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ADVANCING LIBERTY WITH RESPONSIBILITY BY PROMOTING MARKET SOLUTIONS FOR MISSOURI PUBLIC POLICY

CASE STUDY

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THE ECONOMIC IMPACT OF THE MISSOURI E-10 ETHANOL MANDATE

By Justin P. Hauke and David Stokes

Missouri is one of only three states that require a 10-percent minimum ethanol blend (E-10) for retail gasoline sold within the state.[1] The Missouri Corn Merchandising Council (MCMC) recently released a study purporting to demonstrate the positive economic benefits of the state's ethanol mandate for Missouri consumers.[2] The study claimed that Missourians will save more than $285 million through ethanol-induced fuel cost reductions in 2008 and nearly $2 billion in present value during the following decade.[3] The MCMC study ignores important effects of the E-10 mandate, however, most notably the documented decrease in fuel efficiency of E-10 blended fuel and the taxpayer cost of ethanol subsidies.[4] We find that accounting for these costs significantly impacts the MCMC savings projections and would result in a net loss to Missouri consumers of almost $1 billion during the next decade. If one were to consider the additional impact of the E-10 mandate on higher food prices and CO_2 gas emissions, these costs would be even higher.

In 2006, the Missouri General Assembly passed a law mandating that by January 1, 2008, all retail gasoline sold within the state must consist of a minimum 10-percent ethanol blend.[5] Missouri was only the third state to enact such a mandate, following Minnesota and Hawaii. After the E-10 mandate was passed, but prior to its adoption, about 70 percent of the state's gas stations voluntarily switched to blended ethanol in the fuel they sold to consumers. The mandate's impact on initial ethanol production costs had little effect for Missouri consumers, because the ethanol production and distribution process was largely in full operation by the time the mandate took effect.

However, Missouri's ethanol fuel standards do impact the price Missouri consumers pay at the pump. The E-10 mandate represents nearly 295 million gallons of ethanol-blended fuel, or approximately 5 percent of total U.S. production. The MCMC attempts to quantify the impact of the E-10 mandate on Missouri gasoline prices during the following decade. Table 1 presents the estimated savings to Missouri drivers projected by the MCMC.[6]

Table 1

	GASOLINE RACK ($/GAL)	GASOLINE RETAIL ($/GAL)	ETHANOL FOB PLANT ($/GAL)	ETHANOL NET* ($/GAL)	E-10 WHOLESALE ($/GAL)	E-10 RETAIL ($/GAL)	E-10 SAVINGS ($/GAL)	MO USE (MIL. GAL)	GAS SAVINGS (MIL $)
2007 (act)	$2.195	$2.642	$1.938	$1.428	$2.137	$2.565	$0.077	2947.2	158.9
2008	$2.445	$2.913	$1.972	$1.462	$2.376	$2.815	$0.098	2937.0	288.7
2009	$2.258	$2.717	$1.950	$1.440	$2.221	$2.635	$0.082	2937.7	240.3
2010	$2.114	$2.573	$1.785	$1.275	$2.075	$2.489	$0.084	2946.0	247.2
2011	$2.088	$2.547	$2.058	$1.548	$2.079	$2.493	$0.054	2953.5	159.5
2012	$2.055	$2.514	$2.099	$1.589	$2.053	$2.467	$0.047	2977.5	138.8
2013	$2.025	$2.484	$1.738	$1.228	$1.990	$2.404	$0.080	3000.3	239.1
2014	$2.053	$2.512	$1.863	$1.353	$2.028	$2.442	$0.070	3019.3	211.4
2015	$2.021	$2.480	$1.847	$1.337	$1.998	$2.412	$0.068	3033.2	207.5
2016	$2.002	$2.461	$1.868	$1.358	$1.982	$2.397	$0.064	3048.8	196.3
2017	$2.062	$2.521	$1.885	$1.375	$2.038	$2.452	$0.069	3057.5	210.1
Avg.	$2.120	$2.579	$1.909	$1.399	$2.089	$2.506	$0.072	2987.1	208.9

Source: http://www.mocorn.org/news/2008/LECG_MO_E10_Analysis.pdf

Government officials cannot simply take tax dollars from the public, give those tax dollars to ethanol blenders, and then have ethanol supporters tell the public that ethanol is saving them money with cheaper fuel as though the subsidy never existed.

The methodology of the MCMC study is fairly straightforward. The author computed the price difference between projected pure-grade gasoline and E-10 blended fuel, and then multiplied that difference by projected annual Missouri gasoline consumption.[7] In Table 1, "Gasoline Rack" is the wholesale price of gasoline in Missouri, projected by the U.S. Department of Energy.[8] "Ethanol FOB Plant" is the average wholesale price of ethanol, prior to delivery.[9] The author notes that ethanol producers qualify for the $0.51-per-gallon federal Volumetric Ethanol Excise Tax Credit (VEETC) after ethanol-blended fuel is delivered to retailers, and therefore the wholesale cost of E-10 is the weighted-average wholesale cost of blended gasoline and subsidized ethanol (90 percent gasoline, 10 percent subsidized ethanol). The retail costs of gasoline/E-10 reflect an average retail markup of 8.7 cents per gallon, and federal and state excise taxes of 36 cents per gallon.[10] Based on these numbers, Missouri consumers saved 7.7 cents per gallon on E-10 blended fuel in 2007 and are projected to save an average 7.2 cents per gallon per year during the next decade. This savings amounts to more than $150 million in 2007 (using the MCMC assumption that 70 percent of gasoline consumption was E-10), and an average of $213.9 million per year during the next 10 years (assuming margins and tax policy remain stable).

At a minimum, there are two major errors within this simple analysis. The first is that the federal tax credit of 51 cents per gallon is computed in the wholesale cost of ethanol, with no account made of the fact that the credit is a taxpayer-funded subsidy.[11] In other words, this subsidy is not "free" money that magically lowers ethanol production costs. It is money paid in taxes that the government, for whatever reason, has decided should be given to corn farmers and ethanol producers. Government officials cannot simply take tax dollars from the public, give those tax dollars to ethanol blenders, and then have ethanol supporters tell the public that ethanol is saving them money with cheaper fuel as though the subsidy never existed.

The second problem with the MCMC study is that it ignores the documented decrease in fuel efficiency associated with E-10 blended fuel. The Environmental Protection Agency, in a 2006 technical support document about oxygenated

gasoline fuel economy reductions, estimates that ethanol contains roughly 33 percent less energy per gallon than pure grade gasoline.[12] E-10 blended fuel therefore reduces per-gallon mileage by approximately 3.33 percent per gallon. The Missouri Corn Growers Association (MCGA) reports a 10- to 20-percent decrease in fuel efficiency associated with E-85 fuel (85 percent ethanol).[13] If we assume that ethanol fuel efficiency decreases linearly, the E-85 decrease would translate to a fuel mileage decrease ranging from 1.2 to 2.35 percent for E-10 blended fuel.[14] The MCMC's cost savings projections fail to account for the additional fuel consumption consumers will need to purchase to maintain their energy output under the E-10 mandate.[15] As a conservative benchmark, we consider this increase to be 2.5 percent of projected consumption, the approximate midpoint between the EPA and MCGA estimates.

Table 2 provides revised estimates of savings to Missouri consumers using the MCMC study methodology, accounting for the cost discrepancies described above. The columns to the left of the division are the same as those reported in the MCMC study, and are identical to the numbers reported in Figure 1. The first three columns to the right of the division represent, respectively, the taxpayer cost of the per-gallon VEETC subsidy for projected gasoline consumption (using E-10 blended fuel), the cost of additional fuel consumption associated with the lower fuel efficiency of E-10 fuel, and the additional VEETC subsidy costs associated with increased fuel consumption.

The taxpayer cost of the VEETC subsidy is computed by multiplying the projected gallons of Missouri gasoline consumption by $0.51 and then multiplying this product by 10 percent (because only 10 percent of E-10 fuel consists of ethanol).[16] We computed the cost of increased Missouri fuel consumption by multiplying projected gasoline consumption by 2.5 percent (the assumed decrease in fuel efficiency associated with E-10 blended fuel), and then multiplied this quantity by the projected retail price of E-10 blended fuel. Lastly, we account for the *additional* ethanol subsidy costs associated with the increase in fuel consumption in the same way described above.

The final column of Table 2 reports the revised cost of the E-10 mandate to Missouri consumers (net of the costs described above). These numbers suggest that Missouri consumers are actually worse off because of the E-10 mandate, in contrast to the savings projections provided by the MCMC study. Missourians will spend an additional $118 million (about $29 per Missouri driver) per year, on average, during the next decade in net E-10–related costs. These costs translate to a net loss of nearly $1 billion (in present value) during the following decade.

The impact of these revisions for Missouri consumers is significant. Although Missourians may *nominally* pay less for gasoline at the pump after the E-10 mandate, these savings will not reflect the *actual* costs Missourians would pay in complying with new ethanol fuel standards. Ethanol subsidies are not free money — they are simply a wealth transfer from one taxpayer to another. In other words, if the cost of gasoline were $2.50 per gallon and the government

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Table 2: Savings to Missouri Drivers From E-10

	GASOLINE RACK ($/GAL)	ETHANOL NET* ($/GAL)	GASOLINE RETAIL ($/GAL)	E-10 RETAIL ($/GAL)	E-10 SAVINGS ($/GAL)	MO GAS USE (MIL. GAL)	GAS SAVINGS (MIL $)	(1) VEETC SUBSIDY COST (MIL $)	(2) FUEL USE INCREASE (MIL $)	(3) ADDITIONAL VEETC SUBSIDY (MIL $)	(4) REVISED GAS SAVINGS (MIL $)
2007 (a)	$2.195	$1.428	$2.642	$2.565	$0.077	2,947.20	$158.2	$105.22	$0.00	$0.00	$53.02
2008 (e)	$2.445	$1.462	$2.913	$2.815	$0.098	2,937.00	$288.7	$149.79	$206.67	$10.54	($78.29)
2009 (e)	$2.258	$1.440	$2.717	$2.635	$0.082	2,937.70	$240.3	$149.82	$193.54	$9.87	($112.92)
2010 (e)	$2.114	$1.275	$2.573	$2.489	$0.084	2,946.00	$247.2	$150.25	$183.32	$9.35	($95.75)
2011 (e)	$2.088	$1.548	$2.547	$2.493	$0.054	2,953.50	$159.5	$150.63	$184.08	$9.39	($184.60)
2012 (e)	$2.055	$1.589	$2.514	$2.467	$0.047	2,977.50	$138.8	$151.85	$183.67	$9.37	($206.14)
2013 (e)	$2.025	$1.228	$2.484	$2.404	$0.080	3,000.30	$239.1	$153.02	$180.34	$9.20	($103.43)
2014 (e)	$2.053	$1.353	$2.512	$2.442	$0.070	3,019.30	$211.4	$153.98	$184.33	$9.40	($136.36)
2015 (e)	$2.021	$1.337	$2.480	$2.412	$0.068	3,033.20	$207.5	$154.69	$182.87	$9.33	($139.42)
2016 (e)	$2.002	$1.358	$2.461	$2.397	$0.064	3,048.80	$196.3	$155.49	$182.67	$9.32	($151.13)
2017 (e)	$2.062	$1.375	$2.521	$2.452	$0.069	3,057.50	$210.1	$155.93	$187.45	$9.56	($142.89)
					Net Savings:	**$1,835.7**				**Net Costs:**	**($989.39)**
VEETC Tax Cost (per gallon): $0.510				Fuel Efficiency Decrease: 2.50%							

Note: We use the MCMC study assumption that 70 percent of gasoline purchased in 2007 contained E-10 blended fuel. Net savings and costs are in present value.
*(1) VEETC subsidy cost = $0.51 per gallon tax cost per gallon of ethanol sold (E-10 fuel contains 10 percent ethanol per gallon) = (Mo. gas use) * ($0.51) * (0.1)*
*(2) Fuel use increase = projected gasoline use * 2.5% fuel efficiency reduction * E-10 retail price = Mo. gas use * (0.025) * (E-10 retail)*
*(3) Additional VEETC subsidy = $0.51 per gallon tax cost per gallon of additional (post-mandate) ethanol sold = (2) * ($0.51) * (0.1)*
(4) Revised gas savings = gas savings - (1) - (2) - (3)

It is not meaningful to compare the price of a gallon of pure-grade gasoline to a gallon of E-10 fuel if each unit does not have the same energy content.

granted a $1.00-per-gallon gasoline subsidy, the cost of gasoline would still be $2.50 — not $1.50. If this were not the case, the cost of gasoline could be "free" if the government subsidized the entire cost. But this subsidy has to come from somewhere. In the case of the ethanol subsidy, taxpayers are indirectly paying for higher ethanol costs. Therefore, the actual amount Missourians pay for E-10 fuel is not reflected in the retail price at the pump. In comparing the wholesale price of gasoline to subsidized ethanol, the MCMC study is highly misleading.

In addition, it is not meaningful to compare the price of a gallon of pure-grade gasoline to a gallon of E-10 fuel if each unit does not have the same energy content. Because E-10 fuel is, on average, approximately 2.5 percent less efficient than regular gasoline, a more direct cost comparison would involve measuring the price of each fuel type in relation to its energy content. For example, in 2007, the MCMC study listed the retail price of gasoline as $2.642 per gallon, compared to $2.565 per gallon for E-10. But if we adjust the E-10 price to reflect the amount it would take to purchase the same energy content as a gallon of regular gasoline, the adjusted E-10 price would be $2.629. Therefore, even with the $0.51-per-gallon VEETC subsidy, the retail cost of E-10 fuel is essentially the same as the cost of regular gasoline. Without the subsidy, E-10 fuel is significantly more expensive at the pump. This regulation increases costs either way, whether paid at the point of fuel purchase or through a generally higher tax burden.

Lastly, the MCMC study does not address (and we do not consider) several additional costs associated with increased ethanol fuel production. A study in the academic journal *Science* found that the conversion of forests and grassland to grow crops instead, stemming from the farming incentives that new demand for ethanol will bring, would double greenhouse-gas emissions during the next 30 years.[17] About 2.7 times more carbon is stored in terrestrial soils and plant material

than in the Earth's atmosphere. This carbon is released when land is cleared for ethanol production. *Science* claims that it will take 167 years for the reductions in carbon emissions associated with the use of E-10 fuel to "pay back" the carbon released by land-use change attributed to increased ethanol production.

Economists have also noted the link between ethanol mandates and higher food and commodity prices.[18] Although it would be difficult to isolate the impact of the E-10 mandate (which has a marginal effect on demand) on food prices (which are affected by global forces), it is clear that such fuel standards have had an impact on the prices that Missourians pay at the grocery store. Although our study does not focus on these topics, they certainly deserve further consideration. The MCMC study, by failing to acknowledge these relationships, does a disservice to Missouri consumers who rely on accurate information about the effect of new ethanol standards on Missouri wallets.

Ethanol mandates will not solve Missouri's energy problems. Contrary to the results implied by the MCMC study, ethanol mandates will not translate into fuel savings for Missouri consumers. In contrast, Missouri consumers can expect to pay more because of E-10 legislation than they would have paid otherwise. We estimate that these costs will total nearly $1 billion during the next decade. Considering the dramatic increase in fuel prices during the last few years, these regulations will result in a higher bill for Missouri consumers to bear. Missouri should adopt energy policies that benefit all Missourians, not just those who happen to be on the winning end of a corporate subsidy. At the very least, Missourians deserve accurate, impartial information about how new energy policies will affect them.

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NOTES

1 *The other two states are Minnesota and Hawaii. Additional states (e.g., Montana) have since passed similar ethanol-blended fuel guidelines that will require use of the blend in the near future.*

2 *Urbanchuk, John M. "Impact of Ethanol on Retail Gasoline Prices in Missouri," Missouri Corn Merchandising Council, April 2008. Online here: tinyurl.com/45dba9*

3 *The MCMC study doesn't actually compute a NPV calculation, but for comparison purposes we include it here, using a discount rate of 4 percent, the approximate yield of a 10-year Treasury bond. This is the same discount factor we use in our revised cost projection calculation.*

4 *Estimates of the decrease in E-10 fuel efficiency range from 1.5 percent (see: American Coalition for Ethanol, "Fuel Economy Study: Comparing Performance and Cost of Various Ethanol Blends and Standard Unleaded Gasoline," December 2007) to 3.33 percent (see: United States Environmental Protection Agency Office of Transportation and Air Quality, "Final Technical Support Document. Fuel Economy Labeling of Motor Vehicles: Revisions to Improve Calculation of Fuel Economy Estimates," January 2006, p. 82). Additional research puts the efficiency loss at approximately 2 percent of regular unleaded fuel (see, for example: Renewable Fuels Association FAQ, ethanolrfa.org; and: Wen, Zhiyou, John Ignosh, and Jactone Arogo. "Fuel Ethanol," Virginia Tech University, Virginia Cooperative Extension, No. 442-884, 2007).*

5 *The full text of this bill, Missouri HB 864 (2005), can be found online here: tinyurl.com/4t47j9*

6 *This table is a reproduction of Table 1 of the MCMC ethanol study, which appeared on page 2.*

7 *Missouri gasoline consumption estimates can be found in the Department of Energy's Energy Information Agency Prime Supplier. Online here: tinyurl.com/3sd8o8*

8 *Ibid*

9 *See the U.S. Department of Agriculture's data on forecasted ethanol production costs. Online here: tinyurl.com/5yomt3*

10 *Information about retail markup spreads and federal and state tax rates can be found on the U.S. Department of Energy website. Online here: tinyurl.com/4mwbzh*

11 *The 2008 U.S. Farm Bill (HB 2419) actually decreased the VEETC tax credit from $0.51 to $0.45 per gallon. However, for direct comparison with the MCMC study, we continue to use the $0.51-per-gallon subsidy figure throughout this paper.*

12 *See: United States Environmental Protection Agency Office of Transportation and Air Quality, "Final Technical Support Document. Fuel Economy Labeling of Motor Vehicles: Revisions to Improve Calculation of Fuel Economy Estimates," January 2006, p. 82. Online here: tinyurl.com/4g9xvo*

13 *Online here: mda.mo.gov/pdf/e10_faq.pdf. Note that the MCGA and MCMC cosponsor a joint ethanol information website. Online here: mocorn.org*

14 *This decrease is consistent with other studies of ethanol fuel efficiency losses, which range from 1.5 percent to 2 percent for E-10 fuel. See note 3 above for citation details.*

15 *The EIA fuel consumption projections were for regular gasoline, not oxygenated fuel.*

16 *We recognize that some readers may object to our assumption that Missourians alone bear the full cost of the VEETC federal tax credit. In other words, because the VEETC tax credit is paid by taxpayers at the federal level, taxpayers outside Missouri contribute a large share of the total revenue required to support the subsidy. We reject this argument on philosophical grounds, because subsidies are ultimately a wealth transfer from one taxpayer to another. However, if we were to assume that Missourians paid only 2 percent of the total VEETC subsidy (assuming that the taxes were spread evenly across the entire U.S. population), the Missouri E-10 savings during the next decade would be about $350 million, still more than $1.5 billion less than those claimed in the MCMC study. However, we reiterate that this is not the appropriate way to view a federal subsidy, in any sense.*

17 *See: Searchinger, Timothy, Ralph Heimlich, R.A. Houghton, Fengxia Dong, Amani Elobeid, Jacinto Fabioso, Simla Tokgoz, Dermot Hayes, and Yu Tun-Hsiang. "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change." Science 29, February 2008, pp. 1238–1240. Online here: tinyurl.com/4cn52q*

18 *See, for example: Buntrock, Gerrit. "Cheap no more," The Economist, December 6, 2007. Online here: tinyurl.com/25mt3o*

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