AN ANALYSIS OF THE COTTONSEED PRICING STRUCTURE IN TEXAS

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Abstract

The general objective of this study was to determine how variations in cottonseed supply factors, demand factors, and the five quality attributes reported under the current grading system (oil, ammonia, moisture, free fatty acids, and foreign matter) affect the price of whole cottonseed. It was found that cottonseed oil prices, cottonseed meal prices, moisture levels, free fatty acid levels, and foreign matter levels had statistically significant impacts on Texas cottonseed prices over the 1987-1996 marketing years. Results indicated that as cottonseed oil prices changed by 1 percent, cottonseed prices changed by about 0.33 percent. Cottonseed prices changed by about 0.40 percent as cottonseed meal prices changed by 1 percent. As moisture, free fatty acid, and foreign matter levels increased by one unit, cottonseed prices decreased by approximately 23 cents per ton, 4.56 dollars per ton, and 91 cents per ton, respectively. Results suggest that the current formula pricing system understates discounts for cottonseed moisture, free fatty acid, and foreign matter content.

Introduction

Cotton lint and seed production has been the leading source of agricultural cash receipts in Texas for all field crops since the early 1980's. The value added to the Texas economy by the cotton sector was over $1.4 billion in 1996 [Texas Agricultural Statistics Service (TASS), various issues]. In Texas, the farm value of cottonseed production currently averages over $200 million per year (TASS, various issues). Many cotton farmers depend upon the income from cottonseed sales to pay the costs of ginning their cotton crops (Hudson, 1946). The National Cottonseed Products Association (NCPA) (1997) reports that cottonseed contributes approximately 15 percent of the farmer's cotton crop income.

The two major buyers of cottonseed from gins are oil mills and livestock producers, particularly dairy producers. Only a small fraction of the seed produced each year is used to plant the next year's crop [U.S. Department of Agriculture (USDA), 1986-1996]. The prices that oil mills and dairies pay for cottonseed often differ. The oil mill determines the price it will offer for cottonseed based partly on the value of the products (oil, meal, hulls, and linters) it can obtain from cottonseed (NCPA, 1989). In many regions of the U.S., the dairy market pays a premium over the oil mill price (Warner, 1988). Dairy producers tend to be reluctant to feed new types of feed ingredients or change to new feeding procedures, but once changes are made in a feeding program, producers tend to maintain the new program despite changes in the market prices of feed ingredients (Chandler, 1992).

An important aspect of the cottonseed pricing structure is the grading system utilized in the cottonseed industry. Under this grading system, a sample is taken from each cottonseed shipment as it arrives at the oil mill. An independent government authorized laboratory analyzes the sample according to specified procedures and reports the grade to the oil mill (NCPA, 1989). Grades are based on the percentages of oil, ammonia, foreign matter, moisture, and free fatty acids contained in the seed sample. Higher percentages of oil and ammonia are more desirable and increase the grade of the seed, while higher percentages of foreign matter, moisture, and free fatty acids are undesirable and decrease the grade of the seed. The composite grade (CG) is broken into a quantity index and a quality index. The overall grade of cottonseed is determined by multiplying the quantity index by the quality index and dividing the result by one hundred. The quantity index is calculated as follows:

(1) $QT = (4 * OIL) + (6 * AMM) + V$

where QT is the quantity index, OIL is the oil percentage, AMM is the ammonia percentage, and V is the variety adjustment factor. The formula for the quality index is:

(2) $QL = 100 - (0.4 * FFA) - (0.1 * FM) - (0.1 * M)$

where QL represents the quality index, FFA represents one unit for every 0.1 percent free fatty acids in excess of 1.8 percent, FM represents one unit for every 0.1 percent foreign matter in excess of 1.0 percent, and M represents one unit for every 0.1 percent moisture in excess of 12.0 percent.

Many oil mills and dairies establish a price that they will pay for 100 grade cottonseed from gins. They pay premiums for grades higher than 100 and discounts for grades lower than 100. Alternatively, cottonseed purchasers may buy seed "as is" and pay a price based upon the individual quality attributes rather than the composite grade of each individual lot (NCPA, 1989). Ginners then base the prices which they pay producers for cottonseed on a margin per ton under the prices at which they can sell the cottonseed and on prices that competing gins are paying producers for cottonseed (Hudson, 1946). Gins effectively play the role of a marketing agent for the producer. Producers do not receive different prices for different lots of cottonseed based on who buys their seed. Instead, they receive an average price per ton, which is determined by the gin.

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Under the current formula pricing system for cottonseed, there are no widely accepted base levels of quality characteristics. Since the composite grade is multiplied by a market price for cottonseed grading 100 and a vast number of quality combinations can comprise 100 grade cottonseed, a base price for cottonseed does not exist. Given this complexity of the pricing structure and a lack of uniformity in pricing decisions, the market values of individual cottonseed quality characteristics are not known.

To date, there is no published research on the effects of changes in cottonseed supply, demand, and quality factors on Texas cottonseed prices. This type of information is important to cotton producers because it can be integrated into financial, production, and marketing decisions to improve profitability. The general objective of this study is to determine how supply factors, demand factors, and variations in the five cottonseed quality attributes reported under the current grading system (oil, ammonia, foreign matter, moisture, and free fatty acid levels) affect the price of whole cottonseed in Texas.

Methods and Procedures

The conceptual price model for cottonseed was specified as:

(3) $P_{CS} = h(PPI, PRODCTN, P_{CSOIL}, P_{CSM}, OIL, AMM, M, FFA, FM)$

where P_{CS} is the average monthly Texas cottonseed price in dollars per ton (TASS, various issues), PPI is the monthly producer price index for all farm products (U.S. Department of Labor, various issues), PRODCTN is the annual Texas cottonseed production in tons (TASS, various issues), P_{CSOIL} is the average monthly U.S. cottonseed oil price in cents per pound (USDA, 1986-1997), P_{CSM} is the average monthly Texas cottonseed meal price in dollars per ton (*Feedstuffs*, 1987-1996), OIL is the average monthly oil percentage for Texas cottonseed, AMM is the average monthly ammonia percentage for Texas cottonseed, M is the average monthly moisture percentage for Texas cottonseed, FFA is the average monthly free fatty acid percentage for Texas cottonseed, and FM is the average monthly foreign matter percentage for Texas cottonseed (USDA, 1987-1996).

The producer price index for all farm products (PPI) was included in the regression model to capture the effects changes in the general price level on cottonseed prices. The annual cottonseed production observation for a given marketing year (PRODCTN) represented annual shifts in cottonseed supply. This variable was believed not to be affected by cottonseed prices since cottonseed production is fixed in a given marketing year and responds annually to cotton lint prices instead of cottonseed prices. Cottonseed product prices (P_{CSOIL} and P_{CSM}) were included in the model to represent demand factors affecting cottonseed prices. The OIL, AMM, M, FFA, and FM (cottonseed quality attributes) variables were hypothesized to capture the effects of quality characteristics on the price of whole cottonseed.

For estimation purposes, two interaction terms combining oil and ammonia and moisture, free fatty acids, and foreign matter were used as independent variables. The reasoning for constructing these interaction terms was that oil and ammonia appear to be analyzed as a combination in the marketplace as indicated by the quantity index, and moisture, free fatty acids, and foreign matter appear to be analyzed as a combination in the marketplace as evidenced by the quality index. In addition, the interaction terms performed better statistically than their individual components.

Further, the cottonseed meal price variable was lagged three months to maximize the contribution of cottonseed meal prices to model performance. Unlike cottonseed oil price signals, cottonseed meal price signals must be transmitted from livestock producers to oil mills. This cottonseed meal price signal delay may explain the three month lag for the cottonseed meal price variable. An analysis of error term models for individual variables, a technique discussed in detail in Brown and Ethridge (1995), revealed the need for reciprocal specifications for both the cottonseed oil and lagged cottonseed meal price variables. Therefore, the empirical model was specified as follows:

(4) $P_{CS} = \beta_0 + \beta_1 * PPI + \beta_2 * PRODCTN + \beta_3 * 1/P_{CSOIL} + \beta_4 * 1/L3P_{CSM} + \beta_5 * OILAMM + \beta_6 * MFFAFM$

where $L3P_{CSM}$ represents the average monthly Texas cottonseed meal price lagged three months, OILAMM represents the average monthly oil percentage times the average monthly ammonia percentage for Texas cottonseed, and MFFAFM represents the average monthly moisture percentage times the average monthly free fatty acid percentage times the average monthly foreign matter percentage for Texas cottonseed. The empirical model was estimated by using the maximum likelihood procedure with one autoregressive lag, AR(1), that corrected for positive first-order autocorrelation.

Each independent variable was interpreted, and the statistical significance of each variable was noted. Next, by taking the partial derivative of the estimated cottonseed price equation with respect to a specific cottonseed quality attribute, a marginal implicit price was derived. The estimated marginal implicit price of a quality attribute measured the change in cottonseed prices as that quality attribute changed by one unit, holding all other factors constant.

The estimated marginal implicit prices for moisture, free fatty acids, and foreign matter were then compared to the corresponding marginal implicit prices under the formula pricing system for cottonseed. Under the formula pricing system, the sale price of cottonseed is determined by the following formula:

(5) $P_{CS} = MP * CG / 100$

where MP is the market price of cottonseed grading one-hundred.

After substituting the components of the composite grade into Equation 5, the following relationship resulted:

(6) $P_{CS} = MP * [((QT * QL) / 100) + R) / 100]$

where R represents the rounding element. Equations 1 and 2 were then substituted into Equation 6, and the following equation resulted:

(7) $P_{CS} = MP * [(((4 * OIL + 6 * AMM + V) * (100 - (0.4 * FFA + 0.1 * FM + 0.1 * M)) / 100) + R] / 100$

The implicit prices for moisture, free fatty acids, and foreign matter as determined by the current formula pricing system were calculated as follows: (1) the market price, quality attributes not under consideration, variety adjustment factor, and rounding were held constant at specified levels and entered into equation 7, then (2) the quality attribute under consideration was varied in equation 7. The marginal implicit price of a particular quality attribute under the formula pricing system was the partial derivative of cottonseed sale price with respect to that quality attribute. The specified levels for the quality attributes were considered to be average levels of these quality attributes in cottonseed at Texas oil mills.

Results

Descriptive statistics for the dependent and independent variables are presented in Table 1. Estimates for the cottonseed price model are summarized in Table 2 (SAS Institute, Inc., 1989-1996). Estimated coefficients were statistically significant at the 0.05 level for all factors except cottonseed production and the oil and ammonia interaction. The model explained about 84 percent of the total variation in Texas cottonseed prices over the study period. This measure indicated that the model had satisfactory explanatory power and fit the data reasonably well.

Producer Price Index for All Farm Products

The estimated relationship between the producer price index for all farm products and the price of cottonseed was linear, direct, and statistically significant. The estimated coefficient for the PPI variable suggested that as the producer price index increased by one unit, cottonseed prices increased by 1.03 dollars per ton. Thus, as the general price level for all farm products rose, cottonseed prices rose, ceteris paribus.

Annual Cottonseed Production

The relationship between the annual production of cottonseed and cottonseed prices was inverse, linear, and statistically significant. The estimated coefficient for the PRODCTN variable was suggested that as cottonseed production in a given marketing year increased by one ton, then the monthly cottonseed prices in that marketing year decreased by 0.01 dollars per ton. This inverse relationship existed because, given the demand for cottonseed, larger quantities of cottonseed available in the marketplace resulted in less competition among buyers to acquire their desired quantities of cottonseed. Higher annual quantities of cottonseed supplied tended to decrease cottonseed prices holding all other factors affecting cottonseed prices constant.

Cottonseed Oil Prices

Cottonseed oil prices exhibited a statistically significant relationship with cottonseed prices. Results indicated that cottonseed prices changed by about 0.33 percent as the price of cottonseed oil changed by 1 percent. As cottonseed oil prices increased, cottonseed prices increased at decreasing rate. Since cottonseed demand was derived from demand for cottonseed products such as cottonseed oil, increases (decreases) in cottonseed oil demand increased (decreased) the demand for raw cottonseed and, subsequently, increased (decreased) cottonseed prices.

Cottonseed Meal Prices

The lagged cottonseed meal prices also displayed a statistically significant relationship with cottonseed prices. Results indicated that cottonseed prices changed by about 0.40 percent as cottonseed meal prices changed by 1 percent. As cottonseed meal prices increased to their maximum value, cottonseed prices increased at decreasing rate. Because cottonseed demand was derived from demand for cottonseed products such as cottonseed meal, increases (decreases) in cottonseed meal demand increased (decreased) the demand for raw cottonseed and, subsequently, increased (decreased) cottonseed prices.

The cottonseed meal coefficient was larger than the cottonseed oil coefficient possibly because the quantity of meal that could be obtained from a ton of cottonseed was approximately three times the quantity of oil that could be obtained from the same ton of cottonseed. Therefore, a given change in cottonseed meal prices would have a greater effect on cottonseed prices than a comparable change in cottonseed oil prices.

Oil and Ammonia Interaction

The estimated relationship between cottonseed prices and the oil and ammonia interaction term was not statistically significantly different from zero. Thus, the coefficient for the oil and ammonia interaction term was not interpreted.

Moisture, Free Fatty Acid, and Foreign Matter Interaction

The relationship between cottonseed prices and the moisture, free fatty acid, and foreign matter interaction term was found to be statistically significant, linear, and inverse. The negative effect associated with MFFAFM suggested that as the size of the interaction between moisture, free fatty acids, and foreign matter increased by one unit, cottonseed prices decreased by 0.28 dollars per ton. As the combination of moisture, free fatty acids, and foreign matter in a lot of cottonseed increased, the quality of that lot of cottonseed was negatively impacted, e.g., the storage life of that cottonseed decreased. Cottonseed prices reflected the preference for cottonseed containing lower combined levels of these three quality attributes.

Estimated Marginal Implicit Prices

Because the OILAMM interaction term was not statistically significantly different from zero, marginal implicit prices, premiums, and discounts were not calculated for oil and ammonia. The linear specification of the MFFAFM interaction term resulted in constant marginal implicit prices for moisture, free fatty acids, and foreign matter across all attribute levels. The marginal implicit prices for moisture (dP_{CS}/dP_M), free fatty acids (dP_{CS}/dP_{FFA}), and foreign matter (dP_{CS}/dP_{FM}) appear in Equations 8 through 10, respectively.

(8) $\delta P_{CS}/dP_M = -0.285094 * FFA * FM.$

(9) $\delta P_{CS}/dP_{FFA} = -0.285094 * M * FM.$

(10) $\delta P_{CS}/dP_{FM} = -0.285094 * M * FFA.$

The marginal implicit price for moisture was a function of both free fatty acid and foreign matter percentage. Similarly, the marginal implicit price for free fatty acids was a function of both moisture and foreign matter percentage. Finally, the marginal implicit price for foreign matter was a function of both moisture and free fatty acid percentage.

Marginal implicit prices were also calculated holding the quality attributes not under consideration at specified levels (18.0 percent oil, 4.0 percent ammonia, 8.0 percent moisture, 0.4 percent free fatty acids, and 2.0 percent foreign matter). These marginal implicit prices appear in Table 3. As moisture percentage increased by one unit (e.g., from 8.0 percent to 9.0 percent), cottonseed prices decreased by about 0.23 dollars per ton. A one unit increase in free fatty acid percentage (e.g., from 0.4 percent to 1.4 percent) resulted in about a 4.56 dollars per ton decrease in cottonseed prices. Finally, cottonseed prices decreased by about 0.91 dollars per ton as foreign matter percentage increased by one unit (e.g., from 2.0 percent to 3.0 percent).

It should be noted that a one unit increase in, e.g., moisture percentage compared to free fatty acid percentage was a proportionally smaller increase in moisture levels compared to free fatty acid levels. The same holds true for a one unit increase in moisture percentage compared to a one unit increase in foreign matter percentage. Further, a one-tenth unit change in a particular quality attribute (e.g., from 8.0 percent moisture to 8.1 percent moisture) would be a more realistic increment of change.

Comparison of Estimated and Formula Pricing System Marginal Implicit Prices

The estimated marginal implicit prices for moisture, free fatty acids, and foreign matter were compared to marginal implicit prices for these three cottonseed quality attributes as determined by the current formula pricing system. The marginal implicit price of moisture under the formula pricing system was computed holding MP at 100 dollars per ton, OIL at 18.0 percent, AMM at 4.0 percent, FFA at 0.4 percent, FM at 2.0 percent, V at five, and R at zero. The resulting marginal implicit price was -0.101 dollars per ton. This was approximately 0.127 dollars per ton lower than the marginal implicit price for moisture estimated from the regression equation (-0.228 dollars per ton). This suggested that while the formula pricing system appears to penalize cotton producers approximately 0.10 dollars per ton of cottonseed for an additional unit of moisture, the market actually penalizes cotton producers approximately 0.23 dollars per ton of cottonseed for an additional unit of moisture. Thus, the formula pricing system appears to understate the negative impact of moisture content on cottonseed prices.

Under the formula pricing system, the marginal implicit price of free fatty acids was computed holding MP at 100 dollars per ton, OIL at 18.0 percent, AMM at 4.0 percent, M at 8.0 percent, FM at 2.0 percent, V at five, and R at zero. The resulting marginal implicit price was -0.404 dollars per ton. This was about 4.158 dollars per ton lower than the marginal implicit price for free fatty acids estimated from the regression equation (-4.56 dollars per ton). This suggested that the market actually penalizes cotton producers approximately 4.56 dollars per ton of cottonseed for an additional unit of free fatty acids, while the formula pricing system appears to penalize cotton producers approximately 0.40 dollars per ton of cottonseed for an additional unit of free fatty acids. Thus, the formula pricing system again appears to understate the negative impact of free fatty acid content on cottonseed prices.

The marginal implicit price of foreign matter under the formula pricing system was computed holding MP at 100 dollars per ton, OIL at 18.0 percent, AMM at 4.0 percent, M at 8.0 percent, FFA at 0.4 percent, V at five, and R at zero. The resulting marginal implicit price was -0.101 dollars per ton. This was approximately 0.810 dollars per ton lower than the marginal implicit price for foreign matter estimated from the regression equation (-0.911 dollars per ton). This suggested that while the formula pricing system appears to penalize cotton producers approximately 0.10 dollars per ton of cottonseed for an additional unit of foreign matter, the market actually penalizes cotton producers approximately 0.91 dollars per ton of cottonseed for an additional unit of foreign matter. Thus, the formula pricing system also appears to understate the negative impact of foreign matter content on cottonseed prices.

Premiums and Discounts

This section illustrates the use of marginal implicit prices derived earlier in calculating cottonseed prices and quality premiums and discounts for various combinations of cottonseed quality attributes. Cottonseed prices were estimated for cottonseed containing 8.0 percent moisture and 2.0 percent foreign matter at free fatty acid levels of 0.4 percent, 1.1 percent, and 1.8 percent holding oil and ammonia levels constant at levels considered by oil mills to be average values of these quality attributes (18.0 percent oil and 4.0 percent ammonia) and all other independent variables constant at historical means for the data set (Table 1). Under these conditions, the estimated cottonseed price for cottonseed containing 0.4 percent free fatty acids was estimated at 109.21 dollars per ton. The estimated cottonseed price was 106.02 dollars per ton for cottonseed with 1.1 percent free fatty acids and 102.83 dollars per ton for cottonseed with 1.8 percent free fatty acids under the same conditions.

Premiums and discounts above and below these prices were computed for twenty-four additional combinations of moisture and foreign matter levels for each of the three free fatty acid levels. The estimated premiums and discounts for these different quality attribute combinations are reported in Table 4. To illustrate how to read this table, for cottonseed containing 8.0 percent moisture, 2.00 percent foreign matter, and 0.4 percent free fatty acids, the corresponding cottonseed price estimation in Table 4 was approximately 109.21 dollars per ton. For cottonseed containing 7.0 percent moisture, 1.25 percent foreign matter, and 0.4 percent free fatty acids, the corresponding premium estimation in Table 4 was about 0.83 dollars per ton. This estimated premium can be added to the estimated cottonseed price mentioned above to obtain a cottonseed price estimate for cottonseed containing 7.0 percent moisture, 1.25 percent foreign matter, and 0.4 percent free fatty acids of about 110.04 dollars per ton.

Conclusions

Several general conclusions and assertions can be made regarding this study. First, the discrepancy between the marginal implicit prices under the formula pricing system and the estimated marginal implicit prices highlights several potential problems with the current formula pricing system. The current formula pricing system appears to be understating the discounts for moisture, free fatty acids, and foreign matter. Thus, the current formula pricing system appears to be sending cottonseed market participants inaccurate signals concerning the values of the different quality attributes contained in cottonseed. If cotton producers incorporate these potentially biased market values for cottonseed quality attributes into their financial, production, and marketing decision making processes, then less than optimum decisions can result. This has implications for the cotton producer's profitability.

Another problem with the current formula pricing system is that there are no widely accepted base levels for the five cottonseed quality attributes measured under the current grading system. Similarly, there is no widely accepted base price for cottonseed. Under the current formula pricing system, the composite grade is multiplied by a market price for cottonseed grading 100. However, a vast number of quality combinations can comprise 100 grade cottonseed. By defining base levels for these quality attributes, a base cottonseed price could then be identified. This base cottonseed price would exist for cottonseed containing the base levels of all five quality attributes considered in the current grading formula. Premiums and discounts could then be discussed in terms relative to the base price and could be compared from one marketing year to another.

An additional potential problem with the current formula pricing system is that it does not account for discounts for moisture, free fatty acid, and foreign matter levels below specified thresholds (12.0 percent moisture, 1.8 percent free fatty acids, and 1.0 percent foreign matter). However, the results of the current study suggest that discounts do exist for levels of these quality attributes below the threshold values. Under the current formula pricing system, for example, cottonseed containing 12.0 percent moisture is not distinguished from cottonseed containing 9.0 percent moisture. However, the storage life of cottonseed containing 12.0 percent moisture should be shorter than the storage life for cottonseed containing 9.0 percent moisture holding all other factors constant.

It was hypothesized that dairy demand for cottonseed is more inelastic than oil mill demand for cottonseed. This underscores the importance of focusing cottonseed demand expansion efforts on the dairy market. Increased revenues from cottonseed sales should result from increased demand for cottonseed, especially increased dairy demand for cottonseed. Marketing programs for cottonseed should be primarily focused on promoting the use of cottonseed as a livestock feed. As more dairies bypass the oil mills and purchase cottonseed directly from gins, it will become more difficult for oil mills to justify their existence. In order to satisfy dairy demand for cottonseed, oil mills will have to produce value-added cottonseed products that livestock producers are willing to pay premiums for over cottonseed sold directly from gins. Coating cottonseed with cornstarch to improve seed handling characteristics is one new value-added process that holds great potential for oil mills willing to invest in this technology and for increasing dairy demand for cottonseed (Cotton Incorporated, 1998).

As with any research effort, this study had limitations. The primary limitation with this research concerned the data. The data used in this analysis were aggregated for the state of Texas and, in the case of cottonseed oil prices, for the entire U.S. In particular, the aggregation of the quality data obscured much of the variation that existed in the individual lots of cottonseed sold. A geographical limitation associated with this study was that the estimated effects of different supply, demand, and quality factors on Texas cottonseed prices may not be representative of corresponding effects for the rest of the Cotton Belt. In addition, there could be differences in the market valuations of supply, demand, and quality factors among different regions within Texas. Another limitation of this study was that, because of a lack of data, the demand for cottonseed was not separated into oil mill demand and dairy demand. Cottonseed prices can differ greatly between these two markets. The importance placed on individual quality factors also differs between these two markets because the end uses for cottonseed going to the oil mills are not the same as the end uses for cottonseed going to dairies.

Many opportunities exist for further research related to this study. First, there is a need for the collection of price and quality data for individual cottonseed lot sales. This would enable a study to be conducted on the effects of various factors on cottonseed prices that accounts for the variations among individual market transactions. Another potential research topic involves expanding this analysis of the cottonseed pricing structure to include additional quality variables. A study similar to the present one could be conducted for multiple regions within Texas or multiple regions within the U.S. as well. Finally, an analysis of the similarities and differences between the cottonseed pricing structures in the oil mill and the dairy markets could also be performed.

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Table 1. Definitions and Summary Statistics of the Variables Used in the Model.

Variable Definition	Mean	Standard	Minimum Deviation	Maximum
P_{CS} Monthly Texas cottonseed price in dollars/ton	105.741	19.128	64.000	137.000
PPI Monthly producer price index for all farm products; unitless	107.052	6.353	94.900	120.200
PRODCTN Annual Texas cottonseed production in tons	1803.49	315.950	1189.000	2147.000
P_{CSOIL} Monthly Mississippi Valley Points cottonseed oil price in cents/pound	22.678	4.019	15.440	33.160
$L3P_{CSM}$ Monthly Texas cottonseed meal price in dollars/ton	173.828	28.217	121.500	238.250
OILAMM Monthly Texas cottonseed oil % times ammonia %	73.449	7.135	66.789	121.000
MFFAFM Monthly Texas cottonseed moisture % times free fatty acid % times foreign matter %	10.742	9.825	2.700	55.680

Number of Observations = 58

Table 2. Cottonseed Price Model Estimates from Maximum Likelihood Regression.

Independent Prob. Variables	Coefficient Estimates	Standard Error	t-ratio	
Intercept	99.529900	46.9275	1.993	0.0517
PPI	1.030239	0.3097	3.326	0.0017
PRODCTN	-0.011802	0.00537	-2.197	0.0327
$1/P_{CSOIL}$	-779.331521	256.5-	3.038	0.0038
$1/L3P_{CSM}$	7301.756179	1633.1	4.471	0.0001
OILAMM	0.067644	0.1784	0.379	0.7066
MFFAFM	-0.284738	0.1297	-2.196	0.0328
R-Squared	0.8366			
No. Observations	58			

Source: SAS Institute, Inc., 1989-1996.

Table 3. Estimated Marginal Implicit Prices for Cottonseed Quality Attributes.

Quality Attribute	Marginal Implicit Price (Dollars/ton)
Moisture	-0.2277904
Free Fatty Acid	-4.555808
Foreign Matter	-0.9111616

Table 4. Cottonseed Premium and Discount Estimations for Various Moisture, Free Fatty Acid, and Foreign Matter Combinations. [a]

FFA = 0.4 %					
M	7.0 %	8.0 %	9.0 %	10.0 %	11.0 %
FM					
1.25 %	0.8257	0.6834	0.5410	0.3986	0.2563
2.00 %	0.2278	**109.2116** [b]	-0.2278	-0.4556	-0.6834
2.75 %	-0.3702	-0.6834	-0.9966	-1.3098	-1.6230
3.50 %	-0.9681	-1.3667	-1.7654	-2.1640	-2.5626
4.25 %	-1.5660	-2.0501	-2.5342	-3.0182	-3.5023
FFA = 1.1 %					
M	7.0 %	8.0 %	9.0 %	10.0 %	11.0 %
FM					
1.25 %	2.2708	1.8793	1.4878	1.0962	0.7047
2.00 %	0.6264	**106.0225** [b]	-0.6264	-1.2529	-1.8793
2.75 %	-1.0179	-1.8793	-2.7406	-3.6019	-4.4633
3.50 %	-2.6623	-3.7585	-4.8548	-5.9510	-7.0473
4.25 %	-4.3067	-5.6378	-6.9690	-8.3001	-9.6313
FFA = 1.8 %					
M	7.0 %	8.0 %	9.0 %	10.0 %	11.0 %
FM					
1.25 %	3.7158	3.0752	2.4345	1.7938	1.1532
2.00 %	1.0251	**102.8335** [b]	-1.0251	-2.0501	-3.0752
2.75 %	-1.6657	-3.0752	-4.4846	-5.8941	-7.3035
3.50 %	-4.3565	-6.1503	-7.9442	-9.7380	-11.5319
4.25 %	-7.0473	-9.2255	-11.4038	-13.5820	-15.7602

[a] Premiums and discounts in dollars/ton.

[b] Cottonseed prices in dollars/ton.