



BRIEFING

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Ethanol Demand and Corn Prices: Impacts on Cattle and Hog Producers

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Objective

Analysis

for Informed

Decision Making

Increases in the demand for corn-based ethanol have contributed to substantially higher corn prices. For example, Central Illinois corn prices increased from \$1.84/bushel in the fourth quarter of 2005 to \$3.28/bushel in the fourth quarter of 2006, an increase of 78.3 percent (LMIC, 2006). Much of the increase in corn prices occurred during the fall of 2006 when, between August and early December, the December 2006 CBOT corn futures increased by nearly 60 percent (Agricultural Online, 2006). Corn constitutes about 95 percent of total feed grain use (corn, oats, barley, and sorghum). These corn price changes, therefore, have increased feed costs and breakeven prices for cattle and hog finishers. Economists generally believe that the U.S. goal of energy independence will sustain strong demand for ethanol and other bio-fuels, thus, future corn prices are likely to be higher than they were in the 1990's and from 2000 to 2005 (Caldwell, 2006).

The purpose of this briefing is to evaluate the effects of the 2005-2006 increases in corn prices on prices, production, and revenues in the fed cattle, feeder cattle, and hog sectors. The corn price increases are treated as permanent and the impacts on the livestock sectors cover an intermediate term period. The estimated effects emphasize the consequences to livestock producers of a booming ethanol industry that has benefited corn growers, ethanol

investors and firms, and ethanol producing communities.

Analysts indicate most of the recent corn price increases are due to strong demand for corn-based ethanol and expected reductions in U.S. corn stocks (Good, 2006; Hurt, 2006). Recent increases in ethanol demand are primarily the result of (a) states banning the oxygenate MTBE (Methyl Tertiary Butyl Ether) from U.S. gasoline in May 2006 because of ground water pollution problems, (b) mandated bio-fuel use under Renewable Fuels Standards (RFS) of the Energy Policy Act of 2005, and (c) large increases in world oil prices from 2005 to 2006 (Caldwell, 2006; Agricultural Online, 12/12/2006). Ethanol production has recently received more public attention; however, its production history dates back several decades. For example, in 1980 the United States produced about 175 million gallons of ethanol. By 2005, U.S. ethanol production had increased to about 3.9 billion gallons, and was estimated to reach nearly 5 billion gallons in 2006 (Tomson, 2007). From January 2005 to January 2006, the U.S. ethanol industry expanded from 81 to 95 plants (RFA, 2006).

The effects of the recent corn price increases are analyzed in terms of expected changes in prices, quantities, and revenues in the cattle and hog sectors. The primary focus of the discussion is on revenue changes.

Changes in these variables cover an intermediate period of four years to allow for livestock price and supply adjustments to the increased feed costs. The 2005-2006 corn price increases are assumed to be permanent as ethanol and corn demands are expected to remain robust relative to expected increases in ethanol and corn production (Caldwell, 2006). This assumption may not hold if there are changes in demand and supply certain conditions in the ethanol, feed grains, and livestock industries.

Corn and Ethanol Prices

The price of corn affects the cost of weight gain and feeding margins in livestock finishing (Anderson and Trapp, 1997). For example, increases in corn prices normally reduce cattle feeding margins (fed cattle revenues less feeder cattle and feed costs). Feedlot operators usually adjust to higher feed costs by bidding down input prices of feeder cattle and also by reducing finishing weights and placements of lighter-weight feeders. The result may be to increase the price of fed cattle to beef packers. In the hog finishing industry, input prices of feeder pigs and output prices of barrows and gilts could follow the same pattern.

Market prices for corn are determined by a combination of demand, supply, and stochastic factors in the feed grains and livestock sectors. Industrial demand for corn (i.e., ethanol demand, demand for corn syrups, etc.) is an increasingly important component of total corn demand. Other demand sources include food, feed, export, and seed use as well as demands by livestock finishers for distilled grain products. Ethanol demand and production capacity primarily influence ethanol prices. The Nebraska Ethanol Board (NEB) has published a monthly series of ethanol rack (wholesale) prices since 1982. The Renewable Fuels Association (RFA) has published

monthly data on ethanol production since 1980. Figure 1 shows real (1982-84 constant dollar) annual average ethanol prices and ethanol production from 1982 to 2006. From 1982 to 1999, ethanol production increased from about 0.35 billion gallons to 1.47 billion gallons, or about 320 percent, while real ethanol prices decreased from about \$1.77/gallon to \$.59/gallon, or about 67 percent. After 1999, the price-quantity relationships changed as both ethanol production and real ethanol prices increased, indicating the demand for ethanol increased faster than the supply of ethanol. For example, from 1999 to 2006 real ethanol prices increased from \$0.78/gallon to \$1.29/gallon, or about 65 percent, and ethanol production increased from 1.47 billion gallons to 4.8 billion gallons, or about 227 percent. Over the 1982-2006 period, real corn prices and real ethanol prices were highly correlated with a correlation coefficient of 0.81. Also as a note of interest, the NEB data indicate that, from 1982-2006, ethanol wholesale prices sold at an average premium of \$0.56/gallon to unleaded wholesale gasoline prices.

Model and Assumptions

Modeling the effects of increasing corn prices on cattle and hog producers requires knowledge of the

relationship between corn prices and livestock demands (prices) and supplies. Conceptually, shifts in livestock demands and supplies occur through changing feed costs in livestock finishing. Corn price effects are estimated using coefficients of a dynamic, econometric demand and supply model of the livestock-feed grain sectors (Marsh, 2007). The time-path solution to the systems model provides interim multipliers that are used to calculate four-year changes in cattle and slaughter hog prices and quantities subsequent to permanent increases in corn prices.

The corn price change examined in the analysis is the increase in real corn prices from the fourth quarter of 2005 to the fourth quarter of 2006, which was 71.8 percent. Livestock sector revenues are obtained by multiplying prices by quantities, where quantities are expressed in live weight pounds. Cattle and hog prices and revenues are expressed in real terms and their changes are expressed as deviations from average real 2000-2005 values (Table1).

Several assumptions are made with respect to the model. First, based on the consensus of economists and livestock industry analysts, the recent corn price increases are assumed to be primarily driven by increased demand for ethanol (Hurt, 2006; Tomson,

Figure 1: Real Prices and Production of Ethanol

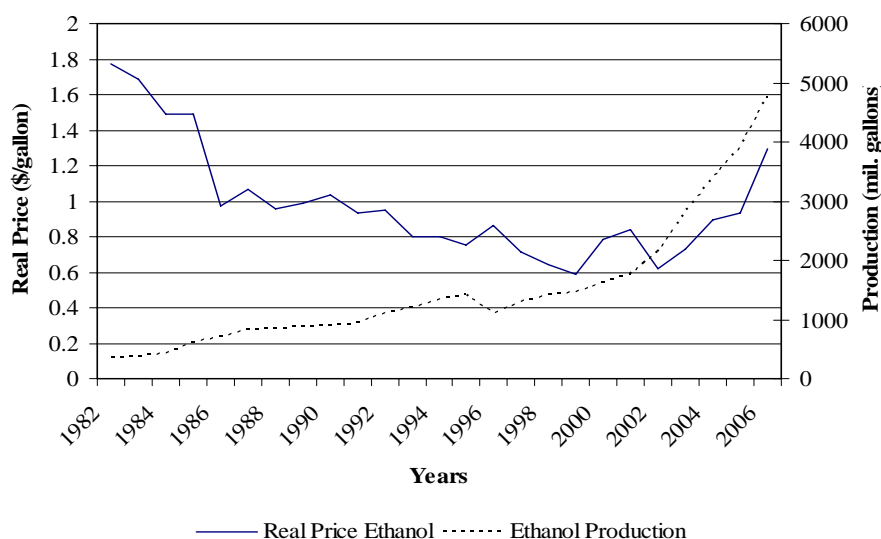


Table 1: Effects of Corn Price Increases (2005-2006) on Livestock Prices, Quantities, and Revenues

<u>Corn Price Increase 71.8%</u>		
Sectors	Value	Percent
<u>Feeder Cattle</u>		
Price (\$/cwt)	-7.10	-12.96
Quantity (mil. hd)	-1.23	-3.24
Revenue	-1.98	-15.20
<u>Fed Cattle</u>		
Price (\$/cwt)	1.00	2.35
Quantity (bil. lbs)	-1.98	-4.63
Revenue (bil. \$)	-0.44	-2.42
<u>Hogs</u>		
Price (\$/cwt)	1.07	4.40
Quantity (bil. lbs.)	-1.83	-6.87
Revenue (bil. \$)	-0.18	-2.76

Notes: Numbers in the “Percent” column are the numbers in the “Value” column expressed as percentages of their average 2000-2005 values. The 2000-2005 real prices for the livestock sectors are: feeder cattle = \$54.79/cwt, fed cattle = \$42.43/cwt, and slaughter hogs = \$24.39/cwt. The 2000-2005 average production quantities for the livestock sectors are: feeder cattle = 38.04 million head (average weaning weight of 625 pounds), slaughter cattle = 42.86 billion pounds (live weight), and slaughter hogs = 26.74 billion pounds (live weight). The 2000-2005 average real revenues for the livestock sectors are: feeder cattle = \$13.03 billion, fed cattle = \$18.19 billion, and hogs = \$6.52 billion.

2007). Second, the impact period involves the intermediate term of four years to allow for supply responses by feeder calf producers and livestock finishers to market price changes. The supply responses of cattle and hog producers are influenced by biological factors and producer expectations which relate back to changes in breeding herd inventories. Third, the 2005-2006 corn price increases are considered permanent since corn market demand is expected to remain robust relative to expected increases in corn production. The effects of using other cellulose biomass feed stocks in ethanol production such as crop residues, wood chips, switch grasses, etc. are not analyzed since the substitution effects of these materials (for corn) are not established. Fourth, all other factors affecting livestock and feed grain demands and supplies are assumed to remain at their average 2000-2005 levels. This assumption excludes potential offsets to corn price increases such as changes in consumer demands, technologies, joint product prices, and marketing costs. Finally, the effects on livestock revenues from utilizing distillers grain products

(ethanol by-products) in feed rations are not analyzed since cost of gain implications are not provided. As of mid January 2007, Midwest dried distillers grain (DDSG) prices and feed corn prices each averaged close to 6.5 cents per pound. Thus, DDSG offered little cost advantage at that time. However, distillers grains can be used by livestock finishers to replace some of the corn allocated to ethanol production.

Results

Table 1 presents the estimated changes in real cattle and hog prices, quantities, and revenues based on a permanent 71.8 percent increase in real corn prices. Feeder cattle, fed cattle, and hog producers all experience reductions in revenues due to expected demand and supply shifts in their sectors. In the feeder cattle sector, the corn price increase reduces feedlot demand (price) for feeder cattle. The decline in feeder cattle price results in reduced feeder cattle supplies as cow-calf producers adjust to lower expected profits. With the analysis extending beyond one year, feeder prices and quantities adjust in

the course of the cattle cycle, resulting in changes in prices and quantities that are different relative to their initial changes. For example, the short run (one year) effect of the corn price shock is to reduce feeder cattle prices by about 14.9 percent (not shown). But the ensuing years’ reduction in feeder supplies will result in increasing feeder prices, moderating the decline in feeder prices to about 13.0 percent (rather than the 14.9 percent) in four years (Table1).

In the fed cattle sector, the increased feedlot cost of gain results in lower fed cattle production due to reduced slaughter weights and feeder cattle placements (leftward shift in fed cattle supply). Since meat packer demand is relatively unresponsive to changes in cattle prices (that is, price inelastic) and assuming it does not shift downward, the market price of fed cattle increases. Coupled with the effect on feeder cattle prices, the feed cost increase results in a narrowing of the feeder cattle-fed cattle price spread. Similar price and quantity adjustments occur in the hog sector; however, feeder pig-slaughter hog price spreads are not examined due to thin spot markets for feeder pigs.

The results show that the ethanol-driven, feed cost impacts on livestock revenues are not trivial. Total revenue declines in all livestock sectors by \$2.60 billion, or about 6.50 percent of annual average total real revenues over the period 2000-2005. Real feeder cattle revenues (cow-calf and yearling producers) decline by \$1.98 billion, or 15.20 percent of 2000-2005 annual average revenues. Real fed cattle revenues (cattle finishers) decline by \$0.44 billion, or 2.42 percent of 2000-2005 annual average revenues. Hog sector revenues (farrow-to-finish operators) decline by \$0.18 billion, or 2.76 percent of 2000-2005 annual average revenues.

The relative differences in the revenue declines among the livestock sectors is a function of the demand and supply elasticities in the structural livestock-feed grains model and the time-paths of the interim multipliers in the model solution. These factors contribute to different price and quantity responses to feed cost increases. For example, feeder cattle prices and supplies decline by 12.96 percent and 3.24 percent, respectively, while fed cattle prices increase by 2.35 percent and fed cattle supplies decrease by 4.63 percent. Hog prices increase by 4.40 percent and hog supplies decrease by 6.87 percent.

The results in Table 1 are based on a precipitous increase in corn prices that is an aberration relative to changes in corn prices in years prior to the 2005-2006. For example, from 2000 to 2006 the coefficient of variation in real corn price (standard deviation of corn price divided by mean of corn price) was 26.2 percent. Using this percentage to represent the corn price increase and applying it to the interim multipliers, the revenue results are less dramatic. Specifically, real revenues in the feeder cattle, slaughter cattle, and slaughter hog sectors decline by \$0.77 billion, \$0.10 billion, and \$0.04 billion, respectively (not shown). These estimates represent about 5.91 percent, 0.55 percent, and 0.61 percent of their respective 2000-2005 average revenues.

Conclusion

Increases in the demand for corn-based ethanol, though beneficial to corn producers, investors, and ethanol producing communities, negatively affect revenues received by cattle and hog producers. Though not studied here, declining revenues

would likely occur in the poultry industry. From 1982 to 2006 ethanol demand and production capacity increased substantially. However, demand increases were of particular note from 2005 to 2006 due to elimination of MTBE from gasoline, the 2005 Energy Policy Act, and increasing world oil prices. These developments have concerned livestock producers as the competition from industrial demand has increased feed grain prices and finishing costs.

A multiplier analysis, strongly tied to ethanol demand growth, was used to estimate the real revenue effects of high corn prices on cattle and hog producers for a period of four years. Results indicate that the ethanol-driven impacts resulted in revenue reductions in the feeder cattle, fed cattle, and hog sectors of about 15.20 percent, 2.42 percent, and 2.76 percent of 2000-2005 annual average livestock revenues.

The relatively large reduction in revenues in the feeder cattle sector (compared to the finishing sectors) results from the reduction in both feeder cattle prices and supplies, assuming no offsets to the corn price increases. Because of feeding margin adjustments in cattle and hog finishing, reductions in slaughter production are partially offset by slightly higher slaughter prices. The analysis is based on data at the aggregate level, and so the estimated price and quantity (revenue) changes were not translated into *profit* changes. The model results also did not provide information about the distribution of revenue losses by firm size or by regions of the country. While the model does not incorporate the retail beef sector, it is likely that higher feed (corn) prices will increase retail meat prices to consumers. The corn model results are conditional upon the assumptions and restrictions

imposed on the impact estimation. For example, other factors important to the corn and ethanol industries are not accounted for in the analysis that could modify the estimated revenue changes. These factors include changes in U.S. import tariffs on ethanol, ethanol tax incentives, competition from other feedstock (cellulose biomass) sources in ethanol production, and the effects of utilizing ethanol by-products in livestock feed rations. In addition, future corn production (acreage/yield) responses, ethanol demand changes relative to ethanol capacity, and consumer responses to probable higher meat prices will ultimately affect prices, quantities, and revenues in the livestock sectors.

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