from average		3.44	12.31	13.78
Percentage deviation from average		2.2%	7.8%	8.7%
<u>Crude oil price</u> (dollars per barrel)				
Baseline	63.78	36.16	47.14	65.79
Absolute deviation from average		-27.62	-16.64	2.00
Percentage deviation from average		-43.3%	-26.1%	3.1%
<u>Corn price</u> (dollars per bushel)				
Baseline	3.78	2.41	2.38	2.65
Absolute deviation from average		-1.38	-1.40	-1.14
Percentage deviation from average		-36.4%	-37.1%	-30.0%
1. Ethanol tax credit expires	3.70	2.36	2.34	2.55
3. Ethanol tariff expires	3.69	2.38	2.37	2.64
10. No total RFS	3.58	2.22	2.33	2.65
11. No RFS, credits, or tariffs	3.29	1.92	2.06	2.55
Absolute change from baseline				
<u>Corn price</u> (dollars per bushel)				
1. Ethanol tax credit expires	-0.08	-0.04	-0.04	-0.09
3. Ethanol tariff expires	-0.09	-0.02	-0.01	-0.01
10. No total RFS	-0.21	-0.19	-0.05	0.00
11. No RFS, credits, or tariffs	-0.49	-0.49	-0.32	-0.10
Percentage change from baseline				
<u>Corn price</u>				
1. Ethanol tax credit expires	-2.0%	-1.7%	-1.6%	-3.5%
3. Ethanol tariff expires	-2.4%	-0.9%	-0.3%	-0.2%
10. No total RFS	-5.4%	-7.8%	-2.0%	0.0%
11. No RFS, credits, or tariffs	-12.9%	-20.3%	-13.3%	-3.6%

Countercyclical triggers

All of the countercyclical scenarios (2, 4, 6 and 9) use a trigger where support to the domestic ethanol sector is reduced when the season-average corn price exceeds \$4.00 per bushel.

- In scenario 2, the ethanol tax credit is reduced when corn prices exceed \$4.00 per bushel.
- In scenario 4, the ethanol tariff is reduced when corn prices exceed \$4.00 per bushel.
- In scenario 6, the ethanol plant payment is reduced when corn prices exceed \$4.00 per bushel.
- In scenario 9, the RFS is reduced when corn prices exceed \$4.00 per bushel.

The trigger used in these scenarios has the effect of reducing ethanol production when corn prices are over \$4.00 per bushel. This has a moderating impact on corn prices.

Instead of being tied to a \$4.00 corn price, the trigger could be set at a different fixed level, or as a function of a moving average of market prices. In either case, the qualitative results would be similar to those reported here, although the magnitude of impacts would depend on the trigger level. The analysis uses realized season-average prices as a trigger. To put this into operation would require projections of these prices or an alternative mechanism. Using observed monthly prices, for example, would result in policies more immediately responsive to market developments, but could result in frequent policy adjustments during the course of a year.

Another option would be to set a trigger based on actual or projected corn stocks-to-use ratios, a signal of when the physical availability of grain for other users is most at risk. Prices generally increase as stocks-to-use ratios fall, but recent experience shows the correlation is not perfect.

A corn price-based trigger does help moderate high corn prices for livestock producers, but it has negative impacts on ethanol producer profits when corn prices are high. In the case of drought, for example, the assumed trigger would reduce ethanol industry support at the same time that high corn prices are increasing costs to ethanol producers. The reduction in plant profitability causes a reduction in ethanol production that in turn moderates corn price impacts.

Another alternative trigger would be tied to petroleum prices--higher petroleum prices would result in lower supports for ethanol production. Such an approach would only reduce ethanol plant profitability at a time when profits are likely to be strong anyway, as high petroleum prices usually result in high ethanol prices. It would still help moderate high corn prices that are caused by high petroleum prices, but it would not moderate high corn prices caused by a drought or any factor other than high oil prices.

For any countercyclical program, the choice of a trigger involves important trade-offs. The trigger assumed in these scenarios is simple and the results illustrate some of these trade-offs.

Endnotes

¹ The organizations that helped identify the first nine alternative scenarios include the Texas Cattle Feeders Association, the Texas and Southwestern Cattle Raisers Association, the Independent Cattlemen's Association of Texas, the Texas Pork Producers Association, the Texas Poultry Federation, the Texas Association of Dairymen, the Corn Producers Association of Texas, the Texas Corn Producers Board, the Texas Grain Sorghum Producers Association, the South Texas Cotton and Grain Association and the Southwest Council of Agribusiness.

² **FAPRI U.S. Baseline Briefing Book**, FAPRI-MU Report #01-09, March 2009, www.fapri.missouri.edu. For a description of a previous version of the ethanol model used in this analysis, see **Model of the US Ethanol Market**, FAPRI-MU Report #07-08, July 2008.

³ The baseline average ethanol domestic use from 2011-2018 is 16.6 billion gallons (Table 2). That average includes two very different cases. If the petroleum price or the corn yield is high, then there is a greater likelihood that buyers and sellers settle on an amount of ethanol that is greater than the mandated minimum. In this case, the mandate is not binding: it does not bind the behavior of people in the market, who make and use the quantities they would anyway given the prevailing conditions. If the petroleum price or corn yield is low, then the market might settle on a volume of ethanol use less than the mandate, so the mandate requires that a higher amount is bought and sold. In this case, the mandate is binding: blenders are required to handle more biofuel than they would otherwise, so they bid higher the prices at which they buy biofuels and then price biofuel-blended fuels at prices below their costs in order to sell it to consumers who would otherwise not buy all the biofuel at a higher price.

⁴ This scenario assumes few hindrances to set an upper limit on estimated market effects. A more gradual adoption process that permits different maximum inclusion rates for different cars would lead to smaller estimated market effects during the baseline period than those shown here.

⁵ The results here, as throughout this report, are sensitive to the policy assumptions. The choice of a specific trigger of \$4.00 per bushel that marks the limit above which the payment to plants starts to decline was somewhat arbitrary. The average payment tends to be high in the early years and the average payment then decreases as corn prices tend to rise at first. If the trigger were set very low, then payments would be lower overall. If the trigger were set very high, then payments would always average close to their maximum. This dependency on exact triggers applies to other scenarios with a countercyclical element.

⁶ These two sets are not mutually exclusive. A mostly random number of the 25 scenarios with high petroleum price will also happen to have a low corn yield.

⁷ Factors other than corn yields and petroleum prices also affect stochastic prices. For example, export demand and shocks to the supply and demand of other commodities can also affect corn prices. These other factors explain why corn the 2010/11 corn price is actually lower in outcome #288 than in outcome #5, even though corn yields are similar in the two outcomes and petroleum prices are higher in outcome #288.

Table A.1.a. Ethanol tax credit expires
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Ethanol tax credit expires	Absolute difference	Percentage difference
Tax and tariff provisions	(Dollars per gallon)			
Ethanol tax credit	0.45	0.00	-0.45	n.a.
Biodiesel tax credit	1.00	1.00	0.00	n.a.
Ethanol specific tariff	0.54	0.54	0.00	n.a.
	(Billion gallons)			
Renewable Fuel Standard	19.58	19.58	0.00	0.0%
Biofuel sector results	(Billion gallons)			
Ethanol production	15.38	15.08	-0.30	-1.9%
Ethanol imports	1.38	1.39	0.01	0.6%
Ethanol domestic disappearance	16.56	16.26	-0.30	-1.8%
Biodiesel production	1.18	1.19	0.01	0.9%
	(Dollars per gallon)			
Ethanol price, conventional rack, Omaha	2.07	2.04	-0.02	-1.2%
Ethanol effective retail price	2.05	2.09	0.04	2.1%
Dry mill returns over operating costs	0.38	0.36	-0.02	-4.5%
Biodiesel rack price	4.45	4.46	0.01	0.3%
Corn sector supply and use	(Billion bushels)			
Corn production	13.82	13.75	-0.06	-0.5%
Corn ethanol use	5.09	4.98	-0.11	-2.1%
Corn feed use	5.28	5.30	0.02	0.4%
Corn exports	2.08	2.11	0.03	1.3%
Soybean sector supply and use	(Billion bushels)			
Soybean production	3.32	3.33	0.01	0.2%
Soybean crush	1.98	1.98	0.00	0.1%
Soybean exports	1.17	1.18	0.00	0.4%
Crop planted acreage	(Million acres)			
Corn	89.89	89.49	-0.40	-0.4%
Soybeans	76.72	76.90	0.18	0.2%
Wheat	58.81	58.81	0.00	0.0%
9 other crops plus hay	94.08	94.10	0.02	0.0%
Conservation reserve area	29.58	29.66	0.08	0.3%
12 crops + hay + CRP	349.08	348.96	-0.12	0.0%
Crop sector prices	(Dollars per bushel)			
Corn farm price	4.04	4.02	-0.02	-0.6%
Soybean farm price	9.73	9.71	-0.02	-0.2%
Wheat farm price	5.74	5.72	-0.02	-0.3%
	(Cents per pound)			
Upland cotton farm price	58.90	58.85	-0.05	-0.1%
Soybean oil market price, Decatur	47.34	47.48	0.14	0.3%
	(Dollars per ton)			
Soymeal price, 48% protein	259.63	258.67	-0.95	-0.4%
Distillers grain price, Indiana	133.80	133.75	-0.05	0.0%

Table A.1.b. Ethanol tax credit expires
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Ethanol tax credit expires	Absolute difference	Percentage difference
Meat and milk production	(Billion pounds)			
Beef production	26.51	26.51	0.00	0.0%
Pork production	24.66	24.69	0.03	0.1%
Broiler production	39.50	39.54	0.04	0.1%
Milk production	199.01	199.05	0.03	0.0%
Livestock and dairy prices	(Dollars per hundredweight)			
Steers, Nebraska direct	101.60	101.49	-0.10	-0.1%
Feeder steers, 600-650 lbs., OK City	130.34	130.28	-0.06	0.0%
Barrows & gilts, 51-52% lean	54.70	54.56	-0.14	-0.3%
Broilers, 12-city wholesale	86.18	85.98	-0.21	-0.2%
All milk	17.06	17.05	-0.01	-0.1%
Livestock and dairy net returns	(Mixed units)			
Cow-calf (\$ per cow)	35.29	35.27	-0.02	0.0%
Hog farrow-finish (\$ per cwt)	2.07	2.14	0.07	3.4%
Chicken feed price ratio	5.72	5.72	0.00	0.1%
Milk (\$ per cwt)	0.32	0.32	0.00	1.5%
Farm income	(Billion dollars)			
Crop receipts	188.83	188.23	-0.59	-0.3%
Livestock receipts	156.98	156.79	-0.18	-0.1%
Government payments	13.27	13.29	0.02	0.1%
Feed costs	42.78	42.56	-0.21	-0.5%
Rent to non-operator landlords	12.67	12.55	-0.12	-1.0%
Other production expenses	258.32	258.11	-0.21	-0.1%
Total production expenses	313.77	313.23	-0.54	-0.2%
Other net farm income	50.19	50.14	-0.04	-0.1%
Net farm income	95.49	95.23	-0.26	-0.3%
Farm program outlays	(Billion dollars)			
Net CCC outlays (fiscal year basis)	10.78	10.79	0.02	0.1%
Consumer food expenditures	(Billion dollars)			
	1,395.87	1,395.66	-0.22	0.0%

Table A.2.a. Countercyclical ethanol tax credit
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Countercyclical ethanol tax credit	Absolute difference	Percentage difference
Tax and tariff provisions	(Dollars per gallon)			
Ethanol tax credit	0.45	0.39	-0.06	-12.5%
Biodiesel tax credit	1.00	1.00	0.00	0.0%
Ethanol specific tariff	0.54	0.54	0.00	0.0%
	(Billion gallons)			
Renewable Fuel Standard	19.58	19.58	0.00	0.0%
Biofuel sector results	(Billion gallons)			
Ethanol production	15.38	15.31	-0.06	-0.4%
Ethanol imports	1.38	1.37	-0.01	-0.9%
Ethanol domestic disappearance	16.56	16.48	-0.08	-0.5%
Biodiesel production	1.18	1.18	0.00	0.1%
	(Dollars per gallon)			
Ethanol price, conventional rack, Omaha	2.07	2.06	-0.01	-0.3%
Ethanol effective retail price	2.05	2.06	0.01	0.4%
Dry mill returns over operating costs	0.38	0.38	0.00	-1.1%
Biodiesel rack price	4.45	4.45	0.00	0.0%
Corn sector supply and use	(Billion bushels)			
Corn production	13.82	13.80	-0.02	-0.1%
Corn ethanol use	5.09	5.07	-0.02	-0.4%
Corn feed use	5.28	5.28	0.00	0.1%
Corn exports	2.08	2.09	0.00	0.2%
Soybean sector supply and use	(Billion bushels)			
Soybean production	3.32	3.32	0.00	0.0%
Soybean crush	1.98	1.98	0.00	0.0%
Soybean exports	1.17	1.17	0.00	0.1%
Crop planted acreage	(Million acres)			
Corn	89.89	89.80	-0.09	-0.1%
Soybeans	76.72	76.77	0.04	0.1%
Wheat	58.81	58.81	0.01	0.0%
9 other crops plus hay	94.08	94.09	0.00	0.0%
Conservation reserve area	29.58	29.59	0.01	0.0%
12 crops + hay + CRP	349.08	349.06	-0.02	0.0%
Crop sector prices	(Dollars per bushel)			
Corn farm price	4.04	4.03	0.00	-0.1%
Soybean farm price	9.73	9.72	-0.01	-0.1%
Wheat farm price	5.74	5.74	0.00	-0.1%
	(Cents per pound)			
Upland cotton farm price	58.90	58.89	-0.01	0.0%
Soybean oil market price, Decatur	47.34	47.33	-0.01	0.0%
	(Dollars per ton)			
Soymeal price, 48% protein	259.63	259.48	-0.14	-0.1%
Distillers grain price, Indiana	133.80	133.81	0.01	0.0%

Table A.2.b. Countercyclical ethanol tax credit
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Countercyclical ethanol tax credit	Absolute difference	Percentage difference
Meat and milk production	(Billion pounds)			
Beef production	26.51	26.51	0.00	0.0%
Pork production	24.66	24.67	0.00	0.0%
Broiler production	39.50	39.50	0.00	0.0%
Milk production	199.01	199.01	0.00	0.0%
Livestock and dairy prices	(Dollars per hundredweight)			
Steers, Nebraska direct	101.60	101.59	-0.01	0.0%
Feeder steers, 600-650 lbs., OK City	130.34	130.33	-0.01	0.0%
Barrows & gilts, 51-52% lean	54.70	54.69	-0.02	0.0%
Broilers, 12-city wholesale	86.18	86.17	-0.02	0.0%
All milk	17.06	17.06	0.00	0.0%
Livestock and dairy net returns	(Mixed units)			
Cow-calf (\$ per cow)	35.29	35.30	0.01	0.0%
Hog farrow-finish (\$ per cwt)	2.07	2.08	0.01	0.6%
Chicken feed price ratio	5.72	5.72	0.00	0.0%
Milk (\$ per cwt)	0.32	0.32	0.00	0.3%
Farm income	(Billion dollars)			
Crop receipts	188.83	188.72	-0.11	-0.1%
Livestock receipts	156.98	156.96	-0.02	0.0%
Government payments	13.27	13.25	-0.02	-0.1%
Feed costs	42.78	42.75	-0.03	-0.1%
Rent to non-operator landlords	12.67	12.65	-0.02	-0.2%
Other production expenses	258.32	258.29	-0.03	0.0%
Total production expenses	313.77	313.69	-0.08	0.0%
Other net farm income	50.19	50.20	0.02	0.0%
Net farm income	95.49	95.44	-0.04	0.0%
Farm program outlays	(Billion dollars)			
Net CCC outlays (fiscal year basis)	10.78	10.76	-0.01	-0.1%
Consumer food expenditures	(Billion dollars)			
	1,395.87	1,395.91	0.04	0.0%

Table A.3.a. Ethanol tariff expires
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Ethanol tariff expires	Absolute difference	Percentage difference
Tax and tariff provisions	(Dollars per gallon)			
Ethanol tax credit	0.45	0.45	0.00	n.a.
Biodiesel tax credit	1.00	1.00	0.00	n.a.
Ethanol specific tariff	0.54	0.00	-0.54	n.a.
	(Billion gallons)			
Renewable Fuel Standard	19.58	19.58	0.00	0.0%
Biofuel sector results	(Billion gallons)			
Ethanol production	15.38	14.03	-1.35	-8.8%
Ethanol imports	1.38	3.16	1.78	128.4%
Ethanol domestic disappearance	16.56	16.95	0.39	2.3%
Biodiesel production	1.18	1.18	0.01	0.5%
	(Dollars per gallon)			
Ethanol price, conventional rack, Omaha	2.07	1.97	-0.10	-4.8%
Ethanol effective retail price	2.05	2.03	-0.02	-1.0%
Dry mill returns over operating costs	0.38	0.32	-0.06	-16.1%
Biodiesel rack price	4.45	4.40	-0.04	-1.0%
Corn sector supply and use	(Billion bushels)			
Corn production	13.82	13.55	-0.27	-1.9%
Corn ethanol use	5.09	4.62	-0.47	-9.3%
Corn feed use	5.28	5.37	0.10	1.8%
Corn exports	2.08	2.19	0.11	5.3%
Soybean sector supply and use	(Billion bushels)			
Soybean production	3.32	3.35	0.03	0.8%
Soybean crush	1.98	1.99	0.01	0.4%
Soybean exports	1.17	1.19	0.02	1.5%
Crop planted acreage	(Million acres)			
Corn	89.89	88.22	-1.67	-1.9%
Soybeans	76.72	77.39	0.67	0.9%
Wheat	58.81	58.86	0.05	0.1%
9 other crops plus hay	94.08	94.17	0.09	0.1%
Conservation reserve area	29.58	29.86	0.28	1.0%
12 crops + hay + CRP	349.08	348.51	-0.57	-0.2%
Crop sector prices	(Dollars per bushel)			
Corn farm price	4.04	3.93	-0.11	-2.8%
Soybean farm price	9.73	9.60	-0.13	-1.4%
Wheat farm price	5.74	5.65	-0.09	-1.6%
	(Cents per pound)			
Upland cotton farm price	58.90	58.69	-0.21	-0.4%
Soybean oil market price, Decatur	47.34	46.74	-0.60	-1.3%
	(Dollars per ton)			
Soymeal price, 48% protein	259.63	257.86	-1.77	-0.7%
Distillers grain price, Indiana	133.80	133.12	-0.68	-0.5%

Table A.3.b. Ethanol tariff expires
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Ethanol tariff expires	Absolute difference	Percentage difference
Meat and milk production	(Billion pounds)			
Beef production	26.51	26.52	0.01	0.0%
Pork production	24.66	24.76	0.10	0.4%
Broiler production	39.50	39.62	0.12	0.3%
Milk production	199.01	199.13	0.12	0.1%
Livestock and dairy prices	(Dollars per hundredweight)			
Steers, Nebraska direct	101.60	101.24	-0.36	-0.4%
Feeder steers, 600-650 lbs., OK City	130.34	130.26	-0.08	-0.1%
Barrows & gilts, 51-52% lean	54.70	54.19	-0.52	-0.9%
Broilers, 12-city wholesale	86.18	85.56	-0.62	-0.7%
All milk	17.06	17.01	-0.05	-0.3%
Livestock and dairy net returns	(Mixed units)			
Cow-calf (\$ per cow)	35.29	35.92	0.63	1.8%
Hog farrow-finish (\$ per cwt)	2.07	2.40	0.33	16.1%
Chicken feed price ratio	5.72	5.74	0.02	0.4%
Milk (\$ per cwt)	0.32	0.36	0.04	11.9%
Farm income	(Billion dollars)			
Crop receipts	188.83	186.11	-2.72	-1.4%
Livestock receipts	156.98	156.37	-0.61	-0.4%
Government payments	13.27	13.31	0.05	0.3%
Feed costs	42.78	41.91	-0.86	-2.0%
Rent to non-operator landlords	12.67	12.14	-0.54	-4.2%
Other production expenses	258.32	257.58	-0.74	-0.3%
Total production expenses	313.77	311.63	-2.14	-0.7%
Other net farm income	50.19	50.11	-0.08	-0.2%
Net farm income	95.49	94.27	-1.22	-1.3%
Farm program outlays	(Billion dollars)			
Net CCC outlays (fiscal year basis)	10.78	10.85	0.07	0.7%
Consumer food expenditures	(Billion dollars)			
	1,395.87	1,394.96	-0.91	-0.1%

Table A.4.a. Countercyclical ethanol tariff
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Countercyclical ethanol tariff	Absolute difference	Percentage difference
(Dollars per gallon)				
Tax and tariff provisions				
Ethanol tax credit	0.45	0.45	0.00	0.0%
Biodiesel tax credit	1.00	1.00	0.00	0.0%
Ethanol specific tariff	0.54	0.47	-0.07	-12.2%
(Billion gallons)				
Renewable Fuel Standard	19.58	19.58	0.00	0.0%
(Billion gallons)				
Biofuel sector results				
Ethanol production	15.38	15.23	-0.15	-1.0%
Ethanol imports	1.38	1.56	0.18	12.8%
Ethanol domestic disappearance	16.56	16.58	0.03	0.2%
Biodiesel production	1.18	1.18	0.00	0.1%
(Dollars per gallon)				
Ethanol price, conventional rack, Omaha	2.07	2.06	-0.01	-0.4%
Ethanol effective retail price	2.05	2.05	0.00	-0.1%
Dry mill returns over operating costs	0.38	0.37	-0.01	-1.3%
Biodiesel rack price	4.45	4.44	-0.01	-0.1%
(Billion bushels)				
Corn sector supply and use				
Corn production	13.82	13.79	-0.03	-0.2%
Corn ethanol use	5.09	5.04	-0.05	-1.0%
Corn feed use	5.28	5.28	0.01	0.2%
Corn exports	2.08	2.10	0.01	0.5%
(Billion bushels)				
Soybean sector supply and use				
Soybean production	3.32	3.33	0.00	0.1%
Soybean crush	1.98	1.98	0.00	0.0%
Soybean exports	1.17	1.17	0.00	0.2%
(Million acres)				
Crop planted acreage				
Corn	89.89	89.69	-0.20	-0.2%
Soybeans	76.72	76.81	0.09	0.1%
Wheat	58.81	58.82	0.01	0.0%
9 other crops plus hay	94.08	94.10	0.01	0.0%
Conservation reserve area	29.58	29.61	0.03	0.1%
12 crops + hay + CRP	349.08	349.03	-0.05	0.0%
(Dollars per bushel)				
Crop sector prices				
Corn farm price	4.04	4.03	-0.01	-0.3%
Soybean farm price	9.73	9.71	-0.02	-0.2%
Wheat farm price	5.74	5.73	-0.01	-0.2%
(Cents per pound)				
Upland cotton farm price	58.90	58.88	-0.02	0.0%
Soybean oil market price, Decatur	47.34	47.26	-0.08	-0.2%
(Dollars per ton)				
Soymeal price, 48% protein	259.63	259.41	-0.22	-0.1%
Distillers grain price, Indiana	133.80	133.77	-0.03	0.0%

Table A.4.b. Countercyclical ethanol tariff
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Countercyclical ethanol tariff	Absolute difference	Percentage difference
Meat and milk production	(Billion pounds)			
Beef production	26.51	26.51	0.00	0.0%
Pork production	24.66	24.67	0.01	0.0%
Broiler production	39.50	39.51	0.01	0.0%
Milk production	199.01	199.03	0.01	0.0%
Livestock and dairy prices	(Dollars per hundredweight)			
Steers, Nebraska direct	101.60	101.57	-0.03	0.0%
Feeder steers, 600-650 lbs., OK City	130.34	130.34	0.00	0.0%
Barrows & gilts, 51-52% lean	54.70	54.65	-0.05	-0.1%
Broilers, 12-city wholesale	86.18	86.13	-0.05	-0.1%
All milk	17.06	17.06	-0.01	0.0%
Livestock and dairy net returns	(Mixed units)			
Cow-calf (\$ per cow)	35.29	35.40	0.11	0.3%
Hog farrow-finish (\$ per cwt)	2.07	2.11	0.04	1.9%
Chicken feed price ratio	5.72	5.72	0.00	0.1%
Milk (\$ per cwt)	0.32	0.32	0.00	0.9%
Farm income	(Billion dollars)			
Crop receipts	188.83	188.55	-0.28	-0.1%
Livestock receipts	156.98	156.93	-0.05	0.0%
Government payments	13.27	13.25	-0.02	-0.1%
Feed costs	42.78	42.70	-0.08	-0.2%
Rent to non-operator landlords	12.67	12.62	-0.06	-0.5%
Other production expenses	258.32	258.23	-0.08	0.0%
Total production expenses	313.77	313.54	-0.23	-0.1%
Other net farm income	50.19	50.20	0.02	0.0%
Net farm income	95.49	95.38	-0.11	-0.1%
Farm program outlays	(Billion dollars)			
Net CCC outlays (fiscal year basis)	10.78	10.77	-0.01	-0.1%
Consumer food expenditures	(Billion dollars)			
	1,395.87	1,395.78	-0.09	0.0%

Table A.5.a. 15% ethanol blends allowed
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	15% ethanol blends allowed	Absolute difference	Percentage difference
Tax and tariff provisions (Dollars per gallon)				
Ethanol tax credit	0.45	0.45	0.00	n.a.
Biodiesel tax credit	1.00	1.00	0.00	n.a.
Ethanol specific tariff	0.54	0.54	0.00	n.a.
Renewable Fuel Standard (Billion gallons)				
Renewable Fuel Standard	19.58	19.58	0.00	0.0%
Biofuel sector results (Billion gallons)				
Ethanol production	15.38	16.00	0.63	4.1%
Ethanol imports	1.38	1.54	0.16	11.5%
Ethanol domestic disappearance	16.56	17.34	0.78	4.7%
Biodiesel production	1.18	1.17	0.00	-0.3%
Ethanol prices (Dollars per gallon)				
Ethanol price, conventional rack, Omaha	2.07	2.11	0.04	2.0%
Ethanol effective retail price	2.05	2.23	0.18	8.9%
Dry mill returns over operating costs	0.38	0.41	0.03	6.9%
Biodiesel rack price	4.45	4.46	0.01	0.2%
Corn sector supply and use (Billion bushels)				
Corn production	13.82	13.91	0.10	0.7%
Corn ethanol use	5.09	5.27	0.18	3.5%
Corn feed use	5.28	5.24	-0.04	-0.7%
Corn exports	2.08	2.04	-0.04	-2.0%
Soybean sector supply and use (Billion bushels)				
Soybean production	3.32	3.31	-0.01	-0.3%
Soybean crush	1.98	1.97	0.00	-0.1%
Soybean exports	1.17	1.17	-0.01	-0.5%
Crop planted acreage (Million acres)				
Corn	89.89	90.50	0.61	0.7%
Soybeans	76.72	76.48	-0.25	-0.3%
Wheat	58.81	58.80	-0.01	0.0%
9 other crops plus hay	94.08	94.05	-0.03	0.0%
Conservation reserve area	29.58	29.47	-0.11	-0.4%
12 crops + hay + CRP	349.08	349.29	0.21	0.1%
Crop sector prices (Dollars per bushel)				
Corn farm price	4.04	4.08	0.04	1.1%
Soybean farm price	9.73	9.77	0.04	0.4%
Wheat farm price	5.74	5.78	0.03	0.6%
Other crop prices (Cents per pound)				
Upland cotton farm price	58.90	58.98	0.08	0.1%
Soybean oil market price, Decatur	47.34	47.50	0.16	0.3%
Protein prices (Dollars per ton)				
Soymeal price, 48% protein	259.63	260.30	0.67	0.3%
Distillers grain price, Indiana	133.80	133.91	0.12	0.1%

Table A.5.b. 15% ethanol blends allowed
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	15% ethanol blends allowed	Absolute difference	Percentage difference
Meat and milk production	(Billion pounds)			
Beef production	26.51	26.51	0.00	0.0%
Pork production	24.66	24.63	-0.04	-0.1%
Broiler production	39.50	39.45	-0.05	-0.1%
Milk production	199.01	198.97	-0.04	0.0%
Livestock and dairy prices	(Dollars per hundredweight)			
Steers, Nebraska direct	101.60	101.73	0.13	0.1%
Feeder steers, 600-650 lbs., OK City	130.34	130.41	0.07	0.1%
Barrows & gilts, 51-52% lean	54.70	54.90	0.20	0.4%
Broilers, 12-city wholesale	86.18	86.43	0.24	0.3%
All milk	17.06	17.08	0.02	0.1%
Livestock and dairy net returns	(Mixed units)			
Cow-calf (\$ per cow)	35.29	35.20	-0.09	-0.3%
Hog farrow-finish (\$ per cwt)	2.07	1.98	-0.09	-4.4%
Chicken feed price ratio	5.72	5.71	-0.01	-0.1%
Milk (\$ per cwt)	0.32	0.30	-0.02	-5.2%
Farm income	(Billion dollars)			
Crop receipts	188.83	189.86	1.04	0.6%
Livestock receipts	156.98	157.21	0.23	0.1%
Government payments	13.27	13.24	-0.02	-0.2%
Feed costs	42.78	43.09	0.31	0.7%
Rent to non-operator landlords	12.67	12.89	0.21	1.7%
Other production expenses	258.32	258.63	0.31	0.1%
Total production expenses	313.77	314.60	0.83	0.3%
Other net farm income	50.19	50.23	0.04	0.1%
Net farm income	95.49	95.95	0.46	0.5%
Farm program outlays	(Billion dollars)			
Net CCC outlays (fiscal year basis)	10.78	10.75	-0.03	-0.3%
Consumer food expenditures	(Billion dollars)			
	1,395.87	1,396.21	0.34	0.0%

Table A.6.a. Countercyclical ethanol plant payment
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Countercyclical plant payment	Absolute difference	Percentage difference
Tax and tariff provisions (Dollars per gallon)				
Ethanol tax credit	0.45	0.00	-0.45	-100.0%
Ethanol plant payment	0.00	0.40	0.40	n.a.
Biodiesel tax credit	1.00	1.00	0.00	0.0%
Ethanol specific tariff	0.54	0.00	-0.54	-100.0%
(Billion gallons)				
Renewable Fuel Standard	19.58	19.58	0.00	0.0%
Biofuel sector results (Billion gallons)				
Ethanol production	15.38	15.19	-0.19	-1.2%
Ethanol imports	1.38	1.62	0.24	17.3%
Ethanol domestic disappearance	16.56	16.49	-0.07	-0.4%
Biodiesel production	1.18	1.18	0.00	0.1%
(Dollars per gallon)				
Ethanol price, conventional rack, Omaha	2.07	1.65	-0.42	-20.2%
Ethanol effective retail price	2.05	2.05	0.00	0.2%
Dry mill returns over operating costs	0.38	0.37	-0.01	-3.3%
Biodiesel rack price	4.45	4.43	-0.01	-0.3%
Corn sector supply and use (Billion bushels)				
Corn production	13.82	13.75	-0.07	-0.5%
Corn ethanol use	5.09	4.96	-0.13	-2.6%
Corn feed use	5.28	5.30	0.03	0.5%
Corn exports	2.08	2.12	0.04	1.8%
Soybean sector supply and use (Billion bushels)				
Soybean production	3.32	3.33	0.01	0.2%
Soybean crush	1.98	1.98	0.00	0.1%
Soybean exports	1.17	1.18	0.00	0.4%
Crop planted acreage (Million acres)				
Corn	89.89	89.45	-0.44	-0.5%
Soybeans	76.72	76.90	0.18	0.2%
Wheat	58.81	58.84	0.04	0.1%
9 other crops plus hay	94.08	94.23	0.15	0.2%
Conservation reserve area	29.58	29.62	0.04	0.1%
12 crops + hay + CRP	349.08	349.05	-0.03	0.0%
Crop sector prices (Dollars per bushel)				
Corn farm price	4.04	4.02	-0.02	-0.5%
Soybean farm price	9.73	9.70	-0.03	-0.3%
Wheat farm price	5.74	5.73	-0.01	-0.1%
(Cents per pound)				
Upland cotton farm price	58.90	58.88	-0.02	0.0%
Soybean oil market price, Decatur	47.34	47.17	-0.17	-0.4%
(Dollars per ton)				
Soymeal price, 48% protein	259.63	259.48	-0.15	-0.1%
Distillers grain price, Indiana	133.80	134.02	0.22	0.2%

Table A.6.b. Countercyclical ethanol plant payment
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Countercyclical plant payment	Absolute difference	Percentage difference
Meat and milk production	(Billion pounds)			
Beef production	26.51	26.51	0.00	0.0%
Pork production	24.66	24.68	0.02	0.1%
Broiler production	39.50	39.51	0.01	0.0%
Milk production	199.01	199.03	0.02	0.0%
Livestock and dairy prices	(Dollars per hundredweight)			
Steers, Nebraska direct	101.60	101.54	-0.05	-0.1%
Feeder steers, 600-650 lbs., OK City	130.34	130.33	-0.01	0.0%
Barrows & gilts, 51-52% lean	54.70	54.61	-0.09	-0.2%
Broilers, 12-city wholesale	86.18	86.11	-0.08	-0.1%
All milk	17.06	17.05	-0.01	0.0%
Livestock and dairy net returns	(Mixed units)			
Cow-calf (\$ per cow)	35.29	35.41	0.12	0.3%
Hog farrow-finish (\$ per cwt)	2.07	2.13	0.06	3.0%
Chicken feed price ratio	5.72	5.72	0.01	0.1%
Milk (\$ per cwt)	0.32	0.32	0.00	1.1%
Farm income	(Billion dollars)			
Crop receipts	188.83	188.37	-0.45	-0.2%
Livestock receipts	156.98	156.89	-0.09	-0.1%
Government payments	13.27	13.22	-0.05	-0.4%
Feed costs	42.78	42.64	-0.14	-0.3%
Rent to non-operator landlords	12.67	12.57	-0.10	-0.8%
Other production expenses	258.32	258.17	-0.15	-0.1%
Total production expenses	313.77	313.37	-0.40	-0.1%
Other net farm income	50.19	50.21	0.02	0.0%
Net farm income	95.49	95.32	-0.17	-0.2%
Farm program outlays	(Billion dollars)			
Net CCC outlays (fiscal year basis)	10.78	10.75	-0.03	-0.3%
Consumer food expenditures	(Billion dollars)			
	1,395.87	1,395.72	-0.15	0.0%

Table A.7.a. Modified Renewable Fuel Standard
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Modified RFS	Absolute difference	Percentage difference
Tax and tariff provisions	(Dollars per gallon)			
Ethanol tax credit	0.45	0.45	0.00	n.a.
Biodiesel tax credit	1.00	1.00	0.00	n.a.
Ethanol specific tariff	0.54	0.54	0.00	n.a.
	(Billion gallons)			
Renewable Fuel Standard	19.58	18.58	-1.00	-5.1%
Biofuel sector results	(Billion gallons)			
Ethanol production	15.38	14.82	-0.56	-3.6%
Ethanol imports	1.38	1.27	-0.11	-8.1%
Ethanol domestic disappearance	16.56	15.89	-0.67	-4.1%
Biodiesel production	1.18	1.18	0.00	0.3%
	(Dollars per gallon)			
Ethanol price, conventional rack, Omaha	2.07	2.05	-0.01	-0.7%
Ethanol effective retail price	2.05	2.08	0.03	1.3%
Dry mill returns over operating costs	0.38	0.38	0.00	0.0%
Biodiesel rack price	4.45	4.43	-0.01	-0.3%
Corn sector supply and use	(Billion bushels)			
Corn production	13.82	13.69	-0.13	-0.9%
Corn ethanol use	5.09	4.89	-0.20	-4.0%
Corn feed use	5.28	5.31	0.04	0.7%
Corn exports	2.08	2.13	0.04	2.1%
Soybean sector supply and use	(Billion bushels)			
Soybean production	3.32	3.33	0.01	0.3%
Soybean crush	1.98	1.98	0.00	0.2%
Soybean exports	1.17	1.18	0.01	0.6%
Crop planted acreage	(Million acres)			
Corn	89.89	89.12	-0.77	-0.9%
Soybeans	76.72	77.01	0.29	0.4%
Wheat	58.81	58.81	0.00	0.0%
9 other crops plus hay	94.08	94.13	0.05	0.0%
Conservation reserve area	29.58	29.74	0.16	0.5%
12 crops + hay + CRP	349.08	348.81	-0.27	-0.1%
Crop sector prices	(Dollars per bushel)			
Corn farm price	4.04	4.00	-0.04	-1.0%
Soybean farm price	9.73	9.69	-0.04	-0.4%
Wheat farm price	5.74	5.71	-0.03	-0.6%
	(Cents per pound)			
Upland cotton farm price	58.90	58.81	-0.10	-0.2%
Soybean oil market price, Decatur	47.34	47.14	-0.20	-0.4%
	(Dollars per ton)			
Soymeal price, 48% protein	259.63	259.15	-0.48	-0.2%
Distillers grain price, Indiana	133.80	133.81	0.01	0.0%

Table A.7.b. Modified Renewable Fuel Standard
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Modified RFS	Absolute difference	Percentage difference
Meat and milk production	(Billion pounds)			
Beef production	26.51	26.51	0.00	0.0%
Pork production	24.66	24.72	0.06	0.2%
Broiler production	39.50	39.56	0.06	0.1%
Milk production	199.01	199.07	0.06	0.0%
Livestock and dairy prices	(Dollars per hundredweight)			
Steers, Nebraska direct	101.60	101.42	-0.18	-0.2%
Feeder steers, 600-650 lbs., OK City	130.34	130.22	-0.12	-0.1%
Barrows & gilts, 51-52% lean	54.70	54.42	-0.28	-0.5%
Broilers, 12-city wholesale	86.18	85.89	-0.30	-0.3%
All milk	17.06	17.04	-0.03	-0.2%
Livestock and dairy net returns	(Mixed units)			
Cow-calf (\$ per cow)	35.29	35.25	-0.04	-0.1%
Hog farrow-finish (\$ per cwt)	2.07	2.12	0.06	2.7%
Chicken feed price ratio	5.72	5.72	0.00	0.0%
Milk (\$ per cwt)	0.32	0.32	0.00	1.6%
Farm income	(Billion dollars)			
Crop receipts	188.83	187.67	-1.16	-0.6%
Livestock receipts	156.98	156.66	-0.32	-0.2%
Government payments	13.27	13.28	0.01	0.1%
Feed costs	42.78	42.42	-0.35	-0.8%
Rent to non-operator landlords	12.67	12.40	-0.27	-2.1%
Other production expenses	258.32	257.94	-0.38	-0.1%
Total production expenses	313.77	312.77	-1.00	-0.3%
Other net farm income	50.19	50.13	-0.06	-0.1%
Net farm income	95.49	94.97	-0.52	-0.5%
Farm program outlays	(Billion dollars)			
Net CCC outlays (fiscal year basis)	10.78	10.83	0.05	0.5%
Consumer food expenditures	(Billion dollars)			
	1,395.87	1,395.49	-0.38	0.0%

Table A.8.a. Distillers grains diversion
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Distillers grains diversion	Absolute difference	Percentage difference
Tax and tariff provisions				
		(Dollars per gallon)		
Ethanol tax credit	0.45	0.45	0.00	0.0%
Biodiesel tax credit	1.00	1.00	0.00	0.0%
Ethanol specific tariff	0.54	0.54	0.00	0.0%
		(Billion gallons)		
Renewable Fuel Standard	19.58	19.58	0.00	0.0%
Biofuel sector results				
		(Billion gallons)		
Ethanol production	15.38	15.36	-0.02	-0.1%
Ethanol imports	1.38	1.39	0.00	0.1%
Ethanol domestic disappearance	16.56	16.54	-0.02	-0.1%
Biodiesel production	1.18	1.18	0.00	-0.1%
		(Dollars per gallon)		
Ethanol price, conventional rack, Omaha	2.07	2.07	0.00	0.1%
Ethanol effective retail price	2.05	2.05	0.00	0.0%
Dry mill returns over operating costs	0.38	0.38	0.00	0.6%
Biodiesel rack price	4.45	4.45	0.00	0.1%
Corn sector supply and use				
		(Billion bushels)		
Corn production	13.82	14.00	0.19	1.3%
Corn ethanol use	5.09	5.09	0.00	0.0%
Corn feed use	5.28	5.54	0.27	5.1%
Corn exports	2.08	2.00	-0.08	-4.1%
Soybean sector supply and use				
		(Billion bushels)		
Soybean production	3.32	3.31	-0.01	-0.2%
Soybean crush	1.98	1.98	0.00	0.1%
Soybean exports	1.17	1.16	-0.01	-0.7%
Crop planted acreage				
		(Million acres)		
Corn	89.89	91.04	1.15	1.3%
Soybeans	76.72	76.49	-0.24	-0.3%
Wheat	58.81	58.77	-0.03	-0.1%
9 other crops plus hay	94.08	93.99	-0.09	-0.1%
Conservation reserve area	29.58	29.29	-0.28	-1.0%
12 crops + hay + CRP	349.08	349.58	0.50	0.1%
Crop sector prices				
		(Dollars per bushel)		
Corn farm price	4.04	4.13	0.09	2.2%
Soybean farm price	9.73	9.86	0.13	1.3%
Wheat farm price	5.74	5.82	0.07	1.3%
		(Cents per pound)		
Upland cotton farm price	58.90	59.05	0.14	0.2%
Soybean oil market price, Decatur	47.34	47.38	0.04	0.1%
		(Dollars per ton)		
Soymeal price, 48% protein	259.63	265.81	6.18	2.4%
Distillers grain price, Indiana	133.80	144.54	10.74	8.0%

Table A.8.b. Distillers grains diversion
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Distillers grains diversion	Absolute difference	Percentage difference
Meat and milk production	(Billion pounds)			
Beef production	26.51	26.50	-0.02	-0.1%
Pork production	24.66	24.53	-0.14	-0.6%
Broiler production	39.50	39.26	-0.24	-0.6%
Milk production	199.01	198.83	-0.19	-0.1%
Livestock and dairy prices	(Dollars per hundredweight)			
Steers, Nebraska direct	101.60	102.19	0.59	0.6%
Feeder steers, 600-650 lbs., OK City	130.34	130.22	-0.11	-0.1%
Barrows & gilts, 51-52% lean	54.70	55.48	0.78	1.4%
Broilers, 12-city wholesale	86.18	87.38	1.19	1.4%
All milk	17.06	17.15	0.08	0.5%
Livestock and dairy net returns	(Mixed units)			
Cow-calf (\$ per cow)	35.29	34.19	-1.10	-3.1%
Hog farrow-finish (\$ per cwt)	2.07	1.73	-0.33	-16.1%
Chicken feed price ratio	5.72	5.69	-0.02	-0.4%
Milk (\$ per cwt)	0.32	0.27	-0.05	-14.5%
Farm income	(Billion dollars)			
Crop receipts	188.83	191.23	2.40	1.3%
Livestock receipts	156.98	157.92	0.95	0.6%
Government payments	13.27	13.16	-0.11	-0.8%
Feed costs	42.78	45.19	2.41	5.6%
Rent to non-operator landlords	12.67	13.10	0.42	3.3%
Other production expenses	258.32	258.89	0.57	0.2%
Total production expenses	313.77	317.17	3.40	1.1%
Other net farm income	50.19	50.31	0.13	0.3%
Net farm income	95.49	95.45	-0.04	0.0%
Farm program outlays	(Billion dollars)			
Net CCC outlays (fiscal year basis)	10.78	10.66	-0.12	-1.1%
Consumer food expenditures	(Billion dollars)			
	1,395.87	1,396.97	1.09	0.1%
Distillers grains supply and use	(Million tons, dry equivalent)			
Production	39.82	39.90	0.08	0.2%
Feed use	33.02	23.15	-9.86	-29.9%
Other use	0.46	10.66	10.20	2195.0%
Net exports	6.34	6.08	-0.26	-4.0%

Table A.9.a. Countercyclical Renewable Fuel Standard
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Countercyclical RFS	Absolute difference	Percentage difference
Tax and tariff provisions	(Dollars per gallon)			
Ethanol tax credit	0.45	0.39	-0.06	-12.5%
Biodiesel tax credit	1.00	1.00	0.00	0.0%
Ethanol specific tariff	0.54	0.54	0.00	0.0%
	(Billion gallons)			
Renewable Fuel Standard	19.58	19.04	-0.54	-2.8%
Biofuel sector results	(Billion gallons)			
Ethanol production	15.38	15.07	-0.31	-2.0%
Ethanol imports	1.38	1.31	-0.07	-5.3%
Ethanol domestic disappearance	16.56	16.17	-0.38	-2.3%
Biodiesel production	1.18	1.18	0.00	0.2%
	(Dollars per gallon)			
Ethanol price, conventional rack, Omaha	2.07	2.04	-0.03	-1.2%
Ethanol effective retail price	2.05	2.06	0.01	0.5%
Dry mill returns over operating costs	0.38	0.36	-0.02	-4.3%
Biodiesel rack price	4.45	4.44	-0.01	-0.2%
Corn sector supply and use	(Billion bushels)			
Corn production	13.82	13.75	-0.07	-0.5%
Corn ethanol use	5.09	4.98	-0.11	-2.2%
Corn feed use	5.28	5.30	0.02	0.4%
Corn exports	2.08	2.11	0.03	1.3%
Soybean sector supply and use	(Billion bushels)			
Soybean production	3.32	3.33	0.01	0.2%
Soybean crush	1.98	1.98	0.00	0.1%
Soybean exports	1.17	1.18	0.01	0.4%
Crop planted acreage	(Million acres)			
Corn	89.89	89.48	-0.41	-0.5%
Soybeans	76.72	76.91	0.19	0.2%
Wheat	58.81	58.83	0.02	0.0%
9 other crops plus hay	94.08	94.11	0.03	0.0%
Conservation reserve area	29.58	29.63	0.05	0.2%
12 crops + hay + CRP	349.08	348.96	-0.12	0.0%
Crop sector prices	(Dollars per bushel)			
Corn farm price	4.04	4.01	-0.03	-0.7%
Soybean farm price	9.73	9.69	-0.04	-0.4%
Wheat farm price	5.74	5.72	-0.02	-0.4%
	(Cents per pound)			
Upland cotton farm price	58.90	58.85	-0.05	-0.1%
Soybean oil market price, Decatur	47.34	47.19	-0.15	-0.3%
	(Dollars per ton)			
Soymeal price, 48% protein	259.63	259.04	-0.59	-0.2%
Distillers grain price, Indiana	133.80	133.60	-0.20	-0.1%

Table A.9.b. Countercyclical Renewable Fuel Standard
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	Countercyclical RFS	Absolute difference	Percentage difference
Meat and milk production	(Billion pounds)			
Beef production	26.51	26.51	0.00	0.0%
Pork production	24.66	24.68	0.02	0.1%
Broiler production	39.50	39.52	0.02	0.1%
Milk production	199.01	199.04	0.02	0.0%
Livestock and dairy prices	(Dollars per hundredweight)			
Steers, Nebraska direct	101.60	101.53	-0.07	-0.1%
Feeder steers, 600-650 lbs., OK City	130.34	130.35	0.01	0.0%
Barrows & gilts, 51-52% lean	54.70	54.60	-0.10	-0.2%
Broilers, 12-city wholesale	86.18	86.07	-0.12	-0.1%
All milk	17.06	17.05	-0.01	-0.1%
Livestock and dairy net returns	(Mixed units)			
Cow-calf (\$ per cow)	35.29	35.55	0.26	0.7%
Hog farrow-finish (\$ per cwt)	2.07	2.17	0.11	5.1%
Chicken feed price ratio	5.72	5.73	0.01	0.2%
Milk (\$ per cwt)	0.32	0.33	0.01	3.9%
Farm income	(Billion dollars)			
Crop receipts	188.83	188.19	-0.63	-0.3%
Livestock receipts	156.98	156.86	-0.11	-0.1%
Government payments	13.27	13.25	-0.02	-0.1%
Feed costs	42.78	42.58	-0.20	-0.5%
Rent to non-operator landlords	12.67	12.56	-0.11	-0.9%
Other production expenses	258.32	258.16	-0.16	-0.1%
Total production expenses	313.77	313.30	-0.47	-0.2%
Other net farm income	50.19	50.21	0.02	0.0%
Net farm income	95.49	95.21	-0.27	-0.3%
Farm program outlays	(Billion dollars)			
Net CCC outlays (fiscal year basis)	10.78	10.77	0.00	0.0%
Consumer food expenditures	(Billion dollars)			
	1,395.87	1,395.69	-0.19	0.0%

Table A.10.a. Eliminating the total RFS
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	No total RFS	Absolute difference	Percentage difference
Tax and tariff provisions (Dollars per gallon)				
Ethanol tax credit	0.45	0.45	0.00	0.0%
Biodiesel tax credit	1.00	1.00	0.00	0.0%
Ethanol specific tariff	0.54	0.54	0.00	0.0%
(Billion gallons)				
Renewable Fuel Standard	19.58	5.33	-14.25	-72.8%
Biofuel sector results (Billion gallons)				
Ethanol production	15.38	13.46	-1.91	-12.4%
Ethanol imports	1.38	1.15	-0.23	-16.9%
Ethanol domestic disappearance	16.56	14.40	-2.16	-13.0%
Biodiesel production	1.18	1.19	0.01	1.0%
(Dollars per gallon)				
Ethanol price, conventional rack, Omaha	2.07	1.90	-0.17	-8.2%
Ethanol effective retail price	2.05	2.12	0.07	3.3%
Dry mill returns over operating costs	0.38	0.27	-0.11	-28.9%
Biodiesel rack price	4.45	4.39	-0.06	-1.2%
Corn sector supply and use (Billion bushels)				
Corn production	13.82	13.44	-0.37	-2.7%
Corn ethanol use	5.09	4.38	-0.71	-13.9%
Corn feed use	5.28	5.43	0.15	2.9%
Corn exports	2.08	2.26	0.17	8.3%
Soybean sector supply and use (Billion bushels)				
Soybean production	3.32	3.36	0.04	1.2%
Soybean crush	1.98	1.99	0.01	0.5%
Soybean exports	1.17	1.20	0.02	2.1%
Crop planted acreage (Million acres)				
Corn	89.89	87.57	-2.32	-2.6%
Soybeans	76.72	77.69	0.97	1.3%
Wheat	58.81	58.91	0.11	0.2%
9 other crops plus hay	94.08	94.21	0.13	0.1%
Conservation reserve area	29.58	29.90	0.33	1.1%
12 crops + hay + CRP	349.08	348.29	-0.79	-0.2%
Crop sector prices (Dollars per bushel)				
Corn farm price	4.04	3.85	-0.18	-4.6%
Soybean farm price	9.73	9.53	-0.20	-2.0%
Wheat farm price	5.74	5.60	-0.15	-2.5%
(Cents per pound)				
Upland cotton farm price	58.90	58.60	-0.30	-0.5%
Soybean oil market price, Decatur	47.34	46.54	-0.80	-1.7%
(Dollars per ton)				
Soymeal price, 48% protein	259.63	256.58	-3.04	-1.2%
Distillers grain price, Indiana	133.80	132.21	-1.59	-1.2%

Table A.10.b. Eliminating the total RFS
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	No total RFS	Absolute difference	Percentage difference
Meat and milk production	(Billion pounds)			
Beef production	26.51	26.52	0.01	0.0%
Pork production	24.66	24.78	0.11	0.5%
Broiler production	39.50	39.68	0.18	0.5%
Milk production	199.01	199.17	0.16	0.1%
Livestock and dairy prices	(Dollars per hundredweight)			
Steers, Nebraska direct	101.60	101.08	-0.52	-0.5%
Feeder steers, 600-650 lbs., OK City	130.34	130.34	0.00	0.0%
Barrows & gilts, 51-52% lean	54.70	54.01	-0.69	-1.3%
Broilers, 12-city wholesale	86.18	85.27	-0.91	-1.1%
All milk	17.06	16.99	-0.07	-0.4%
Livestock and dairy net returns	(Mixed units)			
Cow-calf (\$ per cow)	35.29	36.50	1.21	3.4%
Hog farrow-finish (\$ per cwt)	2.07	2.70	0.63	30.6%
Chicken feed price ratio	5.72	5.76	0.04	0.8%
Milk (\$ per cwt)	0.32	0.40	0.08	25.8%
Farm income	(Billion dollars)			
Crop receipts	188.83	184.78	-4.05	-2.1%
Livestock receipts	156.98	156.11	-0.86	-0.6%
Government payments	13.27	13.45	0.18	1.4%
Feed costs	42.78	41.42	-1.36	-3.2%
Rent to non-operator landlords	12.67	11.98	-0.70	-5.5%
Other production expenses	258.32	257.42	-0.90	-0.3%
Total production expenses	313.77	310.81	-2.96	-0.9%
Other net farm income	50.19	50.08	-0.10	-0.2%
Net farm income	95.49	93.61	-1.87	-2.0%
Farm program outlays	(Billion dollars)			
Net CCC outlays (fiscal year basis)	10.78	10.96	0.19	1.7%
Consumer food expenditures	(Billion dollars)			
	1,395.87	1,394.72	-1.15	-0.1%

Table A.11.a. No corn ethanol support policies
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	No total RFS, no tax credits, no tariffs	Absolute difference	Percentage difference
Tax and tariff provisions (Dollars per gallon)				
Ethanol tax credit	0.45	0.00	-0.45	-100.0%
Biodiesel tax credit	1.00	1.00	0.00	0.0%
Ethanol specific tariff	0.54	0.00	-0.54	-100.0%
Renewable Fuel Standard (Billion gallons)				
Renewable Fuel Standard	19.58	5.33	-14.25	-72.8%
Biofuel sector results (Billion gallons)				
Ethanol production	15.38	9.87	-5.50	-35.8%
Ethanol imports	1.38	1.57	0.19	13.7%
Ethanol domestic disappearance	16.56	11.04	-5.52	-33.4%
Biodiesel production	1.18	1.21	0.03	2.8%
Ethanol prices (Dollars per gallon)				
Ethanol price, conventional rack, Omaha	2.07	1.59	-0.47	-22.8%
Ethanol effective retail price	2.05	2.26	0.21	10.2%
Dry mill returns over operating costs	0.38	0.08	-0.30	-77.8%
Biodiesel rack price	4.45	4.29	-0.16	-3.6%
Corn sector supply and use (Billion bushels)				
Corn production	13.82	12.78	-1.04	-7.5%
Corn ethanol use	5.09	3.07	-2.02	-39.8%
Corn feed use	5.28	5.73	0.46	8.7%
Corn exports	2.08	2.59	0.51	24.5%
Soybean sector supply and use (Billion bushels)				
Soybean production	3.32	3.43	0.11	3.3%
Soybean crush	1.98	2.01	0.03	1.5%
Soybean exports	1.17	1.24	0.07	5.7%
Crop planted acreage (Million acres)				
Corn	89.89	83.43	-6.46	-7.2%
Soybeans	76.72	79.39	2.67	3.5%
Wheat	58.81	59.05	0.24	0.4%
9 other crops plus hay	94.08	94.40	0.32	0.3%
Conservation reserve area	29.58	30.62	1.04	3.5%
12 crops + hay + CRP	349.08	346.89	-2.19	-0.6%
Crop sector prices (Dollars per bushel)				
Corn farm price	4.04	3.51	-0.53	-13.1%
Soybean farm price	9.73	9.19	-0.54	-5.6%
Wheat farm price	5.74	5.32	-0.42	-7.4%
Other crop prices (Cents per pound)				
Upland cotton farm price	58.90	58.01	-0.89	-1.5%
Soybean oil market price, Decatur	47.34	45.09	-2.25	-4.8%
Protein prices (Dollars per ton)				
Soymeal price, 48% protein	259.63	251.76	-7.87	-3.0%
Distillers grain price, Indiana	133.80	130.17	-3.63	-2.7%

Table A.11.b. No corn ethanol support policies
(Averages of 500 stochastic outcomes for 2011-2018)

	Baseline	No total RFS, no tax credits, no tariffs	Absolute difference	Percentage difference
Meat and milk production	(Billion pounds)			
Beef production	26.51	26.56	0.04	0.2%
Pork production	24.66	25.06	0.40	1.6%
Broiler production	39.50	40.07	0.57	1.4%
Milk production	199.01	199.54	0.53	0.3%
Livestock and dairy prices	(Dollars per hundredweight)			
Steers, Nebraska direct	101.60	99.94	-1.66	-1.6%
Feeder steers, 600-650 lbs., OK City	130.34	130.26	-0.08	-0.1%
Barrows & gilts, 51-52% lean	54.70	52.45	-2.25	-4.1%
Broilers, 12-city wholesale	86.18	83.33	-2.85	-3.3%
All milk	17.06	16.83	-0.23	-1.3%
Livestock and dairy net returns	(Mixed units)			
Cow-calf (\$ per cow)	35.29	38.50	3.21	9.1%
Hog farrow-finish (\$ per cwt)	2.07	3.71	1.65	79.8%
Chicken feed price ratio	5.72	5.82	0.11	1.9%
Milk (\$ per cwt)	0.32	0.54	0.22	68.4%
Farm income	(Billion dollars)			
Crop receipts	188.83	177.38	-11.45	-6.1%
Livestock receipts	156.98	154.24	-2.74	-1.7%
Government payments	13.27	13.80	0.53	4.0%
Feed costs	42.78	38.83	-3.95	-9.2%
Rent to non-operator landlords	12.67	10.56	-2.11	-16.7%
Other production expenses	258.32	255.56	-2.75	-1.1%
Total production expenses	313.77	304.95	-8.82	-2.8%
Other net farm income	50.19	49.84	-0.35	-0.7%
Net farm income	95.49	90.30	-5.19	-5.4%
Farm program outlays	(Billion dollars)			
Net CCC outlays (fiscal year basis)	10.78	11.31	0.54	5.0%
Consumer food expenditures	(Billion dollars)			
	1,395.87	1,391.89	-3.98	-0.3%