Cottonseed Prices in Georgia An Analysis of the Wholesale Marketing Margin

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Georgia farmers have voiced some concern in recent years about equity of prices paid for their cottonseed. Interest was particularly strong early in the 1973-74 season due to the fact that prices for cottonseed oil and cottonseed meal - the two main cottonseed products - exhibited large price increases at the wholesale level. The implied concern is that price increases for products produced from cottonseed are not adequately shared with cotton producers, i.e., the margin between gin-run cottonseed prices and cottonseed product prices is too large.

Both cotton producers and cotton ginners who buy gin-run cottonseed need a systematic method of judging appropriateness of cottonseed marketing margins and prices paid to farmers in a given year.

Objectives

The objective of this report is to examine behavior of the wholesale marketing margin for cottonseed in Georgia and to estimate, based on this margin, what the farm price for cottonseed will be for any level of wholesale prices for cottonseed products. Specific objectives are as follows:

(1) Examine, for the years 1962-72, yields of products from a ton of cottonseed.

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(2) Combine these yield data with wholesale prices in Georgia in order to determine the market value of products obtained from a ton of cottonseed in each year.

(3) Compare these wholesale values with farm prices in order to observe how the marketing margin and the farmers' share of income have behaved over the eleven-year period.

(4) Use wholesale and farm price behavior over the past years to estimate prices that farmers can reasonably expected to receive for their cottonseed.

Cottonseed Products

Cottonseed which are not kept for next season's planting are sent to crushing plants where four marketable products are normally obtained: cottonseed meal, oil, hulls and linters.

Table 1 shows estimates of the yield of products from a ton of seed during the years 1962-72, expressed in both pounds and percent. Over the eleven-year period, meal yields averaged 46.5% of a ton of cottonseed, oil accounted for 16.4%, hulls accounted for 23.4%, and linters averaged 9.0%. The remaining 4.6% of the average volume of a ton of cottonseed is waste material which has no market value.

Market Value of Cottonseed Products

Estimates of Southeastern wholesale market prices of cottonseed meal, oil, hulls and linters during 1962-72 are listed in Table 2 and graphed in Figure 1. All of these price series are quite variable and they often

Table 1. Estimated Yield of Cottonseed Meal, Oil, Hulls, Linters and Waste Products from Crushing a Ton of Cottonseed, U.S., 1962-72.

Year Beginning August	Yield of Products Per Ton of Seed Crushed									
	Meal		Oil		Hulls		Linters		Waste[a]	
	lb.	%	lb.	%	lb.	%	lb.	%	lb.	%
1962	937	46.85	333	16.65	464	23.20	171	8.55	95	4.75
1963	948	47.40	336	16.80	455	22.75	171	8.55	90	4.50
1964	934	46.70	337	16.85	458	22.90	176	8.80	95	4.75
1965	940	47.00	331	16.55	453	22.65	174	8.70	102	5.10
1966	950	47.50	333	16.65	457	22.85	188	9.40	72	3.60
1967	935	46.75	333	16.65	474	23.70	180	9.00	78	3.90
1968	910	45.50	326	16.30	470	23.50	189	9.45	105	5.25
1969	935	46.75	327	16.35	461	23.05	189	9.45	88	4.40
1970	927	46.35	325	16.25	468	23.40	194	9.70	86	4.30
1971	906	45.30	322	16.10	494	24.70	182	9.10	96	4.80
1972	910	45.50	314	15.70	497	24.85	175	8.75	104	5.20
Average	930.2	46.5	328.8	16.4	468.3	23.4	180.8	9.0	91.9	4.6

[a] Includes motes, grabbots, and hullfibers

SOURCE: U.S. Department of Agriculture, Agricultural Marketing Service.

Table 2. Market Price per Ton of Products Obtained from Crushing Cottonseed, Southeastern U.S., 1962-72

Year Beginning August	Market Price of Products				Weighted Average Value of Products[e]
	Meal[a]	Oil[b]	Hulls[c]	Linters[d]	
	Dollars per ton				
1962	66.50	210.00	15.00	77.00	76.18
1963	72.45	200.00	15.00	70.00	77.34
1964	64.35	232.00	15.00	77.80	79.42
1965	64.90	260.00	18.00	84.80	84.99
1966	81.75	286.00	22.00	132.40	103.92
1967	80.35	236.00	22.00	112.20	92.17
1968	77.20	262.00	11.00	91.40	89.05
1969	69.20	220.00	29.60	73.60	82.10
1970	78.70	270.00	23.00	76.60	93.16
1971	76.45	306.00	26.00	80.00	97.60
1972	96.70	236.00	21.00	78.00	93.09
Average	75.32	247.1	19.73	86.7	88.09

a/ Season average price of bulk cottonseed meal, 41% protein, in Atlanta.

b/ Season average price of crude cottonseed oil in tank cars, f.o.b., at all Southeastern mills.

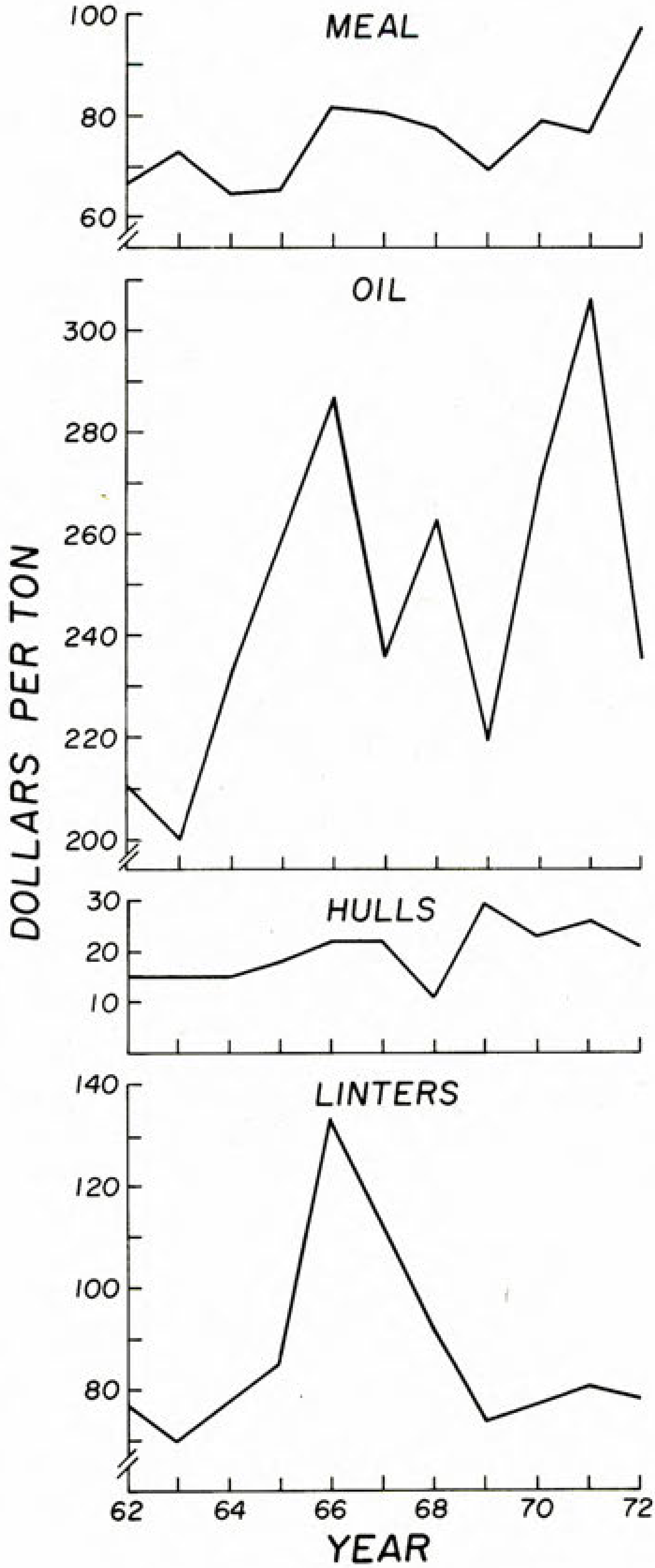
c/ Season average price of cottonseed hulls in carload lots, in Atlanta.

d/ Season weighted average price of linters for all grades and market points, f.o.b. mills.

e/ Weighted by percentages in Table 1.

SOURCE: [9, selected issues].

Figure 1. Market Price per Ton of Products Obtained from Cottonseed, 1962-72.



move in opposite directions, e.g., meal price may increase as oil price decreases.

In order to examine the farm-to-wholesale price spread, it is necessary to determine for each year a "representative" price at the wholesale level. This is done in the last column of Table 2, where a weighted average value of the four products is given. The weights used in each year are the percentages that each product is of total yield in that year, as given in Table 1. This weighted average of wholesale product prices is the market value of products obtained from a ton of cottonseed. It ranges from $76.18 per ton to $103.92 per ton and averages $88.09 per ton during the eleven-year period. In 1972 it was $93.09 per ton (Table 2).

Marketing Margin and Farmers' Share

By subtracting the average price paid to Georgia farmers for a ton of cottonseed from the weighted average wholesale value of cottonseed products, the wholesale marketing margin is estimated (Table 3 and Figure 2). During 1962-72, this margin ranged from $30.54 per ton to $47.50 per ton and averaged $39.66 per ton. In 1972 it was $45.59 per ton.

Column D of Table 3 expresses the marketing margin as a percentage of total value of a ton of cottonseed products. These figures ranged from 37.0% to 52.3% and averaged 45.0%. In 1972, the marketing margin averaged 49¢ of each dollar paid for cottonseed products.

Farmers' share of income from cottonseed products is shown in column E of Table 3. Addition of the two percentages in columns D and E will verify that they sum to 100% each year. Thus, the only way for farmers' share of the wholesale dollar to become larger is for the share taken by the marketing chain to become smaller.

Table 3. Market Value and Farm Price of a Ton of Cottonseed, Marketing Margin, and Farmers' Share of Income from a Ton of Cottonseed, Georgia, 1962-72.

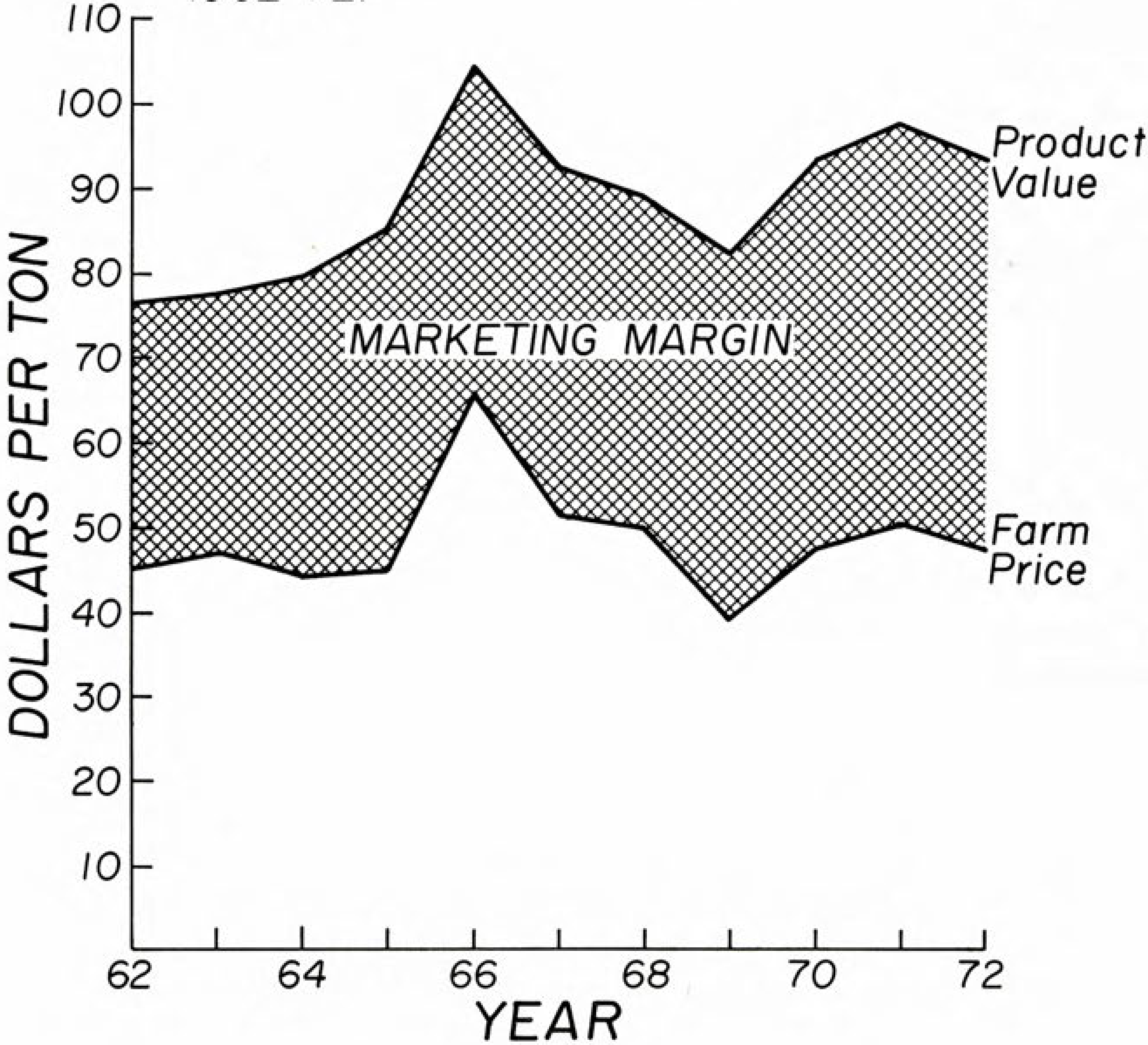
Year Beginning August	(A) Weighted Average Value of Products from a Ton of Cottonseed [a/]	(B) Farm Price for a Ton of Field-Run Cottonseed [b/]	(C) Marketing Margin (A - B)	(D) Marketing Margin Share of Income from Cottonseed Products (C ÷ A)	(E) Farmers' Share of Income from Cottonseed Products (B ÷ A)
	Dollars per ton			Percent	
1962	76.18	45.30	30.88	40.5	59.5
1963	77.34	46.80	30.54	39.5	60.5
1964	79.42	44.30	35.12	44.2	55.8
1965	84.99	44.90	40.09	47.2	52.8
1966	103.92	65.50	38.42	37.0	63.0
1967	92.17	51.60	40.57	44.0	56.0
1968	89.05	49.90	39.15	44.0	56.0
1969	82.10	39.20	42.90	52.3	47.7
1970	93.16	47.60	45.56	48.9	51.1
1971	97.60	50.10	47.50	48.7	51.3
1972	93.09	47.50	45.59	49.0	51.0
Average	88.09	48.43	39.66	45.0	55.0

a/ Reproduced From Table 2.

b/ Season average price received by farmers in Georgia.

SOURCE: [10, selected annual summaries].

Figure 2. Marketing Margin for Crushed Cottonseed, 1962-72.



Predicting Farm Prices for Cottonseed

Demand for farmers' cottonseed is derived from the demand for products obtained from cottonseed. Therefore, changes in wholesale value of cottonseed products should help predict changes in farm cottonseed price. Inspection of Figure 2 will verify that product value and farm price tend to move together.

Obviously the farm-to-wholesale marketing margin for cottonseed products must be sufficiently large to compensate for expenses involved in crushing the seed, refining the products, transporting the raw product to crushing mills and the finished products to collection points, etc. If the costs of performing these necessary functions increase, then the marketing margin will also have to increase.

It is reasonable to expect performance of the marketing system to vary a little from year to year. But, on the average, the marketing margin should generate a fair rate of return for processing and marketing functions performed.

What is needed is a systematic method of statistically estimating the relationship between farm prices and wholesale product values. Linear regression is one of the most common techniques available for this purpose and will be used here.[1/] It is specified that farm price in year t (P_t) is a linear function of wholesale product value in year t (V_t) i.e.,

$$P_t = A + B\ V_t,$$

[1/] The technique of linear regression is explained in many elementary statistics and econometrics text books. See, for example, [1, Ch. 1].

where A and B are parameters to be estimated. The estimated relationships may be expressed as follows:

$$P_t = a + b\ V_t + e_t,$$

where a and b are estimated parameters and e_t is the error of the estimate in year t. The unexplained errors must exhibit a random distribution if the regression equation is to be useful for statistical inference.

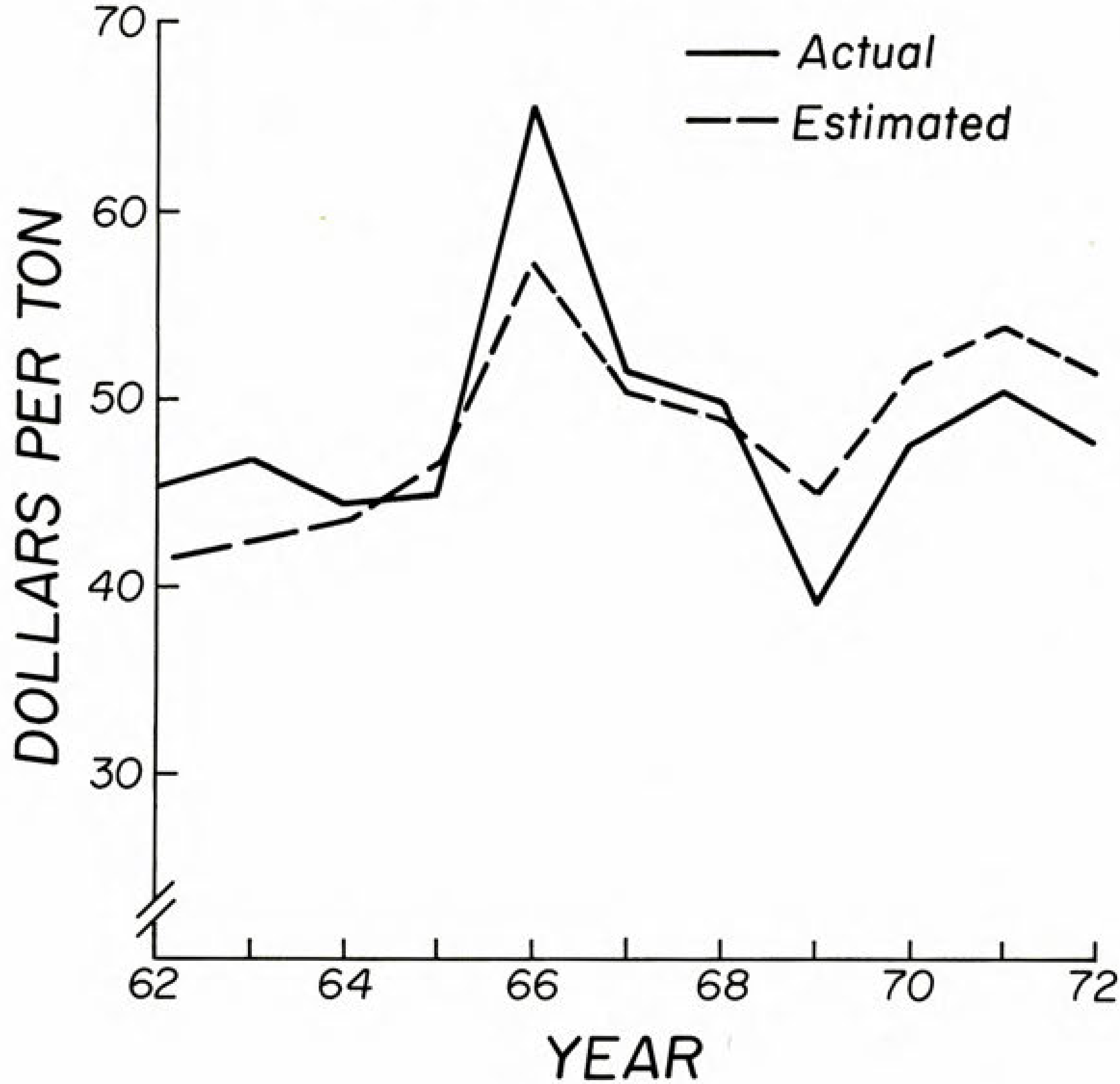
The result of regressing the Georgia farm price of cottonseed (P_t) on wholesale product value (V_t), for the years 1962-72, is as follows:

$$(1) \quad \underset{(14.09)}{P_t = 1.74} + \underset{(0.16)}{0.57V_t} \ ; \quad R^2 = 0.59,$$

where numbers in parentheses below the estimated coefficients are standard errors of the coefficients and R^2 is the coefficient of determination. $R^2 = 0.59$ means that 59% of the total variation in farm cottonseed price is accounted for by changes in cottonseed product value.

Figure 3 compares actual values of P_t during 1962-72 with estimated values obtained from regression equation (1). It is seen that there is a tendency to under-estimate P_t in the early part of the period and to over-estimate it during the latter part of the period. This is synonymous to saying that the annual estimation errors, the e_t's, tend to be positive in the early part of the period and negative in the latter part. The conclusion is that e_t is not random and that at least one additional explanatory variable is needed to estimate what P_t will be in any given year.

Figure 3. Comparison of Actual and Estimated Values of Farm Cottonseed Prices in Georgia Using Regression Equation (1), 1962-72.



Results of equation (1) and Figure 3 indicate that, over the past 11 years, the wholesale marketing margin for cottonseed has tended to get larger in each successive year. There is no doubt a complex of reasons for this; e.g., general inflation, rising labor, machinery and transportation costs, etc. Since these things are usually correlated with the passage of time, a trend variable is often used as a surrogate variable for this complex of interrelated factors.[2/] However, if a variable could be obtained that would more accurately reflect actual changes in wholesale marketing costs, the predictive ability of a regression equation should be improved. To this end, a representative cost index was derived.

Four major cost categories for processing and wholesaling cottonseed are labor, machinery, fuel and electricity, and transportation costs. While these costs are not exhaustive, they are dominant ones that are readily translated into lower prices for the raw product. Based on past publications [2, 5, 6] and on current contacts with the industry, the relative share of each of these costs is estimated to be as follows:

labor costs------------------------------ 35%

machinery costs-------------------------- 25%

fuel and electricity costs--------------- 16%

transportation costs--------------------- 24%

2/ Thus, the estimated equation may be expressed as

$$P_t = a + bV_t + cT + e_t,$$

where T is the year involved (T = 0 for 1962, 1 for 1963,...., 10 for 1972). The resulting regression equation is given as follows:

$$\underset{}{P_t} = \underset{(7.35)}{-25.47} + \underset{(0.09)}{0.92V_t} \underset{(0.24)}{-1.50T} \; ; \quad R^2 = 0.93$$

The statistical fit of this regression equation is quite good. The desire for a "structural" variable rather than a "dummy" variable (time) is based on economic rather than statistical considerations.

Table 4 lists cost indexes for each of these cost categories and, using the above percentages, derives a weighted average cost index for the years 1962-72.

The estimated equation may now be expressed as

$$P_t = a + bV_t + cI_t + e_t,$$

where I_t is the weighted average cost index shown in Table 4. The resulting regression equation is as follows:

$$(2) \quad \underset{}{P_t} = \underset{(8.57)}{6.57} + \underset{(0.11)}{0.83V_t} - \underset{(0.07)}{0.30I_t} \; ; \; R^2 = 0.87$$

It is seen that 87% of the total variation in P_t is accounted for by regression equation (2), and that the standard errors of each coefficient are quite small relative to the size of the coefficients.[3/] Furthermore, inspection of Figure 4 will verify that estimated values of P_t are now quite close to actual values and that annual errors appear to be randomly distributed.[4/] Therefore, it is valid to use regression equation (2) for estimation and prediction.

Regression equation (2) asserts that when wholesale cottonseed product value increases \$1.00 per ton, the farm price increases about \$0.83 per ton. In addition, the farm price decreases about \$0.30 per ton with a 1-point increase in the marketing cost index.

Data were obtained for 11 months (August-June) of the 1973-74 cotton marketing season. These data may be used to see how well regression

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3/ The constant (intercept) term appears to be insignificantly different from zero. But this is an entirely feasible conclusion, since it implies that P_t may go to zero if V_t goes to zero or if I_t gets too large.

4/ The Durbin-Watson d statistic for the regression is 1.97, which supports the conclusion that the residual error terms are not autocorrelated.

Table 4. Determination of a Weighted Average Cost Index (1967=100) for Wholesale Marketing of Cottonseed Products, 1962-72

Year	Labor Cost Index[a/]	Machinery Cost Index[b/]	Fuel & Electricity Cost Index[c/]	Transportation Cost Index[d/]	Weighted Average Cost Index[e/]
	----------	----------	Percent	----------	----------
1962	83.3	90.9	96.7	100.8	91.6
1963	86.0	91.4	96.3	93.2	90.8
1964	88.3	91.9	93.7	100.8	93.1
1965	90.7	92.5	95.5	104.6	95.2
1966	94.6	96.6	97.8	113.5	100.2
1967	100.0	100.0	100.0	100.0	100.0
1968	107.0	103.3	98.9	113.0	106.2
1969	112.8	107.0	100.9	126.5	112.8
1970	119.8	113.7	105.9	128.0	117.9
1971	127.6	119.1	114.2	134.6	125.1
1972	137.4	122.4	118.6	143.5	132.1

a/ Index of annual average hourly earnings of U.S. production workers in the "miscellaneous food and kindred products industry."

SOURCE: [7, monthly reports]

b/ Wholesale price index for "general purpose machinery and equipment" in the U.S.

SOURCE: [8]

c/ Wholesale price index for "fuels and related products and power" in the U.S.

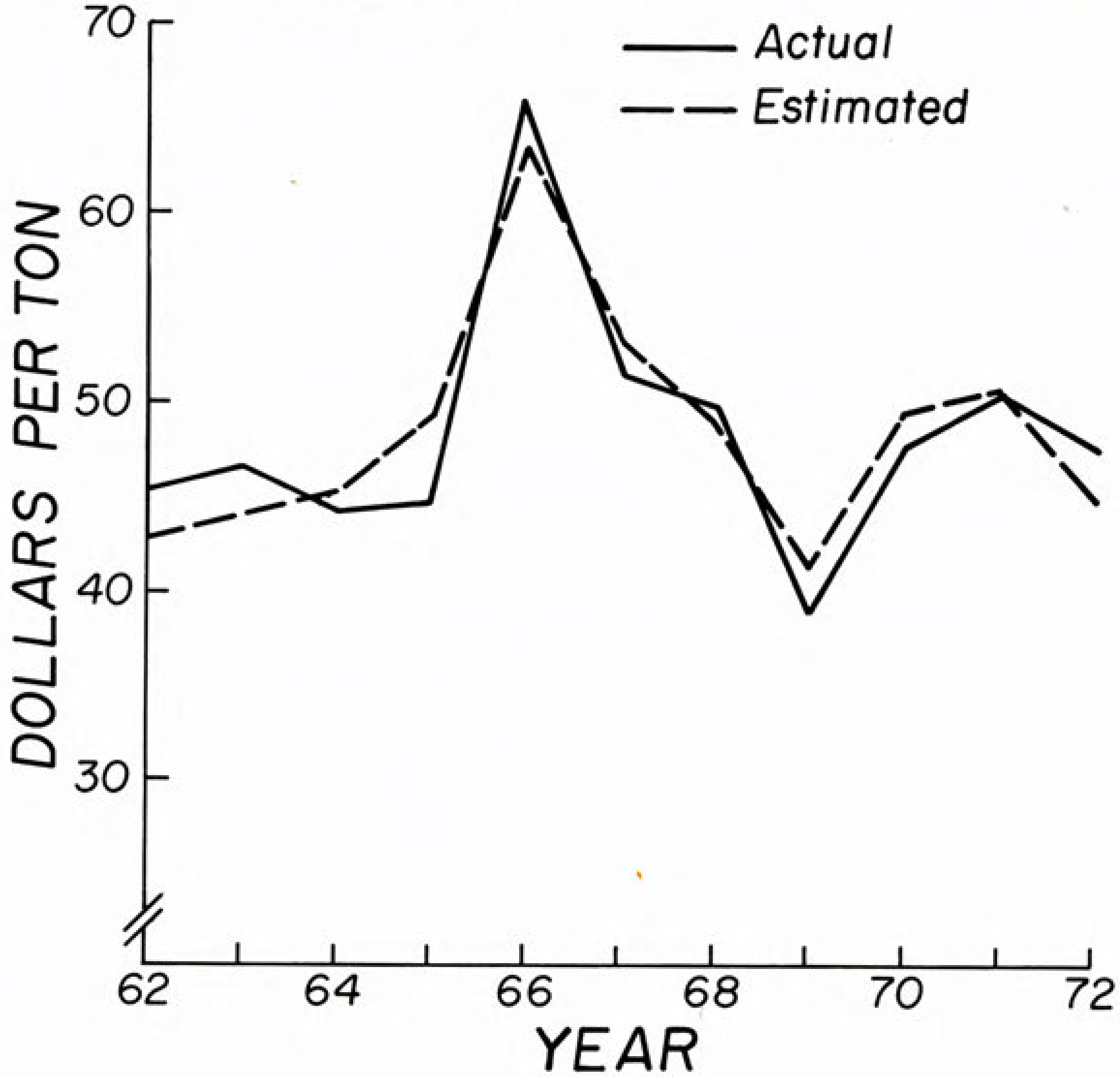
SOURCE: [8]

d/ Index of average freight revenue per ton of cottonseed products, Class I railroads, Southern Region.

SOURCE: [4]

e/ Each index weighted as follows: labor -- 0.35; machinery -- 0.25; fuel and electricity -- 0.16; transportation -- 0.24.

Figure 4. Comparison of Actual and Estimated Values of Farm Cottonseed Prices in Georgia Using Regression Equation (2), 1962-72.



equation (2) "forecasts" the Georgia farm price of cottonseed.[5/]

The weighted average wholesale value of cottonseed for these eleven months is estimated to be $168.40 per ton, which is $75.81 above the comparable 1972-73 value. However, the weighted cost index is also estimated to have increased 11.5 points to 143.6. Inserting these data into regression equation (2) results in a forecasted farm price of $103.26 per ton.

The estimate of $103.26 per ton of cottonseed is subject to inherent random error and should not be considered perfectly accurate.[6/] Rather, any forecast has some probability distribution associated with it. An interval estimate of farm price would incorporate this probability distribution. Thus, assuming that the error terms have a normal distribution[7/], it may be concluded that there is a 95% probability that the farm price for cottonseed in Georgia will not be below $83.52 per ton and not above $123.00 per ton.[8/]

The actual farm cottonseed price during the 11-month period is estimated to have averaged $95.00 per ton [3]. This is below the predicted price of $103.26, but within the interval estimate. Thus, based on this analysis, the 1973-74 farm price for cottonseed appears consistant with past levels of marketing margins.

5/ Since about 95% of all cottonseed products have been marketed by June, the bias associated with using data based on 11 months rather than all 12 months will be small.

6/ This is especially true in the current situation for cottonseed, because both wholesale product value and marketing costs have exhibited such extreme increases.

7/ Examination of the unit normal deviate forms of the residual error terms indicates that the hypothesis of a normal distribution is not rejected at the 99% level of confidence. For an explanation of the unit normal deviate, see [1, p. 88].

8/ For an explanation of how this interval estimate is obtained, see [1, p. 61].

Concluding Remarks

A simple regression model has been formulated which is useful for predicting cottonseed price and/or assessing appropriateness of an existing price. The necessary data are available from secondary sources and the analysis could be done on request. Estimation results should be reliable as long as there is no significant market structural change or alteration of basic cost relationships in the marketing system (which might occur from technological change, etc.). Predictive accuracy would be improved if a more accurate index of wholesale marketing costs could be obtained.

It should be kept in mind that the annual data used will give information only about annual average marketing margins. Early in the marketing season it may take a few weeks for the market to "settle" on the appropriate farm price for cottonseed. If a producer feels that an early season price is not equitable, he might hold his cottonseed for awhile to allow the market time to adjust.

Before this regression model is used to estimate farm cottonseed price for the 1974-75 marketing season, actual 1973-74 price and cost data should be included in the data pool and a new regression equation obtained using this additional information.

References

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[2] Farnworth, V., and D. Jackson, Marketing Margins, Practices and Costs for Soybean and Cottonseed Oils, U.S. Dept. of Agriculture, Agricultural Marketing Service, Marketing Research Report No. 231, May 1958.

[3] Georgia Crop Reporting Service, "Cotton," Georgia Farm Report, May 15, 1974.

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[5] Mitchell, J.A., Supplement to Comparative Economies of Different Types of Cottonseed Oil Mills and Their Effects on Oil Supplies, Prices, and Returns to Growers, (Supplement to Marketing Research Report No. 54), U.S. Dept. of Agriculture, Agricultural Marketing Service, January 1959.

[6] Spilsbury, C.C., Distribution of Marketing and Processing Costs of Cottonseed-Oil Mills, 1948-49 Compared with 1947-48, U.S. Dept. of Agriculture, Production and Marketing Administration, June 1951.

[7] U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings.

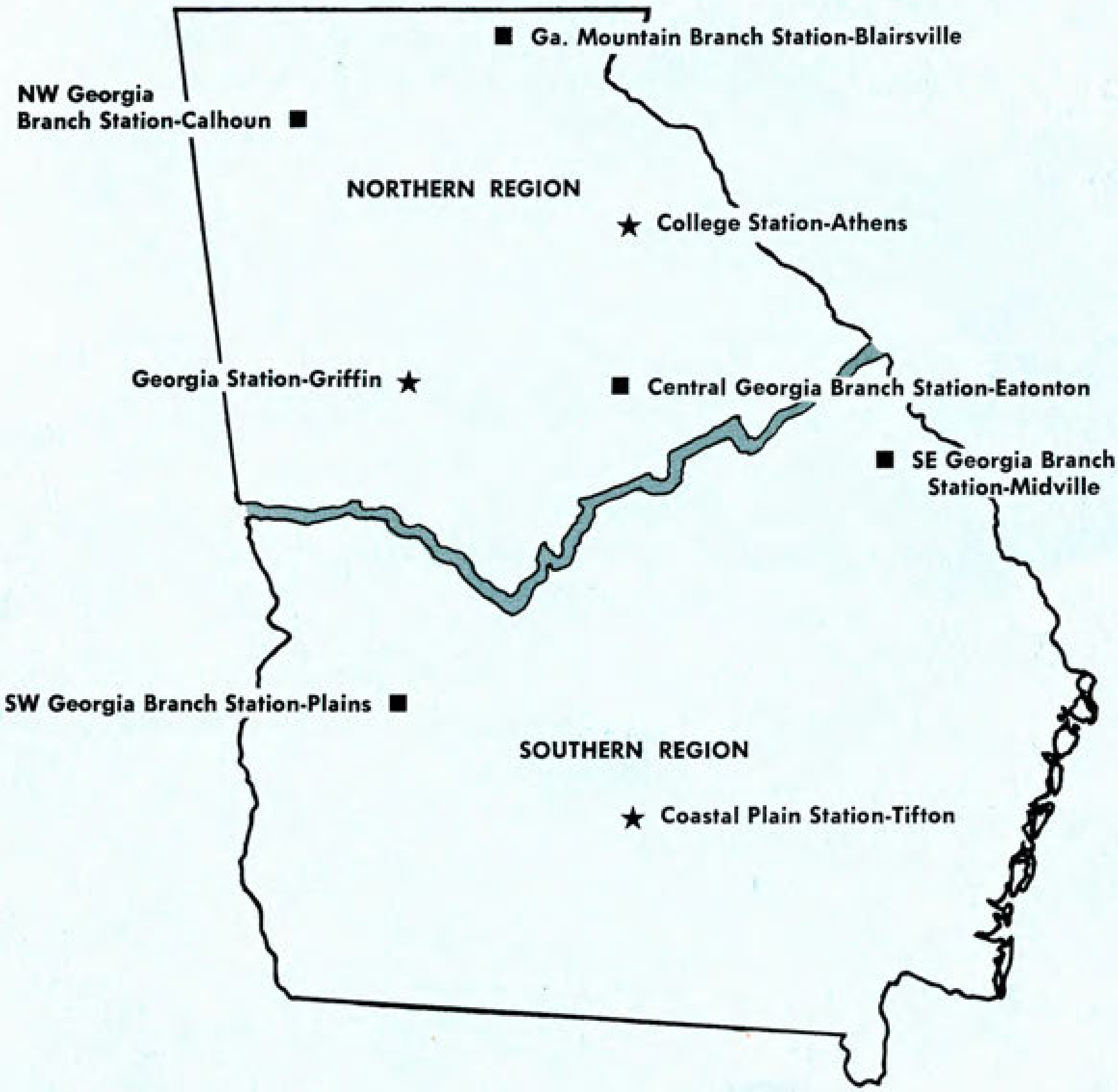
[8] U.S. Department of Labor, Bureau of Labor Statistics, Handbook of Labor Statistics 1972, BLS Bulletin No. 1735.

[9] U.S. Department of Agriculture, Economic Research Service, Fats and Oils Situation.

[10] U.S. Department of Agriculture, Statistical Reporting Service, Agricultural Prices.

University of Georgia
College of Agriculture Experiment Stations

From the cool ruggedness of the northern piedmont to the flat sandy Coastal Plain to the semitropical southern region, Georgia is a study in geographical and climatological contrasts. Since each area of Georgia presents different problems to her farmers, regionalized agricultural research is necessary. To meet this need, the statewide direction and outreach of the University of Georgia College of Agriculture Experiment Stations was planned to place research information of a regional nature only a short driving distance away from any point in the state. The Experiment Stations and their locations are indicated below:



Cost: $460
Quantity: 2,500