The Impact of the Ethanol Boom on Rural America

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Since 2005, surging U.S. ethanol production has helped reshape the rural economy. Ethanol production has increased nonfarm activity in many rural communities. Moreover, increased ethanol production contributed to rising crop prices, increased net returns, and a jump in cropland values both nationally and regionally. However, rising crop prices cut livestock revenues by boosting feed costs. As a result, while ethanol proponents tout the benefits emerging from the ethanol industry, opponents rail against its adverse side effects. Although the expanding ethanol industry has made a sizable impact on the rural economy, that impact has not been as large as initially estimated. (JEL Q1, Q4, R4)

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In 2006, the ethanol industry emerged as a major influence both in and on the U.S. farm economy. Changes in U.S. energy policy in 2005 bolstered the demand for ethanol. In 2006, the surge in crude oil and gasoline prices boosted ethanol profits. The result was a perfect storm for the farm community, where ethanol production and biofuels helped fuel sharp gains in corn prices that spilled over into other agricultural commodities. The promises of the ethanol industry had been fulfilled.

However, the ethanol boom has since faded. Current ethanol production capacity is higher than the demand mandated in the Revised Renewable Fuel Standard for 2008 (Environmental Protection Agency, 2008). Ethanol prices have fallen, shrinking profit margins and trimming forecasts of ethanol production. As the ethanol industry matures, what is the lasting impact on rural communities?

This article describes the economic effects of the ethanol industry on rural communities. Nationally, although crop prices have risen, the ethanol boom explains only part of the national increase in crop prices, net returns, and cropland values. The geographic concentration of ethanol production has led to some spatial changes in crop prices and livestock production. The ethanol industry has helped spur nonfarm economic growth, but the gains have been less than initially touted. As a result, the economic effects of the ethanol industry are probably not as large as most people expected.

FARM SECTOR IMPACTS

Ethanol's primary economic impacts emerge from the farm sector. Coupled with historically high export activity, U.S. ethanol demand has contributed to record high crop prices and strong farm income gains. However, the less-desirable side effects in the farm sector abound, including increased feed costs (from higher crop prices), lower livestock profits, and structural changes in agricultural industries.

Since 2006, U.S. ethanol production has surged. The phaseout of methyl tertiary-butyl ether (MTBE)

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Table 1

Net Returns to U.S. Corn Production (dollars per acre)

Variable	2005	2006	2007	2008 forecast	2008 forecast (without ethanol expansion)
Total production costs	386.88	409.74	443.97	567.36	567.36
Variable	186.37	205.98	228.99	335.15	335.15
Fixed	200.51	203.76	214.98	232.21	232.21
Total revenues	359.27	477.61	658.99	624.97	527.95
Market revenues	296.00	453.26	634.62	600.6	503.58
Average yield (bushel/acre)	148.0	149.1	151.1	154.0	154.0
Farm price (bushel)	2.00	3.04	4.20	3.90	3.27
Government receipts	63.27	24.35	24.37	24.37	24.37
Net returns	(27.61)	67.87	215.02	57.62	(39.4)
Net returns less variable costs	158.76	273.85	444.01	289.82	192.8

NOTE: All variables except average yield are expressed as dollars per acre.

SOURCE: Production costs were obtained from USDA data at www.ers.usda.gov/Data/CostsAndReturns/testpick.htm. Average yield and farm price data were obtained from the "World Agriculture Supply and Demand Estimates–February 2009" at http://usda.mannlib.cornell.edu/usda/current/wasde/wasde-02-10-2009.pdf. Government receipts data were obtained from FAPRI at www.fapri.missouri.edu/outreach/publications/ag_outlook.asp?current_page=outreach.

in several key gasoline markets fueled a surge in ethanol demand and a spike in ethanol profits. The industry quickly responded and by 2008, U.S. ethanol production capacity had reached 10.7 billion gallons, up from 3.6 billion gallons in 2005. Expanding ethanol production translated into a sharp rise in corn demand. Despite near–record high corn production, the ethanol industry is expected to consume 32.7 percent of the 2008 corn crop, up from 14.4 percent in 2005.

In combination with rising export activity, elevated ethanol demand contributed to record high corn prices. By 2008, robust demand was straining U.S. corn production and prices soared to record levels. According to the U.S. Department of Agriculture (USDA), the annual farm price for the 2008 corn crop is expected to reach $3.90 per bushel, up from $2.00 per bushel in 2005.[1] High corn prices also contributed to strong gains in other crop prices as the market competed for planted acres. For example, average annual farm prices for soybeans and wheat are expected to jump more than 60 and 100 percent, respectively, from 2005 to 2008.

Research indicates that ethanol production has a significant impact on corn prices. Based on a quarterly corn price model, a 1 percent increase in ethanol production led to a 0.16 percent increase in corn prices (Fortenbery and Park, 2008). Since 2005, ethanol production has increased by 197.2 percent, which according to the model would lead to a 31.6 percent increase in corn prices (197.2 * 0.16 = 31.6). Based on 2005 corn prices of $2.00 per bushel, corn prices should have risen to $2.63 per bushel, well below current corn price estimates. As a result, ethanol production has contributed to rising corn prices, but other factors such as export demand have also contributed to price increases (Fortenbery and Park, 2008). Moreover, as recent studies indicate corn prices respond to energy prices—the correlation between corn and crude oil prices has strengthened in recent years (Tyner and Taheripour, 2008).

With increased production and record high prices, crop revenues have risen sharply in recent years. On a net basis, corn revenues per acre are expected to rise well above 2005 levels (Table 1).

[1] The average farm price is obtained from the "World Agriculture Supply and Demand Estimates–February 2009" (USDA, 2009).

Table 2

Rail Summary: 2006-08 and 2016 Marketing Years

Variable	2006	2007	2008	2016
Ethanol production (billion gallons)	5.8	9.4	11.2	15.0
Number of projected rail carloads				
Ethanol production	119,347	190,816	227,755	306,122
Distillers' dried grains with solubles	26,338	41,650	49,533	66,576

SOURCE: USDA, "Expansion of U.S. Corn-based Ethanol from the Agricultural Transportation Perspective" in *Ethanol Transportation Backgrounder*, September 2007; www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5063605&acct=atpub.

The surge in market-based revenues more than offsets the declines in government payments, primarily from countercyclical payments[2] and higher input costs, emerging from energy-based inputs such as fuel and fertilizer. However, ethanol did not contribute to all of the revenue gains from corn production. In fact, based on the model estimates discussed previously, increased ethanol production from 2005 to 2008 contributed 63 cents to the price of a bushel of corn. Assuming no increase in ethanol production and the loss of 63 cents *ceteris paribus*, corn prices would decline to $3.27 per bushel and net returns would turn negative, roughly equivalent to 2005 levels.

Ethanol production has been found to influence both local and national corn prices. In analysis of basis patterns that measure changes in the difference between local cash prices and national prices, an ethanol plant raised corn prices by 12.5 cents per bushel on average (McNew and Griffith, 2005). Price increases tended to be greater at the plant site, ranging from 4.6 to 19.3 cents per bushel. As a result of transportation cost savings, other research has estimated that corn prices fall 0.2361 cents per bushel for every mile farther from an ethanol plant (Gallagher, Wisner, and Brubaker, 2005).

Increased crop profits quickly translated into higher land values. Nationally, U.S. cropland values rose 12.5 percent in 2006 and an additional 10.4 percent in 2007, the strongest gains since the 1970s.[3] The largest gains emerged in the Northern Plains and the Corn Belt, where cropland values jumped almost 20 percent in 2007. Even within major corn production regions, cropland value gains rose faster in locations in closer proximity to an ethanol plant (Henderson and Gloy, forthcoming). In the Federal Reserve District of Kansas City, farmland value gains were almost double in locations within 50 miles of an ethanol plant. The larger land value gains near ethanol plants reflected the capitalized value of the stronger crop prices and net returns to corn production closer to the ethanol plant (Henderson and Gloy, forthcoming).

The rapid expansion of ethanol production has also altered transportation and storage patterns in some parts of the Corn Belt. After the surge in ethanol production, anecdotal reports indicate that ethanol producers experience more difficulty shipping final products by rail. Ethanol production has also altered the shipping flows of grain. In fact, in 2006, the state of Iowa expected to import corn to meet industry needs for rising ethanol production (Roe, Jolly, and Wisner, 2006). On a national basis, reaching the 15 billion gallon mandate by 2016 is expected to increase ethanol rail shipments and dried distilled grain shipments by more than 150 percent above 2006 levels (Table 2). Grain storage patterns have also changed as local producers

[2] Under the countercyclical payment program, government subsidy payments are triggered when crop prices fall below specified levels. In 2005 and 2006, crop prices in general were low, triggering larger payments under the countercyclical payment program. The rise in crop prices in 2007 and 2008 above the trigger prices led to lower countercyclical payments. In 2005 and 2006, countercyclical program payments topped $4.0 billion annually. In 2008, countercyclical program payments are projected to fall to $720 million after dropping to $1.1 billion in 2007.

[3] USDA farmland values are measured as of January 1. As a result, reported increases from 2007 to 2008 reflect 2007 land value increases.

and grain storage facilities are needed to store more grain for year-round processing at ethanol plants.

The livestock sector has probably been the most strongly affected by rising crop prices. Higher crop prices have led to major gains in feed costs. The USDA indicates that in September 2008, cattle feed costs increased 52 percent and broiler feed costs rose 64 percent over the previous year (USDA, 2008). Feed costs rose less rapidly for cattle producers as they are better able to replace corn with distilled grains, a by-product of ethanol production, in cattle feed rations. Rising feed costs have boosted the breakeven price from livestock feeding: Cattle and hog feeders operated in the red for most of 2008. Still, it is important to remember that rising crop prices are driven by other factors, such as robust export activity, in addition to the ethanol boom.

Ethanol production has contributed to shifts in cattle feeding operations. Livestock numbers have declined in response to higher feed costs and declining profits. With higher feed costs, livestock feeders often slaughter more animals at lower weights to reduce costs. In fact, the number of heifers and gilts sent to slaughter increased in 2007 and slaughter weights for cattle and hogs declined.

The production of distilled grains may have contributed to a modest shift in feeding locations. Distilled grains are a by-product of the ethanol industry and are a partial substitute for corn in cattle feed. However, unlike corn, distilled grains quickly spoil and are difficult to transport. As a result, as was expected, the price of distilled grains fell sharply near ethanol plants and reduced the feed costs of local cattle feeders. With lower feed costs, cattle feeders near ethanol plants would enjoy larger profits and expand production, whereas feeders farther away would cut production. In fact, policymakers in the Corn Belt were touting ethanol production as a way to spark an expansion in the livestock industry. The large-scale shifts in cattle feeding, however, have yet to emerge. From 2005 to 2008, cattle feeding costs in Nebraska and Texas rose 9.3 and 9.5 percent, respectively.

In general, ethanol production has contributed to higher corn prices at the national and local levels. However, other factors, such as export activity, have also contributed to higher prices. Still, higher feed costs are straining profit margins for the livestock industry. Few shifts in the geographic location of livestock production have emerged, although local corn prices and farmland values have risen more in locations closer to an ethanol plant.

NONFARM IMPACTS

While ethanol production has led to mixed impacts on the farm sector, it has led to increased nonfarm activity. Ethanol production stimulates nonfarm activity initially from new plant construction and then through ongoing plant operation. Although ethanol plants do help stimulate nonfarm activity in rural places, the benefits are probably not as large as some initial projections.

Over the past few years, several economic impact studies have been conducted on the ethanol industry. The economic impacts touted in these studies are heavily dependent on the assumptions embedded in the model. As a result, the economic impacts vary with the local labor force, crop production impacts, the local business environment, the economic multipliers used to calculated indirect impacts, changes to industries from ethanol production, and induced impacts (i.e., changes in household spending from additional income to the region).[4]

Ethanol's first nonfarm economic impact occurs during plant construction. Construction activity has the potential to stimulate economic growth in the local community as new workers are hired and various inputs are used for plant construction. However, these impacts are temporary and eliminated after plant completion. A study of four Missouri ethanol plants indicated that the construction phase produced a total of 2,098 construction jobs (Pierce, Horner, and Milhollin, 2007). However, other studies do not model the economic impacts of the construction phase because the jobs are temporary and often filled by out-of-state workers with many of the other services and goods used during construction imported from outside the region (Swenson, 2008). Regardless, the increase in temporary workers does provide an economic boost at

[4] Most economic impacts studies use input-output analysis to model economic impacts. IMPLAN is the program commonly used to conduct the analysis (available at www.implan.com).

Table 3

Economic Impact Estimates for a 100 MGY Capacity Ethanol Refinery

	Hamilton, Illinois		Kankakee, Illinois		Iowa		
Type of impact	Output ($ million)	Jobs	Output ($ million)	Jobs	Output ($ million)	Jobs	Value-added ($ million)
Direct	214.6	39	214.6	39	227.0	46	35.5
Indirect	14.6	97	27.2	152	25.3	95	11.0
Induced	1.6	17	5.7	59	2.0	29	1.2
Total	230.8	153	247.5	250	254.2	170	47.7

SOURCE: Low and Isserman (2009); Swenson (2008).

local restaurants and hotels as temporary workers find places to eat and sleep.

The long-term direct economic impacts from ethanol emerge from the continued operation of the ethanol plant. First, ethanol plants employ people to operate the facility. In general, ethanol plants typically employ between 35 and 45 people. Smaller plants (50 million gallons per year [MGY] capacity) employ roughly 35 people; larger plants (100 MGY capacity) employ more than 40 people (Swenson, 2008; Low and Isserman, 2009). As the size of new plants increases due to economies of scale, the number of workers needed in the ethanol industry could decline if larger plants replace older, smaller plants.

Second, ethanol plants produce ethanol and distilled grains, which boosts overall economic activity in the community. Economic activity often is measured on a gross basis in terms of output (sales) and on a value-added, net basis, measuring the wages and salaries paid to workers, returns to proprietors, investors, and indirect tax payments above and beyond the costs of inputs. Recent studies indicate that a single 100 MGY ethanol plant would boost direct output (gross sales) for the county in which the plant is located by roughly $215 to $227 million dollars and value-added activity by $35.5 million dollars (Table 3).

The direct economic impacts from ethanol plants are expected to ripple through the economy and support increased industry activity and boost household spending. The size of these industry and household impacts depends heavily on the size of the economic multipliers in the local economy. Disagreements over the economic impacts of the ethanol industry vary with the assumptions surrounding the economic multipliers. The biggest economic assumption is the impact on crop production in the region. Studies assuming larger production impacts have larger economic multipliers. Recent economic impact studies (Swenson, 2008; Low and Isserman, 2009) have reduced economic multipliers associated with the ethanol industry (Table 4). Recent studies assume that the local production response is muted because most of the highly productive agricultural farmland is already in production. As a result, most of the changes in crop production will be the substitution of corn for other crop production (Low and Isserman, 2009).[5]

In terms of output, industry (indirect) impacts are much larger than household (induced) impacts. For example, in Iowa, a 100 MGY ethanol plant had an indirect multiplier of 0.11, meaning that for every dollar of output, the ethanol plant stimulated an additional 11 cents in industry output (see Table 4). In contrast, household spending is expected to rise 1 to 3 cents for every dollar increase in output from an ethanol plant.

Industry and household impacts, however, varied with the local business environment and size of the economy. For example, the industry multiplier for a 100 MGY plant was 0.13 in Kankakee,

[5] Many initial studies assumed a fixed-proportions input-output model that does not incorporate various types of potential substitutions in local economic activity (Low and Isserman, 2009).

Table 4

Output and Employment Multipliers from Ethanol Plants

Economic study	Output multiplier	Employment multiplier
Nebraska (Petersan, 2002)		
40 MGY ethanol plant		
Industry (indirect)	0.28	1.90
Household spending (induced)	0.09	0.95
Total	0.37	2.86
Iowa (Swenson, 2008)		
50 MGY ethanol plant		
Industry (indirect)	0.11	2.14
Household spending (induced)	0.02	0.66
Total	0.13	2.80
Iowa (Swenson, 2008)		
100 MGY ethanol plant		
Industry (indirect)	0.11	2.07
Household spending (induced)	0.01	0.63
Total	0.12	2.70
Hamilton, Illinois (Low and Isserman, 2009)		
100 MGY ethanol plant		
Industry (indirect)	0.07	2.49
Household spending (induced)	0.01	0.44
Total	0.08	2.92
Kankakee, Illinois (Low and Isserman, 2009)		
100 MGY ethanol plant		
Industry (indirect)	0.13	3.90
Household spending (induced)	0.03	1.51
Total	0.15	5.41

Illinois (year 2000 population 3,029), compared with 0.07 in Hamilton, Illinois (year 2000 population 25,561). With a much larger and more complex economy, Kankakee has a greater ability to provide more inputs to the ethanol plant and thus a higher indirect multiplier (Low and Isserman, 2009).

A similar pattern emerges from employment, or job, multipliers. Indirect industry multipliers are larger than induced (household spending) multipliers (see Table 4). In addition, larger, more-complex economies are expected to enjoy larger multipliers than small rural economies. It is important to note that rising output and household spending would boost tax revenues at various levels.

LONG-TERM IMPACTS

The ethanol industry is expected to provide valuable future contributions to rural communities. Because expectations regarding the contribution of ethanol plants to economic output have declined recently, the biggest challenge might be shrinking profit margins in ethanol production. Ethanol is a policy-driven market and changes in policy will shape its long-term survival.

The long-term impacts of ethanol production clearly depend on the viability of the ethanol industry. Some analysts indicate that ethanol profitability will rise and fall with crude oil prices. In fact, ethanol prices do move with crude oil prices. How-

Figure 1

Ethanol and Corn Price Spreads

NOTE: Calculation based on Commodity Research Bureau data. The spread shows the net return from the sale of a gallon of ethanol after paying for the corn used to produce it. One bushel of corn is assumed to yield 2.8 gallons of ethanol. Spread = Ethanol Price – (Corn Price/2.8).

ever, corn prices—the largest ethanol production costs—also are moving with ethanol and crude oil prices. Recent history shows that even with record high crude oil prices, ethanol profits have narrowed significantly. Since 2006, ethanol profits have sharply declined as corn prices have risen faster than ethanol prices. The ethanol-corn price spread, which measures the net returns to ethanol after paying for corn, is just one indicator suggesting that profit margins have fallen (Figure 1). The biggest sign of struggles in the ethanol industry is the recent idling of several ethanol plants under construction and the bankruptcy of VeraSun Energy Corporation (McEowen, 2008).

Policy issues probably hold the key to ethanol profitability. As the food-versus-fuel debate intensified, the appetite for ethanol subsidies diminished. A decline in ethanol subsidies and the elimination of the tariff on Brazilian ethanol is expected to lead to lower ethanol production (Thompson, Meyer, and Westoff, 2008). Yet the biggest impact could emerge from the elimination of the ethanol mandate (Westoff, Thompson, and Meyer, 2008).

The reduction in ethanol production and the closure of ethanol production plants could lead to lower economic impacts on rural communities. In general, idling plants would lead to lower crop prices and reduced capitalized returns to cropland at the local level as local demand shrinks. Lost output and employment at the ethanol plant could ripple throughout the local economy, leading to additional job losses and reduced business activity and household spending.

As the ethanol industry works through its own troubling times, which ethanol plants are most susceptible to close? Are older, smaller plants or newer, larger plants in the best position to weather current strains in ethanol profits? Older, smaller plants should have already paid a large proportion of their fixed costs, whereas new, larger plants should have lower fixed costs because of economies of scale. In either case, closures of either type of plant will produce economic losses. However, smaller, older plants with local investors tend to have higher induced impacts on the local economy as local investors spend more money locally

(Swenson and Eathington, 2006). As a result, the closure of locally owned ethanol plants could have larger economic impacts in rural communities than investor-owned plants.

Alternatively, new technologies could emerge to make ethanol more profitable. Since 2001, the ethanol industry has significantly cut the amount of water used in production from almost five gallons of water per gallon of ethanol to less than four (Keeney and Muller, 2006; Wu, 2008). What innovations will emerge from new technology that will boost ethanol productivity? Over the past few years, ethanol yields per bushel of corn have increased 6.4 percent for dry mills (Wu, 2008), rising to 2.8 gallons of ethanol per bushel of corn in 2008. Scientists are also exploring how enzymes could boost ethanol yields (McGinnis, 2007). If the market stabilizes and mandates hold, ethanol production could support economic activity into the future.

CONCLUSION

An ethanol boom has helped spur economic activity in many rural communities. Ethanol production has added value to U.S. corn production and contributed to higher cropland values, but it has posed some challenges to the livestock sector. New ethanol plants have added jobs in many rural communities, which have supported additional gains in related industry and household spending. However, as more insight into the ethanol industry is gained, expectations regarding the wave of pending activity have declined. Proponents have touted ethanol as fueling the current farm boom and spurring a wave of business activity on rural Main Streets. Opponents have identified ethanol as the root cause of lost profitability in the livestock industry. In both cases, the economic impacts of ethanol are probably not as large as touted.

REFERENCES

Environmental Protection Agency. "Renewable Fuel Standard Program: Technical Amendments." October 2, 2008; www.epa.gov/OMS/renewablefuels/.

Fortenbery, T. Randall and Park, Hwanil. "The Effect of Ethanol Production on the U.S. National Corn Price." Staff Paper No. 523, University of Wisconsin, Department of Agricultural and Applied Economics, April 2008; www.aae.wisc.edu/pubs/sps/pdf/stpap523.pdf.

Gallagher, Paul; Wisner, Robert and Brubacker, Heather. "Price Relationships in Processors' Input Market Areas: Testing Theories for Corn Prices Near Ethanol Plants." *Canadian Journal of Agricultural Economics*, 2005, *53*(2-3), pp. 117-39.

Henderson, Jason and Gloy, Brent. "The Impact of Ethanol Plants on Cropland Values in the Great Plains." *Agricultural Finance Review* (forthcoming).

Keeney, Dennis and Muller, Mark. "Water Use by Ethanol Plants: Potential Challenges." Institute for Agriculture and Trade Policy, October 2006; www.agobservatory.org/library.cfm?refid=89449.

Low, Sarah A. and Isserman, Andrew M. "Ethanol and the Local Economy: Industry Trends, Location Factors, Economic Impacts, and Risks." *Economic Development Quarterly*, February 2009, *23*, pp. 71-88.

McEowen, Roger. "VeraSun Energy Bankruptcy Poses Perils for Farmers and Elevators." Center for Agricultural Lay and Taxation, Iowa State University, November 18, 2008; www.calt.iastate.edu/verasun.html.

McGinnis, Laura. "Fueling America—Without Petroleum." *Agricultural Research*, U.S. Department of Agriculture. Agricultural Research Service, April 2007, pp. 10-13; www.ars.usda.gov/is/ar/archive/apr07/petro0407.pdf.

McNew, Kevin and Griffith, Duane. "Measuring the Impact of Ethanol Plants on Local Grain Prices." *Review of Agricultural Economics*, June 2005, *27*(2), pp. 164-80.

Petersan, Donis. "Estimated Economic Effects for the Prospective Fagen Ethanol Project at Central City, Nebraska." Economic Development Department, Nebraska Public Power District, December 2002; www.ne-ethanol.org/pdf/centralcityethanol.pdf.

Pierce, Vern; Horner, Joe and Ryan Milhollin, Ryan. "Employment and Economic Benefits of Ethanol Production in Missouri." Commercial Agriculture Program, University of Missouri Extension, February 2007; http://agebb.missouri.edu/commag/ethanolreport2007.pdf.

Roe, Josh D.; Jolly, Robert W. and Wisner, Robert N. "Another Plant?!...The Rapid Expansion in the Ethanol Industry and Its Effects All the Way Down to the Farm Gate." Presented at the American Agricultural Economics Association Annual Meeting, Long Beach, CA, July 23-26, 2006; http://ageconsearch.umn.edu/bitstream/21066/1/sp06ro04.pdf.

Swenson, David A. "The Economic Impact of Ethanol Production in Iowa." Staff General Research Paper No. 12865, Department of Economics, Iowa State University, January 2008; www.econ.iastate.edu/research/webpapers/paper_12865.pdf.

Swenson, David and Eathington, Liesl. "Determining the Regional Economic Values of Ethanol Production in Iowa Considering Different Levels of Local Investment." Department of Economics, Iowa State University, July 2006; www.valuechains.org/bewg/Documents/eth_full0706.pdf.

Thompson, Wyatt; Meyer, Seth and Westoff, Patrick. "Model of the U.S. Ethanol Market." FAPRI-MU Report No. 07-08, Food and Agricultural Policy Research Institute, University of Missouri, July 2008; www.fapri.missouri.edu/outreach/publications/2008/fapri_mu_report_07_08.pdf.

Tyner, Walle E. and Taheripour, Farzad. "Policy Options for Integrated Energy and Agricultural Markets." *Review of Agricultural Economics*, 2008, *30*(3), pp. 387-96; www.agecon.purdue.edu/news/financial/RAE_paper_2008.pdf.

U.S. Department of Agriculture, Economic Research Service. "Livestock, Dairy, and Poultry Outlook–December 2008." December 2008; www.ers.usda.gov/publications/ldp/.

U.S. Department of Agriculture, World Agricultural Outlook Board. "World Agriculture Supply and Demand Estimates–February 2009." WASDE-467, February 2009; http://usda.mannlib.cornell.edu/usda/current/wasde/wasde-02-10-2009.pdf.

Westoff, Patrick; Thompson, Wyatt and Meyer, Seth. "Biofuels: Impact of Selected Farm Bill Provisions and Other Biofuel Policy Options." FAPRI-MU Report No. 06-08, Food and Agricultural Policy Research Institute, University of Missouri, June 2008; www.fapri.missouri.edu/outreach/publications/2008/fapri_mu_report_06_08.pdf.

Wu, May. "Analysis of Efficiency of the U.S. Ethanol Industry 2007." Center for Transportation Research, Argonne National Laboratory, March 27, 2008; www1.eere.energy.gov/biomass/pdfs/anl_ethanol_analysis_2007.pdf.