The Effect of Grain Prices on the U.S. Catfish Industry: Implications of U.S. Ethanol Production

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This study estimates the relationship between catfish feed prices (per-unit cost) and relevant economic factors such as the price of farm-raised catfish, farm inputs, and feed ingredients, which include corn, soybean meal, cottonseed meal, and wheat middling. Given changes in these economic factors it was assumed that the responsiveness of feed cost was not instantaneous, and a partial-adjustment model was used in estimation. Results show that a one-percent increase in corn prices will cause a 0.062-percent increase in catfish feed cost in the short run and a 0.16-percent increase in the long run. A one-percent increase in soybean meal prices results in a 0.125 percent and 0.322 percent increase in catfish feed cost in the short run and long run, respectively.

Rising catfish feed cost induced by the recent spike in grain prices has negatively affected U.S. catfish farmers. The severity of the present outlook for catfish farmers received national attention in the *New York Times* and the *Washington Post*. Both publications acknowledge that the dramatic increase in corn and soybean prices, which is often attributed to the growth in U.S. ethanol and biofuels production, has resulted in farm closures in a number of catfish producing states (Byrd 2008; Streiteld 2008). Arkansas, Louisiana, Alabama, and Mississippi account for almost all U.S. catfish production. Byrd (2008) notes that in 2008, the price of farm-raised catfish in these states was about $0.80 per pound, but the production costs were as high as $0.90 cents per pound. In the face of consistent negative returns, catfish farmers are draining their ponds and many employees in the catfish sector have lost their jobs in the process.

Given the recent increase in catfish feed cost, the primary objective of this study was to assess how feed costs are affected by grain prices. To accomplish this objective we econometrically estimated the relationship between catfish feed prices (per-unit cost) and relevant economic factors such as the price of farm-raised catfish, farm inputs, and feed ingredients, which include corn, soybean meal, cottonseed meal and wheat middling. Given changes in these economic factors, it was assumed that the responsiveness of feed cost was not instantaneous, and a partial-adjustment model was used in estimation. Estimation results were then used to derive short-run and long-run elasticities. Of particular interest was the responsiveness of feed cost to changes in corn and soybean-meal prices. The results also were used to assess the implications of U.S. ethanol production on the U.S. catfish farm sector.

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Background

Feed costs, which are a core part of animal production, play a key role in determining livestock prices. Feed costs represent 50 to 70 percent of livestock-production expenses and are a critical component of livestock profitability (Wright et al. 2007). Regardless of the feed formula, corn and soybean meal are always key ingredients in making the lowest-cost and most-nutritious catfish feed. Cottonseed meal and wheat middling are also important catfish feed ingredients. For instance, catfish feed that is 32 percent protein contains about 32.1 percent corn grain, 41.6 percent soybean meal, ten percent cottonseed meal, and ten percent wheat middling (Robinson et al. 2006).

In recent years the demand for corn has increased due to the growth of U.S. ethanol production. From 2000–2006, ethanol production increased from 1.6 billion gallons to approximately 5 billions, an increase of 212.5 percent (Collins 2007). Because corn is the primary ingredient for U.S. ethanol production, corn production has expanded and corn prices have significantly increased. According to the National Agricultural Statistics Service, the average corn price (farm level) in 2005 was

$1.96 per bushel. Corn prices increased from $2.00 per bushel in January 2006 to $5.50 in April 2008 (Figure 1).

From 2005–2008, the price of soybean meal, cottonseed meal, and wheat middling also increased (Figure1). In 2005, the average price of soybean meal was $189.29 per ton; prices increased throughout 2006 and 2007, reaching $412.25 per ton in July 2008. Cottonseed-meal prices increased from $112.50 per ton in January 2005 to over $335.00 per ton in 2008. As shown in Figure 1, the increase in wheat-middling prices is more recent.

Empirical Results

Catfish feed supply is a function of the feed price; the prices of corn, soybean meal, wheat middling, and cottonseed meal; fuel prices to account for transportation and equipment use; and technology. Feed demand is a function of the feed price, the price of farm-raised catfish, and fuel prices. Assuming the feed market is in equilibrium, a reduced-form feed-cost equation is defined as

$$(1)\quad FC_t = \beta_0 + \beta_1 FC_{t-1} + \beta_2 Pf_t + \beta_3 Pco_t + \beta_4 Pso_t + \beta_5 Pwh_t + \beta_6 Pct_t + \beta_7 PE_t + \beta_8 t + \varepsilon_t,$$

where FC is feed cost in $/lb; FC_{t-1} is feed cost lagged one month; Pf is the catfish price at the farm level; Pco is the price of corn (#2 yellow) in $/bushel; Pso is the price of soybean meal (49 percent protein) in $/ton; Pwh is the wheat-middling price in $/ton; Pct is the cottonseed-meal price in $/ton; PE is the price of diesel fuel (fuel-price index); t is a trend term; and ε is a random error term.

Equation 1 was estimated using monthly data from January 1996 to December 2007. Data sources include Hanson and Sites (2007), the National Agricultural Statistics Service (NASS 2007), the Bureau of Labor Statistics (BLS 2008), and the Economic Research Service (ERS 2008). Descriptive statistics for all model variables are given in Table 1.

Ordinary Least Square (OLS) was used to estimate Equation 1. The OLS results are presented in Table 2. Overall, the model variables explained a significant percentage of the variation in feed cost ($R^2 = 0.96$) and the Durbin-h statistic indicated that there was no first-order autocorrelation. Lagged feed cost, corn price, soybean-meal price, cottonseed-meal price and the trend term were all significant at the one-percent level. The estimates show that feed cost in the previous month explained 61 percent of current feed cost, and for every one-dollar increase in corn prices, feed cost increase $5.16 per ton. The effect of a one-dollar rise in the prices of soybean and cottonseed meal on feed cost was 0.15 and $0.12 per ton, respectively. These estimates are smaller than corn because soybean and cottonseed meal are priced in dollars per ton whereas corn is priced in dollars per bushel.

Short- and long-run elasticities (evaluated at the sample mean values) are presented in Table 3.

Table 1. Descriptive Statistics: 1996–2007.

Variable	Unit	Mean	Standard deviation	Minimum	Maximum
FC	$/ton	236.65	35.08	186.00	337.48
Pf	$/lb	0.71	0.08	0.53	0.96
Pco	$/bushel	2.86	0.72	1.91	5.17
Pso	$/ton	197.91	46.63	132.30	331.28
Pwh	$/ton	69.82	25.47	21.88	148.00
Pct	$/ton	149.57	29.89	100.65	224.50
PE	index	113.66	64.44	38.10	296.70

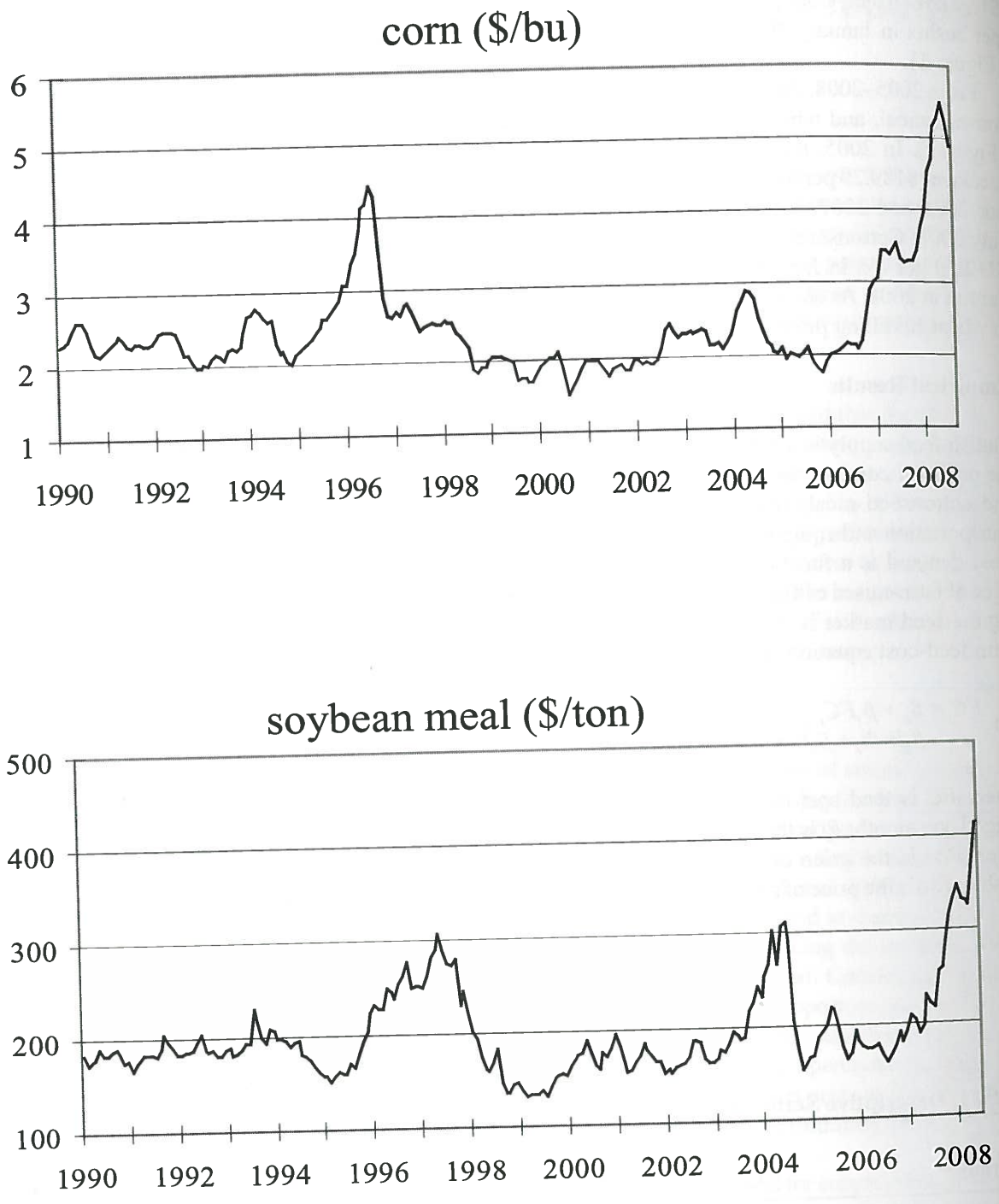
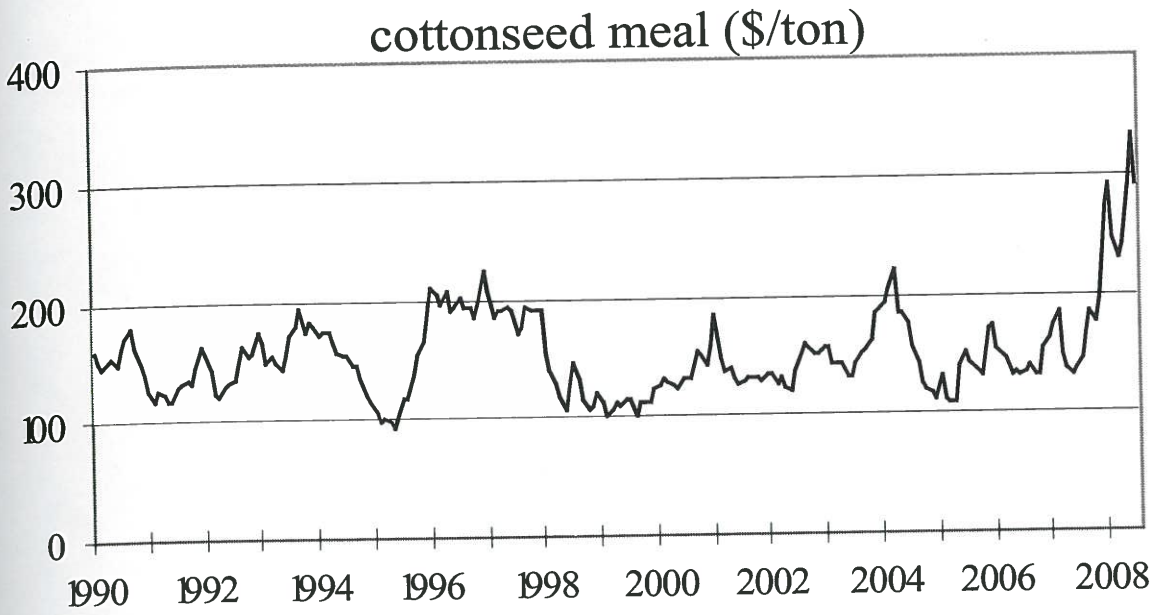


Figure 1. Price of Primary Catfish Feed Ingredient: 1990–2008.

(Source: USDA-ERS).



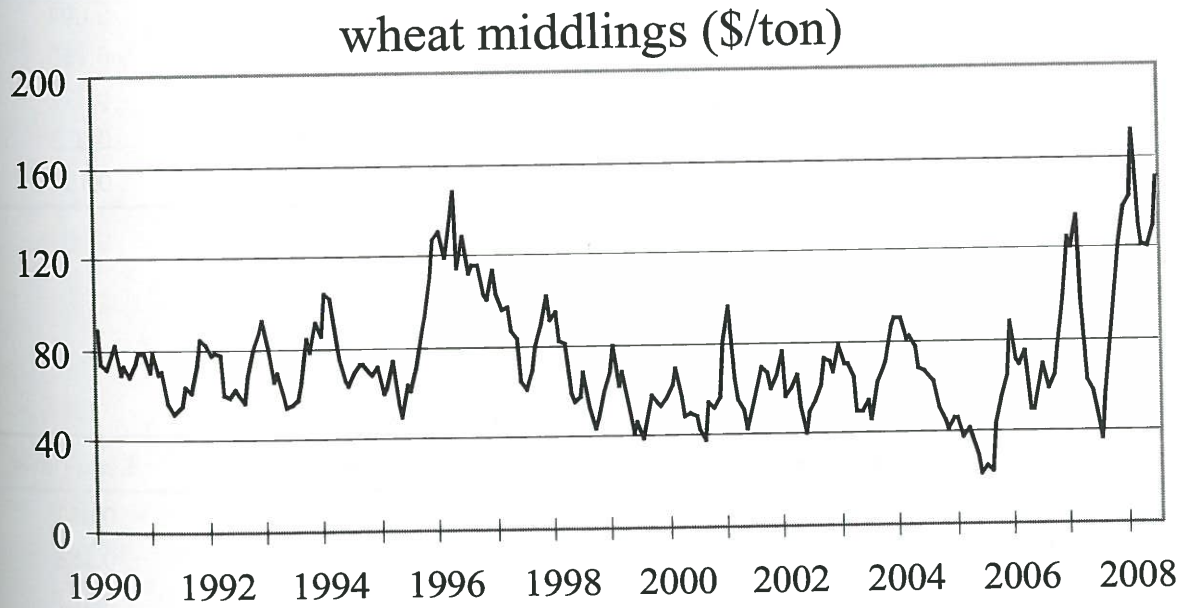


Figure 1. Price of Primary Catfish Feed Ingredient: 1990–2008 (Continued).

(Source: USDA-ERS).

Table 2. Feed Cost: OLS Results.

Variable	Estimate	t-value
Constant	7.78	0.99
FC(t−1)	0.61	16.43*
Pf	12.24	1.31
Pco	5.16	3.28*
Pso	0.15	5.80*
Pwh	0.07	1.54
Pct	0.12	2.76*
PE	−0.02	−0.67
R^2=0.96; Durbin-h = 0.07		

* indicates the 0.01 significance level

Table 3. Feed Cost Elasticities (Evaluated at Mean Values).

Elasticity	Variable	Short run	Long run
%ΔFC ÷ %ΔPf	catfish farm price	0.037	0.094
%ΔFC ÷ %ΔPco	corn price	0.062	0.160
%ΔFC ÷ %ΔPso	soybean meal price	0.125	0.322
%ΔFC ÷ %ΔPwh	wheat middling price	0.021	0.053
%ΔFC ÷ %ΔPct	cotton seed meal price	0.076	0.194

Table 4. Feed Cost Elasticities (Evaluated at 2007 Mean Values).

Elasticity	Variable	Short run	Long run
%ΔFC ÷ %ΔPf	catfish farm price	0.033	0.083
%ΔFC ÷ %ΔPco	corn price	0.073	0.188
%ΔFC ÷ %ΔPso	soybean meal price	0.126	0.323
%ΔFC ÷ %ΔPwh	wheat middling price	0.021	0.055
%ΔFC ÷ %ΔPct	cotton seed meal price	0.067	0.172

Results show that in the short run, a one-percent increase in the price of corn will cause a 0.062-percent increase in per-unit catfish feed cost. In the long run the feed cost would increase by 0.160 percent. Given that soybean meal is used to a greater extent in feed mixtures, the effect of soybean-meal prices was greater than the effect of corn prices, where the short- and long-run elasticities were 0.125 and 0.322, respectively. Lastly, the short-run and long-run elasticities for cottonseed meal were 0.076 and 0.194, respectively.

Given that the increase in grain prices is fairly recent, the short- and long-run elasticities are also evaluated at 2007 mean values (Table 4). The corn and soybean-meal price elasticities evaluated at 2007 mean values were greater than the elasticities evaluated at the sample mean values; however, the differences in the elasticity values were not significant.

Conclusion and Ethanol Implications

This study estimates the relationship between catfish feed cost and relevant economic factors such as the price of farm-raised catfish, farm inputs, and feed ingredients: corn, soybean meal, cottonseed meal, and wheat middling. Given changes in these economics factors, it was assumed that the responsiveness of feed cost was not instantaneous. Results show that the responsiveness of catfish feed cost to a one-percent change in corn prices was 0.062 percent in the short run and 0.16 percent in the long run. The responsiveness of catfish feed cost to a one-percent changes in soybean-meal prices was 0.125 and 0.322 percent in the short run and long run, respectively.

Park and Fortenbery (2007) found that for every one-percent increase in ethanol production, corn prices rise by 0.16 percent in the short run, *ceteris paribus*. Using their results, we can infer the effect of ethanol on catfish feed cost. If ethanol production increases by 100 percent, the price of corn price will increase by 16 percent; given this 16 percent increase in corn price, our results indicate that catfish feed cost would increase by 1.2 percent in the short run and 3.0 percent in the long run.

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